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

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 years, 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).

Methodology: The experiment conducted during *Rabi* season in the years, 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). The experiment was laid out in randomized block design with three replications. The treatments consisted of T_0Control (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: Revealed that the treatment T_9- 75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha) 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, fresh and dry weight of onion bulb.

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

Keywords:INM, RDF, Growth, Biofertilizer, Vermicompost and Farmyard manure.

Comment [1]: You have already put this in the "Place and duration of study" section. Please do not repeat it in the methodology section.

Comment [2]: What analytical tools do you for data analysis? Commonly for multiple treatments, ANOVA (Analysis of Variance) is preferred. Please also mention what Mean Difference Test you use (Tukey HSD, LSD, DMRT, Dunnet or others).

Comment [3]: is this treatment significantly different compared to other treatments?

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 minerals, especially calcium, potassium and phosphorus besides having fairly good quantities of carbohydrates, proteins and vitamin C and minerals like phosphorus (39 mg), calcium (27 mg), sodium (1.0 mg), iron (0.7 mg) and potassium (1.57 mg) per 100 g of material**(Aykroyd,1963).**Although the nutritive value of onion is low, it is greatly valued for its inevitable and extensive usage as a vegetable and medicine as well in the world. 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. 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. The use of FYM, vermicompost and biofertilizers in such situation is, therefore, a practically paying proposal. The steady depletion of native soil fertility and the occurrence of multiple nutrient deficiencies in onion fields have led to the identification of nutrient management as a key factor limiting sustainable onion production. 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. 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 (**Tandon and Tiwari, 2008).** 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

Comment [4]: could you please provide more recent references? (at least recent 10 years)

Comment [5]: could you please provide reference to support this statement

Comment [6]: Please do not bold

2.MATERIALS AND METHODS

Comment [7]: please add data analysis in this section

The experiment conducted during *Rabi* season in the years, 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). The experiment was laid out in randomized block design with three replications. The treatments consisted of T_0Control

Comment [8]: Does this mean that this research was conducted during 2021 to 2023?

(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) were studied in RBD keeping three replications in each treatment plants were transplanted in a plot size 1.8mx1.2m and at the spacing of 15x10cm.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 leaf length freshwater bulb (g) dry weight of bulb (g).Data of both the years was statistically analyses as per standard method suggested by Panse and Sukhatme (1985).

Comment [9]: Could you please arrange this treatment in the form of a table?

Comment [10]: could you please provide more recent references?(at least recent 10 years)

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 are given in Table-1.As evident from the data, significant difference among the treatments was recorded at 30 DAT(days after transplanting) 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.

Comment [11]: what data analysis has been used to determine significant differences?

Comment [12]: This should be put at the beginning of the paragraph.

Effect of different treatments on plant height (cm) at 60 DAT after transplanting is given in Table-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. 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 ofKumar *et al*. (2017), Badal *et al*. (2019),Chhabra and Wankhade and Kale (2019),Upadhay *et al*. (2023).

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

Comment [13]: It would be better if the data in this table were arranged in the form of a graphic so that the growth pattern could be shown more clearly.

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	28.40	29.92	45.13	46.83	58.87	59.88

	t/ha)						
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

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.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 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.

Data regarding number of leaves per plant have been presented in Table- 2. Effects on number of leaves was 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.

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*. (2013),Vachan and Tripathi(2017), Chhabra and Vishwakarma (2019),Singh *et al*. (2019).

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

Comment [14]: It would be better if the data in this table were arranged in the form of a bar chart with an error bar

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

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.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*. (2018),Vachan and Tripathi(2017), Chhabra and Vishwakarma (2019), Dhakad *et al*. (2019).

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

Comment [15]: It would be better if the data in this table were arranged in the form of a graphic so that the leaves' length pattern could be shown more clearly

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

4.4 Effect of integrated nutrient management on fresh weight of bulb (g)) &dry weight of bulb (g)) of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23.

The result of present study clearly indicate that data presented in Table-4 on the effect of integrated nutrient management on fresh and dry weight of onion bulb. As evident from the data, significant effects of different treatments was seen on Fresh weight of bulb during both the years of study**.** During 2021-22, the fresh weight of bulb was maximum (77.78g) 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}. The minimum fresh weight of bulb (54.52g) was recorded in case of control (T_0).During 2022-23, the maximum fresh weight of bulb (78.78g) 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_7.T_8,T_{11}, T_{12} and T_{13}. The minimum fresh weight of bulb (48.98) was recorded in case of control (T_0). significant effects of different treatments was seen on dry weight of bulb during both the years of study**.** During 2021-22, the dry weight of bulb was maximum (10.55g) 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} which was at par with the T_8. The minimum dry weight of bulb (4.77g) was recorded in case of control (T_0). During 2022-23, the maximum dry weight of bulb (10.04g) 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 dry weight of bulb (4.89) was recorded in case of control (T_0). A better

nutritional environment in the root zone and throughout the plant system may be the cause of the application of rising fertility levels. Since nitrogen serves as the building block for all living things, it is widely known that it is the mineral nutrient that plants need the most of all for growth and development. Due to its dependence on vital substances such amino acids, protein, nucleic acids, enzymes, co-enzymes, and alkaloids, it also plays a significant part in plant metabolism. Like nitrogen, phosphorus is a nutrient that plants require in quite high concentrations for typical plant growth. Adenosine diphosphate (ADP) and adenosine triphosphate (ATP) are the major P-containing molecules that provide internal energy to plants. The findings of this investigation were in close conformity with those ofKumar *et al*. (2017), Sinha *et al*. (2017), Wankhade and Kale (2019), Kaur and Singh (2019), Chhabra and Vishwakarma (2019) and Gashaw *et al*. (2021), Upadhay *et al*. (2023) in onion.

Table. 4. Effect of integrated nutrient management on fresh weight of bulb (g)) &dry weight of bulb (g)) of onion (*Allium cepa* L.) during the year of 2021-22 & 2022-23.

Treatment Details		Fresh weight of bulb (g))		Dry weight of bulb (g))	
		2021-22	2022-23	2021-22	2022-23
T_0	Control (without fertilizers)	54.52	48.98	4.77	4.89
T_1	100% RDF (NPK@150:50:80 Kg/ha)	63.88	64.87	5.42	5.55
T_2	100% RDF + FYM (10 t/ha)	64.75	65.75	6.86	6.92
T_3	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	65.34	66.34	7.33	7.81
T_4	100% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	65.23	66.23	5.88	6.09
T_5	100% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	67.87	68.87	6.22	6.18
T_6	75% RDF + FYM (10 t/ha)	70.53	71.53	7.97	8.61
T_7	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	73.76	74.76	8.11	8.01
T_8	75% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	74.65	75.65	9.12	9.25
T_9	75% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	77.78	78.78	10.55	10.04

Comment [16]: It would be better if the data in this table were arranged in the form of a bar chart with an error bar

T_{10}	50% RDF + FYM (10 t/ha)	69.61	70.61	6.64	6.83
T_{11}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha)	71.87	72.87	8.57	8.08
T_{12}	50% RDF + FYM (10 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	72.44	73.44	8.12	9.15
T_{13}	50% RDF + FYM (5 t/ha) + Vermicompost (2 t/ha) + Azotobacter (5 Kg/ha) + PSB (5 Kg/ha)	75.65	76.65	9.58	9.39
SE(m) ±		1.004	2.281	0.25	0.261
CD (P=0.05)		2.921	6.633	0.72	0.76

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, leaf length, fresh and dry weight of onion bulb.

Comment [17]: what could be suggested based on this conclusion for the next research

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