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Response of Foliar Application of Macro and Micronutrients on Growth, Yield an Quality of *Kharif* Greengram (*Vignaradiata* L.)

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Abstract: *The field experiment was conducted during* kharif2013 *at the Research Farm of All India Co-ordinated Research Project on Irrigation Water Management, Mahatma Phule Krishi Vidyapeeth, Rahurion clayey soil to study the response offoliar application of macro and micronutrients on growth, yield and quality of* kharif *green gram (*Vigna radiata *L.).Amongst the growth characters,* viz. *plant height, number of functional leaves per plant, number of branches per plant and dry matter per plant were significantly influenced by treatment in GRDF + foliar spray of DAP @ 1% + Urea @ 1% + Boron @ 0.2% at flowering.The mean values of yield attributes* viz., *number of pods plant^{-1} (25.13), weight of pod plant^{-1} (15.63 g) and 100 grain weight (5.80 g) were increased significantly in treatment GRDF + foliar spray of DAP @ 1% + Urea @ 1% + B @ 0.2%.Grain yield (16.07 q ha^{-1}) and straw yield (16.90 q ha^{-1}). The protein content in grain was statistically non-significant due to foliar spray ofmicronutrient and macronutrient and show uniform protein per cent in all the treatments.*

Keywords: *macronutrients, micronutrients, GRDF, nutrient uptake*

INTRODUCTION

Pulses are important not only for their value as human food but also because of high protein content for livestock. It has been important component of Indian agriculture enabling the land to restore fertility by fixing nitrogen, so as to produce reasonable yields of succeeding crops and to meet out the demand of dietary requirement regarding proteins, carbohydrates and other nutrient sources. On an average, pulses contain 22-24 per cent protein as against 8-10 per cent in cereals. A good amount of lysine is present in the pulses. Pulses vary in maturity periods, hence are useful in different cropping systems.

Green gram locally called as moong or mug (*Vigna radiata* L.) belongs to the family *leguminosae*, which fixes atmospheric nitrogen and improves soil fertility by adding 20-25 kg N ha^{-1}. Being a short duration crop and having wider adaptability, it can be grown in summer as well as in *kharif* season. The greengram foliage left over after picking of mature pods can either be fed to livestock or it may ploughed in situ as a green manure to enrich soil with organic matter. Employment is provided to the farmers and the agricultural labours during off season. Mungbean is a very short duration crop so it can be grown as catch crop.

In India mungbean is cultivated on 3.44 million hectares and its total production is 1.60 million tones with productivity 486 kg ha^{-1} (Anonymous, 2012a). In Maharashtra, area under mungbean is 6.61 lakh hectares and its production and productivity is 3.71 lakh tones and 555 kg ha^{-1} (Anonymous, 2012b).

Fertilizer is the most critical input for any crop, for utilizing the yield potential of improved high yielding crop. However, in recent days *i.e.* post green revolution era, due to indiscriminate nutrient mining, soil fertility and depleting at an alarming rate and to provide food for nearly 121 crores population there is need fertilizers to augment the sustainable crop production.

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Generally, availability of nitrogen, phosphorus and potassium in Indian as well as in Maharashtra soil is abundant but its availability to crop is very low. Nitrogen is a component of many important organic compounds ranging from protein to nucleic acids. It is an integral part of chlorophyll, which is the primary absorber of light energy needed for photosynthesis. It is the most useful for vegetative growth of plants. Phosphorus plays a central role in energy transfer and protein metabolism. It is an important structural component of many biochemicals including nucleic acids. It is also associated with root growth and early maturity of crops.

So there is much need to give fertilizers through soil as well foliar application. Low and variable seed yield is a major problem limiting the production and rapid expansion of grain legumes including mungbean in tropic. The serious problem of flower drop and poor seed setting need serious attentions. Some are being increasingly employed as an aid to enhance yield. Macronutrient *viz.*, nitrogen and phosphorus etc. were found to successful as a foliar spray in some crops to overcome deficiency of particular macronutrient, increasing photosynthetic efficiency, prevent senescence.

With this background, a field trial was carried out to study the "Effect of foliar application of macronutrients on growth, yield and quality of *kharif* greengram (*Vigna radiata* L.)" during *kharif* 2013.

MATERIAL AND METHODS

The field experiment was conducted at the Research Farm of All India Co-ordinated Research Project on Water Management, MPKV., Rahuri during *kharif* 2013. The soils of the experimental field was clayey in texture with low in available nitrogen (202.50 kg ha^{-1}), medium in available phosphorus (18.10 kg ha^{-1}), high in available potassium (405.30 kg ha^{-1}) and alkaline in reaction (pH 8.1).

The experiment was laid out in randomized block design with three replications. There were nine treatment combinations comprising of micronutrient and macronutrient foliar sprays along with general recommended dose of fertilizer (GRDF) in *kharif*green gram. GRDF was 20 kg N + 40 kg P_2O_5 + 5 t FYM ha^{-1}. Nine treatment combinations viz. T_1:GRDF, T_2: GRDF + Di-ammonium phosphate (DAP) @ 2%, T_3:GRDF + urea @ 2%, T_4:GRDF + Boron (B) @ 0.2%, T_5:GRDF + Molybdènem (Mo) @ 0.05%, T_6:GRDF + DAP @ 1% + urea @ 1%, T_7:GRDF + DAP @ 1% + urea @ 1% + B @ 0.2%, T_8:GRDF + DAP @ 1% + urea @ 1% + Mo @ 0.05% and T_9:GRDF + B @ 0.2% + Mo @ 0.05%.The gross and net plot sizes were 3.0 m x 5.0 m and 2.4 m x 4.6 m, respectively. All foliar applicationswere given at flowering stage.GRDF was applied as a basal dose through Di-ammonium phosphate and FYM to all the treatments. Seed of variety "*Vaibhav*" was used @ 15 kg ha^{-1}. Seeds were treated with rhizobium and phosphate solubilizing bacteria culture @ 25 gm kg^{-1} seed before sowing.

Sowing was done at 30 cm x 10 cm spacing. Gap filling was undertaken 10 days after sowing wherever necessary and thinning was carried out at 20 DAS by keeping only one healthy seedling per hill to maintain optimum plant population.

The cultural operations and plant protection measures were carried out as per crop production schedule requirement. The season in general was favorable for normal growth and development of greengram.

RESULTS AND DISCUSSION

Effect on yield attributing characters

Plant height

The maximum and significantly higher plant height (61.68 cm) was recorded in treatment GRDF + foliar spray of DAP @ 1% + urea @1% + B @ 0.2% followed by GRDF + foliar spray of DAP @ 1% + urea @ 1% + Mo @ 0.05% (58.96 cm). Rest of the treatments were at par with each other. These finding is conformity with Dixit and Elamathi (2007).

No. of branches plant^{-1}

The number of branches were recorded in treatment GRDF + foliar sprays of DAP @ 1% + urea @ 1% + B @ 0.2% (3.67) The lowest number of branches was recorded in treatment GRDF (Control) (2.10). The decline of number of branches at harvest is might be because of mechanical damage during picking of pod and senescence of plant.These finding is conformity with Tate (2010).

No. of leaves plant^{-1}

The highest number of functional leaves were recorded in treatment GRDF + foliar sprays of DAP @ 1% + urea @ 1% + B @ 0.2% (6.40) followed by GRDF + foliar sprays of DAP @ 1% + urea @ 1% + Mo @ 0.05% (5.67), GRDF + foliar sprays of DAP @ 1% + urea @1% (5.47). Same decline trend observed in at harvest because of maximum leaves drop down due to picking of pods. These finding is conformity with Tate (2010).

No. of root nodules at 50 % flowering

The number of root nodules per plant was found to be significant as influenced by different foliar sprays of macronutrient and micronutrient. The highest number of root nodules recorded in treatment when application of GRDF + foliar spray of DAP @ 1% + urea @ 1% + B @ 0.2% and the lowest number of root nodules recorded in control.

This is might be because of foliar application of urea and molybdenum, both are helps to increases vegetative growth in legume and increase root nodules significantly due to ample supply of nitrogen.These finding is conformity with Dixit and Elamathi (2007).

Dry matter plant^{-1}

The highest dry matter per plant was recorded in treatment GRDF + foliar spray of DAP @ 1% + urea @1% + B @ 0.2% (24.96 g) followed by GRDF + foliar spray of DAP @n1% + urea @ 1% + Mo @ 0.05% (23.93 g). The lowest dry matter was recorded in GRDF (control) (17.12g) and at par with GRDF + foliar spray of Mo @ 0.05% (18.25 g).

This is might be because of supply of urea and DAP through foliar sprays which play vital role in vegetative growth and increase root shoot ratio. Also provision of molybdenum through foliar spray act as co-enzyme and helps to fixation of atmospheric nitrogen and act as nitrate reductase co-enzyme. Thus ample supply of nitrogen to plant increase the dry matter at harvest.These findings is conformity with Dixit and Elamathi (2007).

No. of pods plant^{-1}

The data regarding mean number of pod plant^{-1} were highest in treatment GRDF + foliar sprays of DAP @ 1% + urea @ 1% + Boron @ 0.2%. This is might be because of ample supply of nitrogen and phosphorus through foliar sprays and boron play vital role in for pollen viability due to increase fertilization, pod setting and number of pod plant^{-1}. Similar results have been reported by Deshmukh (1981) and Dixit and Elamathi (2007).

Wt. of pods plant^{-1}

The weight of pod was higher in treatment GRDF + foliar spray of DAP @ 1% + urea @ 1% + B @ 0.2% (15.63 g) than other treatments. The lowest weight of pod was recorded without foliar spray (7.45 g) and at par with GRDF + foliar spray of Mo @ 0.05% (8.32). These finding is conformity with Tate (2010).

Grain yield (q ha^{-1})

The application of GRDF + foliar spray of DAP @ 1% + urea @1% + B @0.2% at flowering after sowing was significantly increased the grain yield. The grain yield was significantly higher in GRDF + foliar spray of DAP @ 1% + urea @ 1% + B @ 0.2% (16.07 qha^{-1}) over rest of the treatments. The lowest grain yield was recorded in GRDF (control) (10.76 qha^{-1}) and at par with GRDF + foliar spray of B @ 0.2% (11.50 q ha^{-1}), GRDF + foliar spray of Mo @ 0.05% (11.07 q ha^{-1}) and GRDF + foliar spray of B @ 0.2% + Mo @ 0.05% (11.90 qha^{-1}).

The causes to increasing yield is due to high dry matter production efficient translocation to the developing sink leading to higher grain yield. Nitrogen and phosphorus plays vital role for efficient translocation to increase sink. Main cause behind increase the yield due to supply of boron through foliar sprays it increases pollen viability, pod setting and pod size which was ultimate cause to increase yield.

These results are conformity withBehra and Elamathi (2007) and Dixit and Elamathi (2007)

Straw yield (q ha^{-1})

The mean straw yield of greengram was 14.20 qha^{-1}. The straw yield was significantly influenced by foliar sprays. The straw yield was maximum in GRDF + foliar sprays of DAP @1% + urea @ 1% + B @ 0.2% (16.90 q ha^{-1}) followed by GRDF + foliar sprays of DAP @ 1% + urea @ 1% + Mo @ 0.05% (16.33 qha^{-1}). The lowest straw yield recorded in control treatment (12.07 q ha^{-1}) and at par with GRDF + foliar sprays of B @ 0.2% (12.93 qha^{-1}), GRDF + foliar sprays of Mo @ 0.05% (12.50 q ha^{-1}) and GRDF + foliar spray of B @ 0.2% + Mo @ 0.05% (13.40 q ha^{-1}).

This is might be because of ample supply of nutrient through foliar sprays which increases vegetative growth and due to nutrient phosphorus and boron play role for increasing in productivity of crop.

Protein content

The protein content in grain was statistically non-significant due to foliar spray ofmicronutrient and macronutrient and show uniform protein per cent in all the treatments.

Table 1
Effect of macronutrients and micronutrients on yield attributing characters at harvest on *kharif*green gram

Treatments		*Plants height (cm)*	*No. of branches*	*No. of leaves*	*No. of root nodules at 50% flowering*	*Dry matter plant^{-1} (g)*	*No. of pods plant^{-1}*	*Wt. of pods plant^{-1} (g)*	*Grain yield plant^{-1} (g)*	*Straw yield plant^{-1} (g)*	*100 grain weight (g)*
T_1	GRDF (control)	51.32	2.10	3.47	27.53	17.12	17.53	7.45	2.92	3.83	4.51
T_2	DAP @ 2%	57.61	2.90	4.60	29.47	22.15	22.00	12.49	3.97	4.35	5.11
T_3	Urea @ 2%	56.54	2.67	4.40	28.20	21.00	21.20	11.51	3.83	4.21	4.99
T_4	B @ 0.2%	54.77	2.33	4.07	28.80	19.14	19.47	9.48	3.42	3.95	4.73
T_5	Mo @ 0.05%	54.18	2.33	3.80	28.13	18.25	18.53	8.32	3.19	3.93	4.64
T_6	DAP @ 1% + urea @ 1%	57.90	3.00	5.47	27.80	22.97	23.07	13.44	4.11	4.57	5.38
T_7	DAP @ 1% + urea @ 1% + B @ 0.2%	61.68	3.67	6.40	30.40	24.96	25.13	15.63	4.56	5.05	5.80
T_8	DAP @ 1% + urea @ 1% + Mo @ 0.05%	58.96	3.25	5.67	29.87	23.93	23.67	13.48	4.22	4.74	5.48
T_9	B @ 0.2 + Mo @ 0.05%	55.00	2.47	4.20	28.07	19.58	19.53	11.19	3.68	4.08	4.84
S.E. ±		0.34	0.07	0.07	0.30	0.20	0.16	0.37	0.05	0.09	0.01
C.D. at 5%		1.04	0.21	0.21	0.90	0.62	0.50	1.13	0.15	0.28	0.04
General mean		56.64	2.47	4.67	28.70	21.01	21.15	11.84	3.77	4.30	5.05

Table 2
Grain yield, straw yield, protein contentand nutrient uptake ofgreen gram as influenced by different treatments

	Treatments	*Grain yield (q ha^{-1})*	*Straw yield (q ha^{-1})*	*Protein content (%)*
T_1	GRDF (control)	10.76	12.07	23.25
T_2	DAP @ 2%	13.67	14.60	23.87
T_3	Urea @ 2%	12.43	13.93	24.00
T_4	B @ 0.2%	11.50	12.93	23.87
T_5	Mo @ 0.05%	11.07	12.50	23.68
T_6	DAP @ 1% + urea @ 1%	14.12	15.10	24.43
T_7	DAP @ 1% + urea @ 1% + B @ 0.2%	16.07	16.90	24.68
T_8	DAP @ 1% + urea @ 1% + Mo @ 0.05%	15.07	16.33	24.56
T_9	B @ 0.2% + Mo @ 0.05%	11.90	13.40	23.87
S.E. ±		0.13	0.08	3..12
C.D. at 5%		0.40	0.24	N.S.
General mean		12.95	14.20	23.90

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