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Effect of foliar application of nutrients on growth and yield of chickpea (*Cicer arietinum* L.)

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Abstract

The present investigation aimed to find out the “Effect of Foliar Application of Nutrients on Growth and Yield of Chickpea (*Cicer arietinum* L.)” was carried out at Instructional Farm Faculty of Agriculture and Veterinary Sciences, Mewar University Chittorgarh, Rajasthan. Geographically Chittorgarh. The experiment was laid out in Randomized Block Design. Replicated thrice with 09 treatment combinations, comprising like T₁ Control, T₂ NPK 1.5% at pre-flowering and pod formation stage, T₃ Nano DAP 0.25% at pre-flowering and pod formation stage, T₄ Zinc 0.5% at pre-flowering and pod formation stage. T₅ Boron 0.2% at flowering time and pod formation stage, T₆ 2 NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage, T₇ Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage, T₈ Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage and T₉ 1% KNO₃+ Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage.

The application of 1% KNO₃+ Zinc 0.5% pre-flowering and pod formation stage on productivity was found most effective improve success on growth yield of chickpea crops. The plant height was found to be maximum ((12.54, 54.21 and 59.32), Branches maximum (8.99), number of nodules maximum (11.28, 19.26 and 26.73) at 30, 60 DAS and at harvest, highest fresh weight of nodules (0.29 and 0.42g), maximum dry weight of nodules (0.037, and 0.068 g),

The maximum number of pods (69.55 plant⁻¹), number of number of seeds (2.29 pos⁻¹), seed yield (1696.43 kg ha⁻¹), straw yield (3509.70 kg ha⁻¹) in under treatment T₇ (1% KNO₃+ Zinc 0.5% pre-flowering and pod formation stage). The minimum growth yield and economics were recorded in T₁ (Control).

Keywords: Chickpea, foliar application of nutrients

Introduction

Chickpeas are grown in over 50 countries, spanning regions such as the Indian subcontinent, North Africa, the Middle East, Southern Europe, the Americas, and Australia (Jukanti *et al.*, 2012) [7]. It is the premier pulse crop of Indian subcontinent and an important crop for vegetarian people as primary source of protein, it is third most important pulse crop grown in the world after dry beans and peas (Kaur *et al.*, 2020, Sharma *et al.*, 2025) [8, 15]. It is mainly roasted, boiled, or fried and is used as the central ingredient in main dishes. The seeds can be eaten whole split and decorticated (dal) or ground as flour (basan), the shoots and green leaves are even cooked and eaten as green vegetables. Chickpeas are an excellent source of carbohydrates and protein, accounting for roughly 80% of their total dry weight (Chibbar *et al.*, 2010) [4].

Chickpea contains 18-22% protein, 52-70% carbohydrate, 4-10% fat and sufficient quantity of minerals, calcium, phosphorus, iron and vitamins. Besides, it is also important for sustainable agriculture as it improves the physico-chemical and biological properties of the soil. Its deep roots also open the soil, which ensure better aeration and heavy leaf drop increases the organic matter in the soil. It can fix about 25-30 kg N ha⁻¹ through symbiosis and hence minimize dependency on chemical fertilizers (Pujitha *et al.*, 2022) [12].

Materials and Methods

The present experiment was carried out at Agronomy Research Farm of Mewar University, Gangrar, Chittorgarh, Rajasthan. Geographically Chittorgarh is located at 24.88°N 74.63°E. It has

an average elevation of 394 meter (1292 ft). Chittorgarh is located in the southern part of the state of Rajasthan, in the northwestern part of India. Net plot size 1.8 x 3= 5.4 m² and Spacing 30 x 10 cm with use of variety GNG-217.

Results and Discussion

Growth Attributes

The application of different irrigation levels in chickpea significantly influenced the growth characters at all growth stages Table 1, 2, 3, 4 and 5. It was recorded that the highest plant height (12.54, 54.21 and 59.32 cm) Branches was found to be maximum (8.99) at flowering number of nodules was found to be maximum (11.28, 19.26 and 26.73), highest fresh weight of nodules (0.29 and 0.42g) maximum dry weight of nodules (0.038, and 0.068 g) were recorded significantly higher in T₉ 1% KNO₃+ Zinc 0.5% pre-flowering and pod formation stage

The highest, plant height, number of branches found in gram crop might be due to addition of micro nutrient Zn and Boron in conjunction with foliar spray of all necessary macro and micro nutrients and their uptake by gram crop. It results in increased availability of all nutrients to plants and enhanced meristematic activity, cell division, enlargement and elongation of cells resulting in higher growth contributing characters. The results are in conformity with Rawat *et al.* (2021) ^[14], Rathod *et al.* (2017) ^[13], Das *et al.* (2017) ^[5], Kumar *et al.* (2023) ^[9], Muhammad (2023) ^[11], Singh *et al.* (2024) ^[16].

The foliar supplementation of various nutrients which is essential to enhancing tryptophan production a precursor of auxin, a hormone responsible for stem elongation and growth (Nadergoli *et al.*, 2011). Zinc also activates specific enzymes involved in cell division as well as elongation, Zinc plays a crucial role in the synthesis and metabolism of cellular components in both plants and animals, particularly influencing cell elongation, differentiation, and apical dominance all of which are directly related to shoot growth (Blesseena *et al.*, 2019) ^[3]. It also contributes indirectly to improved carbohydrate metabolism and translocation, thereby promoting overall vegetative growth. Boron application might be supported cell elongation and differentiation, further contributing to increased shoot growth. Another factor contributing to this increase was the extra fertilizer input from foliar supplementation of various nutrients which increased the nutrients uptake in plant. It consequently contributed to the growth of the plant's height, number of

branches, root length, quantity of nodules, their fresh and dry weights, and dry matter production. The Similar results were also published by, Kumar *et al.* (2023) ^[9] and Akshara *et al.* (2024) ^[1].

Yield attributes and yield

The data presented in Table 3 to 4 revealed that yield attributes of chickpea viz., The maximum Number of pods (69.55 plant⁻¹), maximum number of number of seeds (2.29 pos⁻¹), maximum seed yield (1696.43 kg ha⁻¹) and stover yield (3509.70 kg ha⁻¹) under treatment T₉ 1% KNO₃+ Zinc 0.5% pre-flowering and pod formation stage), which was at par with T₆ and T₇. In the present study, significant differences were observed in grain and straw yield of chickpea because of foliar spray of different nutrients. Among yield contributing characters, The highest grain yield, stover yield, yield increase over control is obtained due to the availability of both macro and micro nutrients is uniform throughout the vegetative growth stage of crop. Due to foliar application of nutrients 1% KNO₃+ Zinc 0.5% pre-flowering and pod formation stage.

Increase in yield was mainly due to the increased nutrient supply. It perhaps helped in quick absorption of nutrients at the time of reproductive stage where the nutrient demand was at the peak due to indeterminate growth habit of the crop. Hence, it reduced the flower drop and ultimately enhanced the pod setting and resulted in higher seed yield. As pod number is considered to be the major yield determinant in pulses, foliar application of 1% KNO₃+ Zinc 0.5% was able to increase the pod number in this experiment. The increased grain yield in chickpea due to beneficial effect of nutrients applied at proper time and stage was also reported by Anju *et al.*, (2017) ^[2], Jadhav and Kulkarni (2016) ^[6] and Mudalagiriappa *et al.*, (2016) ^[10] where foliar application of nutrients at flowering and pod development stage might have been easily absorbed and better translocated in the plant and maintained constant requirement of nutrients at the reproductive stage of the crop.

The increase in straw yield is directly related mainly to increase in the vegetative growth of the plant. It was mainly due to the maximum plant height. It might be due to continuous supply of nutrients as basal and as nutrient spray which in turn increased the leaf area and dry matter accumulation resulted in higher straw yield. This might be because macronutrients is responsible in influencing the yield attributing characters like pods per plant and which ultimately influenced the grain and straw yields.

Table 1: Effect of Foliar Application of Nutrients on plant height of Chickpea

Treatments	Treatments combination	Plant height (cm)		
		30 DAS	60 DAS	at harvest
T ₁	Control	9.88	44.43	47.27
T ₂	NPK 1.5% at pre-flowering and pod formation stage	11.22	50.55	56.28
T ₃	Nano DAP 0.25% at pre-flowering and pod formation stage	10.53	48.39	53.36
T ₄	Zinc 0.5% at pre-flowering and pod formation stage	10.13	47.97	52.77
T ₅	Boron 0.2% at flowering time and pod formation stage	10.06	47.37	51.43
T ₆	NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	11.91	53.23	58.68
T ₇	Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	11.82	51.55	57.66
T ₈	Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	10.99	50.10	55.37
T ₉	1% KNO ₃ + Zinc 0.5% pre-flowering and pod formation stage	12.54	54.21	59.32
	Sem ±1	0.70	1.75	1.93
	CD at 5%	2.10	5.25	5.80
	CV%	11.00	6.10	6.13

Table 2: Effect of Foliar Application of Nutrients on number of branches of Chickpea

Treatments	Treatments combination	Number of branches at flowering stage
T ₁	Control	6.72
T ₂	NPK 1.5% at pre-flowering and pod formation stage	7.55
T ₃	Nano DAP 0.25% at pre-flowering and pod formation stage	7.16
T ₄	Zinc 0.5% at pre-flowering and pod formation stage	7.00
T ₅	Boron 0.2% at flowering time and pod formation stage	6.99
T ₆	NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	8.56
T ₇	Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	7.82
T ₈	Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	7.33
T ₉	1% KNO ₃ + Zinc 0.5% pre-flowering and pod formation stage	8.99
	Sem ±1	0.27
	CD at 5%	0.82
	CV%	6.27

Table 3: Effect of Foliar Application of Nutrients on number of nodules of Chickpea

Treatments	Treatments combination	Number of nodules		
		At 30 DAS	60 DAS	at harvest
T ₁	Control	9.36	15.45	23.30
T ₂	NPK (19:19:19) 1.5% at pre-flowering and pod formation stage	10.85	17.85	25.34
T ₃	Nano DAP 0.25% at pre-flowering and pod formation stage	10.16	17.11	24.80
T ₄	Zinc 0.5% at pre-flowering and pod formation stage	9.95	17.00	24.53
T ₅	Boron 0.2% at pre flowering and pod formation stage	9.75	16.91	24.32
T ₆	NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	11.25	18.83	25.55
T ₇	Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	11.05	18.04	25.46
T ₈	Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	10.67	17.23	24.97
T ₉	1% KNO ₃ + Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	11.28	19.26	26.73
	Sem ±1	0.57	0.64	0.84
	CD at 5%	1.69	1.91	2.53
	CV%	9.34	6.29	7.66

Table 5: Effect of Foliar Application of Nutrients on number of Dry weight of nodules of Chickpea

Treatments	Treatments combination	Dry weight of nodules		
		30 DAT	60 DAT	at harvest
T ₁	Control	0.028	0.056	0.071
T ₂	NPK (19:19:19) 1.5% at pre-flowering and pod formation stage	0.034	0.064	0.078
T ₃	Nano DAP 0.25% at pre-flowering and pod formation stage	0.029	0.060	0.072
T ₄	Zinc 0.5% at pre-flowering and pod formation stage	0.032	0.058	0.073
T ₅	Boron 0.2% at pre flowering and pod formation stage	0.033	0.062	0.076
T ₆	NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	0.036	0.067	0.083
T ₇	Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	0.035	0.065	0.081
T ₈	Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	0.035	0.062	0.077
T ₉	1% KNO ₃ + Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	0.038	0.068	0.077
	Sem ±1	0.01	0.03	0.08
	CD at 5%	0.04	0.05	NS
	CV%	6.76	6.20	8.04

Table 6: Effect of Foliar Application of Nutrients on Yield of Chickpea

Treatments	Treatments combination	Yield attributes	
		Number of pods Plant ⁻¹	Number of seeds pod ⁻¹
T ₁	Control	53.76	1.81
T ₂	NPK (19:19:19) 1.5% at pre-flowering and pod formation stage	65.59	2.11
T ₃	Nano DAP 0.25% at pre-flowering and pod formation stage	61.36	2.02
T ₄	Zinc 0.5% at pre-flowering and pod formation stage	60.16	1.93
T ₅	Boron 0.2% at pre flowering and pod formation stage	58.07	1.89
T ₆	NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	68.72	2.25
T ₇	Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	67.27	2.21
T ₈	Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	62.93	2.08
T ₉	1% KNO ₃ + Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	69.55	2.29
	Sem ±1	2.71	0.08
	CD at 5%	8.14	0.23
	CV%	7.45	6.34

Table 7: Effect of Foliar Application of Nutrients on Seed and biological Yield of Chickpea

Treatments	Treatments combination	Yield attributes		
		Seed Yield (Seed)	Stover yield (kg ha ⁻¹)	Harvest Index (%)
T ₁	Control	982.14	2179.94	31.06
T ₂	NPK 1.5% at pre-flowering and pod formation stage	1553.57	3277.19	32.16
T ₃	Nano DAP 0.25% at pre-flowering and pod formation stage	1446.43	3072.89	32.01
T ₄	Zinc 0.5% at pre-flowering and pod formation stage	1392.86	3003.79	31.68
T ₅	Boron 0.2% at flowering time and pod formation stage	1321.43	2866.93	31.55
T ₆	NPK 1.5% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	1660.71	3457.05	32.45
T ₇	Nano DAP 0.25% + Zinc 0.5% + Boron 0.3% at pre-flowering and pod formation stage	1607.14	3360.84	32.35
T ₈	Zinc 0.5% + Boron 0.3% pre-flowering and pod formation stage	1500.00	3175.81	32.08
T ₉	1% KNO ₃ + Zinc 0.5% pre-flowering and pod formation stage	1696.43	3509.70	32.59
	Sem ±1	31.60	59.65	0.57
	CD at 5%	94.75	178.83	NS
	CV%	8.99	8.44	7.84

Conclusion

In the light of results summarized above, it may be concluded that for higher growth and seed yield, Application of foliar nutrient 1% KNO₃+ Zinc 0.5% pre-flowering and pod formation stage should preferred over other combination natural farming approaches. The observations are based on one season data, to get more precise information, it is suggested that the experiment.

It can be concluded that we can suggest to farmer use of 1% KNO₃+ Zinc 0.5% increasing yield of crops and improved soil nutrient status.

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