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Residual effect of potash, iron and zinc on growth and yield of chickpea

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Abstract
A field experiment was conducted during the *rabi* season of 2022–23 *and* 2023–24 at the Agronomy Instructional Farm, Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, to evaluate the residual effect of potash, iron and zinc on growth and yield of chickpea. The study comprised 27 treatment combinations involving three levels each of potassium (K_0: 0, K_1: 25, K_2: 50 kg K_2O ha^{-1}), iron (Fe_0: 0, Fe_1: 15, Fe_2: 30 kg Fe ha^{-1}), and zinc (Zn_0: 0, Zn_1: 8, Zn_2: 16 kg Zn ha^{-1}) given to preceding groundnut crop, experiment laid out in a factorial randomized block design with three replications. Recommended dose of fertilizer (12.5:25:25 kg N:P_2O_5:S ha^{-1}) was given to groundnut crop in all treatments. During *rabi* season, only RDF (20:40:00 kg N:P_2O_5:K_2O ha^{-1}) was given to succeeding chickpea. In the succeeding chickpea crop, the residual effect of 50 kg K_2O ha^{-1}, 30 kg Feha^{-1} and 16 kg Zn ha^{-1} led to significant improvements in plant height, number of pods per plant, seed and stover yields.

Keywords: Chickpea, Potash, Iron, Zinc, Residual yield

Introduction
The role of balanced fertilization in sustaining crop productivity has become increasingly important in modern Indian agriculture. Among essential nutrients, potassium (K) and trace elements like iron (Fe) and zinc (Zn) are gaining renewed attention due to their multifaceted contributions to plant health and soil fertility. Overreliance on conventional NPK fertilizers, without adequate supplementation of micronutrients, has led to the emergence of secondary and micronutrient deficiencies, particularly in the coarse-textured and intensively cultivated soils of North Gujarat. Potassium enhances physiological efficiency by regulating water balance, activating key enzymes, and facilitating assimilate transport, while also helping plants withstand environmental stresses. Iron plays a central role in energy transfer and photosynthetic pathways, whereas zinc is indispensable for growth hormones, enzyme systems, and reproductive development in plants.
Chickpea (*Cicer arietinum* L.), one of the most important pulse crops in India, serves as a major source of dietary protein, particularly in vegetarian diets. It holds a prominent place in India's pulse production, with Gujarat being a significant contributor in terms of area and yield. Chickpea not only improves soil fertility through biological nitrogen fixation but also fits well into crop rotations, especially in rainfed and semi-arid regions. However, suboptimal nutrient management particularly deficiencies of potassium, iron, and zinc poses a major constraint to achieving higher productivity and better seed quality. Therefore, integrated nutrient management practices that include both macro- and micronutrients are essential for enhancing chickpea yield, improving soil health, and supporting sustainable agriculture in the region.

Materials and Methods
The experiment was conducted on plot no. C-13 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District Banaskantha. The soil of the experimental site was loamy sand in texture, low in organic carbon, available potassium, sulphur, and DTPA-

extractable iron (Fe), medium in available nitrogen, phosphorus, sulphur, and DTPA-extractable manganese (Mn) and zinc (Zn), and high in DTPA-extractable copper (Cu). The electrical conductivity (EC) of the soil was within the normal range, indicating no salinity hazard. A recommended dose of fertilizer (RDF) comprising 12.5:25:25 kg N:P_2O_5:S ha^{-1} was uniformly applied to the groundnut crop in all treatments.

Results and Discussion

Number of pods per plant and pod weight per plant of chickpea

The data presented in Table 1 revealed that the residual application of potash, iron and zinc significantly improved the number of pods per plant and pod weight per plant of chickpea during both the years and on pooled basis. Among the potassium levels, residual application of 50 kg K ha^{-1} (K_2) recorded the highest number of pods per plant (39.70 pooled) and pod weight per plant (18.02 g pooled), followed by 25 kg K ha^{-1} (K_1), while the lowest values were recorded under the control (K_0).

The improvement may be attributed to the role of potassium in enhancing photosynthesis, enzyme activation, carbohydrate translocation and efficient partitioning of assimilates towards reproductive organs, resulting in better pod formation and development. Similar findings were reported by Goud *et al*. (2014) [4], Jat *et al*. (2017) [5], and Patel *et al*. (2018) [8].

Similarly, residual application of 30 kg Fe ha^{-1} (Fe_2) produced the maximum number of pods per plant (40.16 pooled) and pod weight per plant (17.95 g pooled), followed by 15 kg Fe ha^{-1} (Fe_1). This beneficial effect could be due to the involvement of iron in chlorophyll synthesis, electron transport, nitrogen metabolism and biological nitrogen fixation, which enhanced photosynthetic activity and assimilate production, thereby increasing pod setting and pod growth. Similar observations were made by Patil *et al*. (2007) [9], Yadav *et al*. (2020) [14], and Chauhan *et al*. (2024) [2].

Table 1: Residual effect of potash, iron and zinc on number of pods per plant and pod weight per plant of chickpea

Treatments	Number of pods per plant			Pod weight per plant (g)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Levels of Potash (K)						
K_0: 00 kg ha^{-1}	34.94	36.87	35.91	16.19	17.47	16.83
K_1: 25 kg ha^{-1}	37.71	38.51	38.11	16.48	18.23	17.36
K_2: 50 kg ha^{-1}	39.37	40.04	39.70	17.47	18.58	18.02
S.Em ±	0.848	0.623	0.526	0.250	0.362	0.220
C.D. at 5 %	2.41	1.77	1.48	0.71	1.03	0.62
Levels of Iron (Fe)						
Fe_0: 00 kg ha^{-1}	35.72	36.16	35.94	16.95	17.56	17.26
Fe_1: 15 kg ha^{-1}	36.72	38.52	37.62	16.01	17.99	17.00
Fe_2: 30 kg ha^{-1}	39.58	40.74	40.16	17.17	18.73	17.95
S.Em ±	0.848	0.623	0.526	0.250	0.362	0.220
C.D. at 5 %	2.41	1.77	1.48	0.71	1.03	0.62
Levels of Zinc (Zn)						
Zn_0: 00 kg ha^{-1}	34.91	36.87	35.89	16.31	17.56	16.93
Zn_1: 08 kg ha^{-1}	38.23	38.33	38.28	16.43	17.96	17.20
Zn_2: 16 kg ha^{-1}	38.88	40.22	39.55	17.40	18.75	18.07
S.Em ±	0.848	0.623	0.526	0.250	0.362	0.220
C.D. at 5 %	2.41	1.77	1.48	0.71	1.03	0.62
Interaction						
K × Fe, K × Zn, Fe × Zn, K × Fe × Zn	K x Fe	K x Fe	K x Fe	K x Fe	K x Fe	K x Fe
Year and Year interactions						
Y S.Em ±	-	-	0.429	-	-	0.180
C.D. at 5 %	NS	NS	NS	NS	NS	0.503
Y × K, Y × Fe, Y × Zn, Y × K × Fe, Y × K × Zn, Y × Fe × Zn, Y × K × Fe × Zn	NS	NS	NS	NS	NS	NS
C.V. %	11.80	8.41	10.20	7.77	10.40	9.29

Among the zinc treatments, 16 kg Zn ha^{-1} (Zn_2) recorded the highest number of pods per plant (39.55 pooled) and pod weight per plant (18.07 g pooled), which was statistically at par with 8 kg Zn ha^{-1} (Zn_1) for number of pods per plant. The positive response to zinc may be attributed to its role in auxin synthesis, enzyme activation, protein synthesis and improved nutrient uptake, leading to better flower retention, pod development and accumulation of photosynthates in pods. Supporting evidence comes from Ranparia (2001) [11], Elayaraja and Singaravel (2012) [3].

The interaction effects of potash, iron and zinc as well as their interactions with years were found to be non-significant for both the characters studied, indicating that the residual effects of individual nutrients remained consistent over the two years of experimentation. Overall, the residual application of 50 kg K ha^{-1}, 30 kg Fe ha^{-1} and 16 kg Zn ha^{-1} proved most effective in improving the yield attributes of chickpea.

Seed and Stover yields of chickpea

The data presented in Table 2 indicated that the residual application of potash, iron and zinc significantly influenced the seed and stover yields of chickpea during both the years as well as on pooled basis. Among the potassium levels, the residual application of 50 kg K ha^{-1} (K_2) recorded the highest seed yield (1574 kg ha^{-1}) and stover yield (2622 kg ha⁻¹), followed by 25 kg K ha⁻¹ (K_1), while the lowest yields were obtained under the control (K_0). The increase in yield may be attributed to the residual availability of potassium, which enhanced photosynthesis, enzyme activation, assimilate translocation and water-use efficiency, thereby promoting better growth and dry matter accumulation. Similar results were reported by Goud *et al*. (2014) [4], Jat *et al*. (2017) [5], and Patel *et al*. (2018) [8]. Residual application of 30 kg Fe ha⁻¹ (Fe_2) significantly produced the highest seed yield (1507 kg ha⁻¹) and stover yield (2511 kg ha⁻¹), followed by 15 kg Fe ha⁻¹ (Fe_1). The improvement in yield could be due to the role of iron in chlorophyll synthesis, electron transport, respiration and biological nitrogen fixation, which enhanced photosynthetic efficiency and nutrient utilization, resulting in higher biomass production and seed yield. Similar results were reported by Yadav (2002) [13], Kumar *et al*. (2006) [7], Patil *et al*. (2007) [9] and Thakur *et al*. (2010) [12]. Similarly, the residual application of 16 kg Zn ha⁻¹ (Zn_2) recorded the maximum seed yield (1513 kg ha⁻¹) and stover yield (2519 kg ha⁻¹), followed by 8 kg Zn ha⁻¹ (Zn_1), whereas the lowest yields were observed under Zn_0. The beneficial effect of zinc may be attributed to its involvement in enzyme activation, auxin synthesis, protein metabolism and improved nutrient uptake, leading to enhanced vegetative growth, dry matter production and efficient translocation of photosynthates to developing seeds. Similar findings also reported by Kulhare *et al*. (2014) [6], Ankesh *et al*. (2023) [1], Polara *et al*. (2010) [10].

Table 2: Residual effect of potash, iron and zinc on seed and stover yields of chickpea

Treatments	Seed yield (kg ha^{-1})			Stover yield (kg ha^{-1})		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Levels of Potash (K)						
K_0: 00 kg ha^{-1}	1293	1303	1298	2142	2181	2161
K_1: 25 kg ha^{-1}	1470	1520	1495	2436	2544	2490
K_2: 50 kg ha^{-1}	1557	1591	1574	2581	2663	2622
S.Em ±	32.03	40.01	25.62	52.79	67.19	42.72
C.D. at 5 %	91	114	72	150	191	120
Levels of Iron (Fe)						
Fe_0: 00 kg ha^{-1}	1376	1400	1388	2280	2345	2313
Fe_1: 15 kg ha^{-1}	1448	1494	1471	2401	2499	2450
Fe_2: 30 kg ha^{-1}	1495	1519	1507	2478	2543	2511
S.Em ±	32.03	40.01	25.62	52.79	67.19	42.72
C.D. at 5 %	91	114	72	150	191	120
Levels of Zinc (Zn)						
Zn_0: 00 kg ha^{-1}	1383	1404	1393	2291	2350	2321
Zn_1: 08 kg ha^{-1}	1428	1492	1460	2369	2497	2433
Zn_2: 16 kg ha^{-1}	1508	1517	1513	2499	2539	2519
S.Em ±	32.03	40.01	25.62	52.79	67.19	42.72
C.D. at 5 %	91	114	72	150	191	120
Interaction						
K × Fe, K × Zn, Fe × Zn, K × Fe × Zn	K x Fe	K x Fe	K x Fe	K x Fe	K x Fe	K x Fe
Year and Year interactions						
Y S.Em ±	-	-	20.92	-	-	34.88
C.D. at 5 %	NS	NS	NS	NS	NS	NS
Y × K, Y × Fe, Y × Zn, Y × K × Fe, Y × K × Zn, Y × Fe × Zn, Y × K × Fe × Zn	NS	NS	NS	NS	NS	NS
C.V. %	11.56	14.13	12.94	11.50	14.18	12.95

The interaction effects among potash, iron and zinc, as well as their interactions with years, were found to be non-significant for both seed and stover yields, indicating that the residual effects of individual nutrients remained consistent across the two years of study. Overall, the residual application of 50 kg K ha⁻¹, 30 kg Fe ha⁻¹ and 16 kg Zn ha⁻¹ proved most effective in enhancing the productivity of chickpea.

Summary and conclusion

The experimental results revealed that the residual application of potash, iron and zinc significantly improved the growth, yield attributes and productivity of chickpea. Residual application of 50 kg K ha⁻¹, 30 kg Fe ha⁻¹ and 16 kg Zn ha⁻¹ recorded the highest number of pods per plant, pod weight per plant, seed yield and stover yield over the lower levels and control. The interaction effects among nutrients and with years were non-significant, indicating a stable and consistent residual response across both years. Overall, the study concludes that the residual application of 50 kg K ha⁻¹, 30 kg Fe ha⁻¹ and 16 kg Zn ha⁻¹ is beneficial for enhancing the productivity of chickpea under the given experimental conditions.

Reference

1. Ankesh, Naik A, Ravi S, Pandit S, Rathod S, Bellakki MA. Effect of sulphur and zinc on growth, yield, quality and economics of cowpea (*Vigna unguiculata* L.). The Pharma Innovation Journal. 2023;12(12):589–593.
2. Chauhan KJ, Jat JR, Patel KK, Patel DM, Zankat BH. Effect of prom, sulphur and iron on growth, yield and quality of groundnut. International Journal of Research in Agronomy. 2024;7(12):174–180.
3. Elayaraja D, Singaravel R. Zinc and boron application on groundnut yield and nutrient uptake in coastal sandy soils. Asian Journal of Soil Science. 2012;7(1):50–53.
4. Goud VV, Konde NM, Mohod PV, Kharche VK. Response of chickpea to potassium fertilization on yield, quality, soil fertility and economic in vertisols. Legume Research. 2014;37(3):311–315.

5. Jat R, Naga SR, Choudhary R, Jat S, Mohammad I. Effect of potassium and sulphur fertilization on soil fertility of sesame (*Sesamum indicum* L.). International Journal of Chemical Studies. 2017;5(2):95–96.
6. Kulhare PS, Chaudhary MK, Uike Y, Sharma GD, Thakur RK. Direct and residual effect of Zn alone and incubated with cow dung on growth characters, Zn content, uptake and quality of soybean (*Glycine max* L. Merrill)-wheat (*Triticum aestivum* L.) in a vertisol. Soybean Research. 2014;12(2):136–148.
7. Kumar N, Singh S, Singh V. Effect of iron and sulphur levels on yield, oil content and their uptake by Indian mustard (*Brassica juncea*). Indian Journal of Agronomy. 2006;51(1):63–64.
8. Patel PK, Viradiya MB, Kadivala VH, Shinde RD. Effect of potassium and sulphur on yield attributes, yield and quality of summer groundnut (*Arachis hypogaea* L.) under Middle Gujarat Condition. International Journal of Current Microbiology and Applied Sciences. 2018;7(9):2268–2273.
9. Patil BP, Musale SV, Ranshur NJ, Adsule RN. Effect of Iron and Molybdenum on the efficiency of Rhizobium strain, yield and nutrient uptake by groundnut in inceptisol. An Asian Journal of Soil Science. 2007;2(2):35–40.
10. Polara KB, Sakarvadia HL, Parmar KB, Babariya NB. Direct and residual effect of Zn, Fe, and K on yield and their uptake by wheat - groundnut crop sequence in medium black soils. An Asian Journal of Soil Science. 2010;4(2):238–286.
11. Ranparia LB. Nutrition of groundnut in relation to sulphur, zinc and FYM in medium black calcareous soil of Western Gujarat [PhD thesis]. Junagadh Campus, Gujarat: Gujarat Agricultural University; 2001.
12. Thakur BD, Shaikh FG, Kalegore NK. Response of winter season groundnut (*Arachis hypogaea* L.) to iron and zinc application. Journal of Oilseeds Research. 2010;27(2):181–182.
13. Yadav PS. Response of phosphorus and iron on mungbean to loamy sand soil [M.Sc. Agriculture thesis]. Bikaner, Rajasthan: Rajasthan Agricultural University; 2002.
14. Yadav S, Verma R, Yadav PK, Bamboriya JS. Effect of sulphur and iron on nutrient content, uptake and quality of groundnut (*Arachis hypogaea* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(1):1605–1609.