

# PHYSIOLOGICAL TRANSFORMATIONS OF *CICER ARIETINUM* CROP AFTER APPLYING SOME COMPLEX NPK FERTILIZERS

<sup>1\*</sup>Ovidiu Costică Ungureanu, <sup>1</sup>Iulian Stana, <sup>2</sup>Elena Ungureanu  
<sup>3,4</sup>Viviane Beatrice Bota, <sup>1,4</sup>Violeta Turcuș

<sup>1</sup>Universitatea de Vest „Vasile Goldiș” din Arad

<sup>2</sup>Universitatea de Științe Agricole și Medicină Veterinară „Ion Ionescu de la Brad” din Iași

<sup>3</sup>Asociația Terra Nobillis Arad

<sup>4</sup>Academia Română, Institutul Național de Cercetări Economice „Costin C. Kirițescu”, Centrul de Economie Montană CE-MONT

**Abstract:** Fertilizers are used in order to optimize the nutrition conditions and achieve high yields, without weakening the plant's resistance to pests and diseases, and without polluting the environment. The paper presents the role of soil as a nutrient substrate, the possibilities to improve its fertility, as well as the influence of complex NPK fertilizers on physiological indices of *Cicer arietinum* crop at Ezăreni farm, Iași.

**Keywords:** *Cicer arietinum*, fertilizers, NPK, nutrient substrate, chickpeas

## INTRODUCTION:

Mineral fertilizers have an important role over leguminous production elements (chickpeas-case study), with a broad influence on the plants physiological processes, with implication in the number of pods and beans per plant, weight of 1000 seeds and beans content in oil and proteins. Nitrogenous fertilizers in moderate doses can be useful, especially because in some cases chickpeas don't form nodosities and Nitrogen fixing bacteria don't meet the right conditions to develop, so the plants absorb the Nitrogen available in the soil.

The purpose of this study was to observe the influence of foliar fertilizers on physiological indices with production implications for chickpeas (*Cicer arietinum*) crop.

## MATERIALS AND METHODS:

The following materials were used for the experiments: cambic chernozem soil with the characteristics presented in table 1, *Cicer arietinum* L. seeds of Cicero 1 variety developed at I.C.C.P.T Fundulea (Fig. 1), with the chemical composition presented in table 2.



Fig. 1. *Cicer arietinum* L. plant

Tab. 1.

Agrochemical characteristics of the soil on which the experiments were performed

Depth (cm)	Humus (%)	Clay (%)	Total Nitrogen (mg/100 g soil)	Mobile Phosphorus (mg/100 g soil)	Soluble Potassium (mg/100 g soil)	pH
0-20	3.60	33	0.17	12.6	20.2	6.3
20-40	3.48	34	0.18	15.0	21.3	6.4
40-60	2.92	35	0.16	17.7	24.4	7.0

Tab. 2.

Chemical composition of the chickpeas seeds for 100 g dry substance

Crude protein 18.4 – 18.8%	Phosphorus 270 -176 mg
Carbohydrates 66 – 70%	Carotene (Provitamin A) 350 – 364 u.i.
Fats 5.6 – 6%	Thiamin (Vitamin B1) 0.1 – 0.33 mg
Cellulose 4.2 – 4.4%	Riboflavin (Vitamin B2) 0.56 – 0.6 mg
Ash 2.9 – 3.0%	Nicotinamides 2.7 – 2.9 mg
Calcium 205 – 215 mg	Ascorbic acid (Vitamin C) 5.6 – 5.9 mg
Iron 8.1 – 10.7 mg	Essential aminoacids 0.18 – 0.28%

Foliar fertilization in the field was done using fertilizers from the country as well as from outside the country:

**Folifag (g.l):** Nitrogen 75; Phosphorus 60; Potassium 48; Fe 0,1; Zn 0,05; Mn 0,1; Cu 0,02; B 0,015; Mo 0,007; S 0,5; Mg 0,2.

**Stimucrop:** Nitrogen 10%, Phosphorus 10%, Potassium 10%, Cu, Zn, Mo, B, Mg.

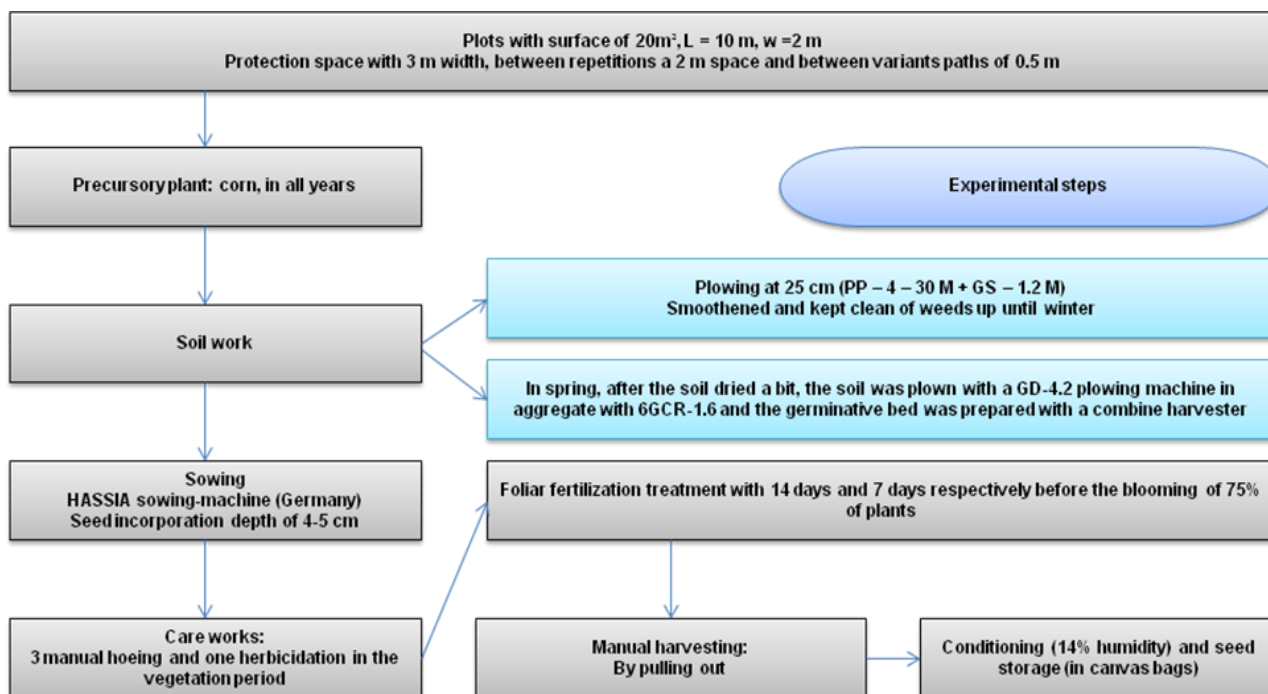
**Nutrileaf:** Nitrogen 20%; Phosphorus 20%; Potassium 20%; Fe 0,1%; Zn 0,05%; Mn 0,05%; Cu 0,05%; B 0,02%; Mo 0,001%; Mg 0,025%.

**Nutrivit:** Nitrogen 20%; Phosphorus 20%; Potassium 20%; Fe 0,146%; Zn 0,73%; Mn 0,001%; Cu 0,02%; B 0,1%; Mo 0,001%; Mg 1,5%, Chlorides < 30 mg/l.

**Stimucrop:** Nitrogen 5%, Phosphorus 3%, Potassium 3%, Cu, Zn, Mo, B, Mg.

**PPCF 2-3-1:** (Plant power + ICF 231): Plant power: Cu 0,6% , Mn 2,2%, Zn 0,6% and **ICF 231 (Folplant) (g/l):** Nitrogen 80; Phosphorus 130; Potassium 40; Fe 0,2 - 0,4; Zn 0,04 - 0,06; Mn 0,25 - 0,35; Cu 0,04 - 0,06; B 0,1; Mo 0,08 - 0,12; S 0,1 - 0,3; Mg 0,1.

A mono-factorial experiment was done with foliar fertilizers in 4 repetitions. The following experimental variants were used (fertilizers types and optimal dose): V1 - untreated NOPOK0 (witness); V2 - Folifag - 1% ; V3 - Folifag - 2% ;V4 - Stimucrop 10-10-10 – 1% ; V5 - PPCF 2-3-1 – 0,5% ; V6 - Nutrileaf – 0,5% ; V7 - Stimucrop 5-3-3 –1%; V8 - Nutrivit – 5 %. Method presented in graphic 1.



Graphic 1. Materials and methods used in the experiment

**RESULTS AND DISCUSSION:**

**The influence of foliar fertilizers on the production of chickpeas seeds**

Application of different foliar fertilizers on chickpeas crop has a positive influence on the morphological particularities of the plants as well as on the productivity elements (seed production), Weight of 1000 beans and chemical composition of the seeds.

The climatic conditions over the 3 years of experiments were alike from a temperature perspective as well as from a precipitation perspective, small climatic differences did not produce significant modifications on the growth and development of chickpea plants.

On average, over the course of 3 years (2013 – 2015) in which the experiments were performed, it could be observed that the chickpea plants fertilized

with foliar fertilizer had production that exceeded that of the witness variant (unfertilized chickpeas), with values between 728 kg/ha and 1.413 kg/ha.

Between the foliar fertilizers used in the experiment, it was found that Folifag (1%), Nutrivit (5%) and P.P.C.F. 2-3-1 (0.5%) products with productions of 2.329 kg/ha (145%), 2.508 kg/ha (157%) and 2.438 kg/ha (152%) respectively, have achieved the smallest productions, but against the witness (unfertilized chickpeas), production increases (significant) were between 728 kg/ha and 907 kg/ha.

From the obtained data we can affirm that chickpea plants react positively to fertilization with foliar fertilizers, production increases being over 728 kg/ha, showing their economic efficiency.

Detailed data is presented in table 3.

Tab. 3.

The influence of foliar fertilizers on the production of chickpeas seeds

Variant	Substance	Year
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	and dose	2013	2014	2015	Average value for 2013-2015		
		Production (kg/ha)	Production (kg/ha)	Production (kg/ha)	Production (kg/ha)	% compared to witness	Difference
1	Untreated	1697	1650	1456	1601	100	-
2	Folifag (1%)	2537	2450	2002	2330	145	729
3	Folifag (2%)	2737	2733	2184	2551	159	950
4	Stimucrop 10-10-10 (1%)	2797	2667	2158	2541	160	907
5	P.P.C.F. 2-3-1 (0.5%)	2650	2583	2080	2438	152	837
6	Nutrileaf (0.5%)	3180	3100	2366	2882	180	1413
7	Stimucrop 5-3-3 (1%)	3300	3100	2210	2870	179	1269
8	Nutrivit (5%)	2653	2817	1054	1508	157	907
DL 5%		34.4 kg/ha	122.7 kg/ha	114.9 kg/ha	230.6 kg/ha		
DL 1%		47.2 kg/ha	168.3 kg/ha	157.6 kg/ha	316.3 kg/ha		
DL 0.1%		64.2 kg/ha	229.0 kg/ha	214.5 kg/ha	430.5 kg/ha		

### The influence of foliar fertilizers on the production of protein for chickpeas

The study of foliar fertilizers effects on chickpeas has shown over the 3 years of experiments significant increases in production, 558 kg/ha to 752 kg/ha productions being with 179 kg/ha to 373 kg/ha bigger than that of the unfertilized witness variant.

The fertilizer Folifag 1% was the less efficient than the others, but the concentration increase from 1% to

2% made of it the most efficient product, protein production reaching 619 kg/ha, with 240 kg/ha more than the witness variant.

Stimucrop 5-3-3 1% product (700 kg/ha) was more efficient than Stimucrop 10-10-10 1% (615 kg/ha), the production achieved by chickpea plants after the treatment exceeding the witness variant with 85% and the Nutrivit 5% treated variant with 26%.

More details can be found in table 4.

Tab. 4.

The influence of foliar fertilizers on the production of protein for chickpeas

Variant	Substance and dose	Year					
		2013	2014	2015	Average value for 2013-2015		
		Production (kg/ha)	Production (kg/ha)	Production (kg/ha)	Production (kg/ha)	% compared to witness	Difference
1	Untreated	393	392	352	379	100	-
2	Folifag (1%)	598	588	488	559	147	179
3	Folifag (2%)	654	664	539	619	163	240
4	Stimucrop 10-10-10 (1%)	668	648	530	615	162	236
5	P.P.C.F. 2-3-1 (0.5%)	628	622	509	586	155	207
6	Nutrileaf (0.5%)	763	756	586	701	185	322
7	Stimucrop 5-3-3 (1%)	792	759	550	700	185	321
8	Nutrivit (5%)	631	681	505	605	160	207
DL 5%		113.7 kg/ha	62.0 kg/ha	51.2 kg/ha	43.6 kg/ha		
DL 1%		156.0 kg/ha	85.1 kg/ha	70.2 kg/ha	59.8 kg/ha		
DL 0.1%		212.3 kg/ha	115.8 kg/ha	95.6 kg/ha	81.4 kg/ha		

### The influence of foliar fertilizers on the Weight of 1000 beans for chickpeas

The Weight of 1000 beans in the 2013-2015 period had average values between 264 g (V8) and 152 g (V1).

Valuable results had the variants for which the Weight of 1000 beans exceeded 250 g, the variants

where Nutrileaf 0.5%, Stimucrop 10-10-10 1% (V4) and Stimucrop 5-3-3 1% (V7) fertilizers were used respectively, and to which the differences were distinctly significant compared to the unfertilized witness variant. The dose increase from 1% to 2% for the Folifag foliar fertilizer led to an increase of the Weight of 1000 beans from 237 g to 239 g (Tab. 5).

Tab. 5.

The influence of foliar fertilizers on the Weight of 1000 beans for chickpeas

Variant	Substance and dose	Year					
		2013	2014	2015	Average value for 2013-2015		
		Weight of 1000 beans (g)	Weight of 1000 beans (g)	Weight of 1000 beans (g)	Weight of 1000 beans (g)	% compared to witness	Difference
1	Untreated	152	152	152	152	100	-
2	Folifag (1%)	237	237	237	237	156	45
3	Folifag (2%)	239	239	239	239	157	45
4	Stimucrop 10-10-10 (1%)	264	264	264	264	173	112
5	P.P.C.F. 2-3-1 (0.5%)	264	264	264	264	173	112
6	Nutrileaf (0.5%)	264	264	264	264	173	112
7	Stimucrop 5-3-3 (1%)	264	264	264	264	173	112
8	Nutrivit (5%)	264	264	264	264	173	112
DL 5%		113.7 kg/ha	62.0 kg/ha	51.2 kg/ha	43.6 kg/ha		
DL 1%		156.0 kg/ha	85.1 kg/ha	70.2 kg/ha	59.8 kg/ha		
DL 0.1%		212.3 kg/ha	115.8 kg/ha	95.6 kg/ha	81.4 kg/ha		

1	Untreated	206	219	152	192	100	-
2	Folifag (1%)	224	259	228	237	123	45
3	Folifag (2%)	227	263	227	239	124	47
4	Stimucrop 10-10-10 (1%)	225	242	250	239	124	47
5	P.P.C.F. 2-3-1 (0.5%)	207	227	240	225	117	32
6	Nutrileaf (0.5%)	241	250	266	252	131	60
7	Stimucrop 5-3-3 (1%)	238	239	250	242	126	50
8	Nutrivit (5%)	213	216	264	231	120	39
DL 5%		10.6 g	19.9 g	10.1 g	31.4 g		
DL 1%		14.5 g	27.3 g	13.9 g	43.1 g		
DL 0.1%		19.7 g	37.2 g	18.9 g	58.6 g		

### The influence of foliar fertilizers on the oil content of chickpea seeds

The use of foliar fertilizers led to a decrease of oil percentage in the seeds, but given the overall production increase after the treatment, the oil production was significantly higher as well.

Significant negative differences compared to the witness variant regarding the oil percentage in seeds

were met in the case of Nutrileaf 0.55 (5.3% oil), Stimucrop 10-10-10 1% (5.4% oil) and Folifag 2% (5.5% oil) foliar fertilizers.

By applying the Folifag 1% and P.P.C.F 0.5% foliar fertilizers on chickpea plants, a 5.8% and 5.6% oil percentage were obtained respectively (Tab. 6).

Tab. 6.

The influence of foliar fertilizers on the oil content of chickpea seeds

Variant	Substance and dose	Year			
		2013	2014	2015	Average value for 2013-2015
		%	%	%	%
0	1	2	3	4	5
1	Untreated	6.1	6.0	5.9	6.0
2	Folifag (1%)	5.9	5.8	5.6	5.8
3	Folifag (2%)	5.6	5.5	5.3	5.5
4	Stimucrop 10-10-10 (1%)	5.5	5.5	5.3	5.4
0	1	2	3	4	5
5	P.P.C.F. 2-3-1 (0.5%)	5.8	5.7	5.5	5.6
6	Nutrileaf (0.5%)	5.4	5.3	5.2	5.3
7	Stimucrop 5-3-3 (1%)	5.3	5.2	5.0	5.2
8	Nutrivit (5%)	5.7	5.6	5.4	5.6
DL 5%		0.5	0.3	0.6	0.3
DL 1%		0.7	0.4	0.8	0.5
DL 0.1%		1.0	0.6	1.0	0.7

### CONCLUSIONS:

The foliar fertilizers treatments on chickpeas crop has led to some valuable morphological characters and productivity elements for all variants.

Compared to the unfertilized chickpeas (1.601 kg/ha), bigger productions were obtained by 45% (Folifag 1%) and 80% (Nutrileaf 0.5%).

Foliar fertilizers also had a role in the plants growth and development, remarkable results were obtained with Stimucrop 5-3-3 (1%) with a production of 2.870 kg/ha and Nutrileaf 0.5% with a production of 2.887 kg/ha.

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