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EFFECT OF INEGRATED NUTRIENT MANAGEMENT GROWTH AND YIELD OF BOTTLE GOURD [*LAGENARIA SICERARIA* STAND L.]

Satish Singh Baghel *et al.,*

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SATISH SINGH BAGHEL*, U. S. BOSE, S.S.SINGH AND T.S.DUDVEY
Department of Horticulture,
College of Agriculture, Jawaharlal Nehru Krishi Vishwavidhaylaya Rewa - 486 001 (M.P.)
e-mail: satishsinghbaghel682@gmail.com

ABSTRACT

The present investigation was conducted during 2013 and 2014 at Village- Khajua, Post-Mahsanw, Distt. - Rewa (M.P.), India, to find out the effect of organic manure, chemical fertilizers and bio fertilizers in an integrated manner for yield maximization and quality improvement in bottle gourd cv. Pusa Naveen. The experiment consisted of sixteen nutrient based treatment combinations, including different level of applications of inorganic fertilizers (Urea, single super phosphate and muriate of potash), organic manure (vermicompost, FYM, Poultry manure) and bio fertilizers (Azospirillum). Present investigation clearly indicated the beneficial effect of integrated nutrient management on yield and quality characters of bottle gourd. The plant was seen earliest days taken for male and female flower initiation (43.39 and 49.87 days respectively) was noted in 100% RDF of NPK + FYM@ 10 t ha^{-1} + Vermicompost@ 5 t ha^{-1} + Poultry manure@ 2.5 t ha^{-1}. IPNM packages on maximum fruit length (22.71 cm), fruit girth (8.68cm) and minimum pedicle length (7.58 cm) was found in Treatment 100% RDF of NPK + FYM@ 10 t ha^{-1} + Vermicompost@ 5 t ha^{-1} + Poultry manure@ 2.5 t ha^{-1}. Significantly maximum fruit yield ha^{-1}(463.31 q) were found in T_{11}. Keeping view on yield sustainability, balance in ecosystem, soil health improvement and good health of human beings.

***Corresponding author**

INTRODUCTION

Our demand of vegetable will be 250 million ton by 2020 AD (Singh, 2000), where as the expected production at present are about 160 million ton and annually 0.8% of agricultural land being usurped for urbanization (Kar, 2002). Vegetables are rich and comparatively cheaper source of vitamins and minerals. 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. Many factors related to vegetable production, nutrient management is one of the key factor for achieving higher yield and better quality of the crop. Modern 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. In India during the past three decades, intensive agriculture involving exhaustive yielding varieties has led to heavy withdrawal of nutrients from the soil. It is also considered that their indiscriminate usage may also cause environmental pollution problem, soil sickness, reduce the microbial activities and availability of essential nutrients and deteriorate the product quality. Organic manures increase the organic matter in the soil. Organic matter in turn releases the plant food in available form for the use of crops. However, organic manures should not be seen only as carriers of plant food. These manures also enable a soil to hold more water and also help to improve the drainage in clay soils. 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. Composts, vermicomposts, poultry manures, FYM etc. are bulky organic manures, although supply low quality of major nutrients, but have potential to supply all essential nutrients for longer periods. It improves physico- chemical and biological properties of the soil such as soil structure, water holding capacity and soil microbial population (Kale *et al*., 1998). 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 (Pandey *et al*., 2009). Keeping in view the above discussed facts and due to lack of sufficient information on INM in bottle gourd particularly in Vindhya state, the present experiment was undertaken to find out the combined effect of organic manure, chemical fertilizers and bio fertilizers in an integrated manner for yield maximization in bottle gourd and study the effect of integrated nutrient management on the quality characters of bottle gourd fruit.

MATERIALS AND METHODS

This present experiment was conducted at Village- Khajua, Post- Mahsanw, Distt. - Rewa (M.P.) for two spring-summer seasons of 2013 and 2014. The soil of experimental site is clay loam in nature with around 0.58% organic carbon, 218 kg ha^{-1} total nitrogen, available phosphorous 21.23 kg ha^{-1}, available potassium 435.5 kg ha^{-1} and pH 6.5. The experimental site is under subtropical region with range of average temperature of 36.19^{0}C (max.) to 17.91^{0}C (min.) and average relative humidity (R.H.) of 66.78% during the experimental period (February to June) of both the years. The experiment was consisted of sixteen treatments with various combinations of nutrient management, applied to bottle gourd variety Pusa Naveen, included different level of applications of inorganic fertilizers (Urea, single super phosphate and muriate of potash), organic manure (vermicompost, FYM, Poultry manure) and bio fertilizers (Azospirillum). 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 × 1.5 m in plots of 4.0 m × 3.0 m size. Normal cultural practices and plant protection measures were followed during the cultivation process. Two plants were selected at random from each plot of each treatment as representative sample for recording the data.

RESULTS AND DISCUSSION

Effect of different nutrient management on flowering characters of bottle gourd

Bottle gourd plants required minimum days taken for first male flower (43.39 days) and first female flower anthesis (49.87 days) were recorded in T_{11} (100% RDF of NPK + FYM@ 10 t ha^{-1} + Vermicompost @ 5 t ha^{-1} + Poultry manure@ 2.5 t ha^{-1}) during both the years as well as pooled analysis which was significantly superior to all the other treatments, but was on a par with T9. Maximum days taken for first male and female flower appearance were with treatment T_{16} (Table 1). The possible reason for above might be due to fact that balance dose of NPK and FYM + vermicompost + poultry manure. Increased growth with higher photosynthetic area for more production and translocation of photoassimilats which ultimately delayed the reproductive phase. Similar results were also reported by (Rajput and Pandey, 2004).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 Asrey 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. Similar kind of result has been revealed in a study on integrated nutrient management in cucumber by Bindyia *et al*., (2006) where they observed that combined application of vermicompost (2 t ha^{-1}) + 50 % RD of NPK (50:30:30 Kg ha^{-1}) + Azotobacter and PSB each at 5 kg ha^{-1} showed earliness and took lesser number of days for 50% flowering. Early flowering may be due to integration effect as vermicompost have soil microbes, nitrogen-fixing bacteria, phosphate solubilizing bacteria and growth hormones like auxine, gibberlines and cytokinins which influence and enhance efficiency of nitrogen greater than that of chemical fertilizer which influence early flowering. The present results are in accordance with the findings of Prasad *et al.,* (2009) in bitter gourd, Suresh Kumar and Karuppaiah (2008) in bitter gourd and Singh and Rani T (2012) in bottle gourd. From these reports, it is evident that the results of the present investigation are well supported by the findings of the earlier research workers.

Effect of different nutrient management on yield attributing characters of bottle gourd:

A significant favorable change were recorded characteristic change in yield attributes towards higher fruit length (22.71 cm) and fruit diameter (8.68 cm) and lowest pedicel length (7.58 cm) T_{11} (100% RDF of NPK + FYM@ 10 t ha^{-1} + Vermicompost@ 5 t ha^{-1} + Poultry manure@ 2.5 t ha^{-1}) (Table

Table 1: Effect of different IPNM Packages on flowering characters of bottle gourd

S.No.	Treatments	Days to first male flower initiation	Days to first female flower initiation
T_1:	Normal dose of NPK 120: 60: 60 kg ha^{-1}	53.93	54.72
T_2:	FYM@ 20 t ha^{-1}	53.38	53.97
T_3:	Vermicompost@10 t ha^{-1}	52.23	52.95
T_4:	Poultrymanure@5 t ha^{-1}	53.03	53.44
T_5:	50% RDF of NPK + FYM @20 t ha^{-1}	51.32	53.66
T_6:	100% RDF of NPK + FYM@10 t ha^{-1} + Vermicompost@5 t ha^{-1}	46.95	51.27
T_7:	50% RDF of NPK + Vermicompost@2.5 t ha^{-1} + Poultrymanure@1.25 t ha^{-1}	54.43	53.25
T_8:	100% RDF of NPK + FYM@5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	51.04	52.55
T_9:	100% RDF of NPK +FYM@5 t ha^{-1} + Vermicompost@10 t ha^{-1}	44.14	50.95
T_{10}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	44.23	51.69
T_{11}:	100% RDF of NPK + FYM@10 t ha^{-1}+ Vermicompost@5 t ha^{-1} + Poultry manure@2.5 t ha^{-1}	43.39	49.87
T_{12}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5t ha^{-1} + Poultrymanure@1.25 t ha^{-1}	49.52	51.54
T_{13}:	50% RDF of NPK+ Vermicompost@10 t ha^{-1}	51.63	52.09
T_{14}:	100% RDF of NPK + Vermicompost@5 t ha^{-1}	50.62	51.84
T_{15}:	100% RDF of NPK + Vermicompost@2.5 t ha^{-1}	51.46	52.38
T_{16}:	Azospirillum@2 kg ha^{-1}	56.69	58.20
	SEm	1.02	0.73
	CD (P=0.05)	2.96	2.13

Table 2: Effect of different IPNM Packages on yield and yield attributing characters of bottle gourd

S.No.	Treatments	Fruit length (cm)	Fruit girth (cm)	Pedicle length (cm)	Fruit yield (q ha^{-1})
T_1:	Normal dose of NPK 120: 60: 60 kg ha^{-1}	16.66	6.58	12.19	134.80
T_2:	FYM@ 20 t ha^{-1}	16.95	7.66	11.93	146.99
T_3:	Vermicompost@10 t ha^{-1}	18.16	8.07	11.42	208.11
T_4:	Poultrymanure@5 t ha^{-1}	17.44	7.98	11.92	163.69
T_5:	50% RDF of NPK + FYM @20 t ha^{-1}	17.26	7.79	11.99	157.85
T_6:	100% RDF of NPK + FYM@10 t ha^{-1} + Vermicompost@5 t ha^{-1}	20.08	8.29	8.89	337.49
T_7:	50% RDF of NPK + Vermicompost@2.5 t ha^{-1} + Poultrymanure@1.25 t ha^{-1}	17.70	8.00	11.58	167.82
T_8:	100% RDF of NPK + FYM@5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	18.49	8.12	11.26	210.81
T_9:	100% RDF of NPK +FYM@5 t ha^{-1} + Vermicompost@10 t ha^{-1}	22.39	8.51	8.10	377.72
T_{10}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5 t ha^{-1} + Azospirillum@1 kg ha^{-1}	21.24	8.48	9.80	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}	22.71	8.68	7.58	463.31
T_{12}:	100% RDF of NPK + FYM@5 t ha^{-1} + Vermicompost@2.5t ha^{-1} + Poultrymanure@1.25 t ha^{-1}	20.77	8.35	9.12	260.18
T_{13}:	50% RDF of NPK+ Vermicompost@10 t ha^{-1}	19.31	8.00	10.60	233.08
T_{14}:	100% RDF of NPK + Vermicompost@5 t ha^{-1}	19.33	8.27	10.48	237.28
T_{15}:	100% RDF of NPK + Vermicompost@2.5 t ha^{-1}	18.48	8.14	9.99	219.23
T_{16}:	Azospirillum@2 kg ha^{-1}	13.86	5.59	12.57	114.11
	SEm	0.41	0.22	0.11	8.51
	CD (P = 0.05)	1.18	0.64	0.33	24.74

2). Minimum results of yield attributing characters were obtained in the plots those received Azospirillum @ 2 kg ha^{-1} T_{16}. It 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. Similar findings with respect to nitrogen and phosphors on yield attributes were also reported by Naik and Srinivas (1992) and Mani *et al*. (2001). According to Anitha *et al*. (2003), the highest yield of pickling melon was obtained with the application of 10 t vermicompost + NPK @ 70: 25: 25 kg ha^{-1}. Experimental results of Anjanappa *et al*. (2012) revealed that enhanced yield parameters of cucumber (cv. Hassan Local) like, number of fruits $vine^{-1}$ and maximum fruit weight were recorded with the application of FYM + Azotobacter + Phosphobacteria + Trichoderma. Mulani *et al*., (2007) reported that in bitter gourd a synergistic interaction between organic manure and bio fertilizers resulted in enhanced fruit length and fruit girth which ultimately increased average fruit weight. 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 and nutrient recovery by plant (Thriveni *et al*., 2015). Thus, the results of the present experiment are in a good agreement with the above mentioned findings.

Effect of different nutrient management on yield of bottle gourd

Fertility levels had significant response on yield of fruits $plot^{-1}$. The application of 100% RDF of NPK + FYM@ 10 t ha^{-1} + Vermicompost@ 5 t ha^{-1} + Poultry manure@ 2.5 t ha^{-1} (treatment, T_{11}) produced highest yield (463.31 q ha^{-1}) during both the years of investigation (Table 2). The fruit yield depends mainly on the length of fruit, diameter of fruit, volume of fruit, average weight of fruit and number of fruit $plant^{-1}$ $plot^{-1}$. The highly suitability of IPNM treatment (T_{11}) imparts favorable yield attributes may because of favorable soil environment under treatment, T_{11} Bahadur *et al*. (2006).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 by Subbaiah *et al*. (1982) in chilli. 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 of Mandai *et al*. (2009) and Thriveni *et al*. (2015) in bitter gourd, Kameswari and Narayanamma (2011) in ridge gourd. Integrated nutrient management treatments rendered their significant effect on almost all the 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} + Vermicompost@ 5 t ha^{-1} + Poultry manure@ 2.5 t ha^{-1} recorded maximum performances with respect to almost all the characters. T_{16} 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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