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Effect of bio fortification of zinc and iron on yields attributes of chickpea (*Cicer arietinum* L.) through agronomic intervention

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Abstract

The present investigation “Effect biofortification of zinc and iron on yield attributes of chickpea (*Cicer arietinum* L.) Through agronomic intervention” was carried out during Rabi season in 2018-19 as Instructional Cum Research Farm of IGKV, Raipur (Chhattisgarh). The experiment was conducted on vertisols soil, which was neutral in soil pH (7.4), low in available nitrogen (226.76 kg ha⁻¹), medium in available phosphorus (12.36 kg ha⁻¹) and high in available potassium (374.34 kg ha⁻¹). The experiment was laid out in Split Plot Design with four replications. The experiment consist of two varieties and six different treatment combination. The significant variation was found in chickpea varieties and different treatment combinations. The maximum number of pods/ plant, more number of seed/ plant and seed yields was reported in treatment RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage followed by treatment RDF+ Soil application of ZnSO₄ @ 25 kg/ha at basal compared to other treatment and lowest in RDF (Standard control) where as 100 seed weight of chickpea showing non significant results. The variety indira chana-1 showing maximum number of pods/ plant, more number of seed/ plant, 100 seed weight and seed yields than variety vaibhav.

Keywords: Bio fortification, zinc, iron, yields attributes, chickpea, *Cicer arietinum* L.

Introduction

Pulses are vital source of stable protein food for the poor and vegetarians which represent the wide population of country. Pulses are not only important source of proteins but it also constituent starch, vitamin, and minerals. Chickpea is most important *Rabi* season pulse crop which has high digestible protein, iron, vitamin B and C. Its leaves contain malic acid which is very useful as stomach ailments and blood purification (Shakya, *et al.*, 2008) [8]. Chickpea is the second most important pulse crop after pigeon pea in the word for human diet and other use. In Chhattisgarh, chickpea is grown over an area of 366.10 thousand ha and average productivity of 1100 kg/ha (Anonymous, 2016-17b).

Legume crop which has unique property to form root nodules with the help of symbiotic nitrogen fixing bacteria *Rhizobium* and fixes atmospheric nitrogen. Chickpea also plays important role in increasing soil fertility due to its nitrogen fixing ability. Micronutrient deficiency Zn and Fe is major problem of now days because of use of high yielding varieties, intensive cropping system, inadequate supply of micronutrient and loss of organic matter content by erosion and pollution. Iron involved in chlorophyll and thylakoid synthesis and development of chloroplast and important element for plant growth and development. Zn application influence on synthesis of auxin, nodulation and nitrogen fixation which enhance the plant growth and development of crop and ultimately influence the seed yield (Kasthurikrishna and Ahlawat, 2000) [4]. Application of Zn enhance quality and yields of chickpea reported by Khan *et al.*, 2003 [5].

Material and methods

A field experiment was carried out at Instructional Cum Research Farm of IGKV, Raipur (Chhattisgarh), during Rabi season in 2018-19. To study the effect of bio fortification of zinc and iron on yields attributes of chickpea (*Cicer arietinum* L.) through agronomic intervention. The experiment comprised of main plots treatment two varieties viz., Vaibhav, Indira chana-1 and six treatment combination viz., T1: Recommended dose of NPK (Standard control), T2: RDF+ 0.5% ZnSO₄ foliar application at flowering and pod formation stage, T3: RDF+ 0.5%

FeSO₄ foliar application at pre flowering and pod formation stage, T4: RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage, T5: RDF+ Seed treatment 2g ZnSO₄/ kg of seed, T6: RDF+ Soil application of ZnSO₄ @ 25 kg/ha at basal in sub plots. The data on yields attributing characters were recorded at harvest stage of crops. The data were tabulated and statistically analysed.

Table 1: Yield attributing characters of chickpea as influenced by varieties and bio fortification of Zn and Fe through agronomic intervention

Treatment	Pods/Plant (No.)	Seeds/ Pod (No.)	100 Seed weight (g)	Seed Yield (kg/ha)
Varieties				
Vaibhav	38.40	1.45	25.07	1640.04
Indira chana-1	40.06	1.69	26.62	1768.16
SEm±	0.13	0.04	0.25	19.52
CD (0.05%)	0.61	0.19	1.17	90.99
Nutrient levels				
Recommended dose of NPK (standard control)	35.80	1.37	25.03	1458.69
RDF + 0.5% ZnSO ₄ foliar application at pre flowering and pod formation stage	39.34	1.55	25.77	1775.27
RDF + 0.5% FeSO ₄ foliar application at pre flowering and pod formation stage	38.86	1.60	25.50	1690.59
RDF+ ZnSO ₄ and FeSO ₄ through foliar application at pre flowering and pod formation stage	42.17	1.75	26.94	1858.84
RDF+ Seed treatment 2 g ZnSO ₄ /kg of seed	37.62	1.47	25.44	1648.64
RDF+ Soil application of ZnSO ₄ @ 25 kg/ha at basal	41.59	1.67	26.40	1792.55
SEm±	0.48	0.05	0.44	30.57
CD (0.05%)	0.41	0.17	NS	88.72

Combination of Zn and Fe was presented on Table 1. The results revealed that maximum number of pods/ plant (40.06) was observed in variety Indira chana-1 and minimum number of pods/ plant (38.40) observed in variety Vaibhav.

The treatment T4: RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage was observed more number of pods/ plant (42.17) compared to all other treatments and lesser number of pods/ plant (35.80) was found in treatment RDF (Standard control). The treatment RDF + soil application of ZnSO₄ 25 kg ha⁻¹ is at basal is at par with RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage. The Zn application increase photosynthetic rate, translocation and assimilation of metabolites in the sink which ultimately increase number of pods plants⁻¹. Similar results was reported by Singh *et al.* (2015) [9].

Number of seeds per pod

The application of ZnSO₄ and FeSO₄ significantly influence the number of seed per pod. The chickpea variety Indira chana-1 observed maximum no. of seed pod⁻¹ (1.69) and minimum no. of seed pod⁻¹ (1.45) in variety Vaibhav. The highest no. of seed pod⁻¹ (1.75) was recorded under treatment RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage compared to all other treatment and lower no. of seed pod⁻¹ (1.37) was observed in treatment RDF (Standard control). The treatment RDF+ Soil application of ZnSO₄ @ 25 kg ha⁻¹ at basal and treatment RDF+ 0.5% ZnSO₄ foliar application at pre flowering and pod formation stage is at par with treatment RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage. Similar results was observed by Nandan *et al.* 2018.

100 Seed weights

The maximum 100 seed weight (26.62 g) was observed in variety Indira chana-1 and minimum 100 seed weight (25.07 g) in chickpea variety Vaibhav. In case of different treatments combination of Zn and Fe, the non significant results was recorded in 100 seed weight.

Results and discussion

Yields attributing parameters

Number of pods per plant

The significant variation was found in chickpea varieties and different treatments.

Seed yields (kg/ha)

The significant variation was found in chickpea varieties and different treatments combination of Zn and Fe. The maximum seed yields (1768.16 kg ha⁻¹) was observed in Indira chana-1 and minimum seed yields (1640.04 kg ha⁻¹) observed in variety Vaibhav. In case of treatments combination the maximum seed yields (1858.84 kg ha⁻¹) was recorded under treatment RDF+ ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage compared to other treatments and minimum seed yield (1458.69 kg ha⁻¹) under treatment RDF (Standard control). The treatment RDF+ Soil application of ZnSO₄ @ 25 kg/ha at basal and RDF + 0.5% ZnSO₄ foliar application at pre flowering and pod formation stage is at par with treatment RDF+ZnSO₄ and FeSO₄ through foliar application at pre flowering and pod formation stage. The similar results was observed by Anitha *et al.* (2005) [11], (Mali *et al.*, 2003) [6] and (Jin *et al.*, 2008).

Interaction effect of chickpea varieties and different treatment combination of ZnSO₄ and FeSO₄ fertilization on yield attributing character was non significant.

Conclusion

From the results it concluded that the application of RDF+ZnSO₄ and FeSO₄ through foliar at pre flowering and pod formation stage has beneficial influence on yields attributing characters of chickpea. The maximum number of pods/plant, seed/pods and higher seed yield observed under treatment RDF+ZnSO₄ and FeSO₄ through foliar at pre flowering and pod formation stage. The chickpea variety Indira chana-1 give maximum yield attributing parameters. However the application of RDF+ZnSO₄ and FeSO₄ through foliar at pre flowering and pod formation stage enhance the seed yields and quality of chickpea and variety Indira chana-1 is superior than variety Vaibhav

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