EFFECTS OF BORON ON THE SEED YIELD AND PROTEIN CONTENT OF GREEN GRAM [*Vigna mungo*] *var.*CO 8

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Abstract: A pot experiment was conducted in the screen house of the Department of Soils and Environment, Agricultural College and Research Institute, Madurai during the year 2014-15 to assess the response of green gram (CO 8) to the soil application of different levels of boron in a boron deficient soil of Madukkur series. It appeared that 1.5 kg of B ha^{-1} significantly increased plant height, number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seeds pod^{-1}, 1000 seed weight, seed yield and protein content (%). The control (0 kg of B ha^{-1}) had the poorest performance in respect of yield and protein content of green gram seed.

Keywords: Boron, Greengram, Grain and Protein

Introduction: The micronutrient deficiencies which were sparse and sporadic initially are now widespread. Inventory of the available micronutrient status of the soil helps in demarcating areas where application of particular micronutrient is needed for profitable crop production. The response of greengram [*Vigna radiate* (L.) R. Wilczek] to Boron (B) application in a boron deficient soil with higher dose of N, P and K was observed in intensive pulse growing areas of Tamil Nadu. Boron is concerned with the buffer action at cellular level and regulatory effect of other nutrients in plants. Boron is involved in development of new cells in meristematic tissues. It is necessary for proper pollination, pod and grain setting. It involves in transformation of sugar and starch. Boron regulates the carbohydrates metabolism, is required in synthesis of amino acids and nodulation in legumes. The response of legumes to soil and foliar application of boron in boron deficient soils has been reported by several workers. With reducing area under pulses and great demand for greengram, the importance of Boron to enhance its yield is imperative. Hence, the objective of the study was to evaluate the effect of boron fertilization on growth, yield and protein content of green gram seed.

Materials and Methods: The study was conducted in the Department of Soils and Environment at screen house, Agricultural College and Research Institute, Madurai to evaluate the effect of fertilizer boron on the yield and protein content of green gram variety CO 8. The pot experiment was conducted, in which the soil type was sandy clay loam in texture; having soil organic carbon of 7.8 g kg^{-1} and moderately slow permeability. The available N, P, K of the experimental soil was low, medium and low with a value of 216, 15 and 246 kg ha^{-1} respectively.

The soil was deficient in available boron recording 0.18 mg kg^{-1} of B lower than the critical value of 0.4 mg kg^{-1}. The soil was acidic in nature with pH 6.9. Borax ($Na_2B_4O_7.10H_2O$) was used for boron fertilization in the study. The boron treatments were eight viz. 0, 0.25, 0.50, 0.75, 1.00, 1.25, 1.50 and 1.75 kg of B ha^{-1}. The number of replication was 3 and pot capacity was 10 kg: and the design of the experiment was Complete Randomized Block Design. The data were analyzed through a statistical computer programme AGRES and SPSS. The pods were separated from plants, was cleaned, dried and weighted separately. The seed weight was recorded in kg ha^{-1} and adjusted at 10% moisture content. A single plant was taken from each pot to measure the yield attributes. In order to determine protein in seeds Kjeldahl's digestion and distillation procedure was followed to determine total nitrogen in seeds. Then the protein content of the grain was determined by multiplying the nitrogen content of grain by 6.25.

Result and Discussion:

Plant height: The analysis of variance @ 0.05% on plant height of green gram at different stages revealed a significant increase due to different levels of soil B application. The values ranged from 39.1 to 46.2 cm during harvest stages in green gram. Application of B to soil at 1.5 kg ha^{-1} recorded the maximum plant height of 46.2cm at harvest stages of greengram. Soil application of boron @ 1.5 kg ha^{-1} recorded significantly higher plant height while the lowest value was recorded in control. Singh and Verma (1991) studied the effect of boron on plant height and reported that the improvement in plant height with the application of boron might be due to the enhancement of photosynthetic and other metabolic activities, which led to an increase in various metabolites responsible for cell division and cell elongation.

Number of branches per plant: Application of boron at @ 1.5 kg ha^{-1} was significantly higher than all the treatments and recorded the maximum number of branches of 2.88, while application of boron @ 1.75 kg ha^{-1} was significantly higher than other treatments in greengram. The results revealed that soil application of boron significantly increased the number of branches, which might be due to the involvement of boron in cell wall development and cell differentiation which resulted in elongation of

shoot and root in plants. This collaborated with the findings of Singh and Verma (1991).

Number of pods per branch: The significant effect of different levels of B was exhibited in the number of pods per branch in green gram**.** The number of pods in greengram as influenced by different levels of soil application of B ranged from 3.15 to 3.84. Application of 1.5 kg ha^{-1} of B recorded the maximum number of pods of 3.84. Increase in number of pods per branch in due to the increase in levels of boron and B availability. The result was in harmony with the findings of Dutta *et al.* (1984) and Keerati – Kasikorn *et al*. (1987) who also reported increase in pods with the application of B.

Number of grains per pod: Soil application of B @ 1.5 kg ha^{-1} significantly increased the number of grains. Maximum number of grains was registered in soil treated with 1.5 kg ha^{-1} followed by application of 1.25 kg ha^{-1} of B which was on par with 1.75 kg ha^{-1} of B. It was found from the present study that application of B upto 1.0 kg ha^{-1} did not increase the number of grains markedly. While, higher levels of B influenced the number of grains per pod. The increase in B to 1.75 kg ha^{-1} recorded lower number of grains per pod. The significant effect of B on number of grains might be due to the contribution of B in reducing the incidence of hollow heart in seeds and also the response of green gram to B in soils deficient in boron. According to Rerkasem (1990), application of borax increased the number of seeds per pod in green gram.

100 seed weight: There was no significant effect of boron on 100 seed weight of green gram in the variety CO 8. Application of 1.5 kg B ha^{-1}recorded higher test weight of 3.30 g over the control. The result may due to the influence of boron on cell division, carbohydrate metabolism, sugar and starch formation, which increased the size and weight of grain and as a result the 100 grain weight increased. Application of 1.5 kg ha^{-1} recorded higher test grain weight, while control recorded lower test grain weight. The non-significant influence of B on test grain weight was also reported by Quddus *et al*. (2011) in green gram.

Grain yield: A significant increase in the grain yield due to application of 1.5 kg ha^{-1} of B was observed as depicted in Table 1. The soil application @ 1.5 kg ha^{-1} of B registered maximum yield of 998 kg ha^{-1} than the control, which registered a minimum yield of 643 kg ha^{-1} followed by application of B @ 1.75 kg ha^{-1}. The yield ranged from 643 to 998 kg ha^{-1}. The highest yield was obtained when B was applied and an increase in grain yield from 6 to 55 % over the control. Quddus *et al*. (2011) found that application of boron gave highest yield of green gram. This result may be due to the impact of boron to make the stigma receptive and sticky and making pollen grain fertile and enhanced the pollination, thus increased fruit setting reduces sterility of flower and thus number of grains per pod increased. The incidence of hollow heart in large and small seeds due to boron deficiency was minimized with boron application. Nevertheless, the incidence of hollow heart in small seeds was still as high as 9 – 11 % (Keerati – Kasikorn *et al*. 1987).

Protein content: Boron had significant influence on the protein content of green gram seeds (Table 1). The highest protein content was found with 1.5 kg B ha^{-1} while the lowest with control which was identical to 1.75 kg B ha^{-1}. It might be due to boron which plays an important role in protein synthesis in plants. Similarly, reported by Kaisher *et al.* 2010, that application of boron increased the protein content of green gram seed. Protein content of groundnut pod was significantly influenced by B application. Maximization of protein in pods of groundnut through application B was reported by many workers (Bhuiyan, 1997 and Murthy, 2006).

Conclusion: Based on the results, it could be concluded that, application of Boron @ 1.5kg ha^{-1} attain higher growth paramater, seed yield and protein content in the green gram [*Vigna mungo*] *var.*CO 8.

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Table 1. Effect of boron on the yield and protein content of green gram

Treatment B dose (kg ha^{-1})	Plant height (cm)	Branches per plant	Pods per branch	Grains per pod	100 seed weight (g)	Seed yield per ha (kg)	Protein content (%)
0.00	39.1	2.22	3.15	7.97	3.09	643	22.1
0.25	40.7	2.33	3.31	8.31	3.11	683	22.8
0.50	41.8	2.35	3.37	8.67	3.15	715	23.2
0.75	42.3	2.35	3.38	8.79	3.17	750	23.9
1.00	43.9	2.46	3.40	9.07	3.18	791	24.9
1.25	44.4	2.52	3.55	9.14	3.21	827	25.9
1.50	46.2	2.88	3.84	9.80	3.30	998	26.9
1.75	45.4	2.65	3.57	9.34	3.28	912	26.5
LSD (0.05)	**1.5**	**0.18**	**0.14**	**0.27**	**NS**	**32.4**	**0.96**

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