



Integrated Nutrient Management in Bottle gourd [*Lagenaria siceraria* (Mol) Standl.] variety *Kashi Ganga* under Malwa condition of Madhya Pradesh

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ABSTRACT: The present experiment “Integrated Nutrient Management in Bottle gourd [*Lagenaria siceraria* (Mol) Standl.] variety *Kashi Ganga* under Malwa condition of Madhya Pradesh” was carried out during Kharif season of 2019 -2020 at the Horticulture Experimental Field, College of Agriculture, RVSKVV, Indore (M.P.). The objective of the trial is to study efficacy of soil amendment on growth, yield and quality traits. The experiment consist of 15 treatments and three replication under randomized block design. The treatment T10 (50% NPK+25% Vermicompost +25% Compost) was found significantly superior as compared to other of treatments in following characters like vine length(cm), length of internode /vine (cm), no of primary branches. Treatment T0 (No application of INM control) observed minimum as compares to other of treatments. The treatment T10 (50%NPK+25% Vermicompost+25%Compost) was found significantly good result in phenological characters like no of node /vine up to first male and female flowers, days to first appearance of male and female flower, Treatment T0 (No application of INM control) observed minimum as compares to other of treatments. The results regarding the yield parameters like days to first picking , avg. fruit weight at every picking (g) ,fruit length (cm) , fruit diameter (cm) , fruit yield /plot (kg), fruit yield (q/ha) number of seeds per pod, pod yield per plant(g) and pod yield (q/ha) were significantly affected by the application of different combination of integrated nutrient management. The maximum result was noted in treatment T10 (50% NPK + 25% Vermicompost + 25% Compost) However, minimum result was noted in T0 (No application of INM control).

KEYWORDS: Bottle gourd, *Lagenaria siceraria* (Mol) Stand, Nutrient, Treatment, Vermicompost, Yield Parameters.

INTRODUCTION

Bottle gourd [*Lagenaria siceraria*(Mol.)Standl.] belong to the family cucurbitaceae. It is originated from South Africa and has a chromosome number of $2n=22$. It is an important crop of India. It is cultivated in summer and rainy season throughout the India. It is an annual vine in warmer climate. The gourd is widely cultivated throughout the tropics especially in India, Srilanka, Indonesia, Mallaysia, Philippines, China, Tropical Africa and South America. The major growing states in the India are Uttar Pradesh, Punjab, Gujarat, Assam, Tamilnadu, Karnataka and Rajasthan. India occupy an area of 0.158 mha with production 2.67 million tonnes and productivity 16.8 t/ha (NHB 2017-18) [1]. It is highly nutritious crop contains, energy 21kal, protein 0.5, fat 0.19 gm, carbohydrate 5.2g, fiber 0.6g, p 34mg, Iron 2.4 mg, B carotene 25 ug, (Leghari *et al.*2014)[2]. As its seeds are good source of protein and oil. They are an excellent source of essential fatty acids, antioxidants, vitamins and sterols. They contain high level of vitamin E, A and C (Hassan *et al.* 2008) [3]. The tender fruits are also used to prepare sweets, rayata, and pickles. The dried shells of mature fruits are extremely hard and are used as containers, water jugs, domestic utensils, musical instruments floats of fishnets or ornamental items.

For increasing the production and productivity, excessive amount inorganic fertilizers are applied which in turn degrade the soil, environmental and affect the human body. Currently the main focus is to decrease the application of organic fertilizers for reducing production cost and environmental pollution. The use of organic manure with reduced quantity of inorganic fertilizers increase soil health, growth and yield of bottle gourd. Various organic sources like vermicompost, humic acid, biofertilizer, farm yard manure improved production and soil health and quality of produce. The Vermicompost is a nutritive organic fertilizer enriched microbiologically-active peat-like material and is commonly used for management of organic wastes by decomposition and humification of biodegradable organic wastes carried out by microbes present in the soil and gut of earthworms. Vermicomposts improve plant growth and development beyond that normally observed soil nutrient transformations and availability.

The humic acid which comprised of mixture of weak aliphatic and aromatic organic acid improved the soil fertility and increase the availability of nutrient that from the soil and consequently affect plant growth and yield of crop.



The biofertilizers is important to substitute of chemical fertilizers for health and production. Biofertilizer have ability to harness carbon, solar energy and atmospheric nitrogen to soil effectively to enrich soil for better plant growth. The farm yard manure (FYM) is most common manure in India. FYM is rich source of organic matter and able to replenish most of the macronutrients being taken up by crop. FYM is good source of different plant nutrients like N, P and K and judicious application of FYM along with inorganic nutrients might be helpful to obtain a good economic returns as well as for providing favorable conditions for subsequent crop. The benefit of integrated use of nutrients of nitrogen generally superior over use of each component separately. Plant needs nitrogen in large amount for the plant growth. Nitrogen plays an essential role in the composition of the proteins in plants. Since it is a major structural and functional factor for every plant, crop yields are highly dependent on N availability to the plant (Leghari *et al*, 2018) [4]. Phosphorous is essential for the normal development of the roots and reproductive organs (flowers, fruit, seeds). Phosphorus promotes strong early plant growth and development of a strong root system. It also promote new vegetative and fruiting tissues in bottle gourd. It sustain quality fruit production over a prolonged period. Potassium sources not only involved in the higher production, maintaining quality but also helps in the reduction of plant susceptibility to biotic and abiotic stresses (Min_Wang, *et al*, 2013 [5] and Oerke and Dehne (2004) [6]).

MATERIALS AND METHODS

The present experiment was conducted at the research farm of College of Agriculture, Indore. Indore is situated in the malwa plateau in western part of M.P. at 22° 43' N latitude and 75° 66' E longitudes with an altitude of 555.7m above mean sea level. Indore region comes under sub-tropical and semi-arid region, having temperature ranging from 29°C - 41°C maximum and 7°C- 23°C minimum in summer and winter season, respectively. Design of experiment was Randomized Complete Block Design (RCBD) with Number of treatments 15 having three replication. The details of experimental plan of present investigation as per proposed technical programme are given below:

Table 1: Treatments Detail of treatments

Symbol	Treatment
T ₀	No application of INM
T ₁	100% NPK
T ₂	100% Vermicompost
T ₃	100% Compost
T ₄	100% Biofertilizer
T ₅	100% Humic acid
T ₆	50% NPK+50% Vermicompost
T ₇	50% NPK+50% Compost
T ₈	50% NPK+50% Biofertilizer
T ₉	50% NPK+50% Humic acid
T ₁₀	50% NPK+ 25% Vermicompost+25% Compost
T ₁₁	50% NPK+25% Vermicompost+25% Biofertilizer
T ₁₂	50% NPK+25% Vermicompost+25% Humic acid
T ₁₃	50% NPK+16% Vermicompost+16% Compost+16% Humic acid
T ₁₄	50% NPK+16% Vermicompost+16% Compost+16% Humic acid+BF

The experimental field was thoroughly ploughed and cross ploughed with the help of mould board plough and harrowing was done with tractor, followed by planking and levelling to bring the field to good tilth. The seeds were sown uniformly in the shallow furrows at a depth of 3 to 4 cm, immediately after sowing the seeds were covered uniformly with moist soil. Two hoeing and weeding were done first at one month after sowing and second at 20 days after first weeding. The data collected on the following germination percentage, plant height, number of primary branches/plant, Days to first picking, Number of fruits per plant at every picking, Fruit length at every picking (cm), Fruit diameter at every picking (cm), Average fruit weight at every picking (g) were



recorded with the three selected plants for study. All the agronomic operation were practices as per recommended and treatments were applied on time.

Table 2. Fertility status of the soil

S. No.	Constitute	Value	Method of analysis
Physical analysis			
1.	Sand%	10.4	Bouyoucos hydrometer method (Piper 1950)[7]
2.	Silt %	35.5	Bouyoucos hydrometer method (Piper 1950)[7]
3.	Clay %	54.0	Bouyoucos hydrometer method (Piper 1950)[7]
Chemical analysis			
4.	Soil pH (1:2)	7.8	Glass electrode method (pH meter) (Piper, 1950)[7]
5.	Electrical conductivity (DSm-1) (1:2)	0.32	(Piper 1950)[7]
6.	Organic carbon %	0.76	Walkley and Black's rapid titration Method (Wakley and Black, 1934)[8]
7.	Available nitrogen (kg/ha)	210	Alkaline permanganate method (Subhiah and Asija, 1965)[9]
8.	Available phosphorus (Kg/ha)	12.6	Spectro Photometer Olsen's method (Olsen et al., 1967)[10]
9.	Available potassium (Kg/ha)	425	Flame photometer methods

Data Analysis: The data on various crop characters were subjected to statistical analysis by adopting appropriate method of analysis of variance as described by Fisher (1958)[11].

RESULTS AND DISCUSSION

Morphological characters of bottle gourd like germination percentage vine length (cm) number of primary branches/plant were observed of bottle gourd at 20, 40 and 60 DAS during the present section. There was significant effect of Integrated Nutrient Management on all successive stages of growth parameters recorded due to treatment T₁₀ (50%NPK+ 25% Vermicompost+25% Compost). It was followed by treatment T₆(50%NPK+50% Vermicompost). Minimum growth parameters were recorded under treatment T₀ (No application of INM). The increased growth parameter might be due to integrated nutrient application of different combination of organic and inorganic fertilizer (50%NPK+ 25% Vermicompost+25% Compost).

Table 3: Response of integrated nutrient management on germination percentage, vine length (cm), No of primary branches/plant, in Bottle gourd (2020).

Treatments	Germination (%)	Vine length 20DAS (cm)	Vine length 40DAS (cm)	Vine length 60DAS (cm)	No of primary branches/plant
T ₀ No application of INM(Control)	63.33	5.22	70.00	125.56	5.52
T ₁ 100% NPK	72.00	7.04	79.44	150.00	7.33



T ₂	100% Vermicompost	65.33	6.43	73.82	133.33	6.03
T ₃	100% Compost	67.00	6.50	78.33	143.89	6.29
T ₄	100% Biofertilizer	63.55	5.54	71.11	130.00	6.18
T ₅	100% Humic acid	70.67	6.62	77.78	150.00	6.70
T ₆	50% NPK+50% Vermicompost	84.67	9.67	101.11	180.00	9.50
T ₇	50% NPK+50% Compost	76.33	7.68	84.56	159.33	7.85
T ₈	50% NPK+50% Biofertilizer	66.33	6.26	76.56	137.22	6.00
T ₉	50% NPK+50% Humic acid	75.33	7.33	81.33	152.56	7.41
T ₁₀	50% NPK+ 25% Vermicompost+25% Compost	90.67	10.51	108.56	193.00	10.67
T ₁₁	50% NPK+25% Vermicompost+25% Biofertilizer	81.67	8.83	88.89	170.00	8.56
T ₁₂	50% NPK+25% Vermicompost+25% Humic acid	81.33	9.17	92.89	175.00	8.85
T ₁₃	50% NPK+16% Vermicompost+16% Compost+16% Humic acid	80.00	8.34	85.56	165.00	8.11
T ₁₄	50% NPK+16% Vermicompost+16% Compost+16% Humic acid+BF	71.00	6.90	80.44	150.67	7.07
	S.Em.±	2.02	0.24	2.66	4.48	0.35
	CD at 5%	5.87	0.70	7.71	12.98	1.03

Abbreviation used: INM (Integrated Nutrient Management), NPK(Nitrogen phosphorus potassium), BF(biofertilizer), CD(critical difference).

The organic and inorganic fertilizer applied in the form of Compost, Vermicompost and NPK might have enhance the soil chemical and physical properties and leading to the adequate supply of nutrient to the plant which might have promoted the maximum vegetative growth while the minimum plant growth was due to non availability of nutrients. Results are in conformity by Prabhu *et al.* (2006)[12] in cucumber with Thriveni *et al.*(2015)[13] in bitter gourd. Yield traits of bottle gourd like, days to first picking, average fruit weight, fruit length, fruit diameter, number of fruit/plant and fruit yield (t/ha) were recorded during the present investigation. There was significant effect of integrated nutrient management on all these yield parameters.

Table 4. Effect of integrated nutrient management on yield parameters such as days to first, second and third picking, Fruit length (cm) and Fruit diameter (cm), Average fruit weight (g) first, second and third picking (2020).

Treatments	Days to first picking	Days to second picking	Days to third picking	Fruit length (cm)	Fruit diameter (cm)	Avg. fruit weight (g) 1 st picking	Avg. fruit weight (g) 2 nd picking	Avg. fruit weight (g) 3 rd picking	
T ₀	No application of INM(Control)	65.00	71.00	76.67	25.12	14.06	342.22	361.11	353.33
T ₁	100% NPK	58.33	64.33	68.33	27.00	17.07	400.00	458.33	446.67
T ₂	100% Vermicompost	62.33	68.00	69.00	25.41	15.00	343.33	380.00	366.67
T ₃	100% Compost	59.00	66.00	71.67	26.00	15.70	378.89	400.00	390.00
T ₄	100% Biofertilizer	62.33	67.33	70.00	25.18	14.68	348.89	366.67	356.67
T ₅	100% Humic acid	58.00	65.33	69.67	26.29	16.11	406.67	500.00	413.33
T ₆	50% NPK+50% Vermicompost	57.33	62.33	66.00	30.00	19.40	688.33	701.67	701.33



T ₇	50%NPK+50% Compost	58.00	63.33	69.00	27.78	18.05	548.89	597.78	583.33
T ₈	50%NPK+50%Biofertilizer	61.00	67.00	70.33	25.85	15.38	376.67	396.67	383.33
T ₉	50%NPK+50%Humic acid	57.67	64.33	69.00	27.67	17.92	430.00	508.33	495.00
T ₁₀	50%NPK+25% Vermicompost+ 25% Compost	56.33	61.67	65.33	32.61	21.22	730.00	760.00	735.00
T ₁₁	50%NPK+25% Vermicompost+ 25% Biofertilizer	57.00	62.67	68.67	29.18	19.00	636.67	660.00	646.67
T ₁₂	50%NPK+25% Vermicompost+ 25% Humic acid	58.00	62.33	66.33	29.67	19.23	643.33	666.67	650.00
T ₁₃	50%NPK+16% Vermicompost+ 16% Compost+16% Humic acid	57.33	63.00	68.67	28.55	18.89	626.67	665.00	643.33
T ₁₄	50%NPK+16% Vermicompost+ 16% Compost+16% Humic acid+BF	57.67	64.67	69.00	26.52	16.18	426.67	450.00	436.67
	S.Em.±	0.79	1.65	1.31	0.86	0.58	14.01	21.99	17.66
	CD at 5%	2.82	3.39	3.82	2.51	1.68	40.58	63.70	51.18

Abbreviation used : INM (Integrated Nutrient Management),NPK(Nitrogen phosphorus potassium), BF(biofertilizer),CD(critical difference).

Table 5. Response of integrated nutrient management on yield parameters such as number of fruit /plant at every picking, Fruit yield (t/ha) (2020).

Treatments	No. of fruits/pla nt 1 st picking	No. of fruits/pl ant 2 nd picking	No. of fruits/p lant 3 rd picking	Fruit yield(t/ha)	Fruit yield(t/ ha)	Fruit yield(q/ ha)
T0 No application of INM(Control)	1.67	2.00	2.33	2.225	3.037	2.740
T1 100% NPK	3.00	4.00	4.33	4.222	4.888	4.444
T2 100% Vermicompost	1.33	3.00	3.33	2.666	3.407	3.259
T3 100% Compost	2.00	3.33	3.67	3.037	3.555	3.333
T4 100%Biofertilizer	1.00	2.67	2.67	2.296	3.259	2.888
T5 100%Humic acid	2.33	3.67	4.33	3.703	4.148	3.703
T6 50%NPK+50% Vermicompost	4.67	5.67	5.33	8.592	9.407	8.814
T7 50%NPK+50% Compost	3.67	4.67	5.00	6.074	7.037	6.740
T8 50%NPK+50%Biofertilizer	1.67	3.33	4.00	2.963	3.703	3.185
T9 50%NPK+50%Humic acid	3.33	4.33	5.33	3.777	5.703	5.259
T10 50%NPK+25% Vermicompost+25%Compost	5.67	7.00	6.67	9.333	10.370	9.777
T11 50%NPK+25% Vermicompost+25%Biofertiliz er	4.00	6.00	5.33	7.259	8.074	7.703
T12 50%NPK+25% Vermicompost+25%Humic acid	4.33	6.33	5.67	7.852	8.444	8.000
T13 50%NPK+16% Vermicompost+16%Compost +16%Humic acid	4.00	5.33	5.33	6.814	7.481	6.000



T14	50%NPK+16% Vermicompost+16%Compost +16%Humic acid+BF	2.67	3.67	4.00	3.777	4.444	3.926
	S.Em.±	0.34	0.42	0.39	2.99	1.54	3.26
	CD at 5%	0.99	1.24	1.15	8.68	4.46	9.45

Abbreviation used: INM (Integrated Nutrient Management), NPK (Nitrogen phosphorus potassium), BF(biofertilizer), CD(critical difference).

On the basis of data presented in the table 4 it is revealed that the maximum days taken to first picking, second and third picking was recorded in T₀ (No application of INM(Control) and minimum days to first picking was recorded in T₁₀ (50% NPK + 25% Vermicompost +25% Compost).It might have facilitated the adequate supply of nutrient to the soil making it available to the plants for early fruiting. These findings are in line with Arshad *et al.*(2014)[14] and Moharana *et al.*(2017) [15] in cucumber. Fruit length and fruit diameter were significantly affected by integrated nutrient management. Maximum fruit length was found in T₁₀ (50%NPK+25% Vermicompost + 25% Compost) while minimum was found in T₀ (No application of INM (Control) . The increment in fruit length might have been due to the diversion of photosynthates to reproductive organs. These results are also in consonance with Ghasem *et al.*(2014)[16] and Jilani *et al.* (2009)[17] in cucumber. Maximum fruit diameter was recorded in T₁₀ (50% NPK + 25% Vermicompost+25%Compost)(21.22cm).It might be due to higher accessibility of nitrogen in chemical fertilizer and organic manure that induced protein production which causes more meristematic cells and cell division that finally led to higher diameter. The minimum fruit diameter was found in T₀(No application of INM (Control). Similar findings are in line with Ghasem *et al.* (2014)[16] and Das *et al.* (2015)[18] in bottle gourd.

Significant effect in fruit weight of integrated nutrient management in different treatment combination of inorganic and organic nutrients. Maximum Weight of fruit (g) was recorded in T₁₀(50%NPK+25% Vermicompost + 25% Compost) and the minimum Weight of fruit (g) was observed in T₀(No application of INM(Control). This might be due to increase in phosphorus content of plant tissue, which results in proper formation of nucleic acids and due to cell division average fruit weight has increased and provides nutrients throughout the growth period. The findings of Jilani *et al.* (2009) [17] in cucumber and Arshad *et al.* (2014)[14]. Number of fruit per vine was significantly affected by integrated nutrient management in different treatment combination of inorganic and organic nutrients. The maximum number of fruit per vine was noted in T₁₀ (50% NPK + 25% Vermicompost + 25% Compost). While, the minimum number of fruit /vine was recorded in T₀ (No application of INM (Control). Effect of integrated nutrient management observed significant effect on fruit yield per plot (kg), fruit yield (q/ha). The maximum fruit yield per plot(kg), fruit yield (q/ha) was recorded in T₁₀(50% NPK + 25% Vermicompost +25% Compost). While the minimum was observed in treatment T₀ (No application of INM(Control).The maximum yield of bottle gourd might be due to improved growth parameter and better source-sink relationship which ultimately resulted in higher yield. These results are in line with the findings of Thriveni *et al.* (2017)[13] in bitter melon and Singh *et al.* (2012) [19] in bottle gourd.

CONCLUSION

The present investigation entitled “*Integrated Nutrient Management in Bottle gourd [Lagenaria siceraria (Mol) Standl.] variety Kashi Ganga under Malwa condition of Madhya Pradesh*” was conducted at the Department of Horticulture, College of Agriculture, Indore (M.P.) during the year 2019-2020. The present investigation was laid out in Randomized Block Design and fifteen treatment combinations were used with three replications. To study the germination percentage, plant height, number of primary branches/plant, days to first picking, number of fruits per plant at every picking, fruit length at every picking (cm), fruit diameter at (50%NPK+25% Vermicompost+25%Compost) was found significantly superior as compared to other treatments in following characters like vine length(cm), length of internode /vine (cm), no. of primary branches. Treatment T₀ (No application of INM control) observed minimum as compared to other treatments. The treatment T₁₀ (50%NPK+25% Vermicompost+25%Compost) was found significantly good result in phenological characters like no. of nodes /vine up to first male and female flowers, days to first appearance of male and female flower. Treatment T₀ (No application of INM control) observed minimum as compared to other treatments. The results regarding yield parameters like days to first picking, avg. fruit weight at every picking (g), fruit length (cm), fruit diameter (cm), fruit yield (t/ha) were significantly affected by the application of different combinations of



integrated nutrient management. The maximum result was noted in treatment T₁₀ (50% NPK + 25% Vermicompost + 25% Compost). However, minimum result was noted in T₀ (No application of INM control).

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