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Effect of integrated nutrient management on growth, yield and quality of ratoon tuberose (*Polianthes tuberose* L.) cv. DOUBLE

■ **MAYURI K. HADWANI[1], D.K. VARU, NIKETA PANJIAR[1] AND V.J. BABARIYA[1]**

Members of the Research Forum

Associated Authors:
[1]Department of Horticulture, College of Agriculture, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA

Author for correspondence :
D.K.VARU
Department of Horticulture, College of Agriculture, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA
Email : dkvaru@jau.in

ABSTRACT : An experiment was conducted to investigate the effect of integrated nutrient management on growth, yield and quality of ratoon tuberose cv. Double at Department of Horticulture, Junagadh Agricultural University, Junagadh. Sixteen treatment combinations of different nutrients were comprised with three replications. Result showed the significant result and application of FYM @ 30 t/ha + PSB @ 2 g/m^2 + *Azotobacter* @ 2 g/m^2 (T_{13}) took minimum days to sprouting (18.47 days), maximum plant height (61.67 cm) and plant spread at E-W and N-S (37.93 cm and 37.07 cm, respectively). With respect to flowering, significantly maximum length of spike (78.00 cm), number of florets per spike (44.07), number of spikes per plant (4.26), number of spikes per net plot (127.67), number of spikes per hectare (4.73 lacks), longest vase life (12.33 days) and *in situ* longevity of spike (20.80 days) were recorded in treatment ½ RDF + NC @ 1 t/ha + PSB @ 1 g/m² + *Azotobacter* @ 1 g/m² (T_4). Similarly, the application of ¼ RDF + PSB @ 1.5 g/m^2+ @ *Azotobacter* 1.5 g/m^2 (T_6) gave poor performance.

KEY WORDS : *Azotobacter*, Phosphate solublizing bacteria, Ratoon, Sprouting

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Tuberose (*Polianthes tuberose* L.) belongs to family Agavaceae is a bulbous ornamental plant producing attractive white and fragrant flowers. The quality and production of cut flowers is primarily a varietal trait, it is greatly influenced by climatic, geographical and nutritional factors. Out of them, nutritional factor is playing a major role. At present, nutrients are supplied through chemical fertilizers. The indiscriminate and continuous use of chemical fertilizers has leaded to an imbalance of nutrients in soil which has an adversely effected the soil health, affecting the yield and quality of the product. Therefore, the integrated use of nutrients is the need of the today. The use of organic manures along with judicious use of chemical fertilizers is nothing but balancing the diet of crop and soil. It improves physico-chemical and biological properties of soil, besides improving the efficiency of applied nutrients.

RESEARCH METHODS

The experiment was carried out at Department of Horticulture, Junagadh Agricultural University, Junagadh, during 2011-2012. The experiment was laid out in Randomized Block Design with 16 treatments and three replications. The different treatments were T_1: RDF @ 180:60:40 NPK kg/ha + FYM @ 20 t /ha, T_2: ½ RDF + PSB @ 1 g/m² + *Azotobacter* @ 1 g/m², T_3: ½ RDF + VC @ 1 t/ha + PSB @ 1 g/m² + *Azotobacter* @ 1 g/m², T_4: ½ RDF + NC @ 1 t/ha + PSB @ 1 g/m² + *Azotobacter* @ 1 g/m², T_5: ½ RDF + CC @ 1 t/ha + PSB @ 1 g/m² + *Azotobacter* @ 1 g/m², T_6: ¼ RDF + PSB @ 1.5 g/m^2+ *Azotobacter* @ 1.5 g/m^2, T_7: ¼ RDF + VC @ 2 t/ha + PSB @ 1.5 g/m^2 + *Azotobacter* @ 1.5 g/m^2, T_8: ¼ RDF + NC @ 2 t/ha + PSB @ 1.5 g/m^2 + *Azotobacter* @ 1.5 g/m2, T_9: ¼ RDF + CC @ 2 t/ha + PSB @ 1.5 g/m^2 + *Azotobacter* @ 1.5 g/m^2, T_{10}: VC @ 2.5 t/ha + PSB @ 2 g/m^2 + *Azotobacter* @ 2 g/m^2, T_{11}: NC @ 2.5 t/ha + PSB @ 2 g/m^2 + *Azotobacter* @ 2 g/m^2, T_{12}: CC @ 2.5 t/ha +

PSB @ 2 g/m^2 + *Azotobacter* @ 2 g/m^2, T_{13}: FYM @ 2.5 t/ha + PSB @ 2 g/m^2 + *Azotobacter* @ 2 g/m^2, T_{14}: VC @ 1.5 t/ha + NC @ 1.5 t/ha + PSB @ 1.5 g/m^2 + *Azotobacter* @ 1.5g/m^2, T_{15}: VC @ 1.5 t/ha + CC @ 1.5 t/ha + PSB @ 1.5 g/m2 + *Azotobacter* @ 1.5g/m^2 and T_{16}: NC @ 1.5 t/ha + CC @ 1.5 t/ha + PSB @ 1.5 g/m^2 + *Azotobacter* @ 1.5g/m^2.

The leaves of previous year crop were cut above the ground level and strong bunds were prepared as per layout. The soil between the spaces of bulbs was dug and thoroughly mixed with organic manure as per treatment. The recommended fertilizer doses of 180:60:40 kg NPK per hectare were applied in form of urea, DAP and muriate of potash. Half dose of nitrogen and full dose of phosphorus and potash were applied as basal dose. The remaining half dose of nitrogen was applied in two spilt doses at interval of 45 and 90 days after application of basal dose. In case of organic source, farm yard manure, vermi compost, neem cake and castor cake were incorporated in the soil according to the treatments of respective plots. Likewise, *Azotobacter* and PSB were calculated with respective treatment and well mixed in organic manure and then applied in the soil of respective plots.

RESEARCH FINDINGS AND DISCUSSION

The data showed significant variation and minimum days for sprouting after cutting (18.47 days), maximum plant height at full bloom stage (61.67 cm)and plant spread at E-W and N-S (37.93 cm and 37.07 cm, respectively) were recorded with an application of FYM @ 30 t/ha + PSB @ 2 g/m^2 + *Azoto*bacter @ 2 g/m^2 (T_{13}) (Table 1). This might be due to better nutrient uptake, photosynthesis, source-sink relationship, besides excellent physiological and bio-chemical activities due to presence of *Azotobacter* and PSB. The present finding are in close conformity with findings of Kukde *et al.* (2006) in tuberose; Gupta *et al.* (2008) and Ranjan and Mansee (2007) in gladiolus; Khan *et al.* (2009) in tulip and Bhatia and Gupta (2007) in carnation.

For flowering parameters, significantly maximum length of spike (78.00 cm), number of florets per spike (44.07), longest vase life (12.33 days), *in situ* longevity of spike (20.80 days) (Table 2), number of spikes per plant (4.26), number of spikes per net plot (127.67) and number of spikes per hectare (4.73 lacks) (Table 3) were recorded in treatment ½ RDF + NC @ 1 t/ha + PSB @ 1 g/m^2 + *Azotobacter* @ 1 g/m^2 (T_4).This might be due to combine application of inorganic fertilizer, neem cake and biofertilizer. The beneficial effect of combined application of neem cake and inorganic fertilizer was possible as because the oil cake not only supply the NPK but also contained micronutrients and amino acid. It also protects the plant from nematodes and trace elements (Purohit and Dushyant, 2006).The results are similarly to the findings of Wange and Patil (1994), Wange *et al.*(1995), Yadav *et al.* (2005), Patil *et al.* (2007), Ranjan *et al.* (2007) and Chaudhary (2009) in

Table 1 : Effect of integrated nutrient management on days to sprouting, plant height, plant spread (E-W & N-S) and no. of leaves per clump in ratoon tuberose cv. DOUBLE

Treatments	Days to sprouting (After cutting)	Plant height (cm)	Plant spread at E-W (cm)	Plant spread at N-S (cm)	No. of leaves per clump
T_1	19.33	55.60	30.13	31.13	82.07
T_2	21.33	52.80	33.73	33.33	76.07
T_3	19.80	55.53	33.13	32.93	80.60
T_4	21.47	42.60	30.33	30.60	78.80
T_5	21.93	54.93	29.33	28.67	77.87
T_6	22.60	40.60	25.40	26.20	78.53
T_7	21.40	49.87	31.47	32.47	80.60
T_8	21.07	49.87	28.00	27.20	78.27
T_9	21.53	51.40	33.60	34.80	78.87
T_{10}	21.13	51.07	32.40	30.67	82.60
T_{11}	20.60	50.87	32.00	31.93	81.80
T_{12}	20.33	45.93	28.00	28.00	81.27
T_{13}	18.47	61.67	37.93	37.07	88.53
T_{14}	23.07	49.93	30.40	31.73	83.13
T_{15}	19.40	55.67	35.87	35.60	84.20
T_{16}	19.53	58.67	36.13	35.80	86.60
S.E. ±	0.630	3.057	2.078	1.938	2.330
C.D. (P=0.05)	1.82	8.83	6.00	5.60	NS
C.V.%	5.25	10.24	11.34	10.57	4.97

Table 2 : Effect of integrated nutrient management on days to first spike emergence, length of spike, no. of florets per spike, diameter of floret, vase life and *in-situ* longevity of spike in ratoon tuberose cv. DOUBLE

Treatments	Days to first spike emergence (after cutting)	Length of spike (cm)	No. of florets per spike	Diameter of floret (mm)	Vase life (days)	*In situ* longevity (days)
T_1	103.93	76.07	42.47	40.66	11.13	19.00
T_2	105.07	73.73	41.60	37.71	11.00	18.87
T_3	104.33	77.47	43.53	41.31	11.60	19.27
T_4	104.20	78.00	44.07	42.16	12.33	20.80
T_5	104.80	74.80	41.87	38.41	10.73	17.47
T_6	104.27	65.53	36.96	37.45	9.20	15.40
T_7	105.47	69.13	38.53	38.53	10.56	17.13
T_8	104.47	73.40	40.80	38.07	10.73	18.87
T_9	104.53	75.93	41.87	39.44	9.93	18.73
T_{10}	105.20	72.07	37.93	39.92	10.53	18.20
T_{11}	104.80	71.33	39.67	39.45	10.00	17.47
T_{12}	105.20	70.73	38.67	38.38	9.60	16.80
T_{13}	103.40	73.07	37.33	38.07	10.27	17.07
T_{14}	105.73	69.67	39.60	37.55	9.80	16.93
T_{15}	104.80	71.00	39.33	38.89	9.93	15.93
T_{16}	105.40	68.33	37.00	37.20	9.73	15.80
S.E..±	2.566	2.256	1.507	1.132	0.369	0.561
C.D. (P=0.05)	NS	6.51	4.35	NS	1.07	1.62
C.V.%	4.24	5.39	6.51	5.03	6.12	5.48

NS=Non-significant

Table 3 : Effect of integrated nutrient management on no. of spikes per plant, no. of spikes per net plot and no. of spikes per ha. in ratoon tuberose cv. DOUBLE

Treatments	No. of spikes per plant	No. of spikes per net plot	No. of spikes per ha (lakh no.)
T_1	3.41	102.33	3.79
T_2	3.36	100.67	3.73
T_3	3.59	107.67	3.99
T_4	4.26	127.67	4.73
T_5	3.03	91.00	3.37
T_6	2.74	82.33	3.05
T_7	3.12	93.67	3.47
T_8	3.12	93.67	3.47
T_9	3.18	95.33	3.53
T_{10}	3.09	92.67	3.43
T_{11}	3.16	94.67	3.51
T_{12}	3.01	93.67	3.47
T_{13}	3.20	96.00	3.55
T_{14}	3.04	91.33	3.38
T_{15}	3.37	101.00	3.74
T_{16}	2.89	86.67	3.21
S.E..±	0.228	6.899	0.255
C.D. (P=0.05)	0.66	19.92	0.74
C.V.%	12.24	12.33	12.29

tuberose; Godse *et al.* (2006) in gladiolus and Bhalla *et al.* (2007) in carnation. Hence, the use of ½ RDF + NC @ 1 t/ha + PSB @ 1 g/m^2 + *Azotobacter* @ 1 g/m^2 helped in realizing better yield and quality of tuberose.

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