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## Integrated nutrient management on growth, flowering, yield and yield attributes of hybrid bitter gourd (*Momordica charantia* L.) VNR 22

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### Abstract

The present investigation was conducted at Fruit Research Station, Lal baugh. College of Agriculture, Junagadh Agricultural University, Junagadh during summer 2018 to find out the effect of inorganic and organic along with biofertilizers on growth, flowering, yield and yield attributes of bitter gourd. Experimental factors included N: P: K three levels (100, 75, 50 % RDF) alone or in integration with FYM or FYM + biofertilizers. The results clearly indicated plants treated with 100 % RDF of NPK + FYM 5 t/ha + Bio fertilizers 4 kg/ha (Azotobacter and phosphate solubilizing bacteria) had a beneficial effect on bitter gourd. The maximum vine length (284.44 cm), number of branches per plant (12.32), minimum days to first male (39.67 days) as well as female flower appearance (42.13 days), average node number of first female flower anthesis (24.47<sup>th</sup> node) and narrow sex ratio (3.09). the same treatment recorded maximum number of fruits per plant (20.63), fruit length (14.87 cm), fruit girth (50.82 mm), fruit weight (83.71 g), fruit yield per plant (1.72 kg), fruit yield per plot (15.20 kg), total fruit yield (5.65 t/ha) and minimum number of seeds per fruit (7.67). Application of 100 per cent NPK integrated with FYM and biofertilizers turned to be the best treatment for increasing growth, flowering, yield and yield attributes of bitter gourd.

**Keywords:** Bitter gourd, farm yard manure, NPK, biofertilizers, growth, flowering and yield

### 1. Introduction

Bitter gourd or balsam pear (*Momordica charantia* L.) is one of the commercially important cucurbitaceous vegetable crops. Bitter gourd is extensively grown throughout the country for its nutritive value and medicinal properties. Fruits contains rich in vitamin C 88 mg/100g, 0.61 mg iron, 20 mg calcium, 70 mg phosphorous, 126 µg carotene, energy 25 kcal, moisture 92.4 %, protein 1.6 g, fat 0.2 g and carbohydrates 4.2 g per 100 g of edible portion (Akter *et al.*, 2009). Bitter gourd is cultivated in an area of 98 thousand ha with a production of 1106 thousand MT, having productivity of 11.28 MT/ha (Anon., 2017).

Among the several factors related to vegetable production, nutrient management is one of the key factor for achieving higher yield and better quality of the crop. The use of high yielding crop varieties and chemical fertilizers has resulted in rapid increase in agricultural production system, at the same time indiscriminate use of chemical fertilizers will lead to widespread nutrient deficiency in soils, disturbed soil reaction, development of nutrient imbalance in plant, increased susceptibility to plant diseases, reduced soil organic matter, lesser occurrence of beneficial soil micro organism and increased environmental pollution as well as human health hazards. Organic manures supply important plant elements, both macro and micro. Apart from supplying plant nutrients, they favors aggregation of fine soil particles, thereby promoting good soil structure and it is also essential for healthy development of soil micro-organisms which further carry out biochemical transformations, play active role in decomposing organic matter and help in releasing the essential plant nutrients (Sureshkumar and Karuppaiah, 2008) [12]. Biofertilizers are microbial in origin and are useful in increasing yield, quality and production of crops when they are used in combination with organic manures and inorganic fertilizers in a balanced proportion (Kumar *et al.*, 2012) [6]. Thus, in this respect integrated nutrient management (INM) plays a vital role to maintain soil fertility, Efficient use of integrated plant nutrient supply system is a

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productivity of vegetable crops in ecologically sustainable manner (Sreenivas *et al.*, 2000) <sup>[11]</sup>. A judicious use of organic manures, chemical fertilizers and biofertilizers may be effective not only in sustaining crop productivity and soil health, but also in supplementing chemical fertilizers, requirements of the crops (Bahadur and Manohar, 2006 and Pandey *et al.*, 2009) <sup>[3, 7]</sup>. Hence this research work was carried out to investigate the effect of inorganic and organic along with biofertilizers on growth, flowering, yield and yield attributes of bitter gourd.

## 2. Materials and Methods

The field experiment was laid out in Randomized Block Design (RBD) with three replications involving ten treatments at Fruit Research Station, Lal baugh. College of Agriculture, Junagadh Agricultural University, Junagadh during summer 2018. This experiment includes ten treatments like 100 % RDF of NPK (60 : 60 : 60 kg/ha) (T<sub>1</sub>), 100 % RDF of NPK + FYM 5 t/ha (T<sub>2</sub>), 100 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha (T<sub>3</sub>), 75 % RDF of NPK (45 : 45 : 45 kg/ha) (T<sub>4</sub>), 75 % RDF of NPK + FYM 5 t/ha (T<sub>5</sub>), 75 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha (T<sub>6</sub>), 50 % RDF of NPK (30 : 30 : 30 kg/ha) (T<sub>7</sub>), 50 % RDF of NPK + FYM 5 t/ha (T<sub>8</sub>), 50 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha (T<sub>9</sub>), Absolute control (T<sub>10</sub>). Bitter gourd seeds of hybrid variety VNR 22 were sown at a spacing of 1.50 m × 2.0 m. The plot size was 7.50 m × 6.00 m and sowing was done during the summer 2018. To study the effect of integrated nutrient management we recorded observations on growth, flowering, yield and yield attributing traits like vine length of plant (cm), number of branches per plant, days to first male and female flower appearance, node number of first female flower anthesis, sex ratio, number of fruits per plant, fruit length (cm), fruit girth (mm), fruit weight (g), fruit yield/plant (kg), fruit yield/plot (kg) and total yield (t/ha) by selecting five plants randomly from each treatment and replications.

## 3. Results and Discussion

The results of the mean data in respect of growth, flowering,

yield and yield attributes as influenced by various treatment combinations are presented in Table 1 and Table 2.

### Effect of INM on growth characters of bitter gourd

Significantly highest vine length (284.44 cm) and higher number of branches per plant (12.32) were recorded in 100% RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha as against lowest vine length (199.73 cm) and number of branches per plant (6.73) recorded with control (Table 1). Enhancement of bitter gourd growth by the application of organic manure, inorganic fertilizers and biofertilizers has vital role in growth of plant. These fertilizers improved root system of plants resulting in it absorb more water and nutrients from soil and consequently they improved different plant organs and also entire plant. There is an enhancement of cell elongation and cell multiplication resulting in more vine length was reported by Sureshkumar and Karuppiah (2008) <sup>[12]</sup>, Prasad *et al.* (2009) <sup>[8]</sup>, and Triveni *et al.* (2015) in bitter gourd (Table 1).

### Effect of INM on flowering characters of bitter gourd

The minimum days to for male flower (39.67 days) and female flower (42.13) appearance were recorded by application of 100 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha which was significantly superior to all the other treatments. Significantly average node number of first flower anthesis (24.47<sup>th</sup> node) and narrow sex ratio (3.09) were recorded in same treatment (Table 1). Whereas maximum days and broad sex ratio were obtained with control. The possible reason for above might be due to stimulating effect of phosphorus on growth hormones which induce early flowering and earliness node number might be due to the enhanced production of growth substances like gibberellic acid, indole acetic acid, dihydrozeatin from biofertilizers which had positive influence on the physiological activity of plants which could assist the plants to induce female flower anthesis concurrent results are in agreement with the result of Sureshkumar and Karuppiah 2008 <sup>[12]</sup>, Baset Mia *et al.* 2011 <sup>[4]</sup>, Thriveni *et al.* 2015 <sup>[13]</sup>. Narrow sex ratio reported by Momin *et al.* 2013 (Table 1).

**Table 1:** Influence of INM on growth and flowering characters of hybrid bitter gourd

Tr. No.	Treatments	Vine length (cm)	Number of branches per plant	Days to first male flower appearance	Days to first female flower appearance	Average node no. of first female flower anthesis	Sex ratio
T <sub>1</sub>	100 % RDF of NPK (60 : 60 : 60 kg/ha)	270.05	10.30	44.62	47.53	28.27	3.25
T <sub>2</sub>	100 % RDF of NPK + FYM 5 t/ha	273.55	10.91	40.73	45.20	26.80	3.20
T <sub>3</sub>	100 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha	284.44	12.32	39.67	42.13	24.47	3.09
T <sub>4</sub>	75 % RDF of NPK (45 : 45 : 45 kg/ha)	263.33	9.40	47.33	49.13	28.47	3.54
T <sub>5</sub>	75 % RDF of NPK + FYM 5 t/ha	265.01	9.94	44.49	48.20	27.40	3.35
T <sub>6</sub>	75 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha	268.22	11.80	42.67	47.00	26.93	3.22
T <sub>7</sub>	50 % RDF of NPK (30 : 30 : 30 kg/ha)	255.52	8.20	46.87	50.73	30.33	3.88
T <sub>8</sub>	50 % RDF of NPK + FYM 5 t/ha	260.59	8.81	45.53	49.87	27.21	3.64
T <sub>9</sub>	50 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha	263.46	9.28	43.67	48.53	27.72	3.12
T <sub>10</sub>	Absolute control	199.73	6.73	50.68	55.67	32.62	3.97
	S.Em.±	10.556	0.716	1.895	2.257	1.184	0.199
	C.D. at 5%	31.36	2.13	5.63	6.71	3.52	0.59
	C. V.%	7.02	12.69	7.35	8.08	7.32	10.05

### Effect of INM on yield and yield attributes of bitter gourd

Fertility levels had significant response on yield attributes. The application of 100 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha produced maximum number of fruits per plant (20.63), highest fruit weight (83.71 g) and fruit yield (5.65 t/ha) (Table 2). The fruit yield depends mainly on the length of fruit, girth of fruit, fruit yield per plant (kg), fruit yield per plot (kg), and average weight of fruit. The highly suitability of INM treatment increased number of fruit might be due to combined effect of organic manure, inorganic fertilizer and biofertilizers which favourably influenced translocation of nutrient to the fruiting nodes results in higher fruiting. The increase in fruit length and girth might have been due to the diversion of photosynthates to reproductive organs and organic manure with biofertilizers provide a production of carbohydrates. In this situations, flow of assimilates to sink was high and might be a reason of higher

fruit length and girth (Prasad *et al.* 2009, Thriveni *et al.* 2015) [8, 13]. Higher yield of bitter gourd in the present study is also related to the influence of luxurious supply of nitrogen, phosphorus, potash, FYM and biofertilizers and their effect absorption which the various physiological and metabolic processes especially protein metabolism. The translocation of these nutrients to the fruiting nodes results in higher fruiting and fruit development and ultimately yield. Similar findings with respect to nitrogen and phosphorus on yield attributes were also reported by Pulak Bhunia Mandai (2009) [9] and Thriveni *et al.* (2015) [13] in bitter gourd, Saravaiya *et al.* (2012) [10] in pointed gourd, Kameswari and Narayanamma (2011) [5] in ridge gourd. Minimum results of yield attributing characters were obtained in control. Thus, the results of the present experiment are in a good agreement with the above mentioned findings.

**Table 2:** Influence of INM on yield and yield attributes of hybrid bitter gourd

Tr. No.	Treatments	Number of fruits per plant	Fruit length (cm)	Fruit girth (mm)	Fruit weight (g)	Fruit yield /plant (kg)	Fruit yield/plot (kg)	Total yield (t/ha)
T <sub>1</sub>	100 % RDF of NPK (60 : 60 : 60 kg/ha)	17.06	12.35	45.42	73.82	1.25	11.00	4.20
T <sub>2</sub>	100 % RDF of NPK + FYM 5 t/ha	18.08	14.49	46.83	77.19	1.39	12.73	4.32
T <sub>3</sub>	100 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha	20.63	14.87	50.82	83.71	1.72	15.20	5.65
T <sub>4</sub>	75 % RDF of NPK (45 : 45 : 45 kg/ha)	16.70	12.20	40.53	64.82	1.08	9.14	3.28
T <sub>5</sub>	75 % RDF of NPK + FYM 5 t/ha	17.50	13.82	44.86	66.42	1.17	10.15	3.97
T <sub>6</sub>	75 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha	18.17	14.39	47.49	77.89	1.41	12.88	4.72
T <sub>7</sub>	50 % RDF of NPK (30 : 30 : 30 kg/ha)	13.67	11.13	38.23	62.78	0.85	7.72	2.86
T <sub>8</sub>	50 % RDF of NPK + FYM 5 t/ha	15.98	12.13	42.12	67.55	1.08	9.38	3.60
T <sub>9</sub>	50 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha	18.36	13.40	46.03	72.91	1.33	12.09	4.42
T <sub>10</sub>	Absolute control	9.89	10.86	30.76	50.46	0.49	4.13	1.67
	S.Em.±	1.179	0.858	2.247	3.951	0.094	0.605	0.307
	C.D. at 5%	3.50	2.55	6.67	11.74	0.28	1.80	0.91
	C. V. %	12.30	11.47	8.99	9.81	13.85	10.03	13.76

### 4. Conclusion

Integrated nutrient management treatments rendered their significant effect on almost all the growth, flowering characters and yield attributing characters as well as fruit yield of hybrid bitter gourd VNR 22. Treatment consisted of 100 % RDF of NPK + FYM 5 t/ha + Biofertilizers 4 kg/ha recorded maximum performances with respect to almost all the characters. Treatment control was the lowest performer for the results of the said characters. So, keeping view on yield sustainability, balance in ecosystem, soil health improvement and good health of human beings it may be suggested that vegetable growers may supplement through the judicious and efficient use of organic, inorganic fertilizers and biofertilizers alone or in combinations.

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