***Original Research Article***

# "Integrated effect of inorganic fertilizers and biofertilizers on growth and yield of onion (*Allium cepa* L.)"


## Abstract

The present investigation was carried out during winter of 2018-2019 at the Horticulture Farm of Post Graduate College, Ghazipur. The experiment was laid out Randomized Block Design with three times. Ten treatment combinations viz. **$T_1$**-Control (100% Recommended dose of NPK), **$T_2$**-75% NPK + 25% Azotobactor, **$T_3$**-50% NPK + 50% Azotobactor, **$T_4$**-25% NPK + 75% Azotobactor, **$T_5$**-75% NPK + 25% PSB, **$T_6$**-50% NPK + 50% PSB, **$T_7$**- 25% NPK + 75% PSB, **$T_8$**-75% NPK + 25% Azotobactor + 25% PSB, **$T_9$**-50% NPK + 50% Azotobactor + 50% PSB and **$T_{10}$**-25% NPK + 75% Azotobactor + 75% PSB. It can be concluded that the maximum growth attributes, yield parameter and yield of onion may be obtained by the application of **75% NPK + 25% *Azotobactor* + 25%PSB**treatment, while, the treatment, i.e. application of 25% NPK + 75% PSB was also found to be good for growth and yield parameter and yield of onion hence, its combination of inorganic fertilizers and bio-fertilizers influence the growth and yield attributes so, it can be recommended for achieving higher yield and economics in present investigation. Therefore, the onion variety of N-53 waf gain higher produced as well as economically benefit, mere by 75% PNPK of RDF+ 25% Azotobacter+25% PSB compared to rest treatment in this field trial.


**Comment [1]:** Randomized Complete Block Design (R.C.B.D) with three replicates

**Comment [2]:** Space: PSB treatment,

**Comment [3]:** Waf? Or was

## Introduction:

**Comment [4]:** There is no citations in this part, so you have to use references.

Vegetables are an important nutritive component of daily diet and the nutritional values of vegetables as a vital source of micronutrients have been well recognized because they are important source of phytochemicals, vitamins, minerals and fibre. Indian council of medicinal research (I.C.M.R.) has given a recommendation that an average person needs daily a diet, which can provide 2800 K calories. According to National Institute of Nutrition, Hyderabad meager intake of vegetables and low-cost protective foods is largely responsible for malnutrition among the Indian people. According to human dietitians about 300g vegetables (125g leafy vegetables, 100g root and tuber vegetables and 75g others vegetables) per capita per day are required but the availability of vegetable in India has increased 378g per capita per day (NHB Data Base 2016-17) which is very high compared to the

**Comment [5]:** (reference)?

recommended dose. Vegetables play a vital role in the balanced diet of human being and neutralize the excess acid in the body provided by foods of animal origin and maintain alkaline reactions for normal metabolism. The total population of this country is about 121crores and present vegetables production of in our country is not sufficient to meet the need of its people. Onion is an important horticultural commodity grown world wide for their culinary purposes and medicial values. India is the second largest producer of onion after china. Area under onion and in India is 5.3 lakh heetane with a total production on value of 55 lakh tonnes, respectindly anonymous, (2023). In India, Maharashtra is the leading onion growing state followed by Gujarat, Orissa, Karnatka, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Bihar and Rajasthan. Onion bulb is rich in minerals like Phosphorus, Calcium and Carbohydrates. It also contains Proteins and Vitamin C. The composition of onion bulb has been presented below. This could be attributed to fewer yields per unit area coupled with increase in population. This low production of onion is due to improper utilization of fertilizers. Optimum fertilizers applications for onion in specific environment are necessary for obtaining good yield of onion. The essential nutrients especially, the primary macro nutrients nitrogen, phosphorus and potassium (NPK) are necessary for growth, development and yield in integrated approach. Onion is a bio-fertilizer responsive vegetable crop with fibrous root system showing higher phosphorous radioactivity and increased weight in roots. Keeping these facts in view, studies regarding the effect of inoculation of bio fertilizers with reduced doses of chemical fertilizers on growth and yield of onion were carried out under field condition.

**Comment [6]:** references?

## MATERIAL AND METHODS:

**Comment [7]:** - What are the studied traits?
- How the data was collected?
- How was the statistical analysis of the data performed?
- How were the averages compared?
- Why are tables placed in this part? They should be moved to the results and discussion part.

The field investigation during winter of 2018-2019 at the Horticulture farm of Post Graduate College, Ghazipur. Geographically the experimental site is located at a latitude of $25^0$ 21` to $25^0$ 24` N and longitude of $83^0$ 35` to $83^0$ 85` E and at altitudes of about 68.89 m from the mean sea level in the alluvial Eastern Gangetic plains of U.P. The experiment was laid out Randomized Block Design with three times. Ten treatment combinations viz. Control (100% Recommended dose of NPK), 75% NPK + 25% Azotobactor, 50% NPK + 50% Azotobactor, 25% NPK + 75% Azotobactor, 75% NPK + 25% PSB, 50% NPK + 50% PSB, 25% NPK + 75% PSB, 75% NPK + 25% Azotobactor + 25% PSB, 50% NPK + 50% Azotobactor + 50% PSB and 25% NPK + 75% Azotobactor + 75% PSB. Seed of onion were sown separately in the nursery on 17th December 2018; 46 days old seedlings were transplanted on 01th February 2019 in the evening after proper soil preparation. A normal size

**Comment [8]:** Randomized Complete Block Design (R.C.B.D) with three replicates

of nursery bed (3.0m x 1.0m) was prepared in the departmental nursery in the month of December 2018. The soil of nursery bed was prepared thoroughly and then a mixture consisting of five parts of clean garden soil. The recommended dose of NPK was applied as per treatment. Nitrogen was applied as per treatment through urea, half as basal dose and remaining half at 40 days after transplanting. Phosphorus and potassium were applied through single super phosphate and murate of potash respectively just before transplanting. Packets of Azotobactor and PSB (200 g each) were brought from market and applied in soil by mixing in fine sand followed by irrigation. The normal recommended dose of Azotobactor and PSB is 2.5 kg/ha. 46 days old seedlings were transplanted at 10 x 10 cm spacing in the evening of 01$^{th}$ February 2019. 90 days after transplanting (at neck fail stage), harvesting 03$^{th}$ May, 2019 was done by khurpi. After harvesting bulb and green tops were separated and bulbs cleaned by removing adhering soil and roots.

**Comment [9]:** - What are the studied traits?
- How the data was collected?
- How was the statistical analysis of the data performed?
- How were the averages compared?

**Table 1: Used of inorganic/fertilizer and biofertilizer in integrated approach on growth attributes as Plant Height (cm), Leaf length (cm), No. of leaves, Neck thickness (cm), Dry matter of bulb (%) and Moisture (%) of transplanted onion crops**

**Comment [10]:** Why is the table placed in this part? It should be moved to the results and discussion part.

| Treatments | Plant Height (cm) | Leaf Length (cm) | No. of leaves | Neck thickness (cm) | Dry matter of bulb (%) | Moisture (%) |
|---|---|---|---|---|---|---|
| Control (100% Recommended dose of NPK) | 44.93 | 39.53 | 7.85 | 2.47 | 16.79 | 85.13 |
| 75% NPK + 25% Azotobactor | 45.05 | 42.76 | 8.84 | 2.38 | 14.93 | 85.01 |
| 50% NPK + 50% Azotobactor | 45.56 | 41.56 | 8.54 | 2.36 | 14.99 | 84.49 |
| 25% NPK + 75% Azotobactor | 45.22 | 40.76 | 8.24 | 2.18 | 15.39 | 84.86 |
| 75% NPK + 25% PSB | 47.37 | 45.54 | 9.83 | 2.31 | 15.62 | 84.82 |
| 50% NPK + 50% PSB | 46.99 | 44.85 | 9.55 | 2.35 | 16.41 | 83.59 |
| 25% NPK + 75% PSB | 46.54 | 43.24 | 9.23 | 2.26 | 15.51 | 84.21 |
| 75% NPK + 25% Azotobactor + 25% PSB | 47.79 | 46.87 | 10.24 | 2.23 | 16.59 | 83.41 |
| 50% NPK + 50% Azotobactor + 50%SB | 44.72 | 44.92 | 8.64 | 2.31 | 15.14 | 84.39 |
| 25% NPK + 75% Azotobactor + 75% PSB | 44.62 | 44.65 | 8.35 | 2.27 | 15.18 | 84.49 |
| CD at 5% | **0.254** | 0.44 | **0.915** | **NS** | **NS** | **NS** |

**Table 2: Yield attributes and gild as diameter of bulbs (on), waist of bulb average field and total field (g/ha) of transplanted onion crops**

Comment [11]: Why is the table placed in this part? It should be moved to the results and discussion part.

| Treatments | Diameter of Bulbs (cm) | Weight of bulb (g/bulb) | Avg. yield (kg/plot) | Total Yield (q/ha) |
|---|---|---|---|---|
| Control (100% Recommended dose of NPK) | 4.03 | 34.25 | 1.32 | 239.64 |
| 75% NPK + 25% Azotobactor | 4.28 | 35.25 | 1.80 | 245.32 |
| 50% NPK + 50% Azotobactor | 4.19 | 34.86 | 1.58 | 243.43 |
| 25% NPK + 75% Azotobactor | 4.13 | 34.57 | 1.45 | 241.54 |
| 75% NPK + 25% PSB | 4.51 | 36.26 | 1.98 | 251.06 |
| 50% NPK + 50% PSB | 4.44 | 35.87 | 1.21 | 249.14 |
| 25% NPK + 75% PSB | 4.37 | 35.56 | 1.90 | 247.21 |
| 75% NPK + 25% Azotobactor + 25% PSB | 4.62 | 36.58 | 2.05 | 252.98 |
| 50% NPK + 50% Azotobactor + 50% PSB | 3.91 | 34.84 | 1.49 | 241.79 |
| 25% NPK + 75% Azotobactor + 75% PSB | 3.81 | 34.54 | 1.37 | 240.48 |
| CD at 5% | **0.054** | 0.195 | 0.165 | **1.207** |

**Table 3: Used of inorganic fertilizer and biofertilizer infragrated approach on economics as gross income (Rs/ha) Metretum (Rs/ha) and benefit cost ratio of transplanted onion crops.**

Comment [12]: Why is the table placed in this part? It should be moved to the results and discussion part.

**Economics:**

| Total Yield (q/ha) | Gross Income (Rs./ha) | Net Income (Rs./ha) | B:C Ratio |
|---|---|---|---|
| 239.64 | 378631.2 | 2,90,631.20 | 1:3.30 |
| 245.32 | 387605.6 | 2,99,605.60 | 1:3.40 |
| 243.43 | 384619.4 | 2,96,619.40 | 1:3.37 |
| 241.54 | 381633.2 | 2,93,633.20 | 1:3.33 |
| 251.06 | 396674.8 | 3,08,674.80 | 1:3.50 |
| 249.14 | 393641.2 | 3,05,641.20 | 1:3.47 |
| 247.21 | 390591.8 | 3,02,591.80 | 1:3.43 |
| 252.98 | 399708.4 | 3,11,708.40 | 1:3.54 |
| 241.79 | 382028.2 | 2,94,028.20 | 1:3.34 |
| 240.48 | 379958.4 | 2,91,958.40 | 1:3.32 |

**Results and Discussion:**

| | | | | | | |
|---|---|---|---|---|---|---|
| 25% NPK + 75% Azotobactor + 75% PSB | 44.62 | 44.65 | 8.35 | 2.27 | 15.18 | 84.49 |
| CD at 5% | **0.254** | 0.44 | **0.915** | **NS** | **NS** | **N** |

Comment [13]: Why is the table placed heret?

**Inorganic fertilizers and bio-fertilizers on growth parameters:** The present investigation in Table 1, effect of inorganic fertilizers with and without bio-fertilizerson growth parametersshowed significant differences between the treatments. Due to inoculation of *Azotobactter* and PSB which improved nitrogen status of the soil as it is a free nitrogen fixer. PSB increases the availability of phosphorus in the soil resulting in higher uptake of phosphorus due to increase in the solubility and mobilization of insoluble soil phosphorus. Thus, efficient and healthy strain of *Azotobactter* and PSB in Rhizosphere have resulted in greater fixation of atmospheric nitrogen, increase the availability of phosphorus for use the plant, resulting in vigorous growth of plant. The maximum plant height (47.79 cm), leaf length (46.87 cm) and number of leaves (10.24) ware recorded with the application of 75% NPK + 25% *Azotobactor* + 25% PSB. Similar results have been reported by **Singh and Pandey (2010), Bhandari *etal.* (2012), Rai *et al.* (2014), Banjar*e et al*. (2015).** The neck thickness (cm), moisture percent and dry matter of bulb (%) of onion crop recorded almost similar in all the treatments and statistically non-significant. The lowest were thickness (2.23 cm), moisture (83.41 %) and bulb dry matter (16.59 %) of onion crop were recorded under treatment of 75 % NPK + 25% Azotobactor + 25 % PSB over rest all treatments, respectively.

**Inorganic fertilizers and bio-fertilizers on yield parameters and yield:**

The significant results of present study in Table 2 clearly indicate that Maximum bulb diameter (4.62 cm), bulb weight (36.58g) and bulb yield (252.98 q/h) was noted under the application of 75% NPK + 25% *Azotobactor* + 25% PSB followed by **$T_7$-** 25% NPK + 75% PSB&**$T_6$**-50% NPK + 50% PSB. The use of bio fertilizers as *Azotobactter* and PSB are very useful for onion cultivation. The fact that *Azotobactor* is known to produce antifungal, antibiotic substances that inhibit the activities of various type of soil fungi. It can also synthesize and secrete thiamin, riboflavin, pyridoxine, cyanocobalamine, nicotini acid, pentathenic acid, indole acetic acid and gibberellins or gibberellins like substances resulting in vigorous plant growth and dry matter production which in turn resulted in better fertilization, bulb development and ultimately the higher yield. *Azotobactor* inoculation helped in increasing nitrogen availability because it is micro *aerophillic* nitrogen fixer. It colonizes the root mass, fixes nitrogen in loose association with plants and these bacteria

induce the plant root to secrete a mucilage which create low oxygen involvement and helps to fix atmospheric nitrogen which refracted in the better yield attributes and PSB increases the availability of phosphorus for growth and development of plant and phosphorus enhances the plant resistance. Bio-fertilizer application had non-significant effect in influencing Sulphur content and pungency. This might be due the fact that there was a poor establishment of source to sink mechanism with plant system. These results are in close conformity with the findings ofJayathilake *et al.* (2006), Singh and Pandey *et al.* (2010),Bhandari *et al.* (2012), Raju *et al.* (2013), Rabarie *et al.* (2014), Banjar*e et al*. (2015) and Yadav*et al.* (2015).

**Inorganic fertilizers and bio fertilizers on Economics:** The data summarized in Table-3 revealed that the application of 75 % NPK + 25 % Azotobactor + 25 % PSB was increased statically gross income over all rest treatments due to RDF (control) and followed by used alone Azotobactor and PSB in present study trial. The higher net income were computed in 75 % NPK + 25 % Azotobactor + 25 % PSB over all rest treatment, respectively. Whereas, in treatment of 75 % NPK + 25 % PSB and 50 % NPK + 50% PSB at similar response in present investigation. As records B:C ratio, it was observed that the maximum benefit cost ratio was noted at 75 % NPK + 25 % Azotobactor + 25 % PSB followed by 75 % NPK + 25 % PSB and 50 % NPK + 50 % PSB treatments. The better performance of combined used biofertilizers, it might be due to the higher productivity in the treatment for onion cultivation. It can be concluded from above findings that onion variety, N-53 nourished by 75 % RDF (NPK) + 25 % Azotobactor + 25 % PSB recorded better growth characters, yield attributes and yield of crop compared with other treatments but require more investment as input cost.

**Comment [14]:** Where is the conclusion?

**References:**


**Anonymous, (2023), Internate of https://icar.org.in (Indian Council of Agriculture Research)**

1. **Singh, P.K. and Pandey, M. (2010).** Study the Effect of Integrated Nutrient Management on Yield and Nutrient Uptake in Cabbage. *Indian J. Hill Farming*, 23(2):39-41.


**Comment [15]:** Rewrite it and give it number 1

**Comment [16]:** Number 2

2. **Bhandari, S.A., Patel, K.S. and Nehete, D.S. (2012).** Effect of integrated nutrient management on growth, yield and quality of garlic (*Allium sativum L*.) cv. Gujrat Garlic-3. *Asian j. Horti*., 7(1): 48-51.
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