

## RESPONSE OF SOME ROMANIAN CHICKPEA CULTIVARS TO DIFFERENTIATED FERTILISATION AND TO DIFFERENT ROW DISTANCE SOWING

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### **ABSTRACT - Response of some Romanian chickpea cultivars to differentiated fertilisation and to different row distance sowing**

The present research aimed at improving chickpea cultivation technology, at contributing to the identification of new chickpea cultivars fit for the reference area, and at expanding chickpea cultivation. The following fertilisation rates are to be noted for their encouraging yields:  $N_{50}P_{60}K_{60}$  and  $N_{100}P_{60}K_{60}$ , which differentiated positively in both cultivation variants, i.e. at a row distance of 30 cm and 50 cm, respectively. The lowest yield was in the Cicero 1 chickpea cultivar, i.e. 893 kg/ha, sowed at a row distance of 30 cm, in the control variant  $N_0P_{60}K_{60}$ . Increasing row distance from 30 to 50 cm increased the yield with 14% on the average in all chickpea cultivars. The highest yield was in the variant sowed at a row distance of 50 cm, and we noted, among chickpea cultivars, the Burnas chickpea cultivar, followed by the Rodin chickpea cultivar, recently developed in Romania. The lowest yields were in the chickpea cultivar Cicero 1. Research was carried out in the area of the locality Comorîște (Caraș-Severin County); the experiments were organised on a typical clayish luvosol, on medium fine, moderately eroded argyle.

**Keywords:** chickpea cultivars, fertilisation rates, row distance

## INTRODUCTION

Chickpea is one of the oldest grain legume crops: archaeological findings point to chickpea being cultivated some 3,000-4,000 BC, in the Mediterranean area and in the Near East (FEHER & BORCEAN 2003).

Ensuring the necessary protein at global level depends more and more on the contribution of these protein rich crops. FAO's "International Dietary Energy Consultative Group" mentions a new "green revolution, that of legumes", while the main expectation in solving the protein deficit worldwide is grain legumes.

This is the main argument in expanding the area cultivated with grain legumes in Western Romania, where there is a long-lasting tradition in the cultivation of chickpea.

From chickpea, we eat both young, green pods prepared as soups or as main dishes, and the grains, roasted and ground, that we eat in different ways: boiled, roasted, in mixture with coffee or even as coffee surrogate, as well as in different confectionary preparations, etc.

Chickpea grains are used in animal feed as grains (crushed) for equine and swine. By-products (straw) are low in nutrients, because they lignify, and the leaves shed. We do not use the green plant as fodder because of its content in oxalic and malic acids; yet the crop is often used in India and Azerbaijan to replace vinegar or to prepare different refreshing drinks.

The goal of the research was to emphasise the effect of fertilisation and of row distance on yield and on quality indicators in the chickpea cultivars *Burnas*, *Rodin* and *Cicero 1*, aiming at expanding its cultivation and at obtaining economically efficient yields.



In the research area, i.e. in the area of the locality Comorîște (Caraș-Severin County), the soil of the experimental plot was a typical clayish luvisol, on medium fine, moderately eroded argyle.

## MATERIAL AND METHOD

We organised a tri-factorial experiment after the sub-divided plot method with three replicates, in which *factor A* was the chickpea cultivar, with three graduations:  $a_1$  – the *Burnas* chickpea cultivar,  $a_2$  – the *Rodin* chickpea cultivar and  $a_3$  – the *Cicero 1* chickpea cultivar; *factor B* – fertilisation arte, with three graduations:  $b_1$  –  $N_0P_{60}K_{60}$ ,  $b_2$  –  $N_{50}P_{60}K_{60}$ ,  $b_3$  –  $N_{100}P_{60}K_{60}$ , and *factor C* row distance, with two graduations:  $c_1$  – 30 cm and  $c_2$  – 50 cm.

Winter wheat was the pre-emergent crop.

The chickpea under study upon setting the experiment were: the *Burnas* chickpea cultivar and the *Rodin* chickpea cultivar, two chickpea cultivars developed in Romania in 2006 at the S.C.D.A. Teleorman, while the *Cicero 1* chickpea cultivar was developed at the I.C.C.P.T. Fundulea in 1973.

To mention that row distance was, in our experiment, 30 and 50 cm, sowing density was 60 germinable seeds per  $m^2$ , and incorporation depth was 4-5 cm.

Sowing was done at a favourable time, i.e. when the temperature set at 4-5°C, which corresponds, calendaristically, to the end of March.

During vegetation, we made biometrical measurements concerning the following: plant height, number of ramifications per plant, number of pods per plant, and number of grains per pod.

Calculus of yield results was done at a moisture of 13%, according to the setting method for field experiments, and the results of biometric measurements were processed through the analysis of the statistic row of variations.

## RESULTS

A synthesis of the yield results is presented in Table 1. The yields of the experimental plot ranged between 687 kg/ha (the *Cicero 1* chickpea cultivar – in the control variant  $N_0P_{60}K_{60}$  and at a row distance of 30 cm) and 3,062 kg/ha (the *Burnas* chickpea cultivar – in the variant  $N_{100}P_{60}K_{60}$  and at a row distance of 50 cm).

Nitrogen fertilisers applied at rates of  $N_{50}$  on a fund of  $P_{60}K_{60}$  increased the yield with 38%, i.e. 495 kg/ha, a very significant difference in yield. Increasing the nitrogen rate to  $N_{100}$  is fully motivated since the increase in yield (93%) is higher than in the variant fertilised with  $N_{50}$ , the difference in yield reaching 1,195 kg/ha a difference ensured statistically as very significant.

Among the biological materials we tested, the best yields ranging between 1,707 and 3,062 kg/ha were in the Romanian chickpea cultivar *Burnas* (better adapted to higher temperatures).

The chickpea cultivar *Rodin* yielded a similar mass, i.e. an average yield of 1,886 kg/ha. The lowest yield was in the chickpea cultivar *Cicero 1* (687 kg/ha) in the control variant  $N_0P_{60}K_{60}$  sowed at a row distance of 30 cm. Increasing row distance from 30 cm to 50 cm is motivated, the average yield in the three chickpea cultivars reaching 9% with a very significant difference of over 153 kg/ha.

Table 1: Crop results in the Comorîște area (Caraș-Severin County) (2010)

A Factor Cultivar	B Factor Nitrogen rate	C Factor Row distance (kg/ha)		Average production (kg/ha)	%	Difference (kg/ha)	Significance
		30	50				
Burnas	N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>	1707	1822	1765	100	-	
	N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>	2224	2342	2283	129	518	xx
	N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>	2960	3062	3011	171	1246	xxx
Rodin	N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>	1239	1442	1341	76	-424	00
	N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>	1709	1930	1820	103	55	
	N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>	2397	2596	2497	141	732	xx
Cicero 1	N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>	687	821	754	43	-1011	000
	N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>	1174	1314	1244	70	-521	00
	N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>	1868	2006	1937	108	172	

DI 5% = 212 kg/ha; DI 1% = 389 kg/ha; DI 0.1% = 433 kg/ha.

## B Factorial averages

Nitrogen rate	N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>	N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>	N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>
Average production (kg/ha)	1287	1782	2482
%	100	138	193
Difference (kg/ha)	-	495	1195
Significance		xxx	xxx

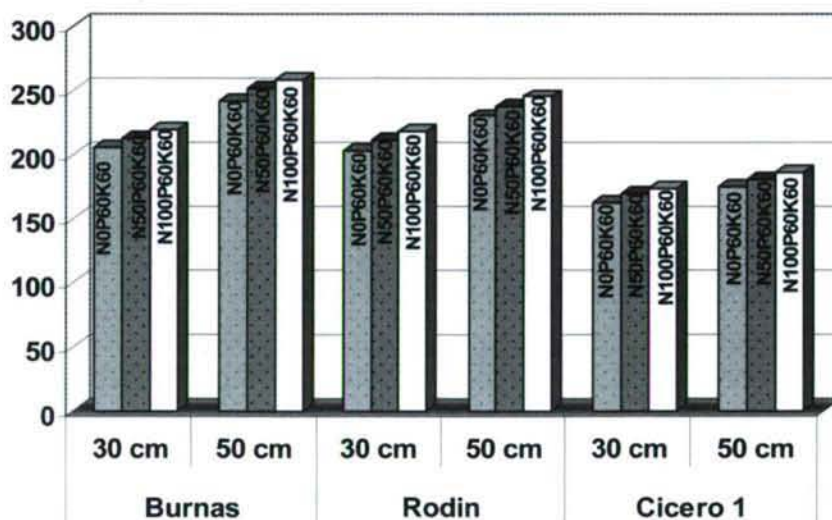
DI 5% = 219 kg/ha; DI 1% = 293 kg/ha; DI 0.1% = 385 kg/ha.

## C Factorial averages

Row distance	30 cm	50 cm
Average production (kg/ha)	1773	1926
%	100	109
Difference (kg/ha)	-	153
Significance		xxx

DI 5% = 15 kg/ha ; DI 1% = 28 kg/ha ; DI 0.1% = 31 kg/ha

Figure 1 shows the variation of the mass of 1,000 grains (g), depending on chickpea cultivar, nitrogen rate, and row distance.



Row distance (cm)	30	50	30	50	30	50	30	50	30	50	30	50	30	50	30	50		
TGM g	205,39	241,92	212,38	250,75	218,92	257,92	202,87	229,71	210,92	237,92	217,61	244,86	162,99	174,56	168,95	180,42		
N rate	N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>	
Genotype	Burnas						Rodin						Cicero 1					
$\bar{X}$	226,71						223,98						174,45					
%	100						98						77					

Figure 1: Variation 1,000-grain weights (g), depending on chickpea cultivar, nitrogen rate, and row distance (2010)



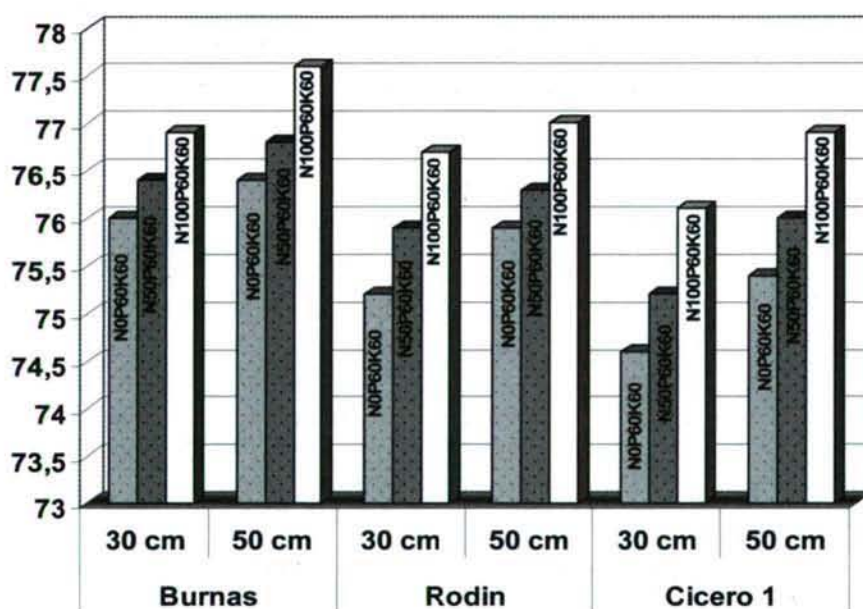
It is obvious that on all agrifunds the highest mass of 1,000 was in the chickpea cultivar Burnas, i.e. between 205.39 and 257.94 g. To note that applying a rate of N<sub>50</sub> contributed to the increase of the mass of 1,000 grains with 6-7 g in the biological experimental materials we used. The lowest values were in all chickpea cultivars in the control variant (N<sub>0</sub>), an agrifund on which the plants filled their grains less than in the other two fertilisation rates.

Figure 2 shows the variation of the hectolitre mass kg/hl, depending on chickpea cultivar, nitrogen rate, and row distance.

Determining this weight feature of the seeds was done to see if it reflects the adjustment of a cultivar to an area given that high hectolitre mass reflects a better quality of the produce, filled grains with compact structure rich in proteins. Measurements were made exclusively on pure seed.

Results differentiate the experimental variants between 74.6 kg/hl and 77.6 kg/hl. The lowest values were in the chickpea cultivar *Cicero 1*, while the highest ones were in the chickpea cultivar *Burnas* followed by the chickpea cultivar *Rodin*.

Among agrifunds, the highest values on the agrifund fertilised with N<sub>100</sub>P<sub>60</sub> K<sub>60</sub>, while the lowest values on the control agrifund with a constant fund of P<sub>60</sub>K<sub>60</sub>, on which the plants developed less than on the other ones, which had a negative impact on the seed filling and maturation.



Row distance (cm)	30	50	30	50	30	50	30	50	30	50	30	50	30	50	30	50		
HM kg/hl	76	76,4	76,4	76,8	76,9	77,6	75,2	75,9	75,9	76,3	76,7	77	74,6	75,4	75,2	76,0	76,1	76,9
Nitrogen rate	N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>0</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>50</sub> P <sub>60</sub> K <sub>60</sub>		N <sub>100</sub> P <sub>60</sub> K <sub>60</sub>	
Genotype	Burnas						Rodin						Cicero 1					
$\bar{X}$	76,68						76,16						75,7					
%	100						99,32						98,72					

Figure 2: Variation of the hectolitre mass kg/hl, depending on chickpea cultivar, nitrogen rate, and row distance (2010)

## CONCLUSIONS

1. Results of the research carried out on the response of some chickpea cultivars pointed out that the best results were in the chickpea cultivars *Burnas* and *Rodin* in which average yields per experimental cycle were above 2,120 kg/ha.
2. Nitrogen fertilisers applied at rates of N<sub>50</sub> resulted in an increase in yield of 38%. Increasing the fertiliser rate to N<sub>100</sub> is motivated since there were increases of the yield of 55% compared to the fertilisation rate of N<sub>50</sub>, and of 93% respectively, compared to the control variant.
3. Among the studied chickpea cultivars, to note the chickpea cultivar *Burnas* in which the average yield per fertilisation rate was above 2,350 kg/ha.
4. Increasing row distance from 30 cm to 50 cm is motivated, the increase in yield, on the average for the three chickpea cultivars reaching 9%, i.e. a very significant difference of over 153 kg/ha.

## ACKNOWLEDGEMENTS

This work has benefited from a grant awarded by the Romanian Ministry of Education, Research, Youth and Sport, through the National Council for Scientific Research in Higher Education (PN II IDEI no. 1067/2009, project code ID-867). Title: „**DEVELOPING A CULTIVATION TECHNOLOGY IN LENTIL AND CHICKPEA IN THE SOIL AND CLIMATIC CONDITIONS BETWEEN THE TIMIS AND CARAS AND NERA RIVERS**”. Project Manager: Prof. PhD Gheorghe David.

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