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Effect of sulphur and zinc on chickpea (*Cicer arietinum* L.) under rainfed condition

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Abstract

The present experiment was conducted during the *Rabi* season of 2019-20 at field experimentation center of Rajoula Farm, faculty of agriculture M.G.C.G.V Chitrakoot M.P. was carried through a field experiment on a sandy loam soil deficient in available Sulphur and Zinc on chickpea (*Cicer arietinum*) variety JG-14, during rabi 2019-20. Three levels of Zinc (0, 10 and 15 kg/ha) and three levels of Sulphur (0, 15 and 25 kg/ha) and their possible combinations were applied to soil. The plant was fertilized with uniform doses of RDF (recommended dose of fertilizer) on N and P as 20 and 50 kg/ha respectively through one time a basal application to soil. The growth and ancillary data were collected at 30, 45 DAS and at the harvest the data were collected on test weight and grain yield. The yield varied from 9.16 to 15.90 qha⁻¹ with a general mean of 13.75qha⁻¹. The main effects of sulphur and Zinc and their interaction were significant. It was evident that a combination dose of S₁Zn₂ (15 kg ha⁻¹ sulphur and 15 kg/ha⁻¹ Zinc) was the best, and higher doses than above were economically suitable for a rainfed crop of chickpea JG-14 Variety. It was, therefore, concluded that a combination dose of S₁Zn₂ (15 kg ha⁻¹ sulphur and 15 kg/ha⁻¹ Zinc) was optimum for growth and yield of Chickpea (*Cicer arietinum* L.) Under the given agro-ecosystem of experimentation.

Keywords: Chickpea, sulphur, zinc and rainfed

Introduction

Chickpea is an important source of protein in the diets of the poor, and is particularly important in vegetarian diets. Also, it is being used increasingly as a substitute for animal protein. Chickpeas are a helpful source of zinc, foliate and protein. They are also very high in dietary fiber and hence a healthy source of carbohydrates for persons with insulin sensitivity or diabetes. Chickpeas are low in fat and most of this is polyunsaturated. One hundred grams of mature boiled chickpeas contains 164 calories, 2.6g of fat (of which only 0.27g is saturated), 7.6g of dietary fiber and 8.9g of protein. Chickpeas also provide dietary calcium (49–53mg/100g). According to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) chickpea seeds contain on average- 23% protein, 64% total carbohydrates (47% starch, 6% soluble sugar), 5% fat, 6% crude fiber and 3% ash. High mineral content has been reported for phosphorus (340mg/100g), calcium (190mg/100g), magnesium (140mg/100g), iron (7mg/100g) and zinc (3mg/100g). Fayaz Hussain *et al.* (2020) [4], Sudhir Singh *et al.* (2018) [11].

Sulphur (S) is an essential element in forming proteins, enzymes, vitamins, and chlorophyll in plants. It is crucial in nodule development and efficient nitrogen fixation in legumes. Protein synthesis requires large amounts of sulphur, especially in the formation of oils within the seed, and is a sulphur is a constituent of several amino acids and vitamins found in both plants and animals. Thus, sulphur is an important factor in determining the nutritional quality of foods. Sulphur is also important in photosynthesis and contributes to crop winter hardiness. Tariq shah *et al.* (2017) [12].

Zn is involved in auxin metabolism like, tryptophanesynthesis, tryptamine metabolism. Zn also plays an important role in protein synthesis and nucleic acid and helps in utilization of N and P by plants. It is associated with water uptake and retention in the plants. Zn is also known to stimulate plant resistance to dry and hot weather and also bacterial and fungal diseases. Zinc also stabilizes ribosomal fraction in the plants. Boyer, T.C. and Stout, P.R. (1959) [2].

Methods and Materials

The present experiment was conducted during the Rabi season of 2019-120 with Randomized block design along with three replication of chickpea crop variety JG-14 at Rajula Farm of the

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Faculty of Agricultural Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna (Madhya Pradesh) located from 24° 31' N latitude and 81° 15' E latitude. Soil samples were collected separately from each plot of the experimental field to a depth of 0-15 cm prior to sowing of mustard crop. The Samples Were Analyzed For its physico-chemical properties and the mean values obtained are given. The soil of experimental site was sandy loam in texture, low in organic carbon, nitrogen and phosphorus and medium in available potassium. Black, C.A. (1965)^[1], Fisher, R.A. (1947)^[5].

Results and Discussions

A field experiment on a sandy loam soil deficient in available Sulphur and Zinc on chickpea (*Cicer arietinum*) variety JG-14, during rabi 2019-20. Three levels of Zinc (0, 10 and 15 kg/ha) and three levels of Sulphur (0, 15 and 25 kg/ha) and their possible combinations were applied to soil. The plant was fertilized with uniform doses of RDF (recommended dose of fertilizer) on N and P as 20 and 50 kg/ha respectively through one time a basal application to soil. The growth and ancillary data were collected at 30, 45 DAS and at the harvest the data were collected on test weight and grain yield

The observations were recorded on growth parameters, like plant height, root length, number of branches and sub-branches (secondary branches) plant⁻¹ and yield contributory characters viz., nodule number, pod number, seed/pod and grain test weight were recorded. Sudhir Singh *et al.* (2018)^[11]. The results indicated that all these parameters were significantly increased due to sulphur and Zinc application. Their interaction was also significant. It was evident that a combination dose of S₁Zn₂ (15 kg ha⁻¹ sulphur and 15 kg ha⁻¹ Zinc) was found to be best giving the maximum values. The yield varied from 9.16 to 15.90 q ha⁻¹ with a general mean of 13.75 q ha⁻¹. Jagmohan Singh, Raminder Kaur Hundal* and B.S Dhillon (2017)^[7].

The main effects of sulphur and Zinc and their interaction were significant. It was evident that a combination dose of S₁Zn₂ (15 kg ha⁻¹ sulphur and 15 kg ha⁻¹ Zinc) was the best, and higher doses than above were economically suitable for a rainfed crop of chickpea JG-14 Variety. It was, therefore, concluded that a combination dose of S₁Zn₂ (15 kg ha⁻¹ sulphur and 15 kg ha⁻¹ Zinc) was optimum for growth and yield of Chickpea (*Cicer arietinum* L.) Under the given agro-ecosystem of experimentation. Khalil Khan, Mohammad Mazid (2018)^[9].

Table 1: Growth, yield and yield attributes of chickpea as influenced by Sulphur and Zinc.

Treatments	Plant height (cm)		No of branches per plant		Length of root (cm)	No. of root nodules per plant	Pods plant ⁻¹	Seed pods plant ⁻¹	test weight (weight of 100 grain in g)	Grain yield
	45DAS	Harvest stage	Primary	Secondary	45DAS	75DAS				
S ₀	24.53	52.47	3.38	9.92	9.66	8.00	38.16	28.77	157.54	12.90
S ₁	26.13	57.95	3.56	10.20	10.68	9.55	41.57	30.33	155.75	14.08
S ₂	25.10	55.12	3.52	10.28	10.61	9.00	42.61	30.33	157.60	13.75
SE±	0.18	0.21	0.03	0.02	0.17	0.19	0.29	0.30	2.19	0.26
C.D. at 0.5%	0.54	0.64	0.11	0.06	0.52	0.60	0.89	0.91	NS	0.80
Zn ₀	21.26	42.95	3.24	9.68	8.41	6.55	33.75	26.33	158.33	10.41
Zn ₁	22.86	48.67	3.44	10.12	10.04	8.33	40.81	29.55	156.08	13.57
Zn ₂	25.25	55.18	3.78	10.59	12.51	11.66	47.78	33.55	156.47	16.54
SE±	0.18	0.21	0.03	0.02	0.17	0.19	0.29	0.30	2.19	0.26
C.D. at 0.5%	0.54	0.64	0.11	0.06	0.52	0.60	0.89	0.91	NS	0.80
P x Zn	NS	1.12	NS	0.10	NS	1.04	1.55	NS	NS	1.40

Conclusion

The findings elude that application of 15kg S with 15kg Zn/ha proved the most optimum and the beneficial fertility management for the “JG-14” Variety Chickpea for the Bundelkhand /Chitrakoot region of Madhya Pradesh. This fertility management (S₁Zn₂) resulted in maximum seed productivity up to 15.90q/ha.

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