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## Effect of different organic, bioenhancers and inorganic techniques on quality of okra (*Abelmoschus esculantus* L.)

**Krapal Singh Verma, Dr. SS Singh, Dr. SP Mishra, Dr. P Sirothia and Mahendra Jadia**

**Abstract**

The experiment was carried out to find out the effect of different organic, bioenhancers and inorganic techniques on growth and yield of okra. The treatment combinations involving three levels of organic manure i.e. 20 t FYM ha<sup>-1</sup>, 10 t vermicompost ha<sup>-1</sup> and 10 t goat manure ha<sup>-1</sup>, three levels of bio-enhancers i.e. Panchgavya (Foliar spray @ 3% at 30, 45, 60 and 90 DAS), Beejamrit (Seed treatment @ 10%) and Jiwamrit (500 lit./ha at each irrigation) and chemical fertilizers in three levels i.e. 0 (control), 100% RDF (100,60,80 NPK kg ha<sup>-1</sup>) and 50% RDF (50,30,40 NPK kg ha<sup>-1</sup>) were given in Kashi Pragati variety. Maximum dry weight of fruit (g), Fiber content in fruit (%), Ascorbic acid content in fruit (mg/g) and Iodine content in fruit (ppm) were observed by application of 10 t Vermicompost ha<sup>-1</sup>, Panchgavya (Foliar spray @ 3% at 30, 45, 60 and 90 DAS) and 100% RDF (100,60,80 NPK kg ha<sup>-1</sup>) at all the growth stages.

**Keywords:** Organic, bioenhancers, inorganic, quality, okra

**Introduction**

Okra [*Abelmoschus esculentus* (L.) Moench] has hold a key rank in vegetables it is preferred fruit vegetable cultivated richly in the subtropical, tropical and warm region of the world as India, Turkey, Africa and other neighbouring countries. In India, okra is a most prominent vegetable crop cultivated for its fresh soft green fruits during rainy and summer seasons. India is the biggest producer of okra ranked first (72.9%) in the world (Anonymous 2017a) [1]. There is still scope to expand the export to markets of GCC, EU and Singapore. Okra is widely cultivated in plans of the India. Okra crop occupying nearly 511 thousand hectares area, 5848.6 thousand metric tonnes production and 11.40 metric tonnes/ ha productivity (Anonymous 2017b) [2]. Okra crop covered 5.05% of total area and 3.46% of total vegetable production. In Madhya Pradesh total area under okra crop is 27.11 thousand hectares with production 342.05 thousand metric tonnes and productivity 12.62 metric tonnes/ ha (Anonymous 2017c) [3]. According to Aykroyd (1941) [4] 100g edible fresh and mature fruits contain 89.6% moisture and large number of chemical components including vitamin A, B and C (88 IU, 63 IU and 13mg respectively) besides minerals like carbohydrate 6.4g, protein 1.9g, fat 0.2g, fiber 1.2g, calcium 66mg, phosphorus 56mg and iron 1.5mg. It has ayurvedic and medical properties. The academic and applied researches emphasized that, lots of pesticides and fertilizer are used to increase production particularly in vegetable crops. The application of chemical fertilizers and pesticides in vegetable crops is hazardous for human health and environment. Among the bulky organic manures, the farm yard manure, goat manure, vermicompost and compost are the most commonly used for crop production. FYM is easily available and extensively used organic source of plant nutrient. Vermicompost is also seems to be very dynamic manure for quality and production of the crop. The combination of manures in addition with chemical fertilizers may be helpful to maintain the soil richness and health by increase content of organic carbon in soil for sustaining the productivity.

Use of Bio-enhancers is a new concept in organic agriculture. In fact these are biological preparations, prepared by animal & plant based residues through active fermentation over specific duration. The basic components are cow urine and cow dung. For enhancing their activities few more plant and cow products are incorporated. There are many bio enhancers, named by the developer who attempted their efficacy in crop production. Some of these bio enhancers are in common use are *Panchgavya*, *Jiwamrita*, *Amrit Pani*, *Bijamrita*, *Vermi wash* etc. In fact, these are ample source of microbial consortia, macro and micronutrients and plant growth regulators including immunity boosters. Bio enhancers are used to treat seedlings /

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seeds, enrich soil and develop better plant vigour. No doubt modern agriculture is rooted on the application of organic farming, which plays a major role for producing the good quality and higher yield in okra per unit area. There is a necessity to explore alternative sources of nutrient which could be inexpensive, easily available and eco-friendly so that growers may be able to lower the investment done on fertilizer along with maintaining suitable soil environmental conditions foremost to ecological sustainable farming.

### Method and Materials

A field experiment on different organic, bioenhancers and inorganic techniques on growth and yield of okra (*Abelmoschus esculantus* (L.) Moench) was carried out during *Kharif* season 2016 and 2017 at Mahatma Gandhi Chitrakoot Gramodaya Vishwa Vidyalaya, Chitrakoot, District Satna (M.P.). The research work was conducted in the Factorial Completely Randomized Block Design with three replications. Each replication was comprised of 27 treatment combinations. The treatment combinations involving three levels of organic manure i.e. 20 t FYM ha<sup>-1</sup>, 10 t vermicompost ha<sup>-1</sup> and 10 t goat manure ha<sup>-1</sup>, three levels of bio-enhancers i.e. Panchgavya (Foliar spray @ 3% at 30, 45, 60 and 90 DAS), Beejamrit (Seed treatment @ 10%) and Jiwamrit (500 lit./ha at each irrigation) and chemical fertilizers in three levels i.e. 0 (control), 100% RDF (100,60,80 NPK kg ha<sup>-1</sup>) and 50% RDF (50,30,40 NPK kg ha<sup>-1</sup>) were given in Kashi Pragati (VRO-6) variety. The climate of the region is semi-arid and sub-tropical having extreme winter and summer. During the winter months, the temperature drops down to as low as 2°C while in the summer months the temperature extend above 47°C, hot desiccating winds (Loo) are regular symptom during summers while, there may be infrequent spell of frost during the winter months. The soil of the investigation field was clay loam with good drainage and uniform texture with medium NPK status. Observations were recorded according to standard procedure on Dry weight of fruit (g), Fiber content in fruit (%), Ascorbic acid content in fruit (mg/g) and Iodine content in fruit (ppm).

### Result and discussion

Among quality parameters viz., dry weight of fruit, ascorbic acid content in fruit, fiber content % and iodine content (ppm) were studied in okra. Significantly maximum dry weight of fruit was noted in treatments O<sub>2</sub> (10 t VC ha<sup>-1</sup>) in both the year and pooled. The probable cause may be due to increased availability of nitrogen and phosphorus leads to increased okra dry matter yield of fruit. These results were corroborated with the findings of Nirmala and Vadivel (1999) [8] and Premsekhar and Rajashree (2009) [9]. In case of bio-enhancers, the treatment B<sub>1</sub> (Panchgavya Foliar spray @ 3% at 30, 45, 60 and 90 DAS) was recorded significantly maximum dry weight of fruit in both the year and pooled. Panchgavya combination is adjudged as the best organic nutrition practice for sustainability by its overall performance on growth, productivity, quality of crops. These results were corroborated with the findings of Vennila and Jayanthi (2008) [15] and Rajesh and Kaliyamoorthy (2013) [10]. As regards to chemical fertilizers, significantly maximum dry weight of fruit was obtained in treatment F<sub>2</sub> (100% RDF 100, 60, 80 kg NPK ha<sup>-1</sup>) in both the year and pooled. This may be due to application of major and minor nutrients, increased the photosynthetic

activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improving the plant growth ultimately dry weight of fruit. The findings are also in agreement with the findings of Gowed *et al.* (2002), Kumar *et al.* (2013) [10] and Kumar and Singh (2015) [6].

It was observed that treatments O<sub>2</sub> (10 t VC ha<sup>-1</sup>) had the significantly highest ascorbic acid content in fruit in both the year and pooled. Application of vermicompost might have the ability to increase the availability of other nutrients like nitrogen, phosphorus and potassium probably due to higher rate of mineralization and favorable condition for microbial and chemical activity, which in turn increased the N, P, K and ascorbic acid content in okra fruits. Another reason might be the increased activity of nitrate reductive enzymes which helped in synthesis of certain amino acids and protein as reported by Raj and Kumari (2001) [11]. In case of bio-enhancers, the treatment B<sub>1</sub> (Panchgavya Foliar spray @ 3% at 30, 45, 60 and 90 DAS) was recorded maximum ascorbic acid content in fruit in both the year and pooled. Panchgavya combination is adjudged as the best organic nutrition practice for sustainability by its overall performance on growth, productivity, quality of crops. These results were in close conformity with the findings of Sreenivasa *et al.* (2010) [13] and Rajesh and Kaliyamoorthy (2013) [10]. As regards to chemical fertilizers, significantly maximum ascorbic acid content in fruit was obtained in treatment F<sub>2</sub> (100% RDF 100, 60, 80 kg NPK ha<sup>-1</sup>) in first year and pooled. The accumulation of higher ascorbic acid content in the fruits might be correlated with the increased activity of nitrate reductase which helped in synthesis of certain amino acids and proteins. These results are also corroborated by the findings of Sharma *et al.* (2011) [12].

It was observed that treatments O<sub>2</sub> (10 t VC ha<sup>-1</sup>) had the significantly highest fiber content in both the year and pooled. Among organic sources could be attributed to better and balanced nutrition and production of growth promoting substances by organics which might have led to better quality like decrease in crude fiber content of fresh fruits. These results were corroborated with the findings of Raj and Kumari (2001) [11] and Premsekhar and Rajashree (2009) [9]. In case of bio-enhancers, the treatment B<sub>1</sub> (Panchgavya Foliar spray @ 3% at 30, 45, 60 and 90 DAS) was recorded maximum fiber content in both the year and pooled. Panchgavya combination is adjudged as the best organic nutrition practice for sustainability by its overall performance on growth, productivity, quality of crops. As regards to chemical fertilizers, significantly maximum fiber content was obtained in treatment F<sub>2</sub> (100% RDF 100, 60, 80 kg NPK ha<sup>-1</sup>) in both the year and pooled. These results were corroborated with the findings of Thirunavukkarasu and Balaji (2015) [14].

It was observed that treatments O<sub>2</sub> (10 t VC ha<sup>-1</sup>) had the significantly highest iodine content in both the year and pooled. In case of bio-enhancers, the treatment B<sub>1</sub> (Panchgavya Foliar spray @ 3% at 30, 45, 60 and 90 DAS) was recorded maximum iodine content in both the year and pooled. Panchgavya combination is adjudged as the best organic nutrition practice for sustainability by its overall performance on growth, productivity, quality of crops. As regards to chemical fertilizers, significantly maximum iodine content was obtained in treatment F<sub>2</sub> (100% RDF 100, 60, 80 kg NPK ha<sup>-1</sup>) in both the year and pooled.

**Table 1:** Effect of different organic manures, bio-enhancers and chemical fertilizers on quality of okra

Treatment	Average dry fruit weight (g)			Ascorbic acid content in fruit (mg/g)			Fiber content %			Iodine content (ppm)		
	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled
O <sub>1</sub> (20 t FYM/ha)	7.14	8.40	7.77	2.70	2.93	2.82	2.07	2.46	2.27	10.66	11.08	10.87
O <sub>2</sub> (10 t VC/ha)	8.19	10.06	9.12	2.88	3.08	2.98	2.30	2.93	2.62	12.96	13.58	13.27
O <sub>3</sub> (10 t GM/ha)	6.33	7.03	6.68	2.53	2.80	2.67	1.85	2.06	1.95	8.05	8.33	8.19
SEm ±	0.01	0.05	0.02	0.05	0.05	0.05	0.02	0.04	0.03	0.04	0.06	0.04
CD 5%	0.03	0.14	0.07	0.14	0.15	0.14	0.05	0.11	0.07	0.11	0.17	0.12
B <sub>1</sub> (Panchgavya (Foliar spray @ 3% at 30, 45, 60 and 90 DAS)	7.55	9.11	8.33	2.76	2.99	2.88	2.15	2.65	2.40	11.50	12.02	11.76
B <sub>2</sub> (Beejamrit (Seed treatment @ 10%)	6.90	7.92	7.41	2.65	2.89	2.77	2.00	2.35	2.18	9.71	10.09	9.90
B <sub>3</sub> (Jiwamrit (Applied with every irrigation @ 500 lit./ha)	7.20	8.46	7.83	2.70	2.93	2.82	2.07	2.46	2.26	10.47	10.89	10.68
SEm ±	0.01	0.05	0.02	0.05	0.05	0.05	0.02	0.04	0.03	0.04	0.06	0.04
CD 5%	0.03	0.14	0.07	N.S.	N.S.	N.S.	0.05	0.11	0.07	0.11	0.17	0.12
F <sub>1</sub> (Control)	5.92	6.42	6.17	2.42	2.72	2.57	1.71	1.90	1.81	6.72	7.01	6.87
F <sub>2</sub> (RDF (100,60,80 kg NPK /ha)	8.76	11.17	9.97	2.96	3.17	3.07	2.42	3.21	2.82	14.45	15.24	14.84
F <sub>3</sub> (50% of RDF (50,30,40 kg NPK /ha)	6.98	7.90	7.44	2.73	2.93	2.83	2.09	2.34	2.21	10.50	10.75	10.62
SEm ±	0.01	0.05	0.02	0.05	0.05	0.05	0.02	0.04	0.03	0.04	0.06	0.04
CD 5%	0.03	0.14	0.07	0.14	0.15	0.14	0.05	0.11	0.07	0.11	0.17	0.12

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