Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6524

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (4):** 56-62 (2018)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Effect of Micronutrients Mixture Application on Growth, Yield and Nutrient Uptake of Mungbean in Southern Dry Zone (Zone 6) of Karnataka

Divyashree*, K. S., Prakash, S. S., Yogananda, S. B. and Atheefa Munawery

Department of Soil Science, University of Agriculture Sciences, GKVK, Bangalore - 560065

*Corresponding Author E-mail: divyashree.agri@gmail.com

Received: 26.05.2018 | Revised: 30.06.2018 | Accepted: 8.07.2018

ABSTRACT

A field experiment was conducted during early Kharif 2015 on sandy loam soil at College of Agriculture, V.C. Farm, Mandya, University of agricultural Sciences, Bengaluru, Karnataka to study the effect of different methods of micronutrients mixture application on growth, yield and nutrient uptake of mung bean in Southern Dry Zone (Zone 6) of Karnataka. The experiment was laid out in RCBD with twelve treatments including control, RDF alone, RDF +water spray / soil / foliar / seed treatment with MM (Fe, Mn, Zn, Cu, B, Mo and deficient micronutrients). Results revealed that application of RDF +foliar application of MM at 30 and 45 DAS recorded significantly superior yield of 1140.84 kg ha^{-1} which increased about 7.16 , 38.39 and 56.13 per cent over soil application of MM (Fe+Mn+Zn+Cu+B) along with RDF, RDF alone and control respectively. However, grain yield with RDF +foliar application of MM at 30 and 45 DAS and RDF +Soil application of MM treatments were statistically non-significant .Also significantly higher uptake of micronutrients in grains Fe, Mn, Zn, Cu and B (209.23,15.17, 32.31,14.78 and 57.64 mg kg^{-1}) . Suggesting the the supplementation of MM as basal enhances the early vigour thus helps in better yield. Similarly foliar application at later stages is responsible for translocation of assimilates to sink thus resulting in higher yield.

Key words: *Greengram, Micronutrients mixture (MM), Foliar application, Soil application, Benefit cost ratio*

INTRODUCTION

Pulses are one of the important segments of Indian agriculture after cereals and oilseeds. The split grains of the pulses called dahl which is excellent source of high quality protein, essential amino acids, fatty acids, fibres, minerals and vitamins. Pulses are not only improve soil health by enriching nitrogen status, long term fertility but also sustainability of the cropping systems. It meets upto 80% of its nitrogen requirement by symbiotic nitrogen fixation from air and leaves behind substantial amount of residual nitrogen and organic matter for subsequent crops. Greengram [*Vigna radiate* (L.) Wilczek] also known as mungbean is an important pulse crop of India.

Cite this article: Divyashree, K.S., Prakash, S.S., Yogananda, S.B. and Munawery, A., Effect of Micronutrients Mixture Application on Growth, Yield and Nutrient Uptake of Mungbean in Southern Dry Zone (Zone 6) of Karnataka, *Int. J. Pure App. Biosci.* **6(4):** 56-62 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6524

It is a short duration crop and can be grown twice a year *viz.* (i) the warmer, rainy season or *Kharif* (June-October) and (ii) the cool, dry season or rabi (October-April). It is also considered as "Golden Bean" because of its nutritional value (Its seed contains 24.2% protein, 1.3% fat and 60.4% carbohydrate) and suitability for increasing the soil fertility by way of addition of nitrogen (30 kg ha^{-1} $annum^{-1}$). Application of micronutrients in small quantities (0.5 to 2 kg ha^{-1}) has resulted in 40-120 per cent increase in grain yield, indicating that it is not the single nutrient deficiency is limiting the productivity of pulses rather multi micronutrients deficiencies are quite often the reasons for low productivity. The multi-micronutrients mixture facilitate the application of the wide range of plant nutrients in the proportion and to suit the specific requirements of a crop in different stages of growth, and are more relevant under specific nutrient management practices[3]. Therefore, keeping in view role of micronutrients in mungbean the present investigation "effect of different methods of micronutrients mixture application on yield, nutrient uptake and economics of mung bean in Southern Dry Zone (Zone 6) of Karnataka during *Kharif* season.

MATERIAL AND METHODS

A field experiment was conducted during early *Kharif* 2015 on sandy loam soil at College of Agriculture, V.C. Farm, Mandya, University of agricultural Sciences, Bengaluru, Karnataka to study the effect of different methods of micronutrients mixture application on yield, nutrient uptake and economics of mung bean in Southern Dry Zone (Zone 6) of Karnataka. The twelve treatments combinations including control, RDF alone, RDF +water spray / soil / foliar / seed treatment with MM (Fe, Mn, Zn, Cu, B, Mo and deficient micronutrients). All twelve treatments combination were replicated three times in randomized block design.

The soil was sandy loam in texture with 75.03, 18.2, and 6.77 per cent sand, silt and clay, respectively and bulk density of 1.5 Mg cm^{-3}. The soil was neutral in reaction (pH 7.21) and low in soluble salts (0.16 dS m^{-1}). The soil was low in organic carbon (4.8 g kg^{-1}), available nitrogen (151.2 kg ha^{-1}) and available P_2O_5 (9.64 kg ha^{-1}), while it was medium in K_2O (202.944 kg ha^{-1}) and high in sulphur (15.67 mg kg^{-1}). The exchangeable calcium and magnesium content of soil was 3.4 and 2.5 meq 100 g^{-1}, respectively. The DTPA extractable micronutrient content *viz.*, zinc, iron, copper manganese and boron were 0.52, 7.82, 0.41, 8.62 and 0.46 mg kg^{-1}, respectively. Zn and B content were below the critical limit. Mungbean variety KKM-3 was sown at 30cm row and 10 cm plant to plant apart. Recommended dose of NPK for greengram is 20:50:50 kg ha^{-1} was supplied with urea, single super phosphate amd murate of potash respectively and micronutries like Fe, Mn, Zn, Cu, B and Mo was applied in the form of Iron sulphate, Manganese sulphate, Zinc sulphate, Copper sulphate, Borax and Ammonium molybdate respectively. To reduce weed infestation one hand weeding was done at 25 days after sowing. In all 4 irrigations were given at different stages of crop growth to fulfill the water requirement. To control the whitefly (*Bemisia tobaci*), Roger 30 EC @ 1.0 litre ha-1 was uniformly sprayed at vegetative growth stage of the crop. Crop was harvested at proper maturity. Periodical and quantitative observations were taken in order to assess the effect of micronutrients mixture on growth, yield, nutrient uptake and economics of mungbean.

RESULTS AND DISCUSSION

Plant height, number of leaves and chlorophyll content

Micronutrients mixture application on mungbean was significantly increased all growth characters viz., plant height ,number of leaves, chlorophyll content, control and RDF treatments but its efficacy was significantly enhanced when application along with micronutrients mixture (Table 1). The increase in growth attributes of mungbean with the findings of[7] plant height in control was 20.42 cm which increased significantly to 28.11 cm due to application of RDF + soil application of

MM followed by 27.66 cm with the application of RDF + foliar application of MM at 30DAS. The maximum number of leaves per plant (18.43) was recorded due to application of RDF + soil application of MM these were significantly higher than that recorded in control (14.11), T_2 RDF(15.23).The higher chlorophyll content of 48.81 was recorded due to application of RDF + soil application of micronutrients mixture.

The increase in growth parameters with supplementation of micronutrients mixture might be attributed to the balanced nutrition of the crop. Also, the addition of the micronutrients helps in better utilization of the major nutrients to produce higher biomass production. The hidden deficiencies of micronutrients are overcome due to their supplementation during the growth period, which results in better crop growth and thereby yield. The beneficial effect on use of multi micronutrients mixture have been reported in different crops for good growth; Blackgram[4,6] Cowpea[2], Chickpea[8] and Mungbean[7].

Test weight and Yield

The data on test weight, grain and Stover yield as influenced by application of RDF + micronutrients mixture are presented in Table 2.

The effect of treatments on the test weight at both the picking was non-significant. However, application of RDF + foliar application of micronutrients mixture at 30 and 45 DAS recorded highest test weight at first (4.49 g) and second picking (4.28 g) followed by T_8 (4.35 and 4.18 g, respectively). The lower test weight was recorded in control (4.14 and 4.06 g at first and second pickings, respectively).

The results indicated that the different methods of application of micronutrients mixture along with RDF significantly increased the grain yield of greengram over control. Significantly superior yield of 1140.84 kg ha^{-1} was registered in RDF + foliar application of micronutrients mixture at 30 and 45 DAS followed by 1064.56 kg ha^{-1} with the application of RDF + soil application of micronutrients mixture. Significantly higher stover yield of 2483.86 kg ha^{-1} was recorded due to soil application of RDF+MM followed by 2386.63 and 2333.13 kg ha^{-1} due to (RDF + soil application of deficient micronutrients) and T_6 (RDF + foliar application of MM at 30 and 45 DAS) respectively compared to control (1831.97 kg ha^{-1}), RDF only (1962.31 kg ha^{-1}), RDF + Water spray (1957.18 kg ha^{-1}) and RDF + MM seed treatment (2062.27 kg ha^{-1}).

Application of (Fe, Mn, Cu, Zn and B) maintained early crop vigour and growth, dry matter production by augmenting photosynthetic process and higher production of photosynthatase as some of these acts as co-factor in enzyme involved in electron transport process of photosynthesis and respiration and in chloroplast synthesis, which might have helped in better growth[1].

Nutrient uptake

The micronutrients uptake in grain, Stover, husk and total by greengram as influenced by application of RDF and MM is presented in Table 3and 4.

Micronutrients

The data on micronutrients uptake in grain, stover, husk and total by greengram as influenced by application of RDF and micronutrients mixture are presented in Table 12 and 13.

Iron (g ha^{-1})

The iron uptake by greengram grain, stover, husk and total varied significantly due to application of micronutrients mixture. Significantly higher Fe uptake by grain and total uptake of 218.91 and 1269.35g ha^{-1} was recorded due to application of RDF +foliar application of MM at 30 and 45 DAS compared to control (73.02 and 345.72 g ha^{-1}, respectively) and most other treatments. While in stover significantly higher uptake of 896.44 g ha^{-1} was recorded due to application of RDF + FS of MM at 30 DAS as compared to control (251.03 g ha^{-1}) but it was on par with the uptake (894.13 g ha^{-1}) recorded due to application of RDF + foliar spray of MM at 30 and 45 DAS, While Fe uptake by husk was not significant.

Manganese (g ha^{-1})

The results revealed that significantly higher uptake of manganese was registered due to different treatments except in husk. Significantly higher Mn uptake of 20.25 g ha^{-1} by grain was recorded due to application of RDF + foliar spray of MM at 30 and 45 DAS compared to all other treatments except T_4 and T_9 treatments. While in stover the higher uptake of 125.68 g ha^{-1} was recorded in T_6 and it was significantly higher than that recorded in other treatments. There was no significant difference in the uptake by husk due to treatments effect. The total Mn uptake by greengram due to application of RDF + foliar spray of MM at 30 and 45 DAS, T_6 (146.12 g ha^{-1}) was significantly higher than that observed in all other treatments.

Zinc (g ha^{-1})

Significantly higher Zn uptake of 43.83, 0.075 and 109.34 g ha^{-1} in grain, husk and total, respectively was recorded in treatment receiving RDF + foliar spray of MM at 30 and 45 DAS compared to control and other treatments. However, in stover significantly higher uptake of 66.23 g ha^{-1} was recorded with the soil application of RDF along with MM compared to other treatments. However, significantly highest zinc uptake of 109.34 g ha^{-1} was noticed in treatment receiving RDF + foliar spray of MM at 30 and 45 DAS .

Copper (g ha^{-1})

The uptake of Cu by stover (20.82 g ha^{-1}) and total (43.10 g ha^{-1}) was significantly higher in the treatment that received RDF + foliar spray of MM at 30 and 45 DAS than all other treatments expect T_2+foliar application of MM at 45 DAS (17.70 and 43.10 g ha^{-1} respectively) and T_2+soil application of MM (18.07 and 41.04 g ha^{-1} respectively). However, in grains significantly higher uptake of 20.26 g ha^{-1} was recorded due to soil application of RDF along with MM. The Cu uptake in husk did not vary significantly due to treatments.

Boron (g ha^{-1})

The boron uptake in grain, stover, husk and total varied significantly due to application of RDF along with micronutrients mixture. Significantly higher uptake of boron in grain, husk and total of 58.04, 7.99 and 193.13 g ha^{-1} were observed due to application of RDF + foliar spray of MM at 30 and 45 DAS compared to control. Whereas, in stover higher uptake of 115.26 g ha^{-1} was noticed due to application of RDF + soil application of MM and it was significantly higher when compared to control (27.02 g ha^{-1}) and all other treatments. However, higher total Boron uptake was noticed in RDF + foliar spray of MM at 30 and 45 DAS (165.7 g ha^{-1})

The nutrient uptake is product of nutrient content and yield. Higher the yield higher will be the uptake of nutrient. Thus higher nutrient uptake by greengram was recorded with the soil and foliar application of micronutrients mixture compared to control, RDF and application of only deficient nutrients. The positive effect may also have been exerted by crops. Some plants can modify the rhizosphere by the excretion of H^+ ions or organic acids that enhance micronutrient availability and uptake[5].

Table 1: Plant height, number of leaves and chlorophyll content (mg cm^{-2}) as influenced by application of micronutrients mixture in greengram

Treatments	Plant height (cm)	Number of leaves	Chlorophyll content
Absolute control	20.42	14.11	46.93
Only RDF	27.14	15.23	53.98
RDF +water spray	27.61	15.85	53.35
RDF +foliar application of MM at 30 DAS	27.66	17.80	54.69
RDF +foliar application of MM at 45 DAS	24.51	16.55	53.10
RDF +foliar application of MM at 30 & 45DAS	25.18	18.36	56.52

RDF +foliar application of deficient MM at 30 DAS	24.81	15.99	50.82
RDF +Mo seed treatment + foliar application of deficient MM at 30 DAS	25.71	18.37	51.07
RDF +soil application of MM	28.11	18.43	51.44
RDF +soil application of deficient MM	27.36	17.24	51.23
RDF +Mo seed treatment + soil application of deficient MM	23.45	17.48	51.31
RDF +Mo seed treatment + MM seed treatment	26.35	18.07	52.62
SEm±	**1.22**	**0.80**	**1.46**
CD (p=0.05)	**3.64**	**2.36**	**4.34**

T_1: Absolute control
T_2: Only RDF
T_3:T_2+water spray
T_4: T_2+foliar application of MM at 30 DAS
T_5: T_2+foliar application of MM at 45 DAS
T_6: T_2+foliar application of MM at 30 & 45DAS
* MM –micronutrients mixture
* RDF –Recommended Dose of Fertilizer
T_7: T_2+foliar application of deficient MM at 30 DAS
T_8:T_2+Mo seed treatment + foliar application of deficient MM at 30 DAS
T_9: T_2+soil application of MM
T_{10}: T_2 +soil application of deficient MM
T_{11}: T_2+Mo seed treatment + soil application of deficient MM
T_{12}: T_2+Mo seed treatment + MM seed treatment
* Deficient micronutrient: Zn and B

Table 2: Test weight (100 grain weight in g), grain yield and stover yield (kg ha^{-1}) as influenced by application of micronutrients mixture in greengram at harvest

Treatments	Test weight (g)		Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
	First picking	Second picking		
T_1	4.14	4.06	730.70	1831.97
T_2	4.20	4.10	821.01	1962.31
T_3	4.21	4.11	825.37	1957.18
T_4	4.32	4.16	1023.58	2290.10
T_5	4.14	3.90	1018.07	2278.11
T_6	4.49	4.28	1140.84	2333.13
T_7	4.25	4.13	985.24	2281.53
T_8	4.35	4.18	1020.85	2296.90
T_9	4.28	4.13	1064.56	2483.86
T_{10}	4.25	4.08	1036.74	2386.63
T_{11}	4.25	4.10	986.85	2269.18
T_{12}	4.34	4.11	1024.31	2062.27
SEm±	**0.07**	**0.07**	**32.28**	**68.41**
CD (p=0.05)	**NS**	**NS**	**95.86**	**203.16**

Table 3: Total uptake of iron, manganese and zinc (mg kg^{-1}) in greengram grain, stover and husk as influenced by application of micronutrients mixture

Treatments	Fe (g ha^{-1})				Mn (g ha^{-1})				Zn (g ha^{-1})			
	Grain	Stover	Husk	Total	Grain	Stover	Husk	Total	Grain	Stover	Husk	Total
T_1	73.02	251.03	21.67	345.72	5.34	40.00	0.096	45.43	14.29	23.89	0.033	38.22
T_2	107.39	398.49	25.06	530.94	8.28	55.11	0.153	63.54	20.61	34.45	0.041	55.11
T_3	113.37	403.7	29.21	546.28	8.38	62.19	0.162	70.72	20.89	35.31	0.046	56.25
T_4	181.35	896.44	27.78	1125.18	18.57	105.81	0.162	124.55	32.21	55.51	0.067	87.78
T_5	163.17	719.41	29.61	912.18	16.86	108.59	0.148	125.59	31.86	58.57	0.060	90.50
T_6	218.91	894.13	31.54	1144.58	20.25	125.68	0.184	146.12	43.83	65.43	0.075	109.34
T_7	161.13	663.06	30.83	855.03	15.26	93.87	0.178	109.31	29.55	47.68	0.048	77.28
T_8	192.53	738.16	28.71	959.40	15.52	113.33	0.157	129.01	32.2	56.82	0.044	89.07
T_9	179.17	716.56	37.68	933.42	17.95	108.81	0.174	126.93	34.08	66.23	0.062	100.37
T_{10}	167.87	593.6	36.08	797.54	16.36	104.87	0.188	121.42	30.87	52.54	0.053	83.47
T_{11}	159.98	538.68	29.06	727.72	13.59	105.33	0.144	119.06	29.46	44.4	0.040	73.90
T_{12}	132.72	454.7	29.66	617.08	11.23	83.1	0.161	94.49	24.09	41.08	0.043	65.22
SEm±	**6.88**	**40.7**	**2.86**	**44.98**	**0.97**	**3.85**	**0.016**	**4.64**	**1.46**	**2.79**	**0.004**	**4.09**
CD (p=0.05)	**20.43**	**120.87**	**NS**	**133.58**	**2.88**	**11.43**	**NS**	**13.78**	**4.36**	**8.29**	**0.013**	**12.14**

Table 4: Total uptake of copper and boron (mg kg^{-1}) in greengram grain, stover and husk as influenced by application of micronutrients mixture

Treatments	Cu (g ha^{-1})				B (g ha^{-1})			
	Grain	Stover	Husk	Total	Grain	Stover	Husk	Total
T_1	8.33	5.17	1.43	14.92	10.88	27.02	1.044	38.94
T_2	12.44	8.96	2.17	23.57	16.95	46.3	2.083	65.33
T_3	12.09	10.19	2.35	24.63	17.38	46.56	2.428	66.37
T_4	17.99	16.05	2.40	36.44	44.99	67.51	4.388	116.88
T_5	18.43	17.7	2.42	38.56	38.41	83.41	5.774	127.59
T_6	19.8	20.82	2.49	43.10	58.04	94.11	7.987	160.14
T_7	17.81	16.32	2.50	36.63	19.79	64.37	6.813	90.98
T_8	17.75	17.07	2.50	37.31	28.78	66.32	3.205	98.30
T_9	20.26	18.07	2.71	41.04	44.88	115.26	5.560	165.70
T_{10}	19.17	15.95	2.93	38.05	29.09	82.88	5.360	117.33
T_{11}	17.37	15.83	2.01	35.21	40.65	76.6	4.343	121.59
T_{12}	14.68	12.91	2.46	30.05	45.9	54.59	4.740	105.23
SEm±	**0.77**	**1.05**	**0.26**	**1.59**	**1.67**	**2.85**	**0.365**	**5.23**
CD (p=0.05)	**2.29**	**3.13**	**NS**	**4.71**	**4.97**	**8.46**	**1.084**	**15.52**

REFERENCES

1. HAZRA, P., MAITY, T. K. AND MANDAL, A. R., Effect of foliar application of micronutrients on growth and yield of okra (*Abelmoschus esculentus* L). *Prog. Hort.*, **19:** 219-222 (1987).
2. HEMN, O. S., Effect of Foliar Fertilization of Fe, B and Zn on nutrient concentration and seed protein of Cowpea "*Vigna Unguiculata*". *J. Agri. Vet. Sci*., **(6):** 42-46 (2013).

3. HEGDE, D. M., SUDHAKARA BABU, S. N. AND IYLN, M., Role of Customized Fertilizers in the Improvement of Productivity of Different Crops and Cropping Systems. In Proceedings of national seminar on "Standards and Technology of Value Added / Fortified / *Customized Fertilizers as a Source of Plant Nutrients*". (ICAR- IISS, Bhopal, India) (2007).
4. KANNAN, P., ARUNACHALAM, P., PRABUKUMAR, G. AND PRABHAHARAN, J., Response of Blackgram (*Vigna Mungo* L.) to multi micronutrients mixtures under Rainfed *Alfisol . J. Indian Soc. Soil Sci.,* **62(2):** 154-160 (2014).
5. MARSCHNER, H., Marschner's *Mineral Nutrition of Higher Plants*. Third edition. Elsevier Ltd (2012).
6. POONGOTHAI, S. AND CHITDESHWARI, T., Response of blackgram to multi micronutrients mixture. *Madras Agric. J.,* **90(7-9):** 442-443 (2003).
7. QUDDUS, M. A., RASHID, M. H., HOSSAIN, M. A. AND NASER, H. M., Effect of zinc and boron on yield and yield contributing characters of mungbean in low ganges river floodplain soil at Madaripur. Bangladesh. *Bangladesh J. Agril. Res*.**, 36(1):** 75-85 (2011).
8. VALENCIANO, J. B., BOTO, J. A. AND MARCELO, V., Response of chickpea (*Cicer arietinum* L.) Yield to zinc, boron and molybdenum application under pot conditions. *Spanish J. Agril. Res*., **8(3)***:*797-807 (2010).