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## Influence of foliar application of nutrients on yield and economics of chickpea

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**Abstract**

A field experiment was carried out during *rabi* 2018-19 at Research Farm of College of Agriculture, Nagpur to study the "Effect of nutrients foliar application on growth and yield of chickpea (*Cicer arietinum* L.)". The experiment was laid out in Factorial Randomized Block Design with twelve treatment combination and three replication. The treatment consisted of four nutrients foliar application [Water spray (Control), 1% KNO<sub>3</sub>, 2% Urea and 0.5% Zinc] and three stages of its application [Vegetative, Pre-flowering and Vegetative + pre-flowering]. The results showed that yield attributing character *viz.* number of pods plant<sup>-1</sup>, weight of pods plant<sup>-1</sup>, grain yield plant<sup>-1</sup> (g), grain yield, straw yield and biological yield (q ha<sup>-1</sup>) were significantly higher with foliar application of 2% urea at vegetative and pre-flowering stage. Also the economics studies *viz.* GMR, NMR and B:C ratio were also higher with 2% urea spray at vegetative + pre-flowering stage.

**Keywords:** Chickpea, foliar application, urea, KNO<sub>3</sub>, zinc, vegetative and pre-flowering stage

**Introduction**

It is important to increase the production potential of all the pulse crops to meet the ever increasing demand. Chickpea seeds contain, on an average, 23% protein, 63% total carbohydrates, 5% fat, 6% crude fiber and 3% ash and also rich in calcium, iron and niacin (Mula *et al.*, 2011) [11]. There is also a high mineral content of phosphorus, calcium, magnesium, iron and zinc. Chickpea seed, leaves and straw are used in many ways for human consumption. Malic and oxalic acids collected from green leaves are prescribed for intestinal disorders. Straw forms an excellent fodder for cattle.

Foliar fertilization of pulses during the seed development stage had received considerable attention to increase their seed production. The efficiency of nutrient uptake through foliar spray is considered to be greater than soil application of nutrients particularly when the soil moisture is poor. Urea is one of the most widely used foliar N-fertilizers, characterized by high leaf penetration rate and low cost, and most plants can absorb it rapidly and hydrolyse in the cytosol (Witte *et al.*, 2002) [9]. Potassium is a key nutrient in the plant's tolerance to stress such as high/low temperatures, drought, disease and pest occurrences. Potassium influences the water economy and crop growth through its effects on water uptake, root growth, maintenance of turgor, transpiration and stomatal regulation (Nelson, 1980) [7]. Zinc plays an important role in plant reproductive development for initiation of flowering, floral development, male and female gametogenesis, fertilization and seed development. Zinc plays important role as a metal component of enzymes or as a functional, structural, or regulator cofactor of large number of enzymes (Marschner, 1986) [5].

**Materials and methods**

A field experiment was carried out to study the effect of foliar application of nutrients on growth and yield of chickpea at Agronomy Section Farm, College of Agriculture, Nagpur during *rabi* season of 2018-19. The soil of experimental plot was medium black, clayey in texture, containing 0.50 % organic carbon, low in available nitrogen (260 kg ha<sup>-1</sup>), phosphorus (19.25 kg ha<sup>-1</sup>) and medium available potash (371 kg ha<sup>-1</sup>) with a pH of 7.7. The experiment was laid out in a factorial randomized block design with 12 treatment combinations consisted of four foliar spray (Water spray (F<sub>1</sub>), 1% KNO<sub>3</sub> (F<sub>2</sub>), 2% urea (F<sub>3</sub>), 0.5% zinc (F<sub>4</sub>)) at three growth stages (vegetative (S<sub>1</sub>), pre-flowering (S<sub>2</sub>) and vegetative + pre-flowering stage (S<sub>3</sub>)) replicated thrice. Chickpea variety Jaki-9218 was selected for the study. The seeds were treated with Carbendazim @ 4 g kg<sup>-1</sup> seeds and drilled at a spacing of 30 × 10 cm. The recommended dose of fertilizer 25:50:00 kg NPK ha<sup>-1</sup> of was applied in the form of urea and single super phosphate, respectively as soil application at the time of sowing.

## Results and Discussion

### Yield attributes

From the data given in Table No. 1 revealed that foliar spray of 2% urea (F<sub>3</sub>) produced significantly highest number of pods plant<sup>-1</sup>, weight of pods plant<sup>-1</sup> (g) and grain yield plant<sup>-1</sup> (73.56, 28.23 g and 26.87 g) and was significantly superior over other treatments. Foliar spray of 1% KNO<sub>3</sub> (69.06, 25.88 g and 24.20 g) and 0.5% zinc spray (67.31, 25.03 g and 23.23 g), being at par with each other, were significantly superior over control (61.89, 20.78 g and 19.04 g). Foliar spray of urea at the commencement of flowering stage might have helped in reducing flower drop and contributed more for reproductive organs such as stamens and pollen resulting in increased number of pods plant<sup>-1</sup>. Also it might have been effectively absorbed by chickpea and translocated more efficiently to developing pods for proper filling of grains which might have resulted into increased weight of pods plant<sup>-1</sup>. The increase in grain yield plant<sup>-1</sup> could be attributed to corresponding increase in number of pods plant<sup>-1</sup> and weight of pods plant<sup>-1</sup>. Similar results were confirmed by Atram (2007)<sup>[2]</sup>, Tanwar *et al.* (2014)<sup>[8]</sup>. They reported that foliar application of 2% urea solution at flower initiation stage and 10 days thereafter significantly improved number of pods plant<sup>-1</sup> and weight of pods<sup>-1</sup>.

Among the growth stages, foliar spray of nutrients at vegetative + pre-flowering stage (S<sub>3</sub>) produced significantly higher number of pods plant<sup>-1</sup>, weight of pods plant<sup>-1</sup> (g) and grain yield plant<sup>-1</sup> (72.23, 27.04 g and 25.36 g) superior over foliar spray of nutrients at vegetative stage (S<sub>1</sub>) (63.54, 22.49 g and 20.92 g) or at pre-flowering stage (S<sub>2</sub>) (68.09, 25.41 g and 23.73 g) alone.

Interaction effect between foliar spray of nutrient and growth stages of its application was found to be non-significant.

**Yield:** Significantly highest grain, straw and biological yield was observed with 2% urea spray (19.23, 36.54 and 55.77 q ha<sup>-1</sup>). It was followed by 1% KNO<sub>3</sub> spray (17.33, 29.46 and 27.41 q ha<sup>-1</sup>) and 0.5% zinc (17.13, 27.41 and 44.54 q ha<sup>-1</sup>). Increase in grain yield of chickpea due to foliar application of nitrogen might be due to increased yield parameter *viz.* number of pods plant<sup>-1</sup>, weight of pods plant<sup>-1</sup> and grain yield plant<sup>-1</sup>. Bhowmick *et al.* (2013)<sup>[3]</sup>, Tanwar *et al.* (2014)<sup>[8]</sup> reported that foliar application of 2% urea gives highest grain, straw and biological yield q ha<sup>-1</sup>.

Among the growth stages, foliar application of nutrients at vegetative + pre-flowering stage, both found significantly higher grain, straw and biological yield (19.43, 32.69 and 52.12 q ha<sup>-1</sup>) superior over single foliar application either at vegetative stage or at pre-flowering stage.

Interaction effect between foliar application of nutrients and growth stages of its application was found to be non significant.

### Economics

GMR, NMR and B:C Ratio was influenced significantly due to foliar spray of nutrients. Application of 2% urea registered significantly highest GMR, NMR and B:C Ratio (Rs. 1,01,711, 78,759 and 3.7 ha<sup>-1</sup>). It was followed by application of 1% KNO<sub>3</sub> (Rs. 94,777, 65,841 and 3.2 ha<sup>-1</sup>) and 0.5% zinc spray (Rs. 92,857, 64,577 and 3.2 ha<sup>-1</sup>), both being at par with each other, proved significantly higher over water spray (Rs. 80,640, 53,011 and 2.9 ha<sup>-1</sup>)

This results are in confirmation with the findings of Bodhade (2007)<sup>[4]</sup>, Tanwar *et al.* (2014)<sup>[8]</sup> and Aggarwal *et al.* (2015)<sup>[1]</sup>. They reported that highest gross monetary return, net monetary return and B:C ratio were obtained with 2% urea spray at flower initiation + pod formation.

**Table 1:** Yield attributes and yield as influenced by different treatments

Treatments	No. of pods plant <sup>-1</sup>	Weight of pods plant <sup>-1</sup>	Grain yield plant <sup>-1</sup>	Grain yield q ha <sup>-1</sup>	Straw yield q ha <sup>-1</sup>	Biological yield q ha <sup>-1</sup>
<b>A. Nutrient foliar application</b>						
F <sub>1</sub> - Control (water spray)	61.89	20.78	19.04	15.02	22.53	37.55
F <sub>2</sub> - 1% KNO <sub>3</sub>	69.06	25.88	24.20	17.33	29.46	46.79
F <sub>3</sub> - 2% Urea	73.56	28.23	26.87	19.23	36.54	55.77
F <sub>4</sub> - 0.5% Zinc	67.31	25.03	23.23	17.13	27.41	44.54
SE(m) ±	1.10	0.33	0.38	0.59	0.97	1.55
CD at 5%	3.23	0.97	1.12	1.72	2.84	4.55
<b>B. Growth stages</b>						
S <sub>1</sub> - Vegetative stage	63.54	22.49	20.92	15.10	25.51	40.61
S <sub>2</sub> - Pre-flowering stage	68.09	25.41	23.73	17.00	28.74	45.74
S <sub>3</sub> -Vegetative and pre flowering stage	72.23	27.04	25.36	19.43	32.69	52.12
SE(m) ±	0.95	0.29	0.33	0.51	0.84	1.34
CD at 5%	2.80	0.84	0.97	1.49	2.46	3.94
<b>Interaction (F×S)</b>						
SE(m) ±	1.91	0.58	0.66	1.02	1.68	2.69
CD at 5%	NS	NS	NS	NS	NS	NS
G. M.	68.00	25.08	23.30	17.18	28.98	46.16

**Table 2:** GMR, NMR and B:C ratio as influenced by different treatments

	Treatment	GMR (Rs. ha <sup>-1</sup> )	NMR (Rs. ha <sup>-1</sup> )	Benefit: Cost ratio
A	<b>Nutrients foliar application</b>			
	F <sub>1</sub> -Control (water spray)	80,640	53,011	2.9
	F <sub>2</sub> - 1% KNO <sub>3</sub>	94777	65,841	3.2
	F <sub>3</sub> - 2% Urea	1,07,117	78,759	3.7
	F <sub>4</sub> - 0.5% Zinc	92,857	64,577	3.2
	SE(m) ±	3191	3191	-
	CD at 5%	9357	9357	-
B	<b>Growth stages</b>			
	S <sub>1</sub> - Vegetative stage	82,530	54,673	2.9

	S <sub>2</sub> -Pre-flowering stage	92,907	64,669	3.2
	S <sub>3</sub> - Vegetative and pre-flowering stage	1,06,106	77,299	3.6
	SE(m) ±	2763	2763	-
	CD at 5%	8103	8103	-
<b>C</b>	<b>Interaction (F×S)</b>			
	SE(m) ±	5526	5526	-
	CD at 5%	NS	NS	-
	G.M.	93,848	65,547	3.3

### Conclusion

Foliar application of 2% urea at vegetative and pre-flowering stage significantly increased the yield attributes *viz.* number of pods plant<sup>-1</sup>, weight of pods plant<sup>-1</sup> (g), grain yield plant<sup>-1</sup> (g), and grain yield, straw yield and biological yield (q ha<sup>-1</sup>) of chickpea also gave significantly highest gross monetary return, net monetary return and B:C ratio.

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