Evaluation of Yield and Growth Performance of Bhendi (OKRA) Incorporated With Liquid Biofertilizer and Organic Manure under Irrigated UP Land Condition Ecosystem

Deivasigamani S, S. Kavitha, R.Vimalraj, A.Santhoshkumar and V.Prashath
Krishna College of Agriculture and Technology
(Affiliated to Tamilnadu Agricultural University, Coimbatore –641 003)
Srirengapuram – 625532, Madurai District, Tamil Nadu

Abstract: **The experiment was conducted on Krishna College of Agriculture and Technology, Usilampatti, Madurai district, Tamilnadu. To study the growth and yield of bhendi by different organic sources along with liquid Bio-fertilizers and the economics of different treatment combinations. The experiment comprised of 7 treatments with three replications and used in Randomized block design (RBD). The treatments consist of T_1-Control (RDF), T2-FYM @12t/ha + Azospirillum @1.25 l/ha, T_3-Vermicompost@5t/ha + Azospirillum@1.25 l/ha, T_4 – Sheep manure@5 t/ha + Azospirillum@1.25 l/ha, T5-FYM@ 6.5 t/ha + Phosphobacteria@1.25 l/ha, T6-Vermicompost@2.5 t/ha + Phosphobacteria @1.25 l/ha and T7-Sheep manure@2.5 t/ha + Phosphobacteria@1.25 l/ha. The growth and yield parameters of bhendi were recorded at maturity stage, among the various treatments (T_4-sheep manure@5t/ha+Azospirillum@1.25l/ha) was recorded the highest plant height (82 cm,); stem girth (6.30cm); no of leaves per plant (16.67);no of fruits per plant (5.67); no of seeds per fruit (71.33); fruit length (20.23 cm) and fruit yield (4772.87 kg/ha). The Economics analyzed for the treatments total cost of the production (Rs. 13500), gross income (Rs. 95457), net income (Rs. 81957) and BCR (7.07) was recorded.**

Key words: **Bhendi, FYM, Vermicompost, sheep manure, Azospirillum, Phosphobacteria, growth and yield.**

INTRODUCTION

Abelmoschus esculentus is a flowering plant in the Malvaceae family that is referred to as ladies' fingers or bhendi in various places. Its green seed pods are delicious. The geographical origin of bhendi is disputed, with supporters of West African, Ethiopian, Southeast Asian, and South Asian origins. Globally, the plant is grown in warm temperate, tropical, and subtropical climates. It is growing in hot summers with minimum and maximum temperatures of 18°C and 35°C is ideal for this warm-season vegetable crop, which may be grown in gardens and on big commercial farms. Sandy loam to clay loam with abundant organic matter and improved drainage is the best soil for bhendi growth. It can thrive in thick soils if there is adequate drainage. Soil should have a pH between 6.0 and 6.5.

It is high in dietary fiber, vitamins A, B, and C, minerals (calcium, sodium, potassium, zinc, and iron), antioxidants, and folate. Proteins (15-26%), edible seed oil (20-40%), and unsaturated fatty acids, such as linoleic acid, which is vital for human nutrition, are all abundant in okra seed. The mature fruit and stems are utilized in the production of paper. Food additives can be made from okra mucilage (Dorcas and Adesike, 2022).

Consumable unripe fruit has a high nutritional content; 100 g contains 89.6 g of moisture, 6.4 g of carbohydrates, 1.9 g of protein, 0.2 g of fat, 1.2 g of fiber, 0.7 g of minerals, 88 IU of vitamin A, 0.07 mg of thiamine, 0.10 mg of riboflavin, 0.60 mg of nicotinic acid, and 13 mg of vitamin C. Okra seeds have a protein content of 21-25% and an edible oil content of 14-23%. Okra oil is used in the soap and cosmetics industries as well as in vanaspati, and the protein is utilized to make cattle feed (Sonam et al., 2024).

India leads the world in okra production with 6.18 million tons, followed by Nigeria with 1.82 million tons, with an expected 9.96 million tons produced worldwide (FAOSTAT, 2020). Okra fruit yield in Nigeria peaked in 2010 at an average of 27,275 kg/ha. Since then, it has been declining, with the biggest reduction being in 2011 when the average yield was 8,735 kg/ha. Fruit production declines

over time are attributed to the intricate relationships between biotic and abiotic stressors. The yield decline is partly influenced by the lack of improved okra cultivars with significant favorable end-user features (Kumar et al., 2010).

The world's biggest producer of bhendi is India. Brazil, West Africa, and many other nations also use it as a vegetable. West Bengal, Bihar, and Uttar Pradesh are the three main states in India that produce the most bhendi. Uttar Pradesh, Bihar, West Bengal, Odisha, Assam, Andhra Pradesh, and Karnataka are the states that produce the most bhendi. The annual production of bhendi is 8,900,301 tons worldwide (Akash, 2022). With an annual output volume of 5,507,000 tons, India is the world's largest producer of bhendi. Nigeria produces 1,978,286 tons annually, placing it in second place. With an estimated 1184.2 thousand tons produced year, Andhra Pradesh is the state that produces the most bhendi, followed by West Bengal (862.1 thousand tons). Bihar (788.3 thousand tons) follows. In 2017, Tamilnadu was recorded at 123.222 tons.

With the following precise goals in mind, the current study was conducted to examine the evolution of yield and growth performance of bhendi (okra) combined with liquid biofertilizers and organic manure under garden land conditions.

1. To study the role of organic manures in bhendi,
2. To study the growth and yield parameter in bhendi through various organic manures and liquid bio fertilizers etc.,
3. To study the economics for the various organic treatments.

MATERIALS AND METHODS

The experiments were conducted during summer season, 2023, at the Crop Research Farm, Department of Agronomy, Krishna College of Agriculture and Technology, Madurai which is located 9° 58' N Latitude, 77° 48'E Longitude and 218m altitude above mean sea level. The average temperature of the region is ranging from 26.3 to 37.3° C. The average annual rainfall is 950 mm. The relative humidity ranges from 72 to 75%. The experimental field was red loamy soil with pH 6.5, available nitrogen (231 kg ha^{-1}), available phosphorus (16 kg ha^{-1}) and available potassium (293 kg ha^{-1}). Randomized Block Design with replicated thrice, in the newly initiated organic farming trial. There were seven treatments involving different organic manures and liquid biofertilizers along with control (No organic manure). T_1-Control (RDF), T2-FYM @12t/ha + Azospirillum @1.25l/ha, T3-Vermicompost @ 5t/ha + Azospirillum @1.25l/ha, T4- Sheep Manure @5t/ha + Azospirillum@1.25l/ha, T5-FYM @ 6.5t/ha + Phosphobacteria @1.25l/ha, T6-Vermicompost @2.5t/ha + Phosphobacteria @1.25l/ha, T_7-Sheep manure @2.5t/ha + Phosphobacteria @1.25l/ha. The bhendi traditional variety of Pachaneela vendai was sown at 45 x 30 cm spacing were adopted. Observations recorded on plant height (cm), stem grith (cm), number of fruits/plants, fruits length, Number of leaves /plants, Number of seeds/fruit and fruit yield (kg/ha) was recorded. The data obtained on various parameters were tabulated and subjected to statistical analysis by the method suggested by Snedecor and Cochran (1967). The levels of treatment were compared by critical difference at 5% level of probability.

RESULTS AND DISCUSSION

Growth parameters

The Plant height differed significantly due to different organic sources. The maximum plant height (82 cm), stem girth (6.30 cm) and no of leaves/plant (16.67) was recorded at maturity stage from T_4-Sheep manure @5t/ha + azospirillum@ 1.25l/ha which was followed by the T_3-Vermicompost@5t/ha + azospirillum@ 1.25 l/ha were recorded in the plant height of (77.67 cm), stem girth (5.17 cm) and no of leaves/plant (11.67). The minimum plant height (58.67 cm), stem girth (5.17 cm) and no of leaves/plant (11.67) was recorded in (T_1 -Control RDF). Because of the sheep manure and Azospirillum application, the height of the plant significantly increased. Abhinav Miglani *et.al*. (2017), similarly conclude that the application of organic manure had positive effect on growth of bhendi.

Yield and yield parameters

The observations on yield and yield attributes of bhendi were statistically analyzed and have represented in table.1. The data revealed that application of Sheep manure @5t/ha + azospirillum@ 1.25l/ha (T_4) recorded the highest number of fruit /plant (5.67), No. of seeds/fruit (71.33), fruit length (20.23 cm), No. of seeds/plant (71.33) and fruit yield (4772.87 kg/ha) was recorded which was significantly followed by T_3-

Vermicompost @ 5t/ha + azospirillum @ 1.25l/ha were recorded the number of fruits/plants (5.33), No of seeds/fruit (68.33), fruit length (19.63 cm) and fruit yield (4372.46 kg/ha) was recorded. The beneficial effect of vermicompost on yield and yield attributes might be attributed to its ability to sustain availability of nutrient throughout the growing season. (Kondappa *et al.,* 2009; Sharma *et al.,* 2010 and Yadav and Yadav, 2010).

Bio fertilizers play an important role in transporting of available nutrient (N, P, K, Fe, Mg) from the soil into the plant through root system, promotes plant growth also enhance fruit size (Sajid *et al.,* 2013).The least no of the fruit /plant (3.33), No of seeds/fruit (46.33), fruit length (11.30 cm) and fruit yield (1352.22 kg/ha) was recorded in (T_1 - Control RDF). Plants only uptake essential nutrient and liquid bio-fertilizers enhances the Availability of NPK which boosts up crop yield (Din et al., 2007).

Table 1. Influence of different organic sources of plant height, stem girth, no of leaves/plant, no of fruits/plant, fruit length (cm), no of seeds per fruit & fruits yield(kg/ha) of bhendi

Treatments	Plant height (cm)	Stem girth (cm)	No of leaves/plant	No of fruits / plant	No of seeds/fruit	Fruit length (cm)	Yield (kg/ha)	Economics			
								Total cost of production (Rs./ ha)	Grass income (Rs./ ha)	Net Income (Rs./ ha)	BCR
T_1-Control	58.67	5.17	11.67	3.33	46.33	11.30	1352.22	10000	27044	17044	2.70
T_2-FYM@ 12t/ha + azospirillum@ 1.25l/ha	77.67	6.07	15.33	5.33	68.33	19.63	4372.46	13500	87449	73949	6.47
T_3-Vermicompost@5t/ha +azospirillum@ 1.25l/ha	75.67	5.67	13.33	4.00	64.00	18.43	4291.49	13500	85829	72329	6.35
T_4-Sheep manure @5t/ha +azospirillum@ 1.25l/ha	82.00	6.30	16.67	5.67	71.33	20.23	4772.87	13500	95457	81957	7.07
T_5-FYM @ 6.5t/ha + phosphobacteria@1.25l/ ha	74.67	5.33	12.33	4.33	57.00	15.77	2267.20	13500	45344	31844	3.35
T_6-Vermicompost @2.5t/ha + phosphobacteria@1.25l/ ha	68.33	5.17	14.67	3.33	51.67	14.43	2510.12	11000	50202	39202	4.56
T_7-Sheep manure @2.5t/ha + phosphobacteria@1.25l/ ha	70.33	5.20	11.33	3.67	49.67	14.30	1805.66	10500	36113	25613	3.43
S.Ed	2.99	0.17	1.07	0.64	1.50	0.40	170				
C.D	6.0	1.5	3.0	1.5	4.0	1.50	350				

*Fruit Rs.20/kg

ECONOMICS

Among the various treatments, T_4 - SheepManure @ 5t/ha + Azospirillum @1.25l/ha mixed well and broadcasted two days before sowing recorded the highest return rupee^{-1} invested of (7.07). Followed by T_2-FYM@12t/ha + Azospirillum @1.25l/ha was recorded the return rupee^{-1} invested of (6.47) while the least return rupee^{-1} invested of Rs. 2.70 was observed in the treatment (T_1 -Control RDF).

CONCLUSIONS

Based on the above findings, it is concluded that for obtaining highest profit from bhendi. Application of T4- Sheep Manure @ 5t/ha + Azospirillum @1.25l/ha can significantly gives highest no of leaves (16.67),stem girth (6.3cm),no of fruits/plant (5.67), no of seeds/fruit (71.33) , Length of the fruit (20.23 cm) and fruit yield (4772.87 kg/ha) was recorded respectively. The poultry manure plays an

important role in transporting of available nutrient (NPK) from the soil into the plant through root system. Bio fertilizers are promoting plant growth also enhanced the maximum growth and yield of bhendi with highest yield were obtained.

REFERENCE

[1] Abhinav Miglani, Navdeep Gandhi, Navjot Singh, Jasreen Kaur, (2017). Influence of Different Organic Manures on Growth and Yield of Okra. International journal of advance research in science and engineering. Volume 06(01). Pp: 886-892.

[2] Akash K., Elango.R, Parthasarathi.R and Kavinilavu.N (2022). Influence of Liquid Formulations on Growth and Yield of Bhendi Var. Arka Anamika. Indian Journal of Natural Sciences. Vol.13 / Issue 74.

[3] Din, M., Qasim, M. and Alam, M. (2007). Effect of different levels of N, P and K on the growth and yield of cabbage. Journal of Agricultural Research, 45: 171-176.

[4] Dorcas Olubunmi Ibitoye and Adesike Oladoyin Kolawole. (2022). Farmers' Appraisal on Okra [*Abelmoschus esculentus* (L.)] Production and Phenotypic Characterization: A Synergistic Approach for Improvement. Front. Plant Sci., 24 March 2022. Sec. Plant Breeding. Volume 13.

[5] FAOSTAT (2020). Food and Agricultural Organization Statistics. (assessed August 2020).

[6] Sajid A., Hafiz, U.J., Rana, N.R., Irfan A.S., Salman, M.N., Zeshan, M.S., Dawood, A.S. and Amjad, M.N. (2013). Foliar application of some macro and micro nutrients improves tomato growth, flowering and yield. International Journal of Biosciences, 3(10): 280-287

[7] Sonam Jadhav, S.J. Shinde and Kalyani D. Deshmukh. (2024). Effect of biofertilizer, liquid organic manures along with inorganic fertilizers combination on chlorophyll content, nutrient uptake and economics of okra (*abelmoschus esculentus l. Moench*). Plant Archives Vol. 24, No. 2, 2024 pp. 675-678.

[8] Kondappa, D., Radder, B. M., Patil. P. L., Hebsur, N. S., & Alagundagi, S. C. (2009). Effect of integrated nutrient management on growth, yield and economics of chilli (cv. Byadgi Dabbi) in a vertisol. Karnataka Journal of Agricultural Sciences, 22: 438-440

[9] Kumar, S., Dagnoko, S., Haougui, A., Ratnadass, A., Pasternak, N., and Kouame, C. (2010). Okra (*Abelmoschus* spp.) in West and Central Africa: potential and progress on its improvement. Afr. J. Agric. Res. 25, 3590–3359.

[10] Sharma, T. R., Pandey, A. K., Updhyaya, S. D., & Agrawal S. B. (2010). Effect of vermicompost on yield and quality of kharif season okra [Abelmoschus esculentus (L.) Moench]. Vegetable Science, 37(1-2): 181-183.

[11] Snedecor GW, Cochran, W. 1967. Statistical methods, Iowa state Univ., Ames.593.

[12] Yadav, S. S., & Yadav, N. (2010). Effect of integrated nutrient management on yield of okra in Zaid crop. Bhartiya Krishi Anusandhan Patrika, 25: 2-4.