Plant Archives Vol. 24, No. 2, 2024 pp. 675-678 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.2.094

EFFECT OF BIOFERTILIZER, LIQUID ORGANIC MANURES ALONG WITH INORGANIC FERTILIZERS COMBINATION ON CHLOROPHYLL CONTENT, NUTRIENT UPTAKE AND ECONOMICS OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH)

Sonam D. Jadhav*, S.J. Shinde and Kalyani D. Deshmukh

Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani - 431 402, Maharashtra, India.

*Corresponding author E-mail : sonamjadhav0123@gmail.com

(Date of Receiving-24-03-2024; Date of Acceptance-15-06-2024)

ABSTRACT

An experiment was conducted at Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during *kharif* 2019 to study the effect of *biofertilizer*, liquid organic manures *viz*., *Panchagavya*, *Vermiwash*, *Jeevamrit* and *Cow urine* along with inorganic fertilizers combination on chlorophyll content, nutrient uptake and economics of okra in the open field condition. The experiment was laid in *Randomized Block Design* with fifteen treatments replicated twice by using the variety *Parbhani Kranti*. Different concentration of liquid organic manures like *Panchagavya*, *Vermiwash*, *Cow urine* and *Jeevamrit* and biofertilizer like *Azospirillium* was applied through foliar spray and drenching at 15, 45 and 75 DAS along with RDF (N:P:K::100:50:50]. The observations on higher chlorophyll content, maximum nutrient content and benefit cost of ratio were recorded during the investigation. The higher chlorophyll content (52.80 SPAD units), maximum nutrient content N (2.67%), P (0.42%) and K (1.45%) were best with various organic liquid manures, *Azospirillum* along with recommended dose of fertilizers as compared to RDF alone. The economic study showed that, the minimum cost of production (Rs.128170 ha $^{-1}$) was required in the treatment of recommended dose of fertilizer (T_1) while, maximum gross monetary returns (Rs. 244425 ha^{-1}) was recorded in the treatment (T_{14}), net monetary returns (Rs. 110110 ha^{-1}) and highest benefit cost ratio (1.83) was recorded in the treatment (T_{12}) and it was followed by treatment (T_{13}). The result of the present investigation revealed that, for getting higher growth, yield, higher chlorophyll content, maximum nutrient uptake and more monetary returns from the okra crop grown in field condition, the crop should be supplied with application of *Azospirillum*, different organic liquid manures along with RDF (100:50:50 NPK kg/ha)

Key words : *Azospirillum*, Chlorophyll, Cow urine, Economics, Jeevamrit, Nutrient uptake, Okra, Panchagavya, Vermiwash.

Introduction

Okra (*Abelmoschus esculentus* L. Moench) is a fast growing, erect, herbaceous annual and belongs to the family Malvaceae. Okra is an economically important vegetable crop grown in tropical and sub-tropical parts of world. It is a warm season vegetable crop and it grows best in hot summer with minimum and maximum temperature 18ºC and 35ºC for cultivation as a garden crop as well as on large commercial farms. It is one of the most popular vegetable cultivated in India, commonly called as *bhendi* or lady's finger. It is popularly grown during rainy and summer season throughout India. It contain 2n=2x=132 chromosome. It has an origin in tropical or subtropical Africa. It has multiple uses, okra fruits are used as vegetable in India, Brazil, West Africa and many other countries. It has good nutritional value as 100 g consumable unripe fruit contains moisture 89.6 g, carbohydrates 6.4 g, protein 1.9 g, fat 0.2 g, fibre 1.2 g, minerals 0.7 g, vitamin A 88 IU, thiamine 0.07 mg, riboflavin 0.10 mg, nicotinic acid 0.60 mg and vitamin C

13 mg. The dry seeds of okra contain 14-23 % edible oil and 21-25% protein (Thamburaj and Singh, 2005). Oil from okra is used in soaps, cosmetic industry and as vanaspati, while protein is used for cattle feed preparation (Bini, 2003).

The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. The cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach of small and marginal farmers. The use of organic liquid products such as beejamrit, jeevamrit and panchagavya results in higher growth, yield and quality of crops. Theses liquid organic solution are prepared form cowdung, urine, milk, curd, ghee, legume flour and jaggary. They contain macro nutrients, essential micro nutrients, many vitamins, essential micro nutrients, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms (Palekar, 2006; Natarajan, 2007; Sreenivasa *et al*., 2010).

Continuous use of inorganic fertilizers resulted in deficiency of micronutrients, imbalance in soil physiochemical properties and unsustainable crop production. The increase cost of inorganic fertilizers, application of recommended dose is difficult to be afforded by the small and marginal farmers. Hence, renewable and low cost sources of plant nutrients for supplementing and complementing chemical fertilizers should be substituted, which can be afforded by majority of farming community. Integrated nutrient management would be a viable strategy for advocating judicious and efficient use of chemical fertilizers with matching addition of fermented liquid organic manure and biofertilizers to meet the nutrient requirement of crop would be an inevitable practice in the years to come for sustainable agriculture. The result of this research was helpful to identify the best biofertilizer, fermented liquid organic manures and recommended dose of fertilizer combination for maximum chlorophyll contain, nutrient uptake and benefit cost ratio of okra.

Materials and Methods

The investigation was carried out at the Department of Horticulture, Vansantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during the year 2019 in the month of July – October to know the effect of biofertilizer, liquid organic manures along with inorganic fertilizers on economic yield of okra. The experiment was laid out in randomized block design with 15 treatments and each replicated twice. The treatments involved were T_1 [Control (100:50:50 kg/ha)], T_2 [RDF + Vermiwash], T_3 [RDF + Jeevamrit], T_4 [RDF + Cow urine], T_5 [RDF + Panchagavya], T_6 [RDF + Biofertilizer], T_7 [RDF + Jeevamrit + Vermiwash], T_8 [RDF + Jeevamrit + Cow urine], T_9 [RDF + Jeevamrit + Panchagavya], T_{10} [RDF + Jeevamrit + Biofertilizer], T_{11}[RDF + Jeevamrit + Cow urine + Panchagavya], T_{12} [RDF + Jeevamrit + Cow urine + Biofertilizer], T_{13} [RDF + Jeevamrit + Vermiwash + Cow urine], T_{14} [RDF + Jeevamrit + Vermiwash + Panchagavya] and T_{15} [RDF + Jeevamrit + Vermiwash + Cow urine + Panchagavya + Biofertilizer]. The plot size was 3.0 m × 2.0 m and spacing followed by 60 cm × 30 cm. the land was brought to a fine tilth through ploughing and tillage. Irrigation channels and bunds were maintained properly.

The dibbling of seed directly in the open field condition, before dibbling the seed were treated with Beejamrit by dipping for 5 hrs. Light irrigation was given after sowing. Recommended dose of fertilizer (NPK) was applied before dibbling of seed. Recommended dose Nitrogen, phosphorus and potash were applied through urea, single superphosphate and muriate of potash, respectively at 100 kg N/ha, 50 kg P_2O_5/ha and 50 kg K_2O/ha. Application of full dose of Phosphorous, Potassium and half dose of Nitrogen were applied just before the dibbling of seed and remaining half dose of Nitrogen was just 30 days after sowing. Application of liquid organic manures *viz*., vermiwash (100 lit/ha), panchagavya (500 lit/ha) and cow urine (100 lit/ha) was applied through spraying at 15, 45 and 75 DAS, jeevamrit (500 lit/ha) was applied through drenching at 15, 45 and 75 days after sowing and application of *Azospirillum* (2.5 lit/ha) through drenching at 15, 45 and 75 days after sowing.

All cultural practices were followed regularly during crop growth and observations were recorded on plant analysis i.e. chlorophyll content (SPAD meter), nitrogen (%), phosporous (%), potassium (%) and economics.

- **Nitrogen content :** The nitrogen content in lettuce leaves was determined by Micro Kjeldhal's method (AOAC, 1990).
- **Phosphorus content :** The plant phosphorus was determined calorimetrically (yellow colour method) as described by Jackson (1973).
- **Potassium content :** The potassium content of plant sample was estimated using method described by Piper (1966) on Flame photometer.

The data generated during the investigation was subjected to statistical analysis to test the significance among the treatments on various characters of okra under study was done according to the procedure given by Panse and Sukhatmane (1985).

Results and Discussion

Plant analysis

The data on plant analysis as influenced by different treatments of liquid organic manures and inorganic fertilizers is presented in Table 1. The findings of the present study as well as relevant discussion have presented under the following heads.

Table 1 : Effect of biofertilizer, liquid organic manures along with inorganic fertilizers on plant analysis of okra.

Treatment no.	Chlorophyll content (SPAD units)	Nutrient content (%)		
		Nitrogen	Phosphorus	Potassium
T_1	45.78	2.18	0.18	1.26
T_2	48.26	2.31	0.22	1.30
T_3	48.52	2.26	0.21	1.30
T_4	49.94	2.23	0.20	1.29
T_5	48.91	2.28	0.22	1.31
T_6	48.18	2.29	0.23	1.32
T_7	50.70	2.42	0.26	1.35
T_8	51.02	2.33	0.24	1.34
T_9	50.25	2.37	0.25	1.37
T_{10}	51.58	2.40	0.26	1.36
T_{11}	52.54	2.53	0.34	1.41
T_{12}	52.80	2.52	0.35	1.40
T_{13}	51.81	2.54	0.34	1.40
T_{14}	52.56	2.58	0.37	1.42
T_{15}	52.30	2.67	0.42	1.45
SE ±	0.716	0.044	0.020	0.034
CD at 5%	2.193	0.135	0.061	0.103

Table 2 : Effect of biofertilizer, liquid organic manures and inorganic fertilizers combination on benefit cost ratio of okra.

Tr. no.	Yield/ha (q)	Operational cost (Rs./ha)	Gross returns (Rs. /ha)	Net returns (Rs. /ha)	B:C ratio
T_1	127.53	128170	191295	63125	1.49
T_2	140.16	133370	210240	76870	1.57
T_3	137.14	130720	205710	74990	1.57
T_4	131.15	128420	196725	68305	1.53
T_5	141.05	133570	211575	78005	1.58
T_6	139.59	128545	209385	80840	1.62
T_7	153.89	135920	230835	94915	1.69
T_8	144.90	130970	217350	86380	1.65
T_9	152.80	136120	229200	93080	1.68
T_{10}	152.44	131095	228660	97565	1.74
T_{11}	161.02	136370	241530	105160	1.77
T_{12}	160.97	131345	241455	110110	1.83
T_{13}	161.56	136170	242340	106170	1.77
T_{14}	162.95	141320	244425	103105	1.72
T_{15}	156.78	141945	235170	93225	1.65

Price of okra = 15 Rs kg^{-1}

Chlorophyll content

A critical examination of data in Table 1 revealed that application of biofertilizer, liquid organic manures along with recommended dose of fertilizer significantly increased the chlorophyll content of leaves of different treatments at 70 DAS over control. There was significant variation with respect to relative chlorophyll content of leaves.

The maximum value of chlorophyll content (52.80 SPAD units) was observed in treatment T_{12} [RDF + Jeevamrit + Cow urine + Biofertilizer] which was at par with treatments T_{15} (52.30 SPAD units), T_{13} (51.81 SPAD units), T_{14} (52.56 SPAD units), T_{11} (52.54 SPAD units), T_{10} (51.58 SPAD units), T_7 (50.70 SPAD units) and T_8 (51.02 SPAD units). However, the minimum value of chlorophyll content (45.78 SPAD units) was observed in T_1 [control].

The above results indicate that the application of organic liquid manures, *Azospirillum* along with recommended dose of fertilizer increased the chlorophyll content in leaves in treatment T_{12} over control. Fermented liquid organic manures contain microbial population and promote growth of plant in addition to nutrients which helps to increase chlorophyll content in leaves might have lead to increased photosynthesis activity which in turn have better growth attributes. The results are in conformity with those reported by Rakesh *et al.* (2017) in okra.

Nutrient content in plant

The okra plant was analyzed for major nutrient i.e. nitrogen, phosphorus and potassium content in plant (%) after harvest of the crop. The data related to nutrient content in plant of okra under the influence of different treatments are presented in Table 1.

Nitrogen content (%)

The treatment T_{15} [RDF + Jeevamrit + Vermiwash + Cow urine + Panchagavya + Biofertilizer] recorded maximum nitrogen content (2.67 %), which was statistically at par with treatments T_{14} (2.58%) and T_{13}

(2.54%). However, the minimum nitrogen content (2.18%) was recorded in treatment T_1 [control].

Phosphorus content (%)

The treatment T_{15} [RDF + Jeevamrit + Vermiwash + Cow urine + Panchagavya + Biofertilizer] recorded maximum phosphorus content (0.42 %) which was statistically at par with the treatment T_{14} [RDF + Jeevamrit + Vermiwash + Panchagavya] (0.37%). However, the minimum phosphorus content (0.18%) was recorded in the treatment T_1 [control].

Potassium content (%)

The treatment T_{15} [RDF + Jeevamrit + Vermiwash + Cow urine + Panchagavya + Biofertilizer] recorded higher potassium content (1.45%), which was statistically at par with treatments T_{14} (1.42%), T_{13} (1.40%), T_{12} (1.40%), T_{11} (1.41%), T_{10} (1.36%), T_9 (1.37%) and T_7 (1.35%). However, the minimum potassium content (1.26%) was recorded in treatment T_1 [control].

The above results indicated that the nutrient content *viz*., N, P and K in plant were significantly maximum in the treatment T_{15} [RDF + Jeevamrit + Vermiwash + Cow urine + Panchagavya + Biofertilizer]. The lowest nutrient content *viz*., N, P and K in plant were observed in the treatment T_1 [control]. This is because of maintained level of nutrient in plant tissue and might be due to biofertilizer, liquid organic manures along with recommended dose of fertilizer as they provide required quantity of nutrient for the growth and yield of crop. The results obtained similar with the reports of Chandrakala (2008) in chilli, Anisa (2011) in okra and Gore and Sreenivasa (2011) in tomato.

Economics parameter

Benefit cost ratio

The data from Table 2 revealed that, there were significant differences in benefit cost ratio among the different treatments under experimentation. Significantly maximum fruit yield (162.95 q/ha) was obtained under the treatment T_{14} [RDF + Jeevamrit + Vermiwash + Panchagavya]. The results indicated that the treatment T_{12} [RDF + Jeevamrit + Cow urine + Biofertilizer] recorded maximum net returns (400582.1 Rs) with the higher benefit cost ratio of (3.46). However, the lowest fruit yield (127.53 q/ha) and net returns (286722 Rs) with the minimum benefit cost ratio (2.79) were recorded in the treatment T_1 [control].

Conclusion

Based on present investigation the application of liquid organic manures (Vermiwash, Jeevamrit, Cow urine and Panchagavya), *Azospirillium* along with recommended dose of fertilizer was found useful for increase in early growth and higher yield of okra cv. Parbhani kranti which is due to resulted in maximum amount of chlorophyll content in leaves, higher amount of available nutrient content in plant and more monetary returns from okra crop than compared with RDF alone. The results are based on one season trial hence it is need to conduct two or more trials so that to achieve proper conclusion.

References

A.O.A.C. (1990). *Official Methods of Analysis*. Ed. 12, Association of Official Analytical Chemists, Washington, D.C.

Bini, N. (2003). Post-harvest quality evaluation of okra [*Abelmoschus esculentus* (L.) Moench]. *M.Sc. (Ag) thesis*, Kerala Agricultural University, Thrissur, 68p.

Chandrakala, M. (2008). Effect of FYM and fermented liquid manures on yield and quality of chilli (*Capsicum annum* L.). *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad (India).

Gore, N.S. and Sreenivasa M.N. (2011). Influence of liquid organic manures on growth, nutrient content and yield of tomato (*Lycopersicon esculentum* Mill.) in the sterilized soil. *Karnataka J. Agric. Sci*., **24(2)**, 153-157.

Jackson, M.L. (1973). *Soil Chemical Analysis*. Prentice, Hall of India Pvt. Ltd. New Delhi.

Natarjan, K. (2007). Pancagavya for plant. *Proc. Nation. Conf. Glory Gomatha*, Dec. 1-3, 2007, S. V. Veterinary Univ., Tirupati, pp. 72-75.

Palekar, S. (2006). *Shoonya bandovalada naisargika krushi*, published by Swamy Anand, Agri Prakashna, Bangalore, India.

Panse, V.G. and Sukhatme P.U. (1985). *Statistical Methods for Agricultural Workers*. Indian Council of Agriculture Research, New Delhi. pp: 199-216.

Piper, C.S. (1966). *Soil and Plant Analysis*. Asian Reprint, Hans Publication Bombay, India.

Rakesh S., Poonguzhali S., Saranya B., Suguna S. and Jothibasu K. (2017). Effect of panchagavya on growth and yield of *Abelmoschus esculentus* cv. Arka Anamika. *Int. J. Curr. Microbiol. App. Sci*., **6(9)**, 3090-3097.

Sreenivasa, M.N., Nagaraj M. Naik and Bhat S.N. (2010). Beejamruth: A source for beneficial bacteria. *Karnataka J. Agric. Sci*., **17(3)**, 72-77.

Thamburaj, S. and Singh N. (2005). *A text book of vegetables, tuber crops and spices*. Directorate of information and Publications of Agriculture, ICAR, New Delhi. pp. 76-77.