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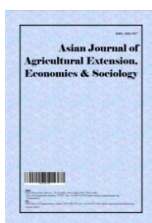
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## **Economics of Indian Bean [*Lablab purpureus* (L.) Sweet] Production Influenced by Application of Novel Organic Liquid Nutrient and Novel Plus Organic Liquid Nutrient**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author DDC conducted whole research and wrote entire manuscript along with preparation of tables, graphs and calculation. Author NKP helped to design experiment reviewed entire manuscript and made appropriate corrections. Author CSD provided all the information about Novel organic liquid nutrient and Novel Plus organic liquid nutrient. Author BMT helped in calculation of economics. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/AJAEES/2020/v38i930414

Editor(s):

(1) Dr. Adesoji Solomon Adedapo, Obafemi Awolowo University, Nigeria.

Reviewers:

(1) Habtamu Zeleke, Haramaya University, Ethiopia.

(2) Dirvi Surya Abbas, Universitas Muhammadiyah Tangerang, Indonesia.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/61449>

**Original Research Article**

**Received 22 July 2020**  
**Accepted 27 September 2020**  
**Published 07 October 2020**

### **ABSTRACT**

Indian bean is an imperious vegetable crop of India as it works as source of nutritional food along with handful amount of money to grower in its seasonal tenure. Organic farming is crucial need of recent era in order to provide healthy food without adversely affecting the ecosystem. Considering above given facts, present experiment was taken with objective to find out effects of Novel organic liquid nutrient and Novel Plus organic liquid nutrient application on economics of Indian bean

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[*Lablab purpureus* (L.) Sweet] production. The experiment was portrayed under Randomized Block Designed with three replications and seven treatments i.e. No spray ( $T_1$ ), 0.5% Novel organic liquid nutrient ( $T_2$ ), 1.0% Novel organic liquid nutrient ( $T_3$ ), 1.5% Novel organic liquid nutrient ( $T_4$ ), 0.5% Novel Plus organic liquid nutrient ( $T_5$ ), 1.0% Novel Plus organic liquid nutrient ( $T_6$ ) and 1.5% Novel Plus organic liquid nutrient ( $T_7$ ) at Navsari Agricultural University, Gujarat, India on Indian bean variety Gujarat Navsari Indian Bean 22 (GNIB 22). Higher net income (Rs. 1,05,178 per ha) and BCR (1.21) were found under the treatment  $T_5$  (0.5% Novel Plus organic liquid nutrient). Thus, application of 0.5% Novel Plus organic liquid nutrient increases the yield and BCR of Indian bean production without adversely affecting the ecosystem as it is an organic input.

**Keywords:** BCR; *Dolichos bean*; *hyacinth bean*; *net income*; *organic farming*.

## 1. INTRODUCTION

Primarily India is an agricultural country so economics of farm produce plays an important role in country's economy. Seventy percent of rural household depends directly on agriculture for their livelihood in India. Horticulture is an inseparable part of agriculture, India has witnessed increase in horticultural production over the last decade, the area under horticultural crops grew by 2.6% per annum and annual production increased by 4.8%. The contribution of vegetable production remains highest (59 - 61%) among all other horticultural crop over the last five years. Since 2004 - 05 to 2017 - 18, the production of vegetables has increased from 101.2 million tonnes to 184.40 million tonnes. Vegetable crop covers 10,259 '000 hectare area with production of 1,84,394 '000 metric tonnes and 17.97 metric tonnes per hectare productivity in India [1].

Indian bean is believed to be originated in India, a bushy semi erect herb belongs to family Fabaceae which botanically known as *Lablab purpureus* (L.) Sweet with  $2n = 22$

chromosomes. It is commonly known as Field bean, Hyacinth bean, Dolichos bean, Egyptian bean, Bonavist bean, Sem, etc. [2]. Indian bean is considered as a poor man's meat as it has many nutritional benefits and it is the best source of digestible vegetable protein (20 - 25%) required for human health, [3]. It is multipurpose crop use as vegetable, pulse and forage. Unlike other leguminous crop, it has also capacity to fix atmospheric nitrogen in soil. India has 227.78 '000 hectare area under Indian bean cultivation with 2,276.95 '000 metric tonnes vegetable bean production and 10 metric tonnes per hectare productivity [1].

In recent times, organic produces are in huge demand due to increased awareness about health in public. While protecting the environment, organic farming also provides healthy food and good returns of capital in long term farming [4]. Economic benefits ultimately matters for vegetable growers and Novel organic liquid nutrient plays an important role to improve it [5]. Novel organic liquid nutrient is a product of Navsari Agricultural University which was patented in the year of 2012. It is prepared from

**Table 1. Nutritional and biochemical composition of Novel organic liquid nutrient and Novel Plus organic liquid nutrient**

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

*Note: Alongside this contents, Novel Plus organic liquid nutrients also have addition of various botanicals which is the reason behind its insecticidal properties*

banana pseudostem sap. Novel Plus organic liquid nutrient is recent upgraded product of Navsari Agricultural University similar to Novel organic liquid nutrient but it has additional insecticidal properties which are due to incorporation of different botanicals in formulation. Composition of Novel organic liquid nutrients and Novel Plus organic liquid nutrients were given in Table 1 [6].

Gujarat Navsari Indian Bean 22 (GNIB 22) was released by Pulses and Castor Research Station, Navsari Agricultural University, Navsari in the year of 2017. The variety was found to have good quality for marketable as well as cooking traits. GNIB 22 is recommended for late *Kharif* (Monsoon) and late *Rabi* (Winter) season in south Gujarat [7].

For growers, economics plays a vital role in selection of crop and economics is an integral part of production technology of vegetable crops. Economic feasibility of the fertilizer practices is an essential element to improve crop productivity [8]. By considering above given facts present experiment was taken to observe effects of Novel organic liquid nutrient and Novel Plus organic liquid nutrient on Economics of Indian bean production.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Site and Weather Data

The present experiment was conducted during time period of *Rabi* (Winter) season 2018 - 2019 at Department of Vegetable Science, Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. According to agro - climatic conditions of Gujarat state, Navsari comes under south Gujarat Heavy Rainfall Zone (AES - III). The climate of this zone is typically tropical and monsoonal. Winter starts from November and ends by the mid of February. From middle of February gradual rise in temperature was seen. GNIB 22 is well suited for late *Kharif* (Monsoon) and *Rabi* (Winter) sowing of crop in south Gujarat region. The planting was done at spacing of 90 cm × 30 cm with 25 kg/ha seed rate in *Rabi* (Winter).

### 2.2 Treatment Details

In present experiment seven treatments i.e. No spray ( $T_1$ ), 0.5% Novel organic liquid nutrient

( $T_2$ ), 1.0% Novel organic liquid nutrient ( $T_3$ ), 1.5% Novel organic liquid nutrient ( $T_4$ ), 0.5% Novel Plus organic liquid nutrient ( $T_5$ ), 1.0% Novel Plus organic liquid nutrient ( $T_6$ ) and 1.5% Novel Plus organic liquid nutrient ( $T_7$ ) were applied with three replications under Randomized Block Design. No spray was done in treatment  $T_1$  while, treatments  $T_2$  to  $T_7$  were applied as two foliar spray on plants at 30 and 60 days after sowing (DAS).

### 2.3 Methodology for Preparation of Solution

1. Bottle containing both the liquid nutrients was shaken properly before use.
2. 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.
3. Prepared solution was poured in Knapsack sprayer and individual plant was sprayed thoroughly treatment wise.
4. The first and second spraying was done at 30 DAS and 60 DAS, respectively in morning hours during 9:00 to 10:30 time period.

### 2.4 Calculation of Cost of Cultivation

Cost A, Cost B, Cost C, Gross return, Net return, Benefit Cost Ratio were computed as part of cost of cultivation. Formula for calculation of cost of cultivation is given below [9]. Details of economics of Indian bean cultivation affected by application of Novel organic nutrient and Novel Plus organic liquid nutrient were given in Table 2.

Cost  $A_1$ : It includes, value of hired human labour, value of hired and owned machine labour, value of seed (both farm seed and purchased), value of manures (owned and purchased) and fertilizers, depreciation on fixed assets, irrigation charges, land revenue, interest on working capital and miscellaneous expenses.

Cost  $A_2$ : Cost  $A_1$  + rent paid for leased in land (here, rent paid for leased in land is not applicable so,  $A_1 = A_2$ )

Cost  $B_1$ : Cost  $A_1$  + interest of fixed capital (excluding land)

Cost B<sub>2</sub>: Cost B<sub>1</sub> + rental value of owned land + rent for leased in land (Here, rent for leased in land is not applicable)

Cost C<sub>1</sub>: Cost B<sub>1</sub> + imputed value of family labour (Here, imputed value of family labour is not applicable)

Cost C<sub>2</sub>: Cost B<sub>2</sub> + imputed value of family labour (Here, imputed value of family labour is not applicable)

Cost C<sub>3</sub>: Cost C<sub>2</sub> + 10 per cent of cost C<sub>2</sub> as management cost.

Gross return = Pod yield (kg) × Price of 1 kg pod (Here, price of 1 kg pod is Rs. 35)

Net return = Gross Return – Cost C<sub>3</sub>

$$BCR = \frac{\text{Net income}}{\text{Cost } C_3}$$

### 3. RESULTS AND DISCUSSION

Novel and Novel Plus organic nutrient spray had significant influence on economics of Indian bean production which was displayed in Table 2 and comparison of net income and BCR influenced by various treatments portrayed in Fig. 1. The highest net income (Rs. 1,05,178 per hectare) and BCR (1.21) were registered under the

treatment T<sub>5</sub>. While, the lowest net income (Rs. 61,637 per hectare) was observed under the treatment T<sub>1</sub> and the lowest BCR (0.66) was found under the treatment T<sub>4</sub>.

Outcome regarding economics was might be due to the reason that treatment T<sub>6</sub> had the highest yield per hectare but concentration of organic liquid nutrient is high which leads to more consumption of organic liquid nutrient that ultimately increases the cost and reduces net income along with BCR. While, T<sub>5</sub> had the second highest yield per hectare but concentration is low which leads to lower requirement of liquid nutrient that ultimately reduces the cost and increases net income along with BCR. Although, plants treated with Novel plus organic liquid nutrients have higher yield, net income and BCR in comparison to control. The results might be due to the reason that, yield was found higher under the plants treated with Novel Plus organic liquid nutrients and Novel Plus organic liquid nutrient has insecticidal properties which helps to reduce the cost of plant protective chemicals which decreases the cost of cultivation. Novel plus organic liquid nutrients contains higher amount of macro and micro nutrient which improves photosynthesis, production of carbohydrates and their translocation from source to sink which excreted positive effect on yield [10]. These results are in line with [11] in onion.

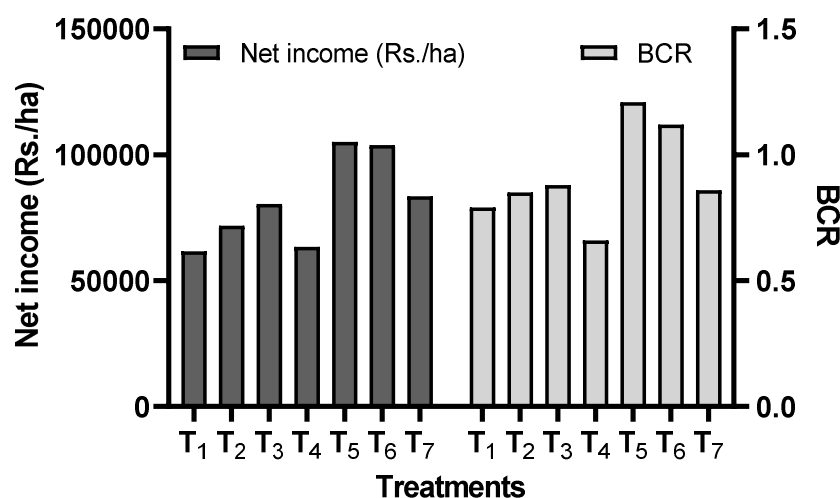


Fig. 1. Influence of Novel organic liquid nutrient and Novel Plus organic liquid nutrient on net income and BCR of Indian bean cultivation

**Table 2. Economics of Indian bean cultivation affected by application of Novel organic nutrient and Novel Plus organic liquid nutrient**

No.	Particulars	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>
1	Value of hired human labour	28,480	28,480	28,480	28,480	28,480	28,480	28,480
2	Value of hired and own machine	10,800	10,800	10,800	10,800	10,800	10,800	10,800
3	Value of seeds	6,000	6,000	6,000	6,000	6,000	6,000	6,000
4	Value of manures	1,200	1,200	1,200	1,200	1,200	1,200	1,200
5	Value of fertilizers	2,222	2,222	2,222	2,222	2,222	2,222	2,222
6	Irrigation charges	4,800	4,800	4,800	4,800	4,800	4,800	4,800
7	Land revenue	500	500	500	500	500	500	500
8	Miscellaneous expenses	500	500	500	500	500	500	500
9	Depreciation cost	1,080	1,080	1,080	1,080	1,080	1,080	1,080
10	Plant protection charges	1,450	NA	NA	NA	NA	NA	NA
11	Novel organic liquid nutrient / Novel Plus organic liquid nutrient cost	NA	6,050	10,860	15,670	6,050	10,860	15,670
12	Interest on working capital	3,992	4,314	4,651	4,988	4,314	4,651	4,988
13	Cost A <sub>1</sub>	61,024	65,946	71,093	76,240	65,946	71,093	76,240
14	Cost A <sub>2</sub>	61,024	65,946	71,093	76,240	65,946	71,093	76,240
15	Interest on fixed capital (excluding land)	1,080	1,080	1,080	1,080	1,080	1,080	1,080
16	Cost B <sub>1</sub>	62,104	67,026	72,173	77,320	67,026	72,173	77,320
17	Rental value of own land	8,722	9,763	10,734	9,966	12,007	12,292	11,320
18	Cost B <sub>2</sub>	70,826	76,789	82,907	87,286	79,033	84,465	88,640
19	Cost C <sub>1</sub>	62,104	67,026	72,173	77,320	67,026	72,173	77,320
20	Cost C <sub>2</sub>	70,826	76,789	82,907	87,286	79,033	84,465	88,640
21	10 % of Cost C <sub>2</sub> as management	7,083	7,679	8,291	8,729	7,903	8,446	8,864
22	Cost C <sub>3</sub>	77,908	84,468	91,198	96,014	86,937	92,911	97,504
23	Gross return	1,39,545	1,56,205	1,71,745	1,59,460	1,92,115	1,96,665	1,81,125
24	Net return	61,637	71,737	80,547	63,446	1,05,178	1,03,754	83,621
26	BCR	0.79	0.85	0.88	0.66	1.21	1.12	0.86

#### 4. CONCLUSION

By considering findings of present experiment, it can be concluded that spraying of 0.5% Novel Plus organic liquid nutrient helps to improve yield along with higher net income (Rs. 1,05,178 per hectare) and BCR (1.21) due incorporation of botanicals in Novel Plus organic liquid nutrients which leads to reduce the cost of chemicals in comparison to other treatments. So in the company of all other treatments, T<sub>5</sub> is considered as economically viable for Indian bean production.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:  
The peer review history for this paper can be accessed here:  
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