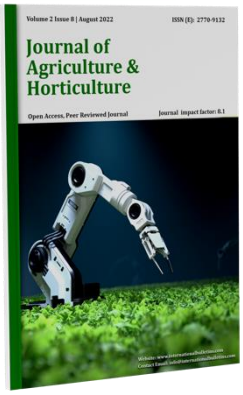

SELECTION OF VALUABLE CHICKPEA SOURCES FOR RAINFED AREAS.

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Abstract: In this article, the growth period duration, yield components, productivity indicators, and grain quality characteristics of the studied chickpea varieties and samples were examined over the years. The obtained research results were statistically analyzed based on the Dospehov method.

The growth period duration of chickpea varieties and samples showed a small experimental error, with LSD05% values of 2.04 in 2023 and 2.36 in 2024. Regarding yield indicators, the LSD05% was 2.37 in 2023 and 2.06 in 2024. The protein content in chickpea grains had LSD05% values of 2.12 in 2023 and 2.33 in 2024. The 1000-seed weight indicator showed LSD05% values of 0.47 in 2023 and 0.46 in 2024, confirming that there was no experimental error among the replications.

During this research, six samples demonstrated positive results compared to the standard variety in terms of valuable trait indicators. These samples were selected and recommended for practical breeding purposes.

Key words: Chickpea crop, varieties and samples, growth period duration, protein content indicator, grain yield, 1000-seed weight.

In recent years, due to drastic climate changes worldwide, the chickpea crop has been significantly affected during its developmental stages. Rising temperatures, sudden cold spells, and damage caused by diseases and pests have negatively impacted grain quality, leading to a sharp decline in yield.

To address these challenges, one of the key tasks for leading plant breeders worldwide is to develop early-maturing, biotic- and abiotic-stress-resistant, and competitive chickpea varieties and samples. This involves creating initial breeding materials for practical selection and developing new varieties based on them.

According to the experiments conducted by A. Osvin et al., chickpea is one of the most important crops in the world and is considered a protein-rich plant. It can be cultivated in both irrigated and rainfed fields. The average yield is 1 c/ha, while the highest recorded yield is 6 c/ha. The researchers emphasized that abiotic climatic factors have a negative impact on yield indicators. [1; 1-24]

According to the scientific studies conducted by K. Tetiana et al., in recent years, drought has had a strong impact on grain yield and quality in the rainfed fields of Ukraine. As a result, the chickpea species (*Cicer arietinum L.*) has been widely cultivated due to its drought resistance. Because of its heat tolerance, chickpea is grown extensively in rainfed fields worldwide, particularly in India, Australia, and the Mediterranean region. Chickpea grains contain 22–31% protein, 4–7% fat, as well as essential amino acids, vitamins, and other valuable nutrients, distinguishing it from other leguminous crops. [2; 919–925]

According to M. Adem et al., chickpea is widely grown in the arid and semi-arid regions of northeastern Ethiopia, where its cultivation depends on soil moisture levels. In this region, chickpea planting is carried out when rainfall is sufficient. Choosing the optimal planting time ensures higher yield compared to late sowing. Conversely, if planting is delayed, drought stress during the plant's growth period leads to a decrease in yield. [3; 222–233]

M. Dürdane et al. conducted studies in Turkey, confirming that chickpea is a protein-rich crop, with its grains containing an average of 22–26% protein. Both cultivated and wild varieties of this crop serve as a food source for humans and livestock. The plant's root system forms a symbiotic relationship with nitrogen-fixing rhizobium bacteria, enriching the soil with nutrients. [4; 116–124]

According to N.K. Judith et al., in Kenya, chickpea is cultivated as a green manure crop to improve soil fertility. Between 2006 and 2019, chickpea production increased from 7.7 to 14.2 million tons. [5; 32–47]

Research Methods

Field experiments, phenological observations, harvesting, yield calculation, and laboratory analyses were conducted based on the methodologies of the "All-Union Institute of Plant Industry" (1984) and the Agricultural Crop Variety Testing Center. Grain quality indicators were assessed using the guidelines outlined in *"Methodological Recommendations for Grain Quality Evaluation."* Statistical data analysis was performed using Microsoft Excel and GenStat 13 software. Statistical analyses were carried out following the methodologies presented in B.A. Dospehov's (1985) scientific works. The field experiment design was structured using the *Complete Block Design* and *Alpha Lattice Design* in the GenStat 13 program.

Introduction

Scientific research was conducted at the **Rainfed Farming Research Institute** on its rainfed field experimental plots. Over the years, 20 chickpea varieties and samples were tested in three replications, each allocated to a 10 m^2 plot.

During the 2023–2024 period, the growth period duration of chickpea samples in the control variety testing nursery was studied. In 2023, this duration ranged between **81 and 93 days**, whereas in 2024, it extended from **84 to 95 days**. The control variety *Yulduz* exhibited a growth period of **86–87 days**.

Compared to the control variety, the following samples demonstrated earlier maturation:

- **In 2023:**
  - *FLIP13-344C, FLIP13-363C, FLIP13-126C* matured in **81 days**
  - *FLIP13-293C* in **82 days**
  - *FLIP13-264C, FLIP13-165C* in **84 days**
- **In 2024:**
  - *FLIP13-293C, FLIP13-126C* matured in **84 days**
  - *FLIP13-344C* in **85 days**

These samples fully matured earlier than the control variety.

The yield performance of chickpea varieties and samples ranged from **5.49 to 18.75 c/ha in 2023** and from **6.1 to 20.6 c/ha in 2024**. The lower yield in 2023 was attributed to lower precipitation compared to 2024 (**Table 1**).

The yield performance of the control variety *Yulduz* was recorded at **14.4 c/ha in 2023** and **15.8 c/ha in 2024**. Compared to the control variety, **10 samples in 2023** and **12 samples in 2024** demonstrated a **higher yield ranging from 2.5 to 6.7 c/ha**.

Table 1

Growth Period and Yield Performance of Chickpea Varieties and Samples *(Gallaaral, 2023–2024)*

lot	ep	Blok	Entry	Name	Vegetation period, day		Yield, c/ha	
					2023 year	2024 year	2023 year	2024 year
		1	1	**Yulduz(control)**	86	87	14,4	15,8
		1	6	FLIP13-129C	93	95	9,1	9,8
		1	11	FLIP13-264C	84	86	16,5	19,3
		1	16	FLIP13-377C	89	94	11,5	13,2
		2	2	FLIP13-84C	85	86	18,8	20,1
		2	7	FLIP13-130C	92	94	10,4	11,8
		2	12	FLIP13-293C	82	84	17,1	18,5
		2	17	FLIP13-384C	91	93	10,3	11,1
		3	3	FLIP13-96C	88	91	11,1	12,7
0		3	8	FLIP13-141C	93	95	5,5	6,1
1		3	13	FLIP13-344C	81	85	16,4	18,7
2		3	18	FLIP 82-150C	92	94	11,5	12,0
3		4	4	FLIP13-125C	86	88	15,2	17,5
4		4	9	FLIP13-142C	91	93	6,5	7,0
5		4	14	FLIP13-363C	81	86	17,1	19,8
6		4	19	FLIP88-85C	85	87	14,5	16,7
7		5	5	FLIP13-126C	81	84	17,4	19,2
8		5	10	FLIP13-165C	84	86	17,4	19,5
9		5	15	FLIP13-370C	85	87	18,4	20,6
0		5	20	FLIP93-93C	86	88	17,7	20,3
				Min	**81**	**84**	**5,49**	**6,1**
				Mean	**87**	**89**	**13,85**	**15,5**
				Max	**93**	**95**	**18,75**	**20,6**

LSD_{05}	**1,78**	**2,11**	**0,33**	**0,32**
LSD_{05} %	**2,04**	**2,36**	**2,37**	**2,06**
S	**1,10**	**1,31**	**0,20**	**0,20**
Cv %	**1,30**	**1,50**	**1,50**	**1,30**

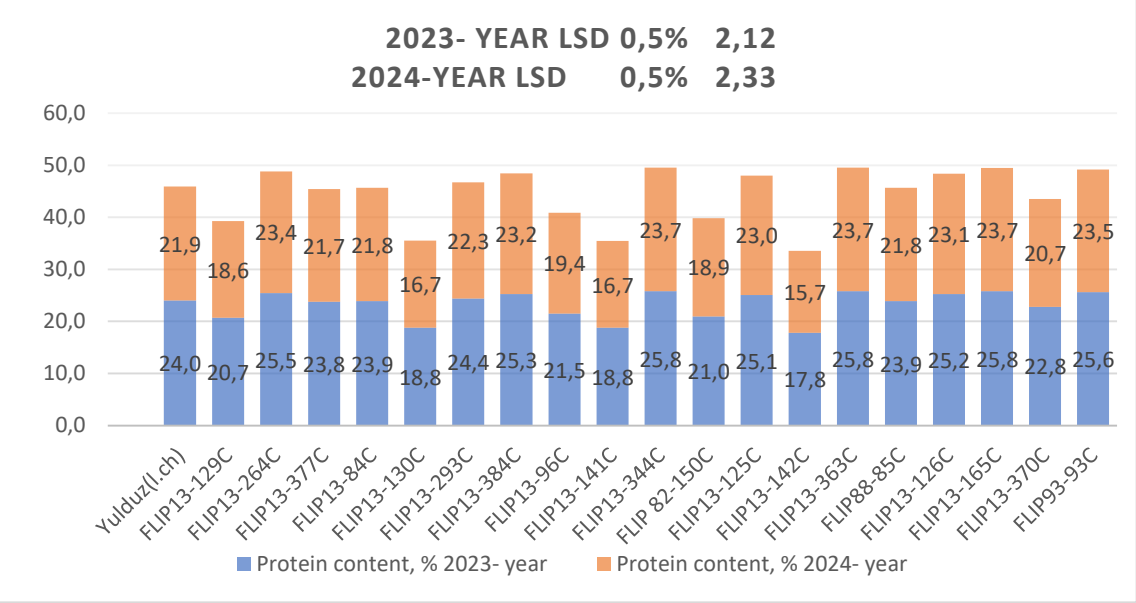
When analyzing the **protein content in chickpea grains** under laboratory conditions, variations were observed across different years. In **2023**, the protein content in chickpea varieties and samples ranged from **17.8% to 25.8%**. The control variety *Yulduz* had a protein content of **24.0%**.

Compared to the control variety:

- **FLIP13-344C, FLIP13-363C, and FLIP13-165C** had the highest protein content at **25.8%**.
- **FLIP93-93C, FLIP13-264C, FLIP13-126C, and FLIP13-384C** had protein levels ranging from **25.2% to 25.6%**, indicating superior protein content (**Figure 1**).

In **2024**, due to higher precipitation, grain yield increased. However, this had a negative impact on grain quality indicators, including protein content.

Figure 1. Protein Content of Chickpea Varieties and Samples *(2023–2024)*



In **2024**, laboratory analysis determined that the **protein content of chickpea varieties and samples ranged from 15.7% to 23.7%**. The control variety *Yulduz* had a protein content of **21.9%**.

Compared to the control variety:

- **FLIP13-344C, FLIP13-363C, and FLIP13-165C** had the highest protein content at **23.7%**.
- **FLIP93-93C** had **23.5%**, while **FLIP13-264C** had **23.4%**.

- Additionally, **five more samples** showed high-quality indicators and were selected for further use.

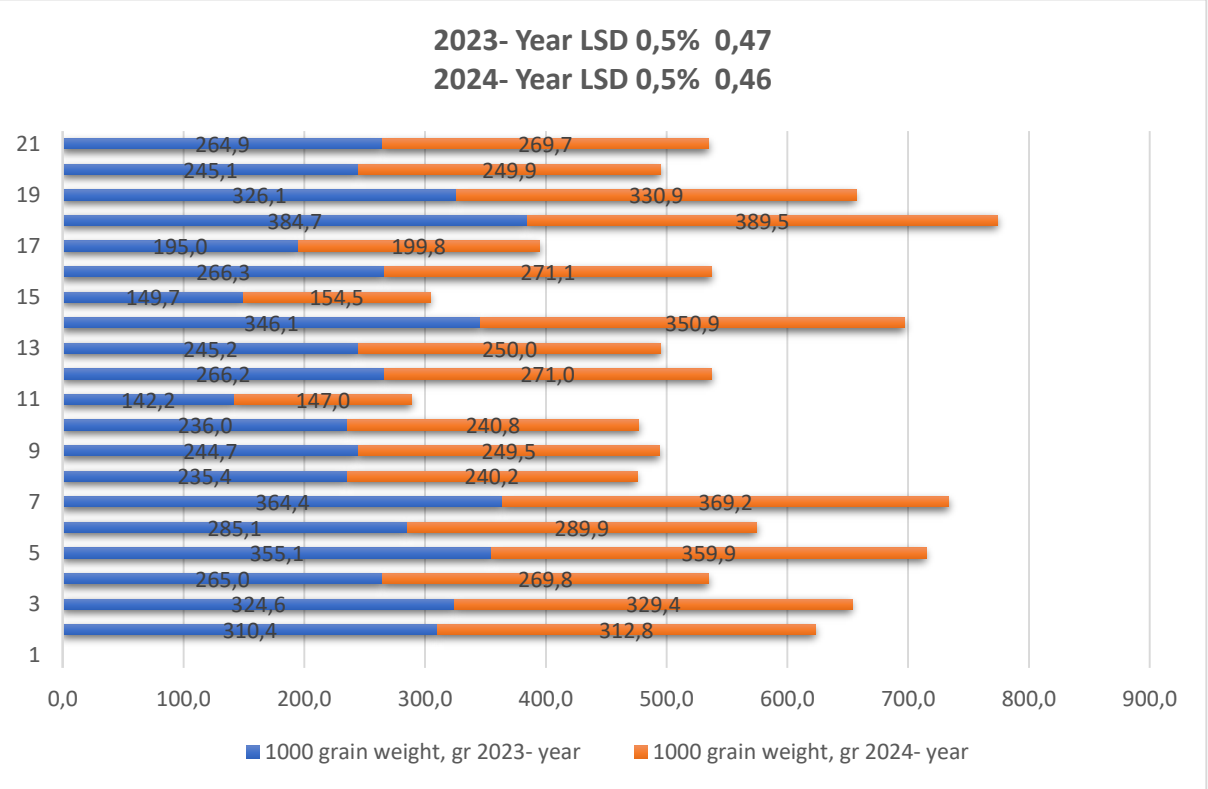
1000-Grain Weight and Yield Correlation

The **1000-grain weight** of chickpea varieties and samples demonstrated a **positive correlation** with yield performance.

- In **2023**, the control variety *Yulduz* had a 1000-grain weight of **310.4 g**.
- In **2024**, this value increased to **312.8 g**.

This difference was attributed to **higher temperatures** during the podding phase in **2023**, which affected grain filling. In **2024**, however, improved rainfall and optimal temperature conditions during the vegetative and generative phases resulted in **better grain development**.

Figure 2. 1000-Grain Weight of Chickpea Varieties and Samples ***(2023–2024)***



Conclusion

Several chickpea samples demonstrated **positive results** compared to the control variety.

- **FLIP13-126C** had the highest **1000-grain weight**, reaching **384.7 g** in **2023** and **389.5 g** in **2024**.
- **FLIP13-130C** followed with **364.4 g** in **2023** and **369.2 g** in **2024**.
- **FLIP13-377C** showed **355.1 g** in **2023** and **359.9 g** in **2024**.

The study concluded that **yield and grain quality indicators varied** over the years due to **weather conditions and rainfall levels**. Based on the **2023-2024** results, **six chickpea samples** outperformed the control variety in terms of **growth period, yield, and grain quality**. These samples have been **selected and recommended for practical breeding programs**.

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