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Selection of New Genotypes of Winter Chickpeas with High Productivity, High Photosynthetic Productivity, Resistance to Fusariosis Disease and Adaptation to Mechanism

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Abstract: More than 12 million tons of chickpea were grown in the world in the last year's season, and India, Australia, Myanmar, Pakistan, Turkey, Ethiopia, Russia, and Iran are the countries that produce the most chickpeas. Currently, the possibility of meeting the demand for chickpea grain from the crop grown in our republic is very low. Therefore, grains of the main leguminous crops are exported from abroad. In turn, the year-by-year increase in population increases the demand for chickpea grain. It is no secret that the main part of the cultivated crop is collected by manual labor. Solving this problem requires the creation and introduction of varieties adapted to mechanization.

In the study, 20 winter chickpea genotypes were evaluated and selected under irrigated field conditions. Winter chickpea genotypes were determined by parameters such as growth period, plant height, location of lower pods relative to the soil surface, yield indicators, weight of 1000 grains, NDVI indicator, chlorophyll content, and protein content. Among the 20 studied varieties and lines of winter chickpea, 3-4 days earlier than standard varieties, adapted to mechanization, plant height 58.0-64.3 cm, weight of 1000 grains 345.6-370.1 g, yield 21.1-26 ,1 c/ha, protein content of 27.7-29.3 percent, high photosynthetic productivity, 7 genotypes were selected. In the study, the Obikor (KR20-CICTN-37) variety, which is early-yielding, adapted to mechanization, has high photosynthetic productivity, and is superior to standard varieties, was selected and recommended to be submitted to the Agricultural Crops Varieties Testing Center.

Keywords: winter chickpea, genotype, variety, line, plant height, yield, chlorophyll content, fusarium disease.

INTRODUCTION

It is known that as a result of the annual growth of the population worldwide, the demand for food products, especially products rich in protein, is increasing.

Chickpeas are widely used by our people in cooking nutritious liquid and thick dishes, in the preparation of desserts and canned goods.

Protein should be on average 90-100 g in food consumed by a person in 1 day. It is 12% of daily food calories [2].

Chickpea grain contains up to 30% of protein, 47-60% of starch, 4-8% of fat, 2.3-5% of ash elements, various vitamins, and in terms of strength and nutrition, it is close to the meat of livestock [1].

Also, according to the results of many years of research, 5-7 kg, sometimes 8-9 kg of vegetable protein are used to get 1 kg of animal protein. The loss of nutrients during their preparation is 20-30%. This will increase the protein deficiency. According to zootechnical standards, one energy food unit (EOB) should contain 110-115 g of digestible protein. Currently, one feed unit used in animal husbandry contains 85 g of digestible protein [3].

Analysis of feed utilization shows that protein deficiency per feed unit leads to a 1.3-1.5-fold increase in feed consumption in ruminant cattle, and a 2-fold increase in pigs [5].

Chickpea belong to the genus Cicer. There are 27 species in this category. 4 of them are annuals, and one of the 4 is a cultural species - Cicer arietinum. In addition to the cultivated species, there are 6 wild species in the CIS: 4 in Central Asia (C. flexuosum Lipsky, C. macrocanthim M. Pop, C. songoricum Steph, C. pungens Boiss), two in the Caucasus (C. ervoides (Silb) Fenzl and C. .anatolicum Aleph) occurs. These species are distributed in mountainous dry stony slopes and produce large vegetative masses and pods that burst when ripe. It has not been determined whether these species can be used as a starting material due to the cracking of the pods [6, 14, 15].

Morphological characteristics of pea varieties are different: ground-covering, slightly erect-stemmed, and erect-growing. Low-growing varieties are up to 35 cm tall, slightly erect and erect varieties are relatively tall, 30-70 cm [16].

In the dry lands of Uzbekistan, it is necessary to allocate more fertile, well-supplied with moisture, clean from perennial weeds, typical and gray soils for peas. The growing period of peas varies depending on the variety and growing conditions. Usually, its growth period is 80-110 days, most varieties ripen in 70-80 days after germination [22, 23].

K.K.Paliwal, S.R.Ramgiri, M.S.Lal found in their experiments that the number of pods in peas and the number of grains in pods have a positive effect on its yield and crop quality. If the number of pods and grains is large, the yield is high, and it has been proven that the mass of 1000 grains has a positive effect on productivity. The weight of 1000 grains of peas grown on irrigated land is 11-20 g compared to that of non-irrigated land. found to be high [8].

Z.S. Bobomurodov, 1992-1994, collected the samples of peas in the conditions of irrigated gray soils of Samarkand region in order to study the methods of planting peas. During field experiments, he tried different planting schemes. Hashaki pea samples K-295 and K-296 were determined by different methods as 45, 60, 70 cm between rows, and 3, 6, 9, 12, 15 cm between plants. The highest productivity is shown in options with a row spacing of 45, seedling thickness of 9 - 12 cm, 34.4 - 34.6 per hectare from sample K-295; The sample K-296 yielded 34.2-34.3 tons per hectare [24].

N. N. Balashova, in her scientific works published in recent years, writes that peas are grown in small areas in lower Povalje, Saratov, Orenburg, Penza, Astrakhan and Omsk regions of Russia. Chickea is a suitable companion crop for wheat in the Russian conditions. He noted that when wheat was planted after chickea, the yield increased from 26.4 t/ha to 35 t/ha. Currently, the Kabuli type of chickpea is being developed by the ICARDA International Research Institute for Arid Regions. Due to the fact that peas do not require nitrogen and are a crop that is resistant to any unfavorable conditions, its prospects are expanding more and more [21].

M.G. Saxena noted the damage of peas by Ascochyta robici and Fusarium rasintectum fungi in Syrian soil and climate conditions. He found that chickpea yields increased by 73% when irrigated compared to non-irrigated conditions in Syria, and 65% when planted before winter compared to spring planting [12, 13, 19].

R.S.Malhotra and others found out that some species were slightly damaged by frost when they were planted in the fall and evaluated the cold resistance of different varieties of chickea in different soil and climate conditions of India [7, 17, 18].

Poma, I., Sarno, R., Noto, F. and Zora, conducted experiments on the planting pattern and thickness of chickea, and considered that the best planting pattern for chickea should be 40 x 10 cm, and the thickness should be 25 plants per 1 m2 [10].

VD Patil, YS Nerkar, DK Dayama recommended sowing 22.5 - 30.0 cm between rows and 5 cm between plants from November 15 to December 15 to obtain higher yield from Indian cultivar ICCC-4 [9].

T. Wery planted chickea in French conditions from November 15 to December 15, and noted that when 60-80 plants were left on 1 m2, he got abundant and high-quality chickea [20].

S.S. Grewal believes that irrigation is the main factor in growing a rich crop of chickpeas in Indian conditions. According to the results of the research, it was observed that the quality of the grain improves along with the abundant yield of peas when irrigated [4].
B. Sandhu conducted an experiment on the irrigated flat and sandy land of India and achieved 18.7-21.4 t/ha of chickea [11].

MATERIALS AND METHODS

Field experiments were conducted in the experimental field of Guzor district branch and Kamashi district branch of Southern Agricultural Scientific Research Institute. Experiments in field conditions were conducted in the field experiment area of the Laboratory of Genetics and Breeding of Legumes. Experiments in laboratory conditions were carried out in the institute's "Laboratory of Plant Biochemistry and Evaluation of Quality Indicators" and "Laboratory of Organo-Mineral Fertilizers and Agrochemical Gross Analysis".
The experiment layout is based on Complete block design and Alpha lattice design of GenStat 13 software. Phenological observations, calculations and analyzes are carried out according to the method of the All-Union Plant Science Institute VIR, 1984, and biometric analyzes are carried out according to the methods of the Center for Testing Agricultural Crops (1985, 1989).
Technological quality indicators of grain of autumn chickea grown in the experimental field were determined according to methodological manuals "Metodycheskie rekomendatsii po otsenke kachestvo zerna", "Metody biokhimicheskogo issledovaniya rastenii".
Statistical analyzes were performed based on the method of B.A. Dospekhov (1985).
The amount of chlorophyll pigment in plant leaves was measured and compared among varieties during the conversion of sunlight into energy through photosynthesis. For this, it was done by sending a wave to the specified surface of the leaves using the "Chlorophyll Meter SPAD-502 Plus" device available at the institute.

RESULTS AND DISCUSSION

Research work was carried out in the experimental area of Guzor department of the Southern Agricultural Scientific Research Institute to select productive, mechanized and high photosynthetic productivity varieties of winter chickpea in irrigated fields. 20 cultivars and lines were planted in 3 replications on a plot area of 10 m^2 in the winter chickpea competitive cultivar trial nursery. Planting of field experiments was carried out on November 25.

Table-1. Field germination of winter chickpea varieties and lines, Guzor-2022.

№	Name of genotypes	Planting time	Germination date	Field germination, %		
				Number of planting seeds, pcs	The number of germinated plants, pcs	Germination, %
1	**Obod (check)**	25.11.21	17.01.22	145	143	98.6
2	**Polvon (check)**	25.11.21	19.01.22	145	138	95.2
3	KR-20-LCAYT-RF-1	25.11.21	17.01.22	145	142	97.7
4	KR-20-LCAYT-RF-2	25.11.21	19.01.22	145	143	98.4
5	KR-20-LCAYT-RF-3	25.11.21	17.01.22	145	140	96.3
6	KR-20-LCAYT-RF-5	25.11.21	20.01.22	145	142	97.7
7	KR-20-LCAYT-RF-6	25.11.21	18.01.22	145	138	94.9
8	KR-20-LCAYT-RF-7	25.11.21	17.01.22	145	139	95.6
9	KR-20-LCAYT-RF-8	25.11.21	19.01.22	145	142	98.2
10	KR-20-LCAYT-RF-10	25.11.21	18.01.22	145	143	98.9

11	KR-20-LCAYT-RF-11	25.11.21	17.01.22	145	140	96.3
12	KR-20-LCAYT-RF-12	25.11.21	20.01.22	145	139	95.9
13	KR-20-LCAYT-RF-13	25.11.21	18.01.22	145	142	98.2
14	KR-20-LCAYT-RF-14	25.11.21	17.01.22	145	140	96.8
15	KR20-CICTN-01	25.11.21	18.01.22	145	138	94.9
16	KR20-CICTN-11	25.11.21	20.01.22	145	138	95.2
17	KR20-CICTN-17	25.11.21	19.01.22	145	142	98.2
18	KR20-CICTN-24	25.11.21	17.01.22	145	140	96.6
19	KR20-CICTN-33	25.11.21	20.01.22	145	142	98.2
20	KR20-CICTN-37	25.11.21	18.01.22	145	143	98.9
	Minimum	**25.11.21**	**17.01.22**	**145**	**138**	**94.9**
	Mean	**25.11.21**	**18.01.22**	**145**	**141**	**97.0**
	Maximum	**25.11.21**	**20.01.22**	**145**	**143**	**98.9**
	LSD					**0.76**
	LSD %					**0.79**
	CV %					**0.5**

Germination of varieties and lines took place on January 17-20, depending on weather conditions. It was determined that the field germination of the seeds of the varieties and lines was in the range of 94.9-98.9 percent.

The growth development of winter chickpea varieties and lines was studied in the phases of branching, budding, flowering, podding and full maturing. It was determined that the branching phase was on February 14-22, the budding phase was on April 2-10, flowering was on April 8-19, pod formation was on April 22-May 4, and the full maturing phase was on June 1-11.

Table-2. Growth phases of winter chickpea varieties and lines, Guzor-2022.

№	Name of genotypes	Branching date	Budding date	Flowering date	Podding date	Maturity date	Days to maturity date
1	**Obod (check)**	20.02.22	07.04.22	12.04.22	28.04.22	05.06.22	139
2	**Polvon (check)**	18.02.22	08.04.22	15.04.22	30.04.22	06.06.22	138
3	KR-20-LCAYT-RF-1	14.02.22	02.04.22	08.04.22	24.04.22	02.06.22	136
4	KR-20-LCAYT-RF-2	21.02.22	09.04.22	16.04.22	02.05.22	07.06.22	139
5	KR-20-LCAYT-RF-3	15.02.22	03.04.22	10.04.22	22.04.22	04.06.22	138
6	KR-20-LCAYT-RF-5	21.02.22	10.04.22	16.04.22	28.04.22	09.06.22	140
7	KR-20-LCAYT-RF-6	18.02.22	09.04.22	14.04.22	26.04.22	11.06.22	144
8	KR-20-LCAYT-RF-7	20.02.22	09.04.22	17.04.22	01.05.22	08.06.22	142
9	KR-20-LCAYT-RF-8	18.02.22	03.04.22	08.04.22	24.04.22	01.06.22	133
10	KR-20-LCAYT-RF-10	14.02.22	04.04.22	19.04.22	04.05.22	03.06.22	136
11	KR-20-LCAYT-RF-11	18.02.22	08.04.22	14.04.22	29.04.22	09.06.22	143
12	KR-20-LCAYT-RF-12	19.02.22	07.04.22	13.04.22	26.04.22	11.06.22	142
13	KR-20-LCAYT-RF-13	15.02.22	05.04.22	11.04.22	23.04.22	04.06.22	137
14	KR-20-LCAYT-RF-14	18.02.22	06.04.22	14.04.22	26.04.22	07.06.22	142
15	KR20-CICTN-01	21.02.22	10.04.22	16.04.22	30.04.22	09.06.22	142
16	KR20-CICTN-11	22.02.22	08.04.22	15.04.22	27.04.22	11.06.22	142
17	KR20-CICTN-17	17.02.22	04.04.22	09.04.22	24.04.22	08.06.22	140

18	KR20-CICTN-24	21.02.22	06.04.22	11.04.22	28.04.22	04.06.22	138
19	KR20-CICTN-33	21.02.22	08.04.22	15.04.22	24.04.22	08.06.22	139
20	KR20-CICTN-37	17.02.22	07.04.22	14.04.22	27.04.22	02.06.22	135
	Minimum	**14.02.22**	**02.04.22**	**08.04.22**	**22.04.22**	**01.06.22**	**133**
	Mean	**18.02.22**	**07.04.22**	**13.04.22**	**27.04.22**	**06.06.22**	**139**
	Maximum	**22.02.22**	**10.04.22**	**19.04.22**	**04.05.22**	**11.06.22**	**144**
	LSD						**1.32**
	LSD %						**0.95**
	CV %						**0.6**

The vegetation period was 133-144 days. The model Abad variety reached the full maturing phase in 139 days and the Polvon variety in 138 days, while 5 winter chickpea lines were found to be early compared to the model varieties.

Currently, in the cultivation of winter chickpea varieties, selection of varieties suitable for harvesting with the help of mechanization and introduction into production remains one of the most urgent tasks. Because the main part of the grown crop is collected by manual labor. Therefore, when choosing varieties suitable for mechanized harvesting of winter chickpea, it is necessary to take into account the location of the lower pods and the length of the plant with the surface of the soil.

Table-3. Selection of varieties and lines of winter chickpea adapted to mechanization, Guzor-2022.

№	Name of genotypes	Plant height, cm				The location of the lower pods (relative to the soil surface), cm			
		Rep-1	Rep-2	Rep-3	Mean	Rep-1	Rep-2	Rep-3	Mean
1	**Obod (check)**	53.6	52.6	54.2	**53.5**	16.3	17.3	16.9	**16.8**
2	**Polvon (check)**	46.8	45.9	46.4	**46.4**	12.6	13.2	12.9	**12.9**
3	KR-20-LCAYT-RF-1	62.6	63.5	61.8	**62.6**	18.6	19.4	19.1	**19.0**
4	KR-20-LCAYT-RF-2	42.6	43.2	42.8	**42.9**	14.2	15.3	13.8	**14.4**
5	KR-20-LCAYT-RF-3	59.2	60.4	61.6	**60.4**	20.3	18.2	19.6	**19.4**
6	KR-20-LCAYT-RF-5	51.4	52.6	50.8	**51.6**	14.3	15.2	14.8	**14.8**
7	KR-20-LCAYT-RF-6	41.4	42.3	40.7	**41.5**	15.2	15.3	15.1	**15.2**
8	KR-20-LCAYT-RF-7	38.9	39.2	38.1	**38.7**	12.6	12.8	12.3	**12.6**
9	KR-20-LCAYT-RF-8	64.3	65.3	63.4	**64.3**	20.8	21.2	20.6	**20.9**
10	KR-20-LCAYT-RF-10	62.4	60.6	59.7	**60.9**	18.6	19.2	18.9	**18.9**
11	KR-20-LCAYT-RF-11	45.3	46.8	46.2	**46.1**	13.6	14.2	14.1	**14.0**
12	KR-20-LCAYT-RF-12	52.3	54.2	51.9	**52.8**	15.3	16.2	16.4	**16.0**
13	KR-20-LCAYT-RF-13	57.6	58.3	58.1	**58.0**	19.6	18.8	19.2	**19.2**
14	KR-20-LCAYT-RF-14	39.5	38.2	39.7	**39.1**	11.6	12.5	12.4	**12.2**
15	KR20-CICTN-01	44.3	45.2	45.8	**45.1**	15.6	16.2	15.8	**15.9**
16	KR20-CICTN-11	49.2	50.6	48.3	**49.4**	14.3	14.7	14.6	**14.5**
17	KR20-CICTN-17	60.4	60.8	60.7	**60.6**	18.9	19.2	18.8	**19.0**
18	KR20-CICTN-24	45.9	46.3	46.2	**46.1**	15.3	15.1	15.6	**15.3**
19	KR20-CICTN-33	53.6	52.4	51.7	**52.6**	18.3	19.2	19.6	**19.0**
20	KR20-CICTN-37	63.2	64.8	63.4	**63.8**	20.8	21.3	21.7	**21.3**
	Minimum				**38.7**				**12.2**
	Mean				**51.8**				**16.6**
	Maximum				**64.3**				**21.3**

LSD	**1.31**
LSD %	**2.52**
CV %	**1.6**

According to the results of the 3rd return, when analyzing the plant height of winter chickpea varieties and lines, it was found that the average height was 38.7-64.3 cm. The standard plant height was 53.5 cm in the Abad variety and 46.4 cm in the Polvon variety. According to the statistical mathematical analysis, it was observed that the plant height was higher in 7 lines. The height of the 7 lines selected according to the plant height indicator was 58.0-64.3 cm.

It was found that the distance between the lower pods and the soil surface of winter chickpea varieties and lines was in the range of 12.2-21.3 cm. It was found that the lower pods were located at a distance of 16.8 cm from the soil surface in the case of the Obad variety and 12.9 cm in the Polvon variety. It was found that there were 8 lines with higher performance than the model varieties.

7 lines with a high plant height and a large distance of the lower pods from the soil surface were selected and used for breeding to create new varieties adapted to mechanization.

The number of pods per bush and the number of grains in pods and the number of grains per bush are particularly important for increasing productivity. The average number of pods per plant in 20 varieties and varieties of winter chickpea studied was from 27 to 49 pieces. The number of pods in one plant was 33 in the model Abad variety and 29 in the Polvan variety. It was found that there were 12 lines with higher number of pods than the model cultivars.

When the number of grains per plant was studied, it was noted that it was in the range of 30-51. It was found that there are 11 lines where the number of grains per plant is higher than that of the model varieties.

The weight of 1000 grains of winter chickpea varieties and rows is the main indicator of high productivity. According to the demand of the population, there is a great need for large grain pea grains.

It was noted that the weight of 1000 grains of 20 varieties and varieties of winter chickpeas was in the range of 266.1-370.1 g. The weight of 1000 grains was 322.6 g in the Andoza Obad variety, while this indicator was found to be higher in 8 varieties and lines.

Table-4. Productivity indicators of winter chickpea varieties and lines, Guzor-2022.

№	Name of genotypes	The number of pods per plant, pcs				The number of grains per plant, pcs	TKW, g
		1 grains	2 grains	3 grains	Total		
1	**Obod (check)**	28	4	1	33	39	322.6
2	**Polvon (check)**	27	2	0	29	31	362.4
3	KR-20-LCAYT-RF-1	35	3	1	39	45	357.5
4	KR-20-LCAYT-RF-2	25	2	0	27	30	320.8
5	KR-20-LCAYT-RF-3	36	5	1	42	49	370.1
6	KR-20-LCAYT-RF-5	33	5	0	38	42	295.3
7	KR-20-LCAYT-RF-6	27	2	0	29	32	283.4
8	KR-20-LCAYT-RF-7	34	4	0	38	43	266.1
9	KR-20-LCAYT-RF-8	35	3	2	40	46	345.6
10	KR-20-LCAYT-RF-10	39	4	1	43	48	365.9
11	KR-20-LCAYT-RF-11	32	3	1	35	39	310.8
12	KR-20-LCAYT-RF-12	30	1	0	31	33	272.1
13	KR-20-LCAYT-RF-13	35	4	0	39	44	348.1

14	KR-20-LCAYT-RF-14	27	1	1	29	32	319.3
15	KR20-CICTN-01	36	2	0	38	41	292.4
16	KR20-CICTN-11	38	3	1	42	47	272.0
17	KR20-CICTN-17	41	4	0	45	49	356.1
18	KR20-CICTN-24	26	4	0	30	35	267.2
19	KR20-CICTN-33	28	4	0	32	36	303.2
20	KR20-CICTN-37	46	3	0	49	51	362.9
	Minimum	**25**	**1**	**0**	**27**	**30**	**266.1**
	Mean	**33**	**3**	**1**	**37**	**41**	**319.7**
	Maximum	**46**	**5**	**2**	**49**	**51**	**370.1**
	LSD					**2.02**	**3.37**
	LSD %					**4.97**	**1.05**
	CV %					**3.1**	**0.7**

The main indicator of all agricultural crops is productivity. All other indicators serve for selection aimed at increasing productivity.

In the framework of the study, it was found that the yield indicators of winter chickpea varieties and rows were in the range of 12.9-26.1 ts/ha. Productivity was 18.1 t/ha in model Abad variety and 15.9 t/ha in Polvon variety, and it was found that the productivity in 7 lines is superior to model varieties.

When studying the correlative relationship of productivity with other indicators, there is a negative correlation with the vegetation period of r=-0.69; r=0.88 with the number of pods per plant; r=0.89 with the number of grains in one plant; r=0.79 with a weight of 1000 grains; it was found that there is a strong positive correlation with the amount of protein, r=0.79.

3.2.5-жадвал

Table-5. Yield and protein content of winter chickpea varieties and lines, Guzor-2022.

№	Name of genotypes	Grain yield, c/ha				Protein content, %
		Rep-1	Rep-2	Rep-3	Mean	
1	**Obod (check)**	18.2	18.8	17.4	**18.1**	26.7
2	**Polvon (check)**	15.3	16.4	15.9	**15.9**	24.2
3	KR-20-LCAYT-RF-1	22.2	23.1	23.7	**23.0**	29.1
4	KR-20-LCAYT-RF-2	13.6	14.2	14.5	**14.1**	22.3
5	KR-20-LCAYT-RF-3	25.4	26.3	25.9	**25.9**	27.7
6	KR-20-LCAYT-RF-5	17.2	18.4	17.6	**17.7**	24.3
7	KR-20-LCAYT-RF-6	13.5	12.8	12.4	**12.9**	22.2
8	KR-20-LCAYT-RF-7	15.3	16.4	15.8	**15.8**	25.9
9	KR-20-LCAYT-RF-8	22.6	21.8	21.6	**22.0**	29.0
10	KR-20-LCAYT-RF-10	24.3	25.1	24.7	**24.7**	28.5
11	KR-20-LCAYT-RF-11	17.4	17.3	18.2	**17.6**	25.5
12	KR-20-LCAYT-RF-12	12.7	13.8	13.4	**13.3**	23.9
13	KR-20-LCAYT-RF-13	20.8	21.6	20.9	**21.1**	29.1
14	KR-20-LCAYT-RF-14	14.8	14.2	14.6	**14.5**	26.7
15	KR20-CICTN-01	16.2	15.9	16.1	**16.1**	21.9
16	KR20-CICTN-11	18.3	18.4	17.6	**18.1**	24.4
17	KR20-CICTN-17	24.8	25.6	25.3	**25.2**	29.3
18	KR20-CICTN-24	13.8	13.2	12.8	**13.3**	25.8
19	KR20-CICTN-33	15.2	15.6	16.1	**15.6**	24.7
20	KR20-CICTN-37	26.3	26.1	25.8	**26.1**	28.1

Minimum	**12.9**	**21.9**
Mean	**18.6**	**26.0**
Maximum	**26.1**	**29.3**
LSD	**0.77**	**0.57**
LSD %	**4.14**	**2.18**
CV %	**2.6**	**1.3**

It was found that the protein content of the grain of winter chickpeas was in the range of 21.9-29.3 percent. It was noted that the amount of protein was 26.7% in the sample Abad variety and 24.2% in the Polvan variety. It was found that there are 7 lines in which the protein content of the grain is superior to the model varieties.

In order to evaluate the photosynthetic productivity of winter chickpea cultivars and lines, the amount of green biomass was estimated using the GreenSeeker tool in 3 development phases. In this case, the device evaluates the degree of greenness of varieties and lines and the coverage of the earth with leaves using infrared rays. It was found that the amount of green biomass of winter chickpea varieties and lines was 0.244-0.312 in the budding phase, 0.275-0.375 in the flowering phase, and 0.456-0.618 in the podding phase. It was noted that there were 10 lines with higher green biomass content than the model cultivars.

Table-6. Selection of varieties and lines of high photosynthetic productivity of winter chickpea, Guzor-2022.

№	Name of genotypes	Grain yield, c/ha	Level of greenness, NDVI			Chlorophyll content		
			Budding date	Flowering date	Podding date	Budding date	Flowering date	Podding date
1	**Obod (check)**	18.1	0.258	0.318	0.527	32.9	43.2	50.8
2	**Polvon (check)**	15.9	0.245	0.296	0.456	29.2	38.8	44.5
3	KR-20-LCAYT-RF-1	23.0	0.294	0.361	0.590	32.9	45.8	53.8
4	KR-20-LCAYT-RF-2	14.1	0.230	0.287	0.494	26.1	37.0	45.9
5	KR-20-LCAYT-RF-3	25.9	0.308	0.375	0.603	34.9	42.0	49.0
6	KR-20-LCAYT-RF-5	17.7	0.261	0.314	0.526	30.9	36.5	44.0
7	KR-20-LCAYT-RF-6	12.9	0.280	0.303	0.504	33.0	39.4	46.6
8	KR-20-LCAYT-RF-7	15.8	0.234	0.284	0.474	28.4	40.1	45.6
9	KR-20-LCAYT-RF-8	22.0	0.294	0.346	0.574	35.9	46.1	55.1
10	KR-20-LCAYT-RF-10	24.7	0.312	0.368	0.590	33.0	43.4	51.3
11	KR-20-LCAYT-RF-11	17.6	0.263	0.320	0.525	27.7	36.5	43.2
12	KR-20-LCAYT-RF-12	13.3	0.236	0.275	0.479	29.7	36.0	44.4
13	KR-20-LCAYT-RF-13	21.1	0.288	0.357	0.580	34.9	41.6	47.9
14	KR-20-LCAYT-RF-14	14.5	0.254	0.288	0.537	30.8	37.4	45.9
15	KR20-CICTN-01	16.1	0.246	0.296	0.488	26.8	34.5	42.9
16	KR20-CICTN-11	18.1	0.291	0.334	0.545	32.8	38.1	45.7
17	KR20-CICTN-17	25.2	0.305	0.374	0.618	36.3	43.2	52.9
18	KR20-CICTN-24	13.3	0.257	0.296	0.534	27.2	35.7	45.1
19	KR20-CICTN-33	15.6	0.224	0.285	0.493	29.4	37.0	44.4
20	KR20-CICTN-37	26.1	0.296	0.352	0.610	33.5	40.8	48.2
	Minimum	**12.9**	**0.224**	**0.275**	**0.456**	**26.1**	**34.5**	**42.9**
	Mean	**18.6**	**0.269**	**0.321**	**0.537**	**31.3**	**39.7**	**47.4**
	Maximum	**26.1**	**0.312**	**0.375**	**0.618**	**36.3**	**46.1**	**55.1**
	LSD	**0.77**						

LSD %	**4.14**
CV %	**2.6**

It was found that the correlative relationship between the amount of green biomass and the yield is strongly positive, r=0.83 in the budding phase, r=0.94 in the flowering phase, and r=0.88 in the podding phase.

The amount of chlorophyll in the leaves of the varieties and lines was 26.1-36.3% in the budding phase, 34.5-46.1% in the flowering phase, and 42.9-55.1% in the podding phase. 8 varieties and lines with high chlorophyll content in leaves were found to have high photosynthetic productivity.

Conclusions: Among the 20 varieties and lines studied in the nursery of winter chickpea competition in irrigated fields, 3-4 days earlier compared to standard varieties, adapted to mechanization, plant height 58.0-64.3 cm, weight of 1000 grains 345.6-370.1 g, 7 lines with high photosynthetic productivity with yield of 21.1-26.1 t/ha, protein content of 27.7-29.3% were selected. Obikor (KR20-CICTN-37) variety, which is early-early, fruitful, adapted to mechanization, has high photosynthetic productivity, and its indicators are higher than standard varieties, was selected in the competitive variety testing nursery, and it was recommended to submit it to the Agricultural Crops Variety Testing Center.

REFERENCE

[1] Amanov, O. A., Otakulova, D. A., & Kayumov, N. S. (2021). Study of chickchickpea lines in rainfed areas on the basis of yield and grain quality traits. In *Наука, Образование, Общество: Актуальные Вопросы, Достижения и Инновации* (pp. 34-36).

[2] Amirkulov, O. S., Ziyadov, E. O., & Kayumov, N. S. (2021). Selection of chickchickpea lines in rainfed areas on the basis of yield and protein content traits. In *Наука, образование, инновации: актуальные вопросы и современные аспекты* (pp. 63-65).

[3] Dilmurodov, S., & Kayumov, N. (2022). Selection of productive lines of winter chickchickpea for dryland areas. *Theoretical aspects in the formation of pedagogical sciences*, *1*(1), 27-31.

[4] Grewal, S. S., Sud, A. D., Singh, K., & Singh, P. (1984). Effect of minimal irrigation on profile-water use, water expense and yield of chickchickpea as modified by seasonal rainfall in shiwalik region.

[5] Kayumov, N. S. (2021). Selection of drought resistant lines of chickchickpea for rainfed areas with low rainfall. In *Наука, образование, инновации: актуальные вопросы и современные аспекты* (pp. 59-62).

[6] Kayumov, N. S., & Dilmurodov, S. D. (2020). Selection of heat and drought tolerant varieties and lines of chickchickpea for rainfed areas. In *Высокие технологии, наука и образование: актуальные вопросы, достижения и инновации* (pp. 129-131).

[7] Malhotra, R. S., & Singh, K. B. (1991). Gene action for cold tolerance in chickchickpea. *Theoretical and Applied Genetics*, *82*(5), 598-601.

[8] Paliwal, K. K., Ramgiri, S. R., Lal, M. S., Kottu, G. K., & Mishra, R. (1987). Correlation and path coefficient analysis in chickchickpea Cicer arietinum. *Legume Research (India)*.

[9] Patil, V. D., Nerkar, Y. S., & Dayama, D. K. (1987). Inheritance of quantitative characters in chickchickpea. *Indian Journal of Agricultural Sciences (India)*.

[10] Poma, I., Sarno, R., Noto, F., & Zora, D. (1990). Effects of sowing density and arrangement on quality and yield characteristics of chickchickchickpea. *Informatore Agrario*, *46*(40), 47-49.

[11] Sandhu, B. S., Prihar, S. S., Khera, K. L., & Sandhu, K. S. (1978). Scheduling irrigation to chickchickpea [India]. *Indian Journal of Agricultural Sciences*.

[12] Saxena, M. C. (1980, February). Recent advances in chickchickpea agronomy. In *Proceedings of the international workshop on chickchickpea improvement* (Vol. 28, pp. 89-96). Hyderabad, India: ICRISAT.

[13] Saxena, M. C. (1990). Problems and potential of chickchickpea production in the nineties. *Chickchickpea in the Nineties*, 13-25.

[14]Shakirjanovich, K. N., & Dilmurodovich, D. S. (2021). Analysis of yield and protein content of drought-resistant chickchickpea lines for rainfed areas. *International journal of discourse on innovation, integration and education*, *2*(1), 108-111.

[15]Shakirjonovich, K. N. (2023, January). Field study of heat and drought resistance of chickchickchickpea varieties and samples in rainfried areas southern institute of agricultural scientific research. In *Proceedings of International Conference on Modern Science and Scientific Studies* (Vol. 2, No. 1, pp. 4-7).

[16]Shakirjonovich, K. N., & Dilmuradovich, D. S. (2023). Productivity, Grain Quality Indicator and Continuity of the Growth Period of Chickchickchickpea Varieties and Samples. *Vital Annex: International Journal of Novel Research in Advanced Sciences*, *2*(1), 4-10.

[17]Singh, K. B., Malhotra, R. S., Halila, M. H., Knights, E. J., & Verma, M. M. (1993). Current status and future strategy in breeding chickchickpea for resistance to biotic and abiotic stresses. *Euphytica*, *73*(1), 137-149.

[18]Singh, K. B., Malhotra, R. S., Saxena, M. C., & Bejiga, G. (1997). Superiority of winter sowing over traditional spring sowing of chickchickpea in the Mediterranean region. *Agronomy Journal*, *89*(1), 112-118.

[19]Erskine, W., Tufail, M., Russell, A., Tyagi, M. C., Rahman, M. M., & Saxena, M. C. (1993). Current and future strategies in breeding lentil for resistance to biotic and abiotic stresses. *Euphytica*, *73*(1), 127-135.

[20]Wery, J. (2005). Differential effects of soil water deficit on the basic plant functions and their significance to analyse crop responses to water deficit in indeterminate plants. *Australian Journal of Agricultural Research*, *56*(11), 1201-1209.

[21]Балашова, Н. Н., & Чекрыгина, Т. А. (2013). Особенности применения мсфо 41"Сельское хозяйство" сельскохозяйственными предприятиями в современных условиях. *Бизнес. Образование. Право*, (2), 105-108.

[22]Зиядов, Э. О., Каюмов, Н. Ш., & Аманов, О. А. (2020). Лалмикор майдонларда нўхатнинг эртапишар ва ҳосилдор нав ва намуналарини танлаш. *Молодой ученый*, (38), 215-217.

[23]Файзуллаева, Д., Каюмов, Н. Ш., & Дилмуродов, Ш. Д. (2020). Лалмикор майдонлар учун нўхатнинг эртапишар тизмалари селекцияси. *Молодой ученый*, (34), 161-163.

[24]Bobokulov, Z. R., & Bobomurodov, Z. S. (2021). Productivity Of Chikpea Varieties And The Effect Of Different Planting Times And Depths On Grain Quality Indicators. *NVEO-NATURAL VOLATILES & ESSENTIAL OILS Journal| NVEO*, 7524-7532.