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Effect of Nitrogen and Phosphorous Levels on Growth and Yield of Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] cv. Pusa Naveen

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ABSTRACT

A field experiment was conducted during summer (zaid) 2015 at Department of Horticulture, MJRP College of Agriculture & Research, MJRP University Jaipur (Rajasthan). The experiment consisted of nine treatments with three replications evaluated in randomized block design. Results of field experiment revealed that the minimum days required to opening female flower from sowing (36.36 days) and node number at which first female flower appears (4.95) was recorded under T_8 treatment followed by T_7 (38.69 days) whereas the maximum days (43.26 days and 6.92) were under control. Whereas, length of main vine and per cent fruit set were the maximum recorded under application of T_8. Maximum length (42.85 cm), girth (24.32 cm), fresh weight (1077.27 g) and number of fruits per plant (13.44) were recorded under T_8 treatment and the minimum under control. The maximum yield (361.96 q ha^{-1}) was obtained under T_7 and the minimum under control (91.84 q ha^{-1}). Application of 110 kg N + 70 kg P_2O_5 ha^{-1} recorded significantly higher net returns (327756.52 Rs ha^{-1}) and B: C ratio (9.58) which was found statistically superior over other treatments.

Key words: *Bottle gourd, nutrients, growth characters, fruit characters, fruit yield and B: C ratio.*

INTRODUCTION

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] known as calabash gourd or white flowered gourd, belongs to family cucurbitaceae, is one of the most important cucurbitaceous vegetable. It has become a popular crop because of prolific bearing habit and low cost of cultivation. In addition, tender fruits are used for making sweetmeats and dried fruits are used for making musical instruments. Cucurbits are mostly indigenous to India and they are widely grown throughout the country[1]. It is a rich source of carbohydrate content *viz.* crude fibre, sugars and different dietary fibre constituents, lignin, cellulose, hemicelluloses and mineral's like calcium, phosphorus and iron[2]. It is quite often included in the diet of old patients, as it has certain curative properties for diuretic patients.

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It is also known to calm the nerves and remove chronic constipation. It is especially recommended in the diet of patients suffering from high blood pressure. It is also useful in curing the urinary disorders. When taken with a pinch of salt, it can control severe diarrhoea.

India is world's largest producer of vegetables next to China, with an annual production around 168300 ('000 MT) from 9541 ('000 ha) of land with the productivity of 17.64 MT ha^{-1}. Area under bottle gourd cultivation in India is 111 ('000 ha) with annual production of 1836 ('000 MT) [3]. The vegetable requirement for the country has been estimated as 225 million tonnes by 2020 [1]. In view of its importance it is necessary to know about its improved cultivation and technology to obtain higher yields. To achieve this target and to provide balanced diet, it is necessary to boost up the production of vegetables by increasing area, use of improved agro-technologies and by developing and using high yielding varieties / improved varieties.

In recent years a new technology has been developed for increasing the yield of vegetables, fruits, cereals etc. through the use of improved seeds. The improved seeds have been found to produce high yield and quality, if subjected to proper cultural practices.

Adequate mineral fertilization is considered to be one of the most important prerequisite in this respect. Amongst nutrients, inorganic nitrogenous fertilizers are commonly used by most of the farmers because of quick availability of nitrogen to the plants[4]. Application of fertilizer, especially nitrogen is considered to be the most important factor for vegetable production, but its deficiency and proper placement limits crop production drastically. It imparts dark green colour to plants and promotes overall growth and finely governs the yield.

Nitrogen application is one of the important nutrient amendments made to the soil to improve growth and yield of many crop plants[5]. Next to nitrogen, phosphorus is the second important nutrient required by plants. Phosphorus is of paramount importance for energy transfer in living cells by means of high energy phosphate bonds of ATP [6]. It also affects protein content, quality and yield of the bottle gourd and it may increase the plant resistance to diseases.

Phosphorus is necessary for cellular preparation and in the metabolism of starch, protein and fats. One of the most important effects of phosphorus on plants is the stimulation of early root formation and growth. Low available phosphorus content in soil means delay in maturity and poor plant growth.

During the present investigation, an attempt has been made to find out the effect of various levels of nitrogen and phosphorus in an improved variety of bottle gourd. It is well known that an improved variety imparts better growth, high yield, uniform maturity and increase duration of harvest.

Thus, keeping the above facts in mind there is a necessity to plan a field experiment for economic use of applied nutrients and maintenance of soil fertility at sustainable level of production. With these considerations, a field experiment entitled "Response of Nitrogen and Phosphorus Levels on Growth and Yield of Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]" has been planned during 2015 at Research Farm, Department of Horticulture, MJRP College of Agriculture & Research, MJRP University, during summer (zaid) season 2015, with the objectives: To study the interaction effect between N and P for growth and yield of bottle gourd and to measure the economics of the various treatments.

MATERIALS AND METHODS

The present experiment was carried out at the Research Farm, Department of Horticulture, MJRP College of Agriculture & Research, Achrol, Jaipur, MJRP University, Jaipur (Rajasthan) during summer (zaid) season of 2015. Jaipur is situated at 26.92^0 N North latitude, 75.82^0 E East longitudes and an altitude of 427 meters above mean sea level. This region falls under agro climatic zone- III A (Semi-Arid eastern Plain) of the state. The soil of experimental site was clay loam in texture, slightly alkaline in reaction, low in

available nitrogen, medium in available phosphorus and potassium. The experiment was conducted in "Randomized Block Design" with nine treatments replicated three times. Bottle gourd cv. Pusa Naveen planted at spacing of 2.0 × 2.0 m (P-P × R-R). Both levels of phosphorus were given through single super phosphate (SSP) and potash was given through muriate of potash (KCl) at the time of sowing as a basal dose. Whereas, the nitrogen was supplied through urea, half dose at the sowing time and remaining between 25 - 30 DAS as top dressing. Randomization of the treatments was done with the help of random number table as advocated by Fisher[7]. Detail of treatments with their symbols given in Table 1.

Days taken from sowing to the opening of first female flower in 50 per cent of the plants were recorded for each treatment. Total number of nodes from the base of the plant to the node at which first female flower appeared was recorded as node number. Length of main vine was measured in centimetres from the base of the vine to the tip of main vine at the time of maturity. Percentage fruit set was established by using number of female flowers per plant and number of fruits per plant.

Five fruits selected randomly were picked up from the marketable harvest of each selected plant in each treatment and fruit length was measured in centimetres from the base of calyx to the tip of the fruit and average was computed. Same fruits were used taken for measuring the length and girth of fruits. The girth was measured in centimetres at its central point. The number of days from the date of anthesis to the date of harvesting was counted as number of days from anthesis to market harvesting. Fruit weight was recorded by dividing weight of marketable fruits in gram with total number of fruits of each picking for each selected plant and average was computed. Two plants were selected randomly and then counted the fruits separately for each plant after that their average was computed. All the fruits obtained from a plant were weighed in kg up to two decimal places. The yield was calculated by weighing the total marketable fruits from the beginning to the end of season.

Net returns were estimated as net income obtained after deducting cost of cultivation from the gross returns.

Net returns (Rs ha^{-1}) = Gross returns (Rs ha^{-1}) – Cost of cultivation (Rs ha^{-1})

Benefit Cost (B: C) ratio was calculated treatment-wise to ascertain economic viability of the treatments by using following formula

$$\text{B: C ratio} = \frac{\text{Net returns (Rs ha}^{-1}\text{)}}{\text{Total cost (cost of cultivation + cost of treatments) (Rs ha}^{-1}\text{)}}$$

The data collected during the course of investigation were subjected to statistical analysis by adopting appropriate method of analysis of variance as described by Fisher[7]. The critical difference for the treatment comparison was worked out, wherever the F test was found significant at 5% level of significance.

RESULTS AND DISCUSSION

Effect of fertilizers level on growth characters

It is apparent from the data (Table 2) that all the treatments significantly decreased days taken from sowing to the opening of first female flower as compared to absolute control. the minimum days required to opening female flower from sowing was recorded under T_8 (36.36 days), followed by T_7 (38.69 days), whereas the maximum days were noted under control (43.26 days). It is explicit from the data (Table 2) that all treatments significantly decreased node number at which the first female flower appeared over absolute control. All the fertilizer treatments recorded significant decrease in node number at which first female flower appeared, over absolute control (6.92). Treatment T_8 recorded significantly the lowest node number (4.95),

followed by T_7 (5.73), whereas the maximum node number were noted under control (6.92).

Application of increasing doses of N + P fertilizers brought about significant increase in length of main vine (Table 2). Significantly, the highest length of main vine (5.08 cm) was obtained with under treatment T_8 that was at par with the treatment T_7 (4.97 cm), which was statistically significant over the control (3.59 cm). All the applied treatments significantly increased fruit set over absolute control. A perusal of data (Table 2) shows that all the fertilizer treatments gave significantly higher per cent fruit set over control. Significantly highest per cent fruit set (54.20%) was obtained under T_8 treatment, which was higher by 43.15 and 29.43 per cent respectively, over absolute control (30.81%) and T_1 (38.25%). These results agree with the findings of Singh *et al*[8]. Umamaheswarappa *et al*.[9] conducted an experiment at Bangalore, to investigate the effect of various doses of NPK on bottle gourd cv. Arka Bahar, showed that fruit yield ha^{-1} had strong positive association with vine length, number of leaves per vine, number of female flowers per vine, number of branches per vine, vine girth, total chlorophyll content in leaf, total dry weight of plant, number of fruits per vine, fruit weight, fruit length and fruit girth. Nitrogen levels had a significant effect on number of days required for initiation of first male and female flowers, number of male and female flowers per vine, fruit set per cent and sex ratio. Phosphorous levels also showed positive effect on number of male and female flowers per vine, fruit set per cent and sex ratio. Husna *et al*.[10] at Dhaka (Bangladesh) observed that plant length, number of branches and number of flowers increased significantly with increasing N level

***Effect of fertilizers levels on fruit characters*:**

It is apparent from data (Table 3) that all the fertilizer treatments significantly enhanced length of fruits over control. Further, application of increasing doses of N + P fertilizers brought about significant increase in length of fruits. Significantly the maximum length of fruits (42.85 cm) was obtained with application of 110 kg N + 70 P_2O_5 kg/ha, which was at par with the treatment of 110 kg N + 50 kg P_2O_5 ha^{-1} (39.10 cm) respectively. The mean increase in the length of fruits was 49.33 per cent over absolute control (21.71 cm). Similar trend was found for the girth and weight of the fruit. All the applied fertilizer treatments significantly reduced number of days from anthesis to market harvesting over absolute control (14.58 days). Application of increasing doses of N + P fertilizers brought about significant reductions in days from anthesis to market harvesting. Significantly the lowest days from anthesis to market harvesting (10.86 days) were obtained with application of 110 kg N + 70 kg P_2O_5 ha^{-1}. The observed results are close with the earlier findings of Yadav *et al*[11]. Jan *et al*.[12] in Pakistan, observed that NPK fertilizer doses has significant effect on days to germination, fruit weight (g), fruit volume (ml), number of fruits vine^{-1}, vine length (cm) and yield (t ha^{-1}) crop on bottle gourd.

Effect of fertilizers levels on yield

Data presented in Table 4 show that all the fertilizer treatments recorded significantly higher number of fruits per plant over control. Significantly, the highest number of fruits plant^{-1} (13.44) was obtained with application of treatment T_8, which was higher by 61.53 per cent over control (5.17). But, it was statistically at par with the treatments T_6 and T_7. Significantly, the highest yield per plant and per ha (14.48 kg/plant & 361.96 q/ha) was obtained with the application of fertilizer 110 kg N + 70 kg P_2O_5 ha^{-1}, which were higher over control (3.67 kg/plant & 91.84 q/ha) and 60 kg N ha^{-1} (5.70 kg/plant & 142.55 q/ha).

Shukla and Prabhakar[13] reported that the bottle gourd cv. Arka Bahar, spaced differently with either 1 or 2 plants hill^{-1} and given N: P_2O_5:K_2O at 180:100:100 kg ha^{-1} as a full dose or one-third of this amount as a reduced dose. Spacing the plants at 300 x 45 cm with 1 plant hill^{-1} gave the highest average yield of 384.54 q ha^{-1}. The average yield was 385.37 q/ha with the full dose of NPK and 300.74 q/ha with the reduced dose. Al-Bahash and Wajdyi[14] recorded that, fertilizer application date had no significant effect on yield or yield components

and there was no interaction between sowing date and fertilizer application date. Patil *et al.*[15] observed that nitrogen significantly increased the vine length, number of pistillate flowers, number of fruits and ultimately yield of bottle gourd *cv*. Samrat and the crop was highly responsive to it. The best results were obtained at middle dose of these nutrients. Nitrogen, phosphorus and potassium at the rate of 150:50:50 kg/ha respectively gave the maximum yield and was thus optimum fertilizer dose under semi-arid conditions of Western Maharashtra. Husna *et al.*[10] at Dhaka (Bangladesh) observed that, yield of bottle gourd increased significantly with increasing N level. These results agree with the findings of Jan *et al*[12].

***Effect of fertilizer levels on economics*:**

It is clear from the data (Table 4), that all the treatments recorded significant increase in net monetary returns over control. Further, application of increasing doses of N + P fertilizers brought about significant increase in net monetary returns. Significantly, the highest monetary returns (327756.52 Rs ha^{-1}) were obtained with application of 110 kg N + 70 kg P_2O_5 ha^{-1}, which was higher by 81.02 per cent over control (62218.47 Rs ha^{-1}). Significantly, the highest B C ratio (9.58) was estimated with application of 110 kg N + 70 kg P_2O_5 ha^{-1}, which was higher over control (2.10) and over other treatments. These results also confirm the findings of Nawab Ali *et al*.[16] and Singh[17] with similar pattern with different values.

Table 1: Details of treatment combinations

Treatments	Fertilizer doses (kg ha^{-1})
T_1	60
T_2	110
T_3	50
T_4	70
T_5	60 + 50
T_6	60 +70
T_7	110 +50
T_8	110 +70
T_0	No fertilizers (Control)

Table 2: Effect of nitrogen and phosphorus levels on growth characters of Bottle gourd cv. Pusa Naveen

Treatments	Days taken from sowing to the opening of first female flower	Node number at which first female flower appears	Length of main vine (cm)	Fruit set (%)
T_1	41.08	6.42	3.97	38.25
T_2	40.68	5.97	4.03	39.24
T_3	40.94	6.33	3.87	40.33
T_4	39.44	5.22	4.14	43.52
T_5	39.33	6.17	4.35	47.50
T_6	39.00	5.45	4.54	49.68
T_7	38.69	5.73	4.97	50.67
T_8	36.36	4.95	5.08	54.20
T_0	41.08	6.92	3.59	30.81
CD (P = 0.05)	3.58	0.43	0.48	-

Table 3: Effect of nitrogen and phosphorus levels on fruit characters of Bottle gourd cv. Pusa Naveen

Treatments	Length of fruits (cm)	Girth of fruits (cm)	Number of days taken from anthesis to harvesting	Fresh weight of fruit (g)
T_1	28.58	17.96	13.03	754.24
T_2	32.31	20.00	12.82	815.14
T_3	29.93	20.81	13.00	760.32
T_4	32.80	21.00	12.68	827.43
T_5	36.54	22.01	11.63	926.25
T_6	38.60	22.34	11.39	955.71
T_7	39.10	23.04	11.01	1041.06
T_8	42.85	24.32	10.86	1077.27
T_0	21.71	15.01	14.58	710.58
CD (P = 0.05)	3.89	2.36	1.48	97.72

Table 4: Effect of nitrogen and phosphorus levels on yield characters and economics of Bottle gourd cv. Pusa Naveen

Treatments	Number of fruits/plant	Yield (kg/plant)	Yield (q/ha)	Net returns (Rs/ha)	B : C ratio
T_1	07.56	05.70	142.55	112146.16	3.69
T_2	08.53	06.95	173.83	142772.41	4.60
T_3	08.60	06.54	163.47	131594.80	4.13
T_4	10.28	08.51	212.65	179875.51	5.49
T_5	11.05	10.24	255.88	223221.36	6.84
T_6	12.34	11.79	294.83	261281.34	7.79
T_7	12.71	13.23	330.80	297490.62	8.93
T_8	13.44	14.48	361.96	327756.52	9.58
T_0	05.17	03.67	091.84	062218.47	2.10
CD (P = 0.05)	1.35	1.14	32.50	-	-

CONCLUSION

On the basis of the results emanated from present investigation conducted during summer (zaid) 2015, it could be concluded that application of 110 kg N + 70 kg P_2O_5 ha^{-1} may be applied in improved bottle gourd to achieve higher fruit yield ha^{-1}, net returns and B : C ratio. However this result varies according to soil and climatic condition and therefore requires further experimentation.

REFERENCES

1. Samadia, D.K. Studies on combing ability and stability parameters in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. Ph.D. Thesis, Rajasthan Agricultural University, Bikaner, Rajasthan. (1997)
2. Modgil, M., Modgil, R. and Kumar, R. Carbohydrate and minerals content of chyote (*Sechiumedule*) and bottle gourd (*Lagenarira siceraria*). *Journal of Human Ecology*. **15 (2):** 157-159 (2004).
3. Saxena, M., Bhattacharya, S. and Malhotra, S. K. *Horticultural Statistics at a Glance*. Oxford University Press, YMCA Library Building, 1 Jai Singh Road, New Delhi 110001, India. (2015).
4. Prasad, P.H., Mandal, A.R., Sarkar, A., Thapa, U. And Maity, T.K. Effect of biofertilizer and nitrogen on growth and

yield attributes of bitter gourd (*Momordica charantia* L.). International Conference on Horticulture held at Bidhan Chandra Krishi Viswaviyalaya, Mohanpur, Nadia (West Bengal). (2009).

5. Reddy, K.J. Nutrient stress. In: Physiology and Molecular Biology of Stress Tolerance in Plants, pp. 187-217 (2006).
6. Reddy, T.T. and Reddy, G.H.S. Principles of Agronomy. Published by Kalyani Publishers, New Delhi. (2002).
7. Fisher, R.A. Statistical Tables for Research Workers. Oliver and Boyd, Edinburgh, London. (1950).
8. Singh, D.N., Mishra, R.S. and Parida, A.K. Effect of nitrogen, phosphorus, potassium and spacing of flowering, fruiting and fruit characters of muskmelon. *Orissa Journal of Horticulture*. **23(1/2):** 70-76 (1995).
9. Umamaheswarappa, P., Krishnappa, K.S., Murthy, P.V., Nagarajappa, A. and Muthu, M.P. Uptake of NPK by plant and leaf chlorophyll content of bottle gourd *cv* Arka Bahar as influenced by various levels of N, P and K. *Environment and Ecology*. **22 (4):** 653-656 (2004).
10. Husna, A., Mahmud, F., Islam, M.R., Mahmud, M.A.A. and Ratna, M. Genetic variability, correlation and path co-efficient analysis in Bottle Gourd (*Lagenaria siceraria* L.). *Advances in Biological Research*. **5 (6):** 323-327 (2011).
11. Yadav, N., Tiwari, O.P. and Shrivastava, G.K. Response of spring sunflower (*Helianthus annuus*) to nitrogen and row spacing with different intercrops for rice fallows of eastern Madhya Pradesh. *Journal of Oilseeds Research*. **15 (2):** 377-378 (1998).
12. Jan, N.D., Iqbal, M., Ghafppr, A.W.K. and Jillani, M.S. Effect of NPK fertilizer and spacing on the yield of bottle gourd (*Lagenaria siceraria*). *Pakistan Journal of Biological Science*. **3 (3):** 448-449. (2000).
13. Shukla, V. and Prabhakar, B.S. Effect of plant spacing and fertilizer on yield of bottle gourd. *South Indian Horticulture.* **35 (6):** 453-454. (1987).
14. Al-Bahash, N.A. and Wajdyi, B.M. The effect of planting dates and time of application of compound fertilizers on yield of bottle gourd (*Lagenaria siceraria*). *Journal of Agriculture and Water Resources Research*. **7 (1):** 37-45. (1988).
15. Patil, S.R., Desai, U.T., Pawar, B.G. and Patil, B.T. Effect of NPK doses on growth and yield of bottle gourd *cv.* Samrat. *Journal of Maharashtra Agricultural University*. **21(1):** 65-67. (1996).
16. Nawab, R.S., Rehman, M. and Hussain, S.A. Response of *Momordica charantia* L. (Bitter gourd) cultivars to nitrogen levels. *Sarhad Journal Agriculture*. **11 (5):** 585-589. (1995).
17. Singh, S.P. Effect of integrated nutrient management on growth, yield and economics of turmeric (*Curcuma longa* L.) var. Rajendra Sonia. *The Asian Journal of Horticulture*. **7 (2):** 478-480. (2012).