Response of Foliar Spray of Nutrients on Yield and Nutrient Uptake by Black gram (*Vigna mungo* L.)

Abstract

A field experiment was conducted at experimental farm, Department of Agronomy, A field experiment was conducted at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan) during Rabi season of 2023-24 to Response of foliar spray of nutrients on yield and nutrient uptake by black gram variety "Pratap Urd-1" was used in this study. The result revealed that the maximum yield parameter such as number of pods per plant (15.20), number of seed per pod (6.44), grain yield (11.52 q/ha), straw yield (5.62 q/ha) with application of T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 %. The maximum nitrogen content in grain and straw (3.58 and 1.64%), phosphorus (0.39 and 0.48%), potassium content (1.73 and 1.62%) and nitrogen uptake in grain and straw (27.37 and 25.62 kg/ha), phosphorus (4.49 and 7.50 kg/ha) and potassium uptake (19.93 and 25.30 kg/ha) were recorded with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 %. It was concluded that the treatment T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % found significantly higher yield and nutrient uptake by black gram.

Key words: -Foliar application; Macro & Micro nutrients; ; Yield

1. Introduction

Black gram [*Vigna mungo* (L.)] is one among the food legumes which is well suited under intensive cropping systems due to its short duration. Pulses are crops high in energy, yet they are grown on marginal and sub-marginal soils in rainfed environments with minimal inputs. Because they are leguminous crops, they are neglected in the very important area of nutrient management. But from the perspective of essentiality, each and every essential element is necessary for the growth of plants (Fageria *et al.* 2009).

However, the use of high analysis fertilizers devoid of secondary and micronutrients, along with the development of agriculture, result in different nutritional shortages that require external supplementation. A balanced supply of secondary and micronutrients promotes plant growth in both quantity and quality, resulting in agricultural production that is profitable. Out of the 16 necessary elements, pulses in particular require higher concentrations of P, Ca, Mg, S, and Mo (Thiyagarajan *et al.* 2003).

Generally speaking, calcium is a structural element of membranes and cell walls and is essential for root elongation, growth, and enzyme control in addition to cell division. Lack of calcium ions inhibits the growth of nodule bacteria, which affects nitrogen fixation, especially in legumes (Ali and Venkatesh 2009).

Pulses specially need more amounts of P, Ca, Mg, S and Mo out of 16 essential elements (Thiyagarajan *et al.* 2003). In general, calcium is a structural component of cell wall and membranes which has its key role in cell division, growth, enzyme regulation and root elongation. Particularly in legumes, lack of calcium ions prevents the development of nodule bacteria, thus affecting nitrogen fixation (Ali and Venkatesh 2009).

The most deficient micronutrient in Indian soils is zinc, making it mandatory to include in the nutrient management practices. It improves the quality of the produce apart from improving the yields and play greater role in the synthesis of auxins. 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, appropriate recommendations are needed because of increasing fertilizer costs and awareness of environmental problems. The plant tissue contains nutrients in small amounts when the dry matter is concerned except some major elements like carbon. For producing one ton of biomass pulses major and minor elements (Choudhary *et al.* 2014).

2. Materials and Methods

A field experiment was conducted during Rabi season of 2023-24 at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.32%), deficient inavailable zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in

randomized block design with three replications consisting of nine treatments *viz.* The experiment was laid out in randomized block design with three replications and ten treatments *i.e.* T_1-Control, T_2-75% RDF (15: 37.5:0 NPK kg/ha), T_3-100% RDF (20:50:0 NPK kg/ha), T_4-100% RDF + Foliar application of 1 % $CaNO_3$, T_5-100% RDF + Foliar application of 1 % $MgNO_3$, T_6-100% RDF + Foliar application of 1 % Sulphur, T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur, T_8-100% RDF + Foliar application of $ZnSO_4$ @ 0.2 % and T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2. The required quantities of fertilizers as per treatments were applied. The doses of NPK were applied in the form of urea, diammonium phosphate, murate of potash respectively. The half dose of nitrogen gives basal dose and remain two split doses after irrigation and full dose of potassium at basal dose and phosphorus doses giving according to treatments.

3. Results and Discussion

3.1 Yield and yield attributes

The data significantly (Table 1.0) higher number of pods per plant was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (15.20), it was found at par with T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and T_5-100% RDF + Foliar application of 1 % $MgNO_3$ (14.70 and 14.40). The minimum number of pods per plant was obtained with T_1-Control (8.60). The significantly higher number of seed per pod was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (6.44), it was found at par with T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and T_5-100% RDF + Foliar application of 1 % $MgNO_3$ (6.22). The minimum number of seed per pod was obtained with T_1-Control (4.72). Same findings also reported by Thalooth *et al.* (2006), Yedukondalu *et al.* (2007), Kale *et al.* (2011), Choudhary *et al.* (2014) and Manjhi *et al.* (2020).

The data significantly (table 1.0) higher grain yield was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (11.52 q/ha), it was found at par with T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and T_5-100% RDF + Foliar application of 1 % $MgNO_3$ and T_5-100% RDF + Foliar application of 1 % $MgNO_3$ (10.63 and 9.78 q/ha). The minimum grain yield was obtained with T_1-Control (7.28 q/ha). The significantly higher grain yield was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (15.62 q/ha), it was found at par with T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and T_5-100% RDF + Foliar application of 1 % $MgNO_3$ (14.70 and 13.70 q/ha). The minimum grain yield was obtained with T_1-Control (11.30 q/ha). These results also confirmed by Huda *et al.* (2010), Rady and Osman (2010), Pathak *et al.* (2012), Neuhaus *et al.* (2014) and Krishnaveni *et al.* (2018).

3.2 Nutrient content and uptake

The data significantly (Table 2.0) higher nitrogen content in grain was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (3.58 %). The minimum nitrogen content in grain was obtained with T_1-Control (2.92 %). The significantly higher nitrogen content in straw was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (1.64 %). The minimum nitrogen content in straw was obtained with T_1-Control (1.25 %). The significantly higher phosphorus content in grain was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (0.39 %). The minimum phosphorus content in grain was obtained with T_1-Control (0.18 %). The significantly higher phosphorus content in straw was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (0.48 %). The minimum phosphorus content in straw was obtained with T_1-Control (0.28 %). The significantly higher potassium content in grain was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (1.73 %). The minimum potassium content in grain was obtained with T_1-Control (1.55 %). The significantly higher potassium content in straw was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (1.62 %). The minimum potassium content in straw was obtained with T_1-Control (1.35 %). Similar concluded by Shanti *et al*. (2008), Howladar *et al*. (2014), Puniya *et al.* (2014) and Prasad *et al*. (2016).

The data significantly (Table 3.0) higher nitrogen uptake in grain was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (27.37 kg/ha). The minimum nitrogen uptake in grain was obtained with T_1-Control (21.26 kg/ha). The significantly higher nitrogen uptake in straw was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (25.62 kg/ha). The minimum nitrogen uptake in straw was obtained with T_1-Control (14.13 kg/ha). The significantly higher phosphorus uptake in grain was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (4.49 kg/ha). The minimum phosphorus uptake in grain was obtained with T_1-Control (1.31 kg/ha). The significantly higher phosphorus uptake in straw was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (7.50 kg/ha). The minimum phosphorus uptake in straw was obtained with T_1-Control (3.16 kg/ha). The significantly higher potassium uptake in grain was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (19.93 kg/ha). The minimum potassium uptake in grain was obtained with T_1-Control (11.28 kg/ha). The significantly higher potassium uptake in straw was obtained with T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % (25.30 kg/ha). The minimum potassium uptake in straw was obtained with T_1-Control (15.26 kg/ha). These findings also supported by Kundu and Sarkar (2009), Ranade and Malvi (2011), Mobarak *et al.* (2013) and Meena *et al.* (2020).

Conclusion: -

On the basis of one-year experimentation it was concluded that treatment T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 % found significantly higher yield and nutrient uptake by black gram. However, the treatment 100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur + Foliar application of $ZnSO_4$ @ 0.2 % superior among all treatment with higher productivity.

Table 1.0 Effect of foliar spray of nutrients on yield attributes and yield of black gram

Treatments	Number of pods per plant	Number of seed per plant	Grain yield (q/ha)	Straw yield (q/ha)
T_1-Control	8.60	4.72	7.28	11.30
T_2-75% RDF (15: 37.5:0 NPK kg/ha)	9.45	4.92	8.45	12.52
T_3-100% RDF (20:50:0 NPK kg/ha)	10.20	5.02	8.95	12.68
T_4-100% RDF + Foliar application of 1 % $CaNO_3$	12.90	5.82	9.25	13.20
T_5-100% RDF + Foliar application of 1 % $MgNO_3$	14.40	5.92	9.75	13.70
T_6-100% RDF + Foliar application of 1 % Sulphur	12.30	5.42	8.75	12.82
T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur	14.70	6.22	10.63	14.70
T_8-100% RDF + Foliar application of $ZnSO_4$ @ 0.2 %	10.15	5.22	8.50	12.75
T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 %	15.20	6.44	11.52	15.62
S. Em. ±	0.27	0.08	0.60	0.65
CD (0.05%)	0.82	0.23	1.79	1.97

Table 2.0 Effect of foliar spray of nutrients on nutrient content in black gram

Treatments	Nitrogen content %		Phosphorus content %		Potassium content %	
	Grain	Straw	Grain	Straw	Grain	Straw
T_1-Control	2.92	1.25	0.18	0.28	1.55	1.35
T_2-75% RDF (15: 37.5:0 NPK kg/ha)	3.10	1.42	0.24	0.36	1.60	1.48
T_3-100% RDF (20:50:0 NPK kg/ha)	3.18	1.46	0.28	0.39	1.62	1.52
T_4-100% RDF + Foliar application of 1 % $CaNO_3$	3.30	1.52	0.32	0.42	1.66	1.58
T_5-100% RDF + Foliar application of 1 % $MgNO_3$	3.38	1.55	0.34	0.44	1.68	1.58
T_6-100% RDF + Foliar application of 1 % Sulphur	3.25	1.50	0.30	0.41	1.64	1.56
T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur	3.48	1.60	0.37	0.46	1.70	1.61
T_8-100% RDF + Foliar application of $ZnSO_4$ @ 0.2 %	3.22	1.48	0.29	0.40	1.63	1.54
T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 %	3.58	1.64	0.39	0.48	1.73	1.62
S. Em. ±	0.03	0.01	0.01	0.01	0.02	0.01
CD (0.05%)	0.10	0.04	0.05	0.04	0.05	0.04

Table 3.0 Effect of foliar spray of nutrients on nutrient uptake by black gram

Treatments	Nitrogen uptake (kg/ha)		Phosphorus uptake (kg/ha)		Potassium uptake (kg/ha)	
	Grain	Straw	Grain	Straw	Grain	Straw
T_1-Control	21.26	14.13	1.31	3.16	11.28	15.26
T_2-75% RDF (15: 37.5:0 NPK kg/ha)	26.20	17.78	2.03	4.51	13.52	18.53
T_3-100% RDF (20:50:0 NPK kg/ha)	28.46	18.51	2.51	4.95	14.50	19.27
T_4-100% RDF + Foliar application of 1 % $CaNO_3$	30.53	20.06	2.96	5.54	15.36	20.86
T_5-100% RDF + Foliar application of 1 % $MgNO_3$	32.96	21.24	3.32	6.03	16.38	21.65
T_6-100% RDF + Foliar application of 1 % Sulphur	28.44	19.23	2.63	5.26	14.35	20.00
T_7-100% RDF + Foliar application of 1 % each of $CaNO_3$, $MgNO_3$ and Sulphur	36.99	23.52	3.93	6.76	18.07	23.67
T_8-100% RDF + Foliar application of $ZnSO_4$ @ 0.2 %	27.37	18.87	2.47	5.10	13.86	19.64
T_9-100% RDF + T_7 + Foliar application of $ZnSO_4$ @ 0.2 %	41.24	25.62	4.49	7.50	19.93	25.30
S. Em. ±	2.80	1.46	0.41	0.50	1.20	1.22
CD (0.05%)	8.42	4.40	1.25	1.51	3.59	3.65

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