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Integrated Effect of Inorganic Fertilizers and Biofertilizers on Growth and Yield of Onion (*Allium cepa* L.)

Shivendra Singh [a], Peeyush Kant Singh [a], Pooshpendra Singh Dixit [b], R. B. Singh [c], Ram Pyare [c], Bhayankar [c*] and A. R. Ranjan [d]

[a] PG College, Ghazipur, India.
[b] DRI-KVK, Chitrakoot, India.
[c] CSA University of Agriculture and Technology, Kanpur, India.
[d] Banda Universities of Agriculture and Technology, Banda, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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 in Randomized Block Design with three replications. 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%PSBtreatment (T_8), while, the treatment T_7, i.e. application of 25% NPK + 75% PSB was also found to be good for growth and yield parameter of onion. It was observed that the

**Corresponding author: E-mail: bhayankarcsa12037@gmail.com;*

combination of inorganic fertilizers and bio-fertilizers influence the growth and yield attributes. . Therefore, from the present investigation, it can be concluded that the onion variety N-53 performed economically well by the application of 75% NPK + 25% Azotobacter+25% PSB as compared to rest treatment.

Keywords: NPK; Azotobactor; yield; onion.

1. INTRODUCTION

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 to 378g per capita per day (NHB Data Base 2016-17) which is very high compared to the 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. In India, area under onion is 5.3 lakh hectare with a total production on value of 55 lakh tonnes, respectively, [1]. 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 (Mention Table No.). 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 fertilizer application for onion in specific environment is 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.

2. MATERIALS AND METHODS

The field investigation was carried out 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 in Randomized Block Design with three replication. Ten treatment combinations viz. T1- Control (100% Recommended dose of NPK), T2- 75% NPK + 25% Azotobactor, T3- 50% NPK + 50% Azotobactor, T4- 25% NPK + 75% Azotobactor, T5- 75% NPK + 25% PSB, T6- 50% NPK + 50% PSB, T7- 25% NPK + 75% PSB, T8- 75% NPK + 25% Azotobactor + 25% PSB, T9- 50% NPK + 50% Azotobactor + 50% PSB and T10- 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 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 was added onto it. The recommended dose of NPK was applied as per the treatments. 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 was 2.5 kg/ha. 46 days old seedlings were transplanted at 10 x 10 cm spacing in the evening of 01th February 2019. 90 days after transplanting (at neck fall stage), harvesting was done (03th May, 2019) by khurpi. After harvesting, bulb and green tops were separated and bulbs were cleaned by removing adhering soil and roots.

3. RESULTS AND DISCUSSION

3.1 Inorganic Fertilizers and Bio-Fertilizers on Growth Parameters

The effect of inorganic fertilizers with and without bio-fertilizers on growth parameters showed significant differences between the treatments (Table 1). Due to inoculation of *Azotobactter* and PSB, the nitrogen status of the soil was improved as it is a free nitrogen fixer and fixes atmospheric nitrogen. 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, increased the availability of phosphorus for the use by 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) were recorded with the application of 75% NPK + 25% *Azotobactor* + 25% PSB. Similar results have been reported by Singh and Pandey [2], Bhandari et al. [3], Rai et al. [4], Banjare et al. [5]. The neck thickness, moisture percent and dry matter of bulb of onion crop was recorded almost similar in all the treatments and statistically non-significant. The lowest thickness (2.23 cm), moisture percent (83.41 %) and bulb dry matter (16.59 %) was recorded under treatment of T8-75 % NPK + 25% Azotobactor + 25 % PSB over rest all treatments, respectively.

3.2 Inorganic Fertilizers and Bio-Fertilizers on Yield Parameters and Yield

The significant results of present study was presented in the Table 2 which clearly indicates that the maximum bulb diameter (4.62 cm), bulb weight (36.58g) and bulb yield (252.98 q/h) was noted under the treatment T8 -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 a 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 which 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 of Jayathilake et al. [6], Singh and Pandey [2], Bhandari et al. [3], Raju et al. [7], Rabarie et al. [8], Banjare et al. [5] and Yadav et al. [9].

3.3 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 the gross income statistically over all rest treatments due to RDF (control) and followed by the application of Azotobactor and PSB alone or in combination 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 similar response was noted in present investigation. With respect to 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, might be due to the higher productivity in the treatment.

Table 1. Use of inorganic/fertilizer and biofertilizer in integrated approach on growth attributes of transplanted onion crop

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. Use of inorganic fertilizer and biofertilizer as an integrated approach on yield attribute and yield of transplanted onion crop

Treatments	Diameter of Bulb (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. Use of inorganic fertilizer and biofertilizer as an integrated approach on economics of transplanted onion crop

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

4. CONCLUSION

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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Internate of Indian Council of Agriculture Research; 2023. Available:https://icar.org.in
2. Singh PK, Pandey M. Study the effect of integrated nutrient management on yield and nutrient uptake in cabbage. Indian J. Hill Farming. 2010;23(2):39-41.
3. Bhandari SA, Patel KS, Nehete DS. Effect of integrated nutrient management on growth, yield and quality of garlic (*Allium sativum L*.) cv. Gujrat Garlic-3. Asian J. Horti. 2012;7(1):48-51.
4. Rai S, Rani P, Kumar M, Rai AK, Shahi SK. Effect of intergrated use of vermicompost, FYM, PSB, and azotobacter on physico-chemical properties of soil under onion crop. Enviro. Ecol. 2014;32(4B):1797-1803.
5. Banjare C, Shukla N, Sharma PK, Paranwar M, Chandravans D. Effect of organic substances on yield and quality of onion *(Allium cepa L*.). Inter.J. Farm Sci. 2015;5(1):30-35.
6. Jayathilake PKS, Reddy IP, Srihari D, Reddy KR. Productivity and soil fertility status as influenced by integrated use of N-fixing bio fertilizers, organic manures and inorganic fertilizers in onion. J. Agri. Sci. 2006;2(1).
7. Raju SSV, Nagre PK, Naik P, Bharathi N. Effect of integrated nutrient management on growth, yield and quantity of onion (*Allium cepa L.)* CV. Akola safed. Ecol. Environ. Cons. 2013;19(01):195-215.
8. Rabarie KV, Patel MV, Kadu SP, Umale AA. Combined effect of organic and inorganic fertilizers on growth, yield attiibutes, bulb yield and soil nutrient status after harvest of onion *(Allium cepaL*.). Trends Biosci. 2014;7(23):3861-3864.
9. Yadav R, Dwivedi DH, Govind, Maji S. Effect of integrated nutrient management on growth and yield of onion *(Allium cepa L*.) Cv. Pusa Madhvi. J. Crop Weed. 2015; 11(1):49-53.

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