International Journal of Plant & Soil Science

34(20): 9-16, 2022; Article no.IJPSS.88006
ISSN: 2320-7035

Response of NPK, Zinc and Boron Fertilization on Growth, Yield Attributes and Nutrient Uptake by SUMMER GREEN GRAM (*Vigna radiate* L.) in an Inceptisol of Prayagraj, (Uttar Pradesh)

Jadhav Ravindra [a*#], Narendra Swaroop [a†] and Tarence Thomas [a‡]

[a] *Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj- 211 007, Uttar Pradesh, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2031123

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/88006

Original Research Article

Received 22 March 2022
Accepted 02 June 2022
Published 02 June 2022

ABSTRACT

The study pertaining to the present topic under field investigation entitled "Response of N, P, K, Zinc and Boron fertilization on Soil Health, Growth and Yield attributes of *Summer* Green gram (*Vigna radiata L.*) in an Inceptisol of Prayagraj, Uttar Pradesh)" for two consecutive years, beginning from *summer* seasons of the years 2021 and 2022 at Research Farm, Department of Soil Science and Agricultural Chemistry. The excavated soil sample from the experimental site before conducting research operation, mentioned that, the land topography range was nearly level with a 1-3% slope; the soil is of sandy loam texture with neutral to alkaline in reaction. Among eleven treatments, during field experimentation, the conjunctive use of Nitrogen, Phosphorous, Potassium (NPK) and different micronutrients (Zinc and Boron) levels, together came with the best results significantly. However, the growth factors including pre-harvest parameters *i.e.* height of plant (48 cm), number of branches plant^{-1} (14) and number of pods plant^{-1} (28.63) opined significantly higher in treatment (T_{11}) registering RDF (recommended dose of fertilizer) (20:40:20 NPK kg ha^{-1})+ Zinc@6 kg ha^{-1}+

[#] *Research Scholar;*
[†] *Associate Professor;*
[‡] *Professor and Head;*
**Corresponding author: E-mail: jadhavravindra840@gmail.com;*

Boron @3 kg ha^{-1}, which in turn influenced in achieving highest mean of the number of grains pod^{-1} (12.11), protein content (25.12 %) and weight of 100 grains (6.26 gm), which ultimately gave the highest cumulative mean of grain yield (1594.37 kg ha^{-1}), straw yield (2974.88 kg ha^{-1}), biological yield (4569.24 kg ha^{-1}), harvest index (37.04 %), NPK, Zinc and Boron uptake in green gram grain *i.e.* N 36.28 and 38.18, P 5.46 and 5.73, K 11.84 and 12.47 kg ha^{-1} while Zn 91.97 and 92.19, B 45.75 and 45.94 g ha^{-1}, respectively during two years and straw which was N 30.77 and 31.44, P 3.92 and 4.36, K 23.43 and 23.99 kg ha^{-1} while Zn 67.27 and 67.48 and B 63.08 and 63.15 g ha^{-1}, respectively, net returns of 85,511.55 and 86,837.50 (Rs ha^{-1}), wider B:C ratio (1:2.73 and 1:2.77) as compared to rest of treatments.

Keywords: Green gram; zinc; boron; nutrient uptake and yield and quality attributes.

1. INTRODUCTION

Next to cereals, Pulses play a vital role in agriculture as these provide proteins, minerals, vitamins, rich vegetables and fodder. Because legume crops have self-nitrogen fixing capacity, their contribution has an added advantage in the country's current fertilizer crisis. Pulses form the second largest source of dietary protein. Pulses are annual leguminous crops yielding between one and 12 grains or seeds of variable size, shape and colour within a pod, used for both food and feed. The term "pulses" is limited to crops harvested solely for dry grain, thereby excluding crops harvested green for food, which are classified as vegetable crops, those crops are used mainly for oil extraction and leguminous crops that are used exclusively for sowing purposes.

Apart from the high level of protein 25 %, green gram also contains fat 1.3 %, dietary fiber 3.2 % and carbohydrate 57 %. It is a rich source of calcium in 68 mg/ 100g seeds, phosphorous 300mg/ 100g seed and iron 7mg/ 100g seed. It is also rich in vitamin C and riboflavin. It is one of the predominant sources of protein and certain essential amino acids like lysine and tryptophan in vegetarian diets. It also provides 334 - 344 Kcal Energy [1]. Mung bean has more protein contents and better digestibility than any other pulse crop. The total cultivated area under pulses in India is estimated to be 23.3 million hectares and the productions of pulses are 14.7 million tones. It synthesizes nitrogen in symbiosis with rhizobia and increases soil fertility and biomass of soil. In India, green gram is cultivated either as pure crop or as an inter crops. As a pure crop, it occupies rice or other Kharif fallows and as an inter crop, it is sown with linseed, wheat or mustard. Uttar Pradesh, Bihar, Madhya Pradesh, West Bengal, Rajasthan, Maharashtra and Haryana are the major green gram producing states. The highest productivity of 834 kg ha^{-1} is obtained in Punjab as against the national average of 417 kg ha^{-1}. The productivity of this crop is very low because of its cultivation on marginal and sub- marginal lands of low soil fertility where little attention is paid to adequate fertilization [2].

Lack of zinc causes deficiency in the formation of RNA and protein. Therefore, the plant with a lack of zinc is poor in amount of protein. Hence, the present study was undertaken to examine the integrated impact of spacing, sources of nutrient and method of zinc application on yield attributes, productivity and economics of green gram [3].

Boron is important for sugar translocation, nitrogen utilization and protein synthesis. plays important role in synthesis of essential amino acids like cystine, methionine & certain vitamins like biotine, thymine, Vitamin B1 as well as the formation of ferredoxin & iron- containing plants.

Hence, objectives of the study are simply justified. Keeping these considerations in view, an investigation was taken during *summer* season of 2021 and 2022.

2. MATERIALS AND METHODS

2.1 Experimental Site and Location

The experimental site of the research farm falls under Geographical coordinates of Prayagraj District which is located at 25^{0} 58' N latitude and 81^{0} 52' E longitude with an altitude of 98 meter above mean sea level and is situated 5 km away on the right bank of Yamuna river. Representing the Agro-Ecological Sub Region [North Alluvial plain zone **(**0-1 % slope**)**] and Agro-Climatic Zone (Upper Gangetic Plain Region).

2.2 Climate Condition

The area of the region is characterized by sub-tropical and has a semi-arid type of climate, which experience extremely hot and dry summer spells from April to June where the temperature reaches maximum up to 46^0C and touches 48^0C followed by relative humidity from July to September ranging from 20 - 90 percent, fairly seldom falls of cold with frosty spells as low as 4^0C and dips up to 2^0C is noticed. Here a few showers of cyclonic rains are received called winter monsoon (North-East monsoon), which is seen from November to January and mild climate from February to March. The rainfall in this particular region starts from the middle of July to the end of September and is commonly known as the summer monsoon (South-West monsoon). This South-West monsoon brings a major portion of the rainfall (75 percent) with a mean annually around 900 to 1100 mm.

2.3 Experimental Details

The present research investigation was set- up in a randomized block design (RBD) having eleven treatment combinations which are replicated thrice, randomly allocated in each replication, dividing the research site into thirty-three plots. The Green gram variety PDM-139 (Samrat) was grown during the two experimental years 2021 and 2022. In this study, inorganic fertilizers like Nitrogen, Phosphorous, Potassium, Zinc and Boron were applied.

2.3 Fertilizer Application

The recommended dose of NPK (100%) was applied to the green gram crop were N (20 kg ha^{-1}), P2O5 (40 kg ha^{-1}) and K2O (20 kg ha^{-1}). The 100 percent application of N, P and K was applied as basal dose at the time of sowing. In addition to these applications, Zinc was applied as basal @ 2, 4 and 6 kg ha^{-1} with Boron 1, 2 and 3 kg ha^{-1} only to the treatment with Zn and B. The sources of NPK fertilizers were nitrogen through urea (46% N), phosphorus through single superphosphate (16% P_2O_5), potash through Muriate of potash (60% K_2O) and zinc through zinc sulphate (21% Zn) and Boron through borax (11.3% B) was applied prior to sowing in concerning treatments just before the seed sowing.

Sowing of the Green gram crops was carried out on the 26^{th} and 25^{th} of March month during 2021 and 2022, respectively by manually. Seed variety PDM-139 (Samrat) was sown at the rate of 25 kg ha^{-1} and 5 cm depth, at a row to row spacing of 30 cm and plant to plant spacing 10 cm.

2.4 Plant Analysis

The plant samples of each plot were separately powdered in a stainless steel grinder. Dry powdered samples were ashed in a muffle furnace at 600 ºC and the ash was extracted in 10 mL of 0.36 N H_2SO_4 for 1 h at room temperature. The extract was used for the determination of B calorimetrically using the azomethine-H method [4] and Zn and B by AAS.

2.5 Statistical Analysis

The statistical analysis of the data was carried out using STATISTICA (7.0) software.

Table 1. Treatment details

Treatments	***Summer*** **variety- PDM-139 (Samrat)**
T_1	Absolute control
T_2	Only RDF (20:40:20 NPK kg ha^{-1})
T_3	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 2 kg ha^{-1}+ Boron @ 1 kg ha^{-1}
T_4	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 2 kg ha^{-1}+ Boron @ 2 kg ha^{-1}
T_5	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 2 kg ha^{-1}+ Boron @ 3 kg ha^{-1}
T_6	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 4 kg ha^{-1}+ Boron @ 1 kg ha^{-1}
T_7	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 4 kg ha^{-1}+ Boron @ 2 kg ha^{-1}
T_8	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 4 kg ha^{-1}+ Boron @ 3 kg ha^{-1}
T_9	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 6 kg ha^{-1}+ Boron @ 1 kg ha^{-1}
T_{10}	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 6 kg ha^{-1}+ Boron @ 2 kg ha^{-1}
T_{11}	RDF (20:40:20 NPK kg ha^{-1})+ Zinc @ 6 kg ha^{-1}+ Boron @ 3 kg ha^{-1}

3. RESULTS AND DISCUSSION

3.1 Effect of Nutrient Management on Growth and Development

The data presented in Table 2 revealed that growth of the plants was influenced by the treatments under study. Maximum plant height (average of two years) was observed under the treatment T_{11} (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 3 kg ha^{-1}) (55.8 cm) which significantly differed from all other treatments at 5% level of significance. The second and third highest plant heights were observed under the treatments T_{10} (RDF (20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 2 kg ha^{-1}) (52.7 cm) and T_8 (RDF (20:40:20 NPK kg ha^{-1}) + Zinc @ 4 kg ha^{-1} + Boron @ 3 kg ha^{-1}) (49.9 cm), respectively. Other treatments showed a marginal increment of plant height as compared to T_1 (absolute control) and T_2 (only RDF). In case of other growth parameters (number of branches, number of branches plant^{-1}, number of pods plant^{-1} and number of grains pod^{-1} at 60 days), T_{11} (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 3 kg ha^{-1}) showed significant effect as compared to other treatments. However, critical observation revealed that most of the growth parameters did not differ significantly in both the years of experimentation. A similar finding was also reported by Kumari et al. [5], Kudi et al. [6], Praveena et al. [7], Patel et al. 2019 and Karthik et al. [8].

3.2 Effect of Nutrient Management on Yield and Quality Attributes and Seed Yield

The optimum pod length (8.35 cm), 100 seed weight (6.23 gm) and protein (25.08 %) was observed under treatment T_{11} (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 3 kg ha^{-1}) which significantly differed from all other treatments during both the years (Table 3). The minimal pod length (5.90 cm), 100 seed weight (4.61 gm) and protein (17.86 %) was recorded under the treatment absolute control (T_1). This indicates that the application of different levels of Zn and B along with a recommended dose of fertilizer greatly influenced the pod length and 100 seed weight and protein in grains of green gram as compared to treatment with only RDF (T_2) and absolute control (T_1). This corroborates with the findings of Kumari et al*.,* 2017, Kudi et al., [6] Praveena et al., [7], Patel et al., 2019 and Karthik et al., [8]. Total biomass production was also influenced by different treatments (Table 3). The highest biological yield (4554.38 kg ha^{-1}) was recorded under the treatment T_{11} (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 3 kg ha^{-1}) and the lowest (1963.82 kg ha^{-1}) under the treatment T_1 (absolute control). However, close examination of data indicates that Zn and B gave a synergic effect on the biological yield. Green gram seed yield was also found to be influenced by the treatments and maximum seed yield (1593.35 kg ha^{-1}) was recorded in the plot fertilized with treatment T_{11} (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 3 kg ha^{-1}) which followed the same trend as in case of biological yield. Minimum harvest index (32.17 %) was observed under the treatment T_1 (absolute control) whereas, maximum Harvest Index (37.40 %) was observed under the treatment T_4 (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 2 kg ha^{-1} + Boron @ 2 kg ha^{-1}) which remained at par with T_3 (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 2 kg ha^{-1} + Boron @ 1 kg ha^{-1}), T_5 (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 2 kg ha^{-1} + Boron @ 3 kg ha^{-1}). The findings obtained in this experiment are in agreement with those of Kumari et al. 2017, Kudi et al. [6], Praveena et al. [7], Patel et al., 2019 and Karthik et al. [8].

3.3 Effect of Nutrient Management on Nutrient Uptake by Green Gram

Nitrogen uptake by green gram was directly influenced by applied nutrients (Table 4). The highest uptake in grain and straw of N (37.23 and 31.10 kg ha^{-1}) and K (12.15 and 23.71 kg ha^{-1}) was recorded in the treatment T_{11} (RDF 20:40:20 NPK kg ha^{-1}) + Zinc @ 6 kg ha^{-1} + Boron @ 3 kg ha^{-1}), whereas the lowest N (14.14 and 13.87 kg ha^{-1}) and K (4.89 and 11.15 kg ha^{-1}) was recorded with the treatment T_1 (absolute control). The maximum uptake of P (5.89 and 4.14 kg ha^{-1}) was registered in the treatment T_2 (only RDF), however the lowest uptake of both P (1.74 and 1.90 kg ha^{-1}) was noticed in the treatment of T_1 (absolute control). Similar uptake of nutrients in green gram was reported by Kudi et al., 2018, Parveena et al., 2018, Angmo et al. [9] and Karthik et al., 2021. In the case of B and Zn uptake in grain and straw by green gram, the highest amount (45.84 and 63.11 g B ha^{-1} and 92.08 and 67.37 kg Zn ha^{-1}) was observed under the treatment T_{11} (RDF+B1.5+Zn5.0), whereas, the lowest uptake in grain and straw (28.64 and

Table 2. Growth of green gram at 60 days as influenced by different treatments

Treatments		Plant height (cm)		Branches plant^{-1}		Pods plant^{-1}		Grains pod^{-1}		100 seed weight (gm)	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
T_1	Absolute control	36.41	37.02	5.60	5.90	13.57	14.03	8.40	8.67	4.57	4.64
T_2	Only RDF	39.60	40.17	7.00	7.30	15.77	15.73	9.17	9.23	4.85	4.96
T_3	RDF + Zn@2 + B @1 kg ha^{-1}	40.62	40.72	9.00	9.20	17.13	17.02	9.87	10.03	4.88	5.00
T_4	RDF + Zn@2 + B @2 kg ha^{-1}	41.00	41.19	10.00	10.20	17.60	17.63	10.07	10.30	5.08	5.15
T_5	RDF + Zn@2 + B @3 kg ha^{-1}	43.52	43.38	10.20	10.40	18.30	18.63	10.70	10.88	5.23	5.31
T_6	RDF + Zn@4 + B @1 kg ha^{-1}	44.63	44.75	10.30	10.60	18.27	18.53	10.67	10.97	5.35	5.47
T_7	RDF + Zn@4 + B @2 kg ha^{-1}	45.11	45.27	11.10	11.40	18.73	19.03	11.07	11.23	5.74	5.90
T_8	RDF + Zn@4 + B @3 kg ha^{-1}	45.75	45.91	11.20	11.40	19.67	19.93	11.20	11.33	5.84	5.97
T_9	RDF + Zn@6 + B @1 kg ha^{-1}	46.28	46.35	11.28	11.60	22.53	22.87	11.51	11.80	6.05	6.13
T_{10}	RDF + Zn@6 + B @2 kg ha^{-1}	47.23	47.31	13.00	13.30	27.27	27.50	11.60	11.77	6.16	6.21
T_{11}	RDF + Zn@6 + B @3 kg ha^{-1}	48.00	48.14	14.00	14.30	28.50	28.63	12.05	12.11	6.21	6.26
SE m (±)		0.50	0.30	0.22	0.21	0.34	0.40	0.27	0.27	0.02	0.01
CD (P=0.05)		1.48	0.89	0.64	0.63	1.02	1.17	0.80	0.79	0.07	0.04

Table 3. Green gram yield, quality attributes and yield

Treatments		Pod length (cm)		Seed yield (kg ha^{-1})		Biological yield (kg ha^{-1})		Harvest index (%)		Protein (%)	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
T_1	Absolute control	5.04	5.14	631.25	632.35	1962.70	1964.95	32.16	32.18	17.79	17.95
T_2	Only RDF	6.27	6.40	794.83	795.64	2255.05	2306.85	35.24	34.49	20.28	20.34
T_3	RDF + Zn@2 + B @1 kg ha^{-1}	6.53	6.67	1163.85	1164.12	3099.41	3099.56	37.55	37.55	20.74	20.83
T_4	RDF + Zn@2 + B @2 kg ha^{-1}	6.98	7.07	1284.58	1285.49	3401.19	3470.03	37.76	37.04	21.54	21.60
T_5	RDF + Zn@2 + B @3 kg ha^{-1}	7.08	7.22	1369.32	1370.14	3729.24	3710.35	36.71	36.92	22.33	22.42
T_6	RDF + Zn@4 + B @1 kg ha^{-1}	7.29	7.42	1381.41	1382.00	3819.99	3868.59	36.16	35.72	22.80	22.90
T_7	RDF + Zn@4 + B @2 kg ha^{-1}	7.36	7.53	1458.10	1459.17	4111.00	4161.74	35.46	35.06	23.47	23.59
T_8	RDF + Zn@4 + B @3 kg ha^{-1}	7.82	7.89	1526.13	1527.19	4330.68	4403.58	35.23	34.68	24.05	24.11
T_9	RDF + Zn@6 + B @1 kg ha^{-1}	7.84	7.92	1570.35	1571.73	4402.37	4468.26	35.67	35.17	24.38	24.59
T_{10}	RDF + Zn@6 + B @2 kg ha^{-1}	8.11	8.29	1585.65	1586.37	4488.22	4510.02	35.35	35.17	24.82	24.92
T_{11}	RDF + Zn@6 + B @3 kg ha^{-1}	8.26	8.44	1592.33	1594.37	4539.52	4569.24	35.12	34.91	25.04	25.12
SE m (±)		0.06	0.10	0.32	0.46	25.44	22.43	1.22	1.15	0.14	0.19
CD (P=0.05)		0.18	0.31	0.94	1.37	74.62	65.80	3.65	3.37	0.43	0.56

Table 4. Nutrient uptakes by green gram

Treatments	Nitrogen (kg ha^{-1})				Phosphorus (kg ha^{-1})				Potassium (kg ha^{-1})				Zinc (g ha^{-1})				Boron (g ha^{-1})			
	2021		2022		2021		2022		2021		2022		2021	2022	2021	2022	2021	2022	2021	2022
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T_1 Absolute control	13.82	13.20	14.47	14.54	1.59	1.84	1.89	1.96	4.49	10.87	5.29	11.44	52.17	43.16	52.93	43.24	28.60	42.10	28.67	42.22
T_2 Only RDF	15.92	14.85	17.15	17.04	5.46	3.92	5.73	4.36	5.23	12.83	6.02	13.11	60.96	45.76	62.01	45.95	34.82	46.05	35.02	46.19
T_3 RDF + Zn@2 + B @1 kg ha^{-1}	17.73	16.11	18.39	17.25	3.08	2.76	3.38	2.91	5.80	14.29	6.48	14.82	65.35	48.54	65.76	48.77	39.25	47.08	39.49	47.15
T_4 RDF + Zn@2 + B @2 kg ha^{-1}	19.67	17.25	20.83	18.30	3.49	2.84	3.76	2.95	6.53	16.34	7.38	16.30	67.99	49.49	68.24	49.91	40.31	49.14	40.41	49.27
T_5 RDF + Zn@2 + B @3 kg ha^{-1}	21.75	18.73	23.15	19.80	3.71	3.10	3.93	3.42	7.28	18.03	8.20	18.25	71.94	52.50	72.12	52.60	41.33	54.28	41.52	54.39
T_6 RDF + Zn@4 + B @1 kg ha^{-1}	24.59	20.76	26.16	22.21	4.20	3.22	4.43	3.60	8.27	18.71	9.29	18.95	74.33	54.44	75.04	54.60	42.22	55.15	42.33	55.24
T_7 RDF + Zn@4 + B @2 kg ha^{-1}	28.17	22.92	29.82	24.10	4.48	3.47	4.76	3.75	8.44	19.62	9.50	19.93	77.12	55.33	77.67	55.47	42.45	57.10	42.58	57.21
T_8 RDF + Zn@4 + B @3 kg ha^{-1}	31.50	24.19	33.03	25.33	4.73	3.57	4.92	3.82	9.48	20.81	10.78	21.10	82.60	59.24	83.07	59.46	43.28	58.14	43.49	58.29
T_9 RDF + Zn@6 + B @1 kg ha^{-1}	33.25	25.92	35.17	27.19	5.18	3.63	5.30	3.91	10.09	22.12	11.42	22.46	84.69	62.39	85.06	62.68	44.14	59.15	44.31	59.22
T_{10} RDF + Zn@6 + B @2 kg ha^{-1}	34.40	27.87	36.13	28.72	5.41	3.78	5.60	4.08	10.34	23.07	11.75	23.73	87.61	64.38	88.01	64.56	44.26	61.23	44.49	61.44
T_{11} RDF + Zn@6 + B @3 kg ha^{-1}	36.28	30.77	38.18	31.44	2.64	2.59	2.87	2.63	11.84	23.43	12.47	23.99	91.97	67.27	92.19	67.48	45.75	63.08	45.94	63.15
SE m (±)	0.23	0.23	0.24	0.31	0.11	0.15	0.14	0.06	0.23	0.19	0.19	0.22	0.43	0.14	0.31	0.17	0.16	0.14	0.15	0.20
CD (P=0.05)	0.69	0.67	0.72	0.93	0.32	0.44	0.41	0.19	0.68	0.56	0.58	0.66	1.28	0.43	0.93	0.52	0.49	0.42	0.46	0.59

42.16 g B ha^{-1} and 52.55 and 43.20 g Zn ha^{-1}) was recorded with treatment T_1 (absolute control). This indicates that higher uptake of B and Zn resulted maximum seed yield and biological yield under the same treatments [10,11].

4. CONCLUSION

Based on the results, it is concluded that the application of NPK with micronutrient levels (Zinc and Boron) in treatment (T_9) RDF (20:40:20 NPK kg ha^{-1})+ Zinc@6 kg ha^{-1}+ Boron @1 kg ha^{-1}, gives optimum net return *i.e.,* 85,511.55 (□ ha^{-1}) and 86,837.20 (□ ha^{-1}) during experimental year 2021 and 2022. These results are based on two years (*summer* season) experiment. Thus, treatments T_{11} recorded the finest treatment which increased the accessibility of nutrients and plants nutrient uptake by green gram crop. Treatment (T_{11}) RDF (20:40:20 NPK kg ha^{-1})+ Zinc@6 kg ha^{-1}+ Boron @3 kg ha^{-1}, was also set up greatest treatment in improving plant inspection *i.e.* height of the plant, number of branches plant^{-1}, number of pods plant^{-1}, number of grains pod^{-1}, protein content (%), the weight of 100 seed, grain yield, straw yield and biological yield compared with absolute control treatment (T_1) without any fertilizer utilize.

Zinc and B nutrition with NPK significantly improves the growth, quality and yield parameters and yield in green gram crops. The soil method of application of Zinc and Boron with NPK shows favorable results. It is a preferable nutrient (NPK with micronutrient) management option for yield and profit increment. Hence, it can be recommended to the farmers that to ameliorate the productivity of green gram in the inceptisol of Prayagraj district of Uttar Pradesh, the combined application of NPK, Zinc and Boron is the best option.

ACKNOWLEDGEMENT

Soil and plant analysis assistance from the Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh for conducting the study is duly acknowledged.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Srivastava N, Dawson J. Effect of spacing, sources of nutrient and methods of zinc application on yield and yield attributes of summer Green gram (*Vigna radiata* L.). IJCS. 2017;5(5):1789-1791.
2. Shamsuddoha ATM., Anisuzzaman M, Sutradhar GNC, Hakim MA, Bhuiyan MSI. Effect of sulfur and boron on nutrients in mungbean (*Vigna radiata* L.) and soil health. *International* Journal of Bio-resource and Stress Management. 2011;2 (2):224-229.
3. Krishnaprabu S. Impact of spacing, sources of nutrient and methods of zinc application on yield attributes of green gram (*Vigna radiata* L.). International Journal of Innovative Technology and Exploring Engineering. 2019;8(82).
4. Gaines TP, Mitchell GA. Boron determination in plant tissue by the azomethine H method. Communications in Soil Science and Plant Analysis. 1979;10(8):1099-1108.
5. Kumari. Effect of Foliar Nutrition on Productivity of Green gram (*Vigna radiata* L.) (Masters dissertation, Department of Agronomy, BAU, Jharkhand); 2017.
6. Kudi S, Swaroop N, David AA, Thomas T, Hasan A, Rao S. Effect of different levels of Sulphur and zinc on soil health and yield of Greengram (*Vigna radiata* L.) Var. Patidar-111. Journal of Pharmacognosy and Phytochemistry. 2018;7(3):2271-2274.
7. Praveena R, Ghosh G, Singh V. Effect of foliar spray of boron and different zinc levels on growth and yield of kharif green gram (*Vigna radiata* L.). International Journal of Current Microbiology and Applied Sciences. 2018;7(8):1422-1428.
8. Karthik B, Umesha C, Meshram MR, Mahesh K, Priyadharshini AS. Effect of nitrogen levels and boron on growth and economics of greengram (*Vigna radiata* L.); 2021.
9. Angmo P, Mondal AK, Phogat M, Kumar S, Rai AP. Effect of Phosphorus and Zinc Interaction on Performance of Green Gram [*Vigna radiate* (L.) Wilczek]. Legume Research. 4(2):451-456.
10. Roy PD, Narwal RP, Malik RS, Saha BN, Kumar S. Impact of zinc application methods on green gram (*Vigna radiata* L.) productivity and grain zinc fortification. Journal of Environmental Biology. 2014;35(5):851–854.

11. Ranpariya VS, Polara KB. Effect of Potassium, Zinc and FYM on Content and Uptake of Nutrients of Summer Green Gram (*Vigna radiata* L.) at Different Growth Stages under South Saurashtra Region of Gujarat. International Journal of Pure and Applied Bioscience. 2018;6(1):997-1002.

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