

Effect of integrated nutrient management on yield attributes of onion (*Allium cepa* L.) cv. Pusa Shobha

ABSTRACT

The experiment was conducted at the Horticulture Research Farm, near Gautam Buddha Central Library, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar Raebareli Road Lucknow, (U.P) experiment was conducted during *Rabi* season in the years, of 2021-2022 and 2022-2023. The experiment was laid out in randomized block design with three replications, the recorded data were statistically analyzed using analysis of variance (ANOVA) as formulated at 5% level of significance was used for data analysis of experiment. The treatments consisted of T₀ -Control (without fertilizers); T₁- 100% RDF (NPK@150:50:80 Kg/ha); T₂- 100% RDF + FYM (10 t/ha); T₃ -100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha); T₄ -100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha); T₅ -100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha); T₆ -75% RDF + FYM (10 t/ha); T₇ -75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha); T₈ -75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha); T₉ -75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). T₁₀ -50% RDF + FYM (10 t/ha); T₁₁- 50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha); T₁₂- 50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha); T₁₃ -50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). Results revealed that the treatment T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) performed better results with respect of yield characters such as average bulb weight (g), polar diameter (cm), equatorial diameter (cm), and total bulb yield (q/ha) onion bulb.

Keywords: Integrated nutrient management, Biofertilizer, Phosphorus Solubilizing Bacteria, Azotobacter, Vermicompost, Farmyard manure, Recommended Dose of Fertilizers, Yield, Onion.

1. INTRODUCTION

“Onion (*Allium cepa* L.) is a most important crop belongs to the Alliaceae family. It is native of the Central Asia and chromosome number $2n=16$. It is one of the most important cash vegetable crops among bulb crops and semi-perishable in nature. Onion is an indispensable item in every kitchen as condiment and vegetable, therefore commands an extensive internal market. Onion is mainly used for its flavor and pungency, the chief component of pungency is ‘allyl propyl disulphide’. Onion contains carbohydrate (11.0 g), proteins (1.2 g), fiber (0.6 g), moisture (86.8 g) and several vitamins like vitamin A (0.01 mg), vitamin C (11 mg), thiamine (0.08 mg), riboflavin (0.01 mg) and niacin (0.2 mg). It also contains some minerals like phosphorus (39 mg), calcium (27 mg), sodium (1.0 mg) and potassium (157 mg) per 100 g of bulb (Sharma *et al.*, 2018). Onion is used for flavoring or seasoning the food, both at mature and immature stages; Onion is also used in preparing soups, sauces, curries, pickles and for flavoring or seasoning food. Generally, vegetables require large quantity of major nutrients like nitrogen, phosphorus and potassium, in addition to secondary nutrients such as zinc, boron, copper, calcium and sulphur for better growth, yield and post-harvest life. Continuous and unbalanced fertilizer use has a negative impact on agricultural production sustainability while also producing environmental damage. Inorganic fertilizers being very expensive are difficult for small and marginal farmers to afford” (Shah *et al.*, 2019). “Promotion of the use of inorganic fertilizers for supplying these nutrients in the previous years has now become a bone of contention for its detrimental effect on both soil and environment apart from its enormous price hike every year. Integrated nutrient management (INM) provides excellent opportunities to overcome all the imbalances besides sustaining soil health and enhancing crop production. The use of FYM, vermicompost and biofertilizers in such situation is, therefore, a practically paying proposal. The farmyard manure supply nitrogen, phosphorus and potassium and other essential nutrients in available form to the plants through biological decomposition. It improves the physical, chemical and biological properties of soil such as organic matter content, microbial activities, aggregation, aeration and water holding capacity and available nutrients. Vermicomposting is a mixture of worm casting, organic materials and living earthworms. It is slow releasing organic manure, have most of the macro and micro nutrients that fulfill the nutrient requirement of plants” (Gebremichael *et al.*, 2017). “Although the use of manures as nutrient sources for vegetables is

common, their effectiveness is potentially limited by nutrient release pattern that are often out of synchrony with crop demand, large variability in source quality and various edaphological factors. All of these issues need field experimentation with alternative options. A gradual shift from using purely organic sources to some proportion of inorganic fertilization is gaining acceptance. This shift has formed the basis for INM, which could involve three nutrient sources: microbial inoculants or biofertilizers including *Azotobacter*, *Azospirillum*, and phosphate solubilizing bacteria (PSB); inorganic fertilizers, and organic manures. However, INM further prescribes that selected nutrient inputs be used judiciously to ensure optimum supply of all essential nutrients for sustainable crop production. Hence, the greater its ability to utilize nutrients for crop production, the greater is the yield potential. FYM is the commonly used organic manure but its supply is limited. It contains low and widely varying nutrient concentration. Vermicompost is the good source of all plant nutrients but it is using in high quantity. Use of vermicompost as an excellent organic manure for field crops and vegetable crops has been promoted. Biofertilizers are the inoculation of microorganism which is capable of mobilizing nutrient element from unavailable to available form through biological processes. Biofertilizers are the products that contain living cells of different types of microorganisms; play an important role in atmospheric nitrogen fixation, phosphorus solubilisation and have an ability to convert complex forms of elements to available forms through biological process and improve the crop yield” (Singh and Singh 2018). The use of vermicompost and biofertilizers in such situation is, therefore, practically paying proposal Phosphorus solubilizers bacteria like *Pseudomonas* and *Bacillus* which solubilize phosphorus in soil and make it available to plants. While, *Azospirillum*, a nitrogen fixing organism has been reported to be beneficial and economical for several crops. Therefore, Keeping this the in the view, the present investigation was undertaken to study the effect of integrated nutrient management on yield attributes of onion (*Allium cepa* L.) cv. Pusa Shobha.

2. MATERIALS AND METHODS

The experiment conducted during *Rabi* season in the years, of 2021-2022 and 2022-2023 both the year same time at Horticulture Research Farm, near Gautam Buddha Central Library, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar Raebareli Road

Lucknow, (U.P). The experiment was laid out in randomized block design with three replications, the recorded data were statistically analyzed using analysis of variance (ANOVA) as formulated at 5% level of significance was used for data analysis of experiment described by Panse and Sukhatme(1995) to find out overall total variability present in the material under study for each character and for all the populations. The soil was sandy clay loam texture and slightly alkaline in reaction, good in fertility situated at an elevation of 111 meter above mean sea level in the sub-tropical climate of central Uttar Pradesh at 26°56 North Latitude 80°52 east longitude. The topography of experimental field was fairly uniform during experimental year. According to standard processors, the soil samples were collected randomly from the experiment field at the depth of 0-15cm. The randomly collected samples were thoroughly mixed well and composite soil sample was made up (500 g) of soil, all the cultural practices and treatment application is applicable timely. The sample was analyzed to determine the physical and chemical analysis of soil testing laboratory of university. The pH was determined by electric pH meter as 7.6 and having low in available nitrogen (192 kg/ha) and medium in available P₂O₅ (13.8 kg/ha), K₂O (170 kg/ha). Available nitrogen was determined by alkaline permanganate method as reported by Piper (1966) and available phosphorus and potash by Olsen's method Olsen *et al.* (1954) and Flame photometer method respectively. The Electrical Conductivity (E.C.) was determined by Conductivity Bridge as described by Jackson (1967). Seeds of onion *cv.* Pusa Shobha were sown in nursery beds prepared two months earlier. The soil of seed bed was prepared with compost and mulching was done with straw to protect the young seedlings from adverse climatic condition. Covering materials were removed from the bed after seed germination (5-6 days after sowing) for optimum growth of the seedlings. Seedlings were ready for transplanting 45 days after sowing. The main field was prepared by ploughing with disc plough and subsequent ploughing was done with cultivator followed by leveling. The soil of the experimental site was irrigated before transplanting for optimum moisture in the field. The healthy seedlings having uniform growth were selected and transplanted on well prepared field in the afternoon hours at a spacing of 15 x 10 cm and all cultural operations done timely like weeding, irrigation, plant protection *etc.* The crop was harvested when 75% tops start falling over but before the foliage is completely dry. The bulbs are harvested by hand pulling and with the help of hand hoe. The tops were removed one day after field curing leaving 2.5 cm top only with the bulb.

List 1: Details of the treatments combination:-

TreatmentNo.	TreatmentCombination
T ₀	Control(withoutfertilizers)
T ₁	100%RDF(NPK@150:50:80Kg/ha)
T ₂	100%RDF+FYM(10t/ha)
T ₃	100%RDF+FYM(5t/ha)+Vermicompost(2t/ha)
T ₄	100%RDF+FYM(10t/ha)+Azotobacter(5Kg/ha)+PSB(5Kg/ha)
T ₅	100%RDF +FYM(5t/ha)+Vermicompost(2t/ha)+Azotobacter(5Kg/ha)+PSB(5Kg/ha)
T ₆	75%RDF+FYM(10t/ha)
T ₇	75%RDF+FYM(5t/ha)+Vermicompost(2t/ha)
T ₈	75%RDF+FYM(10t/ha)+Azotobacter(5Kg/ha)+PSB(5 Kg/ha)
T ₉	75%RDF+FYM(5t/ha)+Vermicompost(2t/ha)+Azotobacter(5Kg/ha)+PSB(5Kg/ha)
T ₁₀	50%RDF+FYM(10t/ha)
T ₁₁	50%RDF+FYM(5t/ha)+Vermicompost(2t/ha)
T ₁₂	50%RDF+FYM(10t/ha)+Azotobacter(5Kg/ha)+PSB(5 Kg/ha)
T ₁₃	50%RDF+FYM(5t/ha)+Vermicompost(2t/ha)+Azotobacter(5Kg/ha)+PSB(5Kg/ha)

Note:

RDF- Recommended Dose of Fertilizers (NPK @ 150:50:80Kg/ha)

FYM- Farmyard Manure

PSB- Phosphorus Solubilizing Bacteria

Treatment application

1. FYM

Well rotten farm yard manure was incorporated in the soil at the time of field preparation as per treatment. FYM content 0.52 % N, 0.36 % P and 0.60 % K.

2. Vermicompost

Vermicompost procured from the departmental vermicompost unit was applied in the beds as per treatments and was thoroughly incorporated in to the soil at the time of sowing.

3. Biofertilizers

Azotobacter and PSB @ 5kg ha⁻¹ were mixed with FYM. This mixture was applied in soil after the transplanting of seedling.

4. NPK

Recommended doses of nitrogen (150kg ha⁻¹), phosphorus (50kg ha⁻¹) and potassium (80 kg ha⁻¹) were applied in each plot. The source of nutrients was for nitrogen urea and SSP for phosphorus and sulphur, MOP for potash. Half dose of nitrogen and whole doses of phosphorus and potash were applied as basal dose prior to transplanting of onion seedlings. While the rest of nitrogen was given in 2 equal split doses in transplanted onion seedling, first at 30 and second 45 days after transplanting.

Yield and yield attributing characters was recorded as-

1. Average bulb weight (g)

Five selected plant from each plot and replication were weighed to determine the average weight for bulb yield of a plant.

2. Equatorial diameter of bulb (cm)

Equatorial diameter of randomly selected bulbs were measured at both equatorial portion of bulb with the help of Vernier's calipers was used to denote bulb diameter (cm) of each accessions.

3. Polar diameter of bulb (cm)

Polar diameter of randomly selected bulbs were measured at both polar portion of bulb with the help of Vernier's calipers was used to denote tuber diameter (cm) of each bulb.

4. Bulb yield (q/ha)

After cutting the leaves (2-2.5 cm above the neck) of cured bulbs, bulbs were weighed on electronic balance and bulb yield per net plot was recorded in kilogram which was converted into quintal per hectare as given below:

$$\text{Bulb yield per hectare (q)} = \text{Bulb yield (kg/plot)} \times 10,000 / \text{Net area of plot (m}^2\text{)} \times 100$$

3. RESULTS AND DISCUSSION

Data presented of the both year in Table-1, 2, 3 and 4 the effect of integrated nutrient management on yield and yield attributes of onion showed the significant difference among the treatments.

3.1 Effect of integrated nutrient management on average bulb weight (g) of onion (*Allium cepa* L.)

Average bulb weight- Data presented in Table-1 and Fig.-1, during 2021-22, the maximum average bulb weight (98.86g) was recorded in T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by the T₁₃. The minimum average bulb weight (43.34g) was recorded in case of control T₀. During 2022-23, the maximum average bulb weight (99.87g) was recorded with application of T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by the T₁₃. The minimum average bulb weight (44.35g) was recorded in case of control T₀. These similar results are in conformity by Dhakad *et al.* (2019), Badal *et al.* (2019), Upadhyay *et al.* (2023).

Table-1 Effect of integrated nutrient management on average bulb weight (g) of onion (*Allium cepa* L.)

Average bulb weight (g)			
	Treatment Combination	2021-22	2022-23
T ₀	Control (without fertilizers)	43.34	44.35
T ₁	100% RDF (NPK@150:50:80 Kg/ha)	72.78	73.84
T ₂	100% RDF + FYM (10 t/ha)	73.46	74.92
T ₃	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	75.25	76.28
T ₄	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	77.33	78.45
T ₅	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	79.20	80.20
T ₆	75% RDF + FYM (10 t/ha)	76.89	77.89
T ₇	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	81.56	82.56
T ₈	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	89.78	90.72
T ₉	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	98.86	99.87
T ₁₀	50% RDF + FYM (10 t/ha)	83.44	84.52
T ₁₁	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	85.34	86.45

T ₁₂	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	87.87	88.88
T ₁₃	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	94.56	95.57
SE (m) ±		0.972	0.697
CD (P=0.05)		2.828	2.028

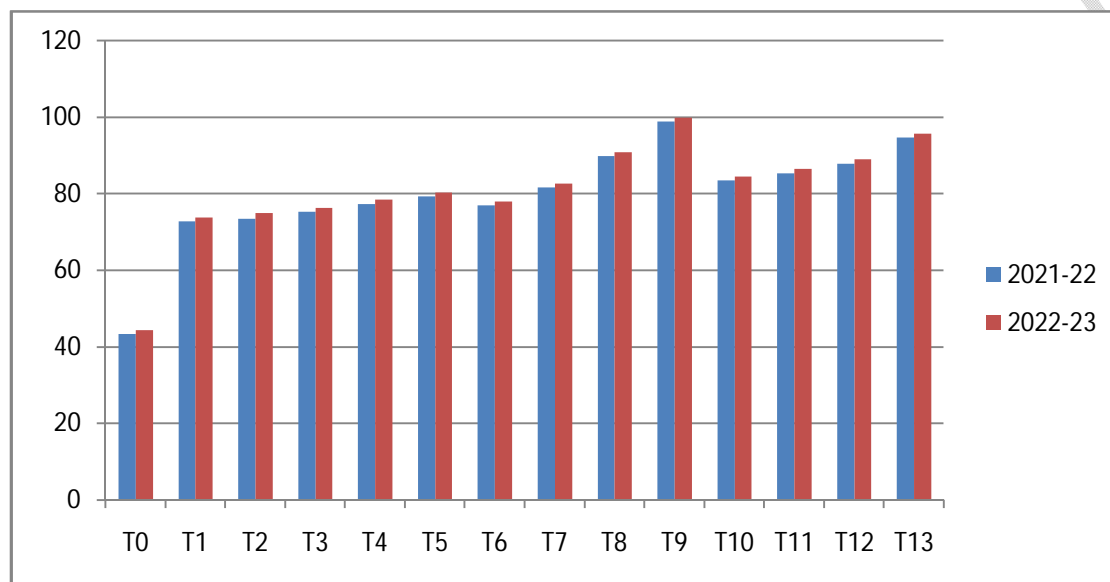


Fig.-1 Effect of integrated nutrient management on average bulb weight (g) of onion (*Allium cepa* L.)

3.2 Effect of integrated nutrient management on polar diameter (cm) of onion (*Allium cepa* L.)

Polar diameter of bulb- Perusal of data in Table-2 and Fig.-2 indicated significant effects of different treatments on polar diameter of bulb in both the years. During 2021-22, the maximum polar diameter (6.12cm) was recorded with application of T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). The minimum polar diameter (3.95cm) was recorded in case of control T₀. During 2022-23, the polar diameter was the maximum (6.32 cm) in case of application T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). The minimum polar diameter (3.85cm) was recorded in case of control T₀. However the use of organic and biofertilizers increase the polar diameter similar results found by Singh *et al.* (2019), Dhakad *et al.* (2019), Kalirawna *et al.* (2022).

Table-2 Effect of integrated nutrient management on polar diameter (cm) of onion (*Allium cepa* L.)

Polar diameter (cm)			
	Treatment Combination	2021-22	2022-23
T ₀	Control (without fertilizers)	3.95	3.85
T ₁	100% RDF (NPK@150:50:80 Kg/ha)	4.13	4.23
T ₂	100% RDF + FYM (10 t/ha)	4.43	4.53
T ₃	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	4.60	4.80
T ₄	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	4.88	4.98
T ₅	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.29	5.39
T ₆	75% RDF + FYM (10 t/ha)	5.53	5.63
T ₇	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	5.65	5.75
T ₈	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.75	5.85
T ₉	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	6.12	6.32
T ₁₀	50% RDF + FYM (10 t/ha)	5.28	5.38
T ₁₁	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	5.67	5.77
T ₁₂	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.56	5.66
T ₁₃	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.85	5.95
SE (m) ±		0.053	0.056
CD (P=0.05)		0.155	0.163

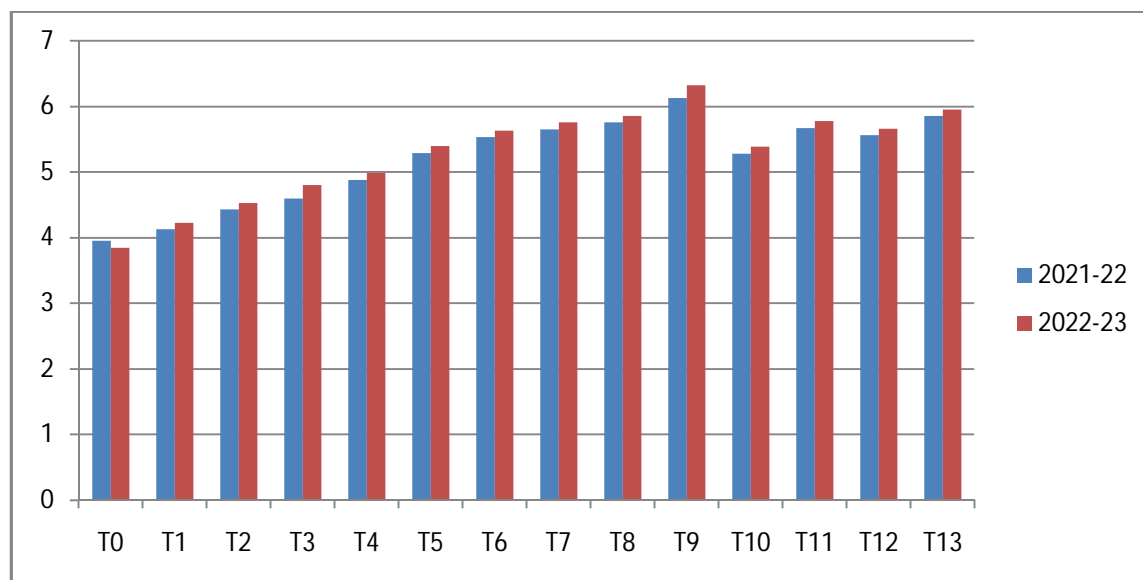


Fig.-2 Effect of integrated nutrient management on polar diameter (cm) of onion (*Allium cepa* L.)

3.3 Effect of integrated nutrient management on equatorial diameter (cm) of onion (*Allium cepa* L.)

Equatorial diameter of bulb- Data in Table-3 and Fig.-3 indicated significant effects of different treatments on Equatorial diameter of bulb during both the years. The maximum Equatorial diameter during 2021-22 (6.21cm) was recorded with application of T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). The minimum Equatorial diameter (3.80cm) was recorded in case of control T₀. During 2022-23, the maximum equatorial diameter (6.24cm) was recorded with application of T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). The minimum equatorial diameter (3.82cm) was recorded in case of control T₀. These similar results are in conformity by Meena *et al.* (2015), Dhakad *et al.* (2019), and Singhet *al.* (2019), Upadhyay *et al.* (2023).

Table-3 Effect of integrated nutrient management on equatorial diameter (cm) of onion (*Allium cepa* L.)

Equatorial diameter (cm)			
	Treatment Combination	2021-22	2022-23
T ₀	Control (without fertilizers)	3.80	3.82
T ₁	100% RDF (NPK@150:50:80 Kg/ha)	4.29	4.30
T ₂	100% RDF + FYM (10 t/ha)	4.38	4.41
T ₃	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	4.70	4.81

T ₄	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	4.98	4.99
T ₅	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.18	5.19
T ₆	75% RDF + FYM (10 t/ha)	5.40	5.42
T ₇	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	5.52	5.53
T ₈	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.69	5.70
T ₉	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	6.21	6.24
T ₁₀	50% RDF + FYM (10 t/ha)	5.26	5.29
T ₁₁	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	5.11	5.24
T ₁₂	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.02	5.02
T ₁₃	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.97	5.98
SE (m) ±		0.064	0.07
CD (P=0.05)		0.188	0.204

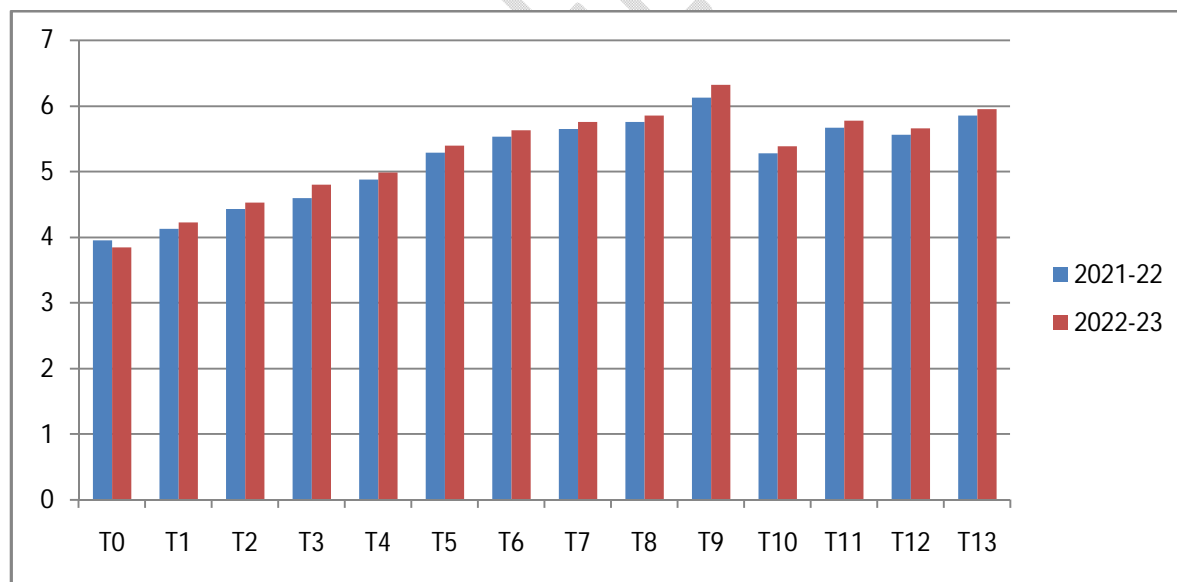


Fig.-3 Effect of integrated nutrient management on equatorial diameter (cm) of onion (*Allium cepa* L.)

3.4 Effect of integrated nutrient management on total bulb yield (q/ha) of onion (*Allium cepa* L.)

Total bulb yield (q/ha) -As evident from the data present in Table-4 and Fig.-4 treatment effect on total bulb yield (q/ha) was significant during both the years. During 2021-22, the maximum total bulb yield (258.79 q/ha) was recorded with T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5Kg/ha) which was at par with T₇, T₈ and T₁₃. On the other hand, the minimum (124.53 q/ha) for total bulb yield was recorded in case of control T₀. During 2022-23, total bulb yield was found to be maximum (259.72 q/ha) in case T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5Kg/ha) which was at par with T₇, T₈ and T₁₃. The minimum total bulb yield (126.85q/ha) was found in control T₀. Similar results were found by Badal *et al.* (2019), Kaur and Singh (2019), Kalirawna *et al.* (2022).

Table-4 Effect of integrated nutrient management on total bulb yield (q/ha) of onion (*Allium cepa* L.)

Total bulb yield (q/ha)			
	Treatment Combination	2021-22	2022-23
T ₀	Control (without fertilizers)	124.53	126.85
T ₁	100% RDF (NPK@150:50:80 Kg/ha)	201.85	203.70
T ₂	100% RDF + FYM (10 t/ha)	209.72	211.57
T ₃	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	220.83	223.61
T ₄	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	218.98	220.83
T ₅	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	230.55	232.87
T ₆	75% RDF + FYM (10 t/ha)	236.57	238.88
T ₇	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	240.74	242.59
T ₈	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	244.44	248.61
T ₉	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	258.79	259.72
T ₁₀	50% RDF + FYM (10 t/ha)	218.05	219.90
T ₁₁	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	232.87	234.72
T ₁₂	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	219.90	222.68
T ₁₃	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	242.12	246.29
SE (m) ±		6.879	6.961
CD (P=0.05)		19.997	20.237

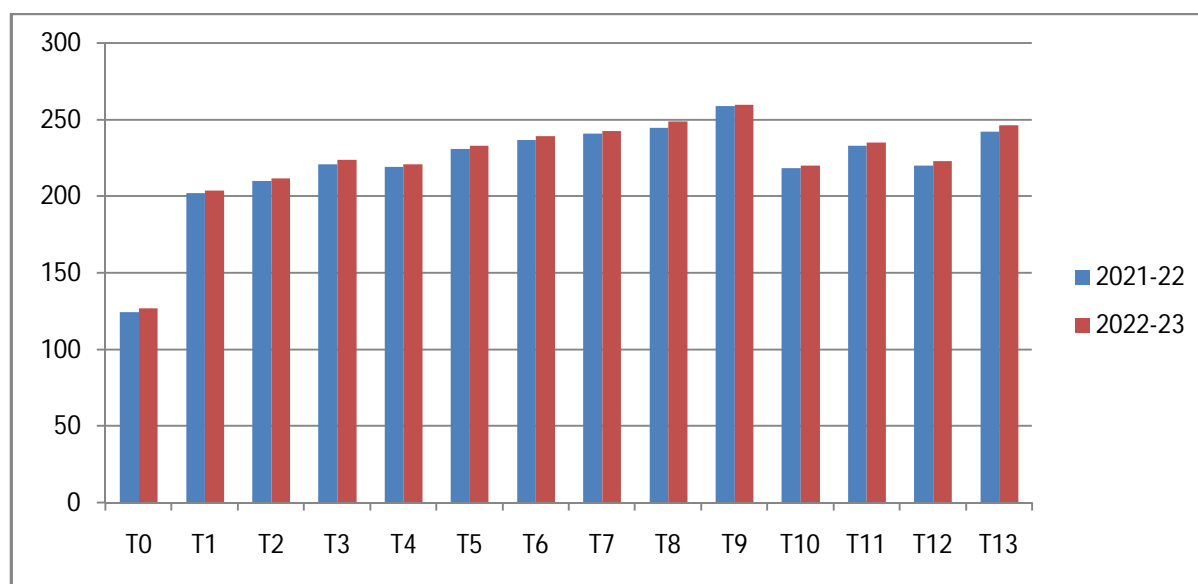


Fig.-4 Effect of integrated nutrient management on total bulb yield (q/ha) of onion (*Allium cepa* L.)

Results showed that weight of bulb, equatorial diameter, polar diameter, and total bulb yield increased with T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). This might be due the facts that combined application of inorganic fertilizers and organic manures helped in the expansion of leaf and chlorophyll content which together might be have accelerated the photosynthetic rate and in turn increased the supply of carbohydrates to the plants. The application of 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) favored the metabolic and auxin activities in plant and ultimately resulted in increased bulb diameter, average bulb weight, number of scales and total yield. Similarly, vermicompost and biofertilizers improved physical, chemical and biological properties of soil which consequently increased the value of yields attributes and finally yield. “Further, it is relevant to note that, organic manure and biofertilizers seems to be directly responsible in increasing crop yields either by accelerating the respiratory process by increasing cell permeability due to hormone growth action or combination of all these processes. It supplies nitrogen, phosphorus, potassium of which phosphorus involved in cell division, photosynthesis and metabolism of carbohydrates where potash regulated proper translocation of photosynthesis and stimulated enzyme activity which in turn might have increased the rate of growth and positive development in yield characters which was resulted in high bulb yield of onion”. These findings are in conformity with Brar *et al.* (2015), Meena *et al.* (2015), Chavan *et al.* (2016), Sharma *et al.* (2017), Prusty *et al.* (2019), Kaur and Singh (2019), Dhakad *et al.* (2019), Sahoo *et al.* (2022), Kalirawna *et al.* (2022), Upadhyay *et al.* (2023).

CONCLUSION

On the basis of experimental results, it could be concluded that the application of T₉- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) was found to be the best treatment combination in terms of yield and yield attributing parameters of onion. Integrated approach of vermicompost, FYM and biofertilizer performed better with respect to yield parameters average bulb weight (g), polar diameter (cm), equatorial diameter (cm) and total bulb yield (q/ha) onion bulb. In the future integrated nutrient management play a vital role to sustain soil fertility and maintain crop productivity for long time. And provide natural and healthy food material for the human being without damaging the environment components.

ACKNOWLEDGEMENTS

I would like to express sincere appreciation to BBAU, Lucknow department of Horticulture and our supervisor for their invaluable support and provision of resources. Your supports play a vital role to complete of this research.

REFERENCES

- Baburao N. P., Sharma Rupesh and Bhagyashree N. P.(2023).** Effect of organic nutrient management on quality parameters of late *kharif* onion (*Allium cepa* L.) cv. Bhima Super. *The PharmaInnovation Journal*, **12**(3), 1872-1878.
- Badal, D. S., Dwivedi, A. K., 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.
- Brar, K.R., Sharma, R., And Kaur, J.,(2015).** Effect of organic sources of nutrients on yield and quality of onion (*Allium cepa* L.). *Indian journal of ecology*, **42**(1), 266-267
- Chhabra, S. and G. Vishwakarma(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.

Dhakad, K. R., Chudasama, V.R., Verma, J., Jalpa, G., Dhaked, K.M.,(2019). Effect of INM in onion (*Allium cepa* L.) With respect to growth and yield under North Gujarat condition.*International Journal of current microbiology applied science*, 8(4), 1618-1622.

Gaur,A.C.,(2010).Biofertilizersinsustainableagriculture, ICAR,NewDelhi, 28-29.

Gebremichael Y, Woldetsadik K, Chavhan A and Gedamu F. (2017).Effect of integrated nutrient management on growth and bulb yield of onion under irrigation at Selekleka.*International Journal of Life Sciences*. 5(2):151-160.

Greenland,D.J,(1975).Themagnitudeandimportanceoftheproblem in Greenland with soil conservation and managementin the humid tropics, *Wiley & Sons, New York, USA*pp.3-7

Gunjan, A., Paliwal, R. and Sarolia, D.K., (2005).Effect of nitrogen and biofertilizer on yieldand qualityofrabi onion(*Alliumcepa*L.)cv.Pusa red. *AgriculturalSciencesDigest*,25(2),124-126.

Jackson, M. L.(1967). Soil Chemical Analysis Prentice Hall of India Pvt. Ltd., New Delhi ; p. 205.

Jawadagi, R.S., N. Basavaraj, B N. Patil, B. Hemla Naik and B.B. channappagoudar,(2012).Effectof differentSource of nutrients on growth,yieldandquality of onion(*Alliumcepa*L.)cv.Bellaryred.*Karnataka JournalofAgriculturalSciences*,25(2),232-235.

Kalirawna, A., Bahadur, V., Kalirawana, S., Kumari, S., Serawat, R., and Kumar, P. (2022). Effect of organic manures and inorganic fertilizers on growth, yield and quality of onion (*Allium cepa* L.) cv. Nasik Red.*The Pharma Innovation Journal*,11(2), 1389-1392.

Meena, A.K., Paliwal, R., Meena, K.K. and Singh, S.P. (2015).Effect of organic manures andbio-fertilizers on yield attributes and economics of kharif onion (*Allium cepa* L.) In semi-arid region.*IndianResearchJournalofGeneticsandBiotechnology*,7(2),259-261.

Olsen, S. R., Col, S. C. W., Watanabe, P. S& Dean, L. A., (1954). Estimation of available P in soil by extraction with HNO₃, Circular USDA. pp. 931.

Panse VG, Sukhatme PV. (1985).Statistical methods for agriculture worker 4thEdn. ICAR, New Delhi.

Piper, C. S.(1966). Soil and plant analysis inter sciences publications, Inc., New York.

Prusty, M., Mishra, N., Kar, D.S. and Pal, S.(2019).Effect of integrated nutrient management on growth and yield of onion (*Allium cepa* L.) cv. Bhima super. *International journal of agriculture sciences*, 11 (4), 7910-7912.

Shah KN, Chaudhary IJ, Rana DK and Singh V. (2019).Impact assessment of different organic manures on growth, morphology and yield of onion (*Allium cepa* L.).*Asian Journal of Agricultural Research*. 13(1): 20-27.

Sahoo,B.B.,Nayak,B.S.,Mohanty,S. K.,andKhanda,C.(2022).Significanceofbiofertilizer incorporation with customized organic manures to reduce inorganic nutrientson growth dynamics, bulb yield and economics of Onion (*Allium cepa* L.) under thewesternundulatingzoneofOdisha.*Vegetos*,1-12.

Sharma, A., Panja, P., and Mandal, J., (2017). Effect of integrated nutrient management on onion (*Allium cepa* L.) Yield, quality attributes, soil properties and production economics under field condition. *Indian journal of ecology*, 44 (5), 355-359.

Sharma SK, Garhwal OP, Mahala P and Yadav TV. (2018). 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*. 7(6):806-811.

Singh D and Singh B. (2018). A study of integrated nutrient management on growth and yield of onion (*Allium cepa* L.). *The Pharma Innovation Journal*. 7(5):473-475.

Singh B.D., Dwivedi A.K., Kumar Vimal, Singh Sopal, Prakash Atul, Verma Somendra and Kumar Jeetendra. (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, 587-590.

Tandon, H.L.S. and K.N. Tiwari. (2008). Nutrient management in horticultural crops. FDC publishers, New Delhi.

Upadhyay, A., Singh R. B., Singh P., Lai B, and 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.