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Impact of Different Organic and Inorganic Fertilizers on Sustainable Production of Bottle Gourd [*Lagenaria siceraria* L.]

Satish Singh Baghel[1*], U. S. Bose[1] and S. S. Singh[2]

[1]JNKVV, College of Agriculture, Rewa- 486001 (M.P.)

[2]MGCGVV, Chitrakoot,Satna- 485334 (M.P.)

*Corresponding Author E-mail: rewahortic@gmail.com

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ABSTRACT

The present investigation was conducted on bottle gourd at progressive farmer's field located at Village- Khajua, Post- Mahsanw, Distt. - Rewa (M.P.) during spring- summer seasons of 2013 and 2014, to find out the Impact of different organic and inorganic fertilizers on sustainable production of bottle gourd (Lagenaria siceraria L.) cv. Pusa Naveen . The experimental material for the present investigation was comprised of sixteen treatments with three replications with spacing of 2.0 m × 0.5 m and of 4.0 m × 3.0 m of plot size. Present investigation clearly indicated the beneficial effect of integrated nutrient management on yield and growth characters of bottle gourd.The results revealed that the plants received 100% RDF of NPK + FYM @ 10 t ha^{-1} + Vermicompost @ 5 t ha^{-1} + Poultry manure @ 2.5 t ha^{-1} had a beneficial effect on bottle gourd viz., maximum vine length (183.09cm), number of nodes branch^{-1} (18.76), maximum length of internodes(11.10 cm), maximum no. of branches plant^{-1}(9.04). INM packages on Maximum fruit yield plot^{-1} (34.75 kg) and fruit yield ha^{-1} (463.31q) was found in the same treatment. Organic manures alone or in combination with inorganic fertilizer significantly hances vegetative growth of bottle gourd plants and substantially improves the fruit yield of the bottle gourd cultivars.

***Key words**: Bottle gourd, Vremicompost, Azospirillum, Poultry manure, FYM, Vine length.*

INTRODUCTION

The importance of vegetables in human nutrition is well known. Vegetables are rich and comparatively cheaper source of vitamins and minerals, which constitute an important component in human nutrition. Besides the nutritional value of vegetables, increased interest is being bestowed on the functional and therapeutic benefits of vegetables in human health. Vegetable consumption in sufficient quantities provides taste, palatability and increases appetite and provides fair amount of fibers. Cucurbit vegetables are fair source of thiamine and riboflavin. Bottle gourd is the leading vegetable crop of India, the higher yield and maximum returns make it the most preferred vegetable crop of Indian farmers.

Bottle gourd (*Lagenaria siceraria* L.) belongs to the family cucurbitaceae and locally known as 'Lauki' is an important gourd having wide range of uses and is largely cultivated in the tropics and subtropics for as vegetable, sweets, raita and pickles.

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It has cooling effect and prevents constipation and has diuretic and cardio-tonic properties. From nutritional point of view, bottle gourd can be considered as nutrition rich fruit vegetable. It contains considerable amount of water 96.1 g, carbohydrates 2.5 g, protein 0.2 g, fat 0.1 g, minerals 0.5 g, fiber 0.6 g, riboflavin 0.023 mg, vitamin 'A' 10 IU, Vitamin 'c' 11 mg, calcium 16 mg, Iron 0.4 mg, phosphorus 14 mg and energy 12 K cal per 100 g of edible fruit. Externally the pulp is applied as poultice and cooling application to the saved head delirium and also rubbed on the flat of the feat and hands to diminish the effect of heat. It helps against constipation, cough night blindness and function as antidote against certain poisons.

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 easy 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 fulfill 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, vermicomposts, 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 bio-fertilizers may be effective not only in sustaining crop productivity and soil health, but also in supplementing chemical fertilizers, requirements of the crops[1].

MATERIALS AND METHODS

The present experiment was conducted at progressive farmer's field located at Village-Khajua, Post- Mahsanw, Distt. - Rewa (M.P.) during spring- summer seasons of 2013 and 2014, The experiment was comprised of sixteen treatments with various combinations of nutrient management, applied to bottle gourd variety Pusa Naveen, included different level of applications of inorganic fertilizers, Organic manure (FYM, vermicompost and poultry manure) and bio-fertilizers (*Azospirillum*) as mentioned in Tables. The experiment was laid out in randomized block design (R.B.D.) with 3 replications of each treatment. Bottle gourd seeds were sown in the field at a spacing of 2.0 m × 0.5 m in plots of 4.0 m × 3.0 m size. Normal cultural practices and plant protection measures were followed during the cultivation process. Five plants were selected at random from each plot of each treatment as representative sample for recording the data. The pooled mean values of each treatment in each replication for individual observation were calculated.

RESULTS AND DISCUSSION

The results of the mean data in respect of growth (vine length, number of nodes branch^{-1}, length of internodes and no. of branches plant^{-1}) and fruit yield of bottle gourd, influenced by various treatment combinations are presented in Table 1 and 2.

Impact of different organic and inorganic fertilizers on growth characters of bottle gourd:

Significantly highest vine length (183.09 cm), maximum number of nodes branch^{-1} (18.76), maximum length of internodes (11.10 cm) and maximum no. of branches plant^{-1} (9.04) were recorded in 100% RDF of NPK + FYM @ 10 t ha^{-1} + Vermicompost @ 5 t ha^{-1} + Poultry

manure @ 2.5 t ha^{-1} as against lowest vine length (111.17cm) and minimum number of nodes $branch^{-1}$ (9.43), lowest length of internodes (4.58 cm) and minimum no. of branches $plant^{-1}$ (3.32) recorded with *Azospirillum* @ 2 kg ha^{-1} (Table 1). NPK, FYM, vermicompost and poultry manure mixture portably stimulates the root growth through efficient translocation of growth promoting substances synthesized in plant followed by enhanced nutrients absorption. Rate of various physiological and biochemical processes enhanced due to development of large photosynthetic areas comprising of wider leaf area and higher weight of branch was observed. The phenomena of increase in growth parameter might be due to better photosynthetic activities in wide photosynthetic area[2-3].

Vine length, number of nodes $branch^{-1}$, length of internodes and number of branches $plant^{-1}$ is a main and key trait that affects the number of fruits. More branches under higher N levels With T_{11} were mainly associated with a total vine length that ultimately affects the branches in a vine. The finding is agreement that increasing N level produced a greater vine length and number of branches compared to lower doses[4]. These beneficial effects of various sources of nutrients were also reported in pumpkin[5] and ridge gourd[6].

The bottle gourd growth parameters were strongly influenced by the combined application of Organic manure and fertilizer and yield highest with the combination. The bottle gourd plant had enough nutrients for rapid growth and development considering the composition of the organic manure which was incorporated into the soil during land preparation. It was observed that the higher the nutrients applied, the higher the values of these traits per plant. The vigorous growth in bottle gourd which was experienced during the growing period as evidenced in the growth parameters that nutrients from mineral fertilizers enhanced the establishment of crops while those from the mineralization of organic matter promoted yield when manures and fertilizers were combined[3].

Impact of different organic and inorganic fertilizers on yield of bottle gourd:

The fruit yield data have been presented in Table 2. A significant favorable change were recorded characteristic change in yield attributes towards higher fruit length (22.71 cm) and girth (8.68 cm) and fruit yield (463.31 q ha^{-1}) in the application of T_{11} (100% RDF of NPK + FYM @ 10 t ha^{-1} + Vermicompost @ 5 t ha^{-1} + Poultry manure @ 2.5 t ha^{-1}). The highest results found is due to luxury supply of nitrogen, phosphorus, potash, vermicompost, FYM and poultry manure and their effect absorption which the various physiological and metabolic processed especially protein metabolism . The translocation of these nutrients to the fruiting nodes results in higher fruiting and fruit development.

In application of inorganic sources of nutrients in combination with FYM, vermicompost and poultry manure lead the plant growth favorably with the production of more carbohydrates. In this situation, flow of assimilates to sink was high and might be the reason of higher fruit length. Besides, more length and girth of fruit under T_{11} exercised positively on fruit weight[6]. Yield is the manifestation of morphological, physiological, biochemical and growth parameters and is considered to result from the trapping and conversion of solar energy efficiency. Yield is polygenic in nature and is influenced by several factors (internal and external) throughout the crop growth period.

In the present study, the treatment with organics along with RDF, recorded significantly higher fruit yield. The reasons for increased fruit yield in bottle gourd was attributed to the increased solubilization effect and availability of nutrients by the addition of organic manure and increased physiological activity leading to the buildup of sufficient food reserves for the developing sinks and better portioning towards the developing fruits. Similar results were also reported in pumpkin[7]. Higher yield of bottle gourd in the present study is also related to the influence of combined effect of organic and inorganic fertilizers. Besides, quick availability of plant

nutrient from inorganic sources, balanced C/N ratio, enhanced the synthesis of photosynthates and production of hormone like substances IAA, GA, amino acids and vitamins resulted in quantitative yield might be due to its additive effect on vegetative growth of the crop ultimately affecting the yield. . The present results are in accordance with the findings in bitter gourd[8]; bottle gourd[9]; cucumber[6]; ridge gourd[10-11] and egg plant[12]. Minimum results of yield and yield attributing characters were obtained in the plots those received *Azospirillum* @ 2 kg ha^{-1}. Thus, the results of the present experiment are in a good agreement with the above mentioned findings.

Table 1: Impact of different organic and inorganic fertilizers on growth characters of bottle gourd

Sr.No.	Treatments	Vine Length (cm)	Number of nodes branch^{-1}	Length of internodes	No. of branches plant^{-1}
T_1:	Normal dose of NPK 120: 60: 60 kg ha^{-1}	118.81	9.63	7.24	5.43
T_2:	FYM@ 20 t ha^{-1}	123.70	10.32	7.36	5.48
T_3:	Vermicompost@10 t ha^{-1}	144.43	11.77	7.72	6.26
T_4:	Poultry manure@5 t ha^{-1}	131.84	10.46	7.63	5.86
T_5:	50% RDF of NPK + FYM @20 t ha^{-1}	127.89	10.14	7.50	5.67
T_6:	100% RDF of NPK + FYM@10 t ha^{-1} + Vermicompost@5 t ha^{-1}	173.58	16.16	9.14	7.65
T_7:	50% RDF of NPK + Vermicompost@2.5 t ha^{-1} + Poultry manure@1.25 t ha^{-1}	137.34	10.93	7.59	6.03
T_8:	100% RDF of NPK + FYM@5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	148.22	12.29	7.94	6.28
T_9:	100% RDF of NPK +FYM@5 t ha^{-1} + Vermicompost@10 t ha^{-1}	179.42	17.92	9.64	8.40
T_{10}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	165.02	14.98	8.95	7.27
T_{11}:	100% RDF of NPK + FYM@10 t ha^{-1}+ Vermicompost@5 t ha^{-1} + Poultry manure@2.5 t ha^{-1}	183.09	18.76	11.10	9.04
T_{12}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5t ha^{-1} + Poultry manure@1.25 t ha^{-1}	169.87	14.38	8.79	7.21
T_{13}:	50% RDF of NPK+ Vermicompost@10 t ha^{-1}	160.00	13.25	8.49	6.63
T_{14}:	100% RDF of NPK + Vermicompost@5 t ha^{-1}	164.34	13.85	8.67	6.79
T_{15}:	100% RDF of NPK + Vermicompost@2.5 t ha^{-1}	153.07	13.16	8.21	6.43
T_{16}:	Azospirillum@2 kg ha^{-1}	111.17	9.43	4.58	3.32
	SEm	3.11	0.34	0.19	0.19
	CD (P=0.05)	9.04	0.99	0.55	0.55

Table 2: Impact of different organic and inorganic fertilizers on Yield characters of bottle gourd

Sr.No.	Treatments	Fruit Yield Plot^{-1} (kg)	Fruit Yield (q ha^{-1})
T_1:	Normal dose of NPK 120: 60: 60 kg ha^{-1}	10.11	134.80
T_2:	FYM@ 20 t ha^{-1}	11.02	146.99
T_3:	Vermicompost@10 t ha^{-1}	15.61	208.11
T_4:	Poultry manure@5 t ha^{-1}	12.28	163.69
T_5:	50% RDF of NPK + FYM @20 t ha^{-1}	11.84	157.85
T_6:	100% RDF of NPK + FYM@10 t ha^{-1} + Vermicompost@5 t ha^{-1}	25.31	337.49
T_7:	50% RDF of NPK + Vermicompost@2.5 t ha^{-1} + Poultry manure@1.25 t ha^{-1}	12.59	167.82
T_8:	100% RDF of NPK + FYM@5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	15.81	210.81
T_9:	100% RDF of NPK +FYM@5 t ha^{-1} + Vermicompost@10 t ha^{-1}	28.33	377.72
T_{10}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	18.37	245.00
T_{11}:	100% RDF of NPK + FYM@10 t ha^{-1}+ Vermicompost@5 t ha^{-1} + Poultry manure@2.5 t ha^{-1}	34.75	463.31
T_{12}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5t ha^{-1} + Poultry manure@1.25 t ha^{-1}	19.51	260.18
T_{13}:	50% RDF of NPK+ Vermicompost@10 t ha^{-1}	17.48	233.08
T_{14}:	100% RDF of NPK + Vermicompost@5 t ha^{-1}	17.80	237.28
T_{15}:	100% RDF of NPK + Vermicompost@2.5 t ha^{-1}	16.44	219.23
T_{16}:	Azospirillum@2 kg ha^{-1}	8.56	114.11
	SEm	0.64	8.51
	CD (P=0.05)	1.86	24.74

CONCLUSION

Different organic and inorganic nutrient management treatments rendered their significant effect on almost all the growth, flowering characters and yield attributing characters as well as fruit yield of bottle gourd cv. Pusa Naveen. Treatment consisted of 100% RDF of NPK + FYM @ 10 t ha^{-1} + Vermicompos t@ 5 t ha^{-1} + Poultry manure @ 2.5 t ha^{-1} was found the best IPNM treatment for spring- summer bottle gourd production under northern plains of India. Treatment, *Azospirillum* @ 2 kg ha^{-1} 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 inorganic fertilizers or FYM, vermicompost and poultry manure, alone or in combinations.

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