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Effect of foliar application of secondary nutrients and zinc on growth and yield of Blackgram

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Abstract
A field experiment was conducted during *rabi,* 2016-17 on sandy loam soils of College Farm, Agricultural College, Mahanandi to study the effect of foliar sprays of secondary nutrients and zinc nutrition on growth, yield attributes and yield of blackgram. The experiment comprised of eight treatments *viz.,* control (T_1), RDF (20-50-0 kg N-P_2O_5-K_2O ha^{-1}) (T_2), RDF + foliar application of one per cent $CaNO_3$ (T_3), RDF + foliar application of one per cent $MgNO_3$ (T_4), RDF + foliar application of one per cent Sulphur (T_5), RDF + foliar application of one per cent each of $CaNO_3$, $MgNO_3$ and Sulphur (T_6), RDF + foliar application of $ZnSO_4$ @ 0.2 per cent (T_7), T_6 + foliar application of $ZnSO_4$ @ 0.2 per cent (T_8). The results revealed that all the growth parameters, yield attributes and yield was significantly influenced with the foliar spray of secondary nutrients (Ca, Mg and Sulphur) and zinc at 25 and 45 DAS along with recommended dose of fertilizers (T_8). This particular treatment was comparable with foliar spray of secondary nutrients along with recommended dose of fertilizers (T_6).

Keywords: Secondary nutrients, zinc, growth parameters, yield and blackgram

Introduction
Pulses are integral part of human diet providing a major source of dietary protein. Blackgram is one among these food legumes which is well suited under intensive cropping systems due to its short duration. In India, blackgram is cultivated in an area of 2.346 M ha with a production of 1.959 M t. In Andhra Pradesh, it occupies an area of 0.315 M ha producing 0.298 M t. The average productivity of blackgram in Andhra Pradesh (946 kg ha^{-1}) is high as compared to India's productivity (604 kg ha^{-1}) (Indiastat, 2015) [11], Being leguminous crops they are side lined in the aspect of nutrient management which is of great concern.

Blackgram as a pulse specially need more amounts of Ca, Mg and S out of 16 essential elements. The plant tissue contains nutrients in small amounts when the dry matter is concerned except some major elements like carbon. The supplementation of these essential nutrients through soil application is a common practice. But soil applied nutrients may or may not be available to plants due to several soil physico-chemical reactions and the entire fertilizer is not utilized by the crop within the season especially relating to short duration crops. The excess fertilizers not only increase the cost of cultivation but also pollute the dynamic soil system. Hence, supplying these small amounts through foliage improves the quality of produce by reaching the site of food synthesis directly and preserves the crop yields with low environmental impact.

Material and Methods
A field experiment was conducted during *rabi,* 2016-17 on sandy loam soils of College Farm, Agricultural College, Mahanandi, Andhra Pradesh. The soil was neutral in reaction, high in phosphorus, potassium and sulphur, medium in calcium, low in magnesium and nearly medium in zinc. The experiment comprised of eight treatments *viz.,* control (T_1), RDF (20-50-0 kg N-P_2O_5-K_2O ha^{-1}) (T_2), RDF + foliar application of one per cent $CaNO_3$ (T_3), RDF + foliar application of one per cent $MgNO_3$ (T_4), RDF + foliar application of one per cent Sulphur (T_5), RDF + foliar application of one per cent each of $CaNO_3$, $MgNO_3$ and Sulphur (T_6), RDF + foliar application of $ZnSO_4$ @ 0.2 per cent (T_7), T_6 + foliar application of $ZnSO_4$ @ 0.2 per cent (T_8). The test variety was TBG-104. The trail was laid out in RBD replicated thrice.

The foliar spray of nutrients was carried out at 25 and 45 DAS @ 500 l ha^{-1}. Five plants in each plot were marked separately for non destructive sampling and destructive samples were drawn from the gross plot leaving the extreme border row. Statistical significance was tested by 'F' value at 5 per cent level of probability and wherever the 'F' value was found significant, critical difference was worked out and the values were furnished.

Results and Discussion

Growth parameters

The results of the investigation revealed that, the growth parameters (plant height, leaf area and dry matter production) of blackgram were significantly influenced by foliar application of secondary nutrients and zinc (Table 1.). The highest values of growth parameters were recorded with T_6 + foliar application $ZnSO_4$ @ 0.2 per cent (T_8) treatment, however it was comparable with RDF + foliar application of one per cent each of $CaNO_3$, $MgNO_3$ and sulphur (T_6) treatment.The treatment control (T_1) recorded significantly lowest values of plant height and dry matter production over the rest of the treatments tried during the experimentation.

With regard to individual foliar sprays of secondary nutrients and zinc, RDF + foliar application of one per cent $MgNO_3$ (T_4) treatment recorded higher growth parameters and was at par with RDF + foliar application of one per cent $CaNO_3$ (T_3) treatment. While, RDF + foliar application of one per cent sulphur (T_5) was comparable with RDF + foliar application $ZnSO_4$ @ 0.2 per cent (T_7) treatment which in turn on par with RDF (T_2) for all the growth parameters recorded.

Table 1: Growth parameters of blackgram as influenced by foliar application of secondary nutrients and zinc.

Treatments	Plant height (cm)	Leaf area index	Dry matter production (kg ha^{-1})
T_1: Control	25.19	0.38	1646
T_2: Recommended dose of fertilizers (RDF)	27.55	0.41	1919
T_3: RDF + Foliar application of 1 % $CaNO_3$	29.45	0.66	2735
T_4: RDF + Foliar application of 1 % $MgNO_3$	30.45	0.70	2788
T_5: RDF + Foliar application of 1 % Sulphur	28.19	0.53	2307
T_6: RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur	31.71	0.85	2948
T_7: RDF + Foliar application of $ZnSO_4$ @ 0.2%	27.88	0.46	2085
T_8: T_6 + Foliar application of $ZnSO_4$ @ 0.2%	32.21	0.93	3104
SEm±	0.497	0.030	78
CD (P=0.05)	1.51	0.09	236

The combined spray of nutrients *i.e*. T_6 + foliar application of $ZnSO_4$ @ 0.2 per cent (T_8) treatment recorded highest growth parameters and this might be due to the balanced supply of the nutrients which promoted the plant growth processes. An increased dry weight with the combined foliar spray of N, P, K and Mg was reported by Mannan (2014) [5]. In addition to secondary nutrients zinc might have played an important role in the production of IAA and there by increased the growth characters. The increments in the growth traits through magnesium foliar application might be due to its role in the synthesis of metabolic products and activation of many enzymes which in turn affect the plant growth. Similar results of increase in the growth parameters with foliar application of magnesium and calcium were reported by Rady and Osman (2010) [8] and Deotale *et al*. (2015) [2].

Yield attributes and yield

Yield attributes (Number of pods $plant^{-1}$, seeds pod^{-1} and 1000 seed weight) and yield were highest with the application of T_6 + foliar application $ZnSO_4$ @ 0.2 per cent (T_8) treatment which was at par with RDF + foliar application of one per cent each of $CaNO_3$, $MgNO_3$ and sulphur (T_6) (Table 2 and 3). Regarding harvest index all the foliar spray treatments except control (T_1) and RDF (T_2) were on par with each other. The yields and harvest index were depicted in Fig. 1.

Among the individual foliar sprays of secondary nutrients and zinc, RDF + foliar application of one per cent $MgNO_3$ (T_4) treatment achieved higher values of yield attributes and yield which was comparable with + foliar application of one per cent $CaNO_3$ (T_3) treatment However, 1000-seed weight was higher with RDF + foliar application of one per cent sulphur (T_5) treatment. RDF + foliar application $ZnSO_4$ @ 0.2 per cent (T_7) treatment recorded non-significant increase over RDF (T_2) with regard to all the yield attributes and yield.

Table 2. Yield attributes of blackgram as influenced by foliar application of secondary nutrients and zinc.

Treatments	Number of pods $plant^{-1}$	Number of seeds pod^{-1}	1000- seed weight (g)
T_1: Control	8.1	4.7	41.30
T_2: Recommended dose of fertilizers (RDF)	9.7	5.0	41.62
T_3: RDF + Foliar application of 1 % $CaNO_3$	12.4	5.8	42.73
T_4: RDF + Foliar application of 1 % $MgNO_3$	13.9	5.9	42.69
T_5: RDF + Foliar application of 1 % Sulphur	11.8	5.4	43.39
T_6: RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur	14.2	6.2	44.14
T_7: RDF + Foliar application of $ZnSO_4$ @ 0.2%	10.1	5.2	42.12
T_8: T_6 + Foliar application of $ZnSO_4$ @ 0.2%	14.7	6.4	44.82
SEm±	0.51	0.13	0.390
CD (P=0.05)	1.6	0.4	1.19

Table 3: Seed yield (kg ha^{-1}), haulm yield (kg ha^{-1}) and harvest index (%) of blackgram as influenced by foliar application of secondary nutrients and zinc.

Treatments	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
T_1: Control	508	1210	28.70
T_2: Recommended dose of fertilizers (RDF)	639	1336	32.22
T_3: RDF + Foliar application of 1 % $CaNO_3$	1019	1776	36.45
T_4: RDF + Foliar application of 1 % $MgNO_3$	1089	1798	37.70
T_5: RDF + Foliar application of 1 % Sulphur	894	1492	37.44
T_6: RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur	1187	1906	38.36
T_7: RDF + Foliar application of $ZnSO_4$ @ 0.2%	782	1377	36.01
T_8: T_6 + Foliar application of $ZnSO_4$ @ 0.2%	1284	2025	38.76
SEm±	48	52	1.763
CD (P=0.05)	146	159	5.34

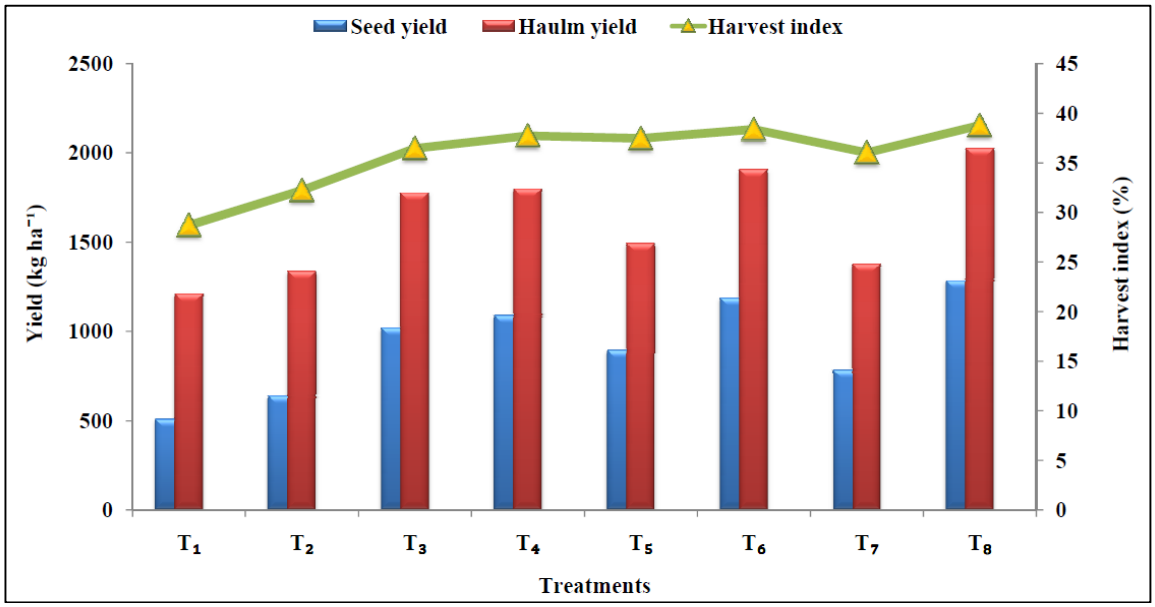

Fig 1: Seed yield (kg ha^{-1}), haulm yield (kg ha^{-1}) and harvest index (%) of blackgram as influenced by foliar application of secondary nutrients and zinc.

Higher yield attributes and yield were noticed with the combined foliar spray of secondary nutrients and zinc which might be attributed due to added advantage of zinc to secondary nutrients leading to optimum availability of nutrients for luxurious crop growth and efficient partitioning of assimilates from source to sink (Prasanna *et al.*, 2013) [7]. Choudhary *et al.* (2014) [1] found higher seed yield with foliar spray of S and Zn, while Veerabhadrappa and Yeledhalli (2005) [10] with Ca and S. Among the individual secondary nutrient foliar sprays, $MgNO_3$ foliar spray found to be promising in obtaining the higher number of pods plant^{-1} which correlates strongest to the yield (Neuhaus *et al*., 2014) [6] and this might be due to enhanced chlorophyll concentration and photosynthetic rate supplying assimilates to developing pods. The same was also reported by Howladar *et al*. (2014) [4]. Foliar application of sulphur had profound influence on the 1000 seed weight being a part of amino acids it might have activated the enzymes and seed formation. These results were also supported by Sarkar and Pal (2006) [9] and Gokila *et al*. (2015) [3].

The combined application of one per cent each of calcium, magnesium, sulphur and 0.2 per cent of zinc along with RDF resulted in a greater increase in the growth parameters and yield. Among the secondary nutrients, magnesium was found to be promising. Though individual zinc foliar spray did not record appreciable results, its combination with secondary nutrients showed synergism resulting in higher yields.

Reference

1. Choudhary P, Jhajharia A, Kumar R. Influence of sulphur and zinc fertilization on yield, yield components and quality traits of soybean (*Glycine max* L.). The Bioscan. 2014; 9(1):137-142.
2. Deotale RD, Mahale SA, Patil SR, Sahane AN, Sawant PP. Effect of foliar sprays of nitrate salts on morpho-physiological traits and yield of greengram. Journal of Soils and Crops. 2015; 25(2):392-392.
3. Gokila B, Baskar K, Saravanapandian P. Effect of sulphur supplementation on growth and yield of blackgram in typic rhodustalf. International Journal of Farm Sciences. 2015; 5(4):56-62.
4. Howladar SM, Osman ASh, Rady MM, Al-Zahrani HS. Magnesium foliar application and phosphorien soil inoculation positively affect *Pisum sativum* L. plants grown on sandy calcareous soil. World Academy of Science, Engineering and Technology. 2014; 8(5):436-440.
5. Mannan MA. Foliar and soil fertilization effect on seed yield and protein content of soybean. Bangladesh Agronomy Journal. 2014; 17(1):67-72.
6. Neuhaus C, Geilfus CM, Mühling KH. Increasing root and leaf growth and yield in Mg-deficient faba beans (*Vicia faba*) by $MgSO_4$ foliar fertilization. Journal of Plant Nutrition and Soil Science. 2014; 177(5):741-747.
7. Prasanna KL, Naidu SMM, Sumathi V, Nagamani C. Effect of nitrogen and zinc on growth, yield and economics of clusterbean [*Cyamopsis tetragonoloba* (L.)

Taub]. The Andhra Agricultural Journal. 2013; 60(2):260-263.
8. Rady MM, Osman ASh. Possibility of overcoming the adverse conditions for growth of bean plants in sandy calcareous soil by using bio-phosphorus fertilizer and magnesium foliar applications. Egyptian Journal of Horticulture. 2010; 37(1):85-101.
9. Sarkar RK, Pal PK. Effect of pre-sowing seed treatment and foliar spray of nitrate salts on growth and yield of greengram. Indian Journal of Agricultural Sciences. 2006; 76(1):62-65.
10. Veerabhadrappa BH, Yeledhalli NA. Effect of soil and foliar application of nutrients on growth and yield of groundnut. Karnataka Journal of Agricultural Sciences. 2005; 18(3):814-816.
11. www.indiastat.com