

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.912.343>

Effect of Organic Manures and Inorganics Fertilizers on Growth and Yield of Bottle Gourd (*Lagenaria siceraria* Mol.) standl

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ABSTRACT

Keywords

Bottle gourd,
Organic (FYM,
Vermicompost,
Poultry manure,
Inorganic (NPK)

Article Info

Accepted:
18 November 2020
Available Online:
10 December 2020

The present experiment was carried out during August to October 2019 in Research field, Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in factorial Randomized Block Design (RBD), with 13 treatments, replicated thrice with organic (FYM, Vermicompost, Poultry Manure) & Inorganic (NPK) on bottle gourd. T₀ control [RND(RDF(120:60:60 Kg NPK) +20t + FYM), T₁ 100% RND through chemical fertilizer, T₂100% RDF + 10t vermicompost, T₃100% RDF + 5t poultry manure, T₄ 75% RDF + 25% through FYM, T₅ 75% RDF + 25% through FYM, T₆ 75% RDF + 25% through vermicompost, T₇ 75% RDF + 25% through poultry manure, T₈ 75%RDF + 25% through (vermicompost + poultry manure), T₉50% RDF + 50% through FYM, T₁₀ 50% RDF + 50% vermicompost, T₁₁ 50% RDF + 50% through poultry manure, T₁₂50% RDF + 50% through (vermicompost + poultry manure) from the present experiment, it is found that Treatment 12 combination of 50% RDF of NPK + 50% through (vermicompost + Poultry manure), was found best in terms of growth, yield and quality parameters of bottle gourd, followed by T₈ 75%RDF + 25% through (vermicompost + poultry manure). In terms of benefit cost ratio T₁₂ (1:3.28) was found maximum Whereas minimum B:C ratio was recorded in T₀(1:1.28) control [RND (RDF (120:60:60 kg NPK) +20t + FYM)].

Introduction

Bottle gourd *Lagenaria siceraria* Mol. Standl. (2n=22) is an important cucurbitaceous crop grown throughout the country. It is a warm season vegetable, which thrives well in warm and humid climate but it can be grown throughout the year in Northern India as offseason vegetable.

The young and tender fruit of bottle gourd are mostly used in rayata, halwa, petha etc. dry

shells of the mature fruits are used to make containers and musical instruments.

Vegetable are important nutritive component of the daily diet because their nutritive value as vital source of vitamins and minerals which has been well recognized.

Vegetable play an important role in the balance diet by providing not only energy but also supplying vita protective nutrition either mineral or vitamins. Thus, vegetables are

getting increasingly higher important in India as well as in the world due to their relevance in achieving nutritional security from emerging nutritional problems in human beings. Today, India is the second largest producer of vegetable in worlds after china.

According to recommendation given by India Council of Medical Research (ICMR) an average man with vegetarian or Non-vegetarian food habit should consume 300g vegetable per day, which includes 125mg leafy vegetable, 100g of root vegetable and 75g of other vegetable. In the year 2002, the total vegetable production of country was 97.5 million tonnes from 7.59 million hectares of land (Gupta *et al.*, 2010). In the country, vegetable crops are grown only in 2.8 percent of total cultivated land and share 10 percent of the world's vegetable production with productivity of 13.6 tha^{-1} , which is quite low as compared to other advanced countries.

All cucurbits are botanically 'pepo' belong to the family *cucurbitaceae*. These are used in the form of Salad Cucumber and long melon), Desert fruits (Musk Melon and Water Melon) cooked as vegetable (bottle gourd). Bitter gourd and sponge gourd) and preserved in the form of sweets (petha and pointed gourd). Cucurbits are the largest groups of summer seasons vegetable and extensively grown in tropical, subtropical and temperate zones of India. It has been important to man as a source of food and utensil since the down civilization. Biochemically the cucurbits are characterized by bitter.

Today agriculture is based on the use of inorganic manures, which play a major role for producing higher yield in per unit area. These are commonly used by most of the farmers because of quick availability of nutrient to the plant and easily available in market. Organic manures increase the organic

matter in the soil. They provide organic acids that help dissolve soil nutrients and make them available for the plants. Application of organic manures improves the soil fertility, soil structure and moisture holding capacity.

Integrated plant nutrient management is one of the recent methods of supplying nutrients to the plants by organic as well as inorganic means together to fulfil the nutrient requirements. At the same time the main aim of integrated plant nutrient management is to minimize the use of chemical fertilizers without sacrificing the yield. Composts, vermicompost, poultry manures, Farmyard manure (FYM) *etc.* are bulky organic manures, although supply low quality of major nutrients, but have potential to supply all essential nutrients for longer periods. Integrated plant nutrient management (IPNM) is the best approach for obtaining potential crop yield with less expenditure.

The optimum dose of nitrogen, phosphorus, and potassium vary greatly cultivar, geographical location and the environmental factors. These factors will have marked effect on the growth and yield parameters of bottle gourd. 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.

Materials and Methods

The experiment was conducted during rainy season of the year 2019 in Departmental research field of Department of Horticulture and Sciences, Prayagraj. The area is situated on the south of Prayagraj on the right bank of Yamuna at Rewa Road at a distance of about 6 km from Prayagraj city. It is situated at 25.8°N latitude and 81.50°E longitudes on elevation of 98 meters from the sea level.

The area of prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°C -48°C and seldom falls as low as 40C-50C. the relative humidity ranges between 20 to 94 percent. The average rainfalls in this area are around 1013.4 mm annually.

The experimental field has an even topography with a gentle slope and good drainage. The sample were drawn from each replication of experimental plot at 0-15cm depth before sowing of the crop and a composite sample was made to determine the physical and chemical properties of soil. The mechanical analysis of the sample soil was done with the half of Bouyoucos hydrometer (1952) method. It is evident from table 1 the soil of the experiment plot was sandy loam in texture, poor in phosphorus and rich in potash. The pH of the soil is slightly towards alkalinity.

Results and Discussion

The morphological, growth, yield and quality characteristics of the bottle gourd, namely vine length (m), number of branches per plant, days to first male flower appearance, days to first female flower appearance, days to first picking, average fruit length (cm), average fruit weight (g), diameter of the fruit (cm), number of fruits per plant, average yield (tonne/ha), TSS and vitamin C were affected by the combined application of FYM, NPK, Vermicompost and Poultry manure.

Application of these individual fertilizers without combination did not have significant increase of yield and related traits but with the great combination of fertilizers and organic manures had significantly increased yield in bottle gourd. The data related to various growth, yield and quality traits in bottle gourd are presented in Table 2 and that regarding

benefit cost ratio were presented in Table 3. Application of recommended dose of fertilizers along with 20 tonnes of FYM had showed the retorted growth, yield and quality of the bottle gourd compared to all other treatment combinations namely vine length (4.57m), number of branches per plant (7.88), average fruit length (25.7cm), average fruit weight (1.28g), diameter of fruit (14.57cm), number of fruits per plant (9.41), fruit yield per plant (12.03 kg), average yield (15.27tonnes/ha), TSS (2.65) and vitamin C (5.16 %). Whereas, highest vine length observed in case of T₁₂ followed by T₈ and T₉ but lowest vine length was observed in T₀ (control). These results are in consonance with Nagar *et al.*, 2017 and Nitin and Saravanan, 2019.

Impact of different nutrient treatment on growth characters of bottle gourd

Integrated management for nutritional balance had an important impact on all growth, yield and quality characteristics (Table 2). Significantly the highest vine length (7.46 m), number of branches per plant (12.44), were reported in 50 percent RDF + 50 percent through (vermicompost + poultry manure) (T₁₂) followed by vine length (7.39), number of branches per plant (12.31) in 75 percent RDF +25 percent through (vermicompost + poultry manure) (T₈) while the lowest vine length (4.57 m), number of branches per plant (7.88) were recorded in control (T₀). The mixture of NPK, vermicompost and poultry manure promotes root development by efficiently translocating growth-promoting compounds synthesized in plants, accompanied by increased absorption of nutrients. Due to the growth of large photosynthetic areas containing the largest vine length and a larger number of branches per plant, the rate of different physiological and biochemical processes increased. These findings are in agreement with Sangeetha *et al.*, (2018) in bitter gourd, Satish *et al.*, (2017)

and Das *et al.*, (2015).

Improved photosynthetic actions in a wide photosynthetic area resulted in better growth parameters this may be due to increased dose of fertilizer to boost the vegetative properties of bottle gourd. Balai *et al.*, (2017) and Nagar *et al.*, (2017) have reported comparable work on bottle gourd species. The combined application of inorganic and organic manures had a big impact on bottle gourd growth parameters. This was due to higher nutrient supply and increased organic manure along with inorganic fertilizer particularly nitrogen, which had a profound effect on the mobilization of nutrients from the unavailable nutrient form, primarily due to enhanced soil physical, chemical and biological properties. The use of organic manure may contribute to an increase in growth parameters, such as the length of the vine and the number of branches, which facilitates the rapid and increased availability of plant nutrients and thus provides a better environment for root

growth and proliferation. More adsorbent surface is also created for nutrient uptake.

Impact of different nutrient treatment on flowering characters of bottle gourd

The flowering traits like days to first male flower appearance and days to first female flower appearance have been presented in Table 2. The first and earliest male flower were appeared in T₁₂ (68 Days) (50% RDF + 50% through (Vermicompost + poultry manure) followed by T₈ (69 days) (75% RDF +25% through (vermicompost + poultry manure) and late male flowering was observed in T₀ (82 days) (control) while significantly minimum days to first and earliest female flower appearance was found in T₁₂ (72 days) followed by T₈ (74 days) whereas, maximum days taken for first male and female flower appearance (82.20 and 86.66 days, respectively) were with treatment combination of RDF of NPK and 20 tonnes of FYM (T₀).

Table.1 Treatment Combination details used in present experiment

Treatments symbols	Treatment combinations
T ₀	Control [RND (RDF (120: 60: 60 kg NPK) + 20t FYM]
T ₁	100% RND through chemical fertilizers
T ₂	100% RDF + 10t vermicompost
T ₃	100% RDF + 5t Poultry manure
T ₄	100% RDF + (5t vermicompost + 2.5t Poultry manure)
T ₅	75% RDF + 25% through FYM
T ₆	75% RDF + 25% through vermicompost
T ₇	75% RDF + 25% through poultry manure
T ₈	75% RDF + 25% through (Vermicompost + Poultry manure)
T ₉	50% RDF + 50% through FYM
T ₁₀	50% RDF + 50% through Vermicompost
T ₁₁	50% RDF + 50% through Poultry manure
T ₁₂	50% RDF + 50% through (Vermicompost + Poultry manure)

Table.2 Effect of organic manures and inorganic fertilizers on various growth, yield and quality related traits in Bottle gourd

s	Treatment combinations	Vine length (m)	No. of branches/ plant	Days to first male flower appearance	Days to first female flower appearance	Days to first picking	Avg. fruit length(cm)	Avg. fruit weight(g)	Diameter of fruit(cm)	No. of fruits per plant	Fruit yield per plant(kg)	Avg. Yield per t/ha	TSS	Vitamin C
To	Control [RND (RDF (120: 60: 60 kg NPK) + 20t FYM)]	4.57	7.88	82.2	86.66	88.58	25.7	1.28	14.57	9.41	12.03	15.27	2.65	5.16
T1	100% RND through chemical fertilizers	6.33	10.22	76.74	78.45	82.43	32.52	1.67	18.57	10.33	17.25	21.9	3.21	6.29
T2	100% RDF + 10t vermicompost	6.84	11.21	74.95	76.77	79.5	33.53	1.55	16.8	13.5	20.93	26.57	3.42	6.13
T3	100% RDF + 5t Poultry manure	6.44	11.61	73.54	75.52	79.53	31.46	1.47	16.05	19.42	28.62	36.34	4.08	6.47
T4	100% RDF +	5.84	11.21	72.02	74.25	78.48	30.42	1.41	20.04	14.51	35.13	44.61	3.75	5.49
T5	75% RDF + 25% through FYM	5.92	12.1	77.98	76.88	79.65	38.44	1.52	19.48	18.56	28.21	35.82	4.12	6.49
T6	75% RDF + 25% through vermicompost	6.69	12.01	71.78	75.38	79.77	35.49	1.54	19.19	16.55	26.01	33.03	3.85	6.78
T7	75% RDF + 25% through poultry manure	6.43	11.74	75.77	79.85	78.51	34.32	1.59	19.6	13.34	24.37	30.95	3.81	6.59
T8	75% RDF + 25% through (Vermicompost + Poultry manure)	7.39	12.31	69.39	74.25	78.4	41.54	1.79	20.23	23.51	35.78	45.43	4.36	7.1
T9	50% RDF + 50% through FYM	6.91	11.85	70.44	74.36	80.31	35.45	1.7	18.51	20.21	34.43	43.72	4.27	5.35
T10	50% RDF + 50% through Vermicompost	5.79	11.69	72.39	75.15	81.53	39.58	1.57	18.53	22.42	28.48	36.16	3.52	5.55
T11	50% RDF + 50% through Poultry manure	6.14	11.55	72.27	76.52	85.59	40.47	1.53	17.51	18.58	26.32	33.42	3.87	5.54
T12	50% RDF + 50% through (Vermicompost + Poultry manure)	7.46	12.44	68.72	72.45	78.37	42.48	1.83	21.08	25.43	36.14	45.89	4.79	7.26
	F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S
	C.D at 5%	0.645	1.753	1.358	0.561	0.3	0.218	0.132	0.972	0.296	2.458	3.122	0.282	0.376
	SEd (+)	0.313	0.849	0.658	0.272	0.145	0.106	0.06	0.471	0.143	1.191	1.513	0.137	0.182
	CV	6.018	9.149	1.094	0.43	0.22	0.364	4.997	3.122	1.011	5.362	5.362	4.377	3.62

Table.3 Benefit cost ratio of various treatment combinations in Bottle gourd cultivation

Treatments Symbols	Yield (t/ha)	Selling Rate (Rs/t)	Gross return (Rs/t)	Cost of cultivation (Rs.)	Net return (Rs/t)	Benefit cost ratio
T₀	15.27	8000	122160	95772	26388	1.280
T₁	21.9	8000	175200	122100	53100	1.430
T₂	26.57	8000	212560	162100	50460	1.310
T₃	36.34	8000	290720	97100	193620	2.990
T₄	33.42	8000	267360	125518	141842	2.130
T₅	35.82	8000	286560	117228	169332	2.440
T₆	33.03	8000	264240	165518	98722	1.600
T₇	30.95	8000	247600	102018	145582	2.430
T₈	45.43	8000	363440	1255118	237922	2.900
T₉	43.72	8000	349760	106728	243032	2.200
T₁₀	44.61	8000	356880	128936	227944	2.770
T₁₁	36.16	8000	289280	116436	172844	2.480
T₁₂	45.89	8000	367120	167228	199892	3.280

The reduction in days to male and female flower initiation was due to stimulating effect of phosphorus on growth hormones which induce early flowering (Singh and Ashrey, 2005). On the other hand, plants of the plots with addition of manure and bio-fertilizers along with inorganic fertilizers took comparatively lesser days for initiation of male and female flowers and minimum number of nodes at which first male and female flower appeared. Similar kind of result has been revealed in a study on integrated nutrient management in cucumber by Bindyia *et al.*, (2006), The present results are in harmony with the findings of Prasad *et al.*, (2009) and Suresh Kumar and Karuppaiah (2008) in bitter gourd and Singh and Teena Rani (2012) in bottle gourd. Maximum days taken for first male and female flower appearance (82.20 and 86.66 days, respectively) were with treatment combination of RDF of NPK and 20 tonnes of

FYM (T₀). The decrease in days for initiation of male and female flowers was due to the stimulating effect of phosphorus on growth hormones that induce early flowering (Singh and Ashrey, 2005). On the other hand, the plants of the plots with the addition of organic manures along with inorganic fertilizers, took comparatively fewer days for the initiation of male and female flowers. Similar results have been found in a study by Bindyia *et al.*, (2006) on integrated nutrient management in cucumber, which is consistent with the results of Prasad *et al.*, (2009) and Suresh Kumar and Karuppaiah (2008) in bitter gourd and Singh and Teena Rani (2012) in bottle gourd.

Impact of different nutrient treatment on yield and yield attributing characters of bottle gourd

Table 2 presents the yield attributing characters such as days of first picking,

average fruit length(cm), average fruit weight(g), fruit diameter (cm), number of fruits per plant, fruit yield per plant and average yield (t/ha) Maximum fruit length (42.48 cm), maximum fruit weight (1.83g), maximum fruit diameter (21.08 cm) and higher number of fruits per plant (25.00) in treatment T₁₂ (50 percent RDF + 50 percent through (vermicompost + poultry manure) showed a significant favourable change in yield attributes towards minimum days after first picking (78.00 days), higher fruit yield per plant (36.14 kg) and maximum yield per hectare (33.42t/ha). The different physiological and metabolic processes, particularly protein metabolism, are due to the luxurious supply of nitrogen, phosphorus, potash, vermicompost, FYM and poultry manure and their absorption effects (Sundararasu 2017).

The translocation to the fruiting nodes of these nutrients results in higher fruiting and fruit growth and yield. Similar findings with respect to nitrogen and phosphorus on yield attributes were also reported by Anjanappa *et al.*, (2012) and Thriveni *et al.*, (2015). When inorganic nutrient sources are applied in combination with FYM, vermicompost and poultry manure contribute favourably to plant growth by producing more carbohydrates. The flow of assimilates to sink was high in this situation and could be the reason for higher fruit size and fruit yield. In addition, fruit length and fruit diameter exercised positively on fruit weight under T₁₂ (Bahadur *et al.*, 2006).

Impact of different nutrient treatment on bottle gourd quality characteristics

In terms of Total Soluble Solid (TSS) treatment T₁₂ (50% RDF + 50% vermicompost + poultry manure) recorded maximum (4.79°Brix) TSS of fruit, followed by T₈ (75% RDF + 25% vermicompost &

poultry manure) with (4.36 °Brix) TSS of fruit, whereas minimum TSS of fruit (2.65°Brix) was recorded in treatment T₀ (control).

In terms of Vitamin C treatment T₁₂ (50% RDF + 50% vermicompost + poultry manure) recorded maximum (7.26%) Vit-C of fruit, followed by T₈ (75% RDF + 25% vermicompost & poultry manure) with (7.10%) Vit-C of fruit, whereas minimum vitamin c of fruit (5.16%) was recorded in treatment T₀ (control). These findings are in accord with Chaudhary *et al.*, (2019) and Imnatemsuet *et al.*, (2020).

Impact of different nutrient treatment on economic analysis (B:C ratio) of bottle gourd

In terms of economic analysis, maximum gross return Rs. 367120.00 and Net Return Rs. 199892.00 was recorded in treatment T₁₂ (50% RDF + 50% vermicompost + poultry manure) and maximum benefit cost ratio of 1:3.28 was recorded in treatment T₁₂ followed by treatment T₈ (75% RDF + 25% vermicompost & poultry manure) with 1:2.90 and minimum gross return, net return and cost benefit ratio (Rs. 122160.00, Rs. 26388.00 and 1:1.28 respectively) was recorded in treatment T₀ (Control, RDF + 20t FYM). These conclusions were also derived by Singh and Teena (2012) and Singh *et al.*, 2012.

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How to cite this article:

Medipalli Pravallika and Deepanshu. 2020. Effect of Organic Manures and Inorganics Fertilizers on Growth and Yield of Bottle Gourd (*Lagenaria siceraria* Mol.) standl. *Int.J.Curr.Microbiol.App.Sci.* 9(12): 2884-2892. doi: <https://doi.org/10.20546/ijcmas.2020.912.343>