# Effect of Nitrogen and Phosphorous Levels on Growth, Fruit characters, Yield and Economics of Bottle gourd [*Lagenaria siceraria* (Mol.) Stand L.]

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## ABSTRACT

**A field experiment was conducted during rabi 2013-14 at Vegetable Research Farm Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture & Sciences (Deemed-to-be-University), Allahabad (U.P). The experiment consisted of nine treatments (One control, two levels of nitrogen (50 and 100 kg ha$^{-1}$), two levels of phosphorus (40 and 80 kg ha$^{-1}$) and four combinations of both the levels of nitrogen and phosphorus).These treatments evaluated in randomized block design with three replications. Bottle gourd variety MGH-4 was used as a test crop. Results of field experiment revealed that the minimum days required to opening female flower from sowing (37 days) and node number at which first female flower appears (4.95) was recorded under application of 100 kg N+80 kg $P_2O_5$ ha$^{-1}$ followed by application of 100 kg N+ 40 kg $P_2O_5$ ha$^{-1}$ (39.33 days) whereas the maximum days (44.33 days and 6.92) were noted under absolute control followed by application of 50 kg N ha$^{-1}$ (42.08 days and 6.42). Whereas, length of main vine and per cent fruit set were the maximum recorded under application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$. Amongst fruit characters the maximum length of fruits (42.82 cm), girth of fruits (24.27 cm), fresh weight of fruit (1081.67 g) and number of fruits plant$^{-1}$ (13.67) were recorded under application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ and the minimum under absolute control followed by application of 50 kg N ha$^{-1}$. Whereas, maximum number of days from anthesis to market harvesting was the recorded under absolute control followed by application of 50 kg N ha$^{-1}$. The maximum yield (209.83 q ha$^{-1}$) was obtained under application of 100 kg N+ 40 kg $P_2O_5$ ha$^{-1}$ and the minimum under absolute control (88.33 q ha$^{-1}$) followed by application of 50 kg N ha$^{-1}$ (149.17 q ha$^{-1}$). Application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ recorded significantly higher net returns (79891 ha$^{-1}$) and B C ratio (3.19) which was found statistically superior over 50 kg N+ 40 kg $P_2O_5$ ha$^{-1}$, 50 kg N ha$^{-1}$, 100 kg N ha$^{-1}$, 40 kg $P_2O_5$ ha$^{-1}$ and 80 kg $P_2O_5$ ha$^{-1}$.**

***Key words:*** *Bottle gourd, Crude fibre, Productivity, Yield,*

## INTRODUCTION

Cucurbits are mostly indigenous to India and they are widely grown throughout the country. Bottle gourd [*Lagenaria siceraria* (Mol.) Stand L.] 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. Bottle gourd is rich source of carbohydrate content viz. crude fibre, sugars and different dietary fibre constituents like NDF, ADF, lignin, cellulose, hemicelluloses and mineral's like calcium, phosphorus and iron **(Modgil *et al.*, 2004)**. It is quite often included in the diet of old patients, as it has certain curative properties for diuretic patients. 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. In view of its importance it is necessary to know about its improved cultivation and technology to obtain higher yields.Nitrogen is indispensable for increasing crop production as it being a constituent of protoplasm and chlorophyll and is associated with the activity of every living cell. Similarly, phosphorus also plays an important role in storage of energy and transfer of it in plant system. A higher level of phosphorous encourages better fruiting in the bottle gourd. In addition phosphorus is an important structural component of nucleic acid, phytin, phospholipids and enzymes. Bottle gourd is heavy remover of these nutrients from soil coupled with loss of nitrogen through volatization and leaching and fixation of phosphorus into unavailable form.

## MATERIAL METHODS

A field experiment was conducted during rabi 2013-14 at Instructional Farm Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture & Sciences (Deemed-to-be-University), Allahabad (U.P). The experiment consisted of nine treatments (One control, two levels of nitrogen (50 and 100 kg ha$^{-1}$), two levels of phosphorus (40 and 80 kg ha$^{-1}$) and four combinations of both the levels of nitrogen and phosphorus).These treatments evaluated in randomized block design with three replications. The nitrogen was applied in two split doses (at sowing and 30 DAS). Bottle gourd variety MGH-4 was used as a test crop. The soil of the experimental field was sandy loam in texture, poor in nitrogen, comparatively rich in phosphorus and medium in potash with slightly alkaline reaction.Both levels of phosphorus were given through single super phosphate (SSP) and potash was given through murate 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, 1950)**. The field was then divided into plots of 4.0 m x 4.0 m = 16.0 sq. m size with

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the provision of irrigation channels and paths. The bottle gourd seeds of variety MGH-4 were sown on 25th, September, 2013. The sowing was done in rows by keeping 2.0 m inter-row spacing and 2.0 m plant to plant spacing. At each hill two seeds were sown at depth of 2.5 cm.

## RESULTS AND DISCUSSION

### Growth characters

Results of field experiment revealed that the minimum days (37 days) required to opening female flower from sowing and node number at which first female flower appears (4.95) was recorded under application of 100 kg N+80 kg $P_2O_5$ ha$^{-1}$ followed by application of 100 kg N+ 40 kg $P_2O_5$ ha$^{-1}$ (39.33 days) whereas, the maximum days and node numbers (44.33 days and 6.92) were noted under absolute control followed by application of 50 kg N ha$^{-1}$ (42.08 days and 6.42). Whereas, the maximum length of main vine (5.17 cm) and per cent fruit set (56.01) were recorded under application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$. Nitrogen is known to be the most important one among nutrients as a constituent of the protoplasm, chlorophyll and the various hormones and growth regulators associated with the growth, production and translocation within the plant system. It is also associated in increasing the succulence of the cells. Further, it aids in proliferation of cells and consequently is responsible for increased number of leaves. Nitrogen has been reported to have important role in increasing the vegetative growth and in the regulation on the use of $P_2O_5$ and $K_2O$. Thus, all these functions have cumulatively acted upon to bring about all round improvement of the crop. The different levels of phosphorus had significant effect on days to opening of first female flowers, number of lateral branches plant$^{-1}$, number of male flowers plant$^{-1}$, number of female flowers plant$^{-1}$, per cent fruit set, number of fruits vine$^{-1}$ and length of fruit. Phosphorus application resulted in significant effect on node number at which first female flower appeared and length of main vine. The study showed that the application of phosphorus increased number of lateral branches plant$^{-1}$. These improvements might have contributed to higher root growth and its proliferation which help in better uptake of required nutrients from soil. Thus better nutritional environment in plants under the influence of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ seems to have promoted height of plants and growth of individual leaf by way of active cell division, and their elongation. The larger canopy development and plant height under this treatment could probably be a reason for increased interception, absorption and utilization of radiant energy which in turn increased overall growth, photosynthesis, CGR, LAI and finally dry matter at successive growth stages.

### Fruit characters

Amongst fruit characters the maximum length of fruits (42.82 cm), girth of fruits (24.27 cm), fresh weight of fruit (1081.67 g) and number of fruits plant$^{-1}$ (13.67) were recorded under application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ and the minimum under absolute control followed by application of 50 kg N ha$^{-1}$. Whereas, maximum number of days from anthesis to market harvesting was the recorded under absolute control followed by application of 50 kg N ha$^{-1}$ similar finding were observed by **(Singh *et. al.*, 1995)**. Nitrogen increased the synthesis of protoplasm and primarily in the manufacture of amino acid and increased auxin activity. It might have increased chlorophyll content of the leaves as well **(Gaur, 1971)**, which will enhance the rate of photosynthesis in leaf. Increased meristmatic activities and increased number of leaves by nitrogen on the various vegetative and productive attributes can be traced to the increased photosynthetic area. The different levels of phosphorus had significant effect on number of fruits vine$^{-1}$, length of fruit, girth of fruits, number of days from anthesis to market harvest, yield plant$^{-1}$. Phosphorus application resulted in significant effect on node number at which first female flower appear, length of main vine and increases number of lateral branches plant$^{-1}$. The increased growth by the use of phosphorus may be explained on the basis of some of the established facts that the phosphorous is known to play an important role in photosynthesis. It is a constituent of nucleo- protein which are responsible for growth, thus the fact that phosphorus promotes the growth is understandable **(Arnon, 1959)** and **(Malik, 1965)**. Thus higher availability of all these inputs as evinced from N and P content in fruit, plant, plant height, dry matter accumulation and LAI demonstrate reduced competition of these between developing structures, consequently improving functional activity of each reproductive structure.It has been well emphasized that N and P fertilization to the tune of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ play vital role in improving three major aspects of yield determination i.e. formation of vegetative structure for nutrient absorption, photosynthesis and source sink length through development of reproductive structure and production of assimilates to fill economically improved sink (source strength). Thus, cumulative influence of N and P application seems to have maintained balanced source sink through improving both the events of crop development (vegetative and generative), ultimately resulted in increased fruit yield (q ha$^{-1}$) supported by **(Abdullah, 2008)** and **(Nath *et al.*, 2009)**.

### Yield and Economics

The maximum fruit yield (209.83 q ha$^{-1}$) was obtained under application of 100 kg N+ 40 kg $P_2O_5$ ha$^{-1}$ and the minimum under absolute control (88.33 q ha$^{-1}$) followed by application of 50 kg N ha$^{-1}$ (149.17 q ha$^{-1}$). Application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ recorded significantly higher net returns (79891 ha$^{-1}$) and B C ratio (3.19) which was found statistically superior over 50 kg N+ 40 kg $P_2O_5$ ha$^{-1}$, 50 kg N ha$^{-1}$, 100 kg N ha$^{-1}$, 40 kg $P_2O_5$ ha$^{-1}$ and 80 kg $P_2O_5$ ha$^{-1}$.

## CONCLUSION

On the basis of the result the minimum days required to opening female flower from sowing (37 days) and node number at which first female flower appears (4.95) was recorded under application of 100 kg N+80 kg $P_2O_5$ ha$^{-1}$ followed by application of 100 kg N+ 40 kg $P_2O_5$ ha$^{-1}$ (39.33 days) whereas the maximum days (44.33 days and 6.92) were noted under absolute control followed by application of 50 kg N ha$^{-1}$ (42.08 days and 6.42). Whereas, length of main vine and per cent fruit set were the maximum recorded under application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$. Amongst fruit characters the maximum length of fruits (42.82 cm), girth of fruits (24.27 cm), fresh weight of fruit (1081.67 g) and number of fruits plant$^{-1}$ (13.67) were recorded under application of 100 kg N+ 80 kg $P_2O_5$ ha$^{-1}$ and the minimum under absolute control followed by application of 50 kg N ha$^{-1}$. Whereas, maximum number of days from anthesis to market

*Table 1 Effect of nitrogen and phosphorous levels on growth, fruit characters, yield and economics of bottle gourd*

| Treatments | Growth Characters | | | | Fruit Characters | | | | | Yield | Economic Evaluation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Days taken from sowing to the opening of first female flower | Node No. at which first female flower appear | Length of main vine (cm) | Per cent fruit set | Length of fruits (cm) | Girth of fruits (cm) | No. of days from anthesis to market harvesting | Fresh weight of fruit (g) | No. of fruits plant$^{-1}$ | (q ha$^{-1}$) | Net returns (₹ ha$^{-1}$) | B C ratio |
| **Fertilizer levels (kg ha$^{-1}$)** | | | | | | | | | | | | |
| $N_1$ (50 ) | 42.08 | 6.42 | 3.97 | 39.25 | 28.35 | 17.95 | 13.09 | 776.00 | 7.67 | 149.17 | 52578 | 2.39 |
| $N_2$ (100) | 41.67 | 5.97 | 4.12 | 40.62 | 32.28 | 20.02 | 12.70 | 818.67 | 8.67 | 169.17 | 61958 | 2.74 |
| $P_1$ (40) | 41.83 | 6.33 | 3.97 | 41.44 | 29.98 | 20.72 | 13.06 | 788.33 | 8.83 | 154.58 | 54707 | 2.42 |
| $P_2$ (80) | 40.50 | 5.22 | 4.11 | 45.60 | 32.73 | 21.10 | 12.21 | 831.67 | 10.17 | 174.58 | 63507 | 2.67 |
| $N_1 + P_1$ (50+40) | 40.50 | 6.17 | 4.40 | 49.56 | 36.52 | 21.98 | 11.67 | 938.33 | 11.00 | 178.75 | 66170 | 2.85 |
| $N_1 + P_2$ (50+80) | 40.00 | 5.45 | 4.57 | 50.99 | 38.57 | 22.33 | 11.28 | 960.00 | 12.33 | 192.08 | 72216 | 3.03 |
| $N_2 + P_1$ (100+40) | 39.33 | 5.73 | 4.97 | 51.99 | 39.10 | 23.33 | 11.04 | 1016.67 | 12.60 | 195.58 | 73387 | 3.01 |
| $N_2 + P_2$ (100+80) | 37.00 | 4.95 | 5.17 | 56.01 | 42.82 | 24.27 | 10.74 | 1081.67 | 13.67 | 209.83 | 79891 | 3.19 |
| SEm± | 0.93 | 0.23 | 0.10 | 1.32 | 1.01 | 0.63 | 0.41 | 27.29 | 0.30 | 3.74 | 1868.30 | 0.08 |
| CD (P = 0.05) | 2.80 | 0.68 | 0.29 | 3.95 | 3.03 | 1.89 | 1.23 | 81.82 | 0.91 | 11.20 | 5601.16 | 0.24 |
| $N_0P_0$ (Control) | 44.33 | 6.92 | 3.57 | 32.87 | 21.64 | 14.98 | 14.50 | 718.42 | 5.33 | 88.33 | 22781.67 | 1.07 |
| Rest | 40.37 | 5.78 | 4.41 | 46.93 | 35.04 | 21.46 | 11.97 | 901.42 | 10.62 | 177.97 | 65551.43 | 2.79 |
| F ratio | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. | Sig. |

harvesting was the recorded under absolute control followed by application of 50 kg N $ha^{-1}$. The maximum yield (209.83 q $ha^{-1}$) was obtained under application of 100 kg N+ 40 kg $P_2O_5$ $ha^{-1}$ and the minimum under absolute control (88.33 q $ha^{-1}$) followed by application of 50 kg N $ha^{-1}$ (149.17 q $ha^{-1}$). Application of 100 kg N+ 80 kg $P_2O_5$ $ha^{-1}$ recorded significantly higher net returns (79891 $ha^{-1}$) and B C ratio (3.19) which was found statistically superior over 50 kg N+ 40 kg $P_2O_5$ $ha^{-1}$, 50 kg N $ha^{-1}$, 100 kg N $ha^{-1}$, 40 kg $P_2O_5$ $ha^{-1}$ and 80 kg $P_2O_5$ $ha^{-1}$.

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