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Impact of Nitrogen Levels and Application of Boron on Yield and Growth of Greengram (*Vigna radiata* L.)

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ABSTRACT: The Purpose of this study was to determine the "Impact of Nitrogen Levels and Application of Boron on Yield and Growth of Greengram (*Vigna radiata* L.)" var. SAMRAT. During the *kharif* of 2020, a field research was undertaken at the Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). Nitrogen and Boron are important elements for improving output and growth. The treatments consisted of nitrogen *viz.* N_1 - 15 kg per ha, N_2 - 20 kg per ha, N_3 - 25 kg per ha and boron *viz.* B_1 - 1 kg at 15 DAS (Soil application), B_2 - 2 kg at 25 DAS (Soil application), B_3 - 0.2% at 35 DAS (Foliar application). The trail was laid out in Randomized Block Design with nine treatments which were replicated thrice. The results showed that growth attributes *viz.* number of pods per plant (25.33), number of seeds per pod (6.67) and test weight (23.10) were recorded maximum with application of Nitrogen 25 kg/ha + Boron 0.2% foliar application at 35 DAS. However, seed yield (1260.44 kg/ha), haulm yield (2764.53 kg/ha), biological yield (4024.97 kg/ha) and harvest index (33.99%) were also obtained with Nitrogen 25 kg/ha + Boron 0.2% foliar application at 35 DAS.

Keywords: Greengram, Nitrogen (N), Boron (B), Foliar Application, Growth and Yield.

INTRODUCTION

Greengram is also known as mung or moong in some areas (*Vigna radiate* L.) mung bean is a high-quality protein source (23-24%) with high levels of lysine (460 mg/g) and tryptophan(460 mg/g). When sprouted, it contains significant amount of ascorbic acid, as well as riboflavin (21 mg/100g) and minerals (3.84 W 100g). The countries total area production is 14.76million tonnes. In India, greengram grown about 3.109 million ha with total production of 0.946 million tonnes. Among the states growing this crop, Rajasthan ranks in first in area, While Maharashtra ranks first in production. Punjab is major state work rate with 805 kg/ha the national average of 304 kg/ha. Among several crop production obstacles appropriate, sustained cultivation of historical low potential cultivars, use of low seed rate, and poor agronomic methods were major factors for increasing low yield in greengram at farmers' fields. The essential components that promote an increased crop output in greengram are nitrogen and boron.

Nitrogen is one of the most important plant nutrients and crop production performance is largely depend on the availability of nitrogen in sufficient quantity. Perhaps the single most significant element limiting crop production is nitrogen. The significant demand of nitrogen for the establishment and growth of conspicuous roots is one of the likely explanations for grain legumes poor yield in general grains Alberada and Bower, (1983). Mung bean grows in two stages, each requiring a substantial amount of nutrients in Trung and Yoshida (1985). Mung bean requires significantly more nitrogen during the reproductive stage then during the vegetative stage. Mitra *et al.,* (1988) found that during the first 20 days of pod and seed development, a middling yielding mung bean crop required as much as 27.86 mg N gm/ha photosynthetic On the other hand, nitrogen deficiency reduced the number of Branches/plant, Plant height, Stem diameter and pod length (Mainul *et al*., 2014). Early vigour is reduced by nitrogen deficit and crop production suffers as a result. Because nitrogen is a key component of proteins, it is especially beneficial for pulse crop. Furthermore, research investigations have indicated that the application of balanced fertilizers, particularly nitrogen, can increase mung bean production and quality (Aslam *et al*., 2010). Moreover, there is an exigency in the country to increase the mung bean yield through proper soil fertility management practices especially Nitrogen.

Boron is the third most abundant micronutrient and it is essential for the stability of plant cell was and membranes (Bassil *et al.,* 2004.) By boosting leaf area expansion, 1000 test weight, nodule development, seed yield, and biological yield, it boosts plant growth and yield. It is required for cell differentiation at all growing tips of plants (meristems) were cell division is active, and it influences major cellular functions and metabolic activities. Researchers studied the effect of boron on pulses and concluded that it is important for protein synthesis and improved protein content. According to Renukadevi *et al.,* (2002) boron application maximize the light interception ratio, biomass production, leaf area index, net assimilation rate, crop growth rate and seed yield in pulses. Among pulses, mung bean is an important pulse crop. It is a high-protein, highely digested source of animal feed in the form of protein concentrates, and it also plays a significant part in human and animal diets. It has a protein content of 24.2 percent, a carbohydrate content of 64.4 percent, and a fat content of 1.3 percent. According to Reddy *et al.,* (2003), the combined impact of boron and other growth regulators is beneficial in increasing photo assimilate translocation, which improves grain production and harvesting index.

MATERIALS AND METHODS

The experiment took place in the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHAUTS). It may be found in a latitude of 250 30` 42`` N, a longitude of 810 60` 56`` E, and a height of 98 meters above mean sea level (MSL). This region is around 12 kilometers from the city, on the right bank of the Yamunariver, along the Prayagraj- Rewa route Prayagraj belongs to sub-tropical and semi-arid atmospheric condition, with both extremes of temperature, *i.e*. winter and summer. It receives southwest monsoon rains which commence in the month of July and withdraws by the end of September. The weekly average of maximum and lowest temperature, relative humidity, and rain fall recorded at the agro metrological observatory unit, school of forestry and environmental sciences, Sam Higginbottom University of Agriculture Technology and Sciences during the experiment`s growth period. There were 9 treatments in the trail that are replicated thrice in Randomized Block Design with the integration levels of nitrogen and application of boron *viz.* T_1: 15 kg N/ha + 1 kg of Boron at 15 DAS (soil application), T_2: 15 kg N/ha + 2 kg of Boron at 25 DAS (soil application), T_3: 15 kg N/ha + 0.2% foliar application of Boron at 35 DAS, T_4: 20 kg N/ha + 1 kg of Boron at 15 DAS (soil application), T_5: 20 kg N/ha + 2 kg of Boron at 25 DAS (soil application), T_6: 20 kg N/ha + 0.2% foliar application of Boron at 35 DAS, T_7: 25 kg N/ha + 1 kg of Boron at 15 DAS (soil application), T_8: 25 kg N/ha + 2kg of Boron at 25 DAS (soil application), T_9: 25 kg N/ha + 0.2% foliar application of Boron at 35 DAS. The soil in the experimental plot had a sandy loamy texture, was almost in soil reaction (pH 7.6), had low organic carbon (0.36 %), available N (210 %), available P (13.05 kg/ha), and available K (156.45 kg/ha) and was low in organic carbon (0.36 %). Fertilizers were appeal as band placement, for which 4-5cm deep furrows were make along the seed rows accompanied by a hand hoe. The supplement sources were Urea, SSP and MOP to fulfill the requirement of nitrogen, phosphorous and potassium. The recommended quantity of fertilizer N:20 kg/h, P:40 kg/ha and K:20 kg/ha were applied according to the treatment details. Irrigation was based on the necessity and as per the time of sowing. The yield parameters *viz.* number of pods per plant, number of seeds per pod, 1000 test weight, grain yield, stover yield and harvest index were recorded with standard process of observation. The data remain statistically analysed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Growth attributes: Data granted in Table 1 showing that growth variables such as Plant height (cm), Number of Branches/plant, Number Nodules/plant were recorded at 15,30,45,60 DAS as shown in Table 1. At 15 DAS the highest plant height with non-significantly recorded as (13.24) significantly increased plant height was seen at 30, 45 and 60 DAS (21.27 cm), (32.60 cm) and(41.86 cm) in 25 kg N/ha + 0.2% B at 35 DAS (Foliar application). However, at 30 DAS 25 kg N/ha + 2 kg B/ha at 25 DAS (Soil application) (19.12), 45 DAS25 kg N/ha + 1 kg B/ha at 15 DAS (soil application) (30.73) and at 60 DAS 25 kg N/ha + 1 kg B/ha at 15 DAS (Soil application) (39.99) were statistically at par to25 kg N/ha + 0.2% B at 35 DAS (Foliar application). No. of Branches/plant at 30, 45, 60 DAS significantly highest no. of branches/plant was recorded (1.63),(3.40) and (3.80) in 25 kg N/ha + 0.2% B at 35 DAS (Foliar application). However, at 30 DAS 20 kg N/ha + 2 kg B/ha at 25 DAS (Soil application) (1.26), 45 DAS 20 kg N/ha + 2 kg B/ha at 25 DAS (soil application) (2.47) and at 60 DAS 25 kg N/ha + 2 kg B/ha at 25 DAS (Soil application) (3.67) were statistically at par to 25 kg N/ha + 0.2% B at 35 DAS (Foliar application). No. of Nodules/plant at 15,30,45,60 DAS significantly highest no. of nodules/plant was recorded (13.80), (36.27), (52.60), (26.27) in 25 kg N/ha + 0.2% B at 35 DAS (Foliar application). However, at 15 DAS 25 kg N/ha + 2 kg B/ha at 25 DAS (Soil application) (12.67), 30 DAS 20 kg N/ha + 0.2% B at 35 DAS (Foliar application) (32.99), 45 DAS 20 kg N/ha + 0.2% B at 35 DAS (Foliar application) (46.92) and at 60 DAS 25 kg N/ha + 1 kg B/ha at 15 DAS (Soil application) (25.33) were statistically at par to25 kg N/ha + 0.2% B at 35 DAS (Foliar application).

This might be due to increase in growth attributes and Praveena *et al*., (2018) has reported that boron shows an crucial role in tissue differentiation together with carbohydrate metabolism it is also a constituent of cell membrane and essential for cell division, maintenance of conducting tissue with Regulatory effect on other element. It is also necessary for sugar translocation in plant and development of new cell in meristematic tissue increases through all growth parameters. Movalia Janaki *et al*., (2018) determined the reason for increase in branches. Boron plays an important role in plant metabolism and translocation of photosynthates from source to sink. Singh *et al.,* (2006) described that the enlargement parameters were significantly enhanced by split application of nitrogen over control.

Table 1: Impact of Levels of Nitrogen and Application Boron on Growth attributes of Greengram.

	Treatments	Plant Height (cm)				No. of Branches			No. of Nodules			
		15	30	45	60	30	45	60	15	30	45	60
T_1	15 kg N/ha + 1 kg B/ha at 15 DAS (Soil Application)	9.33	15.30	26.63	31.23	1.00	2.33	2.54	10.07	29.40	40.76	21.00
T_2	15 kg N/ha + 2 kg B/ha at 25 DAS (Soil Application)	11.28	16.48	26.67	33.60	1.13	2.40	2.67	10.13	31.40	43.22	21.80
T_3	15 kg N/ha + 0.2% B at 35 DAS (Foliar Application)	11.41	16.69	26.70	34.53	1.20	2.43	2.81	10.40	33.13	43.60	22.47
T_4	20 kg N/ha + 1 kg B/ha at 15 DAS (Soil Application)	11.42	17.28	28.07	38.67	1.13	2.60	2.93	10.20	33.40	44.47	23.13
T_5	20 kg N/ha + 2 kg B/ha at 25 DAS (Soil Application)	11.65	17.40	28.57	39.08	1.26	2.47	3.13	10.53	33.54	45.40	23.20
T_6	20 kg N/ha + 0.2% B at 35 DAS (Foliar Application)	12.01	17.80	29.67	39.56	1.33	2.60	3.23	10.40	32.99	46.92	24.53
T_7	25 kg N/ha + 1 kg B/ha at 15 DAS (Soil Application)	12.45	18.60	30.73	39.99	1.40	2.80	3.47	10.20	34.27	48.90	25.33
T_8	25 kg N/ha + 2 kg B/ha at 25 DAS (Soil Application)	13.23	19.12	31.63	40.53	1.53	2.87	3.67	12.67	34.60	49.10	25.40
T_9	25 kg N/ha + 0.2% B at 35 DAS (Foliar Application)	13.24	21.27	32.60	41.86	1.63	3.40	3.80	13.80	36.27	52.60	26.27
	SEm±	-	0.71	0.88	0.76	0.12	0.31	0.08	0.45	1.09	2.17	0.41
	CD (P=0.005)	-	2.14	2.64	2.27	0.37	0.94	0.23	1.34	3.28	6.52	1.22

Yield attributes: Data granted in Table 2. Showing that yield parameters like Pods/plant (no), Seeds/pod (no), Test weigh t(g), Seed yield(kg/ha), Haulmyield (kg/ha), Biological yield (kg/ha) and Harvestindex (%) were recorded after harvesting of crop and shown in Table 2 considerably more pods/plant(25.33), and significantly more seeds each pod with non-significantly (6.67), Test weight with non-significantly (23.10 g), Seed yield (1260.44 kg/ha), Haulm yield (2764.53 kg/ha), Biological yield (4024.97 kg/ha) and Harvest index (33.99%) were recorded with 25 kg N/ha + 0.2% B at 35 DAS (Foliar application). However, Pods/plant (24.37), Seed yield (1159.39 kg/ha), Haulm yield (2667.67 kg/ha), Biological yield (3827.06 kg/ha) in 25 kg N/ha + 2 kg B/ha at 25 DAS (Soil application) are found statistically at par to25 kg N/ha + 0.2% B at 35 DAS (Foliar application). And Harvest index (31.88%) in 20 kg N/ha + 2 kg B/ha at 25 DAS (Soil application) are found statistically at par to 25 kg N/ha + 0.2% B at 35 DAS (Foliar application). This might be due to increase in yield attributes by Praveena *et al*., (2018).

Table 2: Impact of Levels of Nitrogen and Application of Boron on Yield attributes of Greengram.

Treatments	At 60 DAS						
	Pods/plant	Seeds/pod	Test weight (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
$T_1$15 kg N/ha +1 kg B/ha at 15 DAS(Soil Application)	19.53	5.80	21.97	828.22	2046.43	2874.66	28.74
$T_2$15 kg N/ha + 2 kg B/ha at 25 DAS (Soil Application)	20.07	5.60	21.50	807.62	2054.47	2862.09	28.14
$T_3$15 kg N/ha + 0.2% B at 35 DAS (Foliar Application)	19.67	5.73	22.57	845.42	2003.20	2848.62	29.70
$T_4$20 kg N/ha + 1 kg B/ha at 15 DAS (Soil Application)	19.80	5.87	22.93	895.38	2242.41	3137.79	28.32
$T_5$20 kg N/ha + 2 kg B/ha at 25 DAS (Soil Application)	24.13	6.00	22.13	1073.74	2270.53	3344.27	31.88
$T_6$20 kg N/ha + 0.2% B at 35 DAS(Foliar Application)	23.67	6.13	22.27	1078.15	2091.82	3169.97	31.25
$T_7$25 kg N/ha + 1 kg B/ha at 15 DAS (Soil Application)	23.80	6.13	22.33	1037.27	2439.59	3476.83	29.77
$T_8$25 kg N/ha + 2 kg B/ha at 25 DAS (Soil Application)	24.37	6.20	21.33	1159.39	2667.67	3827.06	30.27
T_9 25 kg N/ha + 0.2% B at 35 DAS (Foliar Application)	25.33	6.67	23.10	1260.44	2764.53	4024.97	33.99
SEm±	0.34	-	-	49.89	62.45	97.20	0.96
CD (P=0.05)	1.01	-	-	149.56	187.21	291.47	2.87

This might be due to the application of boron all yield contributing characteristics in greengram, such as number of pods/plant, number of seeds/pod, test weight, seed yield, and Stover yield, were considerably improved by foliar spraying before flowering. Increased vegetative development interms of branch number offered additional locations for photosynthate translocation, resulting in an increase in yield characteristics. Flower development, pollen grain formation, pollen viability, pollen tube expansion for appropriate pollination and seed development may all have a positive influence on yield characteristics

(Dixit and Elamathi 2007). Boron is required more at reproductive stage and foliar applied is instantly present for plant in compare to soil applied boron foliar applied boron in greengram increased the stover yield over the control. Biological is the function of grain yield and stover yield. These findings are in confirmation to earlier reports of Balai *et al*. (2017) and Lokhande (2018). The higher biological yield may be due to enlarge in terms of dry matter and number of branches/plant, vegetative development creates too many sites for photosynthetic translocation, resulting in an increasing in the number of yield characteristics *i.e.* biological yield.

CONCLUSION

It can be established that applying 25 kg N/ha + Boron 0.2 percent foliar spray at 35 DAS to generate higher yield in greengram for optimum agricultural output is the best for rainfed greengram production.

FUTURE SCOPE

As that conclusion are based on research conducted over a single season in Allahabad's agro-ecological environments, more experiments may be necessary before it could be considered a recommendation.

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Conflict of Interest. Nil.

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