

Efficacy of Novel Organic Liquid Nutrient and Novel Plus Organic Liquid Nutrient on Quantitative Traits of Indian Bean [*Lablab purpureus* (L.) Sweet]

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Authors' contributions

This work was carried out in collaboration among all authors. Author DDC has conducted research work, prepared entire manuscript along with statistical analysis, tables and graphs. Author NKP has helped to design and execute experiment. Author CSD has provided the information regarding Novel and Novel Plus organic liquid nutrient. Author DHD has helped in field work during research. All authors read and approved the final manuscript.

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ABSTRACT

Background: Indian bean is established as a prime vegetable crop in India and it attracts a huge market in its seasonal time period due to its multiple uses. Using of organic liquid fertilizer is demand of recent era. Concept of application of organics is vegetable crops is recent trend as it improves yield and helps to extent growth without any adverse effects on ecosystem.

Methods: In this experiment, two organic based nutrient formulations viz. Novel organic liquid nutrient and Novel Plus organic liquid nutrient were applied as a foliar spray at 30 days after sowing and 60 days after sowing on Indian bean variety Gujarat Navsari Indian Bean 22 and evaluated its

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effects on different growth parameters and yield parameters. The experiment was arrayed with Randomized Block Design having three replications and seven treatments *i.e.*, No spray (T₁), 0.5 % Novel organic liquid nutrient (T₂), 1.0 % Novel organic liquid nutrient (T₃), 1.5 % Novel organic liquid nutrient (T₄), 0.5 % Novel Plus organic liquid nutrient (T₅), 1.0 % Novel Plus organic liquid nutrient (T₆) and 1.5 % Novel Plus organic liquid nutrient (T₇).

Result: Treatment T₆ executed maximum plant height and highest number of branches. Maximum fresh weight (30.87 g per plant) and dry weight (8.01 g per plant) were also registered under the same treatment T₆. Similar treatment has proved to be superior for acquiring highest pod weight, maximum number of pods per plant, pod yield per plant and pod yield per individual plot. In terms of apex total pod yield per plot (3,641 g) and pod yield per hectare (5,619 kg) treatment T₆ have performed the best as well. Predominantly, application of 1.0 % Novel Plus organic liquid nutrient on Indian bean [*Lablab purpureus* (L.) Sweet] as a foliar spray had positive effects in aspects of growth as well as yield parameters.

Keywords: *Dolichos bean; foliar spray; growth parameters; organic liquid fertilizers; yield parameters.*

1. INTRODUCTION

Vegetable crops and its derivatives are cogitated as one of the most important horticultural commodities across the nation for the cultivation. It is an indispensable part of every diet which provides nutrients, minerals, vitamins, antioxidants and fiber required for optimum health and wellness. Indian council of medical research (ICMR) have recommended a daily uptake of 300 g vegetables/day including 125 g green leafy vegetables, 100 g root vegetables and 75 g other vegetables [1]. Amongst vegetables, Indian bean [*Lablab purpureus* (L.) Sweet] is one of the oldest legume crop known to be cultivated in dry and semi - arid regions of Asia, Africa and America [2]. Indian bean [*Lablab purpureus* (L.) Sweet] originated in India is a leguminous vegetable crop belongs to family Fabaceae. Morphologically it is a bushy erect herb having an average height of 45 cm with growing phase of 5 months. Commonly it is also known as Field bean, Hyacinth bean, Garden bean, Lablab bean, Dolichos bean, Egyptian bean, Bonavist bean and Sem [3]. In India, it is cultivated in an area of 227.78 thousand hectares ('000 ha) with 2,276.95 thousand metric tonnes ('000 MT) vegetable bean production and 10 MT/ha national productivity. Having an adaptability to flourish in diversified climate it is grown in numerous states such as Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Delhi, Punjab, Gujarat, Maharashtra, Kerala, Karnataka, Tamil Nadu and Uttar Pradesh [4].

Green pods of Indian bean are used commercially as a vegetable produce. Pods and seeds of are highly nutritive. It is a multipurpose

crop grown as pulse, vegetable and forage. Crop has shown to withstand adverse abiotic stresses and proven drought tolerant plant [5]. Therapeutically, plant is used as a decoction in alcoholic intoxication, for the treatment of cholera, diarrhea, globefish poisoning, gonorrhoea, leucorrhoea and nausea. Seeds are used to stimulate the stomach, as an antidote for poisoning, menopause, spasms and for the treatment of colic, rheumatism and sunstroke. Extraction or juice of pods is used as astringent, digestive, stomachic to expel worms [6].

Chiefly, it is a *Rabi* (winter) season vegetable in India for the commercial cultivation. Foliar spray of organic nutrient cause tremendous impact on growth and yield of crop and incorporation of organic nutrient in crop cultivation increases the growth and yield of plant without adversely impact on soil and environment. Novel organic liquid nutrient is a patented product of Navsari Agricultural University, Gujarat, India made from banana pseudostem sap and other organics. Novel Plus organic liquid nutrient is recent upgraded product of Navsari Agricultural University which is an advanced sequel to Novel organic liquid nutrient with additional insecticidal properties. Nutritional composition of Novel organic liquid nutrient and Novel Plus organic liquid nutrient is given in Table 1 and Table 2.

Indian bean variety Gujarat Navsari Indian Bean 22 (GNIB 22) was released by Pulses and Castor Research Station, Navsari Agricultural University, Navsari, Gujarat, India in the year of 2017. This variety appears to be of bushy growth with a yield potential of 4,507 kg/ha. It has higher sugar

Table 1. Nutritional and biochemical composition of novel organic liquid nutrient [8]

Chemical		Biochemical	
Parameters	Mean	Parameters	Content
N	0.062 %	Total phenol	48.0 to 49.1 mg/100 ml
P	0.018 %	Urease activity	63 to 81 U/ml/min
K	0.180 %	Gibberellic Acid	110.2 to 205.0 mg/l
Ca	0.031 %	Cytokinin	137.8 to 244.3 mg/l
Mg	0.092 %	Microbe	Population
S	0.010 %	Total viable count	1065 × 10 ³ CFU/ml
Mn	5.73 ppm	PSB	1025 × 10 ² CFU/ml
Cu	0.40 ppm	<i>Rhizobium</i>	285 × 10 ² CFU/ml
Zn	2.92 ppm	<i>Azotobacter</i>	460 × 10 ² CFU/ml
Fe	109.3 ppm	Fungal count	1200

Table 2. Nutritional composition of novel plus organic liquid nutrient [9]

Parameters	Mean
N	0.071 %
P	0.016 %
K	0.158 %
Na	0.059 %
Ca	0.026 %
Mg	0.147 %
S	0.015 %
Fe	742.0 ppm
Mn	11.53 ppm
Zn	2.30 ppm
Cu	0.26 ppm

and higher test weight against GNIB 21 [7]. GNIB 22 is conquering market place in quality and consumer acceptability because of good cooking traits as well as due to high production even in late season it is well accepted by farmers.

Due to its delectable taste, health beneficial properties as well as easy to pocket prices, it attracts customers easily in seasonal tenure. In recent times, due to the increased awareness of people about health, there has been increasing demand of organically grown foods [10]. The foliar application of the nutrients became a popular and effective method for the supplying of nutrients to plants. Liquid fertilizers like Novel and Novel Plus organic liquid nutrient plays a vital role in cultivation of organic horticultural produces. The foliar fertilization has the advantage of low application rates, the uniform distribution of fertilizer materials and the quick response to applied nutrients [11]. Inculcate organic sources of nutrients for plant growth not

only improves the growth and yield attributes but also amend soil physio - chemical properties [12]. Spraying of Novel organic liquid nutrient and Novel Plus organic liquid nutrient also improves the net income and benefit cost ratio in Indian bean crop [13]. By considering these circumstances, the experiment on effect of various concentration of Novel and Novel Plus organic liquid nutrient foliar spray on growth and yield parameters of Indian bean [*Lablab purpureus* (L.) Sweet] variety GNIB 22 was carried out.

2. MATERIALS AND METHODS

2.1 Experimental Site

The present experiment was conducted at the Department of Vegetable Science, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India during the

Rabi (winter) season 2018-19. The soil of experimental site was heavy black, rich in organic matter and potash, moderately drained and with good water holding capacity. It is a sub-tropical zone having mild winter starts from November and ends by the middle of February. December and January are the coldest months with minimum 7.5°C to maximum 32.5°C. Mean weekly temperature and relative humidity during the study period are shown in Fig. 1.

2.2 Experimental Design and Cultural Details

The experiment was laid out under Randomized Block Design (RBD) with three repetitions across the seven treatments viz., T₁ - No spray, T₂ - 0.5% Novel organic liquid nutrient, T₃ - 1.0% Novel organic liquid nutrient, T₄ - 1.5% Novel organic liquid nutrient, T₅ - 0.5% Novel Plus organic liquid nutrient, T₆ - 1.0% Novel Plus organic liquid nutrient and T₇ - 1.5% Novel Plus organic liquid nutrient. Seeds of Indian bean variety (GNIB 22) is well adapted for late *Kharif* (monsoon) and late *Rabi* (winter) sowing of Indian bean crop in South Gujarat region. Planting was done at spacing of 90 cm × 30 cm with 25 kg/ha seed rate in *Rabi* (winter), 2018-2019.

Bottle containing both the liquid nutrients was shacked properly before use. In this experiment for preparation of 0.5%, 1.0% and 1.5% concentration of Novel organic liquid nutrient and Novel Plus organic liquid nutrient, 50 ml, 100 ml and 150 ml Novel organic liquid nutrient and Novel Plus organic liquid nutrient was measured with help of measuring cylinder and dissolved in 10 litre of water, respectively. Solution was poured in Knapsack sprayer. Individual plant was sprayed thoroughly treatment wise. The first and second spraying was done at 30 days after sowing (DAS) and 60 DAS, respectively in morning hours during 9:00 AM to 10:30 AM time period.

2.3 Observations and Measurement

Plant growth traits such as Plant height and Number of branches per plant were recorded at 40 DAS, 70 DAS and at the time of final picking from tagged five plants in each treatment of all replications. Days to 50% flowering were counted by number of days from the date of sowing to when 50% of the plants have flowering while, for days to first picking, number of days was counted from the date of sowing to when first harvesting of pods is done in particular plot of each treatment in all replications. Pod length was measured in centimetre from the base of calyx to

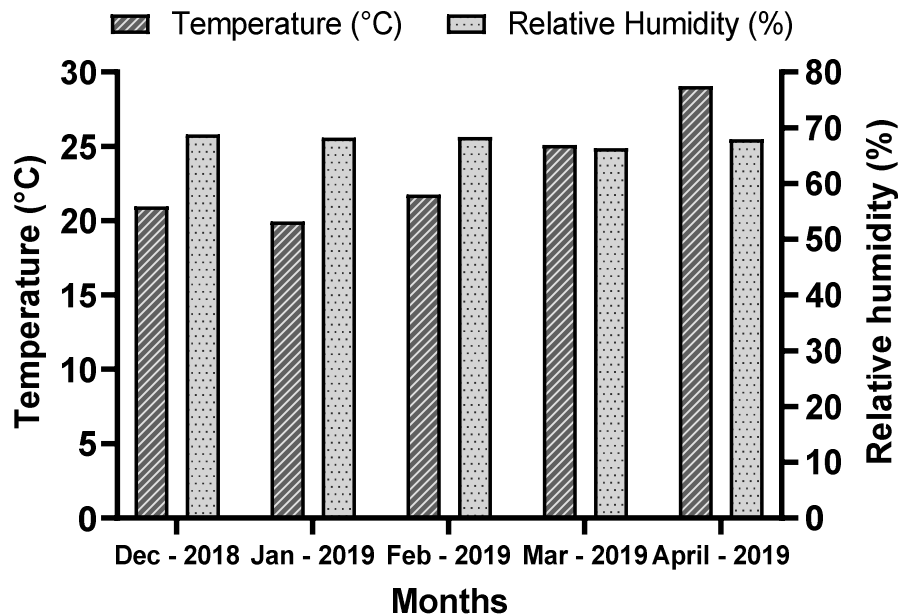


Fig. 1. Mean weekly temperature and relative humidity of experimental period

the tip with use of measure tape and pod width was measured from the centre seed with help of Vernier calliper in centimetre from marketable ten pods of previously tagged five plants in each treatment of all replications at the time of first and second picking. After final picking, five plants other than previously tagged plants were uprooted carefully from net plot of each treatment in all replications. Plants were washed out properly with water to remove dirt, dust and to separate soil particles. Then the fresh weight of whole plant was recorded with help of high precision balance in gram and mean value was taken. For dry weight of plant, plants were sun dried initially and then brought to laboratory in brown paper bags and dried in oven at 60°C until the constant dry weight was obtained.

From marketable ten pods of previously tagged five plants in each treatment of all replications, weight of single pod was taken at the time of first and second picking with help of high precision weighing balance in gram while, number of seeds per pod was counted at the time of second and final picking and number of pods per plant was recorded at each picking. The marketable green pods were picked up at time of each picking from net plot plants in each treatment of all replications and weighed separately as well as total of all picking of pod weight counted in gram considered as pod yield per plot. Pod yield per plant was obtained by dividing pod yield per plot by total number of net plot plants. Pod yield per hectare was counted by converting through multiple factor in kilogram.

2.4 Statistical Analysis

The standard method of analysis of variance technique appropriate to the RBD was followed as described by Panse and Sukhatme [14]. The treatment differences were inspected by employing 'F' test at five percent level of significance on the basis of null hypothesis. The appropriate standard error of mean (S.E.m. \pm) was calculated in each case. The critical difference (C.D.) at five percent level of probability was worked out to compare two treatment means, where the treatment effects were found significant under 'F' test. The percentage of co efficient of variation (C.V. %) was also worked out for all the cases.

3. RESULTS

3.1 Growth Parameters

The mean data concerned with the effect of Novel organic liquid nutrient and Novel Plus organic liquid nutrient spray on growth parameters are presented in Table 3. Plants under the treatment T₆ showed significant effect in aspects of plant height and noted the maximum results at 40 DAS, 70 DAS and at the time of final picking i.e., 16.27 cm, 33.57 cm and 47.43 cm, respectively. Same treatment T₆ recorded the highest number of branches per plant at 40 DAS (7.67), 70 DAS (12.00) and at the time of final harvesting (16.00) although, statistical significance was observed only for the data registered at 70 DAS and at the time of final harvesting. In terms of fresh and dry weight of plant after final picking, significantly maximum weight i.e., 30.87 g per plant and 8.01 g per plant, respectively were noted under the treatment T₆. Parameters like days to 50% flowering, days to first picking, pod length and pod width exerted no significant impact by the application Novel organic liquid nutrient and Novel Plus organic liquid nutrient spray.

3.2 Yield Parameters

The data regarding yield parameters influenced by Novel organic liquid nutrient and Novel Plus organic liquid nutrient spray are tabulated in Table 4, Fig. 2 and Fig. 3. Treatment T₆ noted the highest pod weight (2.13 g and 2.22 g) at the time of first and second picking, respectively. Number of seeds per pod had non-significant impact of Novel and Novel Plus organic liquid nutrients spray. The maximum number of pods per plant (16.93, 18.00, 17.73, 17.60 and 14.33) were noticed under the treatment T₆ at each interval of pickings. The gradual upscaling in pod yield per plant and pod yield per plot was registered under the treatment T₆ at time of first picking (28.83 g and 692.00 g), second picking (32.96 g and 791.00 g), third picking (35.33 g and 848.00 g), fourth picking (31.67 g and 760.00 g) and at the time of final picking (22.92 g and 550.00 g). The highest cumulative pod yield per plot (3,641.00 g) and pod yield per hectare (5,619 kg) were also observed under the treatment T₆.

Table 3. Effect of novel and novel plus organic liquid nutrients on growth parameters in Indian bean

Treatments	Plant height (cm)			No. of branches per plant			Days to 50 % flowering (DAS)	Days to first picking (DAS)	Pod length (cm)		Pod width (cm)		Fresh weight (g per plant)	Dry weight (g per plant)
	40 DAS	70 DAS	At final picking	40 DAS	70 DAS	At final picking			At first picking	At second picking	At first picking	At second picking		
T ₁ : No spray	11.03	25.70	40.43	6.33	8.33	10.67	60.33	70.33	5.60	6.67	1.10	1.13	20.60	4.54
T ₂ : 0.5 % Novel organic liquid nutrient	11.70	26.63	41.63	7.00	9.33	12.33	60.33	70.33	6.33	6.97	1.14	1.14	21.00	4.97
T ₃ : 1.0 % Novel organic liquid nutrient	13.50	28.33	43.00	7.00	10.00	13.33	58.00	68.00	6.59	7.20	1.15	1.17	23.33	5.62
T ₄ : 1.5 % Novel organic liquid nutrient	12.57	27.33	42.33	7.00	9.67	12.67	60.33	70.33	6.54	7.07	1.14	1.15	21.37	5.27
T ₅ : 0.5 % Novel Plus organic liquid nutrient	15.30	32.67	46.23	7.67	11.67	15.00	58.00	68.00	7.32	7.40	1.17	1.19	27.10	6.42
T ₆ : 1.0 % Novel Plus organic liquid nutrient	16.27	33.57	47.43	7.67	12.00	16.00	58.00	68.00	7.36	7.43	1.18	1.20	30.87	8.01
T ₇ : 1.5 % Novel Plus organic liquid nutrient	14.20	30.03	44.13	7.33	11.00	14.33	58.67	68.67	6.67	7.30	1.17	1.19	25.63	6.21
S.Em. ±	0.69	1.04	1.02	0.47	0.66	0.82	1.00	1.00	0.58	0.56	0.03	0.03	1.33	0.32
C.D. at 5 %	2.13	3.19	3.14	NS	2.04	2.54	NS	NS	NS	NS	NS	NS	4.10	0.99
C.V. %	8.87	6.15	4.05	11.29	11.16	10.58	2.93	2.51	12.52	13.53	5.18	4.67	9.50	9.45

Table 4. Effect of Novel and Novel Plus organic liquid nutrients on yield parameters in Indian bean

Treatments	Pod weight (g)		Number of seeds per pod		Number of pods per plant					Total pod yield per plot (g)	Pod yield per hectare (kg)
	At first picking	At second picking	At second picking	At final picking	At 1 st picking	At 2 nd picking	At 3 rd picking	At 4 th picking	At 5 th picking		
T ₁ : No spray	1.51	1.71	3.67	3.00	11.93	12.67	13.20	12.73	8.73	2,583.33	3,987
T ₂ : 0.5 % Novel organic liquid nutrient	1.56	1.76	3.67	3.33	13.67	14.33	14.80	14.40	10.80	2,892.00	4,463
T ₃ : 1.0 % Novel organic liquid nutrient	1.64	1.84	3.67	3.33	14.53	15.07	15.53	15.33	11.87	3,179.67	4,907
T ₄ : 1.5 % Novel organic liquid nutrient	1.57	1.78	3.67	3.33	13.80	14.53	15.00	14.67	11.00	2,952.33	4,556
T ₅ : 0.5 % Novel Plus organic liquid nutrient	1.94	2.12	4.00	4.00	16.40	16.87	17.13	17.13	13.67	3,557.00	5,489
T ₆ : 1.0 % Novel Plus organic liquid nutrient	2.13	2.22	4.00	4.00	16.93	18.00	17.73	17.60	14.33	3,641.00	5,619
T ₇ : 1.5 % Novel Plus organic liquid nutrient	1.74	1.95	4.00	3.67	15.80	16.27	16.67	16.47	13.07	3,353.67	5,175
S.Em. ±	0.12	0.11	0.25	0.25	1.06	0.95	0.89	0.98	1.07	188.67	291.16
C.D. at 5 %	0.38	0.32	NS	NS	NS	2.93	2.75	3.01	3.30	581.39	897.21
C.V. %	12.53	9.57	11.46	12.39	12.42	10.71	9.82	10.94	15.58	10.32	10.32

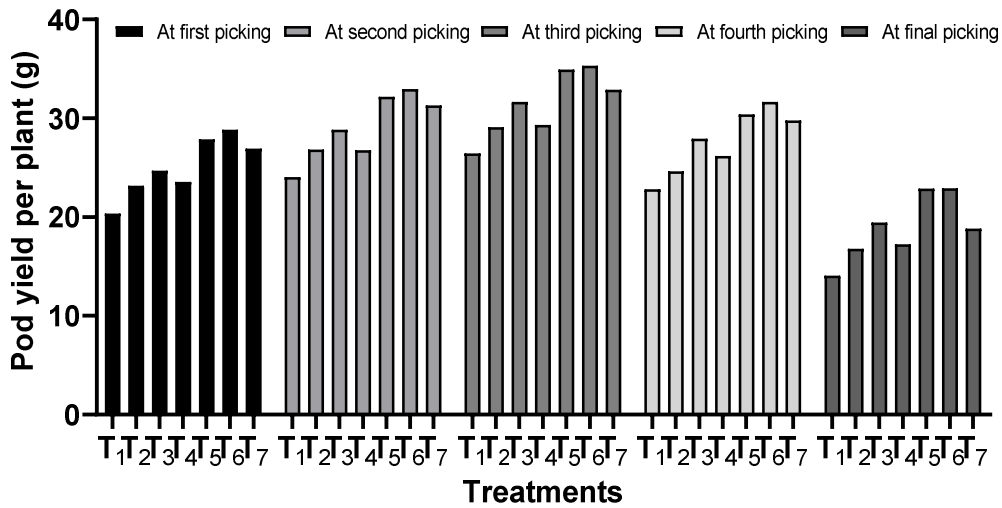


Fig. 2. Effect of Novel and Novel Plus organic liquid nutrients on pod yield per plant (g)

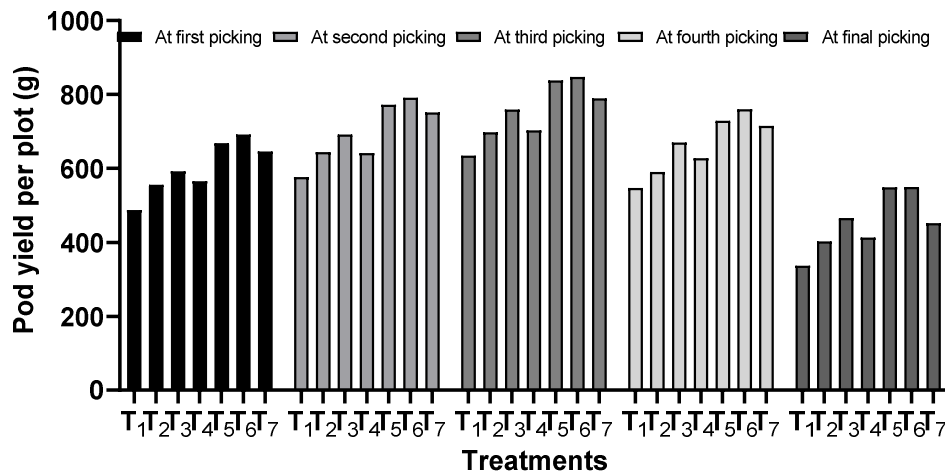


Fig. 3. Effect of Novel and Novel Plus organic liquid nutrients on pod yield per plot (g)

4. DISCUSSION

The incremental in plant height and higher number of branches might be due to the fostered meristematic activities which was catalyzed by growth regulator contains in Novel Plus Organic Liquid Nutrient viz., gibberellic acid, naphthalene acetic acid and cytokinin which leads to enhance cell division and cell elongation [15]. Another reason might be the ample amount of nitrogen content of liquid nutrient which enhances cell division, cell elongation as well as formation of more tissues resulting in luxuriant vegetative

growth which leads to increase in plant height [16]. Moreover, nitrogen also increases the cation exchange capacity of plant roots which makes them efficient in absorbing other nutrients ions like phosphorus, potassium etc. which helps to terminate vegetative growth [17]. The similar results have also been reported by Patel *et al.* [18] in green gram, Singhal *et al.* [19] in cowpea and Chotaliya *et al.* [16] in okra. The observed increase in fresh and dry weight of plant might have been due to the luxurious and overall promotion in the vegetative growth [20]. Another feasible reason behind these results might be the

greater accumulation of photosynthates by vegetative parts as well as the efficient partitioning of photosynthates towards the sink [16]. The results are in conformity with the findings of Patel et al. [18] in green gram, Singhal et al. [19] in cow pea and Salunkhe [21] in onion.

The enhancement in number of pods per plant, pod weight, pod yield, Fresh and dry weight of the plant is due to Novel Plus organic nutrient provides macro and micro nutrient at critical stages as well as improves photosynthetic activity which increases the production of carbohydrates and photosynthates. It also improves the allocation of photosynthates towards the economic part *i.e.*, pods which ultimately contributes towards the increase in number of pods and quantitative traits [22]. Furthermore, spraying of water soluble nutrients increases uptake of nutrients and water along with easy availability of nutrients, resulting in more photosynthesis and enhanced food accumulation in edible parts [19]. The results of present investigation are also corroborated with the findings of Manani [23] and [24] in cowpea, Patel et al. [18] in green gram, Naik [20] in Indian bean, Patel et al. [25] in Cabbage, Shah [26] in sweet potato, Patil and Kolambe [27] in garlic and Salunkhe et al. [21] in onion.

5. CONCLUSION

By considering scenario of present experiment, it can be concluded that application of 1.0 % Novel Plus organic liquid nutrient spray (T₆) amplifies the growth parameters *i.e.*, plant height, number of branches per plant, fresh weight and dry weight of plant as well as yield parameters *i.e.*, pod weight (g), number of pods per plant, pod yield per plant (g) and per plot (g) and pod yield per hectare (kg). So, in view of all other treatments, treatment T₆ - 1.0 % Novel Plus organic liquid nutrient spray is considered as viable in aspects of quantitative traits for cultivation of Indian bean crop.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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