



Effect of Foliar Application of Zinc and PPFM on Growth, Yield Parameters and Quality of Green Gram in Alfisols

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ABSTRACT

Green gram (*Vigna radiata* L.) is an imperative legume crop in Asia. Zinc (Zn) deficiency is a yield-limiting factor for a variety of field crops across the world. To increase zinc concentration in edible portions of food crops, foliar application of zinc containing solutions might be sustainable. Drought stress during the critical stages of crop growth is also the major factor which leads to the lower productivity of green gram. So, the present work was conducted to evaluate the influence of foliar application of zinc and PPFM (Pink Pigmented Facultative Methylophs) along with fertilizers on growth, yield parameters and quality of green gram. The experiment was consisted of soil application of different levels of RDF (Recommended dose of fertilizers) along with the foliar application of Zn and PPFM. The results revealed that various treatments increased growth and yield parameters like plant height, number of pods per plant, number of seeds per pod and quality of green gram. Application of 0.5% ZnSO₄ and 1% PPFM with 125% RDF both at flowering and Pod initiation stages gave higher number of pods per plant, number of seeds per pod, and grain yield and also improved the quality of grains by increasing protein content as compared to control. Thus, we conclude that the combined application of 125% RDF along with the foliar application of 0.5% ZnSO₄ and 1% PPFM improves the growth, yield parameters and quality in green gram crop.

Keywords- Green gram, Zinc, PPFM, Foliar application, balanced fertilization, growth, yield parameters, quality.

INTRODUCTION

According to the nutritionists, pulses are an excellent source of dietary proteins and can play an important role in fulfilling requirements of rapidly increasing population. Green gram is an important pulse crop that can be grown twice a year i.e. in spring and autumn. Among the grain legumes, it is one of the important conventional pulse crops of India. It ranks second to chickpea (*Cicer arietinum*) amongst grain legumes from production point of view. Its seed is more palatable, nutritive, digestible and non-flatulent than other pulses grown in country. It contains 24.7% protein, 0.6% fat, 0.9% fiber and 3.7% ash (Potter and Hotchkiss, 1997). Besides being a rich source of protein, it maintains soil fertility through biological nitrogen fixation in soil and thus plays a vital role in furthering sustainable agriculture (Kannaiyan, 1999).

Green gram is the major source of protein for the vegetarian diet and it is highly preferred to substantiate the human diet. Despite the need, their production is not keeping pace with the rising demand. The low productivity of green gram may be due to nutritional deficiency in soil and imbalanced external fertilization. Farmers have a wrong notion that green gram, being legume crop does not need any nutrient and usually grow it on the marginal lands without applying any fertilizer and irrigation. This seems to be an important reason for the lower productivity in the country. Therefore, adequate amount of nutrient is needed to increase the growth and yield of green gram. Hence the experiment was designed to increase growth, yield parameters and quality of green gram in Alfisols. We focused on balanced nutrition to improve the growth and yield parameters and to increase the quality zinc has been

applied along with this PPFM has been sprayed to overcome the water stress which is the major problem hindering the crop growth and yield.

Objectives of the study

- i. To study the effect of foliar application of Zn and PPFM on growth, yield parameters and quality of green gram
- ii. To develop a nutrient schedule in order to enhance the growth and quality of green gram through balanced fertilization

MATERIAL AND METHODS

The experiment was carried out to study the effect of zinc and PPFM along with different doses of fertilizers on growth, yield parameters and quality of green gram in farmers field at Kinnemangalam village of Thirumangalam block, Madurai with the following set of treatments viz., T₁- (Absolute control), T₂-(75% RDF), T₃-(100% RDF), T₄-(125% RDF), T₅-(T₂+0.5% ZnSO₄ as foliar spray at flowering and pod intimation stages), T₆-(T₃+0.5% ZnSO₄ as foliar spray at flowering and pod intimation stages), T₇-(T₄+0.5% ZnSO₄ foliar spray at flowering and pod initiation stages), T₈-(T₅+1% PPFM as foliar spray at flowering and pod initiation stages), T₉-(T₆+1% PPFM as foliar spray at flowering and pod initiation stages), T₁₀ - (T₇+1% PPFM as foliar spray at flowering and pod initiation stages).

The general property of the surface soil was pH 7.03, EC 0.06 dSm⁻¹, organic carbon 2.71 g kg⁻¹ and available N 216 kg ha⁻¹, P 12.4 kg ha⁻¹, K 273 kg ha⁻¹ and S 3.7 mg kg⁻¹ respectively. The recommended NPKS for green gram was 12.5: 25.0: 12.5 and 10 kg NPKS/ha respectively (RDF). In the net plot area five plants were selected at random and labeled for biometric observations. Plant

height was measured from the ground level to the tip of terminal bud and expressed in cm. Number of pods per plant was counted from the selected tagged plants and the mean number of pods per plant was found out and expressed in numbers. The seeds from ten pods were separated and the number of seeds was counted and the mean was taken.

RESULT AND DISCUSSION

The data pertaining to plant height at 30, 45 DAS and harvest stages are presented in Table 1. Combination of recommended dose of fertilizers, zinc nutrition and PPFM had dramatically increased the plant height significantly from 30, 45 DAS and harvest stages respectively. The plant height ranged on 39.8 to 48.5 cm, 48.6 to 59.4 cm and 53.2 to 64.8 at 30 DAS, 45 DAS and harvest stages respectively. Added to it there was a significant influence of recommended dose of fertilizers, zinc

nutrition and PPFM on number of pods per plant of green gram and presented in the Table 1. Similar to the number of pods per plant, number of seeds per pod was also influenced by the treatments and the results are represented in the Table 1.

The plant height is basically controlled by the genetic character and plays a vital role in productivity. The improvement in plant height may be due to presence of Methylobacterium which influences production of growth regulators like zeatin and related cytokinins, auxins and also altered the agronomic traits like branching, seedling vigour and rooting. The increase in growth of green gram may be due to the growth hormone production by *Methylobacterium sp.* especially through high cytokinin production in apical plants tissues and rhizosphere soil. The results are conformity with observations made by Radha et al. (2009).

Table-1: Effect of treatments on growth and yield parameters of green gram

Treatments	Plant height(cm)			No of Pods plant ⁻¹	No of Seeds pod ⁻¹
	30 DAS	45 DAS	Harvest		
T ₁	39.8	48.6	53.2	18.1	6.2
T ₂	42.1	52.5	57.1	19.3	6.9
T ₃	42.5	52.6	57.4	19.8	7.1
T ₄	43.4	53.7	58.1	20.2	7.4
T ₅	43.7	53.9	58.7	20.7	7.9
T ₆	43.8	55.2	59.5	20.9	8.1
T ₇	44.9	55.7	60.6	21.1	8.6
T ₈	45.3	56.1	60.8	21.3	9.2
T ₉	45.7	56.4	61.2	21.4	9.4
T ₁₀	48.5	59.4	64.8	22.6	10.3
Mean	43.9	54.4	59.1	20.5	8.17
SEd	1.09	0.13	1.45	0.53	0.20
CD(P=0.05)	2.19	2.70	2.95	1.02	0.41

Even in the rainfed condition the plant showed significant growth it may be due to the application of PPFM at critical stages of crop growth. Therefore the phyllosphere spraying of PPFM significantly influenced

the *Methylobacterium* population in the phyllosphere (Holland, 1997).

Application of 125 per cent recommended dose of fertilizers plus 0.5 per cent ZnSO₄

and 1 per cent PPFM recorded significantly higher pods per plant. This might be due to the additional NPK applied in the initial stages which might have helped in the formation of more number of pods per plant. Similar finding was enlightened by Sathiyamoorthi et al. (2008).

Similar to the number of pods per plant, the same treatment which received 125 per cent RDF plus foliar spray of 0.5 per cent ZnSO₄ and one per cent PPFM recorded higher number of seeds per pod over other treatments and control. The increase in seeds per pod might be due to more availability of zinc nutrition to plant at all the growth stages. Similar finding was reported by Deb Roy (2013).

Table 2. Effect of treatments on Crude protein content (%) of green gram

Treatments	Crude protein
T ₁	20.1
T ₂	21.1
T ₃	21.4
T ₄	21.6
T ₅	21.7
T ₆	21.8
T ₇	22.1
T ₈	22.4
T ₉	22.5
T ₁₀	23.1
Mean	21.8
SEd	0.56
CD(P=0.05)	1.09

The protein content of green gram grain varied from 20.1 to 23.1 per cent due to influence of treatments (Table 2). The highest protein content of 23.1 percent was registered with the application of 125 per cent RDF plus foliar spray of 0.5 per cent ZnSO₄ and one per cent PPFM (T₁₀). However it was statistically on par with T₉ and T₈. On the other hand, the lowest protein

content of 20.1 was recorded in T₁ (Absolute control).

The increase in protein content in green gram seeds might be due to zinc application, as zinc improves the quality of seeds as proved by several workers. Zaghloul et al. (2002) and Debroy et al. (2013), who reported that the increase in Zn concentration might be due to increased protein metabolism through several enzymes. There is a positive and close relationship between grain concentration of protein and Zn. Hence the significant increase in protein may be due to the application of zinc.

CONCLUSION

The result of the field experiment showed that application of 125% RDF, externally supplied ZnSO₄ and PPFM have become imperative to crop growth, yield attributes and quality of green gram. From the above discussion, we saw that the effect of PPFM, zinc nutrition and 125% RDF on green gram was superior to all other treatments as it enhanced the growth, yield attributes and quality of green gram as zinc plays a vital role in improving the quality whereas PPFM was highly beneficial on withstanding the drought stress. Thus, combined application of Zinc and PPFM as a foliar spray along with fertilizers is a recommendable option to improve the crop growth, yield parameters which ultimately will result in increased crop yield and quality in green gram of alfisols.

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