



# International Journal of Research in Agronomy

E-ISSN: 2618-0618  
P-ISSN: 2618-060X  
© Agronomy  
NAAS Rating (2025): 5.20  
[www.agronomyjournals.com](http://www.agronomyjournals.com)  
2025; 8(10): 939-943  
Received: 28-07-2025  
Accepted: 02-09-2025

**Lalita Rajwade**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

**RS Sidar**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

**PS Rathiya**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

**Satyendra Kumar**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

**Laxmi Parja**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

**Resham Singh**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

**Vikas Kumar**  
Department of Plant Physiology,  
Indira Gandhi Krishi  
Vishwavidyalaya, Raipur,  
Chhattisgarh, India

## Corresponding Author:

**Lalita Rajwade**  
Department of Agronomy, Indira  
Gandhi Krishi Vishwavidyalaya,  
Raipur, RMD College of Agriculture  
and Research Station, Ambikapur,  
Chhattisgarh, India

## Response of fertility levels and varieties on growth and yield of Faba Bean (*Vicia faba* L.)

**Lalita Rajwade, RS Sidar, PS Rathiya, Satyendra Kumar, Laxmi Parja, Resham Singh and Vikas Kumar**

DOI: <https://www.doi.org/10.33545/2618060X.2025.v8.i10m.4088>

### Abstract

A field experiment was carried out at Instructional cum research farm, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur, IGKV, Raipur, Chhattisgarh during the *Rabi* season of the year 2024 - 2025 to study the response of fertility levels and varieties on growth and yield of faba bean (*Vicia faba* L.). The experiment was laid out in Factorial Randomized block design with three replications. Twelve treatment and four varieties of faba bean V<sub>1</sub> (HB-19-13), V<sub>2</sub> (Vikrant), V<sub>3</sub> (HB-20-4) and V<sub>4</sub> (HB-20-11) allotted to the main plots. The sub-plots comprised three fertility levels, i.e., F<sub>1</sub> 125% RDF, F<sub>2</sub> 100% RDF and F<sub>3</sub> 75% RDF where the recommended dose of fertilizer (RDF) was 40:40:20 NPK kg ha<sup>-1</sup> result inferred that faba bean variety V<sub>2</sub> (Vikrant) Performed better under fertility levels F<sub>1</sub> 125% RDF showed a positive effect on the growth and yield attributes and resulted in maximum yield and higher monetary returns.

**Keywords:** Faba bean, Protein (%), Nutrient

### Introduction

Broad bean ranks as the fourth most significant legume crop globally, following common beans, peas, and chickpeas. Faba bean, considered one of the earliest domesticated plants, is believed to have originated from the Mediterranean region or southwestern Asia. The total global production of faba beans is estimated at 5.43 million tonnes. Leading producers include China, contributing 1.74 million tonnes (32.05%), Ethiopia with 1.01 million tonnes (18.54%), the United Kingdom producing approximately 547.8 thousand tonnes (10.09%) and Australia with 327 thousand tonnes (6.02%), as per Tridge (2019) <sup>[16]</sup>.

Fertilizers play a crucial role in enhancing crop yields, particularly in Indian agricultural conditions where nutrient availability is often a limiting factor. Hence, effective fertilizer management is vital for achieving significant improvements in faba bean production.

Nitrogen, phosphorus and potassium are key macro nutrients that play an important role in the growth, yield and overall quality of faba bean (*Vicia faba* L.) crops Nitrogen is essential for leafy growth and protein formation. Even though faba beans can naturally fix atmospheric nitrogen through their association with Rhizobium bacteria, applying a small amount of nitrogen at the initial growth stage can be helpful (Köpke and Nemecek, 2010).

Nitrogen fertilization is usually unnecessary for faba beans; however, applying a small amount of "starter" nitrogen about 20 kg per hectare can help improve the nodulation process in the plants (Mohamed and Babiker, 2012) <sup>[10]</sup>.

Potassium helps maintain water regulation, strengthens disease resistance, and aids in the movement of nutrients and sugars throughout the plant, which contributes to better seed development and higher yields (Marschner, 2012) <sup>[12]</sup>. Using NPK fertilizers in a balanced manner promotes healthier plants, efficient nitrogen fixation, and improved productivity of faba beans across different environmental conditions.

Enhanced biomass accumulation and grain yield in faba bean have been observed with the application of potassium fertilizer (Mona *et al.*, 2011 and Grzebisz *et al.*, 2013) <sup>[11, 4]</sup>.

## Materials and Methods

A field experiment was carried out at Instructional cum research farm, RMD College of Agriculture and Research Station, Ambikapur, IGKV, Raipur, Chhattisgarh during the *Rabi* season of the year 2024 - 2025. Geographically, Ambikapur lies at 23°15' N latitude, 83°14' E longitude and an altitude of 623 m above mean sea level. The area falls under the northern hill region (Agro-climatic Zone VII) of Chhattisgarh. The state of Chhattisgarh is divided into three agro-climatic zones and Ambikapur coming into the northern hill zone, characterized by undulating topography and red to lateritic soil. The experimental soil was sandy loam (Inceptisol), locally called '*Chawar*'. It was slightly acidic in reaction with medium fertility, having low in N and K<sub>2</sub>O and medium in P<sub>2</sub>O<sub>5</sub>. The experiment site Ambikapur (Chhattisgarh) has a sub-humid climate with rainfall of 1200-1400 mm. mostly during south-west monsoon.

The experiment was laid out in factorial Randomized block design with three replications and twelve treatment sowing was performed manually at the onset of favourable soil moisture conditions. Healthy, uniform - sized seeds were selected and treated with appropriate seed treatment chemicals prior to sowing. Row to row spacing 30 cm and plant to plant spacing 20 cm seed placed at a depth of approximately 5 cm and gently covered with soil to preserve moisture and ensure uniform germination basal application of fertilizer NPK at the time of sowing. As per the treatment schedule, following regional recommendations for leguminous crops. Standard agronomic practices were followed throughout the season to raise healthy and productive crop. Observations were recorded on key growth and yield parameters such as Plant population (m<sup>-2</sup>), Plant height (cm), Number of leaves<sup>-1</sup>, Number of pods plant<sup>-1</sup>, Number of seed pods<sup>-1</sup>, Seed yield (kg ha<sup>-1</sup>), Stover yield (kg ha<sup>-1</sup>), Harvest index (%), Test index (%), Cost of cultivation (₹ ha<sup>-1</sup>), Gross return (₹ ha<sup>-1</sup>), Net return (₹ ha<sup>-1</sup>) and B: C ratio.

Treatment details

| Notation       | Treatment details |
|----------------|-------------------|
| Main plot      | Varieties         |
| V <sub>1</sub> | HB-19-13          |
| V <sub>2</sub> | Vikrant           |
| V <sub>3</sub> | HB-20-4           |
| V <sub>4</sub> | HB-20-11          |
| Sub-plot       | Fertility levels  |
| F <sub>1</sub> | RDF 125%          |
| F <sub>2</sub> | RDF 100%          |
| F <sub>3</sub> | RDF 75%           |

\*RDF= (40:40:20 NPK Kg ha<sup>-1</sup>)

## Results and Discussion

### Pre-harvest observations

#### Plant population (m<sup>-2</sup>)

The plant population (Table 1) of faba bean was recorded at early initial (30 DAS) and at harvest stage of crop non-significant different was observed in plant population due to treatments. However, highest plant population was recorded at initial and harvest stage under the application of 125% RDF (F<sub>1</sub>) 146.75% m<sup>-2</sup> and 142.25 m<sup>-2</sup> respectively.

#### Plant height (cm)

Plant height (Table 1) was recorded at 30 DAS, 60 DAS and 90 DAS and at harvest. The plant height at harvest decreased, with variety V<sub>1</sub> (HB-19-13) recording 49.26 cm, V<sub>2</sub> (Vikrant) showing the highest height of 68.43 cm, V<sub>3</sub> (HB-20-4) recording 49.33 cm and V<sub>4</sub> (HB-20-11) recording 57.63 cm. The

Highest plant height was recorded at harvest under the application of 125% RDF (F<sub>1</sub>) 62.42 cm. Similar results were found by Mishra (2002) <sup>[9]</sup> the plant height was not affected significantly due to different interactions.

#### Number of leaves plant<sup>-1</sup>

Number of leaves plant<sup>-1</sup> (Table 1) was recorded at 30 DAS, 60 DAS, 90 DAS and at harvest. Number of leaves plant<sup>-1</sup> at harvest decreased with variety V<sub>1</sub> (HB-19-13) 46.45 V<sub>2</sub> (Vikrant) showing the highest number of leaves plant<sup>-1</sup> 48.90 V<sub>3</sub> (HB-20-4) 48.71 V<sub>4</sub> (HB-20-11) 48.15. Number of leaves plant<sup>-1</sup> was recorded at harvest under the application of 125% RDF (F<sub>1</sub>) 48.29. Similar results were found by Kubure *et al.* (2016) <sup>[7]</sup> the mean number leaves plant<sup>-1</sup> was affected significantly by the different interaction of varieties and nutrient levels.

### Quality parameters

#### Protein (%)

Variety V<sub>2</sub> (Vikrant) produced significantly higher number of which was significantly higher than variety V<sub>3</sub> (23.54), V<sub>4</sub> (23.50), V<sub>1</sub> (23.46). Similar result was also reported by Pavani *et al.* (2013) <sup>[13]</sup>. Among the nutrient levels, application of 125% RDF was recorded a higher protein content (23.55). The effects of interaction on the protein content (Table 2) were found non-significant. Similar result was found by Gupta *et al.* (2017) <sup>[5]</sup>.

### Yield attributes and yield

#### Number of pods plant<sup>-1</sup>

The maximum number of pods (17.00) was recorded with V<sub>2</sub> (Vikrant) which was significantly higher than V<sub>3</sub> (HB-20-4), V<sub>4</sub> (HB-20-11) and V<sub>1</sub> (HB-19-13) variety V<sub>1</sub> (HB-19-13) recorded lowest number of pods plant<sup>-1</sup> (14.00). Similar result was also reported by Palankar and Malabasari (2014) <sup>[14]</sup>. Application of 125% RDF (16.87) reported a higher number of pods plant<sup>-1</sup> the effects of interaction on the protein content were found non-significant (Table 2). Similar result was found by Gupta *et al.* (2017) <sup>[5]</sup>.

#### Number of seeds pods<sup>-1</sup>

Faba bean variety V<sub>2</sub> (Vikrant) produced significantly higher number of seeds pods<sup>-1</sup> (3.20) followed by V<sub>3</sub> (3.15), V<sub>2</sub> (7.95), V<sub>4</sub> (3.00) and V<sub>1</sub> (2.93). The lowest number of seeds pods<sup>-1</sup> Similar result were also reported by Lad *et al.* (2014) <sup>[8]</sup>. Among the nutrient levels, application of 125% RDF was recorded a higher number of seeds pods<sup>-1</sup> (3.20). The effects of interaction on the number of seeds pods<sup>-1</sup> were found significant (Table 2).

#### Seed yield (kg ha<sup>-1</sup>)

Faba bean was a significantly varied due to different varieties. Variety V<sub>2</sub> (Vikrant) recorded the highest grain yield (3568.89 kg ha<sup>-1</sup>). Application of 125% RDF recorded a higher grain yield (3343.75 kg ha<sup>-1</sup>). Similar result was also reported by Tadesse, N. and Dechassa (2017) <sup>[15]</sup>. The effects of interaction on seed yield (kg ha<sup>-1</sup>) were found non-significant (Table 3).

#### Stover yield (kg ha<sup>-1</sup>)

Stover production between faba bean varieties. Variety V<sub>2</sub> (Vikrant) produced the significantly higher stover production (5917.78 kg ha<sup>-1</sup>). Similar result was also reported by Tadesse, N., and Dechassa (2017) <sup>[15]</sup>. Application of 125% RDF recorded highest stover production (6037.50 kg ha<sup>-1</sup>). The effects of interaction on stover production (kg ha<sup>-1</sup>) was found non-significant (Table 3).

## Economic analysis of treatments

### Cost of cultivation (₹ ha<sup>-1</sup>)

All the four faba bean varieties cost of cultivation (Table 4) were similar (₹33298 ha<sup>-1</sup>). Similarly, cost of cultivation was minimum (₹ 37504 ha<sup>-1</sup>) with the application of 75% RDF (F<sub>3</sub>) the highest cost of cultivation was recorded (₹ 40308 ha<sup>-1</sup>) under application of 125% RDF (F<sub>1</sub>). Similar result was found by Gupta *et al* (2017) [5].

### Gross return (₹ ha<sup>-1</sup>)

The gross return of faba bean (₹ ha<sup>-1</sup>) was greatly affected by different varieties (Table 4). Variety V<sub>2</sub> (Vikrant), which was significantly superior to all other varieties, registered a maximum gross return of (₹ 107070 ha<sup>-1</sup>) faba bean variety V<sub>1</sub> (HB-19-13) has recorded the lowest gross monetary return (₹ 97283 ha<sup>-1</sup>). Application of 125% RDF (₹ 100320) recorded a higher than 75% RDF (₹ 92340) but was at par with 100% RDF (₹ 98970). The effect of interaction on gross return were found non -significant.

### Net returns (₹ ha<sup>-1</sup>)

Different varieties had a significantly impact on the net monetary return (₹ ha<sup>-1</sup>) of faba bean. Variety V<sub>2</sub> (Vikrant) achieved maximum net return (₹ 73772 ha<sup>-1</sup>) which was significantly superior over other varieties.

Due to the different nutrient levels, the net return (₹ ha<sup>-1</sup>) was significantly affected. Application of 100% RDF (F<sub>2</sub>) recorded significantly higher net return (₹ 60064 ha<sup>-1</sup>). Similar finding done by Daur (2008) [3]. The effect of interaction on net return were found non -significant (Table 4).

### B: C Ratio

Benefit: cost ratio (Table 4) of faba bean had a significantly impact on the different varieties. Variety V<sub>2</sub> (Vikrant) was registered the highest B: C ratio (2.21) which was superior to other varieties. Similar result was found by Akhtar *et al.* 2003 [1]. B: C ratio has been significantly affected by nutrient levels. Application of 100% RDF recorded a higher B: C ratio (1.54). Similar result was found by Akhtar *et al.* 2003 [1]. The effect of interaction on B: C ratio were found non -significant.

**Table 1:** Mean plant population (m<sup>-2</sup>), Mean plant height (cm), Number of leaves plant<sup>-1</sup> of faba bean as affected by varieties and nutrient levels.

| Treatment                                                 | Mean plant population (m <sup>-2</sup> )(At harvest) | Mean plant height (cm)(At harvest) | Number of leaves plant <sup>-1</sup> (At harvest) |
|-----------------------------------------------------------|------------------------------------------------------|------------------------------------|---------------------------------------------------|
| <b>Varieties</b>                                          |                                                      |                                    |                                                   |
| V <sub>1</sub> - HB-19-13                                 | 139.30                                               | 49.26                              | 46.45                                             |
| V <sub>2</sub> - Vikrant                                  | 141.54                                               | 68.43                              | 48.90                                             |
| V <sub>3</sub> - HB-20-4                                  | 140.33                                               | 49.33                              | 48.71                                             |
| V <sub>4</sub> - HB-20-11                                 | 138.33                                               | 57.63                              | 48.15                                             |
| S.Em ±                                                    | 1.08                                                 | 1.34                               | 0.05                                              |
| CD (P=0.05)                                               | NS                                                   | 3.67                               | 0.01                                              |
| <b>Fertility levels (40:40:20 NPK kg ha<sup>-1</sup>)</b> |                                                      |                                    |                                                   |
| F <sub>1</sub> - 125% RDF                                 | 142.25                                               | 62.42                              | 48.29                                             |
| F <sub>2</sub> - 100% RDF                                 | 140.87                                               | 58.80                              | 48.09                                             |
| F <sub>3</sub> - 75% RDF                                  | 140.75                                               | 56.17                              | 47.77                                             |
| S.Em ±                                                    | 0.93                                                 | 0.94                               | 0.04                                              |
| CD (P=0.05)                                               | NS                                                   | 2.72                               | 0.01                                              |
| <b>Interaction</b>                                        |                                                      |                                    |                                                   |
| S.Em ±                                                    | 1.87                                                 | 2.08                               | 0.08                                              |
| CD (P=0.05)                                               | NS                                                   | NS                                 | 0.02                                              |

**Table 2:** Number of pods plant<sup>-1</sup>, Number of seed pod<sup>-1</sup>, protein (%) of faba bean as affected by varieties and nutrient levels

| Treatment                                                 | Number of pods <sup>-1</sup> | Number of seed pod <sup>-1</sup> | Protein (%) |
|-----------------------------------------------------------|------------------------------|----------------------------------|-------------|
| <b>Varieties</b>                                          |                              |                                  |             |
| V <sub>1</sub> - HB-19-13                                 | 14.00                        | 2.93                             | 23.46       |
| V <sub>2</sub> - Vikrant                                  | 17.00                        | 3.20                             | 23.58       |
| V <sub>3</sub> - HB-20-4                                  | 15.50                        | 3.15                             | 23.54       |
| V <sub>4</sub> - HB-20-11                                 | 16.66                        | 3.00                             | 23.50       |
| S.Em ±                                                    | 0.08                         | 0.01                             | 0.33        |
| CD (P=0.05)                                               | 0.24                         | 0.04                             | NS          |
| <b>Fertility levels (40:40:20 NPK kg ha<sup>-1</sup>)</b> |                              |                                  |             |
| F <sub>1</sub> - 125% RDF                                 | 16.87                        | 3.20                             | 23.55       |
| F <sub>2</sub> - 100% RDF                                 | 16.25                        | 3.15                             | 23.54       |
| F <sub>3</sub> - 75% RDF                                  | 15.75                        | 3.03                             | 23.47       |
| S.Em ±                                                    | 0.08                         | 0.01                             | 0.28        |
| CD (P=0.05)                                               | 0.21                         | 0.03                             | NS          |
| <b>Interaction</b>                                        |                              |                                  |             |
| S.Em ±                                                    | 0.14                         | 0.02                             | 0.57        |
| CD (P=0.05)                                               | 0.42                         | 0.07                             | NS          |

**Table 3:** Seed yield (kg ha<sup>-1</sup>), Stover yield (kg ha<sup>-1</sup>), Harvest index (%), Seed index (g) of faba bean as affected by varieties and nutrient levels

| Treatment                                                 | Seed yield (kg ha <sup>-1</sup> ) | Stover yield (kg ha <sup>-1</sup> ) | Harvest index (%) | Seed index (g) |
|-----------------------------------------------------------|-----------------------------------|-------------------------------------|-------------------|----------------|
| <b>Varieties</b>                                          |                                   |                                     |                   |                |
| V <sub>1</sub> - HB-19-13                                 | 3,242.78                          | 5,917.78                            | 35.39             | 58.77          |
| V <sub>2</sub> - Vikrant                                  | 3,568.89                          | 6,210.00                            | 36.23             | 59.22          |
| V <sub>3</sub> - HB-20-4                                  | 3,400.00                          | 6,005.56                            | 35.43             | 54.55          |
| V <sub>4</sub> - HB-20-11                                 | 3,249.44                          | 5,993.33                            | 35.11             | 47.88          |
| S.Em ±                                                    | 20.1                              | 4.76                                | 0.46              | 1.65           |
| CD (P=0.05)                                               | 54.46                             | 4.76                                | 0.46              | 1.65           |
| <b>Fertility levels (40:40:20 NPK kg ha<sup>-1</sup>)</b> |                                   |                                     |                   |                |
| F <sub>1</sub> - 125% RDF                                 | 3,434.75                          | 6,037.50                            | 37.69             | 60.00          |
| F <sub>2</sub> - 100% RDF                                 | 3,299.17                          | 6,017.50                            | 35.05             | 59.16          |
| F <sub>3</sub> - 75% RDF                                  | 3,077.92                          | 6,007.50                            | 34.99             | 58.41          |
| S.Em ±                                                    | 17.2                              | 4.12                                | 1.50              | 1.00           |
| CD (P=0.05)                                               | 51.50                             | 4.12                                | 1.50              | 1.00           |
| <b>Interaction</b>                                        |                                   |                                     |                   |                |
| S.Em ±                                                    | 34.89                             | 2.79                                | 0.25              | 1.45           |
| CD (P=0.05)                                               | NS                                | NS                                  | NS                | NS             |

**Table 4:** Effect of varieties and nutrient levels on economic of faba bean

| Treatment                                                   | Cost of cultivation (₹ ha <sup>-1</sup> ) | Gross returns (₹ ha <sup>-1</sup> ) | Net returns (₹ ha <sup>-1</sup> ) | B: C Ratio |
|-------------------------------------------------------------|-------------------------------------------|-------------------------------------|-----------------------------------|------------|
| <b>Varieties</b>                                            |                                           |                                     |                                   |            |
| V <sub>1</sub> -HB-19-13                                    | 33298                                     | 97283                               | 63985                             | 1.92       |
| V <sub>2</sub> -Vikrant                                     | 33298                                     | 107070                              | 73772                             | 2.21       |
| V <sub>3</sub> - HB-20-4                                    | 33298                                     | 99000                               | 65702                             | 1.97       |
| V <sub>4</sub> - HB-20-11                                   | 33298                                     | 97470                               | 64172                             | 1.93       |
| S.Em ±                                                      | -                                         | 4553                                | 4551                              | 0.06       |
| CD (P= 0.05)                                                | -                                         | 18812                               | 18815                             | 0.18       |
| <b>Fertility levels (40: 40: 20 NPK kg ha<sup>-1</sup>)</b> |                                           |                                     |                                   |            |
| F <sub>1</sub> - 125% RDF                                   | 40308                                     | 100320                              | 60012                             | 1.48       |
| F <sub>2</sub> - 100% RDF                                   | 38906                                     | 98970                               | 60064                             | 1.54       |
| F <sub>3</sub> - 75% RDF                                    | 37504                                     | 92340                               | 54836                             | 1.36       |
| S.Em ±                                                      | -                                         | 5583                                | 5182                              | 0.05       |
| CD (P= 0.05)                                                | -                                         | 23071                               | 21823                             | 0.14       |
| <b>Interaction</b>                                          |                                           |                                     |                                   |            |
| CD (P= 0.05)                                                | -                                         | NS                                  | NS                                | NS         |

## Conclusion

The study revealed that the variety Vikrant (V<sub>2</sub>) exhibited superior vegetative growth, reproductive traits and yield performance in faba bean. Enhanced nutrient application, particularly at 125% RDF, significantly improved growth, yield components and biomass accumulation. Economic analysis indicated that Vikrant achieved the highest gross and net returns, while 100% RDF offered the best benefit-cost ratio. Overall, Vikrant under optimal nutrient management proved most effective and economically sustainable for maximizing faba bean productivity.

## References

- Akhtar N, Amjad M, Anjum MA. Growth and yield response of pea (*Pisum sativum* L.) crop to phosphorus and potassium application. Pak J Agric Sci. 2003;40(3-4):217-22.
- Cazzato E, Tufarelli V, Ceci E, Stellacci AM, Laudadio V. Faba bean (*Vicia faba* L.) as a protein source in animal feed and human nutrition. Legume Res. 2012;35(4):301-6.
- Daur I, Sepetoğlu H, Marwat KB, Hassan G, Khan IA. Effect of different levels of nitrogen on dry matter and grain yield of faba bean (*Vicia faba* L.). Pak J Bot. 2008;40(6):2453-60.
- Grzebisz W, Barłóg P, Łukowiak R. The effect of potassium and sulfur fertilization on seed quality of faba bean (*Vicia faba* L.). Agronomy. 2013;9(4):209.
- Gupta S, Kushwah SS, Sharma RK, Singh OP. Effect of irrigation regimes and nutrient levels on growth, yield and quality of drip irrigated broad bean (*Vicia faba* L.). Indian J Agric Sci. 2017;87(10):50-5.
- Kopke U, Nemecek T. Ecological services of faba bean. Field Crops Res. 2010;115(3):217-33.
- Kubure T, Tulu S, Getachew E. Effect of phosphorus fertilization on growth and yield of faba bean (*Vicia faba* L.). Adv Crop Sci Technol. 2016;4(2):234-9.
- Lad NG, Patange MJ, Dhage SJ. Effect of nitrogen and phosphorus levels on growth, yield attributing characters, yield and economics of French bean (*Phaseolus vulgaris* L.). Int J Curr Microbiol Appl Sci. 2014;3(12):822-7.
- Mishra JP. Effect of phosphorus levels on growth and yield of cowpea (*Vigna unguiculata* L.). Indian J Agron. 2002;47(3):436-8.
- Mohamed SSE, Babiker HM. Effects of Rhizobium

- inoculation and urea fertilization on faba bean (*Vicia faba* L.) production in a semi-desert zone. *Adv Environ Biol.* 2012;6(2):824-30.
11. Mona AM, Sabah MA, Rehab AM. Influence of potassium sulfate on faba bean yield and quality. *Aust J Basic Appl Sci.* 2011;5(3):87-95.
  12. Marschner P. Marschner's Mineral Nutrition of Higher Plants. 3<sup>rd</sup> ed. London: Academic Press; 2012.
  13. Pavani S, Bhanurekha K, Sudhakarababu SN, Madhu M. Effect of nitrogen and sulphur on growth, yield and quality of sunflower (*Helianthus annuus* L.). *Crop Res.* 2013;45(1-3):152-5.
  14. Palankar GS, Malabasari TA. Effect of nutrient levels and picking stage on seed yield and quality of cluster bean (*Cyamopsis tetragonoloba* L.). *Res Rev J Agric Allied Sci.* 2014;3(2):45-50.
  15. Tadesse N, Dechassa N. Effect of nitrogen and sulphur application on yield components and yield of common bean (*Phaseolus vulgaris* L.) in Eastern Ethiopia. *Acad Res J Agric Sci Res.* 2017;5(2):77-89.
  16. Tridge. Global production of faba bean (*Vicia faba* L.) by country. *Tridge Market Intelligence.* 2019;65(1):92-5.