E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(11): 44-48
Received: 17-09-2024
Accepted: 30-10-2024

Sukne SS
M.Sc. (Agri) Student, Department of Agronomy, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra, India

AK Ghotmukale
Junior Agronomist, Oilseeds Research Station, Latur, VNMKV, Parbhani, Maharashtra, India

Dr. Karanjikar PN
Professor, Collage of Agriculture, Latur, VNMKV, Parbhani, Maharashtra, India

Suryawanshi SS
M.Sc. (Agri) Student, Department of Agronomy, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra, India

AP Sabale
M.Sc. (Agri) Student, Department of Agronomy, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
Sukne SS
M.Sc. (Agri) Student, Department of Agronomy, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra, India

Yield and economic impact of spacings and varieties of rajma (*Phaseolus vulgaris* L.) cultivation during *kharif* season

Sukne SS, AK Ghotmukale, Dr. Karanjikar PN, Suryawanshi SS and AP Sabale

DOI: https://doi.org/10.33545/2618060X.2024.v7.i11Sa.1929

Abstract
A field experiment was carried out during *kharif* season of 2023-2024 at Experimental farm, Agronomy section, Oilseed Research Station, Latur. To study Effect of spacings on economics and seed yield of rajma (*Phaseolus vulgaris* L.) varieties in *kharif* season. The soil of experimental plot was black clayey in texture, slightly alkaline in reaction having pH (7.7) with chemical composition such as available nitrogen (231 kg ha^{-1}), very low in available phosphorous (18.2 kg ha^{-1}) and very high in available potassium (498.58 kg ha^{-1}). It was well drained and favourable for optimum crop growth.
The experiment was laid out in factorial Randomized Block Design with two factors are Spacing and Varieties have nine treatments. The treatments were S_1: 45 cm × 10 cm, S_2: 45 cm × 20 cm, S_3: 45 cm × 30 cm, V_1: Phule Rajma, V_2: Phule Varun, V_3: Arka Komal. The gross size of each experimental unit was 5.4 m × 4.5 m and Net plot size as per treatment. Sowing was done on 9th July 2023 by dibbling method with seed rate as per treatment. The recommended dose of fertilizer for Rajma crop was 120:60:60 NPK kg ha^{-1}.
The result of the experiment revealed that among the spacing higher yield attributes such as seed yield (1744 kg ha^{-1}), straw yield (2388 kg ha^{-1}), GMR (Rs.1,39,520 ha^{-1}), NMR (Rs. 92,250 ha^{-1}) and B:C ratio (2.96) was observed with an application of 45 cm × 10 cm (S_1) while among varieties higher growth and yield attributes, seed yield (1524 kg ha^{-1}), straw yield (2348 kg ha^{-1}), GMR (Rs.1,21,973 ha^{-1}), NMR (Rs.75,703 ha^{-1}) and B:C ratio (2.63) was observed with a Phule Rajma (V^1). In case of seed yield and net monetary returns (Rs. ha^{-1}) application of spacing 45 cm × 10 cm (S_1) and variety Phule Rajma (V_1) performed better.

Keywords: Rajma, spacing, varieties, growth, yield, economics

Introduction
French bean (*Phaseolus vulgaris* L.) is one of the world's most important food legume for direct human consumption. French bean has evolved from a wild-growing vine distributed in the highlands of middle America and Andes over a period of 7,000-8,000 years. It is originated in the Central and South America and belongs to the family Leguminosae. It is more suitable as a winter (*rabi*) crop in the north eastern plains of India It is also known as bush bean, kidney bean, snap bean, green bean, raj bean, common bean, basic bean, haricot bean, navy bean, pole bean, wax bean, string bean (Duke, 1983; Salunkhe *et al*., 1987; Tindall, 1988) [7, 15, 17]. In India, beans are mainly used as green vegetables and also as pulse. It is valued for its protein (23%) rich seeds. Seeds are also rich in calcium, phosphorus and iron. The fresh pods are used as vegetable. As a nutritious vegetable, it contains calcium (50 mg), phosphorus (28 mg), iron (1.7 mg), carotene (132 mg), thiamine (0.08 mg), riboflavin (0.06 mg) and vitamin C (24.0 mg) in each 100 g of edible pods (Chadha, 2001) [3].
The spacing refers to the distance between individual plants within a row and between rows. It directly affects the availability of resources such as sunlight, water, and nutrients for each plant. Proper spacing ensures efficient utilization of these resources, leading to healthier plants and higher yields. However, inadequate spacing can result in competition among plants, leading to stunted growth and reduced productivity.

On the other hand, the variety of rajma refers to the specific genetic composition and characteristics of the plant. Different varieties exhibit variations in growth habits, disease resistance, yield potential, and quality traits. Selecting the right variety is crucial for maximizing productivity and meeting market demands.

Understanding the effect of spacing and variety on rajma crop is essential for farmers and researchers alike. It can help optimize cultivation practices, improve crop performance, and enhance overall profitability. This research aims to investigate the impact of spacing and variety on aspects of rajma cultivation, including yield components and economics of various treatments.

Materials and Methods

The field experiment was conducted during *kharif* season 2023-24 at Experimental Farm of Agronomy section, Oilseed research station Latur.

The soil at the experimental location had clayey texture, slightly saline in reaction, had low levels of available organic carbon and nitrogen, medium levels of phosphorus and high levels of potassium and was well-drained with a moderate moisture retention capacity, all of these are beneficial for optimal growth and development of French bean.

The experimental was laid out in factorial randomized design with nine treatment combination, consisting of three varieties V_1-Phule Rajma, V_2-Phule Varun and V_3-Arka Komal and three spacings of S_1-45cm × 10cm, S_2-45cm × 20cm and 45cm × 30cm replicated thrice. The gross and net plot size of each experimental unit was 5.4 × 4.5 m^2 and as per treatment, respectively. Sowing was done by dibbling method on 9th July 2023. Half dose of nitrogen along with full basal dose were applied and remaining half dose of nitrogen was applied at 30 days after sowing. The crop was harvested at maturity on 5th October 2023.

Results and Discussion

Effect of Varieties

Yield and yield parameters

The effect of different Varieties on number of seeds pod^{-1} was found to be non- significant. While higher number of seeds pod^{-1} (5.39) was obtained at Arka Komal variety. The effect of different Varieties on No. of seeds pods^{-1}, No. of pod plant^{-1}, Dry wt. of pod plant^{-1}, Seed yield plant^{-1} and Seed index was found to be non- significant. higher number of seeds pod^{-1} (5.39) was obtained at Arka Komal variety. Similar result also reported by Begum *et al* (2003b) [1], Ceyhan *et al*., (2004) [2] and Yadav *et al* (2015) [19].

Higher dry. wt. of pod plant^{-1} (14.03 g) with variety Phule Rajma, similar result were also reported by Murade N.B. *et al* (2014) [10] and Uddin *et al*., (2017) [18]**.**

Seed yield plant^{-1} **(**13.74 g) was obtained at Phule Rajma variety. Similar result was also reported by Patange *et al.*, (2011) [14].

Seed index (g) was not influenced significantly by different varieties, but higher seed index was noticed with the Phule Rajma variety.

The variety Phule Rajma produced significantly higher seed yield (1524.67 kg ha^{-1}), Biological yield and straw yield than Arka Komal variety and it was found at par with the Phule Varun variety. Similar result were also reported by Kabir and Sarkar., (2008) [8] and Patange *et al*., (2011) [14].

The higher harvest index (39.36%) was noticed with the variety Phule Rajma. Whereas lowest harvest index (34.15%) was observed with the Arka Komal variety. Similar result were also reported by Khan and Asif (2001) [9] and Dhanjal *et al*., (2001) [6].

Economics

The variety Phule Rajma produced significantly higher net monetary returns (75,703 ₹ ha^{-1}), gross monetary returns (1,21,973 ₹ ha^{-1}) than Arka Komal variety and it was found at par with the Phule Varun variety. The higher Benefit: Cost ratio (2.63) was noticed with the variety Phule Rajma. Whereas lowest Benefit: Cost ratio (1.79) was observed with the Arka Komal variety. Similar result was also reported by Pandey and Singh (2022) [13].

Effect of Spacing

Yield and yield parameters

The effect of different spacing on number of seeds pod^{-1} was found to be non- significant. While higher number of seeds pod^{-1} (5.39) was obtained at 45 cm × 10 cm spacing. The effect of different spacing on No. of seeds pods^{-1}, No. of pod plant^{-1}, Dry wt. of pod plant^{-1}, Seed yield plant^{-1} and Seed index was found to be non-significant. Similar result were also reported by Ceyhan *et al*., (2004) [2] and Pandey and Singh (2022) [13]. Number of pod plant^{-1} (19.89 g) was obtained significantly superior with the spacing of 45 cm × 30 cm than the spacing of 45 cm × 20 cm and 45 cm × 10 cm. The spacing 45 cm × 20 cm found at par with 45 cm × 10 cm. Similar result also reported by Neethu *et al* (2022) [12] and Pandey and Singh (2022) [13].

Seed index was not influenced significantly by different varieties, but higher seed index was noticed with the Phule Rajma variety.

The variety Phule Rajma produced significantly higher seed yield (1525 kg ha^{-1}), Biological yield and straw yield than Arka Komal variety and it was found at par with the Phule Varun variety. Similar result were also reported by Deshpande *et al.*, (1996) [5], Singh and Yadav (2013) [16], Nayak S. *et al* (2014) [11].

The higher harvest index (39.36%) was noticed with the variety Phule Rajma. Whereas lowest harvest index (34.15%) was observed with the Arka Komal variety. Similar result were also reported by Khan and Asif (2001) [9].

Economics

The gross monetary returns and Net monetary returns (92,250 ₹ ha^{-1}) of spacing 45 cm × 10 cm was obtained significantly superior than the spacing of 45 cm × 20 cm and 45 cm × 30 cm. The spacing of 45 cm × 10 cm recorded higher Benefit: Cost ratio (2.96) followed by 45 cm × 20 cm and 45 cm × 30 cm spacings. Similar result were also reported Deka *et al.*, (2022) [4] and Neethu *et al.*, (2022) [12], Pandey and Singh (2022) [13].

Interaction effect

The effect of interaction between different spacing and varieties sources on yield attributes and economics of Rajma was non-significant.

Table 1: No. of seeds pods^{-1}, No. of pod plant^{-1}, Dry wt. of pod plant^{-1}, Seed yield plant^{-1} and Seed index as influenced by different treatments at harvest

Treatment	No. of pods plant^{-1} (g)	No. of seeds pod^{-1}	Dry. wt. of pod plant^{-1} (g)	Seed yield plant^{-1} (g)	Seed index (g)
A: Varieties (V)					
V_1: Phule Rajma	15.17	5.11	13.95	13.82	35.12
V_2: Phule Varun	14.11	4.90	13.49	13.19	33.16
V_3: Arka Komal	12	5.39	12.27	11.47	31.96
S.Em±	0.511	0.189	0.381	0.365	0.905
CD at 5%	1.532	NS	1.143	1.093	NS
B: Spacing (S)					
S_1: 45 cm × 10 cm	12.94	5.39	12.45	12.32	34.60
S_2: 45 cm × 20 cm	13.44	5.09	12.96	12.66	33.22
S_3: 45 cm × 30 cm	14.89	4.92	14.29	13.99	32.41
S.Em±	0.511	0.189	0.381	0.365	0.905
CD at 5%	1.532	NS	1.143	1.093	NS
C: Interaction (V×S)					
S.Em±	0.88	0.33	0.66	0.63	1.57
CD at 5%	NS	NS	NS	NS	NS
General Mean	13.76	5.13	13.23	12.99	33.41

Table 2: Seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index (%) as influenced by different treatments

Treatment	Seed yield (kg ha^{-1})	Starw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
A: Varieties (V)				
V_1: Phule Rajma	1524.67	2348.54	3873.20	39.36
V_2: Phule Varun	1421.11	2268.10	3689.21	38.52
V_3: Arka Komal	1068.78	2060.88	3129.66	34.15
S.Em±	41.803	67.714	79.291	-
CD at 5%	125.312	202.986	237.688	-
B: Spacing (S)				
S_1: 45 cm × 10 cm	1744.00	2388.51	4132.94	42.20
S_2: 45 cm × 20 cm	1286.44	2179.20	3465.65	37.12
S_3: 45 cm × 30 cm	984.11	2109.37	3093.49	31.81
S.Em±	41.803	67.714	79.291	-
CD at 5%	125.312	202.986	237.688	-
C: Interaction (V×S)				
S.Em±	72.40	117.28	137.34	-
CD at 5%	NS	NS	NS	-
General Mean	1338.9	2225.84	3564.02	37.55

Table 3: Seed yield (kg ha^{-1}) and economics (₹ ha^{-1}) i.e. GMR (Gross Monetary Returns ₹ ha^{-1}), Cost of cultivation (₹ ha^{-1}), NMR (Net Monetary Returns ₹ ha^{-1}), B:C ratio of French bean as influenced by different treatments

Treatment	Seed yield (kg ha^{-1})	Gross Monetary Returns (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net monetary returns (₹ ha^{-1})	B:C ratio
A: Varieties (V)					
V_1: Phule Rajma	1524	121973	46270	75703	2.63
V_2: Phule Varun	1421	113688	46270	67418	2.45
V_3: Arka Komal	1068	85502	47770	37732	1.79
S.Em±	41.80	3344.22	-	3344.22	-
CD at 5%	125.31	10025	-	10025	-
B: Spacing (S)					
S_1:45 cm × 10 cm	1744	139520	47270	92250	2.96
S_2:45 cm × 20 cm	1286	102916	46770	56146	2.21
S_3:45 cm × 30 cm	984	78729	46270	32459	1.71
S.Em±	41.803	3344.22	-	3344.22	-
CD at 5%	125.312	10025	-	10025	-
C: Interaction (V×S)					
S.Em±	72.40	5792.37	-	5792.37	-
CD at 5%	NS	NS	-	NS	-
General Mean	1338	107054	46770	60284	2.29

Plate 1: General View of Experimental Plot

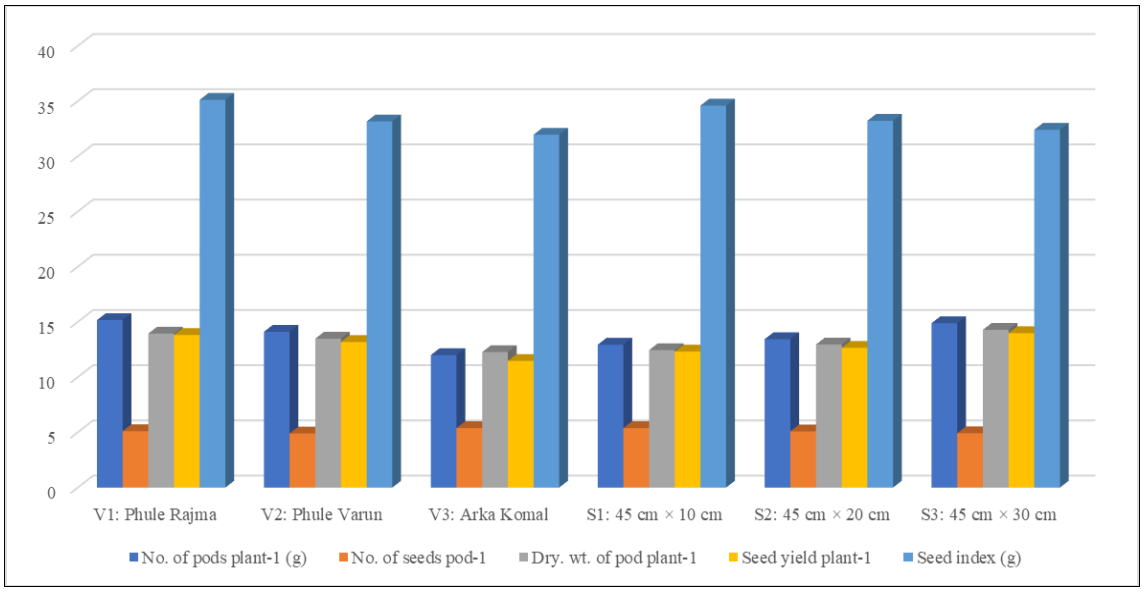

Fig 1: No. of seeds pods^{-1}, No. of pod plant^{-1}, Dry wt. of pod plant^{-1}, Seed yield plant^{-1} and Seed index as influenced by different treatments at harvest

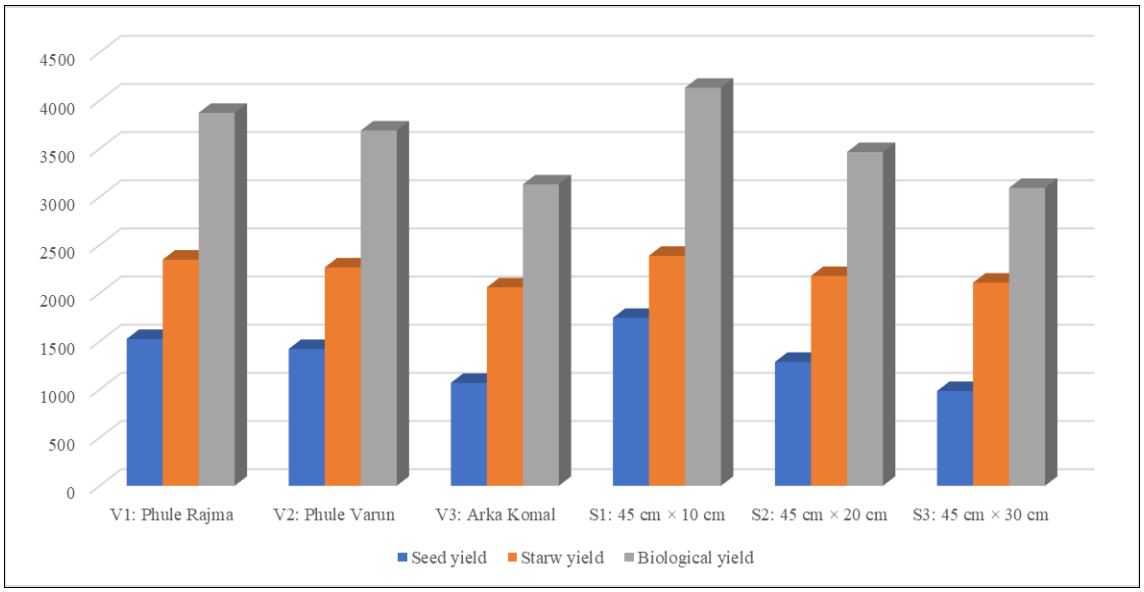

Fig 2: Seed yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha^{-1}) as influenced by different treatments

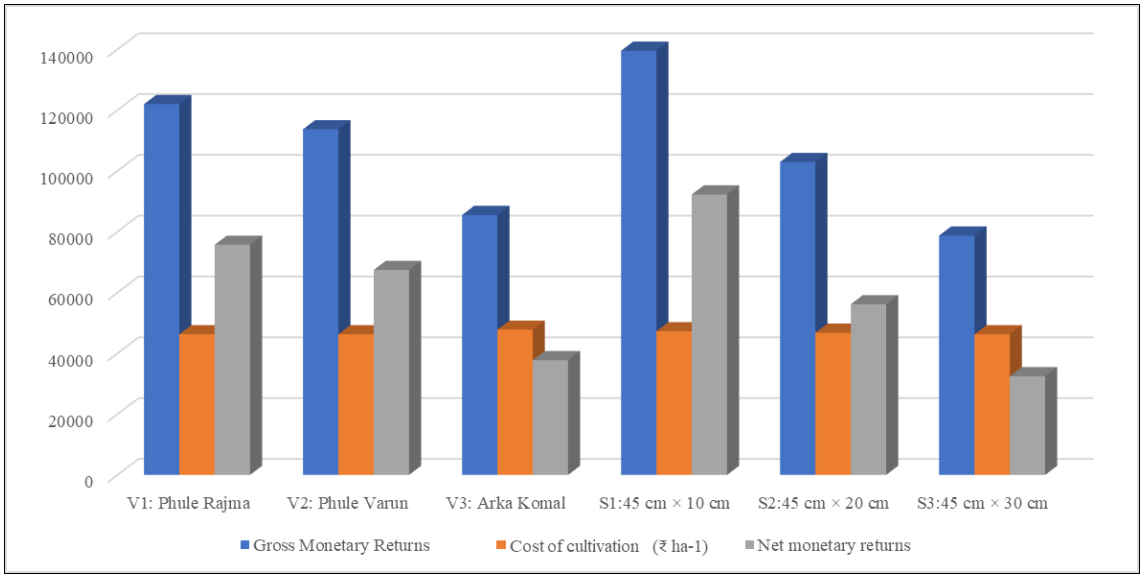

Fig 3: GMR (Gross Monetary Returns ₹ ha^{-1}), Cost of cultivation (₹ ha^{-1}), NMR (Net Monetary Returns ₹ ha^{-1}) of French bean as influenced by different treatments

Conclusion

Optimum requirement of spacing to French bean crop is 45 cm × 10 cm resulted in maximum yield attributing characters and seed and straw yield of Rajma. Higher GMR, NMR with B:C ratio was obtained with the variety Phule Rajma and spacing 45 cm × 10 cm. Best combination of Rajma variety and spacing is Phule Rajma variety with 45 cm × 10 cm spacing was found optimum production.

Acknowledgement

We are grateful to Oilseeds Research Station, Latur and College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani for the financial assistance and infrastructure facilities provided for the conduct of this work.

References

1. Begum A, Ahad A, Kaisar OM, Islam MM, Anam MK. Morphological and reproductive attributes in French bean (*Phaseolus vulgaris* L.) as influenced by sowing time and fertilizer treatment. Pak J Biol Sci. 2003;6(22):1902-6.
2. Ceyhan E. Effect of sowing dates on some yield components and yield of dry bean (*Phaseolus vulgaris* L.) cultivars. Turk J Field Crops. 2004;9(2):87-95.
3. Chadha KL. Handbook of horticulture. New Delhi: Department of Agriculture, Govt. of India; 2001. p. 399-402.
4. Deka KK, Das MR, Bora P, Mazumder N. Effect of sowing dates and spacing on growth and yield of cluster bean (*Cyamopsis tetragonoloba*) in subtropical climate of Assam, India. Indian J Agric Res. 2015;49(3):250-4.
5. Deshpande SB, Jadhav AS, Deokar AB. Effect of phosphorus and intrarow spacing on the yield of French bean. J Maharashtra Agric Univ. 1995;20:423-5.
6. Dhanjal R, Prakash OM, Ahlawat IP. Response of French bean (*Phaseolus vulgaris*) varieties to plant density and nitrogen application. Indian J Agron. 2001;46:277-81.
7. Duke JA. Handbook of legumes of world economic importance. 2nd ed. New York: Plenum Press; 1983. p. 341.
8. Kabir MH, Sarkar MAR. Seed yield of mung bean as affected by variety and plant spacing in Kharif-I season. J Bangladesh Agric Univ. 2008;6(2):101-5.
9. Khan BM, Asif M. Growth and yield response of Mashbean genotypes to various planting densities. J Res Sci. 2001;12(2):167-70.
10. Murade NB, Patil DB, Jagtap HD, More SM. Effect of spacing and fertilizer levels on growth and yield of Urdbean. 2014;9(4):1545-7.
11. Nayak S, Chavan DA, Waghmare YM. Effect of different spacings on growth and yield of black gram (*Vigna mungo* L.) Hepper varieties. Agrotechnol. 2014;2:4.
12. Neethu TM, Nagarajappa A, Srinivasa V, Girijesh GK. Effect of spacing and fertigation on growth and yield parameters of French bean (*Phaseolus vulgaris* L.) under protected cultivation. Legume Res. 2022;45(6):742-8.
13. Pandey A, Singh R. Effect of spacing on yield and economics of varieties of black gram (*Vigna mungo* L.). Int J Plant Soil Sci. 2022;34(15):37-42.
14. Patange J, Mamta, Lad NG, Dhage J, Shubhangi. Effect of sowing dates on growth and yield of French bean (*Phaseolus vulgaris* L.) varieties during kharif season. Adv Res J Crop Improv. 2011;2(1):158-60.
15. Salunkhe DK, Desai BB, Bhat NR. Leguminous vegetables (Peas and Beans). In: Vegetable and Flower Seed Production. New Delhi: Agricole Publishing Academy; 1987. p. 265-302.
16. Singh RP, Yadav S. Effect of different varieties and row spacings on growth and yield of blackgram. M.Sc. thesis, RVSKVV; 2013.
17. Tindall HD. Vegetables in the tropics. London: MacMillan Education Ltd; 1988. p. 527.
18. Uddin FJ, Kashem MA, Islam AM, Sarkar MAR. Optimizing sowing date for French bean varieties under Bangladesh condition. Annu Res Rev Biol. 2017;1:1-7.
19. Yadav BVS, Srinivasulu B, Reddy PSS, Balakrishna M. Influence of sowing dates on growth and yield of French bean (*Phaseolus vulgaris* L.) varieties under Rayalaseema Region of Andhra Pradesh. J Agroecol Nat Resource Manage. 2015;2(2):145-9.