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Effect of Integrated Nutrient Management on Growth of Onion (*Allium cepa* L.) cv. Pusa Shobha

Abhishek Tiwari [a++], M.L. Meena [a#*], Ruchika Abha [a†] and Rajesh Kumar Meena [a†]

[a] Department of Horticulture, School of Agricultural Sciences &Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya-Vihar, Raebareli Road, Lucknow, Uttar Pradesh, Pin-226025, 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

Aim: The objective of the research was to study the effect of integrated nutrient management on growth of onion (*Allium cepa* L.) cv. Pusa Shobha
Study Design: The experiment was laid out in Randomized Block Design (RBD) with three replications.
Place and Duration of Study: The experiment conducted during *Rabi* season in the year of 2021-22 and 2022-23 both the year at Horticulture Research Farm, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar Raebareli Road Lucknow, (U.P).

[++] Ph.D. Research Scholar;
[#] Professor;
[†] Research Scholar;
**Corresponding author: E-mail: drmeena1977@gmail.com;*

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Methodology: The experiment was laid out in RBD with three replications, Mean and ANOVA (Analysis of Variance) was used in field experiment. The treatments consisted of T_0 Control (without fertilizers), T_1- 100% RDF (NPK@150:50:80 Kg/ha): T_2- 100% RDF + FYM (10 t/ha); T_3 -100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha); T_4 -100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha); T_5 -100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha); T_6 -75% RDF + FYM (10 t/ha); T_7 -75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha); T_8 -75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha): T_9 -75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). T_{10} -50% RDF + FYM (10 t/ha); T_{11}- 50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha); T_{12}- 50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha);T_{13} -50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha).

Results: Based on the results, it is clear that the integration of organic manures and bio-fertilizers had a significant effect in enhancing growth parameters of onion and the treatment T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) is significantly different compared to other treatments as performed better with respect to growth characters such as maximum values for plant height at 30, 60 & 90DAT, number of leaves per plant at 30,60 & 90 DAT, length of leaf at 30,60 & 90 DAT of onion.

Conclusion: Integrated approach of Vermicompost, FYM and biofertilizer performed better with respect to growth parameters *viz.* plant height, number of leaves, leaf length of onion.

Keywords: Onion; integrated nutrient management; RDF; growth; biofertilizer; vermicompost; farmyardmanure.

1. INTRODUCTION

Onion is one of the most important vegetable crops grown in India, having both the food and medicinal values. The onion is a major vegetable and spice crop raised all over the world in temperate, subtropical, and tropical climates. Onion bulb is rich in protein, carbohydrates, vitamin C and minerals, like phosphorus, calcium *etc.* [1]. Integrated nutrient management (INM) provides excellent opportunities to overcome all the imbalances besides sustaining soil health and enhancing crop production. Generally, vegetables require large quantity of major nutrients like nitrogen, phosphorus and potassium, in addition to secondary nutrients such as zinc, boron, cupper, calcium and sulphur for better growth, yield and post-harvest life. 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 solubilising bacteria (PSB); inorganic fertilizers, and organic manures. Use of vermicompost as an excellent organic manure for field crops and vegetable crops has been promoted. Vermicompost is recommended for use as an organic fertilizer and as a replacement for chemical fertilizers in organic agriculture. It has a lot of pores, aeration, drainage, and water-holding capacity. Vermicompost has nutrients that are easily accessible from outside sources. Vermicompost is the product of turning organic debris into worm castings. The worm castings are very important to the fertility of the soil as it contains high amounts of nitrogen, potassium, phosphorus, calcium, and magnesium. Castings contain 5 times the available nitrogen, 7 times the available potash, and 1½ times more calcium than found in good top soil [2]. Use of bio fertilizers not only supplement the nutrient but also improve the efficiency of applied nutrients. The use of vermicompost and biofertilizers in such situation is, therefore, a 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. They are known to improve growth, yield as well as productivity of crops. Gaur, [3] studies have also shown that integrated use of chemical fertilizers, organic residues such as FYM, compost etc. and bio fertilizers resulted in reduced losses of nutrients and environmental pollution. However, INM further prescribes that selected nutrient inputs be used judiciously to ensure optimum supply of all essential nutrients for sustainable crop production. Onion is a heavy feeder of mineral elements. A crop of 40 t/ha removes approximately 120 kg of N, 50 kg of

P_2O_5 and 60 kg of K_2O per ha [4]. Hence, the greater its ability to utilize nutrients for crop production, the greater is the yield potential. Keeping this the in the view, the present investigation was undertaken to study the Effect of integrated nutrient management on growth of onion (*Allium cepa* L.) cv. Pusa Shobha.

2. MATERIALS AND METHODS

The experiment conducted during *Rabi* season in the years, of 2021-2023 both the year at Horticulture Research Farm, 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. Experiment was studied in RBD keeping three replications, mean and ANOVA (Analysis of Variance) was used in field experiment. In each treatment plants were transplanted in a plot size 1.8m x 1.2m and at the spacing of 15x10cm. The soil was sandy clay loam 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 Utter Pradesh at 26°56 North Latitude 80°52 east longitude and for the soil testing all standard methods of soil testing is applied. The topography of experimental field was fairly uniform during experimental year. Recommended cultural practices was followed to rise a healthy crop observation was recommended on five randomly selected plant for five characters namely as plant height (cm), number of leaf per plant, length of leaf, fresh weight of bulb (g) and dry weight of bulb (g). Data of both the years was statistically analyses as per standard method suggested by Panse and Sukhatme [5].

Growth characters was recorded as-

1. Plant height (cm):

The plant height was measured from soil surface up to the tip of fully opened leaves with the help of measuring scale and average was worked out. Height of the five randomly selected and tagged plant was measured at 30, 60, 90 days after transplanting (DAT).

2. Number of leaves:

Number of green leaves (functional leaves) of randomly selected plants in each treatment was counted at 30, 60, 90 days after transplanting (DAT) and average was calculated.

3. Leaf length (cm):

The length of leaf every selected plant of each treatment was tagged and it was measured frequently at 30, 60, 90 days after transplanting (DAT) and at harvesting with the help of measuring scale and average was worked out.

Details of the treatments combination:

Treatment No.	Treatment Combination
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)

Note: RDF- Recommended Dose of Fertilizers (NPK@150:50:80 Kg/ha)
FYM- Farmyard Manure
PSB- Phosphorus solubilizing bacteria

3. RESULTS AND DISCUSSION

3.1 Effect of Integrated Nutrient Management on Plant Height (cm) of Onion (*Allium cepa* L.) During the Year of 2021-22 & 2022-23

Effect of different treatments on plant height at 30,60 & 90 DAT (days after transplanting) are given in Table 1 and Fig. 1. As evident from the data, mean significant difference among the treatments was recorded at 30 DAT in both the years. During 2021-22, the maximum plant height at 30 DAT (32.30cm) was recorded with the treatment T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13}. The minimum plant height (16.70 cm) was recorded in case of control T_0. During 2022-23, the plant height was recorded maximum (33.43cm) in case of application of T_9-75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13}. The minimum plant height (15.41cm) was recorded with control T_0.

Effect of different treatments on plant height (cm) at 60 DAT after transplanting is given in Table 1 and Fig. 1. As evident from the data significant difference among the treatments was recorded during both the years. During 2021-22 the maximum plant height (49.76 cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by T_{13}. The minimum plant height (32.33 cm) was recorded in case of control T_0. During 2022-23, the maximum plant height (50.76cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by T_{13} and T_8. The minimum plant height (31.77cm) was recorded in case of control T_0.

Effect of different treatments on plant height (cm) at 90 DAT after transplanting is given in Table 1 and Fig. 1. As evident from the data significant difference among the treatments was recorded during both the years. During 2021-22, the plant height at 90 DAT after transplanting was maximum (62.34cm) with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with the T_{13}. While the minimum plant height (41.31cm) was recorded in case of control T_0. During 2022-23, the maximum plant height (63.98cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13}. The minimum plant height (42.37cm) was recorded in case of control T_0. The findings of this investigation were in close conformity with those of Kumar et al. [6], Badal et al. [7], Chhabra and Wankhade and Kale [8], Upadhay et al. [9].

3.2 Effect of Integrated Nutrient Management on Number of Leaf Per Plant of Onion (*Allium cepa* L.) During the Year of 2021-22 & 2022-23

Data regarding number of leaves per plant have been presented in Table- 2 and Fig. – 2. Effects on number of leaves was significant at plant growth during both the years. During 2021-22, the maximum number of leaves per plant at 30 DAT (8.73) were recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by the T_{13}. The minimum number of leaves per plant (3.12) was recorded in case of control T_0. During 2022-23, the number of leaves per plant was maximum (8.83) in case of application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha). The minimum number of leaves per plant (4.15) was recorded in case of control T_0.

Effects on number of leaves were significant at plant growth during both the years. The treatment effects on number of leaves were significant at plant growth during both the years. At 60 DAT, the maximum number of leaves per plant during 2021-22 (10.03) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13}.The minimum number of leaves per plant (4.10) was recorded in case of control T_0.During 2022-23, the maximum number of leaves per plant (10.13) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13}.The minimum number of leaves per plant (4.15) was recorded in case of control T_0.

Table 1. Effect of integrated nutrient management on plant height (cm) of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23

Treatment Details		Plant height (cm)					
		At 30 DAT		At 60 DAT		At 90 DAT	
		2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T_0	Control (without fertilizers)	16.70	15.41	32.23	31.77	41.31	42.37
T_1	100% RDF (NPK@150:50:80 Kg/ha)	22.31	21.82	39.97	40.97	50.37	51.39
T_2	100% RDF + FYM (10 t/ha)	24.38	24.72	41.21	42.28	52.11	53.18
T_3	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	26.40	26.81	42.49	43.94	53.4	54.48
T_4	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	27.29	28.21	43.3	44.39	54.56	55.96
T_5	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	28.38	29.37	44.49	45.49	55.76	56.98
T_6	75% RDF + FYM (10 t/ha)	26.36	27.26	44.87	45.87	56.87	57.89
T_7	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	28.40	29.92	45.13	46.83	58.87	59.88
T_8	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	30.68	31.73	47.65	48.69	59.87	60.97
T_9	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	32.30	33.43	49.76	50.76	62.34	63.98
T_{10}	50% RDF + FYM (10 t/ha)	25.48	26.83	43.11	44.14	55.31	56.86
T_{11}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	27.28	28.25	44.5	45.57	56.37	57.86
T_{12}	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	26.73	27.83	46.23	47.23	56.13	57.98
T_{13}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	31.56	32.45	48.12	49.12	61.36	62.54
SE(m) ±		0.336	0.369	0.479	0.462	0.771	0.553
CD (P=0.05)		0.977	1.073	1.395	1.344	2.243	1.608

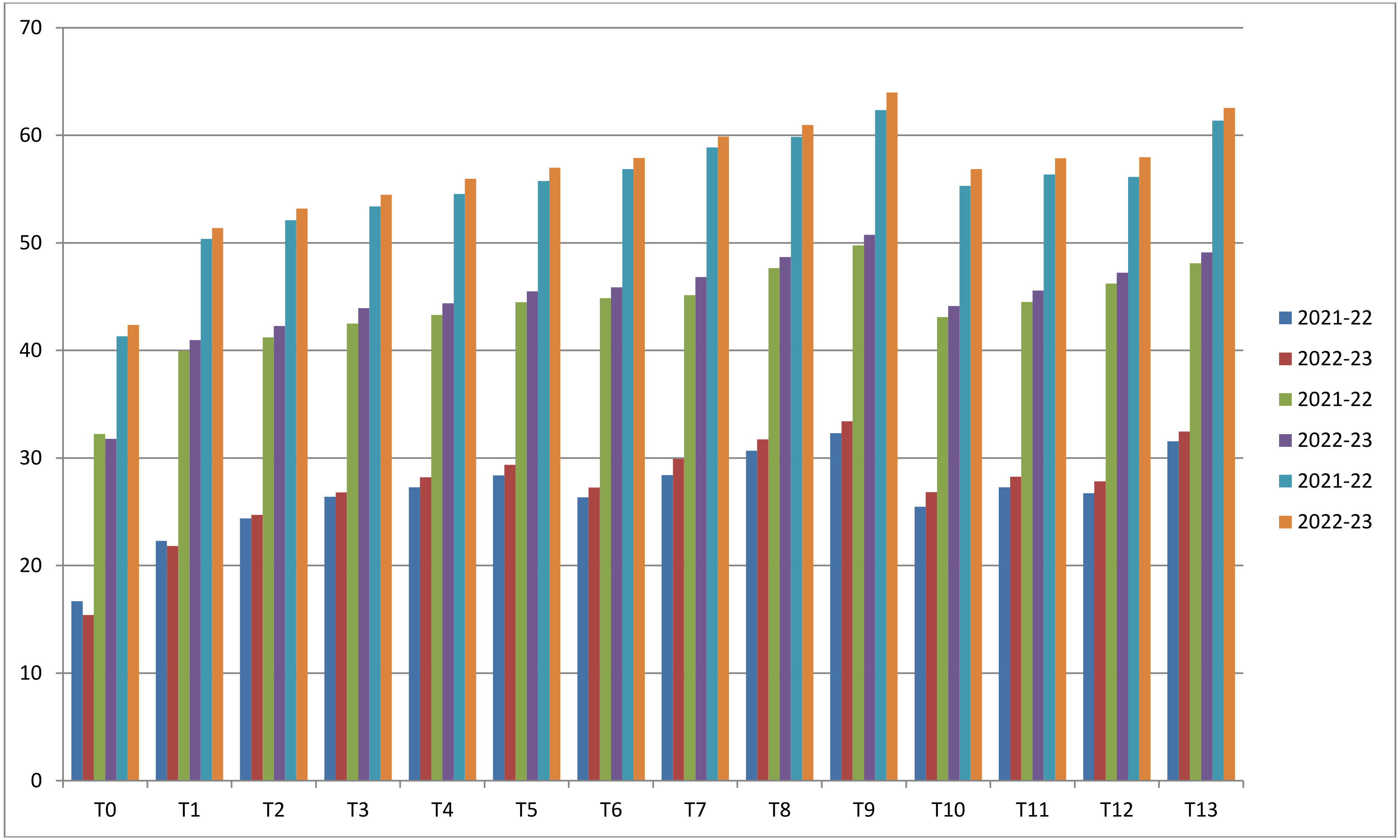

Fig. 1. Effect of integrated nutrient management on plant height (cm) of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23

Table 2. Effect of integrated nutrient management on number of leaf per plant of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23

Treatment Details		Number of leaf per plant					
		At 30 DAT		At 60 DAT		At 90 DAT	
		2021-22	2022-23	2021-22	2022-23	2021- 22	2022-23
T_0	Control (without fertilizers)	3.12	3.15	4.10	4.15	7.20	7.28
T_1	100% RDF (NPK@150:50:80 Kg/ha)	4.35	4.88	6.31	6.42	9.42	9.51
T_2	100% RDF + FYM (10 t/ha)	5.06	5.96	6.90	6.97	9.64	9.74
T_3	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	5.63	5.86	7.30	7.83	10.21	10.31
T_4	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.80	5.91	7.49	7.59	10.49	10.59
T_5	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	5.87	5.97	8.86	8.96	11.07	11.17
T_6	75% RDF + FYM (10 t/ha)	6.81	6.91	8.90	8.99	10.60	10.16
T_7	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	7.37	7.47	9.22	9.32	11.01	11.11
T_8	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	7.89	7.99	9.32	9.42	11.92	11.93
T_9	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	8.73	8.83	10.03	10.13	12.98	12.99
T_{10}	50% RDF + FYM (10 t/ha)	6.2	6.32	8.30	8.13	9.85	9.96
T_{11}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	7.1	7.62	8.95	8.97	10.43	10.53
T_{12}	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	7.38	7.58	9.10	9.14	11.78	11.88
T_{13}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	8.12	8.34	9.82	9.93	12.44	12.54
SE(m) ±		0.067	0.079	0.076	0.075	0.088	0.123
CD (P=0.05)		0.197	0.231	0.223	0.218	0.256	0.357

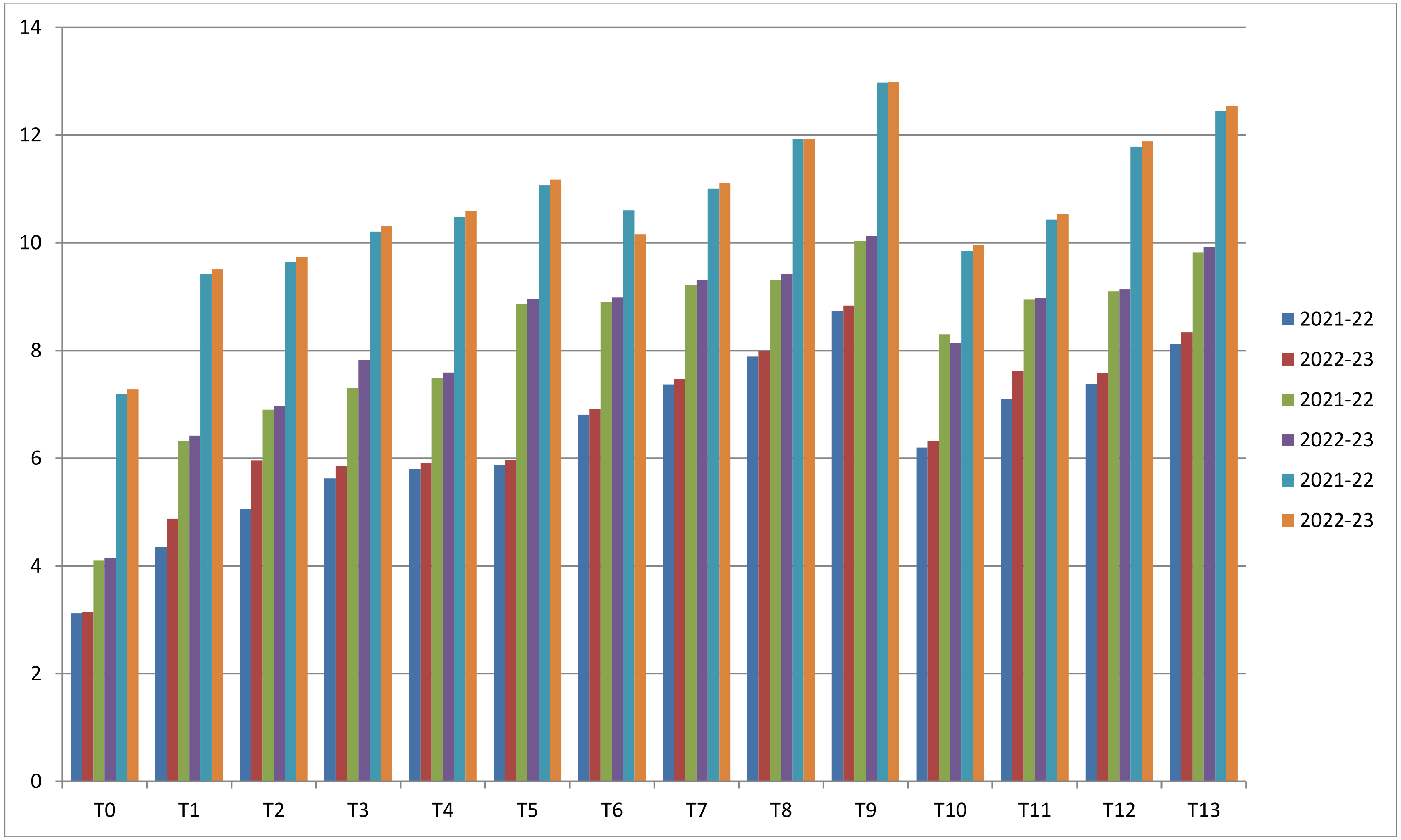

Fig. 2. -Effect of integrated nutrient management on number of leaf per plant of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23

Table 3. Effect of integrated nutrient management on length of leaf (cm) of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23

Treatment Details		Length of leaf (cm)					
		At 30 DAT		At 60 DAT		At 90 DAT	
		2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T_0	Control (without fertilizers)	12.98	13.99	30.23	29.31	38.11	39.19
T_1	100% RDF (NPK@150:50:80 Kg/ha)	20.29	19.86	37.65	38.21	48.76	49.76
T_2	100% RDF + FYM (10 t/ha)	21.92	22.99	39.23	40.11	49.10	50.10
T_3	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	22.31	23.42	40.22	41.22	48.99	50.70
T_4	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	22.59	25.12	41.20	43.55	50.18	51.18
T_5	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	23.21	24.32	42.33	43.11	52.10	53.10
T_6	75% RDF + FYM (10 t/ha)	23.92	24.99	42.78	44.09	52.00	53.11
T_7	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	24.10	25.23	43.35	45.11	54.33	55.23
T_8	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	25.43	26.53	45.93	46.99	56.77	57.67
T_9	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	27.10	28.31	47.90	48.91	58.36	59.36
T_{10}	50% RDF + FYM (10 t/ha)	22.10	23.23	42.10	42.31	51.8	52.91
T_{11}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	23.45	24.56	40.98	41.78	53.89	54.92
T_{12}	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	24.64	25.75	45.55	46.19	55.88	56.97
T_{13}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	26.04	27.05	46.28	47.41	57.56	58.56
SE(m) ±		0.285	0.762	1.386	1.396	0.590	0.653
CD (P=0.05)		0.83	2.217	4.031	4.060	1.716	1.900

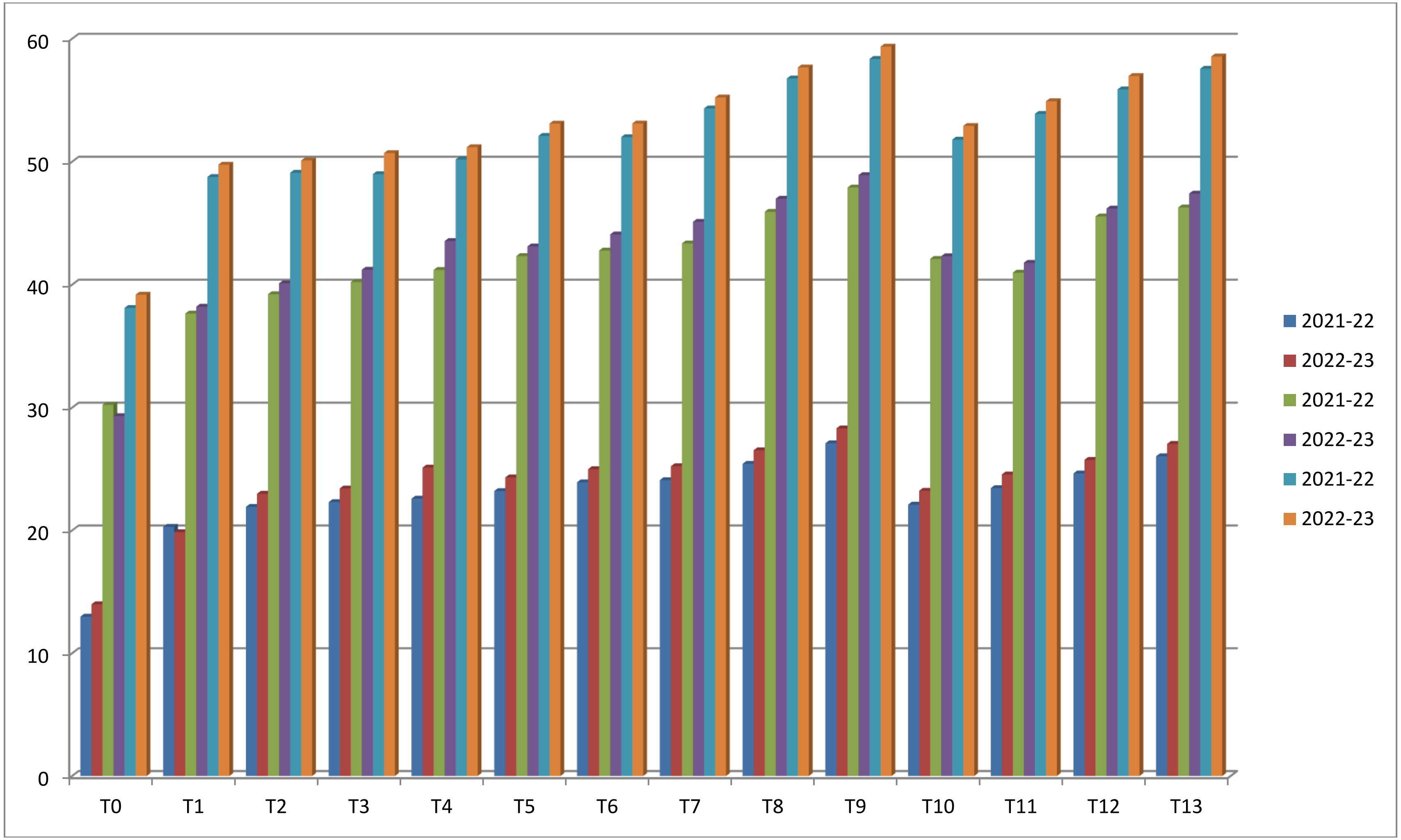

Fig. 3. Effect of integrated nutrient management on length of leaf (cm) of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23

As evident from the data, significant effects of different treatments were recorded during both the years of study**.** During 2021-22, the number of leaves per plant at 90 days after transplanting was the maximum (12.98) with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by the $T_{13,}$ while the minimum number of leaves per plant (7.20) was recorded in case of control T_0. During 2022-23, the maximum number of leaves per plant at 90 days after transplanting (12.99) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by the T_{13}, The minimum number of leaves per plant (7.28) was recorded in case of control T_0. The findings of this investigation were in close conformity with those of Mandal et al. [10], Vachan and Tripathi [11], Chhabra and Vishwakarma [12], Singh et al. [13].

3.3 Effect of Integrated Nutrient Management on Length of Leaf (cm) of Onion (*Allium cepa* L.) During the Year of 2021-22 & 2022-23

The data pertaining to length of the leaf has been presented in Table. 3 and Fig. 3. As evident from the significant effects of different treatments on the length of leaf were recorded at 30 days after transplanting of the plant growth during both the years of study, during 2021-22, the maximum length of leaf at 30 DAT (27.10 cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) followed by the T_{13} which was at par with T_8. The minimum length of leaf (12.98 cm) was recorded in case of control T_0. During 2022-23 the length of leaf was maximum (28.31cm) in case of application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13} and $T_{8.}$ The minimum length of leaf (13.99cm) was recorded in case of control T_0.

As evident from the data significant effects of different treatments on leaf length at 60 DAT, the maximum length of leaf during 2021-22 (47.90cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which at par with $T_{8,}$ T_{12} and T_{13}. while the minimum length of leaf (30.23cm) was recorded in case of control T_0.During 2022-23, the maximum length of leaf (48.91cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which at par with T_7, $T_{8,}T_{12}$ and T_{13}, while the minimum length of leaf (29.31cm) was recorded in case of control T_0.

As evident from the data, significant effects of different treatments was seen on length of leaf at 90 days during both the years of study**.** During 2021-22, the length of leaf at 90 DAT was maximum (58.36cm) with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with the T_{13} and T_8. The minimum length of leaf (38.11cm) was recorded in case of control T_0. During 2022-23, the maximum length of leaf (59.36cm) was recorded with application of T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) which was at par with T_{13} and T_8. The minimum length of leaf (39.19cm) was recorded in case of control T_0. The findings of this investigation were in close conformity with those of Bhati et al. [14], Vachan and Tripathi [11], Chhabra and Vishwakarma [12], Dhakad et al. [15], [16-21].

4. CONCLUSION

On the basis of results, it could be concluded that the application of T_9- 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 plant growth parameters of onion. Integrated approach of Vermicompost, FYM and biofertilizer performed better with respect to growth parameters *viz.* plant height, number of leaves, length of leaf onion. In the future INM can be considered a viable nutrient management is the major component of horticulture for ensuring nutritional security and improving environmental safety for all living beings.

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