

# Influence of Foliar Application of 19:19:19 and Mono Potassium Phosphate on Growth and Yield of Green gram (*Vigna radiata* L.)

## ABSTRACT

**Aims:** Foliar application or foliar nutrition is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Water soluble fertilizers (19:19:19 and mono potassium phosphate) have been introduced exclusively for foliar feeding and fertilization. There is very little information about the foliar application of water soluble fertilizers. There is need for more research in this field. Therefore, foliar nutrition is being recognized as an important method of fertilization in modern agriculture. The current study aimed to study the effect of foliar application of inorganic sources of nutrients for exploiting genetic potential of the crop for supplementing the part of nutrient requirements at critical stages.

**Methodology:** A field experiment was conducted during late kharif 2018 on sandy loam soils at College of Agriculture, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, to study the effect of foliar application of water soluble fertilizers on growth and yield of green gram (*Vigna radiata* L.). The experiment was laid out in a Randomized Complete Block Design comprising of 3 replications and 13 treatment combinations consisting of three water soluble fertilizers along with package of practice (viz., 2 % DAP, 1 % 19:19:19, 2 % 19:19:19, 1 % monopotassium phosphate, 2 % monopotassium phosphate, 1 % 19:19:19 + 1 % monopotassium phosphate). All water soluble fertilizers were given as foliar spray at two crop growth stages (30 and 45 DAS).

**Result:** Foliar application of monopotassium phosphate and 19:19:19 each @ 1 per cent at 30 and 45 DAS along with package of practice recorded significantly higher plant height (56.04 cm), number of leaves plant<sup>-1</sup> (8.46), leaf area (5.37 dm<sup>2</sup> plant<sup>-1</sup>), total dry matter production (22.16 g plant<sup>-1</sup>), number of pods plant<sup>-1</sup> (22.10), number of seeds plant<sup>-1</sup> (12.65), pod length (8.92 cm), seed yield (1038.82 kg ha<sup>-1</sup>) and haulm yield (1675.28 kg ha<sup>-1</sup>), thereby achieved yield increment of 25.07 per cent over package of practice and 46.85 per cent over farmers practice as compared to the other treatments.

**Conclusion:** Foliar application of monopotassium phosphate and 19:19:19 each at 1 per cent at 30 and 45 DAS along with package of practice in late kharif found ideal for achieving higher yield potentiality in green gram.

*Keywords: Green gram, foliar application, water soluble fertilizers, mono potassium phosphate.*

## 1. INTRODUCTION

The green gram (*Vigna radiata* L.) is one of the thirteen food legume grown in India and third most important pulse crop after chickpea and pigeon pea. In India, it occupies 4.32 lakh hectare areas with the production of 21.65 lakh tonnes with the productivity of 5.46 q ha<sup>-1</sup>

<sup>1</sup>(Anon, 2017). It is an excellent source of high quality protein with easy digestibility, consumed as whole grains, dal, sprouted and in variety of ways. Amongst the pulses, green gram ranks second in the nutritive value. It contains about 24 to 25 per cent protein, this being about two third of protein content of soybean, twice that of wheat and thrice that of rice. The protein is comparatively rich in lysine, which is deficient in cereal grains. Hence, a diet combining green gram and cereal grains forms a balanced amino acid diet.

Green gram, like other pulses are considered as subsidiary crops. It is often grown on marginal lands and is usually intercropped with other pulses or planted on bunds. As a crop of secondary importance in many of these systems, it receives little or no purchased high cost inputs and the crop is mainly grown in rainfed condition with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with the crop. Apart from the genetic makeup, the physiological factor viz., slow rate of dry matter accumulation during pre-flowering phase, low partitioning efficiency of assimilates to grains, poor pod setting due to the flower abscission, onset of leaf senescence during the period of pod development and lack of nutrients during critical stage of crop growth, coupled with a number of disease and pest (Mahala *et al.*, 2001) constitute the major constraints for the poor yield. Hence, the productivity of green gram in our country is far below the potential and provides substantial scope for improvement with the adoption of improved agronomic practices. One among them is the foliar application of organic and inorganic sources of nutrients for exploiting genetic potential of the crop is considered to be an efficient and economic method of supplementing the part of nutrient requirements at critical stages.

During the last few years, there is a steady trend to reduce the use of mineral fertilizers, especially soil applied nitrogen, phosphorus and potassium and supplement the mineral nutrition through non-conventional methods (Haytova, 2013). These facts create preconditions to increase the importance of foliar fertilization as an alternative to meet plant nutrient demand during the growing season. The interest on foliar fertilization has risen as a result of many advantages such as quick and efficient utilization of nutrients, elimination of losses through leaching, fixation and regulating the uptake of nutrients by plant (Manonmani and Srimathi, 2009). Foliar feeding is often the most effective and economical way to improve plant nutrient deficiency (Dixit and Elamathi, 2007). Under rainfed condition when the availability of moisture becomes scarce the application of fertilizers as foliar spray resulted in efficient absorption and usage. Though foliar spray is not a substitute to soil application but it certainly act as a supplement to soil application. In almost all the pulses, the extent of flower drop determine the yield and yield attributing characters. Retention of flowers by the plant gives higher yield more than expected yield. According to several studies conducted in different crops by different scientists over the world revealed that, retention of flowers is possible through foliar application of growth regulators as well as macro nutrients during flower initiation and pod development stages along with soil application of micro nutrients (Chaurasia *et al.*, 2005). From all these literature it is expected that water soluble fertilizer spray will have a significant effect on growth and yield of green gram. Very little information is available regarding the response of green gram to foliar application of water soluble fertilizers along with soil application. Hence, the intent of present investigation was to study the effect of foliar application of water soluble fertilizers on growth and yield of green gram.

## **2. MATERIAL AND METHODS**

A field experiment was conducted during late kharif 2019 at College of Agriculture, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka. The experimental site was situated at 13° 58' to 14° 1' North latitude and 75° 34'

to 75° 42' East longitude with an altitude of 650 m above the mean sea level comes under Southern Transition Zone of Karnataka. The experiment was laid out in a Randomized Complete Block Design (RCBD) comprising 3 replication and 13 treatments viz., T<sub>1</sub>: Farmers practice (50 kg DAP acre<sup>-1</sup> as basal application), T<sub>2</sub>: Package of practice (RDF of 13:25:25 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> + 7.5 t FYM ha<sup>-1</sup> + 10 kg ZnSO<sub>4</sub> ha<sup>-1</sup>), T<sub>3</sub>: T<sub>2</sub> + DAP spray @ 2 % at 30 and 45 DAS, T<sub>4</sub>: T<sub>2</sub> + 19:19:19 @ 1 % at 30 DAS, T<sub>5</sub>: T<sub>2</sub> + 19:19:19 @ 1 % at 30 and 45 DAS, T<sub>6</sub>: T<sub>2</sub> + 19:19:19 @ 2 % at 30 DAS, T<sub>7</sub>: T<sub>2</sub> + 19:19:19 @ 2 % at 30 and 45 DAS, T<sub>8</sub>: T<sub>2</sub> + monopotassium phosphate @ 1 % at 30 DAS, T<sub>9</sub>: T<sub>2</sub> + monopotassium phosphate @ 1 % at 30 and 45 DAS, T<sub>10</sub>: T<sub>2</sub> + monopotassium phosphate @ 2 % at 30 DAS, T<sub>11</sub>: T<sub>2</sub> + monopotassium phosphate @ 2 % at 30 and 45 DAS, T<sub>12</sub>: T<sub>2</sub> + monopotassium phosphate and 19:19:19 each @ 1 % at 30 DAS, T<sub>13</sub>: T<sub>2</sub> + monopotassium phosphate and 19:19:19 each @ 1 % at 30 and 45 DAS. Seeds were dibbled at 5 cm depth with a spacing of 30 cm x 10 cm. Irrespective of treatments, basal dose of fertilizer 13:25:25 N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O kg ha<sup>-1</sup> in the form of urea, superphosphate and muriate of potash were supplied to all plots. Foliar application of required quantity of NPK (19:19:19) and monopotassium phosphate (MPP) and DAP were given in two sprays at 30 and 45 DAS. The data on plant height, number of branches, number of leaves, leaf area and dry matter production were taken at 30 and 60 DAS and at maturity and yield and yield components were recorded at harvest as per standard procedures. The analysis of variance was carried out using the Randomized Complete Block Design (Gomez and Gomez, 1984).

### 3. RESULTS AND DISCUSSION

#### 3.1 Effect of foliar application of water soluble fertilizers on growth parameters of green gram

The foliar application of water soluble fertilizers had recorded significant effect on growth parameters of green gram. The results (Table 1) revealed that significantly higher plant height, number of leaves, leaf area and total dry matter production per plant were recorded under the treatment receiving T<sub>2</sub> + monopotassium phosphate and 19:19:19 each @ 1 per cent at 30 and 45 DAS (56.04 cm, 8.46, 5.37 dm<sup>2</sup> plant<sup>-1</sup> and 22.16 g plant<sup>-1</sup>, respectively) it was on par with the treatment T<sub>2</sub> + MPP and 19:19:19 each @ 1 per cent at 30 DAS (54.50 cm, 8.28, 4.89 dm<sup>2</sup> plant<sup>-1</sup> and 21.91 g plant<sup>-1</sup>, respectively) as compared to package of Practice (34.60 cm, 3.73, 2.63 dm<sup>2</sup> plant<sup>-1</sup> and 11.29 g plant<sup>-1</sup>, respectively) whereas, significantly lower plant height, number of leaves, leaf area and total dry matter production per plant were recorded with the farmers practice (32.67 cm, 3.12, 2.51 dm<sup>2</sup> plant<sup>-1</sup> and 9.37 g plant<sup>-1</sup>, respectively). This could be due to increase in the activity of meristematic cell, cell division and cell elongation with application of nutrients as they are known to have favourable effects on metabolic process and better vegetative growth. These results are in agreement with the results obtained in soybean by Sumalatha and Uppar (2019) and Sharifi *et al.* (2018). This may also be attributed to the fact that nitrogen helps in maintaining higher auxin level which might have resulted in better plant height, number of leaves and presumably leaf area of the crop. This resulted into better interception, absorption and utilization of radiant energy, leading to higher photosynthetic rate and finally more accumulation of dry matter by the plants. The increase in dry matter accumulation due to foliar application of nutrients has also been reported by Manonmani and Srimathi (2009) in black gram. The significant improvement in dry matter is due to better nutrition and higher availability of NPK which led into better uptake by the crop. The findings are well supported by the work of Nageswara *et al.* (2015), Kumar *et al.* (2013), Mondal *et al.* (2011) and Verma *et al.* (2009). Faster growth of plants evidenced from increased biomass plant<sup>-1</sup> at successive stages of crop growth was ascribed to the view that there was better availability of metabolites and nutrients which synchronized to the demand for growth and development

of each reproductive structure of the plant. These results are in line with the findings of Mallesha *et al.* (2014).

### 3.2 Effect of foliar application of water soluble fertilizers on yield and yield parameters of green gram

The results (Table 1) revealed that significantly higher number of pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup> and pod length were recorded with the treatment receiving T<sub>2</sub> + monopotassium phosphate and 19:19:19 each @ 1 per cent at 30 and 45 DAS (22.10, 12.65 and 8.92 cm, respectively) it was on par with the treatment T<sub>2</sub> + monopotassium phosphate and 19:19:19 each @ 1 per cent at 30 DAS (21.64, 12.64 and 8.76 cm, respectively) as compared to package of practice (13.15, 12.24 and 7.74 cm, respectively) whereas, significantly lower plant height, number of pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup> and pod length were recorded with the farmers practice (12.59, 11.84 and 7.56 cm, respectively). This could be attributed to higher supply of nutrients through monopotassium phosphate and 19:19:19 at flower initiation and pod development stage which might have caused efficient translocation of photosynthates from source to sink.

Decreased flower drop due to prolonged assimilatory activity of leaves might be another possible reason for higher yield parameters. These results are in confirmation with the results of Mudalagiriappa *et al.* (2016), Ganapathy *et al.* (2008). The economic yield is a part of total biological yield of the crop and it is a function of various independent factors. Among several factors responsible for sustained green gram production, adequate supply of essential nutrients in balanced way at critical crop growth stages is one of the key factors for realizing the potential yield. Foliar application of nutrients has become an established procedure in crop production to increase the yield with supplying nutrients throughout the growing period and minimize the nutrient losses due to increased absorption of nutrients.

Seed and haulm yield of green gram differed significantly due to foliar application of water soluble fertilizers. Among the treatments, T<sub>2</sub> + monopotassium phosphate and 19:19:19 each @ 1 per cent at 30 and 45 DAS increased the seed and haulm yield to the extent of 25.07 per cent and 14.83 per cent, respectively over the package of practice and 46.85 per cent and 46.47 per cent, respectively over the farmers practice (Fig. 1). Among the foliar application of different water soluble fertilizers, irrespective of basal dose of fertilizer application, combined foliar application of monopotassium phosphate + 19:19:19 each @ 1 per cent at 30 and 45 DAS was significantly superior compared to all other treatments. The significant increase in the seed and haulm yield is due to increased and balanced dose of fertilizer application at critical crop growth stages results in increased nutrient supply and reduced nutrient losses which is reflected through increased growth parameters like plant height, number of leaves and leaf area which resulted in higher dry matter production and yield parameters like number of pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup>. These results are in conformity with the findings of Das and Jana (2015), Ghosh and Joseph (2008), Kumar *et al.* (2008), Dixit and Elamathi (2007). This might be also due to better translocation of photosynthates from source to sink due to additional supply of nutrients through foliar spray. These results are in close confirmation with the findings of Swathi (2016) in green gram and later Jadhav *et al.* (2017) in black gram, who reported that application of 19:19:19 @ 1.0 per cent at vegetative stage, 0:52:34 @ 1.0 per cent at flowering stage and 13:00:45 @ 1.0 per cent at grain filling stage along with RDF recorded highest seed and haulm yield (1469 and 2236 kg ha<sup>-1</sup>, respectively) over the control (995 and 1695 kg ha<sup>-1</sup>, respectively). Similarly, Mamathashree *et al.* (2017), Mukund *et al.* (2015) and Mallesha *et al.* (2014) also reported higher seed and haulm yield in pigeonpea. Whereas, Meena *et al.* (2016), Muthalet *et al.*

(2016) and Nageswara *et al.* (2015) in green gram, Bhoje (2016) in chickpea, Pavithra *et al.* (2017) in cluster bean, Siva *et al.* (2017), Arvind *et al.* (2018), Kolekar *et al.* (2018) in soybean.

#### 4. CONCLUSION

From the results it can be concluded that foliar application of monopotassium phosphate and 19:19:19 each at 1 per cent at 30 and 45 DAS along with package of practice in late kharif found ideal for achieving higher yield potentiality in green gram.

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**Table 1. Growth, yield and yield parameters of green gram as influenced by foliar application of water soluble fertilizers at harvest**

Treatments	Plant height (cm)	Number of leaves	Leaf area (dm <sup>2</sup> plant <sup>-1</sup> )	TDM (g plant <sup>-1</sup> )	No. of pods plant <sup>-1</sup>	No. of seeds pod <sup>-1</sup>	Pod length (cm)	Seed yield	Haulm yield
								kg ha <sup>-1</sup>	
T <sub>1</sub>	32.67	3.12	2.51	9.37	12.59	11.84	7.56	707.41	1143.74
T <sub>2</sub>	34.60	3.73	2.63	11.29	13.15	12.24	7.74	830.56	1458.95
T <sub>3</sub>	37.13	4.35	2.93	12.30	16.52	12.59	7.89	887.23	1488.85
T <sub>4</sub>	42.46	4.49	3.16	13.80	18.21	12.61	7.98	899.97	1492.71
T <sub>5</sub>	43.64	5.05	3.60	14.80	18.28	12.62	8.19	907.72	1494.61
T <sub>6</sub>	44.00	5.74	3.83	16.09	18.54	12.62	8.27	911.56	1502.81
T <sub>7</sub>	44.04	5.98	4.02	17.11	19.40	12.63	8.36	919.45	1525.49
T <sub>8</sub>	44.66	6.30	4.19	18.62	19.54	12.63	8.41	924.89	1536.04
T <sub>9</sub>	46.03	6.57	4.52	19.55	19.55	12.63	8.48	948.27	1551.64
T <sub>10</sub>	48.95	6.93	4.59	20.64	19.82	12.63	8.53	978.75	1567.15
T <sub>11</sub>	49.64	7.17	4.77	21.29	20.02	12.64	8.55	983.18	1577.37
T <sub>12</sub>	54.50	8.28	4.89	21.91	21.64	12.64	8.76	1025.59	1653.93
T <sub>13</sub>	56.04	8.46	5.37	22.16	22.10	12.65	8.92	1038.82	1675.28
<b>S. Em. ±</b>	2.06	0.40	0.19	0.27	0.68	0.19	0.12	12.39	32.00
<b>CD (P=0.05)</b>	6.15	1.16	0.56	0.80	2.04	0.58	0.36	37.12	95.41

T<sub>1</sub>: Farmers practice

T<sub>2</sub>: Package of practice

T<sub>3</sub>: T<sub>2</sub>+ DAP spray @ 2 % at 30 and 45

T<sub>4</sub>: T<sub>2</sub>+ 19:19:19 @ 1 % at 30 DAS

T<sub>5</sub>: T<sub>2</sub>+ 19:19:19 @ 1 % at 30 and 45 DAS

T<sub>6</sub>: T<sub>2</sub>+ 19:19:19 @ 2 % at 30 DAS

T<sub>7</sub>: T<sub>2</sub>+ 19:19:19 @ 2 % at 30 and 45 DAS

TDM- Total dry matter

T<sub>8</sub>: T<sub>2</sub>+ MPP @ 1 % at 30 DAS

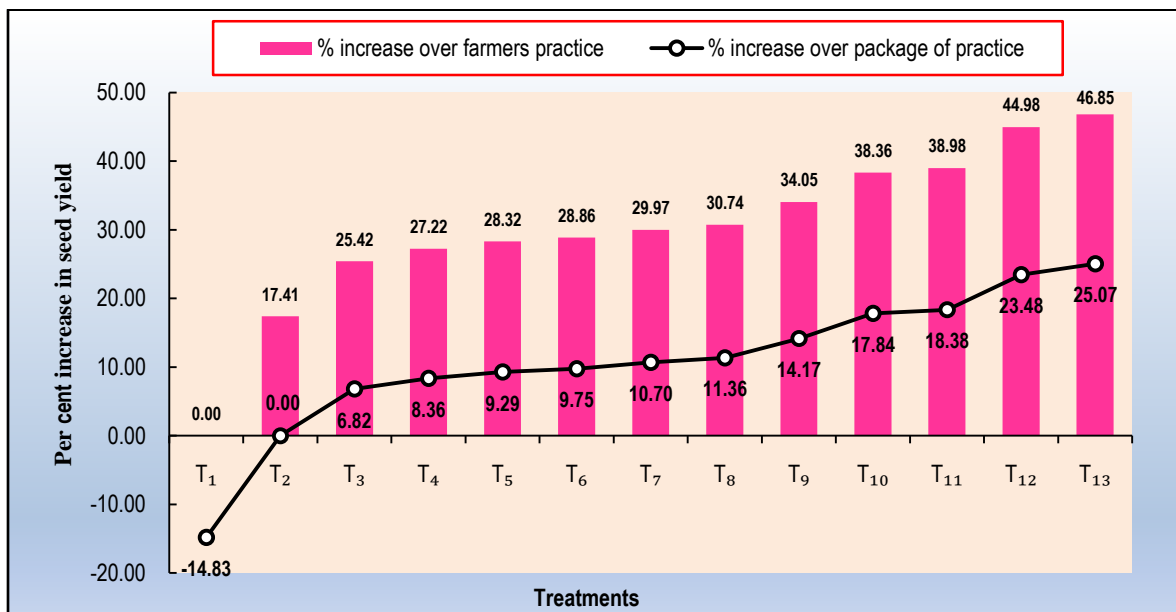
T<sub>9</sub>: T<sub>2</sub>+ MPP @ 1 % at 30 and 45 DAS

T<sub>10</sub>: T<sub>2</sub>+ MPP @ 2 % at 30 DAS

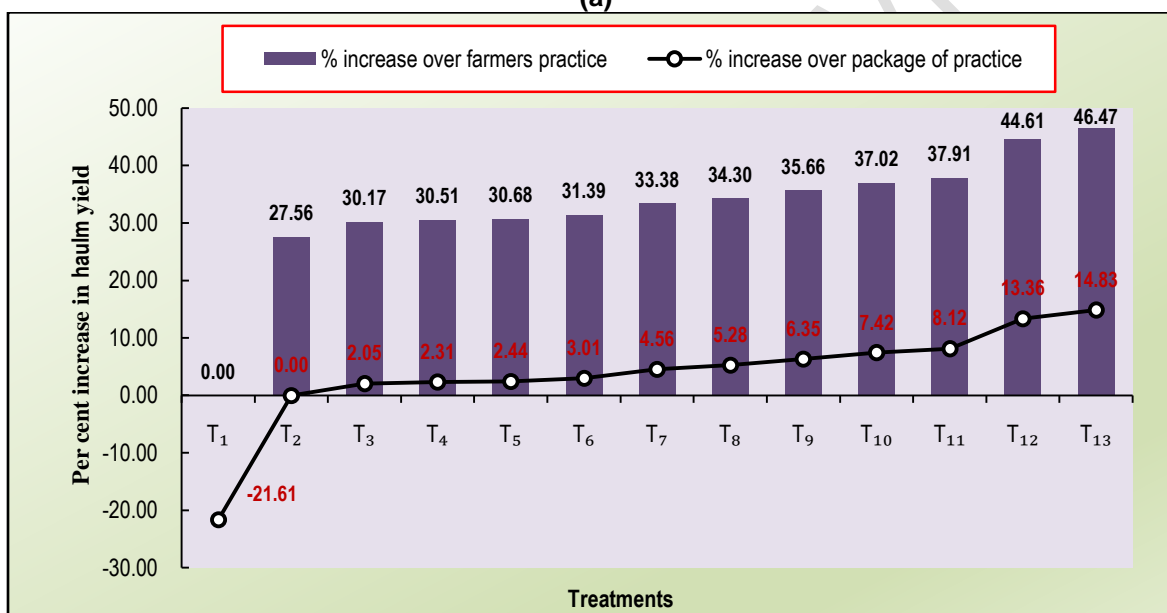
T<sub>11</sub>: T<sub>2</sub>+ MPP @ 2 % at 30 and 45 DAS

T<sub>12</sub>: T<sub>2</sub>+ MPP and 19:19:19 each @ 1% at 30 DAS

T<sub>13</sub>: T<sub>2</sub>+ MPP and 19:19:19 each @ 1% at 30 and 45 DAS



(a)



(b)

- |   |   |
|---|---|
| T <sub>1</sub> : Farmers practice                                 | T <sub>2</sub> + MPP @ 1 % at 30 DAS  |
| T <sub>2</sub> : Package of practice                              | T <sub>9</sub> : T <sub>2</sub> + MPP @ 1 % at 30 and 45 DAS                    |
| T <sub>3</sub> : T <sub>2</sub> + DAP spray @ 2 % at 30 and 45    | T <sub>10</sub> : T <sub>2</sub> + MPP @ 2 % at 30 DAS                          |
| T <sub>4</sub> : T <sub>2</sub> + 19:19:19 @ 1 % at 30 DAS        | T <sub>11</sub> : T <sub>2</sub> + MPP @ 2 % at 30 and 45 DAS                   |
| T <sub>5</sub> : T <sub>2</sub> + 19:19:19 @ 1 % at 30 and 45 DAS | T <sub>12</sub> : T <sub>2</sub> + MPP and 19:19:19 each @ 1 % at 30 DAS        |
| T <sub>6</sub> : T <sub>2</sub> + 19:19:19 @ 2 % at 30 DAS        | T <sub>13</sub> : T <sub>2</sub> + MPP and 19:19:19 each @ 1 % at 30 and 45 DAS |
| T <sub>7</sub> : T <sub>2</sub> + 19:19:19 @ 2 % at 30 and 45 DAS |   |

Fig.1. Influence of foliar application of water soluble fertilizers on per cent increase in (a) seed yield and (b) haulm yield over the farmers practice and package of practice in green gram