International Journal of Plant & Soil Science

Volume 35, Issue 18, Page 1158-1162, 2023; Article no.IJPSS.104095
ISSN: 2320-7035

Influence of Integrated Nutrient Management (INM) on Bulb Yield and Profitability of Onion (*Allium cepa* L.) Crop in Western Uttar Pradesh, India

Jagraj Singh [a*], Satya Prakash [a], Bijendra Singh [a], Vipin Kumar [a], Satendra Kumar [b], Gopal Singh [c] and Mohit [a]

[a] *Department of Vegetable Science, College of Horticulture, SVPUA &T Meerut, (U.P.), 250110, India.*
[b] *Department of Soil Science, College of Agriculture, SVPUA &T Meerut, (U.P.), 250110, India.*
[c] *Department of Plant Pathology, College of Agriculture, SVPUA &T Meerut, (U.P.), 250110, India.*

Authors' contributions

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

Article Information

DOI: 10.9734/IJPSS/2023/v35i183383

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/104095

Original Research Article

Received: 25/05/2023
Accepted: 28/07/2023
Published: 29/07/2023

ABSTRACT

A field experiment was carried out at Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) 250110 during the Rabi seasons of year 2021-22 and 2022 to fulfil various objectives of yield and profitability of bulbs of onion for western Uttar Pradesh climatic conditions. A total of eleven treatments were used in Randomized Complete Block Design (RCBD) with three replications. Out of the eleven treatments, T_7 - 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each) had a beneficial effect on maximum bulb yield (337.49 q/ha), net return (Rs. 208438.14 ha-1) and cost-benefit ratio (4.29) followed by 75% RDF + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each). Whereas, the lowest

---

**Corresponding author: E-mail: bhullarjagraj1313@gmail.com.;*

bulb yield (122.16 q/ha) was observed in T_1 – Control treatment followed by T_8- 50% RDF + FYM @ 12 t/ha. While the minimum net return (Rs. 48307.20 ha-1) and cost-benefit ratio (1.97) were recorded in T_1 – Control treatment followed by treatment T_4- 75% RDF + FYM @ 6 t/ha.

Keywords: Onion; NPKS; FYM; vermicompost; yield and economics.

1. INTRODUCTION

Onion (*Allium cepa* L.) is a widely cultivated and consumed vegetable crop. It is a member of the Amaryllidaceae family and is known for its pungent flavour and characteristic aroma. Onions are grown for their bulbs, and are used in an extensive variety of dishes, including soups, stews, salads, and sauces, and are a staple ingredient in many cuisines around the world. Although they may be produced in a variety of regions and are a cool-season crop, onions demand fertile, well-drained soils with a pH of 6.0 to 6.8. They are typically grown from seeds, sets (small bulbs), or transplants. Onions can be stored for several months under proper conditions of temperature and humidity [1].

Onion bulbs are low in calories but rich in vitamins and minerals and are a good source of dietary fibre. Onions are also a good source of antioxidants and sulphur-containing compounds that may have health benefits. They have been proven to assist in reducing inflammation, lowering blood sugar, and enhancing heart health. However, it's important to note that onions may cause digestive discomfort in some people, particularly when consumed in large amounts [2].

Proper nutrient management is crucial for achieving high yield in onion crops. The goal of integrated nutrient management (INM), a comprehensive strategy for crop nutrition, is to maximise nutrient use effectiveness while lowering environmental impact, boosting profitability, and enhancing soil health [3]. Onion crop has a high nutrient demand and requires balanced nutrition for optimum growth and bulb yield. INM provides a balanced combination of different organic sources of nutrients and inorganic fertilizers, which ensures the supply of all essential nutrients to the crop.

INM promotes the use of organic matter, which improves soil health and enhances the soil's ability to retain moisture and nutrients. INM is a cost-effective approach to crop nutrition as it reduces the reliance on expensive chemical fertilizers and promotes the use of locally available organic resources. INM reduces the environmental impact of agriculture by promoting the use of organic resources and minimizing the use of chemical fertilizers. INM provides a balanced supply of all essential nutrients, which promotes healthy plant growth and maximizes yield [4].

In summary, INM is essential for the sustainable production of onion crops by ensuring a balanced supply of nutrients, improving soil health, maximum profitability and reducing environmental pollution.

2. MATERIALS AND METHODS

A field trial was conducted at Horticultural Research Centre, College of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) 250110 during the Rabi seasons of the year 2021-22 and 2022-23 to fulfil various objectives of the study. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice. Total 11 treatments have been tried i.e., T_1 - Control, T_2 - 100% RDF (NPKS @ 120:60:80:40 kg/ha), T_3 - 100% RDF + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each), T_4 - 75% RDF + FYM @ 6 t/ha, T_5 - 75% RDF + VC @ 2 t/ha, T_6 - 75% RDF + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each), T_7 - 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each), T_8 - 50% RDF + FYM @ 12 t/ha, T_9 - 50% RDF + VC@ 4 t/ha, T_{10} - 50% RDF + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each) and T_{11} - 50% RDF + FYM @ 6 t/ha + VC @ 2 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each). The soil nature of the trial field was sandy loam with a pH level of 7.70 and available nitrogen (149.80 kg ha^{-1}), phosphorous (29.18 kg ha^{-1}), potassium (153 kg ha^{-1}) and sulphur (10.78 kg ha^{-1}). The onion variety NHRDF Red -4 was selected for research reasons. Organic manure, such as FYM, was added into the experimental field 2-3 weeks before the transplanting of onion seedlings, as recommended by the protocols.

Because, FYM is a rich source of organic matter and essential nutrients like nitrogen, phosphorus, and potassium. By applying it two weeks before sowing, it allows time for the organic matter to decompose and release these nutrients into the soil. However, vermicompost was also used in experimental plots during seeding. Nitrogen, phosphorus, potassium, and sulphur were added as urea, di-ammonium phosphate (DAP), muriate of potash (MOP), and sulphur. At the time of transplanting onion seedlings, 50% of nitrogen and the 100% of phosphorus, potassium, and sulphur have been applied in experimental plots. The remaining half-dose of nitrogen has been given in two equal doses at 30 and 60 days after the transplanting of seedlings. During the experiment, all cultural practises were carried out at regular intervals based on the crop's needs. The collected data were statistically examined using standard statistical procedures recommended by Gomez and Gomez [5].

3. RESULTS AND DISCUSSION

3.1 Effect of Integrated Nutrient Management on Yield of Onion

The results of the bulb yield per hectare during two years apart from pooled mean data have been given in Table 1. Based on pooled mean data of both of the years clearly shows that the maximum bulb yield (337.49 q/ha) was observed in T7 **-** 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each), followed by T6 - 75% RDF + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each) treatment (317.00 q/ha). While lowest bulb yield (112.16 q/ha) was recorded under control subsequently T8- 50% RDF + FYM @ 12 t/ha (234.33 q/ha). The significant increase in bulb yield might be due to the integrated use of organic manures and inorganic fertilizers to control the release of nutrients in the soil through the mineralization of organic manures, which might have facilitated better crop growth. The higher yields obtained through INM could be due to added benefits of organic manure and biofertilizers. The addition of organic manures improves soil microbial activities and adds secondary and micronutrients in addition to primary nutrients. The onion crop obtains a balanced supply of nutrients throughout each stage of its growth as a result of a combination of chemical fertilizers, organic manures, and biofertilizers. The increased bulb formation, larger-sized onions, and overall improved yield might be since organic manure supplied balanced nutrition to the crop, improved soil condition and thereby resulted in better growth and development leading to higher yield. The above outcomes are correspondingly in nearby conformism by the result of Thangasamy et al. [6], Sharma et al. [7] Rathod et al. [8] and Verma et al*.* [9] in *Allium cepa* L.

Table 1. Bulb yield of different treatments in onion during both the cropping years 2021-22 and 2022-23

Treatments	1st Year (2021-22)	2nd Year (2022-23)	Pooled
T1	119.00±5.95^{a}	125.33±6.27^{a}	122.17±6.11^{a}
T2	261.00±10.44^{de}	252.00±10.08^{bc}	256.50±10.26^{bc}
T3	313.00±18.78^{f}	301.00±18.06^{e}	307.00±18.42^{ef}
T4	222.00±17.76^{b}	229.66±18.37^{b}	225.83±18.07^{b}
T5	249.66±7.49^{cd}	246.66±7.4b^{c}	248.16±7.45^{ab}
T6	321.00±12.80^{fg}	313.00±12.5^{ef}	317.00±12.65^{fg}
T7	342.33±17.09^{g}	332.67±16.65^{f}	337.50±16.87^{g}
T8	231.66±13.95^{bc}	237.03±14.20^{bc}	234.34±14.08^{ab}
T9	241.00±16.90^{bcd}	264.00±18.50^{cd}	252.50±17.70^{ab}
T10	276.33±22.11^{e}	286.67±22.95^{de}	281.50±22.53^{de}
T11	304.33±12.15^{f}	295.67±11.85^{e}	300.00±12.00^{ef}

Values presented as means ± SD.
Values in columns followed by the same letter (small alphabet) are not significantly different between treatments P < 0.05, Duncan's multiple range test

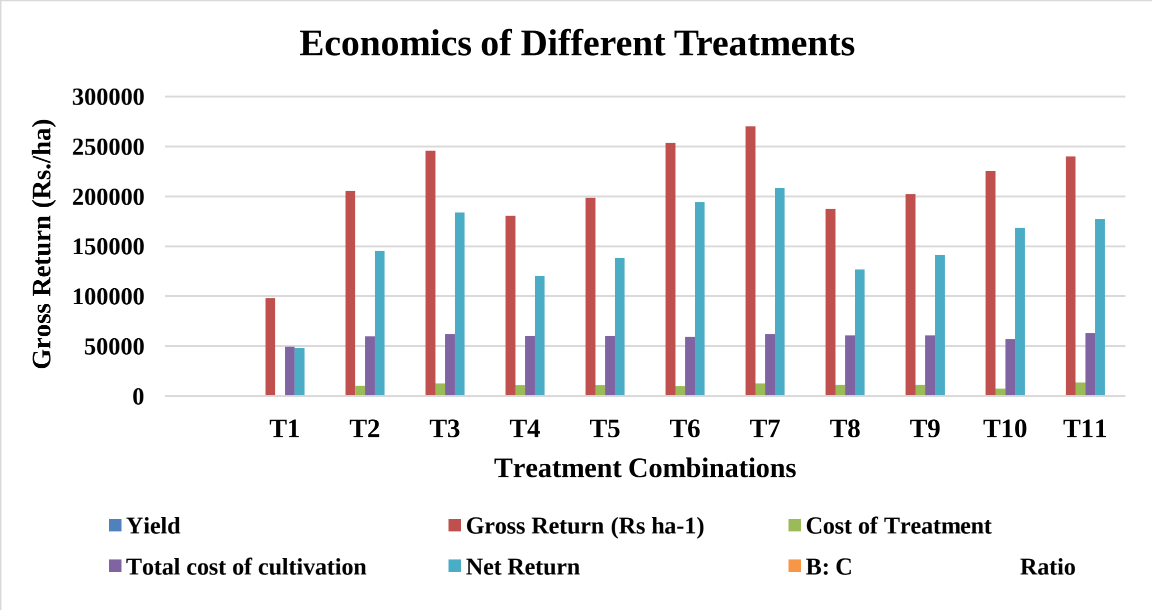

Fig. 1. Economics of different treatments in Onion during both the cropping years 2021-22 and 2022-23

3.2 Effect of Integrated Nutrient Management on the Economics of Treatments

The data (Fig. 1) indicated that the uppermost cost of cultivation (Rs. 61553 ha^{-1}) was noted in 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each). Nevertheless, the lowermost cost of cultivation was recorded (Rs. 49420 ha^{-1}) in control. The highest cost input was observed, which might be attributed to the usage of 75% of the required dose of inorganic fertilizers in addition to FYM, vermicompost, and biofertilizers. i.e., *Azospirillum* and PSB. The highest gross return (Rs. 269992 ha^{-1}), net return (Rs. 208438 ha^{-1}) and cost: benefit ratio (4.36) was recorded in 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each), while the minimum gross return (Rs. 97728 ha^{-1}), net return (Rs. 48307 ha^{-1}) and minimum cost: benefit ratio (1.97) was observed under control treatment during investigation. The higher gross return under 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each) was primarily due to a greater yield, while the higher net return and benefit: cost ratios were due to lower expenses for cultivation underneath 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each). These outcomes are also in conformity with the findings of Kumar et al. [10], Prusty et al. [11] Nirala et al. [12] and Chaudhary et al. [13

4. CONCLUSION

In conclusion, integrated nutrient management positively influences onion yield by ensuring a balanced and sustained supply of nutrients, improving soil health and fertility, enhancing weed and pest management, promoting environmental sustainability, and providing cost-effective solutions. Adopting INM practices can lead to higher onion yields, better crop quality, and increased profitability for farmers. In accordance with the study's findings, it concluded that onion bulb production was shown to be higher with treatment T_8- 75% RDF + FYM@ 2 t/ha + VC@ 1 t/ha + Biofertilizers (*Azospirillum* + PSB @ 5 kg/ha each). It was also noted that the above treatments had the best cost-benefit ratio.

ACKNOWLEDGEMENT

Sincerely and grateful thanks to Department of Vegetable Science, College of Horticulture, SVPUA&T, Meerut and NHRDF Regional Centre, Karnal for providing quality planting material and other facilities for the research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chaudhary SK, Yadav SK, Mahto DK, Singh SK, Singh BB and Sinha N. Effect of Different Organic and Inorganic Sources of Nutrients on Growth and Yield of Rabi Onion (*Allium cepa* L.). Int. J. Curr. Microbiol. App. Sci. 2020;9(10):2851-2858.
2. Fageria MS, Chaudhary BR, and Dhaka RS. Vegetable Crops Production Technology. Kalyani Publishers. 2019; 135.
3. Gomez AK and Gomez AA. Statistical procedure for Agriculture Research. John Willey and Sons Pnc, New York; 1996.
4. Kumar S, Garhwal OP and Sharma A. Effect of Integrated nutrient management on growth and yield attributes of kharif onion (*Allium cepa* L.). Int. J. Pure App. Biosci. 2017;5(3):854-857.
5. Nirala K, Punetha S, Pant SC and Upadhaya S. Effect of Various Organic Manures with Biofertilizers on Growth, Yield and Economics of Onion (*Allium cepa* L.). Int. J. Curr. Microbiol. App. Sci. 2019;8(01):3092-3099.
6. Prusty M, Mishra N, Kar DS and Pal S. Effect of Integrated Nutrient Management on Growth and Yield of Onion (*Allium cepa* L.) cv. Bhima Super. International Journal of Agriculture Sciences. 2019;11(4):7910-7912.
7. Rathod NB, Khandare RN and Karle AS. Effect of organic, inorganic and integrated nutrient management on yield attributes, production of onion and soil properties, under vertisol of Maharashtra. International Journal of Chemical Studies. 2020;8(1): 937-940.
8. Sharma SK, Garhwal OP, Mahala P and Yadav TV. Influence of integrated nutrient management on yield attributes and economics of kharif onion (*Allium cepa* L.) under loamy sand soils. International Journal of Current Microbiology and Applied Sciences. 2018;7(6): 2806-2811.
9. Singh J, Singh MK, Kumar M, Gupta A and Singh KP. Growth, Yield and Quality Parameters of Cucumber (*Cucumis sativus* L.) as Influenced by Integrated Nutrient Management Application. Int. J. Curr. Microbiol. App. Sci. 2020;9(10):1455-1462.
10. Singh J, Singh MK, Kumar M, Kumar V, Singh KP and Omid AQ. Effect of integrated nutrient management on growth, flowering and yield attributes of cucumber (*Cucumis sativus* L.). International Journal of Chemical Studies. 2018;6(4):567-572.
11. Thamburaj S and Singh N. Textbook of Vegetables, Tuber crops and spices. ICAR. New Dehli. 2022;469.
12. Thangasamy A, Lawande KE. Integrated nutrient management for sustainable onion production. Indian J. Hort. 2015;72(3):347-352.
13. Verma N, Jaiswal RK, Ali SA and Dhakad RK. Impact of Biofertilizers on Growth and Yield Attributes of Onion (*Allium cepa* L.) var. AFLR. Int. J. Curr. Microbiol. App. Sci. 2021;10(02): 931-938.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/104095