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Durgeshwar Kumar Basant
Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh, India

LS Verma
Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh, India

Ram Singh
Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh, India

Ishwar Ram Markam
Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Durgeshwar Kumar Basant
Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh, India

Effect of nutrient management on growth, flowering and flower yield of tuberose (*Polianthes tuberose* L.) under Chhattisgarh plain condition

Durgeshwar Kumar Basant, LS Verma, Ram Singh and Ishwar Ram Markam

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Abstract
The present investigation was conducted in the year 2016-17 at the Department of Floriculture and Landscape Architecture, IGKV, Raipur, Chhattisgarh for the effect of integrated nutrient management on growth, flowering and flower yield of tuberose. Ten treatment combinations of different fertilizer and organic manure nutrients were comprised with three replications. Result showed the significant result and the maximum plant height, leaf length, fresh weight, dry weight, number of florets spike^{-1}, length of spike^{-1}, length of rachis and flower yield were recorded under T_9 (75% RDF + FYM @ 3.5 t ha^{-1} + Vermicompost @ 1.5 t ha^{-1} + Poultry manure @ 2 t ha^{-1}) followed by T_7 (50% RDF + FYM @10 t ha^{-1} + Poultry manure @ 2 t ha^{-1}). The maximum number of leaves plant^{-1}, and diameter of floret were found under T_7 (50% RDF + FYM @ 10 t ha^{-1} + Poultry manure @2 t ha^{-1}) whereas the weight of 100 florets was recorded maximum under T_8(50% RDF + Vermicompost @ 5 t ha^{-1} + Poultry manure @ 2 t ha^{-1}).

Keywords: Tuberose, growth, flowering, vase life and yield

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. The tuberose blooms throughout the year, florets are star shaped, waxy and loosely arranged on spike that can reach up to 30 to 45 cm in length. There is high demand for tuberose concrete and absolute in international markets which fetch very good price. Flowers of the Single type (single row of perianth) are commonly used as loose flowers, making garland and essential oil etc, while the double varieties (more than two rows of perianth) are used as cut flowers, garden display and interior decoration. Tuberose which occupies place in ornamental horticulture is one of the commercially exploited flower crops. It produces attractive, elegant and fragrant white flowers. It occupies a very selective and special position to flower loving people because of its prettiness, elegance and sweet pleasant fragrance. It has a great economic potential for cut flower trade and essential oil industry (Alan *et al*., 2007) [1]. The flowers remain fresh for quite a long time and stand distance transportation and fill a useful place in the flower market (Patil *et al*., 1999) [13]. The long spikes of tuberose are used for vase decoration and bouquet preparation whereas the florets were used for artistic garlands preparation, ornaments and buttonhole use. The flowers emit a delightful fragrance are the source of tuberose oil. The natural flower oil of tuberose is one of the most expensive perfume raw materials. Tuberose is grown commercially in tropical and sub-tropical areas of world. In India, commercial cultivation of tuberose is popular in West Bengal, Tamil Nadu, Maharashtra, Andhra Pradesh, Karnataka, Assam, Rajasthan, Gujarat, Uttar Pradesh, Punjab and Chhattisgarh.

The growing period of tuberose is normally one year or more. Therefore, a high amount of organic and inorganic fertilizers are needed to maintain sustainable growth and flowering over a long period. Tuberose is a gross feeder and requires a large quantity of NPK both in the form of organic and inorganic fertilizers (Amarjeet *et al*., 2000) [2].

The effect of chemical fertilizers and organic manures on tuberose production has been reported by several authors for different geographical regions (Yadav *et al*., 1985 and Shankar *et al*., 2010) [23, 17]. Nitrogen, phosphorus and potassium have a significant effect on spike production and floret quality (Singh *et al*., 2005) [21]. Poultry manure is excellent organic manure as it contains high nitrogen, phosphorus, potassium and other essential nutrients (Garg *et al*., 2008) [8].Vermicompost has been shown to have high levels of total and available nitrogen, phosphorus, potassium, micronutrients, and growth regulators as well as microbial and enzymatic activities (Chaoui *et al*., 2003) [3].

The tuberose is a voracious feeder of NPK and responds well to the organic and inorganic nutrient application particularly nitrogenous fertilizers as it is major nutrients required for the optimum growth, development and flowering of tuberose, it has greater influence right from cell division to the development of vegetative and reproductive organs (Sadhu and Bose, 1973) [16].

Materials and Methods

The present experiment was conducted at the Horticultural Research cum Instruction Farm of the Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, during 2016-17. The experiment was laid out in Randomized Block Deign (RBD) with ten treatments and three replication. The different treatments were T_1:100% RDF, T_2: 50% RDF + FYM (20 t ha^{-1}), T_3: 50% RDF + Vermicompost (10 t ha^{-1}), T_4: 50% RDF + Poultry manure (4 t ha^{-1}), T_5: (50% RDF + FYM @ 7 t ha^{-1} + Vermicompost @ 3 t ha^{-1} + Poultry manure @ 1.5 t ha^{-1}), T_6: (50% RDF + FYM @ 10 t ha^{-1} + Vermicompost @ 5 t ha^{-1}), T_7: (50% RDF + FYM @ 10 t ha^{-1} + Poultry manure @ 2 t ha^{-1}), T_8: (50% RDF + Vermicompost @ 5 t ha^{-1} + Poultry manure @ 2 t ha^{-1}), T_9: (75% RDF + FYM @ 3.5 t ha^{-1}) + Vermicompost @ 1.5 t ha^{-1} + Poultry manure @ 2 t ha^{-1}) and T_{10}: (Control).Standard cultivation and recommended cultural practices were followed. The bulbs were planting at a distance of 30 x 30 cm. The observations for vegetative parameters including plant height (cm), number of leaves plant^{-1}, leaf length (cm), fresh weight of leaves (g), dry weight of leaves (g) were recorded at15, 30, 60 and 75 days after planting (DAP). The floral characters observed were length of spike, rachis length (cm), number of florets Spike^{-1}, diameter of florets (cm), weight of 100 florets (g), flowers Yield m^{-1}.

Results and Discussion

Vegetative parameters

The observation on plant height, number of leaves per plant, length of leaves, fresh weight of leaves and dry weight of leaves were recorded periodically at 15, 30, 45, 60 and 75 days after planting (DAP) as influenced by different treatments and the data are given in (Table 1and Table 2)

The maximum plant height (24.25 cm) at 15 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over all the treatments except T_1 (100% RDF), T_7 (50% RDF + FYM 10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which is at par. Minimum plant height (13.82 cm) was observed in treatment T_{10} Control.

The maximum plant height (28.75 cm) at 30 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over treatments T_1 to T_6. However, it was statistically at par with T_7 (50% RDF + FYM 10 t ha$^{-1)}$ + Poultry manure (2 t ha^{-1}) and T_8 (50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1}). The minimum plant height (20.34 cm) was observed in treatment T_{10} Control.

The observed data at 45 and 60 DAP clearly indicated that the maximum plant height (31.78 cm, and 34.09 cm respectively) was observed in treatment T_9 and it was significantly superior over all the treatments. The minimum plant height (22.01 cm and 24.44 cm respectively) was observed in treatment T_{10} Control.

The maximum plant height (36.24 cm) at 75 DAP was recorded in treatment T_9 (75% RDF + FYM 3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over treatments T_1, T_2, T_4, T_5, and T_6. However, it was statistically at par with T_3 (50% RDF + Vermicompost (10 t ha^{-1}), T_7 (50% RDF + FYM 10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and T_8 (50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1}). The minimum plant height (28.69 cm) was observed in treatment T_{10} Control.

The result shows nitrogen and phosphorus had positive correlation with the plant height, it nutrient availability is increased with increase in organic sources viz. FYM, vermicompost and Poultry manure (T_9, T_8, T_7). 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 and Yadav *et al*., 2005) [6, 24].

With respect to number of leaves per plant at different growth stages are presented in the Table 1. At 15 DAP the maximum number of leaves (10.09) at 15 DAP was observed in treatment T_7 (50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over all the treatments except T_3, T_5, T_6, and T_9. The minimum number of leaves per plant (4.83) was observed in treatment T_{10} Control.

The maximum number of leaves (17.69) at 30 DAP was observed in treatment T_7 (50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over all the treatments except T_6 (50% RDF + FYM (10 t ha^{-1}) + Vermicompost (5 t ha^{-1}) while at par with T_6 treatment. The minimum number of leaves per plant (8.93) was observed in treatment T_{10} Control.

At 45, 60 and 75 DAP the maximum number of leaves (21.33, 24.33 and 29.73 respectively) was observed in treatment T_7 (50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over all the treatments except T_5, T_6 where as significant difference was found with rest of the treatment. The minimum number of leaves per plant (11.87, 14.27 and 19.67 respectively) was observed in treatment T_{10} Control. Kabir *et al* (2011) [9] also noted that the number of leaves was significantly increased with the application of half of chemical fertilizer along with 20 t ha^{-1} poultry manure in tuberose.

The maximum length of leaves (9.96 cm) at 15 DAP was observed in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over treatments T_1, T_2, T_3, T_4, T_5, T_6, T_8, and T_{10} but it was statistically at par with T_7. The minimum length of leaves (4.77) was observed in treatment T_{10} (Control).

At 30 and 45 DAP, the data indicates that the maximum leaf length was recorded in treatment T_9 (16.25 and 26.18 cm)

which was at par with T_3, T_7, and T_8 treatments. Minimum length of leaves (9.75 and 15.01 cm) was observed in treatment T_{10} Control.

At 60 DAP, the maximum leaf length was recorded in treatment T_9 (33.86 cm), but it was at par with treatment T_7 (31.80 cm). The minimum leaf length was recorded in treatment T_{10} (21.37 cm).

At 75 DAP, the maximum leaf length was recorded in treatment T_9 (40.05 cm) but it was at par with treatment T_7 (37.15 cm). The minimum leaf length was recorded in treatment T_{10} (28.25 cm). 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 pronounce in FYM + vermicompost + poultry manure combination followed by FYM + poultry manure combination. These results have conformity with the result of Padaganur *et al.* (2010) [11] who reported that application of organic fertilizers along with chemical fertilizers enhanced plant growth and development in tuberose.

The maximum fresh weight of leaves was reported in treatment T_9 (5.30 g) at 15 DAP which was superior over all the treatments but at par with T_7 (4.82 g). The minimum fresh weight of the leaves was recorded in treatment T_{10} (2.00 g). The maximum fresh weight of leaves was reported in treatment T_9 (6.05 g) at 30 DAP which was superior over all the treatments but at par with T_7 (5.31 g), T_8 (5.23 g). The minimum fresh weight of the leaves was recorded in treatment T_{10} (3.00 g). The maximum fresh weight of leaves was reported in treatment T_9 (7.03 g) at 45 DAP which was superior over all the treatments but at par with T_7 (6.18 g).The minimum fresh weight of the leaves was recorded in treatment T_{10} (3.55 g). The maximum fresh weight of leaves was recorded in treatment T_9 (8.03 g) at 60 DAP which was superior over all the treatments but at par with T_3 (7.00 g) and T_7 (7.29 g). The minimum fresh weight of the leaves was recorded in treatment T_{10} (3.70 g). The maximum fresh weight of leaves was observed in treatment T9 (8.75 g) at 75 DAP which was superior over all the treatments but at par with T_3 (7.01 g), T_7 (7.50 g). The minimum fresh weight of the leaves was recorded in treatment T_{10} (3.89 g).

The maximum dry weight of leaves (0.70 g) at 15 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}). The minimum dry weight of leaves (0.21 g) was recorded in treatment T_{10} Control. The maximum dry weight of leaves (1.11 g) at 30 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and the minimum dry weight of leaves (0.68 g) was recorded in treatment T_{10} Control. The maximum dry weight of leaves in gram (1.16 g) at 45 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and the minimum dry weight of leaves (0.69 g) was recorded in treatment T_{10} Control. The maximum dry weight of leaves in gram (1.20 g) at 60 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and the minimum dry weight of leaves (0.70 g) was recorded in treatment T_{10} Control. The maximum dry weight of leaves in gram (1.24 g) at 75 DAP was recorded in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and the minimum dry weight of leaves (0.73 g) was recorded in treatment T_{10} Control.

Table 1: Effect of nutrient management on Plant height, number of leaves plant^{-1} and length of leaves of leaves in tuberose

Treatments	Plant height (cm)					Number of leaves plant^{-1}					Length of leaves (cm)				
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
T_1:100%RDP (180:60:40) NPK	22.11	23.86	24.04	25.07	29.87	6.45	11.93	15.33	17.20	21.73	6.41	12.78	17.15	22.33	30.66
T_2:50% RDF + FYM (20 t ha-1)	19.10	23.34	26.28	27.26	33.03	8.24	14.00	16.38	19.60	24.53	7.36	14.43	20.19	25.33	32.33
T_3:50% RDF + Vermicompost (10 t ha^{-1})	19.12	24.67	27.07	29.22	33.51	8.47	14.35	17.20	20.87	25.17	7.59	15.15	20.31	27.07	34.07
T_4:50% RDF + Poultry manure (4 t ha^{-1})	17.60	22.03	24.44	26.09	30.77	7.39	12.67	14.77	17.93	22.60	6.73	13.00	17.62	22.49	30.16
T_5:50% RDF + FYM (7 t ha^{-1}) + Vermicompost (3 t ha^{-1}) + Poultry manure (1.5 t ha^{-1})	18.56	23.09	25.65	27.10	32.23	9.29	15.55	19.33	21.80	27.00	6.68	13.17	19.08	24.95	32.29
T_6:50% RDF + FYM (10 t ha^{-1}) + Vermicompost (5 t ha^{-1})	18.00	22.57	25.11	26.84	31.23	9.93	16.02	19.93	22.20	27.40	6.77	13.05	18.01	23.02	30.02
T_7:50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1})	21.79	26.20	30.02	32.23	34.68	10.09	17.69	21.33	24.33	29.73	8.65	16.19	22.09	31.80	37.15
T_8:50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1})	19.15	26.12	29.57	30.04	33.71	7.67	13.13	16.00	18.58	24.00	7.64	15.75	21.03	28.31	35.21
T_9:75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1})	24.25	28.75	31.78	34.09	36.24	8.87	15.17	18.27	21.00	26.13	9.96	17.22	26.18	33.86	40.05
T_{10}:Control	13.82	19.34	22.01	24.44	28.69	4.83	8.93	11.87	14.27	19.67	4.77	9.75	15.01	21.37	28.25
S. Em±	0.87	0.92	0.97	1.09	1.05	0.57	0.59	0.70	0.93	1.08	0.44	0.71	1.02	0.88	0.97
C.D at 5%	2.60	2.74	2.89	3.26	3.12	1.70	1.76	2.08	2.78	3.22	1.33	2.11	3.04	2.44	2.98

Table 2: Effect of nutrient management on fresh weight of leaves and dry weight of leaves in tuberose

Treatments	Fresh weight of leaves (g)					Dry weight of leaves (g)				
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
T_1:100% RDF (180:60:40) NPK	3.27	3.59	3.95	4.69	6.06	0.34	0.81	0.83	0.85	0.87
T_2:50% RDF + FYM (20 t ha^{-1})	4.00	4.25	4.72	5.72	6.72	0.34	0.85	0.86	0.88	0.90
T_3:50% RDF + Vermicompost (10 t ha^{-1})	4.28	5.03	5.45	7.00	7.01	0.35	0.72	0.75	0.76	0.78
T_4:50% RDF + Poultry manure (4 t ha^{-1})	3.33	3.69	4.05	5.12	6.21	0.40	0.74	0.76	0.79	0.81
T_5:50% RDF + FYM (7 t ha^{-1}) + Vermicompost (3 t ha^{-1}) + Poultry manure (1.5 t ha^{-1})	3.84	3.92	4.45	5.03	6.61	0.32	0.77	0.79	0.81	0.83
T_6:50% RDF + FYM (10 t ha^{-1}) + Vermicompost (5 t ha^{-1})	3.35	3.74	4.20	4.71	6.36	0.30	0.78	0.80	0.82	0.84

T_7:50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1})	4.82	5.31	6.18	7.29	7.50	0.39	0.73	0.75	0.77	0.79
T_8:50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1})	4.41	5.23	5.72	6.04	7.17	0.37	0.72	0.74	0.78	0.91
T_9: 75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1})	5.30	6.05	7.03	8.03	8.75	0.70	1.11	1.16	1.20	1.24
T_{10}:Control	2.00	3.00	3.55	3.70	3.89	0.21	0.68	0.69	0.70	0.73
S.Em±	0.23	0.28	0.30	0.42	0.38	0.02	0.04	0.04	0.06	0.09
C.D at 5%	0.69	0.90	0.91	1.25	1.13	0.08	0.14	0.13	0.20	0.23

Flower characters and yield

The observation on length of spike, length of rachis, number of florets $spike^{-1}$, diameter of florets, weight of 100 florets and flowers yield (kg m^{-2}) were recorded as influenced by different treatments and the data are given in (Table 3)

The maximum length of spike (72.33 cm) was recorded in the treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over T_2 (50% RDF + FYM (20 t ha^{-1}), T_3 (50% RDF + Vermicompost (10 t ha^{-1}), T_4 (50% RDF + Poultry manure (4 t ha^{-1}), T_5 (50% RDF + FYM (7 t ha^{-1}) + Vermicompost (3 t ha^{-1}) + Poultry manure (1.5 t ha^{-1}), T_6 (50% RDF + FYM (10 t ha^{-1}) + Vermicompost (5 t ha^{-1}) and T_{10} Control, rest of the treatment ware at par. The minimum length of the spike (60.70 cm) was obtained in treatment T_{10} Control.

The effect of organic manures, inorganic fertilizers for Spike length, number of florets, were significantly influenced by the application of RDF 50% in combination with poultry manure 50% followed by RDF 50% in combination with poultry manure 25% and neem cake 25%. This might be attributed to slow and sustained release of nutrients from poultry manure and neem cake. Ranjan, *et al.* (2014) [15]. Similar results have also been reported by Kumar and Singh (1998) [10], Sharma *et al.* (2008) [18], Tripathi *et al.* (2012) [22] and Devi and Singh (2010) [7] in tuberose. Spike length, rachis length and number of florets per spike are also positively influenced by the increasing doses of nitrogen, phosphorus and their interactions.

It is revealed from the data that average length of rachis was significantly influenced by various treatments under investigation. The maximum length of rachis (30.89 cm) was observed in treatment T_9 (75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over treatments T_2, T_3, T_4, T_5, T_6 and T_{10}. However, it was statically at par with T_1, T_7 and T_8 treatments. The minimum length of rachis (20.12 cm) was observed with treatment T_{10} (Control). Chopde *et al.* (2007) [5] and Yadav *et al.* (2005) [24] also found highest length of rachis in tuberose with application of vermicompost. This might be due to integration of inorganic fertilizer like vermicompost which enhanced the plant growth and resulted in maximum length of spike, diameter of spike and length of rachis.

The finding revealed that the maximum number of florets $spike^{-1}$ (42.67) was counted in the treatment T_9(75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and it was significantly superior except T_1 (100% RDF, T_3 - 50% RDF + Vermicompost (10 t ha^{-1}), T_7(50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and T_8(50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) treatments. The minimum number of florets $spike^{-1}$ (32.13) was observed in the treatment T_{10}.

The beneficial effect of combined application of FYM, Vermicompost, Poultry manure was possible due to availability of essential macro and micro nutrients to the plants. Organic nutrients also protects plant from different insect, pest and disease, similar result were also found by (Purohit and Dushyant, 2006) [14]. With combined application of neem cake and inorganic fertilizers in tuberose and found maximum number of florets $spike^{-1}$, and number of spikes per plant in tuberose.

Diameter of florets (cm) the treatment effects were found to vary significantly for flower diameter as presented. The perusal of data clearly indicated that the maximum diameter of floret (4.61 cm) was recorded in treatment T_7 (50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over treatments T_2, T_4, T_5, T_6, and T_{10}. However it was statistically at par with T_1, T_3, T_7, T_8, and T_9. The minimum diameter of floret (1.47 cm) was recorded in treatment T_{10} (Control). The results shows FYM and Poultry manure have significant effect on flower diameter of tuberose, where results were confirmity with the result of (Shubha 2006) [19] who found maximum flower duration and diameter of flower with the treatment of Poultry manure (12.5%).

The data regarding weight of 100 florets (g) under different Treatments is presented. The different treatments of nutrient management had non significant influence on weight of 100 florets. However, the maximum weight of 100 florets was recorded in treatment T_8 (50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) and minimum was noted in treatment T_{10} Control. The recommended dose application by combination of chemical similar trends were noted by Sharma *et al.* (2008) [18], Singh *et al.* (1976) [20], Yadav *et al.* (1985) [23] and Chaudhary *et al.* (2007) [4] in tuberose and organic sources have positive influence on fresh weight of 100 florets specially with application of 50% RDF + Vermicompost and Poultry manure combination.

It is evident from the table that maximum flower yield (1.50 kg ha^{-1}) was counted in the treatment T_9(75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1}) which was significantly superior over treatments T_2, T_3, T_4, T_5 and T_{10}. However it was statistically at par with T_1, T_6, T_8, and T_9. The minimum flower yield (0.50 kg ha^{-1}) was observed in the treatment T_{10} (Control).Similar results were also reported by Singh, *et al.* 2006 [2]. Who reported that poultry litter performed the best in respect of flower characters and flower yield followed by cow dung and vermicompost in tuberose. Similar result were also found by Padaganur, *et al.* 2005 [12]. Who reported that poultry litter performed better report to flower yield than cow dung in tuberose.

Table 3: Effect of nutrient management on length of spike, length of rachis, number of florets spike^{-1}, diameter of florets, weight of 100 florets and flowers yield (kg m^{-2})in tuberose

Treatments	Length of spike (cm)	Length of rachis (cm)	Number of florets spike^{-1}	Diameter of florets (cm)	Weight of 100 florets (g)	Flowers yield (kg m^{-2})
T_1:100% RDF (180:60:40) NPK	70.10	28.66	39.43	4.27	124.67	1.35
T_2:50% RDF + FYM (20 t ha^{-1})	68.29	26.30	35.87	3.00	124.63	0.85
T_3:50% RDF + Vermicompost (10 t ha^{-1})	66.27	25.77	39.61	4.24	124.33	0.95
T_4:50% RDF + Poultry manure (4 t ha^{-1})	65.83	24.36	35.20	3.32	125.67	0.90
T_5:50% RDF + FYM (7 t ha^{-1}) + Vermicompost (3 t ha^{-1}) + Poultry manure (1.5 t ha^{-1})	66.29	26.00	35.76	3.99	125.03	1.00
T_6:50% RDF + FYM (10 t ha^{-1}) + Vermicompost (5 t ha^{-1})	65.27	25.71	35.79	3.48	121.97	1.10
T_7:50% RDF + FYM (10 t ha^{-1}) + Poultry manure (2 t ha^{-1})	69.55	27.76	39.97	4.61	124.67	1.30
T_8:50% RDF + Vermicompost (5 t ha^{-1}) + Poultry manure (2 t ha^{-1})	70.30	27.95	39.66	4.41	127.33	1.25
T_9:75% RDF + FYM (3.5 t ha^{-1}) + Vermicompost (1.5 t ha^{-1}) + Poultry manure (2 t ha^{-1})	72.33	30.89	42.67	4.17	124.00	1.50
T_{10}:Control	60.70	20.12	32.13	1.47	118.68	0.50
S. Em± C.D at 5%	0.97 2.91	1.06 3.17	1.10 3.27	0.19 0.43	3.64 NS 10.81	0.15 0.48

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