

Evaluate the Effect of Zinc and Iron on Growth, Yield and Quality of Chickpea

Abstract

The research was lead at the Soil Science Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. during the *Rabi* season in 2020-21 and 2021-22. The experiment was laid out in Randomized Block Design with sixteen treatments and three replications with four levels of zinc and iron respectively with NPK as an RDF. All plant parameters *i. e.* plant height, number of branches plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, test weight, protein, grain yield and stover yield were found to be significant at C.D @ 5% and best in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) as compare with in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)].

Key words: Zinc, Iron, Chickpea, Plant parameters

Introduction

Chickpea (*Cicer arietinum* L.) is the most important ancient pulse crop being traditionally grown during rabi in India and cultivated mainly in semi-arid and warm temperate regions of world where the temperature is 20-30° C (Reddy, 2009). Chickpea belongs to the Leguminaceae family. It is grown in more than 50 countries, with more than 90 % of chickpea production coming from Asia (Yadav *et al.*, 2007). Chickpea is very valuable in terms of nutritional quality, it is a good source of protein, and have an important role in human diet particularly in developing countries. It contains 22.25 percent protein which is almost three times more than that of cereals.

Chickpea is the highest protein yielding grain legume. The crop has the capacity to fix 140 kg N ha⁻¹ in a growing season (Rupela and Saxena, 1987). 100 g of chickpea seeds provide 360 calories of energy, 5.2 g fat, 2.2 g minerals and 55 g carbohydrates. The malic and oxalic acid present in green leaves is very useful for recovering from intestinal disorder (Amin *et al.*, 2007). It is also rich in Ca, Fe, niacin, vitamin-B and vitamin- C. Its leaves contain malic acid which is very useful for stomach ailments and blood purification. It being a pulse crop enriches the soil through symbiotic nitrogen fixation (Dotaniya *et al.*, 2014).

Significant increases in seed yield of chickpea by Zn application were demonstrated (Valenciano *et al.*, 2010) and in general, each tone of chickpea seed yield removes 38 g of Zn from the soil (Ahlawat *et al.*, 2007). Among micronutrients, Zn deficiency seems to be the

most widespread (Roy *et al.*, 2006) and it has considerable negative effect on chickpea productivity. Zn deficiency is very common among chickpea-growing regions of the world because chickpea is generally considered sensitive to Zn deficiency (Khan *et al.*, 1998). Iron is a structural component of porphyrin molecules, cytochromes, heme, non heme, ferrichrome and leghaemoglobin. These substances are involved in oxidation-reduction reactions in respiration and photosynthesis (Havlin *et al.*, 1997).

Materials and Methods

A field experiment conducted at the Soil Science Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during the *Rabi* season of two years (2020-21 and 2021-22) growing chickpea *Var.* Sadabahar applied 4 levels of zinc and iron respectively Zinc = 0 kg ha⁻¹, 6.67 kg ha⁻¹, 13.34 kg ha⁻¹, 20 kg ha⁻¹ and Iron = 0 kg ha⁻¹, 2.5 kg ha⁻¹, 5 kg ha⁻¹, 7.5 kg ha⁻¹ including RDF for cluster bean = 20:40:20 kg ha⁻¹ experiment is lead to observe the plant parameters like that plant height, number of branches plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, test weight, protein, grain yield and stover yield.

Result and Discussion

A critical perusal of data pertaining in the table 1 and fig. 1 the effect of different levels of Zn and Fe plant height (cm) at different days interval of chickpea in both the years (2020-21 and 2021-22) was found to be significant at C.D @ 5%. The plant height of chickpea was found to be maximum 14.92 cm, 30.14 cm, 38.49 cm and 54.28 cm at 30 DAS, 60 DAS, 90 DAS and at harvest in 2020-21 and 14.96 cm, 30.47 cm, 39.07 cm and 55.09 cm at 30 DAS, 60 DAS, 90 DAS and at harvest in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) and minimum 12.54 cm, 25.33 cm, 32.35 cm and 45.62 cm at 30 DAS, 60 DAS, 90 DAS and at harvest in 2020-21 and 12.58 cm, 25.61 cm, 32.84 cm and 46.30 cm at 30 DAS, 60 DAS, 90 DAS and at harvest in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. Das *et al.*, (2012); Hossain *et al.*, (2016).

A critical perusal of data pertaining in the table 2 and fig. 2 the effect of different levels of Zn and Fe on plant of chickpea in both the years (2020-21 and 2021-22) was found to be significant at C.D @ 5%. The number of branches plant⁻¹ of chickpea was found to be maximum 14.32 in 2020-21 and 14.54 in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 14.25 in 2020-21 and 14.46 in 2021-22 in

treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and minimum 12.04 in 2020-21 and 12.22 in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. The number of pods plant⁻¹ of chickpea was found to be maximum 115.07 in 2020-21 and 116.79 in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 114.45 in 2020-21 and 116.16 in 2021-22 in treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and minimum 85.74 in 2020-21 and 87.03 in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. Deshlahare *et al.*, (2019); Sharma *et al.*, (2019).

The number of seeds pod⁻¹ of chickpea was found to be maximum 2.18 in 2020-21 and 2.21 in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 2.17 in 2020-21 and 2.20 in 2021-22 in treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and minimum 1.83 in 2020-21 and 1.86 in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. The test weight of 1000 seeds (g) of chickpea were found to be maximum 129.18 g in 2020-21 and 131.11 g in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 128.48 g in 2020-21 and 130.41 g in 2021-22 in treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and minimum 108.57 g in 2020-21 and 110.20 g in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. Pooja, C. and Sarawad, I. M. (2019); Kharol *et al.*, (2014).

The protein (%) of chickpea were found to be maximum 23.96 % in 2020-21 and 24.44 % in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 23.76 % in 2020-21 and 24.24 % in 2021-22 in treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and minimum 19.43 % in 2020-21 and 19.82 % in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. Sharma *et al.*, (2019); Kharol *et al.*, (2014).

A critical perusal of data pertaining in the table 3 and fig. 3 the effect of different levels of Zn and Fe on plant of chickpea in both the years (2020-21 and 2021-22) was found to be significant at C.D @ 5%. The seed yield of chickpea was found to be maximum 14.12 q ha⁻¹ in 2020-21 and 14.47 q ha⁻¹ in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 13.28 q ha⁻¹ in 2020-21 and 13.61 q ha⁻¹ in 2021-22 in treatment T₁₄ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 2.5 kg ha⁻¹) and minimum 7.20 q

ha⁻¹ in 2020-21 and 7.38 q ha⁻¹ in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. The stover yield of chickpea was found to be maximum 29.74 q ha⁻¹ in 2020-21 and 30.48 q ha⁻¹ in 2021-22 in treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) followed by 29.58 q ha⁻¹ in 2020-21 and 30.32 q ha⁻¹ in 2021-22 in treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and minimum 23.56 q ha⁻¹ in 2020-21 and 24.15 q ha⁻¹ in 2021-22 in treatment T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)] respectively. Kachave, T. R. and Kausadikar, H. K. (2018); Kuniya *et al.*, (2019).

Table 1. Effect of different levels of zinc and iron on plant height (cm) at different days interval of chickpea.

Treatments	Plant height (cm)							
	2020-21				2021-22			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
T ₁	12.54	25.33	32.35	45.62	12.58	25.61	32.84	46.30
T ₂	13.18	26.62	34.00	47.95	13.22	26.92	34.51	48.67
T ₃	12.65	25.55	32.64	46.02	12.69	25.83	33.13	46.71
T ₄	12.82	25.90	33.08	46.64	12.86	26.18	33.57	47.34
T ₅	13.35	26.97	34.44	48.56	13.39	27.26	34.96	49.29
T ₆	13.51	27.29	34.86	49.15	13.55	27.59	35.38	49.88
T ₇	13.92	28.12	35.91	50.64	13.96	28.43	36.45	51.40
T ₈	13.85	27.98	35.73	50.38	13.89	28.28	36.27	51.14
T ₉	13.77	27.82	35.53	50.09	13.81	28.12	36.06	50.84
T ₁₀	14.29	28.87	36.87	51.98	14.33	29.18	37.42	52.76
T ₁₁	14.04	28.36	36.22	51.07	14.08	28.67	36.77	51.84
T ₁₂	14.43	29.15	37.23	52.49	14.47	29.47	37.79	53.28
T ₁₃	14.76	29.82	38.08	53.69	14.80	30.14	38.65	54.50
T ₁₄	14.51	29.31	37.44	52.78	14.55	29.63	38.00	53.58
T ₁₅	14.84	29.98	38.29	53.98	14.88	30.31	38.86	54.79
T ₁₆	14.92	30.14	38.49	54.28	14.96	30.47	39.07	55.09
F - test	S	S	S	S	S	S	S	S
CD @ 5%	0.60	1.20	1.50	1.77	0.59	1.17	1.71	1.88
S.Ed. (±)	0.30	0.59	0.79	0.87	0.29	0.57	0.84	0.92

Table 2. Effect of different levels of zinc and iron on number of branches plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, test weight of 1000 seeds (g) and protein (%) of chickpea.

Treatments	Number of Branches Plant ⁻¹		Number of Pods Plant ⁻¹		Number of Seeds Pod ⁻¹		Test Weight of 1000 seeds (g)		Protein (%)	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
T ₁	12.04	12.22	85.74	87.03	1.83	1.86	108.57	110.20	19.43	19.82
T ₂	12.65	12.84	101.65	103.17	1.92	1.95	114.11	115.82	20.45	20.86
T ₃	12.14	12.33	97.56	99.02	1.85	1.87	109.52	111.17	19.78	20.18
T ₄	12.31	12.49	98.87	100.35	1.87	1.90	111.00	112.66	20.25	20.66
T ₅	12.82	13.01	102.96	104.50	1.95	1.98	115.58	117.32	20.95	21.37
T ₆	12.97	13.16	104.19	105.75	1.97	2.00	116.97	118.72	21.1	21.52
T ₇	13.36	13.56	107.35	108.96	2.03	2.06	120.52	122.33	22.04	22.48
T ₈	13.30	13.50	106.81	108.42	2.02	2.05	119.91	121.71	21.86	22.30
T ₉	13.22	13.42	106.20	107.79	2.01	2.04	119.22	121.01	21.54	21.97
T ₁₀	13.72	13.92	110.21	111.86	2.09	2.12	123.72	125.58	22.31	22.76
T ₁₁	13.48	13.68	108.28	109.90	2.05	2.08	121.56	123.38	22.18	22.62
T ₁₂	13.85	14.06	111.29	112.96	2.11	2.14	124.93	126.81	23.34	23.81
T ₁₃	14.17	14.38	113.83	115.54	2.15	2.19	127.79	129.71	22.67	23.12
T ₁₄	13.93	14.14	111.90	113.58	2.12	2.15	125.63	127.51	22.84	23.30
T ₁₅	14.25	14.46	114.45	116.16	2.17	2.20	128.48	130.41	23.76	24.24
T ₁₆	14.32	14.54	115.07	116.79	2.18	2.21	129.18	131.11	23.96	24.44
F - test	S	S	S	S	S	S	S	S	S	S
CD @ 5%	0.56	0.60	4.80	5.29	0.09	0.09	5.11	5.55	1.80	1.56
S.Ed. (±)	0.28	0.29	2.35	2.59	0.04	0.05	2.50	2.72	0.40	0.75

Table 3. Effect of different levels of zinc and iron on grain yield (q ha⁻¹) and stover yield (q ha⁻¹) of chickpea.

Treatments	Grain Yield (q ha ⁻¹)		Stover Yield (q ha ⁻¹)	
	2020-21	2021-22	2020-21	2021-22
T₁	7.20	7.38	23.56	24.15
T₂	8.88	9.10	26.27	26.93
T₃	9.09	9.32	25.22	25.85
T₄	9.65	9.89	25.55	26.19
T₅	10.27	10.53	26.61	27.28
T₆	10.04	10.29	26.93	27.60
T₇	11.50	11.79	27.75	28.44
T₈	11.42	11.71	27.61	28.30
T₉	12.33	12.64	27.45	28.14
T₁₀	12.16	12.46	28.48	29.19
T₁₁	12.45	12.76	27.99	28.69
T₁₂	13.15	13.48	28.76	29.48
T₁₃	13.08	13.41	29.42	30.16
T₁₄	13.28	13.61	28.92	29.64
T₁₅	13.05	13.38	29.58	30.32
T₁₆	14.12	14.47	29.74	30.48
F - test	S	S	S	S
CD @ 5%	0.54	0.71	0.97	1.21
S.Ed. (±)	0.26	0.35	0.47	0.59

Fig. 1. Effect of different levels of zinc and iron on plant height (cm) at different days interval of chickpea.

Fig. 2. Effect of different levels of zinc and iron on number of branches plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, test weight of 1000 seeds (g) and protein (%) of chickpea.

Fig. 3. Effect of different levels of zinc and iron on grain yield (q ha⁻¹) and stover yield (q ha⁻¹) of chickpea.

Conclusion

According to the results revealed the treatment T₁₆ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 7.5 kg ha⁻¹) was seen to be best for all the plant parameters which is followed by treatment T₁₅ (RDF @ 100 % + Zinc @ 20 kg ha⁻¹ + Iron @ 5 kg ha⁻¹) and the lowest treatment was T₁ [Absolute control (RDF @ 0 % + Zinc @ 0 kg ha⁻¹ + Iron @ 0 kg ha⁻¹)]. Which proved that full dose of NPK, Fe and Zn are recommendable to the farmers for increasing seed yield.

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