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### Review article

## Chickpea breeding in the Dry arid region of southern Kazakhstan

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### ABSTRACT

This article describes the state of modern chickpea breeding in the fields that conduct chickpea breeding at the Krasnovodopadskaya agricultural experimental station. Research samples of chickpeas from ICARDA at all breeding stages, samples with productivity higher than standard were selected. Selection and valuable traits were revealed when growing collection samples of chickpeas exposed for research in the following stages. Currently, there is a protein shortage in Kazakhstan to overcome this situation, it is important to identify new varieties of chickpeas that give more yield for the further development of the agricultural industry. Studying the samples of chickpea culture, the article identified samples for various economically valuable traits.

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### 1. Introduction

Chickpeas (*Cicer arietinum* L.) are one of the most important protein crops in world agriculture. According to numerous researchers, hard-to-reach phosphorous compounds after chickpeas are available for agricultural crops. Its seeds contain 23.5-28.5 % protein, 4.67-8.19 % oil and up to 42.5-59.28% carbohydrates. It is a good source of pyridoxine, pantoic acid, choline, and phosphorus. Chickpeas contain a significant amount of mineral salts: potassium, calcium, magnesium, sulfur, ammonium, boron, iron, zinc, etc. The content of

magnesium, cobalt and iron is higher than in soy and peas. Dry chickpea grain contains vitamins: PP, A, B1, B2, B6 (Aituev et al., 2004).

Speaking of chickpeas, you can list a number of positive qualities. First, this plant has the ability to accumulate in its seeds, as well as in the green mass, a significant amount of vegetable protein, which is the most important food and feed product (they are extremely important for full-fledged animal feeding). Secondly, these plants are of great agrotechnical importance as nitrogen collectors (this is explained by the activity of nodule bacteria that settle on the roots of legumes and are able to absorb free nitrogen from the air and translate it into forms accessible to plants). Third, legumes have an increased assimilation capacity of the root system in relation to hard-to-dissolve phosphorous compounds that are not readily available for most cereals, i.e. they are a precursor for cereals and other crops. Fourth, chickpeas maintain a high market price (Berlyand and Kryuchev, 1988).

However, chickpeas, as a drought-resistant crop, are of great interest to the south of Kazakhstan and, in the presence of more precocious varieties, can be successfully cultivated here. Another feature of chickpeas, unlike other legumes, is that it is less affected by diseases and pests (Kovalev et al., 1988).

In the current conditions of agricultural development, when the republic is on the eve of joining the WTO, the main task of Kazakhstan's breeders is to create more productive, competitive, commercial varieties of various crops, including chickpea varieties. Thus, over the past 20 years, such genetic sources as Yubileynaya 100 and ICARDA-1 have been of great importance for the implementation of the chickpea breeding program, increasing its immunity and productivity. Taking into account the needs of agricultural producers in Southern Kazakhstan and the direction of farmers' demand towards creating high-quality, early-maturing varieties of the rainfed ecotype, promising numbers F97-141, F95-52, F 97-95, etc. are currently being tested for productivity (Коньирбеков, 2007).

Highest number of chickpea samples (17,258 from 43 countries), it is concentrated in gen-bank the ICRISAT Genbank, India. The collection is studied by 22 morpho-agronomic features. In ICANDRD and the collection includes 12,448 samples of the cultural chickpea species. The study was based on 24 characteristics divided into 2 groups: morpho-agronomic and biotic, as well as abiotic stresses (Namazbekova, 2011).

### 1.1. Soil and climate zones of the region

Climate: The territory of Bogara in the South of Kazakhstan is fully included in the Turan climatic province, the main difference between which and the typical continental subtropical climate of Iran and Afghanistan is a significant severity of the thermal region of the winter half-year and, to a certain extent, a shift in the annual precipitation maximum from winter to spring (Babushkin L. N., 1964).

The soil: South Kazakhstan regions are represented by gray soils and are confined to the foothills and foothill plains of the western spurs of the Tien Shan, which represent a low stage in the vertical zoning system. It occurs in the range of absolute heights from 200-350 to 900-1000 m. Depending on the climatic features and vegetation cover, the following subtypes of gray soils are distinguished in the territory of the region according to the degree of humus content and the severity of morphological and agrochemical properties, which change as the absolute heights decrease: serozems are dark (gray-brown carbonate), ordinary serozems and light serozems. Humus content 0.9-1.1%.

Scientific novelty of research: Проведен исследования 150 samples of chickpeas from East KARD and 70 samples of local chickpeas were studied for economic and breeding valuable traits in rainfed conditions in the following areas: Krasnovodopadsky Agricultural Complex.

## 2. Materials and methods

Phenological observations: a generally accepted method of VIR 1986. The main phases of chickpea plant development are noted. To determine the breeding value based on phenological characteristics, the duration of interphase periods is calculated: "Shoots-budding" and "budding-maturation").

Crop structure: 30 plants each from selected sheaves from accounting sites. The following elements of the crop structure of the tested varieties are taken into account: the length of the stem, the number of internodes (total and productive), the number of beans per plant, the number of seeds in the bean and per plant, and the weight of seeds from the 1st plant.

"Methodological guidelines for the study of the world collection of VIR", - L-1997.

Plant height is an average of 5-10 plants, measured from the base of the plant to the top of the bean. The number of beans in a plant is an average of 5-10 plants.

Methodology for mathematical processing of experimental data, defined by B. A T. Dospekhov.

Breeding nurseries are carried out according to the method on plots of 5, 10, 20 m<sup>2</sup> in 2-fold repetition. Sowing was carried out using the SSFK-7 seed drill. Уборка Collection and breeding nurseries were cleaned manually at the beginning of full ripeness.

### 3. Results and discussion

In the reporting year на всех питомнике испытывались, 220 varieties of legumes were tested at all nurseries селекции Krasnovodopadsky Agricultural Complex.

Plant care during the growing season consisted of two manual weeding operations. Having laid out the experimental plot in accordance with the scheme, the nursery was laid out with the SSFC-7 seed drill (April 3, 2021). After the appearance of themoves, work was carried out on the design of the experimental site with the placement of numbered pegs, stencils and fixing sites in the amount of 10 pieces, counting the density of seedlings and selecting sheaves.

#### 3.1. Results of studying varieties and samples

Phenological observations were made on seedlings in the selection and collection nurseries. В коллекционном питомнике 150 samples of chickpeas were studied in the collection nursery. The emergence of seedlings was noted on 10-12 days after sowing.

**Table 1**

Growing season in collection nurseries.

n/a number	Varietal samples	Start of flowering, date	Time of bean formation, date	Grain maturation time, date
1	Symbat 1 St	22.05.2021	31.05.2021	29.06.2021
2	F10-01S	20.05.2021	29.05.2021	27.06.2021
3	F10-29C	20.05.2021	29.05.2021	27.06.2021
4	F10-16s	19.05.2021	28.05.2021	26.06.2021
1	2	3	4	5
5	F10-06c	19.05.2021	28.05.2021	26.06.2021
6	F10-20C	19.05.2021	28.05.2021	27.06.2021
7	F10-24C	19.05.2021	28.05.2021	27.06.2021
8	F10-07s	20.05.2021	29.05.2021	28.06.2021
9	F10-35S	18.05.2021	27.05.2021	25.06.2021
10	F10-19s	21.05.2021	30.05.2021	28.06.2021

**Table 2**

Results of selected samples by yield PSI on Bogar in 2021.

Selection number	Blossom	Yield c/ha	+/- to the standard
			c/ha
Simbat art.	22.05	5,1	0,0
F10-263c	18.05	5,6	+0,5
F10-100c	19.05	5,5	+0,4
F10-76c	20.05	5,3	-0,2
F10-159c	20.05	5,5	+0,4
F10-92c	20.05	5,7	+0,6
F10-183c	20.05	5,9	+0,8
F10-209c	22.05	5,0	+0,1
F10-113c	22.05	4,8	-0,3

Phenological observations showed that 21 samples were discolored earlier by 3-5 days, the earliest numbers were F10-36c, FF10-30c and FF10-26c than the standard Symbat 1. The remaining chickpea samples were at or below the standard 2-3 days later. Chickpea variety "Symbat 1" matured on 31.06.2021, 21 varieties matured 2-4 days earlier. No complete ascochytiopsis attack was observed during immunological evaluation. No illnesses were observed. 20 numbers were tested in PSI.F6 samples (FF10-263c, F10-100c, F10-76c, F10-10-15976c, F10-159c, F10-92c, and F10-183c, F10-92c и F) with 2-4 days earlier flowering than the standard were installed in the PSI Symbat 1.

As can be seen from the data in Table 2, promising samples, F10-263c, F10-100c, F10-76-76c, F10-159c, F10-92c and F10-183c exceed the standard yield Symbat 1 ranged from +0.2 to +0.8 centners / ha. By the weight of 1000 grains, F10-100c - 370g., F10-76-76c – 360g, F10-92c – 375g were allocated, the rest were on par with the standard.

Phenological observations were carried out in KSI: 15 cultivars were identified by early germination; 20 cultivars were identified by growth intensity grade-samples - F97-171, F98-10, F98-88, F98-12, F98-25 сортотипы опережающих на 98-25 cultivars that were 1-2 days ahead of the standard Symbat 1. Standard grade Symbat 1 entered the flowering phase 22 on May 22 in comparison with the standard, flowering began on May 19 to 24. In the phase of flowering allocated 10 samples of chickpea in the bidding nursery (F98-101c, F98-50C, F98-81c, F98-12C F98-19s, F98-65C, F98-81c F98 95 ° C, F98-103c and F98-114c) at flowering, anticipating 2-3 day standard and "Symbat 1" (Table 3).

**Table 3**

Phenological observations and yield in KSI.

Selection number	branching	flowering	Bean formation	maturation	Yield c/ha	+/- to the standard
Symbat 1, article	26. 04	22. 05	04. 06	29. 07	6,2	
F97-101 with	23. 04	20. 05	01. 06	26. 07	7,2	+1,0
F97-50 with	24. 04	20. 05	02. 06	27. 07	7,1	+0,9
F97-81 with	24. 04	20. 05	02. 06	26. 07	6,5	+0,3
F97-12 with	23. 04	19. 05	01. 06	25. 07	7,5	+1,3
F97-19 with	23. 04	19. 05	01. 06	26. 07	6,6	+0,4
F97-65 with	24. 04	20. 05	02. 06	26. 07	6,9	+0,7
F97-81 with	25. 04	21. 05	03. 06	27. 07	7,0	+0,8
1	2	3	4	5	6	7
F97-95 with	25. 04	21. 05	03. 06	27. 07	7,5	+1,3
F03-103 with	24. 04	20. 05	02. 06	26. 07	7,2	+1,0
F98-114 with	23. 04	19. 05	01. 06	25. 07	7,1	+0,9

**Table 4**

Density of chickpea plants standing.

Grade	Plant height	Number of plants per 1 m <sup>2</sup>
Symbat 1, standard	45	30
F97-01 with	50	32
F97-16 with	16	31
F97-20 with	47	33
F97-12 with	55	35
F97-36 with	50	31
F9 to 18 with	49	31
F9-82c	50	31
F97-14 with	55	32
F9: 30am with	52	33
F9-23C	54	31

Field assessment was carried out on a 5-point scale for ascochytiopsis resistance and 10 samples were isolated. We studied the numbers based on the shape of the bush, tallness and ability to mechanized cleaning, with the

lower beans attached above 15cm and 15 varietal samples were identified. 10 cultivars were selected for drought resistance grade-samples.

Precocity: the flowering period of the central bean: precocious earlier up to 4 days than the standard, medium-ripened  $\pm 2$  days compared to the standard. Late ripening is 2-3 days later than the standard. Selected 10 samples on precocity ie F97-101c, F97-50C, F97-81c, F97-12C, F97-19s, F97-65C, F97-81c, F97 95 ° C, F97-103c and F97-114c 1-6 June to about prasowania beans ahead of the standard for 3-4 days.

Structural analysis: the number of beans, the nature of grains and the weight of 1000 seeds are determined. For chickpea varieties "Simbat 1" weight of 1000 seeds was 315 g, the nature of seeds was 740 g/l. The variety F97-12 was selected, the weight of 1000 seeds is 380 grams, the nature of seeds is 760 g/l. Plant height number F97-114-55-114 - 55cm, number of beans in 1 plant 18.0 pcs, seed weight per plant 11.4 g. This indicator is higher by 9-15-% compared to the variety "Symbat 1". The knotting rate of beans in one plant was from 15 to 20pcs of seeds. On the fixed sites, the density of plant standing in the volume of 10 plots was calculated (Table 4).

The density of plant standing by variety is  $\gamma$ Symbat 1-30 pcs/m<sup>2</sup>, F97-01c-32 pcs/m<sup>2</sup>, F97-16c-31 pcs/m<sup>2</sup>, F97-20c- 33 pcs/m<sup>2</sup>, F97-12c- 35 pcs/m<sup>2</sup>, F 97-36c-31 pc/m<sup>2</sup>. In April, due to low precipitation, the average height of chickpea plants ranged from 35 to 55cm.

According to the results of phenological observations, 5 cultivars were identified by precocity. Selection of autonomous non-commercial organizations in crops of 10 varietal samples based on biological and economically valuable traits. 10 cultivars were selected for drought resistance grade-samples. In the competitive nursery on bogar, 10 varieties of chickpeas were selected, which exceeded the standard yield from 1.0 to 2.1 centners/ha. The average yield of the standard was 5.5 c/ha, and these numbers are F97-06, F97-24, F97-36, F97-26, F97-18, F97-27, F97-14, F97-82, F97-13, F97-1111 above the standard (Symbat 1) was exceeded by 1-1. 3 centners / ha.

#### 4. Conclusion

Phenological observations were carried out in the collection nursery of 150 samples: 20 cultivars were identified according to the growth grade-samples rate: F97-171c, F98-10c, F98-88c, F98-12c, F98-25c leading by 4-5 days. Symbat 1, according to the number of branches, 30 cultivars were identified. Phenological observations showed that 21 samples were discolored earlier by 3-5 days, the earliest numbers were F10-36c, FF10-30c and FF10-26c than the standard Symbat 1.

Control nursery. 5 chickpea samples that exceed the standard are selected Symbat 1 in terms of yield from +0.2 to +0.9 c / ha. The best numbers among chickpeas in terms of yield were: F10-15c-5.2, F10-23c – 5.5, F10-31c 10-31c – 5.7, F10-36c-5.3 and F10 – 45c-5.9 c / ha. The rest of the rooms were at or below standard.

20 samples were tested in PSI.F6 samples ( FF10-263c, F10-100c, F10-76c, F10-10-15976c, F10-159c, F10-92c, and F10-183c, F10-92c и F) with 2-4 days earlier flowering than the standard were installed in the PSI Symbat 1. Promising samples F10-263c, F10-100c, F10-76-76c, F10-159c, F10-92c and F10-183c yield excess over the standard Symbat 1 ranged from +0.2 to +0.8 centners / ha. By the weight of 1000 grains, F10-100c - 370g., F10-76-76c – 360g, F10-92c – 375 g were allocated.

20 samples were tested in KSI. n. According to the growth rate, 20 cultivars were identified - F97-171, F98-10, F98-88, F98-12, F98-25, etc. varietal samples опережающих на that are 1-2 days ahead of the standard Symbat 1. We studied the numbers based on the shape of the bush, tallness and ability to mechanized cleaning, with the lower beans attached above 15 cm. and 15 varietal samples were identified. 10 cultivars were selected for drought resistance grade-samples.

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Resume: In 2021, in the collection, control, preliminary testing of chickpea samples and competitive variety testing, 220 samples were studied for valuable agricultural characteristics, that is, studies were conducted on early gathering, growth rates, branching, flowering dates, early ripening, drought resistance and yield, as a result of which the results were obtained F97-101c, F97-50c, F97-81c, F97-12c, F97-19C, F97-65c, F97-81c, samples F97 - 95C, F97-103c and F97-114c exceeded the standard grade of Symbat-1 in yield by 0.3-1.3 c/ha.

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