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# Effect of different organic sources of nitrogen with biofertilizers on plant growth, flowering and sex expression of bottle gourd (*Lagenaria siceraria* Mol. Standl.) cv. Pusa Naveen

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**Abstract**
A field experiment entitled, "Effect of different organic sources of nitrogen with biofertilizers on plant growth, flowering and sex expression of bottle gourd (*Lagenaria siceraria* Mol. Standl.) cv. Pusa Naveen" was carried out during summer season of the year 2016 at the Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar. Experiment was laid out in randomized block design with different seventeen treatments. Results of experiment revealed that, minimum days taken for germination was observed with treatments $T_{17}$ (100 % Nitrogen through Poultry manure + *Azotobacter* + PSB + *Trichoderma viride*), $T_{16}$ (100 % Nitrogen through Vermicompost + *Azotobacter* + PSB + *Trichoderma viride*), $T_{15}$ (100 % Nitrogen through Castor cake + *Azotobacter* + PSB + *Trichoderma viride*), $T_{13}$ (100 % Nitrogen through Poultry manure + PSB + *Trichoderma Viride*), $T_{10}$ (100 % Nitrogen through FYM + PSB + *Trichoderma viride*), $T_8$ (100 % Nitrogen through Vermicompost + *Azotobacter* + *Trichoderma viride*) and $T_5$ (100 % Nitrogen through Poultry manure). Maximum length of vine at 45 DAS and at last harvest were recorded with 100 % Nitrogen through Poultry manure + *Azotobacter* + PSB + *Trichoderma viride* ($T_{17}$). Whereas, The maximum number of branches per vine was recorded for 100 % Nitrogen through Poultry manure ($T_5$). Whereas, leaf area per vine at 45 DAS was found not significant. Minimum number of male flowers per vine recorded with application of 100 % Nitrogen through FYM. Whereas, number of female flowers per vine and sex ratio of male and female flowers were found not significant.

**Keywords:** Pusa Naveen, Bottle gourd, Nitrogen, Biofertilizers, Growth

## Introduction
Bottle gourd (*Lagenaria siceraria* Mol. Standl.) belongs to the family cucurbitaceae and having chromosome number 2n=22. It is grown extensively throughout tropical and subtropical regions of the world. Its native is thought to be tropical Africa and Asia. It is commonly known as *Lauki*, and *Ghiya* in Hindi. In Gujarat, it is known as *Dudhi.*

The leading states in India, growing bottle gourd on extensive scale are Rajasthan, Punjab, Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, Maharashtra, Gujarat, Andhra Pradesh and Tamil Nadu. In Gujarat, It is grown in almost every district of the state. The major growing area of Gujarat is confined to Ahmadabad, Baroda, Gandhinagar, Kheda, Surat, Junagadh, Mehsana and Banaskantha districts.

Bottle gourd is considered as protective food and supplies of adequate quantities of vitamins, proteins, carbohydrates and minerals. It is a very popular vegetable in the market as well as in the kitchen garden and grown widely in *Kharif* and summer seasons throughout the country. Fruits of bottle gourd are long, round or oval to oblong in shape. Its wild forms are bitter in taste due to a nonglucosidal bitter constituent. The fruits in the green stage are used for vegetable and also for preparation of some sweets. It is also used as utensils, making musical instruments, floats for fishing nets and many other purposes.

In view of the requirements of the increasing population of our country and for maintaining the income of our farming community, it is quite essential to increase the crop production. The best possible way to achieve the desired results is the use of improved farming technology and resources. The combined use of biofertilizers and fertilizers is one of the essential requirements for increasing the yield of vegetable crops. Nutrients directly reflects on the growth and development of plant (Brantley and Warren, 1960) [4].

In the present context of higher prices of fertilizers, it is necessary to provide its substitutes to supply optimum and economical dose of nutrient required for the bottle gourd crop. Bio-fertilizer is defined as a substance which contains living organisms which, when applied to seed, plant surface or soil, colonize the rhizosphere or the interior of the plant and promote growth by increasing the supply or availability of primary nutrients to the host plant. Biofertilizers are well recognized as an important component of integrated plant nutrient management for sustainable agriculture and hold a great promise to improve crop development. In recent years, free living bacteria (*Azotobacter*), associate (*Azospirillum*) and symbiotic (*Rhizobium*) and phosphate solubilizing (*Bacillus megaterium, B. polymyxa* and *P. striata*) are gaining much popularity. Application of biofertilizer encouraged plant growth and productivity of many crops, (Adam *et al.* 2002) [1]. Utilization of bio-fertilizers in the form of microbein is very successful in minimizing chemical fertilizers. It's well known that a considerable number of bacterial species, mostly those associated with the plant rhizosphere are able to exert a beneficial effect on plant growth.

Phosphorus solubilization ability of microorganism is considered to be one of the most important traits associated with plant nutrition. Now a days, *Bacilli, Rhizobia and Pseudomonas* are the best studied P-solubilizer bacteria species (Rodriguez and Fraga, 1999) [16]. Several studies have shown that *bacillus spp*. inoculation to seed and soil can solubilize fixed soil P and applied P, resulting in better growth and higher yield in different crops (Cakmakc *et al.* 2006) [5]. Microorganisms enhance the $P_2O_5$ availability to plants by mineralizing organic P in soil and by solubilizing precipitated phosphates (Pradhan and Sukla, 2005) [15].

Application of heavy doses of chemical fertilizers without organic manures or bio-fertilizers causes deterioration of soil health in terms of physical and chemical properties of soil, declining of soil microbial activities, reduction in soil humus and increased soil, water and air pollution.

FYM is principle source of organic matter in our country. Use of FYM alone or in combination with biofertilizers helps in proper supply of nutrition and maintaining soil health. It supplies the essential plant nutrients, which improve the physico-chemical properties, increases water holding capacity and encourages the soil microbial activities. FYM is also advantageous for its residual value, it contains about 0.64 % N, 0.20 % $P_2O_5$ and 0.50 % $K_2O$ (Gaur, 1991) [10].

Vermicompost is adopted as organic manure produced by use of earthworm. It modifies soil physical and chemical properties. It contains about 3.0 per cent nitrogen, 1.0 per cent phosphorus and 1.5 per cent potassium (Parmar, 2008) [14].

Poultry manure contains uric acid having 3.30 per cent nitrogen which change rapidly to ammonical form and hence efficiently utilized for better plant growth. It contains about 3.30 per cent nitrogen, 0.63 per cent phosphorus and 1.40 per cent potassium (Gaur, 1984) [9].

Castor cake is one of the important sources of organic manure. It contains about 4.4 per cent nitrogen, 2.0 per cent phosphorus and 1.5 per cent potassium along with a large quantity organic matter. Oil cakes are quick acting organic manure. Though they are insoluble in water, their nutrient become quickly available to the crop within a week or ten days after application because the decomposition rate of cake is faster than the other bulky organic manures due to low C : N ratio and nitrifies quickly (Gaur, 1987) [8].

The concept of nutrient management is gaining considerable momentum today but negligible study has been conducted so, the present investigation was planned on effect of different organic sources of nitrogen with biofertilizers on plant growth, flowering and sex expression of bottle gourd (*lagenaria siceraria* mol. Standl.) cv. Pusa Naveen.

## Materials and Methods

The investigation was conducted at the Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, and Sardarkrushinagar. The four different organic manures viz. farmyard manure, castor cake, vermicomposting and poultry manure as a source of nitrogen with bio-fertilizer i.e. Azotobacter, PSB, Trichoderma viride were tested during the *Summer* season of the year 2016. The experiment was laid out in a Randomized Block Design with seventeen treatments were employed and replicated thrice.

**Details of different treatments**

| Treat. No. | Treatments |
|---|---|
| $T_1$ | 100 % RDF + 20 t/ha FYM (control) |
| $T_2$ | 100 % Nitrogen through FYM |
| $T_3$ | 100 % Nitrogen through Castor cake |
| $T_4$ | 100 % Nitrogen through Vermicompost |
| $T_5$ | 100 % Nitrogen through Poultry manure |
| $T_6$ | 100 % Nitrogen through FYM + *Azotobacter* + *Trichoderma viride* |
| $T_7$ | 100 % Nitrogen through Castor cake + *Azotobacter* + *Trichoderma viride* |
| $T_8$ | 100 % Nitrogen through Vermicompost + *Azotobacter* + *Trichoderma viride* |
| $T_9$ | 100 % Nitrogen through Poultry manure + *Azotobacter* + *Trichoderma viride* |
| $T_{10}$ | 100 % Nitrogen through FYM + PSB + *Trichoderma viride* |
| $T_{11}$ | 100 % Nitrogen through Castor cake + PSB + *Trichoderma viride* |
| $T_{12}$ | 100 % Nitrogen through Vermicompost + PSB + *Trichoderma viride* |
| $T_{13}$ | 100 % Nitrogen through Poultry manure + PSB + *Trichoderma viride* |
| $T_{14}$ | 100 % Nitrogen through FYM + *Azotobacter* + PSB + *Trichoderma viride* |
| $T_{15}$ | 100 % Nitrogen through Castor cake+ *Azotobacter* + PSB + *Trichoderma viride* |
| $T_{16}$ | 100 % Nitrogen through Vermicompost + *Azotobacter* + PSB + *Trichoderma viride* |
| $T_{17}$ | 100 % Nitrogen through Poultry manure+ *Azotobacter* + PSB + *Trichoderma viride* |

**Note:** Biofertilizers (Seed treatment): @20 ml per kg seed

To raise the crop recommended package of practices were followed. The treatments were evaluated on the basis of plant growth, flowering and sex expression from ten randomly selected tagged plants at different stages. The mean data were subjected to statistical analysis following analysis of variance technique (Gomez and Gomez, 1984) [11].

## Results and Discussion

### Growth parameters

The mean data presented in Table 1 showed significant to minimum days taken to germination (6.0) was observed in the treatment $T_5$,T8,T10,$T_{13}$, T15,T16 and T17 though it was at par with T4,T7,T9,T12 and T14. The early germination is may be due to high humidity and warming up of the soil created by organic matter supplied by poultry manure and these results are consistent with the findings of the researchers that the addition of organic manures had achieved similar findings in okra, Antoinette *et al.,* (2013). Present findings are similar to Parmar *et al*., (2011) [13] in cucumber, Sarhan *et al.*, (2011) [17] summer squash and Enujeke *et al.,* (2013) [7] in water melon.

Significantly the maximum vine length at 45 DAS (135.34 cm) was observed with the application of (100% Nitrogen through Poultry manure + *Azotobacter* + PSB + *Trichoderma viride*) treatment ($T_{17}$). The maximum vine length at last harvest (292.81 cm) was observed with the application of (100% Nitrogen through Poultry manure + *Azotobacter* + PSB + *Trichoderma viride*) treatment ($T_{17}$). Increased in plant height might be due to the fact that poultry manure contains higher nitrogen and phosphorous as compared to other organic manures and poultry manures droppings readily supply of phosphorous to plants than other organic waste. The present data throws light on combined application of organic fertilizers with bio-fertilizer that has beneficial effects which might be a reason for higher plant height. Present findings are similar to Das *et al.*, (2015) [6], Baghel *et al.*, (2017) [3], Nagar *et al*., (2017) [12] for bottle guard.

Application of 100% Nitrogen through Poultry manure ($T_5$) recorded maximum number of branches per plant (10.40). An increase in number of branches per vine might be due to higher level of nutrients especially nitrogen and phosphorous in poultry manure available for plant growth and their release as well as synchronization of nutrients released within the short period of growth of the bottle guard plant. These results are in conformity with Sarhan *et al.,* (2011) [17] in summer squash, Kumar *et al.,* (2012) in bottle gourd and Enujeke *et al.,* (2013) [7] in water melon. The effect of different sources of nitrogen with biofertilizers was found non-significant for leaf area per vine at 45 DAS.

**Table 1:** Effect of different organic sources of nitrogen with biofertilizers on plant growth, flowering and sex expression of bottle gourd

| Treat No. | Treatment | Days taken to germination | Length of vine at 45 DAS (cm) | Length of vine at last harvest (cm) | Number of branches per plant | Leaf area Per vine at 45 DAS (cm2) | Number of male Flowers | Number of female flower | Sex ratio |
|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 100 % RDF + 20 t/ha FYM (control) | 7.00 | 59.31 | 213.61 | 9.03 | 3257.65 | 130.13 | 26.94 | 4.83 |
| $T_2$ | 100 % Nitrogen through FYM | 7.00 | 81.96 | 219.05 | 8.13 | 3513.66 | 127.07 | 26.32 | 4.82 |
| $T_3$ | 100 % Nitrogen through Castor cake | 6.67 | 70.90 | 224.97 | 10.03 | 3394.33 | 128.27 | 28.34 | 4.54 |
| $T_4$ | 100 % Nitrogen through Vermicompost | 6.33 | 64.27 | 223.03 | 8.50 | 3563.62 | 134.80 | 28.54 | 4.72 |
| $T_5$ | 100 % Nitrogen through Poultry manure | 6.00 | 71.91 | 236.19 | 10.40 | 3555.63 | 132.27 | 28.61 | 4.62 |
| $T_6$ | 100% Nitrogen through FYM + *Azotobacter* + *Trichoderma Viride* | 7.00 | 97.54 | 214.03 | 8.17 | 3543.22 | 139.00 | 28.82 | 4.82 |
| $T_7$ | 100 % Nitrogen through Castor cake + *Azotobacter* + *Trichoderma viride* | 6.33 | 76.84 | 232.60 | 8.00 | 3666.85 | 144.13 | 30.56 | 4.73 |
| $T_8$ | 100 % Nitrogen through Vermicompost + *Azotobacter* + *Trichodermaviride* | 6.00 | 77.25 | 226.01 | 8.43 | 3627.35 | 135.87 | 27.64 | 4.92 |
| $T_9$ | 100 % Nitrogen through Poultry manure + *Azotobacter* + *Trichoderma viride* | 6.33 | 82.94 | 221.92 | 8.77 | 3584.10 | 130.13 | 27.71 | 4.69 |
| $T_{10}$ | 100 % Nitrogen through FYM +PSB + *Trichoderma viride* | 6.00 | 109.88 | 268.53 | 8.60 | 3681.49 | 129.60 | 26.46 | 4.89 |
| $T_{11}$ | 100% Nitrogen through Castor cake+PSB+ *Trichoderma Viride* | 6.67 | 103.05 | 272.63 | 6.13 | 3665.40 | 136.87 | 27.78 | 4.93 |
| $T_{12}$ | 100% Nitrogen through Vermicompost + PSB+ *Trichoderma Viride* | 6.33 | 110.08 | 255.33 | 6.07 | 3596.86 | 131.93 | 27.02 | 4.88 |
| $T_{13}$ | 100 % Nitrogen through Poultry manure + PSB + *Trichoderma Viride* | 6.00 | 111.37 | 270.45 | 6.50 | 3833.03 | 133.27 | 27.09 | 4.92 |
| $T_{14}$ | 100 % Nitrogen through FYM + *Azotobacter* + PSB + *Trichoderma viride* | 6.33 | 106.22 | 248.78 | 6.13 | 3694.78 | 139.87 | 29.58 | 4.72 |
| $T_{15}$ | 100 % Nitrogen through Castor cake + *Azotobacter* + PSB + *Trichoderma viride* | 6.00 | 123.63 | 274.26 | 7.03 | 3731.17 | 136.60 | 29.31 | 4.66 |
| $T_{16}$ | 100 % Nitrogen through Vermicompost + *Azotobacter* + PSB + *Trichoderma viride* | 6.00 | 119.42 | 272.75 | 6.00 | 3786.39 | 131.20 | 27.71 | 4.73 |
| $T_{17}$ | 100 % Nitrogen through Poultry manure + *Azotobacter* + PSB + *Trichoderma viride* | 6.00 | 135.34 | 292.81 | 7.53 | 3894.53 | 142.47 | 30.49 | 4.68 |
| S.Em. (±) | | 0.21 | 4.04 | 10.33 | 0.42 | 110.72 | 2.96 | 0.92 | 0.08 |
| C.D. (P=0.05) | | 0.61 | 11.66 | 29.80 | 1.22 | NS | 8.55 | NS | NS |
| C.V. (%) | | 5.78 | 7.29 | 7.30 | 9.30 | 5.29 | 3.82 | 5.63 | 3.02 |

### Flowering Parameters

Significantly minimum number of male flower plant (127.07) recorded with treatment 100% Nitrogen through FYM ($T_2$). Similar kind of result has been revealed in a study on integrated nutrient management in cucumber by Bindiya *et al.,* (2006). Present findings are similar to Parmar *et al*., (2011) [13] in cucumber, Sarhan *et al*., (2011) [17] in summer squash and Enujeke *et al*., (2013) [7] in water melon. The data revealed that the effect of different sources of nitrogen with biofertilizers on a number of female flowers per plant and sex ratio of male and female flowers were not significant.

## Conclusion

In view of the results obtained from the present investigation, it can be concluded that to achieve better plant growth and early flowering, the treatment with 100 % Nitrogen through Poultry manure + *Azotobacter* + PSB+*Trichoderma viride* should be applied in bottle gourd cv. Pusa Naveen.

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