

Effect of Integrated Nutrient Management on the Growth of Tuberose (*Polianthes tuberosa* L.) cv. Rajat Rekha

ABSTRACT

The present experiment on effect of integrated nutrient management on the growth of Tuberose (*Polianthes tuberosa* L.) cv. Rajat Rekha was carried out during 2021-22 and 2022-23 at Horticulture Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. The experiment consists of eighteen treatments which were replicated three times in Randomized completely block design. The results of investigation revealed that the treatment applied with 75% RDF + 2kg FYM/m² + 300g VC/m² + PSB + Azospirillum (T₁₅) was found to be best in all the growth characters viz., days taken for spouting (12.10 & 14.18), plant height (40.8 & 41.7cm), length of leaves (48.0 & 48.6cm), width of leaves (1.78 & 1.80cm), and number of leaves (60.8 & 61.4).

Keywords: Tuberose, FYM, Vermicompost, PSB and Azospirillum.

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Introduction

Tuberose (*Polianthes tuberosa* L.) belongs to family Agavaceae and is native of Mexico. It is a one of the most important tropical bulbous flowering plants cultivated for production of long lasting flower spikes. It is popularly known as Rajanigandha. Commercial importance of tuberose is due to beauty of the flower, longer vase-life of spikes and aromatic oil extracted from its fragrant white flower and it has a great economic potential for cut flower trade and essential oil industry (Alanetal, 2007).

It has great demand for home decoration, garland, flower decoration, bouquets and pots, in addition to the purpose of cutting flowers. Its essential oil is rich in geraniol, nerol, benzyl alcohol, eugenol, benzyl benzoate and methyl anthranilate and methyl salicylate (Hussain, 1986). Tuberose is a gross feeder and requires a large quantity of NPK, both in the form of organic and inorganic fertilizers (Amarjeet and Godara, 1998). INM helps in maintaining or enhancing soil productivity through a balanced use of fertilizers combined with organic and biological sources of plant nutrients, improving the stock of plant nutrients in

hesoilsandimprovetheefficiencyofplantnutrients,thus,limitinglossestotheenvironment. In the present investigations, studies have been made to know the effect of integratednutrientmanagementon thegrowthofTuberose(*Polianthes tuberosa*L.) cv. Rajat Rekha.

Material and Methods

The experiment was carried out at Horticulture Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh (India) during seasons of 2021-22 and 2022-23. The experiment was laid out in Randomized Block Design with eighteen treatments and three replications. Bulbs of tuberose cv. Rajat Rekha were planted in a spacing 30 cm × 30 cm. The different treatments were T₁ (control), T₂ (100% RDF), T₃ (50% RDF+ 2 kg FYM/m²+ PSB + Azospirillum), T₄ (50% RDF+ 1 kg FYM/m²+ PSB + Azospirillum), T₅ (50% RDF+ 300g VC/m²+ PSB + Azospirillum), T₆ (50% RDF+ 150g VC/m²+ PSB + Azospirillum), T₇ (50% RDF+ 2 kg FYM/m² + 300g VC/m²+ PSB + Azospirillum), T₈ (50% RDF+ 1 kg FYM/m² + 300g VC/m²+ PSB + Azospirillum), T₉ (50% RDF+ 2 kg FYM/m² + 150g VC/m²+ PSB + Azospirillum), T₁₀ (50% RDF+ 1 kg FYM/m² + 150g VC/m²+ PSB + Azospirillum), T₁₁ (75% RDF+ 2 kg FYM/m²+ PSB + Azospirillum), T₁₂ (75% RDF+ 1 kg FYM/m²+ PSB + Azospirillum), T₁₃ (75% RDF+ 300g VC/m²+ PSB + Azospirillum), T₁₄ (75% RDF+ 150g VC/m²+ PSB + Azospirillum), T₁₅ (75% RDF+ 2 kg FYM/m² + 300g VC/m²+ PSB + Azospirillum), T₁₆ (75% RDF+ 1 kg FYM/m² + 300g VC/m²+ PSB + Azospirillum), T₁₇ (75% RDF+ 2 kg FYM/m² + 150g VC/m²+ PSB + Azospirillum) and T₁₈ (75% RDF+ 1 kg FYM/m² + 150g VC/m²+ PSB + Azospirillum). Manures were applied and mixed into the soil thoroughly. The amount and type of manure applied was as per the treatments of respective plots. Cultural practices were kept uniform for all the treatments and standard practices were adopted to raise the crop successfully. Observation on growth attributes i.e. days taken for spouting, plant height (cm), length of leaves (cm), width of leaves (cm) and number of leaves per plant.

Comment [H2]: Add suitable reference

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Result and Discussion

The minimum days taken for spouting (12.10 & 14.18) was recorded in T₁₅ (75% RDF + 2kg FYM/m² + 300g VC/m² + PSB + Azospirillum) and found statistically at par with T₁₆ (14.21 & 15.25 days), T₁₇ (14.18 & 15.20 days) and T₁₈ (14.12 & 15.16 days). The earliest emergence of bulbs in Vermicompost + RDF might be due to the early absorption of N, P and K increased the availability of micronutrients as well as plant hormones due to which the time taken for emergence of bulbs was reduced significantly. Padaganure *et al.* (2005), Kabir *et al.* (2011) and Hadwaniet *et al.*, 2013) reported similar results in tuberose flowers.

Comment [H8]: Mention unit

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Comment [H10]: Early absorption may be found in other treatments also. Mention proper reason

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The maximum plant height (40.8 & 41.7cm) was recorded in T₁₅ (75% RDF + 2kg FYM/m² + 300g VC/m² + PSB + Azospirillum), and found statistically at par with T₁₁ (38.2 & 39.5cm), T₁₂ (37.4 & 38.2cm), T₁₃ (39.0 & 39.8cm), T₁₄ (38.6 & 39.7cm), T₁₆ (40.2 & 41.4cm), T₁₇ (39.7 & 40.3cm) and T₁₈ (39.4 & 40.1cm). However, minimum plant height (28.4 & 30.6cm) was found in control. The result shows nitrogen and phosphorus had positive correlation with the plant height, its nutrient availability is increased with increase in organic sources viz. FYM, vermicompost and PSB. Nitrogen, a constituent of protein and is essential for formation of protoplasm, cell division and cell enlargement, while phosphorus a part of nucleic acids and also responsible for root development and the combined effect of higher availability of both nutrients in plant vicinity enhance the vegetative growth of the plant (Dahiya *et al.*, 2001, Yadav *et al.*, 2005 and Kumaret *et al.*, 2014).

The maximum length of leaves (48.0 & 48.6cm) was recorded in T₁₅ (75% RDF + 2kg FYM/m² + 300g VC/m² + PSB + Azospirillum) and found statistically at par with T₁₁ (44.7 & 45.1cm), T₁₂ (43.8 & 44.3cm), T₁₃ (45.5 & 45.9cm), T₁₄ (44.8 & 45.4cm), T₁₆ (46.8 & 47.3cm), T₁₇ (45.7 & 46.4cm) and T₁₈ (45.7 & 46.1cm). However, minimum length of leaves (37.2 & 37.8cm) was found in control. The results revealed that length of leaves were greater with organic fertilizer application along with chemical fertilizers. These results indicate that application of organic fertilizers had tremendous effects on plant growth and development in tuberose. Further the effect was more pronounced in FYM + vermicompost + PSB combination followed by FYM + PSB combination. These results have conformity with the result of Padaganure *et al.* (2010) who

reported that application of organic fertilizers along with chemical fertilizers enhanced plant growth and development in tuberose. Similar findings were reported by Desai and Thirumala (2015).

The maximum width of leaves (1.78 & 1.80cm) was recorded in T₁₅ (75% RDF + 2kg FYM/m² + 300g VC/m² + PSB + Azospirillum) and found statistically at par with T₁₁ (1.70 & 1.72cm), T₁₂ (1.68 & 1.72cm), T₁₃ (1.72 & 1.75cm), T₁₄ (1.71 & 1.73cm), T₁₆ (1.76 & 1.78cm), T₁₇ (1.75 & 1.77cm) and T₁₈ (1.74 & 1.76cm). However, minimum width of leaves (1.48 & 1.50cm) was found in control. The results indicated that essentiality of nitrogenous element in organic form enhanced to constitute chlorophyll which leads to better leaves over control treatment. Kadu *et al.* (2009) reported that the profound effect of nitrogen fertilization on anatomical structure of tuberose. Similar results were also reported by Meena *et al.*, (2015).

The maximum number of leaves (60.8 & 61.4cm) was recorded in T₁₅ (75% RDF + 2kg FYM/m² + 300g VC/m² + PSB + Azospirillum) and found statistically at par with T₁₆ (58.3 & 60.3cm), T₁₇ (56.9 & 57.4cm) and T₁₈ (56.2 & 56.8cm). However, minimum number of leaves (32.1 & 34.6cm) was found in control. Kabir *et al.* (2011) also noted that the number of leaves was significantly increased with the application of half of chemical fertilizer along with vermicompost in tuberose. These findings are in agreement with Pradhan *et al.*, (2017).

Conclusion

On the basis of finding of two consecutive years of experiments, it can be concluded that treatment T₁₅ (75% RDF + 2 kg FYM/m² + 300g VC/m² + PSB + Azospirillum) may be recommended to farmers of Meerut district, Uttar Pradesh for better growth of tuberose.

Comment [H12]: But for earliness other treatment found better

Table 1 Days taken for sprouting in relation to INM treatments during 2021-22 and 2022-

23

Comment [H13]: Add pooled value of all the treatments

Symbol	Treatments	I st year	II nd year
		2021-22	2022-23
T ₁	Control	20.17	22.29
T ₂	100%RDF	16.14	17.22
T ₃	50%RDF+2 kg FYM/m ² + PSB +Azospirillum	19.16	20.26
T ₄	50%RDF+1 kg FYM/m ² + PSB +Azospirillum	20.17	21.28
T ₅	50%RDF+300g VC/m ² + PSB +Azospirillum	18.15	19.25
T ₆	50%RDF+ 150g VC/m ² + PSB +Azospirillum	19.16	20.26
T ₇	50%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	16.14	17.22
T ₈	50%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	17.18	18.24
T ₉	50%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	17.10	18.20
T ₁₀	50%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	18.15	19.25
T ₁₁	75%RDF+2 kg FYM/m ² + PSB +Azospirillum	15.13	16.21
T ₁₂	75%RDF+1 kg FYM/m ² + PSB +Azospirillum	16.14	17.22
T ₁₃	75%RDF+300g VC/m ² + PSB +Azospirillum	15.13	16.21
T ₁₄	75%RDF+150g VC/m ² + PSB +Azospirillum	15.10	16.17
T ₁₅	75%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	12.10	14.18
T ₁₆	75%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	14.21	15.25
T ₁₇	75%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	14.18	15.20
T ₁₈	75%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	14.12	15.16
	SEm+	0.59	0.63
	C.D. (P=0.05)	1.68	1.79

Table 2 Plant height (cm) in relation to INM treatments at 180 days after planting the bulbs during 2021-22 and 2022-23

Symbol	Treatments	I st year	II nd year
		2021-22	2022-23
T ₁	Control	28.4	30.6
T ₂	100%RDF	37.0	38.4
T ₃	50%RDF+2 kg FYM/m ² + PSB +Azospirillum	33.9	34.8
T ₄	50%RDF+1 kg FYM/m ² + PSB +Azospirillum	33.0	34.4
T ₅	50%RDF+300g VC/m ² + PSB +Azospirillum	35.1	36.4
T ₆	50%RDF+ 150g VC/m ² + PSB +Azospirillum	34.5	35.6
T ₇	50%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	36.9	37.8
T ₈	50%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	36.5	37.5
T ₉	50%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	36.0	37.1
T ₁₀	50%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	35.7	36.4
T ₁₁	75%RDF+2 kg FYM/m ² + PSB +Azospirillum	38.2	39.5
T ₁₂	75%RDF+1 kg FYM/m ² + PSB +Azospirillum	37.4	38.2
T ₁₃	75%RDF+300g VC/m ² + PSB +Azospirillum	39.0	39.8
T ₁₄	75%RDF+150g VC/m ² + PSB +Azospirillum	38.6	39.7
T ₁₅	75%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	40.8	41.7
T ₁₆	75%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	40.2	41.4
T ₁₇	75%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	39.7	40.3
T ₁₈	75%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	39.4	40.1
	SEm+	1.32	1.36
	C.D. (P=0.05)	3.74	3.85

Table 3 Length of leaves (cm) in relation to INM treatments during 2021-22 and 2022-23

Symbol	Treatments	I st year	II nd year
		2021-22	2022-23
T ₁	Control	37.2	37.8

T₂	100%RDF	43.7	44.2
T₃	50%RDF+2 kg FYM/m ² + PSB +Azospirillum	37.7	38.0
T₄	50%RDF+1 kg FYM/m ² + PSB +Azospirillum	37.5	37.8
T₅	50%RDF+300g VC/m ² + PSB +Azospirillum	38.1	38.4
T₆	50%RDF+ 150g VC/m ² + PSB +Azospirillum	38.0	38.4
T₇	50%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	42.8	43.2
T₈	50%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	41.4	42.0
T₉	50%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	38.7	39.0
T₁₀	50%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	38.3	38.7
T₁₁	75%RDF+2 kg FYM/m ² + PSB +Azospirillum	44.7	45.1
T₁₂	75%RDF+1 kg FYM/m ² + PSB +Azospirillum	43.8	44.3
T₁₃	75%RDF+300g VC/m ² + PSB +Azospirillum	45.5	45.9
T₁₄	75%RDF+150g VC/m ² + PSB +Azospirillum	44.8	45.4
T₁₅	75%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	48.0	48.6
T₁₆	75%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	46.8	47.3
T₁₇	75%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	45.9	46.4
T₁₈	75%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	45.7	46.1
	SEm+	1.51	1.52
	C.D. (P=0.05)	4.28	4.32

Table 4 Width of leaves (cm) in relation to INM treatments during 2021-22 and 2022-23

Symbol	Treatments	Ist year	IInd year
		2021-22	2022-23
T₁	Control	1.48	1.50
T₂	100%RDF	1.67	1.70
T₃	50%RDF+2 kg FYM/m ² + PSB +Azospirillum	1.56	1.58
T₄	50%RDF+1 kg FYM/m ² + PSB +Azospirillum	1.54	1.56
T₅	50%RDF+300g VC/m ² + PSB +Azospirillum	1.60	1.63
T₆	50%RDF+ 150g VC/m ² + PSB +Azospirillum	1.58	1.60
T₇	50%RDF+2 kg FYM/m ² +300g VC/m ² + PSB	1.65	1.68

	+Azospirillum		
T₈	50%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	1.64	1.66
T₉	50%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	1.62	1.65
T₁₀	50%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	1.61	1.63
T₁₁	75%RDF+2 kg FYM/m ² + PSB +Azospirillum	1.70	1.72
T₁₂	75%RDF+1 kg FYM/m ² + PSB +Azospirillum	1.68	1.71
T₁₃	75%RDF+300g VC/m ² + PSB +Azospirillum	1.72	1.75
T₁₄	75%RDF+150g VC/m ² + PSB +Azospirillum	1.71	1.73
T₁₅	75%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	1.78	1.80
T₁₆	75%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	1.76	1.78
T₁₇	75%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	1.75	1.77
T₁₈	75%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	1.74	1.76
	SEm+	0.06	0.06
	C.D. (P=0.05)	0.17	0.17

Table 5 Number of leaves in relation to INM treatments at 180 days after planting the bulbs during 2021-22 and 2022-23

Symbol	Treatments	I st year	II nd year
		2021-22	2022-23
T₁	Control	32.1	34.6
T₂	100%RDF	46.3	47.9
T₃	50%RDF+2 kg FYM/m ² + PSB +Azospirillum	36.7	37.2
T₄	50%RDF+1 kg FYM/m ² + PSB +Azospirillum	35.6	36.4
T₅	50%RDF+300g VC/m ² + PSB +Azospirillum	38.9	39.8
T₆	50%RDF+ 150g VC/m ² + PSB +Azospirillum	37.3	38.4
T₇	50%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	44.8	45.8
T₈	50%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	42.8	43.6
T₉	50%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	40.7	42.8

T₁₀	50%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	40.1	41.6
T₁₁	75%RDF+2 kg FYM/m ² + PSB +Azospirillum	49.5	50.6
T₁₂	75%RDF+1 kg FYM/m ² + PSB +Azospirillum	47.8	48.2
T₁₃	75%RDF+300g VC/m ² + PSB +Azospirillum	53.6	54.8
T₁₄	75%RDF+150g VC/m ² + PSB +Azospirillum	51.9	52.7
T₁₅	75%RDF+2 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	60.8	61.4
T₁₆	75%RDF+1 kg FYM/m ² +300g VC/m ² + PSB +Azospirillum	58.3	60.3
T₁₇	75%RDF+2 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	56.9	57.4
T₁₈	75%RDF+1 kg FYM/m ² +150g VC/m ² + PSB +Azospirillum	56.2	56.8
	SEm+	1.67	1.71
	C.D. (P=0.05)	4.74	4.85

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