

Effect of foliar nutrition on growth, yield and yield attributes of chickpea (*Cicer arietinum* L.) under medium black calcareous soil

ABSTRACT

A study was conducted to investigate the “Effect of foliar application of water soluble fertilizers on growth, yield and quality of chickpea (*Cicer arietinum* L.)” was laid out under medium black calcareous soil during *rabi* 2019-20 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The experiment followed a randomized block design (RBD) with three replications, comprising with 10 treatments. The results of the field study indicated that growth, yield and yield attributes of chickpea was significantly influenced by foliar nutrition. The growth, yield and yield attributes parameters *viz.*, plant height (44.50 cm), no. of branches per plant (9.31), no. of nodules per plant (9.88), no. of pods per plant (42.65) and test weight (16.30 g), seed (2395 kg ha⁻¹) and stover yield (3675 kg ha⁻¹) were recorded significantly higher under 100% RDF + 1.0 % (Mono Ammonium Phosphate) at 30 and 45 DAS, at harvest, but plant population and number of seeds per pod did not affect significantly with foliar application of WSF at harvest. At 50 DAS plant height (34.78 cm) and number of branches per plant (6.35) are also significantly highest.

Keywords: Chickpea, Foliar application, Water soluble fertilizers, Growth, yield attributes, yield.

1. INTRODUCTION

Chickpea (*Cicer arietinum* L.) is a member of family Fabaceae that is widely cultivated for its typically yellow-brown, pea like seeds. Chickpea is fourth largest pulse crop in the world. About 90 per cent of chickpea in the world is grown under rainfed conditions, where drought is one of the major constraints. India is the largest producer of chickpea contributing more than 75 per cent of the world population. In India, chickpea total production is 99.38 lakh tonnes in 95.47 lakh ha with a productivity of 1041 kg ha⁻¹[1]. In Gujarat, total production of chickpea is 6.35 lakh MT from an area of 4.05 lakh ha and productivity is 1568 kg ha⁻¹[2]. When fertilizers are applied as foliar, it utilized more than 90 per cent by plant. While similar amount is applied to the soil, only 10 per cent is utilized. Foliar nutrition is designed to eliminate the problems like fixation and immobilization of nutrients. Recently, new generation special fertilizers have been introduced exclusively for foliar feeding and fertilization. Especially fertilizers are a better source for foliar application [3]. These fertilizers have different ratios of N, P and K which are highly water soluble and so amenable for foliar [4]. In pulses, moisture stress had drastic effect on nitrogen fixation besides plant growth. The number of *Rhizobium* in soil decline drastically as soil dries. A suitable way to feeding during and after drought is through foliar nutrition. Hence, foliar nutrition is being recognized as an important method of fertilization in modern agriculture [5].

2. MATERIALS AND METHODS

A field experiment was carried out with chickpea (var.GJG-5) on medium black calcareous soil during *rabi* 2019-20 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. As per Table 1 & 2 the soil had pH 7.78, EC 2.50 dSm⁻¹, available N (236 kg ha⁻¹), P₂O₅ (28.3 kg ha⁻¹) and K₂O (278 kg ha⁻¹). The experiment was laid out in RBD with replicated thrice along with 10 treatments viz., T₁ - Control (N₀ fertilizer), T₂ - 100% RDF, T₃ - 100% RDF + 1.0% WSF (Urea Phosphate) at 30 and 45 DAS, T₄ - 100% RDF + 1.5% WSF (Urea Phosphate) at 30 and 45 DAS, T₅ - 75% RDF + 1.0% WSF (Urea Phosphate) at 30 and 45 DAS, T₆ - 75% RDF + 1.5% WSF (Urea Phosphate) at 30 and 45 DAS, T₇ - 100% RDF + 1.0% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS, T₈ - 100% RDF + 1.5% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS, T₉ - 75% RDF + 1.0% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS, T₁₀ - 75% RDF + 1.5% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS. The N and P₂O₅ were applied in respective plots by using the urea and DAP as a basal dose as per treatment in each plot, respectively. The net plot size was 4.0 m × 2.7 m and the crop was sown on 30th November 2019 keeping a spacing of 45 × 10 cm using recommended seed rate of 60 kg ha⁻¹. At maturity, pod and stover yield data were recorded. The protein content of seed was worked out by multiplying nitrogen content of seed with the factor of 6.25 as reported by [6].

3. RESULTS AND DISCUSSION

The data presented in Table 3 and Table 4 on effect of foliar nutrition on growth, yield and yield attributes of chickpea.

Growth parameters

The data presented in Table 3 indicated that the plant height and number of branches per plant were significantly affected due to foliar application of fertilizers at different stages of the crop. The treatment T₇ (100% RDF + Mono Ammonium Phosphate @ 1.0% at 30 and 45 DAS) recorded significantly higher plant height and number of branches at 50 DAS and at harvest as compared to control. The plant population did not significantly affect by foliar application of any treatment. The increase in growth parameters might be due to foliar application of N and P which helped in acceleration of various metabolic processes in plants, synthesis of IAA, stimulating effect on photosynthetic pigments and enzyme activity resulting greater apical growth. Above results are in line with [7].

Yield and yield attributes

The data concerning seed and stover yield furnished in Table 3 indicated that significant difference was observed in seed and stover yield with respect to foliar spray of WSF. The application of RDF 20:40:00 kg NPK ha⁻¹ + foliar application of WSF (Mono Ammonium Phosphate) @ 1.0 per cent applied at 30 and 45 DAS (T₇) recorded significantly higher seed (2395 kg ha⁻¹) and Stover (3675 kg ha⁻¹) yield as compared to control.

Foliar fertilization involves in physiological and biochemical processes along with N-fixation, higher photosynthetic rate resulting increased yield in chickpea. The present findings are in close agreement with the results obtained by [8] in chickpea and [8] in lentil.

The yield attributes were significantly affected due to foliar application of nutrients. The treatment T₇ (100% RDF + Mono Ammonium Phosphate @ 1.0 % at 30 and 45 DAS) recorded significantly higher number of pods plant⁻¹, number of nodules plant⁻¹ and test weight at harvest than all other treatments. The number of seeds per pod was found no significant. The improvement in yield attributes was due to additive effect of macro nutrients with better translocation of nutrients. The results obtained are in close conformity with the findings of [9] in chickpea and [10] in Soybean and [11] in green gram.

Available nutrients status in soil:

It is apparent from data presented in Table 4 showed that available macro (N, P₂O₅, K₂O and S) and micronutrients (Fe, Mn, Zn and Cu) content in soil have no any significant effect by foliar application of nutrition along with basal dose of fertilizer.

4. CONCLUSION

On the basis of one year experimental data, it can be concluded that the soil application of recommended dose of fertilizer 20:40 kg N: P₂O₅ ha⁻¹ along with foliar application of Mono Ammonium Phosphate (12-61-00 NPK kg ha⁻¹) @ 1.0% at 30 and 45 DAS were found effective in produced sustainable yield and growth of chickpea under irrigated conditions on medium black calcareous soil of South Saurashtra region.

DISCLAIMER(ARTIFICIALINTELLIGENCE)

Author(s) hereby declare that NO generative AltechnologiessuchasLargeLanguageModels(ChatGPT,COPILOT,etc)andtext-to-imagegeneratorshavebeenusedduringwritingoreditingof the manuscripts.

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UNDER PEER REVIEW

Table 1.0: Mechanical Composition of the experimental soil

Particular	Value at soil depth	Method followed
	(0-20 cm)	
Mechanical Composition		
1. Sand %	35.11	International Pipette method (Piper, 1950)
2. Silt %	12.75	
3. Clay %	52.14	
4. Texture class	Clayey	

Table 2.0: Chemical Composition of the experimental soil

Chemical Composition		
1. Soil pH (1:2.5)	7.78	pH meter (Richard, 1954)
2. EC (dS/m) at 25 ° C (1:2.5)	0.51	EC meter (Jackson, 1974)
3. Organic Carbon (%)	0.72	Walkley and Black's method (Jackson, 1974)
4. Available N (kg ha ⁻¹)	236	Alkaline KMnO ₄ method (Subbiah and Asija, 1956)
5. Available P ₂ O ₅ (kg ha ⁻¹)	28.3	Olsen's method (Olsen <i>et. al.</i> , 1954)
6. Available K ₂ O (kg ha ⁻¹)	278	Flame photometric method (Jackson, 1974)
7. Available S (ppm)	10.80	Turbid metric method (Chaudhary and Cornfield, 1966)
8. Available Fe (mg kg ⁻¹)	4.88	DTPA extract method (Lindsay and Norvell, 1978)
9. Available Zn (mg kg ⁻¹)	0.60	
10. Available Mn (mg kg ⁻¹)	6.10	
11. Available Cu (mg kg ⁻¹)	1.32	

Table3. Effect of foliar application of water soluble fertilizer (WSF) on yield and yield attributes of chickpea.

Treatments	Final plant population ha ⁻¹	Plant height (cm)		Number of branches plant ⁻¹		No. of pods plant ⁻¹	No. of seeds pod ⁻¹	No. of nodules plant ⁻¹ (45 DAS)	Test weight (g)	Yield (kg ha ⁻¹)	
		At 50 DAS	At harvest	At 50 DAS	At harvest					Seed	Stover
T ₁ Control	150637	26.72	35.80	3.56	7.50	33.67	1.82	7.13	12.62	1908	2812
T ₂ 100% fertilizer as per RDF	154333	27.82	36.80	3.79	7.55	35.07	1.83	7.87	13.72	1973	2912
T ₃ 100% RDF + 1.0% WSF (Urea Phosphate) at 30 and 45 DAS	167900	30.61	38.90	5.15	8.83	38.59	1.84	8.43	14.33	2065	2957
T ₄ 100% RDF + 1.5% WSF (Urea Phosphate) at 30 and 45 DAS	176467	33.39	43.40	5.62	8.81	38.78	1.89	9.19	15.23	2177	3371
T ₅ 75% RDF + 1.0% WSF (Urea Phosphate) at 30 and 45 DAS	159600	28.59	38.57	4.55	7.98	37.16	1.91	8.35	14.19	1959	3027
T ₆ 75% RDF + 1.5% WSF (Urea Phosphate) at 30 and 45 DAS	161232	28.66	38.57	4.56	7.94	35.96	1.84	8.17	14.26	2018	3064
T ₇ 100% RDF + 1.0% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS	183264	34.78	44.50	6.35	9.31	42.65	1.90	9.88	16.30	2395	3675
T ₈ 100% RDF + 1.5% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS	177527	32.51	44.03	5.59	8.81	39.13	1.96	9.28	15.16	2215	3387
T ₉ 75% RDF + 1.0% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS	161649	29.61	38.80	4.86	7.87	36.10	1.90	8.39	14.37	2081	3049
T ₁₀ 75% RDF + 1.5% WSF (Mono Ammonium Phosphate) at 30 and 45 DAS	156202	29.52	38.47	4.88	7.94	34.77	1.85	8.01	13.51	2024	3025
S.Em±	0.74	1.59	1.89	0.28	0.39	1.65	0.07	0.47	0.61	90.4	163
C.D. at 5%	NS	4.72	5.63	0.82	1.15	4.91	NS	1.40	1.81	269	485

