Environment and Ecology 42 (4B) : 1906—1911, October—December 2024
Article DOI: https://doi.org/10.60151/envec/FTJS8529
ISSN 0970-0420

Study on Effect of INM on Growth, Yield and Quality of Onion (*Allium cepa* L.)

Vikas Kumar, Sandeep Kumar Rajvanshi, Deepak Kumar

Received 18 July 2024, Accepted 7 November 2024, Published on 16 December 2024

ABSTRACT

A field experiment was carried out at Government Agriculture Farm, Department of Agriculture, Kadrabad, Bijnor, Uttar Pradesh during the *rabi* season of 2022-23 with 3 replications and 8 treatments combinations. The grouping of organic, inorganic and bio-fertilizer is giving good results. They are increased the Height of Plant, Number of Leaves, Length of Leaves, Polar Diameter, Equatorial Diameter, Neck Thickness, Number of Scales, Total Soluble Solids and Ultimately Yield (q/ha) in onion. The application of integrated nutrient like inorganic, organic, FYM @ 15 tonnes/ha and bio-fertilizer T_8 (NPK+FYM +*Azotobacter* Phosphate Solubilizing Bacteria), may be suitable for commercial cultivation of onion under western Uttar Pradesh Condition. The present study shows that the onion cv 'Nasik Red' performs very well with T_8 resulting under bijnor condition.

Vikas Kumar[1]*, Sandeep Kumar Rajvanshi[2], Deepak Kumar[3]

[1]Assistant Development Officer (Agriculture)
[2,3]Assistant Professor
[1]Department of Agriculture, Government of Uttar Pradesh, Vikas Bhawan, Bijnor, Uttar Pradesh 246701, India

[2]Department of Agriculture Science, PBR Degree College, Hardoi, Uttar Pradesh 241305, India

[3]Faculty of Agriculture Science, Mohammad Ali Jauhar University, Rampur, Uttar Pradesh 244901, India

Email: vs1744@gmail.com
*Corresponding author

Keywords Integrated Nutrient Management (INM), Quality, Nasik red, FYM, PSB, *Azotobacter*, Bio-fertilizer.

INTRODUCTION

Onion (*Allium cepa* L.) is a popular root vegetable crop belongs to family Alliaceae, genus *Allium* and species *cepa* with Chromosome Number X=8 (2n=16). The genus Alliums contain about 300 species, biennial and perennial bulbous, the inflorescence of onion is 'Tunicated bulb' which developed in the soil. The pungency in onion due to a volatile oil is 'allyl propyl' disulfide ($C_3H_5S_2C_3H_7$). The red color of onion bulb is due to presence of "Anthocyanin" and yellow color of onion due the "Quercetin".

Onion is an abundant resource of calories, vitamins, vitamin 'C' and minerals especially iron, phosphorus and calcium per 100 g edible part of onion bulb contain 86.6% moisture, 11.1 g carbohydrates, 1.2 g proteins, 0.1 g fat, 0.08 mg thiamin, 0.01 mg riboflavin, 11 mg vitamin'C, 47 mg calcium and 0.07 mg iron by Dhaliwal (2015).

Commercially onion grown throughout the world and major producing countries like China, India, USA, Turkey, Pakistan, Iran, Japan, Spain and Brazil. India is the second largest producer of onion after China. India is the second largest onion-growing country in the world after china. The Indian onions are famous for their pungency and are available throughout the year. Presently the area under cultivation of onion

in India is 1.54 million hectares and production is 25.44 million MT with productivity of 16.52 (mt/ha). Maharashtra is the leading onion producing state in India and it contributes 33% share in total onion production. The other most important onion growing states are Maharashtra, Karnataka, Andhra Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh and Orissa. In India per hectare yield is highest in Maharashtra is (34.31 mt/ha) (NHB 2023).

INM on onion responds very well to organic manure. Therefore the soil for onion is liberally manures and fertilized. Onion is high demanding fertilizer feeder crop, great yield losses are noticeable the current era of Agriculture depend greatly on judicious use of chemical fertilizer for increase crop yield. However this fertilizer obtains is short supply and other indiscriminate use has on adverse effect on long term soil health and environment which has reserved global attention.

The rational answer is INM for combine application of chemical fertilizer a longing by means of organic manure, green manure, bio-fertilizer and other organic eco-friendly resources for crop production. The fundamental notion of INM is the upholding and modification of soil productiveness and plant nutrient contribute to optimum level for sustainable. The desired crop productivity and soil health through optimization of the benefits from all possible sources plant nutrient in an integrated manner by Roy and Ange (1991).

FYM is prominent organic compost of integrated nutrient supply system, which upgrades soil health and releases important nutrient. FYM uphold soil fertility and water holding capacity and also upgrades soil structure and texture. It is also increase organic matter in the soil.

Phosphate Solubilizing Bacteria play a significant role in solubilizing insoluble phosphate around 95-99% of the total soil phosphorus are insoluble which are not directly available to plant. The Phosphate Solubilizing Bacteria and fungi may convert insoluble form of phosphorus to soluble form by producing organic acid in general about 15-25% insoluble phosphate can be solubilized and 10-20% increase growth and yield production. Saving chemical fertilizer drastically. *Bacillus polymyxa, Aspergillus awamori, Penecillium digitatum* are some important microorganism by Bhattacharyya and Jain (2008).

INM being moderate input provide highly economic assurance eco-friendly environment system soil health and plant growth by adding organic fertilizer like- FYM, green manure and bio-fertilizer (*Azotobacter* and PSB). As well as supplementary of chemical fertilizer like Nitrogen, Phosphorus and Potash given by Urea, DAP and Muriate of potash. It is produce some growth promoting substances like- Indole acetic acid (IAA), gibberellins, cytokinin, vitamins, which help in root and shoot development and increases growth and yield production and productivity, enhance germination, flowering, maturation as well as better utilization of applied plant nutrient the growth period of crops bio-fertilizer's bacteria secrete some fungicide and antibiotic substances. Which help in reducing occurrence of certain crops decreases and increases disease resistant in plants, these bacteria improve physical and biological properties and also increasing fertility and productivity of soil, organic fertilizer also improved water holding capacity.

MATERIALS AND METHODS

The present study was carried out by transplanting 40 days old disease and insect free healthy seedling of onion cv "Nasik Red" on a raised bed measuring at a spacing of 15 cm×10 cm from November-May, 2023 at Government Agriculture Farm, Department of Agriculture, Kadrabad, Bijnor, Uttar Pradesh. The soil of the experimental farm was sandy-clay to loam, high in organic matter, the availability of Nitrogen, Phosphorus and Potash were in high range 0.75 m was provided between two beds by Swarup (2008).

The experimental field was laid down in Randomized Block Design with 8 treatments and 3 replications. The treatment combinations are comprises viz., T_1-NPK (Control), T_2-NPK+FYM, T_3-NPK+*Azotobacter*, T_4-NPK+Phosphate Solubilizing Bacteria (PSB), T_5-NPK+FYM+*Azotobacter*, T_6-NPK+FYM+Phosphate Solubilizing Bacteria (PSB), T_7-NPK+*Azotobacter*+PSB and T_8-NPK+-FYM+*Azotobacter*+PSB. P and K are useful basal in

all the treatments as per the requirements to balance their respective doses. Other cultural practices like weeding, mulching, hoeing, irrigation, insect-pest and disease management were common for all the treatments. Observations are recorded on various parameters like- Plant Height (cm), Number of Leaves/ Plant, Neck Thickness of Bulb (cm), Polar Diameter of Bulb (cm), Equatorial Diameter of Bulb (cm), Number of Scales Per Bulb and Total Soluble Solid of the Bulb (^{0}Brix). The data recorded observations were used for analysis to test the level of significance as per method given by Chandel (1984).

RESULTS AND DISCUSSION

In the present field experiment all the growth parameters viz., plant height (cm), number of leaves/plant, neck thickness of bulb (cm), polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and total soluble solid of the bulb (^{0}Brix) showed a significant increase (Table 1) with the application of INM in various combinations of nutrients.

The data projected against different treatments of bio-fertilizer markedly affect the height of plants in onion. It clearly indicated that all treatments of bio-fertilizer increased the significantly over the control. Statistical analysis revealed that treatments T_8- (NPK+FYM+*Azotobacter*+PSB) have increased the height of plants (53.56 cm) which is significantly higher over the rest of treatments. The treatments T_8 has maximum height followed by T_7, T_6 and T_5 over the control.

The data revealed that a different treatment of INM affects the number of leaves/plant. It clearly indicated that all treatments of INM increase number of leaves significantly over the control statistical analysis revealed that treatment T_8- (NPK+FYM+*Azotobacter*+PSB) has increased number of leaves (9.19) per plant which is significantly higher over the rest of treatments. The treatment T_8 has maximum number of leaves followed by T_7 and T_6 over the control. The data projected against different treatments of INM markedly affect the neck thickness in onion. It clearly indicate the all the treatment increase the neck thickness significantly over the control. Statistical analysis revealed that treatment T_8 - NPK + FYM + *Azotobacter* + PSB has increased the neck thickness (1.56 cm) which is significantly higher over the treatments. The treatment T_8 has maximum neck thickness followed by T_7 and T_6 over the control. The data projected against different treatments of integrated management markedly affect the polar diameter of onion bulbs. It clearly indicated that all treatments increase the polar diameter of bulbs significantly over the control. Statistically analysis revealed that treatment T_8-NPK + FYM + *Azotobacter* + PSB, has increases the polar diameter of bulb (7.33 cm) which significantly higher over the rest of treatments. The treatment number T_8 has maximum polar diameter of bulbs followed by T_7 and T_6 over the control. The data projected against different treatments of integrated management markedly affect the equatorial diameter of onion bulbs. It clearly indicated

Table 1. Effect of INM on growth, yield and quality of onion.

Parameters / Treatments	Height of plant (cm)	Number of leaves plant	Neck thickness of bulb (cm)	Polar diameter of bulb (cm)	Equatorial diameter of bulb (cm)	Number of scales per bulb	TSS of the bulb (^{0}Brix)	Weight of fresh bulb (g)	Yield (q/ha)
T_1	40.43	5.69	0.64	4.91	4.57	8.20	11.01	52.85	168.98
T_2	48.03	6.45	0.66	5.86	4.86	10.10	12.20	7.90	208.91
T_3	49.42	6.72	1.03	5.76	5.29	10.10	13.86	86.20	229.19
T_4	48.42	6.55	0.97	5.99	5.13	10.60	13.59	82.40	215.75
T_5	51.28	7.38	1.14	6.29	5.37	10.80	14.25	112.30	263.20
T_6	50.49	7.25	1.06	6.72	5.32	11.70	14.66	106.80	252.28
T_7	51.56	7.63	1.26	6.69	5.51	12.20	14.71	130.20	290.90
T_8	53.56	9.19	1.56	7.33	5.70	14.10	14.84	149.60	309.28
SE	1.50	0.36	0.027	0.29	0.277	0.353	0.583	4.30	15.10
CD at 5%	3.22	0.78	0.058	0.62	0.595	0.759	1.25	9.20	33.69

that all treatments increase the equatorial diameter of bulbs significantly over the control. Statistical analysis revealed that treatment T_8- NPK + FYM + *Azotobacter* + PSB, has increases the polar diameter of bulb (5.70 cm) which is significantly higher over the rest of treatments. The treatments number T_8 has maximum polar diameter of bulbs followed by T_7 and T_6 over the control. The data projected against different treatments of integrated management markedly affect the number of scales of onion bulbs. It clearly indicated that all the treatments increase the number of scales of bulbs significantly over the control. Statistically analysis revealed that treatment T_8-NPK + FYM + *Azotobacter* + PSB, has increases the number of scales of bulbs (14.10) which is significantly higher over the rest of treatments. The treatment number T_8 has maximum polar diameter of bulbs followed by T_7 and T_8 in control treatment. Data projected against different treatments of integrated management markedly affect the total soluble solids of onion bulbs. It clearly indicated that all treatments increase the total soluble solids of bulbs significantly over the control. Statistical analysis revealed that treatment T_8-NPK + FYM + *Azotobacter* + PSB, has increases the total soluble solids of bulb (14.84) which is significantly higher over the rest of treatments. The treatment number T_8 has maximum polar diameter of bulbs followed by T_7 and T_6 over the control. The data projected against different treatments of integrated management markedly affect the fresh weight of onion bulb. It clearly indicates that all the treatment increase the fresh weight of onion bulb significantly over the control. Statistical investigation depicted that treatment T_8-NPK + FYM + *Azotobacter* + PSB, has increased the fresh weight of onion bulb (149 g) which is significantly higher in control treatments. The treatment T_8 has maximum neck thickness followed by T_7 and T_6 in control treatment. Data projected against different treatments of integrated management markedly affect the yield of onion bulb. It clearly indicates that all the treatment increase the yield of onion bulb significantly over the control. Statistical investigation depicted that treatment T_8-NPK+FYM+*Azotobacter*+PSB has increased the yield of onion bulb (309 q/ha) which is significantly higher in control treatments. The treatment T_8 has maximum neck thickness followed by T_7 and T_6 over the control.

The findings of this investigation were in close conformity with those of Kumar *et al.* (2017), Badal *et al.* (2019), Wankhade and Kale (2019) and Upadhyay *et al.* (2023).

DISCUSSION

Effect of INM was finding significant on the height of the plant, number of leaves and length in onion. The maximum height of plant, number of leaves and length of leaves in onion was obtained in the treatment T_8-NPK + FYM + *Azotobacter* + PSB, which is indicate vigorous vegetative growth. Since INM supplies all essential elements of the plants in a proper amount, it's promote the development of plant which increased the vegetative growth and the maintenance of the soil fertility and sustainability. The nutrients increased plant height, number of leaves and length of leaves in onion.

The results are in confirming finding of Balmi and Saxena (2007) who observe that combined application of biological fertilizer and chemical fertilizer increased height of plant, number of leaves per plants in onion. Similar results were also found by Yadav *et al.* (2005), who observed increased plant height of the plant in onion. Similar result was also found by Naval and Wani (2006), Ruban (2007) and Tesfaye *et al.* (2007) in onion and other vegetables crops.

The commercial product of onion plant is its bulbs, formation of bulb is governed by application of integrated nutrient. Integrated nutrient supply is significantly increased the size of the bulb polar diameter, equatorial and neck thickness, significantly maximum followed by control in onion. The findings of this investigation were in close conformity with those of Bhati *et al.* (2018), Chhabra and Vishwakarma (2019).

The increased of the size of bulb in the aerial parts of onion plant i.e. height of plant with increased size and number of leaves and length of leaves producing there by increased photosynthetic area. The maximum bulb diameter (polar and equatorial) and nick thickness was obtained from treatment T_8–NPK+ FYM + *Azotobacter* + Phosphate solubi-

lizing bacteria. The result are in conformity with the finding of Balmi and Saxena (2007) who observe that combined application of biological fertilizer and chemical fertilizer increased polar and equatorial diameter and nick thickness of bulb.

Similar results were also found in accordance Yadav *et al.* (2005), Mahanthesh *et al.* (2005) and Muthuramalingam *et al.* (2001).

In the experimental observation the maximum observation recorded in a significant manner. They are observed increased yield and production of the onion bulb. The maximum weight of bulb and yield was obtained from treatment combinations of T_8–NPK+-FYM+*Azotobacter*+Phosphate solubilizing bacteria.

The results are conforming to the findings of Balmi and Saxena (2007), Devi *et al.* (2003) in onion, which was observed that combined application of inorganic, organic fertilizer and biological fertilizers gave higher yield than the inorganic fertilizer alone. Similar results were also found in accordance Mahanthesh *et al.* (2008) and Balmi and Saxena (2007) in onion.

The similar findings of this investigation were in close conformity with those of Gashaw (2021) and Upadhyay *et al.* (2023) in onion.

REFERENCES

Badal DS, Dwivedi AK, Kumar V, Singh S, Prakash A, Verma S, Kumar J (2019) Effect of organic manures and inorganic fertilizers on growth, yield and its attributing traits in garlic (*Allium sativum* L.). *Journal of Pharmacognosy and Phytochemistry* 8 (3) : 587—590.

Balmi PN, Saxena AK (2007) Response of onion (*Allium cepa* L.) to combined application of biological and chemical nitrogenous fertilizers. *Acta Agriculturae Slovenica* 89 (1) : 107—114.

Bhati V, Yadav PK, Kumar R (2018) Effect of levels of inorganic fertilizers, organic manure and bio-fertilizers on plant growth attributes of onion (*Allium cepa* L.) cv N-53 under Hot Arid Region of Western Rajasthan, India. *International Journal Current Microbiology & Applied Science* 7 : 35—93. https://doi.org/10.20546/ijcmas.2018.703.413

Bhattacharyya P, Jain RK (2008) Phosphorus solubilizing biofertilizers in the whirl pool of rock phosphate-challenges and opportunities. *Fertilizer News* 45 : 45—52.

Chandel SRS (1984) Principals of experimental design. A Hand Book of Agriculture Statistics, pp 14—53.

Chhabra S, Vishwakarma G (2019) Effect of integrated nutrient management on growth, yield and quality of onion (*Allium cepa* L.) cv Palam Lohit. *Journal of Pharmacognosy and Phytochemistry SP* 4 : 73—77.

Devi AKB, Limi A, Singh NG (2003) Effect of inorganic and biofertilizers on bulb yield and economic of multiplier onion (*Allium cepa* var. aggregatum). *News Letter National Horticulture Research and Development Foundation* 23 (3) : 1—3.

Dhaliwal MS (2015) Handbook of vegetable crop. Kalyani publishers, New Delhi, India, pp 15—25.

Gashaw B (2021) Evaluation of different rates of NPS on growth and yield performances of garlic (*Allium sativum* L.) in Cheha district, Gurage Zone, Ethiopia. *International Journal of Agronomy,* pp 1—5. https://doi.org/10.1155/2021/7742386

Kumar A, Ram RB, Sutan M, Sachin K, Rahul Y, Meena KR (2017) Effect of organic manures, biofertilizers and micronutrients on growth, yield and quality of onion (*Allium cepa* L.). *International Journal Agriculture Science* 13 (2) : 236—241. https://doi.org/10.15740/has/ijas/13.2/236-241

Mahanthesh B, Sajjan MRP, Vishnuvardhan M, Lakshman (2008) Effect of biofertilizers with levels of NPK on bulb size and other characters of onion (cv Bellary Red) bulb in *kharif* season under integrated condition. *Environment and Ecology* 26 (1) : 155—159.

Mahanthesh B, Venkatesha J, Thippesha D, Poornima G, Umesha K (2005) Effect of biofertilizers with leaves of NPK on growth and yield of onion (*Allium cepa* L.) cv Bellary Red grown under integrated condition in central dry zone of Karnataka. *Karnataka Journal of Horticulture* 1 (3) : 70—75.

Muthuramalingam S, Natrajan S, Sendurkumaran S, Muthu vel I (2001) Morphological character as influenced by spacing and nutrients in seed propagated aggregatum onion. *Madras Agricultural Journal* 88 (7-9) : 379—382.

Naval AM, Wani PV (2006) Effect of *Glomus mosseae* and *Azospirillum lipoferum* inoculation under graded levels of nitrogen fertilizer on growth and yield of onion (*Allium cepa* L.) cv B-780 under field condition. *International Journal of Plant Sciences* 1 (2) : 222—226.

NHB (2023) Indian Horticulture Database. Ministry of Agriculture and Farmers' Welfare, Government of India, Gurugram, pp 275—277.

Roy RN, Ange AL (1991) Integrated plant nutrient systems (IPNS) and sustainable agriculture. Proc. FAI Annual Seminar, FAI, New Delhi SV/1-1/1-12.

Ruban JS (2007) Effect of biofertilizer on seed yielding capacity of onion (*Allium cepa* L.). *Plant Archives* 7 (1):255—256.

Swarup V (2008) Production technology of onion. Vegetable Science and Technology in India, pp 532—536.

Tesfaye B, Pal N, Saxena AK (2007) Response of onion (*Allium cepa* L.) to combined application of biological and chemical nitrogenous fertilizers. *Acta Agriculturae Slovenica* 89 (1) : 107—114. http://dx.doi.org/10.2478/v10014-007-0013-y

Upadhyay A, Singh RB, Singh P, Lai B, Singh S (2023) Effect of integrated nutrient management on yield attributing parameters of *kharif* onion (*Allium cepa* L.). *International Journal of Environment and Climate Change* 13 (10) : 4187—4193. https://doi.org/10.9734/ijecc/2023/v13i103095

Wankhade SD, Kale VS (2019) Effect of organic nutrient management on growth and yield of onion (*Allium cepa* L.) cv Akola Safed. *Journal of Pharmacognosy and Phytochemistry* 8 (1): 1918—1920.

Yadav D, Prasad VM, Gujar KD (2005) Effect of different biofertilizers in association with phosphorous on growth and yield of onion (*Allium cepa* L.) a white onion var Jndwo. *New Agriculturist* 16 (1/2) : 87—89.