# EFFECT OF DIFFERENT ORGANIC NUTRIENT SOURCES ON YIELD QUALITY OF BHENDI AND SOIL PROPERTIES

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**Abstract:** A Field experiment was conducted in *kharif*, 2014 to evaluate the effct of organic and inorganic nutrient sources on soil nutrient status with okra as test crop on medium textured soil.Organic nutrient sources namely Vermicompost, Poultry manure and FYM were evaluated in combination with inorganic fertilizers on growth, yield and quality parameters of okra (bhendi) during *kharif*, 2014 at College Farm, College of Agriculture, Rajendranagar. The experiment was laid out in RBD with the treatments consisting of $T_1$ (control), $T_2$ (RDF), $T_3$ (50% $K_2O$ through MOP and 50% $K_2O$ through FYM), $T_4$ (50% $K_2O$ through MOP and 50% $K_2O$ through VC), $T_5$ (50% $K_2O$ through MOP and 50% $K_2O$ through PM), $T_6$ (75% $K_2O$ through MOP and 25% $K_2O$ through FYM), $T_7$ (75% $K_2O$ through MOP and 25% $K_2O$ through VC), $T_8$ (75% $K_2O$ through MOP and 25% $K_2O$ through PM), $T_9$ (100% $K_2O$ through FYM), $T_{10}$ (100% $K_2O$ through VC) and $T_{11}$ (100% $K_2O$ through PM).Highest fruit yield (7590 kg $ha^{-1}$), lowest crude fibre content (5.9%) and, highest crude protein content (10.8%) were observed in the treatment $T_4$. The study indicates that use of vermicompost an organic nutrient source as a component of integrated nutrient management improves not only yield but also quality of Bhendi. Available nutrient status in soil at harvest was high in the treatments with organic and inorganic combinations, with highest values of N and K recorded in $T_4$ (50% $K_2O$ as MOP + 50% $K_2O$ through Vermicompost). Highest P was recorded in $T_7$ (75% $K_2O$ as MOP + 25% $K_2O$ through Vermicompost).

**Keywords** : Bhendi, yield, quality parameters, Soil nutrient status.

**Introduction:** Environmental issues are capturing more and more of the world's attention, researchers and scientists are aiming at improving environmental quality through the adoption of improved techniques to reduce the impact on the environment. Pollution is becoming a serious problem in agricultural regions as large quantities of various mineral fertilizers and agrochemicals are being applied causing soil and human health problems. Hence alternative production techniques which employ biological or organic compounds for nutrient supply and pest control are needed (Turemis, 2002). Organic farming is not new to Indian farming community which is being successfully practiced in diverse climate, particularly in rainfed, tribal, mountains, hill and resource poor areas of the country and gaining wide attention among farmers, entrepreneurs, policy markers and agricultural scientists for varied reasons such as minimizing the dependence on chemical inputs (fertilizers, pesticides, herbicides and other agro chemicals).

Okra ***[Abelmoschus esculentus L.]*** is an annual herb and vegetable crop grown throughout the tropical and subtropical parts of the world. Okra plays an important role in the human diet by supplying carbohydrates, proteins, fats, minerals and vitamins that are usually deficient in the staple food. Having good nutritional value its yield and quality aspects are also important to be improved in the tropical countries. Making all the nutrient elements available is one of the most important factors for exploiting the yield potential and quality fruits as the imbalanced use of nutrients through chemical fertilizers application leads to deficiencies. Palm *et al.*, (1997) gave the importance of organic manures and inorganic fertilizers as essential tools in okra production. Organic waste from different sources helps in boosting vegetable crop growth and yield as they contain most of the nutrients essential for plant growth.

**Material And Methods:** A field experiment was conducted in the College farm, College of Agriculture, Rajendranagar, during *kharif*, 2014 with eleven treatments replicated thrice in RBD. The treatments consisted of $T_1$ (control), $T_2$ (RDF), $T_3$ (50% $K_2O$ through MOP and 50% $K_2O$ through FYM), $T_4$ (50% $K_2O$ through MOP and 50% $K_2O$ through VC), $T_5$ (50% $K_2O$ through MOP and 50% $K_2O$ through PM), $T_6$ (75% $K_2O$ through MOP and 25% $K_2O$ through FYM), $T_7$ (75% $K_2O$ through MOP and 25% $K_2O$ through VC), $T_8$ (75% $K_2O$ through MOP and 25% $K_2O$ through PM), $T_9$ (100% $K_2O$ through FYM), $T_{10}$ (100% $K_2O$ through VC) and $T_{11}$ (100% $K_2O$ through PM). Inorganic N, P and K were supplied through urea, single super phosphate and muriate of potash. Organic and inorganic nutrient sources were applied as per the treatments before the sowing of okra. . The nutrient composition of different organic nutrient sources used in this study were analysed as per the standard procedures and are presented in Table 1. Soil samples collected nitially and at harvest stages were analysed for pH,EC, soil organic carbon, available N, P and K as per the procedures outlined by Jackson (1973). Plant growth in terms of dry matter production was recorded at 30 DAS, 60 DAS and at harvest stages. Fruit weight per plant were recorded in all the 12 pickings and cumulative values are shown in results. Fresh fruit samples at harvest were analyzed for crude fibre and crude protein content.The results were statistically analysed as per the procedures outlined by Snedecor and Cochran (1967).

**Results And Discussion:**

**Dry Matter Production (kg ha$^{-1}$) :** At 30 DAS, 60 DAS and at harvest, highest dry matter production was recorded under $T_4$ (50% $K_2O$ through MOP and 50% $K_2O$ through VC) while remaining are on par with the treatment $T_2$ (RDF) and $T_3$ (50% $K_2O$ through MOP and 50% $K_2O$ through FYM) (Table 2).

| Table 1 : Physico- chemical and nutrient status of organic nutrient sources | | | |
|---|---|---|---|
| Characteristics | Vermicompost | Farmyard manure | Poultry manure |
| Physico-chemical properties | | | |
| a) pH | 7.3 | 7.1 | 7.7 |
| b) EC (dSm$^{-1}$) | 0.9 | 0.56 | 0.02 |
| Chemical properties | | | |
| a) Total OC (%) | 17.8 | 23.86 | 23.34 |
| Nutrient content | | | |
| b) Nitrogen (%) | 1.13 | 0.46 | 1.13 |
| c) Phosphorus (%) | 0.34 | 0.42 | 0.93 |
| d) Potassium (%) | 0.42 | 0.89 | 0.54 |

Increase in dry matter production of Bhendi with increased levels of N and K were reported by (Paramasivan et al., 2005 and Rani and Jose 2009). Bhendi has indeterminate growth and increased dry matter production was noticed with increase in age of crop. Apart from physiological behavior of crop, K nutrition also had influence on growth and development of crop even upto harvest which was responsible for increase in dry matter production of crop.

Significantly highest fruit yield (7590 kg ha$^{-1}$) was recorded in $T_4$ (50% $K_2O$ through MOP and 50% $K_2O$ through VC). This treatment however was on par with $T_2$ (RDF), $T_3$ (50% $K_2O$ through MOP and 50% $K_2O$ through FYM) and $T_5$ (50% $K_2O$ through MOP and 50% $K_2O$ through PM) which recorded the yield of 7580 kg ha$^{-1}$, 7470 kg ha$^{-1}$ and 7410 kg ha$^{-1}$ respectively (Table 3). All these treatments were significantly superior over other treatment combinations which in turn were on par with each other. Significantly lowest yield (6421 kg ha$^{-1}$) was recorded under $T_1$(Control). On an average percentage increase in yield was 18.2 in T4 as compared to control ($T_1$). K influenced the yield due to its direct or indirect involvement in major plant processes (photosynthesis, respiration, enzyme activation and mobilization) Raut (2011).

| Table 2 : Effect of Integrated Nutrient Management on Dry matter (kg ha$^{-1}$) Production in Bhendi at different crop growth stages | | | | |
|---|---|---|---|---|
| Treatments | | 30 DAS | 60 DAS | At harvest |
| T1 | Control | 180.0 | 970.0 | 1980.0 |
| T2 | RDF | 235.9 | 1365.0 | 2510.0 |
| T3 | 50% $K_2O$ through MOP + 50% $K_2O$ through FYM | 232.9 | 1360.0 | 2495.0 |
| T4 | 50% $K_2O$ through MOP + 50% $K_2O$ through VC | 236.9 | 1370.0 | 2520.0 |
| T5 | 50% $K_2O$ through MOP + 50% $K_2O$ through PM | 226.8 | 1330.0 | 2200.0 |
| T6 | 75% $K_2O$ through MOP + 25% $K_2O$ through FYM | 228.8 | 1340.0 | 2350.0 |
| T7 | 75% $K_2O$ through MOP + 25% $K_2O$ through VC | 231.8 | 1320.0 | 2150.0 |
| T8 | 75% $K_2O$ through MOP + 25% $K_2O$ through PM | 235.8 | 1310.0 | 2090.0 |
| T9 | 100% $K_2O$ through FYM | 227.6 | 1320.0 | 2150.0 |
| T10 | 100% $K_2O$ through VC | 230.9 | 1340.0 | 2350.0 |
| T11 | 100% $K_2O$ through PM | 228.3 | 1320.0 | 2150.0 |
| C.D (P = 0.05%) | | 25.4 | 209.6 | 294.8 |
| SE(m) | | 8.6 | 70.6 | 99.2 |

**Quality Parameters:**

**Crude protein (%):** Quality parameters of bhendi were presented in table 2. The highest crude protein content (10.8%) was observed in the treatment $T_4$ (50% $K_2O$ through MOP and 50% $K_2O$ through VC) and the lowest value (7.5%) was obtained in the treatment $T_1$ (Control). On an average percentage increase in crude protein content was 49.3 in T10 over control ($T_1$). The higher crude protein content in these treatments could be attributed to enhanced increase of nutrients from soil (Samlind Sujin and Sam Ruban, 2007, Rani and Jose 2009).

**Crude fibre (%):** The lowest crude fibre content (5.9%) was observed in $T_4$ (50% $K_2O$ through MOP and 50% $K_2O$ through VC) and the highest crude fibre (9.8%) was recorded in

**Table 3 : Effect of Integrated Nutrient Management on yield and quality parameters of Bhendi**

| Treatments | | Yield (kg $ha^{-1}$) | Crude protein (%) | Crude fibre (%) |
|---|---|---|---|---|
| T1 | Control | 6421 | 7.5 | 9.8 |
| T2 | RDF | 7580 | 7.9 | 9.6 |
| T3 | 50% $K_2O$ through MOP + 50% $K_2O$ through FYM | 7470 | 9.7 | 7.1 |
| T4 | 50% $K_2O$ through MOP + 50% $K_2O$ through VC | 7590 | 10.8 | 5.9 |
| T5 | 50% $K_2O$ through MOP + 50% $K_2O$ through PM | 7410 | 8.7 | 8.2 |
| T6 | 75% $K_2O$ through MOP + 25% $K_2O$ through FYM | 7190 | 9.4 | 7.5 |
| T7 | 75% $K_2O$ through MOP + 25% $K_2O$ through VC | 7130 | 10.5 | 6.4 |
| T8 | 75% $K_2O$ through MOP + 25% $K_2O$ through PM | 7120 | 8.3 | 8.6 |
| T9 | 100% $K_2O$ through FYM | 7210 | 10.1 | 6.8 |
| T10 | 100% $K_2O$ through VC | 7300 | 11.2 | 5.4 |
| T11 | 100% $K_2O$ through PM | 7190 | 9.1 | 7.8 |
| C.D (P = 0.05%) | | 190.9 | 0.99 | 1.15 |
| SE(m) | | 64.3 | 0.33 | 0.39 |

$T_1$ (Control). On an average percentage decrease in crude fibre content was 81.4% in T10 (100% $K_2O$ through VC), over control ($T_1$).

The crude fibre content was low in the treatments involving organic manures or INM. Low crude fibre content is considered to be desirable character. The decrease in crude fibre content can be due to the involvement of K in strengthening the thickness of cell wall. Similar decrease in crude fibre content with increased levels of N were obtained by Irene Velthamoni and Balakrishnan (1990).

**Table 4 : Effect of Integrated Nutrient Management on soil physico chemical properties at harvest**

| Treatments | | pH | EC ($dSm^{-1}$) | O.C (%) |
|---|---|---|---|---|
| T1 | Control | 7.7 | 0.18 | 0.28 |
| T2 | RDF | 7.8 | 0.21 | 0.32 |
| T3 | 50% $K_2O$ through MOP + 50% $K_2O$ through FYM | 7.6 | 0.2 | 0.34 |
| T4 | 50% $K_2O$ through MOP + 50% $K_2O$ through VC | 7.6 | 0.19 | 0.38 |
| T5 | 50% $K_2O$ through MOP + 50% $K_2O$ through PM | 7.5 | 0.2 | 0.34 |
| T6 | 75% $K_2O$ through MOP + 25% $K_2O$ through FYM | 7.5 | 0.2 | 0.34 |
| T7 | 75% $K_2O$ through MOP + 25% $K_2O$ through VC | 7.6 | 0.2 | 0.36 |
| T8 | 75% $K_2O$ through MOP + 25% $K_2O$ through PM | 7.5 | 0.19 | 0.34 |
| T9 | 100% $K_2O$ through FYM | 7.5 | 0.2 | 0.34 |
| T10 | 100% $K_2O$ through VC | 7.6 | 0.19 | 0.37 |
| T11 | 100% $K_2O$ through PM | 7.5 | 0.19 | 0.33 |
| C.D (P = 0.05%) | | N.S | N.S | N.S |
| SE(m) | | 0.108 | 0.015 | 0.021 |

Soil pH and EC were not significantly influenced by various organic and inorganic combinations of manures and fertilizers.

There was no significant effect of treatment on organic carbon content. Highest value of O.C was recorded in $T_4$ (50% $K_2O$ as MOP + 50% $K_2O$ through Vermicompost) and the lowest (0.28%) was observed in $T_1$ (Control). Sharma *et al.* (2005) reported that addition of organic manures increase the microbial activity in the soil which may increase the organic matter content in soils (Agbede et al. 2008).

Available N was affected significantly by different sources of nutrient supply. Maximum available N (200 kg $ha^{-1}$) was recorded under the treatment $T_4$ (50% $K_2O$ as MOP + 50% $K_2O$ through VC). However this was on par with all other treatment combinations except control ($T_1$) which recorded lowest available N (170 kg $ha^{-1}$) at harvest. The increase in the availability of nutrients in soil due to VC,PM and FYM application have been reported earlier by Vasanthi et al., (1995) and Mahamaheswari (1998),. The increase in availability of N in VC treated plots could be due to the fact that the combination of organic matter and its passage through gut of the earthworms subjects the material to breakdown of complex organic materials like proteins, nucleic acids and N containing organic compounds.

**Table 5 : Effect of Integrated Nutrient Management on soil available nutrient status at harvest (kg $ha^{-1}$)**

| Treatments | | Available N | Available P | Available K |
|---|---|---|---|---|
| T1 | Control | 170 | 42 | 267 |
| T2 | RDF | 190 | 48 | 357 |
| T3 | 50% $K_2O$ through MOP + 50% $K_2O$ through FYM | 192 | 46 | 374 |
| T4 | 50% $K_2O$ through MOP + 50% $K_2O$ through VC | 200 | 50 | 388 |
| T5 | 50% $K_2O$ through MOP + 50% $K_2O$ through PM | 192 | 47 | 342 |
| T6 | 75% $K_2O$ through MOP + 25% $K_2O$ through FYM | 190 | 52 | 318 |
| T7 | 75% $K_2O$ through MOP + 25% $K_2O$ through VC | 196 | 54 | 333 |
| T8 | 75% $K_2O$ through MOP + 25% $K_2O$ through PM | 190 | 50 | 311 |
| T9 | 100% $K_2O$ through FYM | 188 | 44 | 291 |
| T10 | 100% $K_2O$ through VC | 198 | 48 | 296 |
| T11 | 100% $K_2O$ through PM | 190 | 46 | 273 |
| C.D (P = 0.05%) | | 12.9 | N.S | 10.4 |
| SE(m) | | 4.3 | 4.0 | 3.5 |

**Available P and K:** Soil available P was significantly influenced by different treatments. In general slightly higher availability of P was noticed in the treatment combinations where part of the $K_2O$ was supplied through organic sources in combination with inorganic sources compared to RDF and control. The increase in availability of P could be attributed to higher level of phosphatase activity and increased mobilization of organic P in VC due to organic acid production in the gut of earthworm (Satchel 1983, Mahamaheswari, 1998 and Velthamoni and Balakrishnan, 1990) reported higher phosphotase activity in the worm cast resulting in increased level of P and higher mineralization of organic compounds containing P. Soil available K was affected significantly by different sources of nutrient supply. Highest available K (388 kg $ha^{-1}$) was recorded under the treatment $T_4$ which was superior to all other treatment combinations. This was followed by $T_2$(RDF), $T_3$ and $T_5$ which recorded 357, 374 and 342 kg $ha^{-1}$ respectively. Comparatively lower of available K was recorded in the treatment where 100% of K was supplied through organic sources viz., VC, FYM and PM. Significantly lowest available K (267 kg $ha^{-1}$) was noticed under the treatment $T_1$(Control). The increase in available K due to application of organic manures could be due to the release of organic acids which dissolved non-exchangeable K to water soluble and exchangeable forms and also due to the formation of organo K complexes of higher solubility.

**References:**


1. Agbede T M, Ojeniyi S O and Adeyemo A J 2008 Effect of poultry manure on soil physical and chemical properties, growth and grain yield of sorghum in southwest Nigeria. *American – Eurasian J. Sustainable Agric*. 2: 72-77.
2. Irene Velthamoni P and Balakrishnan R 1990 Studies on the influence of herbicide, nitrogen and mulching on the nutrient uptake of okra (*Abelmoschus esculentus* (L). Moench) cv. MDU.1. *Indian Journal of Horticulture*. 47 (2): 233-238.
3. Jackson M L 1973 *Soil Chemical Analysis*. Oxford IBH Publishing House, Bombay, 38.
4. Maheswari K M 1998 Nutrient Management in Bhendi (*Abelmoschus esculentus* (L.) Moench) involving Vermicompost. *M. Sc Thesis*. Acharya N G Ranga Agricultural University, Hyderabad.
5. Palm C A, Myer J K and Nandwa S M 1997 Combined use of organic and inorganic nutrient sources for soil fertility maintenance and replenishment. *Soil Science Society of America*, 51 : 93-217.

6. Paramasivan M, Jawahar D and Krishnamoorthi V V 2005 Effect of organic manures and inorganic fertilizers on yield and economics of okra (*Abelmoschus esculentus* (L). Moench.) in an alfisol of tambiraparani tract. *South Indian Horticulture*. 53 (1-6): 312-315.
7. Rani B and Jose A I 2009 Studies on the dynamics of potassium and magnesium in okra (*Abelmoschus esculentus* (L). Moench.). *The Proceedings of the International Plant Nutrition Colloquium XVI UC Davis*.
8. Raut D B, Donde M B and Gaikwad C B 2011 Effect of mulches and potash levels on yield and quality of rabi onion (*Allium cepa* L.). *Agric. Res. Technol*. 36 (3): 499-501.
9. Samlind Sujin G and Sam Ruban J 2007 Effect of different levels of nitrogen and spacings on crude protein (%) of amaranthus cv. CO. 3. *The Asian Journal of Horticulture*. 2 (1): 222-223.
10. Satchel J E 1983 Earthworm ecology from Darwin to vermiculture. Chapman and Hall, London.
11. Sharma R P, Sharma Akhilesh and Sharma J K 2005 Productivity, nutrient uptake, soil fertility and economics as affected by chemical fertilizers and farmyard manure in broccoli (*Brassica oleraceae var italica*) in an Entisol. *Indian Journal of Agricultural Sciences*. 75: 576-579.
12. Snedecor G W and Cochran W G 1967 *Statistical methods*. 6th Edition, Lowa state University Soil Analysis. Arner Society Agronomy Publisher.
13. Turemis N 2002 The effects of different organic deposits on yield and quality of strawberry cultivar. *Acta Hort*, 567: 507-510.
14. Vasanthi D, Rajamannar A and Kumaraswamy K 1995 Influence of vermicompost on the yield and fertility status of the soil under rice-rice cropping system. National Symposium on Organic Farming, MPKV, Pune. p.3.


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