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The importance of chickpea (*Cicer arietinum* L.) and its cultivation in Hungary: A review

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SUMMARY

Climate change today is no longer a question for the future. Climate change impacts not only human populations but also plant species, which are increasingly exposed to its negative effects. The increasing number of days of drought, the lack of precipitation and its unfavorable distribution are observed each year, which require adaptation. Chickpea (Cicer arietinum L.) is a drought-tolerant species characterized by deep root system that enables it to withstand prolonged periods without precipitation. Additionally, it is a thermophilic crop and tolerates moderate increases in average temperature." There is no great tradition of its cultivation and use in Hungary, but it has been cultivated by the Iregszemcse Research Institute since the 1970s. In addition to the positive aspects of its cultivation, it also has good nutritional values, outperforming in some parameters the beans (Phaseolus vulgaris L.) and peas (Pisum sativum L.) what are popular in Hungary. Its high protein and crude fibre content allows it to be used not only for human consumption but also for animal feed. The aim of this review is to describe the importance of chickpea and to identify the advantages and disadvantages of its cultivation.

Keywords: *chickpeas; alternative crops; drought tolerance; sustainable agriculture*

INTRODUCTION

Chickpea (*Cicer arietinum* L.) – commonly referred to as gram, Bengal gram, or garbanzo bean – is the most significant food legume in South Asia and the third most important in globally (FAO, 2025), following common bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.). It is self-pollinated diploid species with a chromosome number of 2n = 2x = 16 (Dixit et al., 2022).

Chickpea is a nutrient-dense legume that plays a significant role in maintaining human health (Sofi et al., 2020). It provides high-quality protein with a favorable amino acid profile, particularly rich in lysine, and is an excellent source of dietary fibre, resistant starch, folate, and essential minerals such as iron and zinc (Singh et al, 2021; Ahmed et al., 2023; Jha et al., 2024). It was studied that regular consumption of chickpea can reduce the risk of chronic diseases including type 2 diabetes, hyperlipidemia, iron-deficiency anemia, and protein-energy malnutrition, due to its low glycemic index, cholesterol-lowering effects, and contributions to micronutrient intake (Jukanti et al., 2012; Younis et al., 2015; Jha et al., 2024).

Chickpea is of a great importance in animal feeding, provides a valuable source of energy and high-quality protein in animal diets and can effectively support milk, meat, and egg production of different livestock species (Bampidis and Christodoulou, 2011). Its seeds can effectively be used as protein sources in ruminant diets (Serrapica et al., 2021), while chickpea straw, with higher metabolizable energy and crude protein than cereal straws (Maheri-Sis et al., 2011), supports effective ruminal digestion and daily weight gains in young ruminants.

The role of chickpeas in agriculture and crop rotation is indisputable. It has excellent stress tolerance, mainly due to its high root mass and reduced transpiration surface, and it has a short growing period. It is currently cultivated in more than 40 countries, mainly in South Asia (Singh & Jauhar, 2006). In 2023, the largest areas were cultivated in India, Pakistan and Turkey (10.470.862 ha, 842.749 ha, 458.772 ha, respectively) (FAO, 2025).

GENERAL CHARACTERISTICS OF CHICKPEAS (CICER ARIETINUM L.)

The chickpea (*Cicer arietinum* L.), as a leguminous plant, belongs to the family Fabaceae (Papilionaceae) (Réthy, 2024), specifically to the genus Cicer. 9 annual and 34 perennial varieties belong to this genus (Sajja et al., 2017). Chickpeas are classified into two distinct genotypic groups, which are the '*kabuli*' (or '*macrosperma*'), characterized by a light-colored seed coat and predominantly cultivated in Europe; and '*desi*' (or '*microsperma*'), which exhibits darker seed coats and is primarily distributed across the eastern Mediterranean, Central Asia, and the Indian subcontinent, with minimal cultivation in Europe (Singh and Diwakar, 1995; Rachwa-Rosiak et al., 2015).

In Hungary, chickpea is an annual herbaceous plant. It possesses a taproot system extending up to 50 centimeters into the soil, facilitating its drought tolerance. It is also a heat-tolerant plant with moderate precipitation requirements, but particularly sensitive to water supply during the emergence, flowering and pod development periods. Chickpea is thermophilic plant, its optimal sowing date is at the end of April, when the

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soil temperature reaches 8–10 °C. Its cultivation does not require high nutrient inputs. It is typically sown at a row spacing of 25–30 cm and a plant spacing of 4–6 cm (Némethy, 2022).

The plant stems are straight, repeatedly branched, cylindrical in cross-section (Cubero, 1976). Branching initiates from the basal nodes at ground level, resulting in a compact and bushy plant architecture (Sajja et al., 2017). The entire surface of the plant is covered with glandular and non-glandular trichomes, except for the flower petals. Acid mixture (malic, oxalic and citric acids) is produced by the plant defends it against the sucking pests. The small leaves are compound, with 5 to 7 pairs of leaflets on each petiole. The anthers dehisce one day before flowering, allowing the plant to perform self-pollination (Sajja et al., 2017). On the 35th to 40th day after germination, each plant develops 40 to 60 flowers. The flowering is prolonged. The small, inflated pods contain 1 to 3 seeds each, easy to harvest because the seeds do not shatter during the ripening (Némethy, 2022).

Diseases and pests are not common in Hungary; however, the cotton bollworm (*Helicoverpa armigera*) caterpillar may appear on the plants. If the plant stand becomes infested with fusarium wilt, it can be a major problem and cannot be controlled. Chickpeas are not damaged by weevils (Némethy, 2022).

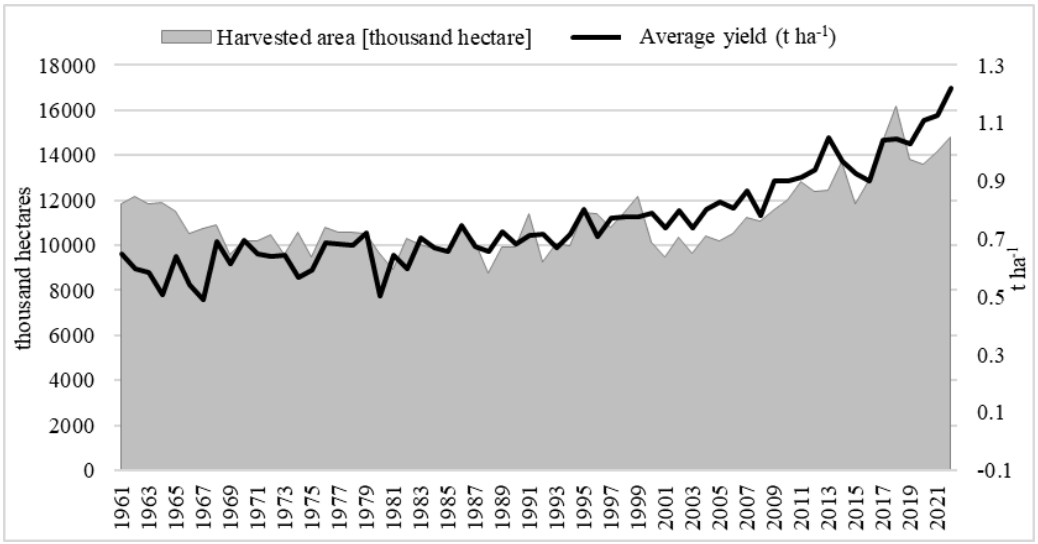
ORIGIN, DOMESTICATION, AND GLOBAL PRODUCTION OF CHICKPEA

Chickpea is one of the earliest domesticated grain crops, with archaeological evidence indicating its cultivation in the Middle East as early as the 8th millennium BCE (Ahmad et al., 2005). Nowadays, the origin of chickpea (*Cicer arietinum* L.) is still not entirely clear. The currently accepted theory is that it may have originated in south-eastern Turkey and Syria (Van der Maesen, 1987). In contrast, De Canolle (1883) placed the point of origin in the south of the Caucasus, while Vavilov (1926) identified the Mediterranean coast and Southwest Asia as the region of origin. Based on archaeological findings Mesopotamia, located in southeastern Turkey, is the centre of origin of chickpea (Igolkina et al., 2023). Today, the largest area of cultivation is in India; however, some records indicate that it is only a few centuries since the most popular type of chickpea, the cream-coloured Kabuli type, was introduced here (Van der Maesen, 1987).

The cultivation of chickpeas in Europe is not widespread, but its area of cultivation is increasing every year. This is due to its favourable nutrient parameters.

The disadvantage of growing chickpea is that high harvested yield per hectare is difficult to realize, with average yield per hectare being around 1 t ha^{-1} (Singh et al., 2021). The cultivated area has shown a slow but steady increase, while the average yield per hectare has shown a relatively higher trend (*Figure 1*). Chickpeas are grown on more than ten million hectares in India; however, in terms of yield, China and Jordan ranked first, with average yields of 5.1 to 5.5 tons per hectare, approximately. From this production, India lagged significantly behind with an average yield of 1.2 tons per hectare (FAO, 2024).

Figure 1. **Cultivated area and average yield per hectare of chickpea worldwide from 1961 to 2022 (FAO, 2024)**



AGRONOMIC REQUIREMENTS OF CHICKPEA CULTIVATION

As with other leguminous plants, chickpea is capable of nitrogen fixation due to the symbiotic relationship formed with Rhizobium spp. bacteria (Singh and Singh, 2018). Chickpea can fix atmospheric nitrogen through a symbiotic association with *Mesorhizobium ciceri*, incorporating part of the fixed nitrogen into its biomass and contributing to soil

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nitrogen enrichment after harvest (Haskett et al., 2016). According to Vargas-Blandino and Crádes-Travieso (2021), chickpea can fix approximately 300 kg of nitrogen per hectare annually, while Maya and Maphosa (2020) reported this value is "only" 140 kg. The nutrient requirements are modest, only the macronutrients need to be replenished (Fülöp et al., 2016). Although it fixes atmospheric nitrogen through symbiosis, it requires nitrogen for its initial development. This makes the cultivation economical, as it also loosens the soil and increases the microbial biomass, thereby promoting the release of nutrients in the soil (Ellouze et al., 2013).

Sowing occurs in April, with an estimated 450,000 to 500,000 germinating seeds per hectare (Fülöp et al., 2016). Although chickpea germination can begin at lower temperatures if the soil is well-watered, emergence will be more dynamic and more uniform development can be observed at higher soil temperatures (Nagy, 2022). It has a low water demand, if sufficient rainfall is available at emergence, and even in case of a prolonged dry period, it is sufficient to apply 10 mm of irrigation once or twice (Dixit et al., 2019).

The optimal germination temperature ranges between 15–25 °C according to Vargas-Blandino and Crádes-Travieso (2021). Auld et al. (1988) determined 13 °C as the optimal temperature of germination, to achieving maximum yield. On the other hand, germination can start at temperatures above 10 °C, but this leads to prolonged hatching.

Considering the root system, it prefers deep-tilled, clayey-loam soils (Vargas-Blandino and Cárdenas-Travieso, 2021), which have adequate drainage capacity and a neutral pH (Maya and Maphosa, 2020). It produces high yields in drier years, but monoculture should be avoided. Harvesting takes place at biological maturity, and the seed crop can be stored with 8–15% moisture content without quality deterioration (Vargas-Blandino and Cárdenas-Travieso, 2021).

CLIMATIC CONDITIONS OF HUNGARY

Hungary is located in the Carpathian Basin, where four different climatic types concentrated. These are: the temperate maritime, continental temperate, oceanic subtropical, and continental subtropical air masses, which influence the climate. Four seasons can be distinguished. The summer is characterized by daily maximum temperatures exceeding 35 °C, and this season lasts for at least three months. Winter is variable, with alternating periods of milder and colder temperatures. The annual precipitation is unpredictable, averaging 600 mm per year, between 550–700 mm (Szentes et al., 2024). The number of sunshine hours ranges between 1,800 and 2,200, with the highest values typical for the southern part of the country.

Hungary is affected more frequently each year by drought, of which four types are distinguished: atmospheric, hydrological, pedological and agricultural droughts (Bathory et al., 2007). Fundamentally, the total amount of precipitation has not significantly decreased each year; rather, its distribution is uneven. The evaporation of this precipitation is highly dependent on temperature and soil conditions, such as the depth of the topsoil and its physical characteristics (Lennert et al., 2024). Given these factors, it is important to adapt our agricultural production accordingly. It is advisable to pay attention that the requirements of the crop to be grown are suitable for these climatic conditions, and successful crop production can be facilitated by practicing moisture-conserving soil cultivation (Mezősi, 2017). Adaptation is key, as it is predicted by 2100, an increase of at least 2.5 °C in the annual average temperature (Bathory et al., 2007).

CULTIVATION OF CHICKPEA IN HUNGARY

There is no tradition of chickpea cultivation in Hungary. Although the Research Institute of Iregszemcse has been working with this plant species since the 1970s, it was only from 1991 that the amount of cultivated area was measurable (*Figure 2*). Between 1991 and 2000, it occupied 200–300 ha of the crop structure, which is a rather small percentage of the total agricultural area. Moreover, the average yield was between 0.7 and 1.0 tons per hectare. In 2001 and 2002, no cultivated area was realized, but production resumed between 2003 and 2017. The yield averages were fluctuating, but it was higher than in the previous period (FAO, 2024).

Although the widespread cultivation of chickpea has not been successful in Hungary since 1991, currently six varieties are listed in the National List of Varieties. These are 'Boglárka', 'Bori', 'Dora', 'Dónia', 'Ireg 22', and 'Katalin'. The first domestic variety was 'Dónia', which was certificated in 1986, while the most recent, 'Ireg 22', has been available since January of 2024 (Nébih, 2024).

The University of Kaposvár, in collaboration with the National Food Chain Safety Office, conducts research on improving the drought tolerance of chickpea (Fülöp, 2016). The Öko-völgy Foundation is promoting the crop in the context of sustainability, while Primag Ltd. is providing expert advice to boost its cultivation. In addition, ÖMKi (Research Institute of Organic Agriculture) aims to educate small and large farmers alike about the benefits of growing leguminous crops, including chickpeas.

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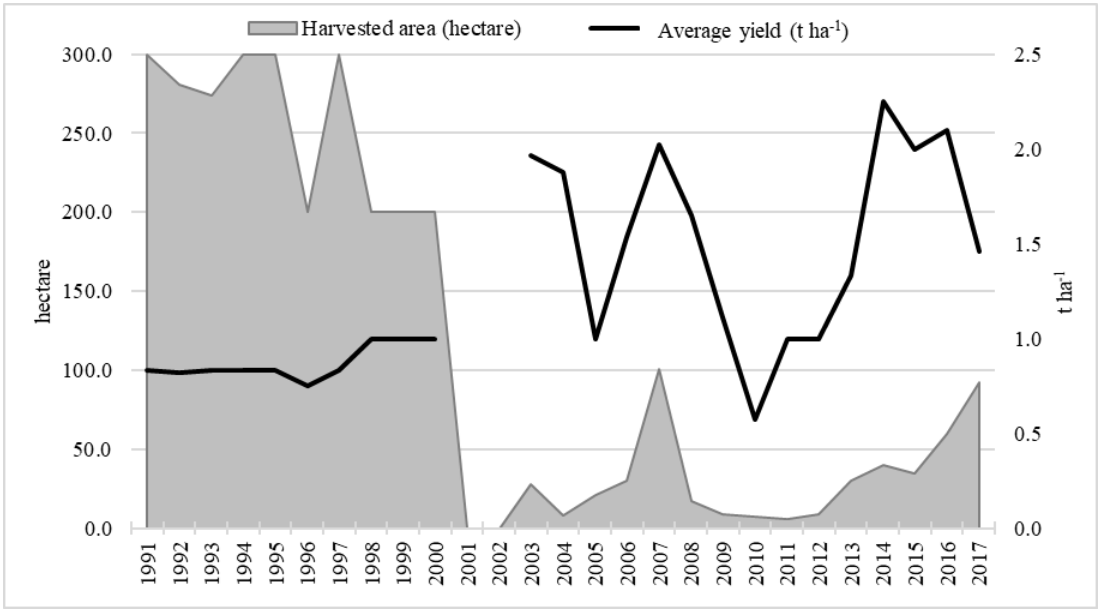
Figure 2. **Cultivated area and average yield of chickpea in Hungary from 1991 to 2017 (FAO, 2024)**



CONCLUSIONS

Summarizing the above, it can be concluded that chickpea is currently not widely cultivated in Hungary, but it is the third most important protein crop in the world. The occurrence of drought years in Hungary (and also in the World) due to climate change will become more frequent every year, and therefore it is justified to change the established seeding structure of Hungarian farmers, as irrigation is not available in a large part of the agricultural area. In addition to its suitability for cultivation in the Hungarian climate, it also plays a role in greenhouse gas sequestration, thus its cultivation could promote sustainability. Although the average yield per hectare is low, the nutritional parameters of the grain are in line with the principles of modern nutrition. The consumption and use of chickpea has been present for centuries. As it was mentioned, the humans used for ritual purposes before our era. Nowadays it can also be used in animal feeding in addition to human consumption. It has a high gastronomic value, and the range of its potential uses is wide. Its medicinal use will hopefully come to the fore again.

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