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Influence of Organic and Inorganic Foliar Nutrients on Green Gram (*Vigna radiata* L.)

Sudipta Pramanik, Santanu Das, Tarun Paul

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Abstract The field experiment was Carried out during summer season of 2016 with green gram variety SML668 to study the effect of organic and inorganic foliar nutrient on the growth, yield components and protein content of green gram. The experiment comprising at 10 treatments like T_1 : RDF-Recommended dose of fertilizer (20:40:20 NPK kg ha^{-1}), T_2: RDF and spray of 0.1% chelated Zn, T_3: RDF + foliar spray of 0.1% boron, T_4 : RDF + foliar spray of 10% cow urine,T_5: RDF + foliar spray of 0.1% chelated Zn + 0.1% boron, T_6 : RDF + foliar spray of 2% 10:26:26, T_7 : RDF + foliar spray of 1% DAP, T_8 : RDF + foliar spray of 1% 20:20:20, T_9 : RDF + foliar spray of 0.75% NaCl, T_{10} : RDF + foliar spray of 0.75% KCl was laid out in a randomized block design with 3 replications.From the result, maximum of grain yield and haulm yield was obtained on RDF + foliar spray of 1% 20:20:20 (T_8) because it caused to increase number of branches $plant^{-1}$ at 45 DAS, dry matter production at 45 DAS and number of pods $plant^{-1}$, followed by the application of RDF + foliar spray of 0.1% chelated Zn + 0.1% boron (T_5). Highest protein content of grains was recorded with RDF + foliar spray of 1% 20:20:20 (T_8) followed by the application of RDF + foliar spray of 0.75% KCl (T_{10}) and RDF + foliar spray of 2% 10:26:26 (T_6), RDF + foliar spray of 1% 20:20:20 (T_8) recorded highest net return followed by RDF + foliar spray of 0.1% boron (T_3). Thus, it can be advised that RDF + foliar spray of 1% 20:20:20 (T_8) may be recommended for cultivation of green gram for better seed yield, protein content and net return.

Keywords Economics, Green gram, Seed yield, Protein content.

Introduction

Green gram (*Vigna radiata* L.Wilczek) is one of the important pulse crop, grown throughout the century during summer season. It contributes 14% in total pulses area and 7% in total pulses production of India. It can tolerate adverse weather conditions and improves the soil fertility by fixing atmospheric nitrogen in the soils. Green gram gives low seed yield mainly due to poor agronomic and nutrient management in West Bengal. Foliar application of nutrients using water soluble fertilizer is one of the possible ways to enhance the productivity of green gram. Foliar spray of fertilizers (NP) may result in economic use of fertilizers which is a high cost input. Foliar spray results higher number of pod $plant^{-1}$, number of seed

Sudipta Pramanik
Department of Agronomy, Calcutta University, West Bengal 700073, India

Santanu Das
PhD Scholar, Department of Agronomy, UBKV, Cooch Behar 736001, West Bengal, India

Tarun Paul*
Assistant Professor, Department of Agronomy, UBKV, Cooch Behar 736001, West Bengal, India
e-mail: tarun.bckv@gmail.com
*Corresponding author

pod^{-1} and also increase the pod length. Foliar feeding is often the most effective and economical way to improve plant nutrition (Pradeep and Elamathi 2007). Adequate supply of nitrogen is essential for normal growth and yield (Mozumder et al. 2003). Nitrogen deficiency decreases leaf area, photosynthetic assimilation and seed growth (Sinclair and Vadez 2002). The foliar application of di-ammonium phosphate was found beneficial than soil application. Seed treatment with *Rhizobium* biofertilizer and foliar application of macro and micronutrients were reported to be effective in increasing the grain yield, haulm yield, NPK uptake and protein content of pulse grains. Boron influences the absorption of NPK and its deficiency or inadequate supply causes decrease in the economic yield of the legume. Boron is also available to the plant through foliar application enhancing seed yield and protein quality (Chdordas 2005). Keeping these in view, the experiment was conducted to study the effect of organic and inorganic foliar nutrient on the growth, yield components and protein content of green gram.

Materials and Methods

The experiment was designed to study the nutrient management in green gram (*Vigna radiata* L.) grown as summer crop. It has been taken at the Agricultural Experimental Station of Calcutta University, Baruipur, South 24 Parganas, situated in the Gangetic alluvial region of Wet Bengal ($88^0$26´´ longitude and $22^0$22´´ N latitude) during summer season of 2016. The soil was Gangetic alluvial clay loam having 0.75% organic carbon, available phosphorus 15.1 kg ha^{-1} and available potassium 257.2 kg ha^{-1} with pH 6.5. The experiment was laid out randomized block design with 10 treatments namely T_1 : RDF-Recommended dose of fertilizer (20:40:20 NPK kg ha^{-1}), T_2: RDF and spray of 0.1% chelated Zn, T_3: RDF + foliar spray of 0.1% boron, T_4: RDF + foliar spray of 10% cow urine, T_5 : RDF + foliar spray of 0.1% chelated Zn + 0.1% boron, T_6 : RDF + foliar spray of 2% 10:26:26, T_7 : RDF + foliar spray of 1% DAP, T_8 : RDF + foliar spray of 1% 20:20:20, T_9 : RDF + foliar spray of 0.75% NaCl, T_{10}: RDF +foliar spray of 0.75% KCl, replicated thrice. The green gram variety SML668 was sown in a spacing of 25 cm × 10 cm at a depth of 2-3 cm. One pre sowing irrigation and subsequent 2 irrigation were given at pre flowering (30 DAS) and flowering stage (45 DAS) to the crop. Foliar spray was done at 40 DAS and 50 DAS of crop as per treatment taken. Normal plant protection measure were adapted to keep away of disease and insect pest. Being a indeterminate crop, green gram do not mature at a time, pod maturation starts from 60 DAS. Therefore, one picking was done manually before the final harvesting of crop. Protein extraction of each sample was done following the method developed by Lowry et al. (1951) and calculation was made using the formula :

$$\text{Protein content (\%)} = \frac{\text{Concentration of protein (µg)} \times \text{Initial buffer (ml)} \times \text{Dilution factor}}{\text{Supernatant volume (ml)} \times \text{Sample weight (µm)}} \times 100$$

Results and Discussion

Growth and yield attributes

Data pertaining to the effect of organic and inorganic foliar nutrient was presented in (Table 1). From the results, maximum plant height of green gram recorded under combination of RDF + foliar spray of 10% cow urine (T_4) at 45 DAS was 9.67 cm. The lowest plant height was recorded at all stages of crop growth in the control treatment. RDF + foliar spray of 1% 20:20:20 (T_8) recorded the highest dry matter accumulation which was statistically at par with RDF + foliar spray of 0.1% chelated Zn + 0.1% boron (T_5) and RDF + foliar spray of 0.1% bron (T_3).The lowest dry weight of green gram was recorded in RDF + foliar spray of 0.75% KCl (T_{10}). Number of branches plant^{-1} was non-significant by various treatments under study. The application of RDF + foliar spray of 1% 20:20:20 (T_8) recorded higher number of branches plant^{-1} and lowest value was observed by control (T_1). The application of RDF + foliar spray of 1% 20:20:20 (T_8) was recorded higher number of pods plant^{-1} which was statistically at par with RDF + foliar spray of 0.1% chelated Zn + 0.1% boron (T_5) and RDF + foliar spray of 0.1% boron (T_3). The lowest no. of pod plant^{-1} was recorded in control (T_1). Application of RDF + foliar spray of 2% 10:26:26 (T_8) recorded significantly higher number of seeds pod^{-1} followed by RDF + foliar spray of 0.1% boron (T_3) and RDF + foliar spray of 0.1%

Table 1. Effect of treatments on physiological growth parameters, yield attributing character, seed yield and protein contents of green gram.

Treatments	Plant height at 45 DAS (cm)	Number of branches plant^{-1} at 45 DAS	Dry matter production at 45 DAS (g plant^{-1})	No. of pod plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Protein content (%)
T_1: Control (RDF + No. spray)	6.67	32.67	4.23	22.73	6.53	34.30	850	3983	16.65
T_2 : RDF + foliar spray of 0.1% chelated Zn	7.00	40.00	6.54	32.89	8.33	37.85	1014	5298	17.05
T_3 : RDF + foliar spray of 0.1% boron	8.33	41.67	5.09	33.22	8.33	37.29	1170	5321	19.15
T_4 : RDF + foliar spray of 10% cow urine	9.67	37.33	4.49	25.89	7.33	37.23	949	4045	18.60
T_5 : RDF + foliar spray of 0.1% chelated Zn + 0.1% boron	5.33	43.33	7.17	33.53	8.33	38.55	1197	5323	19.00
T_6 : RDF + foliar spray of 2% 10:26:26	7.00	33.00	5.73	26.09	8.67	37.63	1064	5224	20.20
T_7 : RDF + foliar spray of 1% DAP	7.67	38.67	5.97	23.55	8.00	37.78	1042	5179	19.40
T_8 : RDF + foliar spray of 1% 20:20:20	7.33	45.33	8.31	34.87	7.33	39.04	1231	5353	21.55
T_9: RDF + foliar spray of 0.75% NaCl	7.00	40.00	5.89	23.55	8.00	37.37	1080	4992	19.95
T_{10}: RDF + foliar spray of 0.75% KCl	7.33	42.33	3.55	24.22	8.00	36.76	1020	4721	21.90
SEm (±)	0.92	2.53	0.68	1.14	0.39	0.65	56.39	63.09	0.30
CD (p = 0.05)	2.73	7.52	2.02	3.39	1.16	1.94	167.54	187.46	0.87

chelated Zn (T_2). The effect of different treatments on test weight (1,000 seed weight) was non-significant. But the highest test weight was observed by the application of RDF + foliar spray of 1% 20:20:20 (T_8). The lowest test weight was recorded in control (T_1).

Seed and haulm yield

From the analyzed data it was observed that seed and haulm yield was significantly influenced by different treatments. The application of RDF + foliar spray of 1% 20:20:20 (T_8) recorded significantly higher seed and haulm yield (1,231 and 5,353 kg ha^{-1}, respectively) followed by the application of RDF foliar spray of 0.1% chelated Zn + 0.1% boron (T_5) (1,197 and 5,323 kg ha^{-1}, respectively) and RDF + foliar spray of 0.1% boron (T_3) (1,170 and 5,321 kg ha^{-1}, respectively). The lowest seed and haulm yield of green gram was recorded in control (T_1). Similar result was also recorded by Mallick and Mallick (2014).

Protein content

Highest protein content of green gram seeds was recorded from the treatments received RDF + foliar spray of 1% 20:20:20 (T_8) followed by RDF + foliar

Table 2. Economics of green gram as influenced by foliar application of organic and inorganic nutrients.

Treatments	Cost of cultivation (× 10^3 Rs ha^{-1})	Gross return (× 10^3 Rs ha^{-1})	Net return (× 10^3 Rs ha^{-1})	Benefit : cost ratio
T_1 : Control (RDF + No. spray)	17	68	51	3.06
T_2 : RDF + foliar spray of 0.1% chelated Zn	21	81	60	2.93
T_3 : RDF + foliar spray of 0.1% boron	19	94	74	3.82
T_4 : RDF + foliar spray of.10% cow urine	18	76	57	3.10
T_5 : RDF + foliar spray of 0.1% chelated Zn + 0.1% boron	21	96	74	3.45
T_6 : RDF + foliar spray of 2% 10:26:26	19	85	66	3.48
T_7 : RDF + foliar spray of 1% DAP	19	83	64	3.44
T_8 : RDF + foliar spray of 1% 20:20:20	21	98	77	3.70
T_9 : RDF + foliar spray of 0.75% NaCl	21	86	65	3.02
T_{10} : RDF + foliar spray of 0.75% KCl	21	82	61	2.91

spray of 0.75% KCl (T_9) and RDF + foliar spray of 2% 10:26:26 (T_6). The lowest seed and haulm yield of green gram was recorded in control (T_1). Similar result was also recorded by Mallick and Mallick (2014) and Chdordas (2005).

Cost of cultivation

The data on cost of cultivation for different treatment recorded higher cost of cultivation over that of control (Table 2). The highest cost of cultivation was incurred towards with RDF + foliar spray of 0.1% chelated Zn + 0.1% boron (T_5) and RDF + foliar spray of 0.75% NaCl (T_9) followed by RDF + foliar spray of 1% 20:20:20 (T_8) and RDF + foliar spray of 0.75% KCl (T_{10}) respectively. The increase cost of cultivation was due to foliar nutrient and its application cost as compared to that of control. The highest gross return (Rs/ha) was recorded in RDF + foliar spray of 1% 20:20:20 (T_8) followed by RDF+ foliar spray of 0.1% chelated Zn + 0.1% boron (T_5). The lowest gross return was obtained from RDF + No. spray (Control) followed by RDF + foliar spray of 10% cow urine (T_4). The data on net return expressed that RDF + foliar spray of 1% 20:20:20 (T_8) recorded the highest net return followed by RDF + foliar spray of 0.1% boron (T_3). Control recorded lowest net return among the treatments.

Conclusion

The result of investigation showed that application of RDF + foliar spray of 1% 20:20:20 (T_8) followed by RDF + foliar spray of 0.1% chelated Zn + 0.1% boron may be recommended for cultivation of green gram for better growth, seed yield, protein contents and net returns.

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