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Effect of Integrated Nutrient Management on Growth and Yield attributing parameters of *Kharif* onion (*Allium cepa* L.)

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ABSTRACT

The experiment was conducted at the Research Farm of the Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur U.P. An experiment was conducted during *Kharif* season in the years, of 2021-22 and 2022-23. The experiment was laid out in randomized block design with three replications. The treatments consisted of T1- Control: T2- 100% RDF (NPK @ 120:60:80 kg/ha; T3- 75% RDF+ FYM 6 t/ha:T4- 75%RDF+ Vermicompost@2 t/ ha; T5- 75%RDF+FYM @ 3t/ha + vermicompost @1 t/ha; T6- 75%RDF + FYM @ 3t/ha+ Vermicompost @ 1t/ha+ Biofertilizer (*Azotobacter* +PSB @5kg/ha each) : T7 - 50% RDF + FYM @ 12t/ha; T8- 50%RDF + Vermicompost @ 4t/ha: T9- 50%RDF+ FYM @6t/ha + Vermicompos @ 2t/ha:T10 - 50%RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha+ Biofertilizer (*Azotobacter* + PSB @ 5kg/ha each).Results revealed that the treatment T10 (50% RDF +FYM @ 6 t/ha + Vermicompost @ 2t/ha+ Biofertilizer (Azotobacter + PSB @ 5kg/ha each), performed better with respect to growth characters such as maximum values for plant height at 90 DAT, number of leaves per plant at 90 DAT, length of leaf at 90 DAT, and yield contributing characters, *viz* Polar diameter, Equatorial diameter, neck thickness of bulb.

Key words: *INM, Growth, Yield, Biofertilizer, Vermicompost, Farm yard manure*

Introduction

Onion (*Allium* cepa L.) belongs to the family Alliaceae. *Allium* the most important cultivated species are onion (*Allium* cepa L.), Leek (*Allium ampeloprasum* L.), Japanese bunching onion (*Allium fistulosum* L.). Onion is one of the most important vegetable and spice crop grown in temperate, subtropical and tropical climates throughout the world. Onion exhibit particular diversity in the Eastern Mediterranean countries, through Turkmenistan, Tajikistan to Pakistan and India, which are the most important sources of genetic diversity and believed to be center of origin. India is one of the leading onion producers with production of 2362.33 thousand MT per year from an area of 1284.99 thousand hectare, with the productivity of 18.10 MT/ha (Horticulture Statistics Department, 2018-19). The basis for

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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 $P_2 O_5$ and 160 kg of K_2O per ha (Tandon and Tiwari, 2008).

Materials and Methods

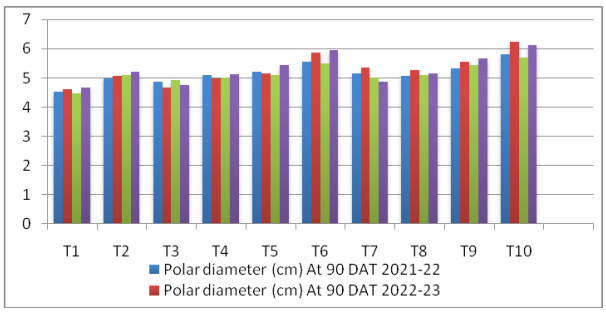
The experiment conducted during *Kharif* season in the years, of 2021-22 and 2022-23 both the year same time at Vegetable Research Farm, Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kalyanpur, Kanpur. The experiment was laid out in randomized block design with three replications. The treatments consisted of T1- Control: T2- 100% RDF (NPK @ 120:60:80 kg/ha; T3- 75% RDF+ FYM 6 t/ha:T4- 75%RDF+ Vermicompost@2 t/ ha; T5- 75%RDF+FYM @ 3t/ha+vermicompost@1 t/ha ; T6- 75%RDF + FYM @ 3t/ha+Vermicompost @ 1t/ha+ Biofertilizer (*Azotobacter* +PSB @5kg/ha each):T7 - 50% RDF + FYM @ 12t/ha; T8- 50%RDF + Vermicompost @ 4t/ha: T9- 50%RDF+ FYM @6t/ha + Vermicompos @ 2t/ha:T10 - 50%RDF + FYM @ 6t/ha + Vermicompost @2t/ha+ Biofertilizer (*Azotobacter* + PSB @ 5kg/ha each). having an even topography with adequate irrigation and proper drainage facilities. The soil was sandy loam, good in fertility. Geographically Kanpur is situated in the Gangetic plains of alluvium of Central U.P. It lies in altitude and longitude ranges between 25.28° to 28.50° 44 north and 79.31° to 84.34° east at elevation of 125.90 m above mean sea level. Kanpur is characterized by sub-tropical climate with hot dry summer and cold winters. The annual rainfall is about 800-880 mm. The major portion of rain is received between July to September, with scattered shower in winter from the North-East monsoon. The maximum temperature ranges from 24 to 46 °C and minimum 7.0 to 24.8 °C with relative humidity from 32 to 98 % in different months of the year. 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 sample were thoroughly mixed well and composite soil sample was made up (500 g) of soil. Thereafter, the sample was analyzed to determine the physical and chemical analysis of soil testing laboratory of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P). The pH was determined by electric pH meter and available Nitrogen was determined by alkaline permagnate method as reported by Piper (1966) and available phosphorus and potash by Olsen's method and Flame photometer method respectively. The E.C. was determined by Conductivity Bridge as described by Jackson (1967).

Results and Discussion

Growth parameters: Data presented in Table 1, the effect of integrated nutrient management on plant growth parameters of *Kharif* onion showed the significant difference among the treatments could be recorded at 90 days after transplanting during both the years of study revealed that the plant growth parameters like plant height (cm), number of leaves per plant, leaf length (cm). During 2021-22, the plant height at 90 days after transplanting was maximum (64.64 cm) with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter + PSB @ 5 kg/ha each) which was at par with the T4, T5, T6,T8 andT9 while the minimum plant height (53.61cm) was recorded in case of T1- control. During 2022-23, the maximum plant height (66.13 cm) was recorded with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which was at par with T4, T5, T6 and T9. The minimum plant height (53.09 cm) was recorded in case of T1- control. During 2021-22, the number of leaves per plant at 90 days after transplantingwas the maximum (14.20) with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) while the minimum number of leaves per plant (7.88) was recorded in case of control (T1). During 2022-23, the maximum number of leaves per plant at 90 days after transplanting (15.77) was recorded with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which was at par with T6 and T9, The minimum number of leaves per plant (9.44) was recorded in case of control (T1). In 2021-22, the length of leaf at 90 DAT was maximum (61.55 cm)

with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which was at par with the T6 and T9. The minimum length of leaf (49.19 cm) was recorded in case of control (T1). During 2022-23, the maximum length of leaf (62.10 cm) was recorded with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which was at par with T4, T5, T6 and T9. The minimum length of leaf (50.25 cm) was recorded in case of control (T1).

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 of Anil Kumar *et al*. (2017), Sinha *et al*. (2017), Vachan and Tripathi (2017), Wankhade and Kale (2019), Kaur and Singh (2019), Chhabra and Vishwakarma (2019) and Gashaw (2021) in onion.



Yield attributing parameters: The result of present study clearly indicate that data presented in Table 2 on the effect of integrated nutrient management on yield and yield attributing parameters showed significant effects of different treatments could be recorded at harvesting stage during both the years of study revealed that yield and yield attributing parameters of sprouting broccoli *viz.* Polar diameter (cm), Equatorial diameter, Neck thickness of bulb (cm). Perusal of data indicated significant effects of different treatments on polar diameter of bulb in both the years. During 2021-22, the maximum polar diameter (5.81cm) was recorded with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which at par with T6 and T9. The minimum polar diameter (4.53 cm) was recorded in case of control (T1). During 2022-23, the polar diameter was the maximum (6.23 cm) in case

Table 1. Effect of Integrated Nutrient Management on Growth parameters of *Kharif* onion (*Allium cepa L.*)

Treatment Details Treatments		Plant height (cm) At 90 DAT		No. of leaf per plant At 90 DAT		Leaf length At 90 DAT	
		2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T_1	Control	53.61	53.09	7.88	9.44	49.19	50.25
T_2	100% RDF (NPK @ 120:60:80 kg/ha	56.79	58.20	10.12	11.34	52.78	54.77
T_3	75% RDF + FYM @ 6 t/ha	55.74	56.69	9.83	11.90	51.68	52.64
T_4	75% RDF + Vermicompost @ 2t/ha	59.66	61.44	8.97	10.74	55.61	57.17
T_5	75% RDF + FYM @ 3 t/ha + Vermicompost @ 1t/ha	59.97	62.33	11.88	14.14	56.27	59.34
T_6	75% RDF+ FYM @ 3t/ha + Vermicompost @ 1t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each)	62.66	64.23	13.10	15.05	58.98	61.42
T_7	50% RDF + FYM @ 12t/ha	57.86	58.96	8.44	12.76	53.38	55.17
T_8	50% RDF + Vermicompost @ 4t/ha	58.97	59.33	9.76	13.65	55.23	54.78
T_9	50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha	60.77	61.87	12.97	14.86	54.34	56.84
T_{10}	50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each)	64.64	66.13	14.20	15.77	61.55	62.10
	SE(m) ±	2.046	2.084	0.366	0.406	1.447	1.933
	CD (P=0.05)	6.125	6.239	1.005	1.215	4.333	5.787

of application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which at par with T6. The minimum polar diameter (4.60 cm) was recorded in case of control. Perusal of data indicated significant effects of different treatments on Equatorial diameter of bulb during both the years. the maximum Equatorial diameter during 2021-22 (5.71cm) was recorded with application of T_{10}- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) which was at par with T_6 and T_9.The minimum Equatorial diameter (4.48 cm) was recorded in case of control. During 2022-23, the maximum Equatorial diameter (6.11cm) was recorded with application of T_{10}- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (*Azotobacter* +PSB @ 5 kg/ha each) which was at par with T_6 and T_9. The minimum Equatorial diameter (4.67 cm) was recorded in case of control. Perusal of data indicated significant effects of different treatments on Neck thickness of bulb during both the years. During 2021-22, the Neck thickness of bulb was minimum neck thickness (0.87 cm) with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (*Azotobacter* +PSB @ 5 kg/ha each) which was at par with T9, while the maximum Neck thickness of bulb (1.24cm) was recorded in case of control (T1). During 2022-23, the minimum Neck thickness of bulb (0.81cm) was recorded with application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (*Azotobacter* +PSB @ 5 kg/ha each). The maximum Neck thickness of bulb (1.23 cm) was recorded in case of control (T1).

Results showed that equatorial diameter, polar diameter, neck thickness, increased with application T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each). 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

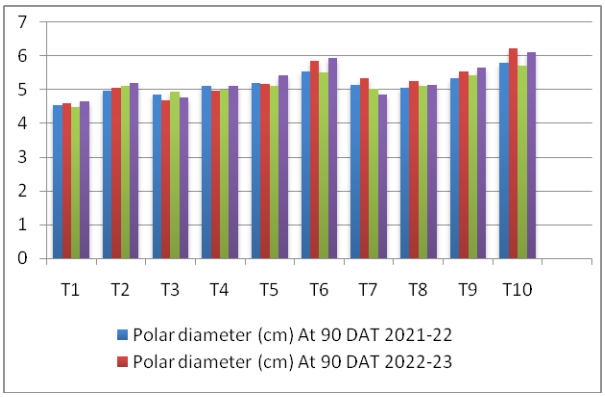


Table 2. Effect of Integrated Nutrient Management on yield attributing parameters of *Kharif* onion (*Allium cepa L.*)

Treatments	Treatment Details	Polar diameter (cm) At 90 DAT		Equatorial diameter (cm) At 90 DAT		Neck thickness of bulb (cm) At 90 DAT	
		2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T_1	Control	4.53	4.60	4.48	4.67	1.24	1.23
T_2	100% RDF (NPK @ 120:60:80 kg/ha	4.97	5.07	5.10	5.21	1.12	1.12
T_3	75% RDF + FYM @ 6 t/ha	4.87	4.68	4.94	4.76	1.23	1.22
T_4	75% RDF + Vermicompost @ 2t/ha	5.11	4.98	5.00	5.12	1.20	1.20
T_5	75% RDF + FYM @ 3 t/ha + Vermicompost @ 1t/ha	5.20	5.16	5.10	5.44	1.07	1.12
T_6	75% RDF+ FYM @ 3t/ha + Vermicompost @ 1t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each)	5.55	5.86	5.50	5.95	1.01	0.98
T_7	50% RDF + FYM @ 12t/ha	5.14	5.35	5.02	4.87	1.05	1.10
T_8	50% RDF + Vermicompost @ 4t/ha	5.07	5.26	5.10	5.15	1.17	1.20
T_9	50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha	5.33	5.55	5.44	5.66	0.93	0.87
T_{10}	50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each)	5.81	6.23	5.71	6.11	0.87	0.81
	SE(m) ±	0.163	0.18	0.187	0.181	0.043	0.030
	CD (P=0.05)	0.488	0.538	0.555	0.542	0.129	0.086

the supply of carbohydrates to the plants. The application of 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha +Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) favored the metabolic and auxin activities in plant and ultimately resulted in increased bulb diameter,. Similarly, vermicompost and biofertilizers improved physical, chemical and biological properties of soil which consequently increased the value of growth parameters, yields attributes and finally yield. These finding are in conformity with Tripathy *et al.* (2013), Brar *et al.* (2015), Sharma *et al.* (2017), Prusty *et al.* (2019), Kaur and Singh (2019), Dhakad *et al* (2019), Kalirawna *et al*. (2022).

Conclusion

On the basis of results, it could be concluded that the application of T10- 50% RDF + FYM @ 6t/ha + Vermicompost @ 2t/ha + Biofertilizer (Azotobacter +PSB @ 5 kg/ha each) was found to be the best treatment combination in terms of plant growth, and yield attributes of *kharif* onion. Integrated approach of Vermicompost and biofertilizer performed better with respect to growth characters (plant height, number of leaves, leaf length), and yield attributing characters (polar diameter, Equatorial diameter and Neck thickness).

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Conflict of Intrests

The authors declare that they have no conflict of interests.

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