AgroLife Scientific Journal - Volume 4, Number 2, 2015
ISSN 2285-5718; ISSN CD-ROM 2285-5726; ISSN ONLINE 2286-0126; ISSN-L 2285-5718

CONTRIBUTION TO THE FOUNDATION OF KNOWLEDGES CONCERNING THE BIOLOGY, ECOLOGY AND CULTURE TECHNOLOGY FOR CHICKPEA (*Cicer arietinum*) IN CLASSIC AND ECOLOGICAL SYSTEM UNDER CONDITIONS OF DOBROGEA PLATEAU

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Abstract

Chickpea, known under the name of "peas of rams", is an annual leguminous plant, originating from Asia Minor. Chickpea seeds have a great nutritional value, are used in human consumption as boiled, roasted or cofee surrogate, being rich in proteins, mineral salts (phosphorus, potassium, magnesium, calcium, iron) and vitamin B complex. Having an increased protein concentration (24%), plus a substantial percentage of carbohydrates and lipids, chickpea has a remarkable food value, largely replacing the meat protein. Chickpea is a characteristic ingredient in Middle East kitchen, Africa and India, known under the name of "desi" and "kabuli".
In Romania, there are cultivated local populations of chickpea: Galben de Moldova (Moldova Yellow), Naut galben de Lovrin (Lovrin Yellow chickpea). Chickpeas have quite high requirements to the temperature, the amount being of 2,000°C and tolerate the easiest, among of all leguminous bean plants, the drought conditions, therefore it can be cultivated in Dobrogea, provided the early spring seeding.

Key words: *chickpea, culture, drought, resistance to water and thermal stress.*

INTRODUCTION

Chickpea grains contain, on average: proteins 20-25%, fats 4-6%, nitrogen free extracts 53-63%, cellulose 4-8%, ash 3-5%.
In recent years, in the world there were cultivated in 2008-11.02 million ha, in 2009-11.08 million ha, with an average yield of 7.71 quintals/ha in 2008 to 8.81 quintals/ha in 2009. In Romania, there were cultivated 10.000 ha in South-East of the country, but in recent years the surfaces were drastically reduced: in 2008, there were cutivated with chickpeas 487 ha, and in 2009 only 78 ha. The average yields were 1,201.2 kg/ha in 2008 and 961.5 kg/ha in 2009.

MATERIALS AND METHODS

Chickpea belongs to genus *Cicer,* species *Arietinum.* It has more subspecies, the most imortant being *Eurasiaticum*.
Cultivated species is *Cicer arietinum* L., divided into four subspecies: *orientale, asiaticum, mediterraneum, eurasiaticum.*
In Romania, there are cultivated local populations of chickpea: Galben de Moldova (Moldova Yellow), Naut galben de Lovrin (Lovrin Yellow chickpea). In the Catalogue of Official Plant Varieties that were cultivated in Romania, 2014 edition, there were published 2 varieties, respectively Burnas and Rodin, registered in 2004 and maintained by Agricultural Research and Development Station from Teleorman. Variety Cicero 1, created by Agricultural Research and Development Institute of Fundulea (NARDI), was cutivated until the last years.

RESULTS AND DISCUSSIONS

Total area harvested with chickpea, on average in the last 5 years (2009-2013), is

12,531,411 ha. In this period, in the European Union there were harvested, on average, 43,797.8 ha, while in Romania the yearly average was 125.6 ha.

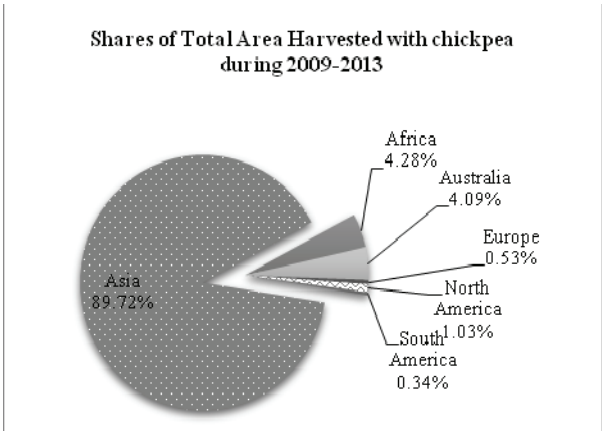

Figure 1. Shares of Total Area Harvested with chickpea during 2009-2013

Figure 2. Chickpea plants before flowering - images from didactic and research field

Chickpea seeds germinate hypogeically. The root has a high power of absorbtion and solubilization, the stalk has 30-60 cm height, is edged, piliferousand erect.

Leaves are compound odd pinnately with 7-17 pairs of leaflets, with dentate margins, leaflets are covered with hairs which secrete oxalic and malic acids.

Flowers are solitary, in different colors, the flowering is echeloned along over 2-3 weeks, and they bloom from the bottom to the top, with self pollination, the pods are short, ovate, pale yellow, covered with hairs.

A pod contain 1-3 seeds, one thousand seeds weight is 230-270 grams, the vegetation period is 91-110 days.

Towards temperatures, chickpea has quite high requirements. The amount of temperature degrees necessary for the entire vegetation period is about 2,000ºC.

Figure 3. Compound leaves imparipenat

Among of all leguminous bean plants, chickpea supports the easiest the drought conditions. The minimum germination temperature is 3-4 °C. At 6-8 °C it emerges in at least 10 days.

As seedlings, it resists until -6 °C and during the vegetation period chickpea requires temperatures up to 20-21°C.

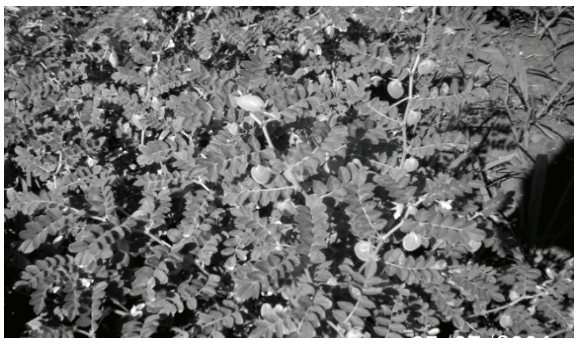

Figure 4. Chickpea plants during kernel filling period - images from didactic and research field

The most appropiate soil for chickpea must have medium texture and rich in calcium. It

doesn't succeed on heavy soils, excessively wet, poorly aerated. It valorizes well the sandy soils and slightly salinated soils (Moise, 2009).
Chickpea is cultivated in Danube Plain, Dobrogea, South Plain of Moldova and in West Plain.

Analysis of the chickpea culture worldwide and in Romania

In recent years, in Romania, the culture of chickpea was almost forgotten. In 2010, according to official data, were cultivated 153 ha with chickpea, in 2011 only 85 ha, in 2012 - 165 ha, and in 2013 - 147 ha.
Worlwide, large cultivating countries, according to FAO official data, are the following: India, with an area cultivated in 2013 of 9,600,000 ha, which represents 68.17% of the worldwide total area cultivated with chickpea (Table 1 and Table 2), followed by Pakistan, with 992,000 ha cultivated in 2013 (which represents 7.32% of the worldwide total area cultivated with chickpea in 2013).

Table 1. Worlwide total area cultivated with chickpea in the period 2010-2013*

Years	**2010**	**2011**	**2012**	**2013**
Total cultivated area (ha)	11986708	13272903	12345432	13540398

*(www faostat.fao.org)

Table 2. Large chickpea cultivating countries in the period 2010-2013*

No.		**Cultivated area (ha)**				**% from worldwide total cultivated area**			
	Country	**2010**	**2011**	**2012**	**2013**	**2010**	**2011**	**2012**	**2013**
1.	India	8170000	9190000	8320000	9600000	68.17	69.25	67.40	70.91
2.	Pakistan	1066900	1053800	1055000	992000	8.903	7.94	8.55	7.32
3.	Australia	500000	653142	456070	573600	4.17	4.92	3.69	4.24
4.	Iran	508313	562375	565000	550000	4.24	4.23	4.58	4.06
5.	Turkey	446218	446413	416242	423557	3.72	3.36	3.37	3.12
6.	Myanmar	327554	333052	336000	335000	2.73	2.51	2.72	2.48
7.	Ethiopia	208389	231299	239512	122248	1.74	1.74	1.94	0.90
8.	Romania	153	85	165	147	0.001277	0.00064	0.001337	0.001086

*(www faostat.fao.org)

Chickpea crop technology in Romania

Considering the small surfaces cultivated with chickpea in Romania, the culture location is not an issue. It can be grown after any plant, but itis not recommended to return after itself and after other leguminous plants. In its culture zone, it returns after cereals or sunflower.
Chickpea is a good preliminary culture plant for the autumn wheat.
Fertilization is made with 200-300 kg/ha superphosphate, at autumn in ploughing, and at seedbed preparation around 100 kg of ammonium nitrate.
The succession of soil tillage is realized in such a manner so that the sowing must be done very early in spring, under optimal conditions.
Immediately after the harvest of preliminary culture and releasing the field of the crop scraps, it is recommended to effectuate a work with the stubble disc harrow. The purpose of harrowing is to shred weeds and crop scraps (stubble field) and to hoe the superficial layer of the soil.
As soon as possible, the field is tilled with the plough in aggregate with serrated disc harrow at a depth of 25-30 cm.
After preliminary cultures harvested in summer, the soil is repeatedly tilled (harrowing), the field is leveled, the clods are shredded and the emerging weeds are destroyed, reducing the reserve of weeds.

After preceding plants with the later harvest, the field can be tilled since autumn or it can be left in a "raw furrow". If the field is worked with harrow and leveled in autumn, in the beginning of spring the field dries faster and more even and it can be sowed earlier.

Figure 5. Flowering and fructification from chickpeas

The cultivators from dry areas (e.g. Dobrogea) prefer this soil tillage system.

Figure 6. Pests attack from chickpeas

In areas with heavy soils and where large amounts of precipitation are falling in winter, autumn harrowing and field leveling can lead to excessive soil compaction during winter, it dries harder in spring and the sowing is delayed. In this case it is preferred that the ploughing should be left unworked over the winter.

In spring, the field is tilled as early as possible, but only after the water has drained in depth to avoid soil compaction by the passing of agricultural aggregates; for the same reasons, the number of the passes of agricultural aggregates on the field should be minimized.

In spring, there are required two tillage works, a harrowing early at spring, for soil mobilization, and a second tillage just before sowing, with combinator or disc harrow in aggregate with tooth harrow and grader blade, to mobilize the soil over the sowing depth.

The chickpea seed and sowing must be realized considering certain parameters and requirements.

The seed used for sowing must have the purity above 96% and germinationabove 90%. The treatment with the product Nitragin has a good efficacy in years with favorable hydric regime.

In order to reduce the percentage of hard seeds, it is practiced seed scarification. This procedure is made without harming the seed and it has the role to improve germination (Panaitescu and Niță, 2011).

The sowing is done in the first emergency, when the soil temperature is around 4°C. If the sowing is later, the soil dries, the emergence is delayed, so as the producing of pods and the yield decreases significantly.

Density at sowing is of 40 seeds per square meter, but in wet areas the density recommended is 50 seeds per square meter.

If the field is free of weeds, it can be sowed in single or double rows, at the distance of 60-70 cm, to have the possibility to remove the weeds. If herbicides with high selectivity are used and there is no need to be done weedings, sowing can be done at relatively close distances (15 cm) or in bands (60-70 cm between the bands and 15 cm between the rows of the band).

The sowing depth is 5-7 cm, depending on the texture and soil humidity.

Seed quantity used for sowing is 80-120 kg/ha, depending on the density established and on the one thousand seed weight.

The maintenance works applied to the chickpea crop ensure the growth and development of plants.

After sowing, before the plants emergence, a roller-harrow work is done in order to destroy the weeds and soil crust.
When the plants have 4-6 cm in height, it is done a work with the rotary hoes, in the period when plants lose their turgescence.

Figure 7. Specific weeds in the chickpea culture - images from didactic and research field

When the chickpea is sown in rare rows, 2-3 weedings are effectuated. Weed control also can be done using herbicides.

Figure 8. The emergence of drought in chickpea culture

Harvest is done when the pods are yellow and the leaves have fallen, in two phases or directly with the harvest combine. If the harvest is delayed, results hard to boil seeds (Panaitescu and Niță, 2011).
In our country, the yields obtained are 10-15 quintals/ha. Chickpea yield capacity is of 25 quintals/ha.

Figure 9. Chickpea pods - images from didactic and research field

Figure 10. Weight of a chickpea plant at full maturity

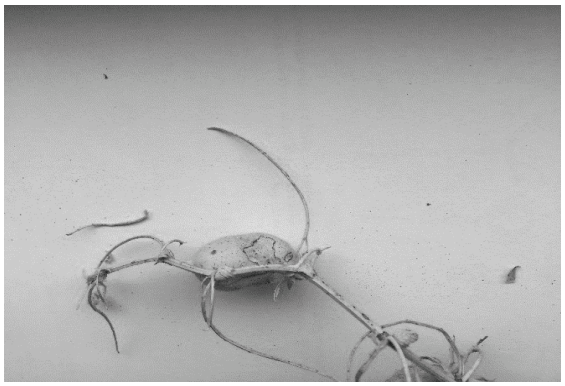

Figure 11. Chickpea capsule damaged by pests

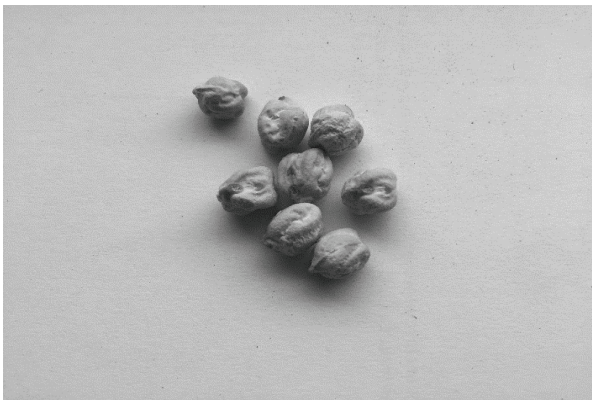

Figure 12. Chickpeas seeds healthy and damaged by pests

CONCLUSIONS

Chickpea has quite high requirements to the temperature, the amount of temperature degrees necessary for all vegetation period being approximately of 2,000ºC. Under climatic conditions from Dobrogea, this requirement can be accomplished.

The minimum germination temperature is 3-4°C. At 6-8°C it emerges in at least 10 days. As seedling it resists until -6°C and during the vegetation period chickpea requires temperatures up to 20-21°C.

Chickpea can valorize, by satisfying yields, the soils with medium texture, rich in calcium, but also sandy soils and slightly salinated soils existing in Dobrogea area.

Considering the fact that, among all leguminous bean plants, chickpea can tolerate drought the easiest, knowing the arid, dry character of Dobrogea area, we can draw the conclusion that chickpea might succeed into culture on the soils and climatic conditions of Dobrogea.

The location of this culture is not an issue. It can becultivated after any plant, but it is not recommended to return after itself and after other leguminous plants. In Dobrogea, among the cultures existing at the moment in the crop structure, it can return after cereals or sunflower. Chickpea is a good preliminary culture plant for autumn wheat (Panaitescu, 2008).

Chickpea has a more evenripening than the other leguminous bean plants (favored by area temperature), erectstalk and indehicentpods, therefore issuited better to mechanical harvesting.

REFERENCES

Ion V., Georgeta Dicu, Băşa A.Gh., State D., 2013. Yield components at some hybrids of sunflower (*Helianthus annuus* L.) under drought conditions from south Romania. Scientific Papers, Series "AgroLife Journal", Vol. 2, No. 2, p. 9-14.

Mihalache M., Ilie L., Marin D.I., 2015. Romanian Soil Resources - "Healthy Soils for a Healthy Life", Scientific Papers, Series "AgroLife Journal", Vol. 4, No. 1, p. 101-110.

Moise Irina, 2009. Pedologie, Taxonomia solurilor României. Ed. Universitară, Bucureşti.

Oprea Cristina Andreea, Marin D.I., Bolohan C., 2015. Influence of some technological factors on grain sorghum (*Sorghum bicolor* L.) moench var. eusorghum) yield grown under the conditions of southeastern Romania. Scientific Papers, Series "AgroLife Journal", Vol. 4, No. 1, p. 123-130.

Panaitescu Liliana, Niţă Simona, 2011. Fitotehnie. Cereale şi leguminoase pentru boabe. Ed. Eurobit, Timişoara.

Panaitescu Liliana, 2008. Evolution of the vegetal production profile in Constanţa. Lucrări Ştiinţifice USAMV Bucureşti, Seria A, Vol. LI.

Panaitescu Liliana, 2008. Biologia şi tehnologia de cultivare a grâului de toamnă în condiţiile din Podişul Dobrogei. Ed. Universitară, Bucureşti.

***Catalogul oficial al soiurilor (hibrizilor) de plante de cultură din România. Bucureşti, 2014.

***www.faostat.fao.org.