© 2016 *RELS*
http://rels.comxa.com
rel_sci@yahoo.com

ISSN: 0974-4908
Res. Environ. Life Sci.
9(1) 56-58 (2016)

Effect of integrated nutrient management on growth and yield of onion (A*llium Cepa* L.)

Sandeep Kumar , M.L. Meena*, Deepa Lal and Tribhuvan Rai
Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow-226 025, India
***e-mail:** drmeena1977@gmail.com

(Received: June 05, 2015; Revised received: November 22, 2015; Accepted: November 28, 2015)

Abstract:A field experiment was carried out in Randomized Block Design with three replications and eight treatments combinations including control. The combination of organic, inorganic and bio-fertilizer is giving good results. They have 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/ha (in quintal) in onion. The application of integrated nutrients viz inorganic, organic, FYM @ 15 tons/ha and bio-fertilizer T_8 (NPK+ FYM + Azotobacter + Phosphate Solubilizing Bacteria,) is suitable for commercial cultivation of onion under central U.P. condition.

Key words: Effect, INM, growth, yield, onion, Nasik Red

Introduction

Onion (*Allium cepa* L.) is the most important vegetable crop of the family Alliaceae having Chromosome no. X=8 (2n=16). The genus allium having about 300 species, biennial and perennial bulbous, the inflorescence of onion is 'Tunicated bulb' which develops in the soil onion has homorhizea root system. The pungency in onion is due to the presence of volatile oil 'allyl propyl disulphide ($C_3 H_{5)}$. The red color of onion bulb is due to presence of "Anthocyanin" and yellow color of onion due to the 'quercertin . Onion is one of the leading vegetable crops worldwide, grown for its culinary and medicinal values purposes. In 2003, it was cultivated in more than 175 countries, on nearly 3 million ha, producing more than 50 million tonnes. Onion is a rich source of calories, vitamins and minerals, especially iron, phosphorus and calcium per 100g edible part of onion bulb contain 86.6% moisture, 11.1g carbohydrates, 1.2 g protein, 0.1 g fat, 0.08 mg thiamine, 0.01 mg riboflavin, 11mg vitamin, 47 mg calcium and 0.07 mg iron (Dhaliwal, 2008). Commercially, onion is grown throughout the world and major producing countries are China, India, USA, Turkey, Pakistan, Iran, Japan, Spain, and Brazil. The world production of the onion 66829917 ('000 MT) with area of 3731659 ('000 ha) and productivity is 17.91 MT/ha). (FAO, 2008). China is, accounting for 22.18 per cent of the world area and 18.78 percent of the world production. In India, onion is being grown in an area of 0.83 million hectares with production of 13.57 million tonnes and the productivity is 16.30 tonnes per hectare which is low. In India Maharashtra is the leading onion growing state and other important states are Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan, Haryana, Uttar Pradesh and Tamil Nadu. In Karnataka, onion is cultivated in an area of 1.65 lakh hectares with production of 30.32 lakh tonnes and the average productivity is 18.40 tonnes per hectare which is low compared to world average. In the year 2008-2009, India exported about 16.70 lakh metric tonnes of fresh onion fetching about Rs. 1827.50 crores. Besides meeting the demand for internal consumption (Kumar, 2010).

Integrated Nutrient management practice of onion responds very well to organic manure. Therefore, the soil for onion is liberally manures. Onion being high demanding not adequately fertilizer, considerable yield losses are apparent the present day modern Agriculture depend heavily on use of chemical fertilizers for boosting crop yield. However, indiscriminate use of fertilizers has an adverse effect on long term soil health and environment which has global attention. The realistic solution is Integrated Nutrient Management system are, the combined application of chemical fertilizers, longing with organic manure, green manure, bio-fertilizer and other organic recyclable materials for crop production. The basic concept underlying INM is the maintenance and adjustment of soil fertility and plant nutrients supply to an optimum level for sustainable. The desired crop productivity and soil health through optimization of the benefits from all possible sources of plant nutrients in an integrated manner (Roy and Ange, 1991). Farmyard manure is conspicuous organic compost of an integrated nutrient supply system, which improves soil health and releases macro and micro nutrient. FYM maintain soil fertility and water holding capacity. It also improves soil structure and texture. It also increases organic matter in the soil.

Similarly, Phosphate Solubilizing Bacteria play a significant role in Solubilizing insoluble phosphate to make available around 95-99% of the total soil phosphorus are insoluble and 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 fertilizers significantly, *Bacillus polymyxa, Aspergillus awamori, Penecillium digitatum,* are some important micro-organism (Bhattacharyya et al., 2000). Integrated nutrient management being moderate input to provide highly economic assurance, ecofriendly environment system soil health and plant growth by adding organic fertilizers like FYM, green manure, and bio-fertilizer (*Azotobacter*, (PSB,). As well as supplementary of chemical fertilizer like N, P and K given by Urea, DAP and Murate of potash. It has produced sum growth promoting substances like Indole acetic acid (IAA), gibberellins, cytokinin, vitamins, which help in root and shoot development and increase growth and yield production and productivity, enhance

germination flowering, maturation as well as better utilization of applied plant nutrient the growth period of crops to the bio-fertilizer 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, increase soil fertility and productivity Organic fertilizers also improved water holding capacity.

Hence, the present study was proposed with the objective of finding the optimum does of INM in onion under Lucknow conditions.

Materials and Methods

The present investigation was carried out during the rabi season at the horticultural research farm, department of applied plant science (Horticulture) at university. The soil of the experimental farm was saline-alkaline loam, low in organic matter; the availability of N, P and K were in medium range. The experimental field was laid down in randomized block design with 8 treatments and replicated thrice. The treatment combinations comprised 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. Phosphorus and potassium were applies 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 were recorded are, Plant Height (cm), No of Leaves per Plant, Neck Thickness of Bulb (cm), Polar Diameter of Bulb (cm), Equatorial Diameter of Bulb (cm), Number of Scales per Bulb and T.S.S. of the Bulb (^{0}Brix). The data recorded were analyzed for ANOVA using RBD as per the procedure to test the level of significance as per method suggested by (Chandel, 1984).

Results and Discussion

The results of present investigation in all the growth parameters viz. plant height (cm), number of leaves per plant, neck thickness of bulb (cm), polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and T.S.S. of the bulb (^{0}Brix) showed a significant increase (Table-1) with the application of integrated nutrient management in various combinations of nutrients. The data depicted against different treatments of bio-fertilizers markedly affected the height of plants of 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) has 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 different treatments of integrated nutrient management it affected the number of leaves per plant. It clearly indicated that all treatments of INM increased the 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 integrated nutrient management markedly affected the neck thickness in onion. It clearly indicates that 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, increased 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 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 increased the polar diameter of bulb (5.70cm) 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 depicted against different treatments of integrated management significantly influenced the number of scales of onion bulbs. It clearly indicated that all the treatments increase the number of scales of bulbs significantly

Table-1: Effect of integrated nutrient management on growth, yield and quality of onion

Treat-ments	Height of Plant (cm)	No. of Leaves / Plant	Neck Thickness of Bulb (cm)	Polar Diameter of Bulb (cm)	Equatorial Diameter of Bulb (cm)	No. of Scales /Bulb	T.S.S. of the Bulb (^{0}Brix)	Weight of Fresh Bulb (g)	Weight of Dry Bulb(g)	Yield (q/ha)
T_1	40.43	5.69	0.64	4.91	4.57	8.20	11.01	52.85	48.23	168.98
T_2	48.03	6.45	0.66	5.86	4.86	10.10	12.20	78.90	74.39	208.91
T_3	49.42	6.72	1.03	5.76	5.29	10.10	13.86	86.20	82.15	229.19
T_4	48.42	6.55	0.97	5.99	5.13	10.60	13.59	82.40	79.25	215.75
T_5	51.28	7.38	1.14	6.29	5.37	10.80	14.25	112.30	108.25	263.20
T_6	50.49	7.25	1.06	6.72	5.32	11.70	14.66	106.80	102.40	252.28
T_7	51.56	7.63	1.26	6.69	5.51	12.20	14.71	130.20	126.15	290.90
T_8	53.56	9.19	1.56	7.33	5.70	14.10	14.84	149.60	145.35	309.28
S.E.	1.50	0.36	0.027	0.29	0.277	0.353	0.583	4.30	3.90	15.10
C.D. at 5%	3.22	0.78	0.058	0.62	0.595	0.759	1.25	9.20	8.90	33.69

Where: 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

over the control. Statistically analysis revealed that treatment T_8- NPK + FYM + *Azotobacter* + PSB, has increased 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 over the control. The 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 depicted 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 analysis revealed that treatment T_8- NPK + FYM + *Azotobacter* + PSB, has increased the fresh weight of onion bulb (149 gm) 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 yield of onion bulb. It clearly indicates that all the treatment increased the yield of onion bulb significantly over the control. Statistical analysis revealed that treatment T_8- NPK + FYM + *Azotobacter* + PSB has increased the yield of onion bulb (309 q/ha) 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 effect of integrated nutrient management was found 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 indicates vigorous vegetative growth. Since integrated nutrient management supply all essential elements of the plants in a proper amount it's promote the growth of the plant which increase the vegetative growth and the maintenance of the soil fertility and sustainability. They are nutrient which increase the plant height, number of leaves and length of leaves in onion. The results are in conformity with the findings of Balmi *et al.* (2007), who observed that combined application of biological fertilizers and chemical fertilizers increased height of plant, number of leaves per plats in onion. Similar results were also found by Yadav et al. (2005), who observed increased plant height of the plant in onion. Similar results were 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 bulb, the formation of bulb is governed by application of integrated nutrient. Integrated nutrient supply is significantly increased in the size of the bulb, diameter (polar and equatorial) and neck thickness significantly maximum followed by control in onion. The increase in size of bulb in the aerial parts of the onion plant that is the height of plant with increased size and number of leaves and length of leaves produced thereby, increasing in the photosynthetic area. The maximum bulb diameter (polar and equatorial) and nick thickness was obtained with the treatment T_8-NPK+FYM+*Azotobacter*+Phoaphate solubilizing bacteria. The result are in conformity with the finding of Balmi *et al.* (2007) who observe that combined application of biological fertilizers and chemical fertilizers increased polar and equatorial diameter and nick thickness of bulb.

The similar results were also found by Yadav *et al.* (2005), Mahanthesh *et al.* (2005) and Muthuramalingam *et al.* (2001). The experimental findings showed that 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 with the treatment combinations of T_8-NPK+ FYM+ *Azotobacter*+ Phoaphate solubilizing bacteria. The results are in conformity with the findings of Balmi *et al.* (2007), and 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 fertilizers alone. Similar results were also found by Mahanthesh *et al.* (2008) and Balemi *et al.* (2007) in onion.

Acknowledgements

Authors are thankful to the Dean, School for Bio-Science and Bio-Technology, Babasaheb Bhimrao Ambedkar University, Lucknow, India for extending the facilities during the course of investigation.

References

Balmi, P.N. and Saxena, A.K.: Response of onion (*Allium cepa* L.) to combined application of biological and chemical nitrogenous fertilizers., *Acta Agri. Slovenica,* **89**: 107-114 (2007).

Bhattacharya, P. and Jain, R.K.: Phosphorus Solubilizing Biofertilizers in the Whirl Pool of Rock Phosphate-challenges and Opportunities., *Fert. News,* **45**: 45-52 (2000).

Chandel, S.R.S.: Principals of Experimental Design. *A Hand Book of Agriculture Statistics*., p. 14-53 (1984).

Devi, A.K.B and Limi, A. and Singh, N.G.: 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**: 1-3(2003).

Dhaliwal, M.S.: *Handbook of Vegetable Crop, Kalyani Publishers., New Delhi, India.* p. 15-25 (2008).

Kumar, B.: *Indian Horticulture Database-2009, National Horticulture Board, Ministry of Agriculture, Govt. of India, Guragaon*., P. 267 (2010).

Mahanthesh B, Venkatesha J, Thippesha D, Poornima G. and Umesha, K.: 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 J. Hort.,* **1**: 70-75 (2005).

Mahanthesh, B. and Sajjan, M.R.P. Vishnuvardhan, M. Lakshman. :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**: 155-159 (2008).

Muthuramalingan, S. Natrajan, S. Sendurkumaran, S. and Muthuvel, I.: Morphological character as influenced by spacing and nutrients in seed propagated aggregatum onion. *Madras Agri. J.,* **88**: 379-382 (2001).

Naval, A.M. and Wani, P.V.: 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. *Intern. J. Pl. Sci.,* **1**: 222-226 (2006).

Roy, R.N. and Ange, A.L.: Integrated plant nutrient systems (IPNS) and Sustainable agriculture. *Proc. FAI Annual Seminar.,* SV/1-1/1-12 (1991).

Ruban, J.S.: Effect of biofertilizer on seed yielding ca- pacity of onion (*Allium cepa* L.). *Plant Archives.,* **7**: 255-256 (2007).

Scholten, O. and VA Van Bruggen.: Improved disease resistance in onion through introgression of disease resistance by the use of wild relatives and the effect of arbuscular mycorrhiza fungi. *Wageningen University., England* (2007).

Tesfaye, B. Pal, N. and Saxena, A.K.: Response of onion (*Allium cepa* L.) to combined application of biological and chemical nitrogenous fertilizers., *Acta Agri. Slovenica,* **89**: 107-114 (2007).

Yadav, D. Prasad, V.M. and Gujar, K.D.: Effect of different biofertilizers in association with phosphorus on growth and yield of white onion (*Allium cepa* L.)., *New agri.,* **16**: 87-89 (2005).