Original Research Article

Influence of Phosphorus, Sulphur and Zinc levels on growth and yield of Blackgram (*Vigna mungo* L.)

ABSTRACT

A field experiment was conducted at Crop Research Farm (CRF) in the department of agronomy, SHUATS, Prayagraj, (U.P) in the crop black gram in *Zaid* season of 2021-2022. To study the effect of Phosphorus, Sulphur and Zinc levels on growth and yield of Blackgram. The treatment consisted of 2 levels of Phosphorus (40, 50 kg/ha), Sulphur (15, 20 kg/ha), Zinc as (10, 15 kg/ha) and a control. The experiment was laid out in RBD with 9 treatments and replicated thrice. The outcome of the experiment showed that application of 50 kg phosphorus along with 15 kg zinc as soil application (Treatment 8) recorded highest plant height (28.50 cm), maximum plant dry weight (4.19 g/plant), number of nodules per plant counted (25.77) and the yield attributes namely, a greater number of pods per plant (30.67), number of seeds per pod (12.00), seed yield (1.00 t/ha), test weight (36.30 g), straw yield (2.44 t/ha) and harvest index was found to be non-significant. Maximum gross return (87520 INR/ha), net return (61532 INR/ha) and benefit: cost ratio (2.36) was also obtained in the same treatment(T_8).

Key words: phosphorus, sulphur, zinc, growth, yield.

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INTRODUCTION

Pulses occupy a unique position in cropping system as a main, catch, cover, green manure and as intercrop.It is commonly grown in soils with low fertility status or with application of low quantities of organic and inorganic sources of plant nutrients, which in turn resulted in deterioration of soil health and productivity (Kumpawat, 2010). Black gram (*Vigna mungo* L.) is a widely grown grain legume and belongs to the family Fabaceae.It is the cheapest source of protein for the poor and is called the poor men's meat (Main, 1976). It contains approximately 25-28 per cent protein, 4.5-5.5 per cent ash, 0.5-1.5 per cent

oil, 3.5-4.5 per cent fibre and 62-65 per cent carbohydrate on dry weight basis (Kaul, 1982). It is one of the important pulse crops grown throughout India. Proper fertilization is essential to improve the productivity of this crop. It can meet its nitrogen requirements by symbiotic fixation of atmospheric nitrogen. The nutrients which need attention are phosphorus and sulphur (Thakur and Negi, 1985; Nandal, *et al*., 1987).

Phosphorus stimulates the symbiotic nitrogen fixation because in presence of phosphorus bacterial cell becomes mobile which is pre requisite for migration of bacterial cell to root hair for nodulation (Charel 2006). Phosphorus helps in proper root development which increases root nodules and consequently increases nitrogen fixation. Both phosphorus and sulphur can improve the quality and quantity. Black gram is mostly cultivated on marginal lands in mono/mixed cropping system without any fertilizers under rained conditions with results in generally low yield compared to its yield potential. The yield potential of crop can be realized and this yield gap can be maintained through adequate and balance supply of plant nutrients. (Renthunglo*et al*., 2018) reported significant superior growth characters, yield attributing of 100% recommended fertilizer dose.

Micronutrients are essential for the cropproduction and among the micronutrients, zinc deficiencyin the plant and soil has been reported across the world(Alloway, 2008). Zinc is an essential element for the activities

of a number of antioxidant enzymes which maintains themembrane lipids, proteins and nucleic acids in plant cells(Cakmak, 2008). In India, zinc is considered as the 3rdimportant yield limiting nutrient after the nitrogen andphosphorus. As most of the marginal soils brought undercultivation are showing the symptoms of zinc deficiency, ithas been predicted that the zinc deficiency in India is likelyto increase from 49-63 per cent by the year 2025(Arunachalam et al., 2013)

MATERIALS AND METHODS

The experiment was carried out during Zaid season 2021- 2022 at the Crop Research Farm (CRF) Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Allahabad), Uttar Pradesh.The trail was conducted in Randomized Block Design containing nine treatment combination with three replications and was laid out with different treatments assigned randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.1) withlow level of organic carbon (0.28%), available N (225

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Kg/ha), P (19.50 kg/ ha) and higher level of K (92.00 kg/ha). All the facilities required for crop cultivation are available. The treatment combinations are T_1- 40 kg/ha Phosphorus + 15 kg/ha Sulphur,T_2-40 kg/ha Phosphorus + 20 kg/ha Sulphur, T_3- 40 kg/ha Phosphorus + 10 kg/ha Zinc,T_4- 40 kg/ha Phosphorus + 15 kg/ha Zinc, T_5- 50 kg/ha Phosphorus + 15 kg/ha Sulphur,T_6- 50 kg/ha Phosphorus + 20 kg/ha Sulphur,T_7- 50 kg/ha Phosphorus + 10 kg/ha Zinc 50 kg/ha, T_8- Phosphorus + 15 kg/ha Zinc, T_9-Control R. D. F (25:50:25 kg/ha). The findings were noted on various growth parameters at harvest viz. plant height (cm), number of nodules per plant counted, dry weight, and the yield attributes namely, number of pods per plant, number of seeds per pod, test weightseed yield and straw yield.

Comment [md1]: Higher or not?

Comment [md2]: What are the considerations in determining this combination and dose in relation to the initial soil nutrient status?

Comment [md3]: Statistic analyisis?

RESULTS AND DISCUSSION

Growth Attributes:

At 45 DAS, maximum plant height (28.50 cm) was noted in treatment no. 8 with application of P 50 kg/ha+ Zn 15 kg/ha which was remarkablybetter over all other treatments and treatment 6 with application of P 50 kg/ha + S 20 kg/ha (27.57 cm) was statistically at par with treatment 8.

At 45 DAS, highest number of nodules per plant (25.77) was noted in treatment no. 8 with application of P 50 kg/ha+ Zn 15 kg/ha which was remarkably better over all other treatments and treatment 7 with application of P 50 kg/ha + Zn 10 kg/ha (24.93) was statistically at par with treatment 8.

At 45 DAS, maximum plant dry weight (4.19 g/plant) was noted in treatment no. 8 with application of P 50 kg/ha+ Zn 15 kg/ha which was remarkably better over all other treatments and treatment 7 with application of P 50 kg/ha + Zn 10 kg/ha (3.76) was statistically at par with treatment 8.

Bhunia *et al.* (2006) who reported increase in growth attributes with increasing phosphorus rates in different spices crop maybe because of the favorable effect of phosphorus on growth parameters due to effective utilization of nutrients through the extensive root system developed by crop plants under phosphorus application. Enhanced plant height with foliar spray of zinc were reported by Singh and Bhatt (2013).

Yield Attributes:

Treatment with application of P 50 kg/ha + Zn 15 kg/ha noted greater number of pods per plant (30.67) which was remarkably better over all other treatments and treatment 7 with application of P 50 kg/ha + Zn

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10 kg/ha (29.90) was statistically at par with treatment 8. Treatment with application of P 50 kg/ha + Zn 15 kg/ha noted greater number of seeds per pod (12.00) which was remarkably better over all others and treatment 7 with application of P 50 kg/ha + Zn 10 kg/ha (11.20) was statistically at par with treatment 8. Treatment with application of P 50 kg/ha + Zn 15 kg/ha noted maximum seed yield (1.00 t/ha) which was remarkably better over all others and treatment 7 with application of P 50 kg/ha + Zn 10 kg/ha (0.820 t/ha) was statistically at par with treatment 8. Treatment with application of P 50 kg/ha + Zn 15 kg/ha noted maximum straw yield (2.44 t/ha) which was remarkably better over all others and treatment 7 with application of P 50 kg/ha + Zn 10 kg/ha (2.20 t/ha) was statistically at par with treatment 8. Treatment with application of P 50 kg/ha + Zn 15 kg/ha noted maximum harvest index (2.44 t/ha) which was remarkably better over all others and treatment 7 with application of P 50 kg/ha + Zn 10 kg/ha (2.20 t/ha) was statistically at par with treatment 8.

Yield attributes were significantly affected by phosphorus levels. Phosphorus plays a primary role in photosynthesis by way of energy transfer and thereby increases photosynthetic efficiency resulting in increased availability of photosynthates. These all together resulted in overall increase in yield attributes. Similar findings were reported by Pal and Jana (1991), Rajkhowa *etal.*, (1992) and Kumar and Singh (2011). Zinc plays a pivotal role in cellular growth, differentiation and metabolism which results in vigorous growth of plants. Similar results were found by Choudhary*et. al.,* (2014).

CONCLUSION

It can be concluded that the application of phosphorous 50 kg/ha and Phosphorus along with 15 Zinc kg/ha was found to be more productive (1 t/ha)and commercially viable (2.36) in blackgram crop.

The conclusion drawn based on one season data only which requires further confirmation for recommendation.

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Table 1: Effect of different levels of Phosphorus, Sulphur and Zinc on growth attributes of Blackgram

Treatments	Plant Height (cm)	No. of nodules/ Plant	Dry weight (g/plant)
* 1. Phosphorus 40 kg/ha + Sulphur 15kg/ha	23.60	21.20	2.86
2. Phosphorus 40 kg/ha + Sulphur 20 kg/ha	24.43	22.40	2.99
3. Phosphorus 40 kg/ha + Zinc 10 kg/ha	23.57	21.80	2.80
4. Phosphorus 40 kg/ha + Zinc 15 kg/ha	24.30	22.91	3.40
5. Phosphorus 50 kg/ha + Sulphur 15 kg/ha	25.77	23.47	2.92
6. Phosphorus 50 kg/ha + Sulphur 20 kg/ha	27.57	24.03	3.03
7. Phosphorus 50 kg/ha +Zinc 10 kg/ha	27.30	24.93	3.76
8. Phosphorus 50 kg/ha +Zinc 15 kg/ha	28.50	25.77	4.19
9. N.P.K 25-50-25 kg/ha (Control)	22.20	20.87	2.10
F test	S	S	S
S Ed (±)	0.49	0.61	0.36
CD (P=0.05)	1.04	1.31	0.76

***** N & K was applied at 25:25 kg/ha as basal

Table 2:Effect of different levels of Phosphorus, Sulphur and Zinc on Yield attributes of Black gram:

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Treatments	No of Pods/plant	No of Seeds/pod	Test weight(g)	Seed yield (t/ha)	Straw yield(t/ha)	Harvest index (%)
* 1. Phosphorus 40 kg/ha + Sulphur 15kg/ha	25.20	9.53	31.74	0.56	1.89	20.25
2. Phosphorus 40 kg/ha + Sulphur 20 kg/ha	26.03	10.14	32.54	0.54	1.91	20.74
3. Phosphorus 40 kg/ha + Zinc 10 kg/ha	27.07	10.37	35.40	0.52	1.93	21.22
4. Phosphorus 40 kg/ha + Zinc 15 kg/ha	28.27	10.58	33.75	0.64	1.97	24.52
5. Phosphorus 50 kg/ha + Sulphur 15 kg/ha	27.91	10.77	34.80	0.55	1.96	20.96
6. Phosphorus 50 kg/ha + Sulphur 20 kg/ha	28.23	10.88	34.77	0.67	1.98	24.13
7. Phosphorus 50 kg/ha +Zinc 10 kg/ha	29.90	11.20	35.77	0.82	2.20	27.15
8. Phosphorus 50 kg/ha +Zinc 15 kg/ha	30.67	12.00	36.30	1.00	2.44	28.98
9. N.P.K 25-50-25 kg/ha (Control)	20.80	7.07	30.00	0.51	1.58	20.20
F test	S	S	S	S	S	NS
S Ed (±)	0.61	0.39	0.43	0.14	0.20	---
CD (P=0.05)	1.30	0.84	0.93	0.30	0.44	---

***** N & K was applied at 25:25 kg/ha as basal

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