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Influence of doses of water soluble fertilizers through drip irrigation on flowering and yield in tuberose (*Polianthes tuberosa* L.) cv. Prajwal

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Abstract
The experiment was carried out in tuberose (*Polianthes tuberose*) cv. Prajwal to investigate the effect of water soluble fertilizers (Urea, N:P:K::19:19:19 and N:P:K::13:00:45) with different doses and combination with straight fertilizers (Urea, DAP and MOP) over the straight fertilizer dose with recommended dose of fertilizer of N:P:K::200:200:200 kg/ha at G.B. Pant University of Agriculture and Technology, Pantnagar during March 2016-January 2018. The bulbs of appropriate size (4.5-5.0 cm length) were planted at spacing of 40 × 40 cm. Fertigation with water soluble fertilizers at the rate of 125 per cent of recommended dose of fertilizers recorded highest plant height (19.80 cm, 31.70 cm and 33.90 cm, respectively) and number of leaves (18.98, 42.82 and 55.69, respectively) at 30 and 60 days after sprouting and at spike emergence. Spike emergence (87.70 days), days to first floret opening (20.07 days) were earliest in T_1 (75 per cent of RDF using WSF). The same treatment showed highest spike length (89.27 cm), number of spike per plant (6.30) and spike yield per m^2 (39.40). The treatment T_4 (100 per cent RDF using WSF) showed maximum vase life (15.10 days) for cut spikes. Whereas the bulb yield per plant (309.87 g) and per m^2 area (1,936.67 g) were affected significantly with T_3 (125 per cent RDF using WSF). The spike yield increased by 38.47 per cent and bulb yield per m2 area increased by 94.70 per cent over the control.

Keywords: Drip irrigation, fertigation, water-soluble fertilizers, tuberose

Introduction

Tuberose (*Polianthes tuberosa* L.), a member of family amaryllidaceae, is an open field cultivated flower that is gaining popularity because of its easy cultivation, hardy nature and wide adoptability to different edaphic and climatic conditions across the country. The plants with their attractive pearl white flower colour and possess a pleasant fragrance, blooms for considerably long period of time and the flowers remain fresh for quite a longer period of time after the spike are cut from the plant. The tuberose plants are valued for multi-purpose uses like as cut flower for floral arrangements, as loose flowers in garlands and *veni* preparations and essential oil in aesthetic and perfumery industry. The dried bulbs of tuberose are often used as a remedy for gonorrhoea.

Under commercial cultivation of tuberose, inadequate plant nutrition mainly causes stunted growth which may lead to decline of plant vigour and eventually lead to reduced productivity and higher cost of production. In recent times, fertigation has proved to be the most economical technique for fertilizer application in many of the horticultural crops and has potential for more accurate and timely crop nutrition ultimately provides better yield, improved quality and early maturity. Fertigation also reduces the wastage of fertilizers through improved fertilizer use efficiency and thus, helps in economizing the use of water and fertilizers and is more economical as reduces the cost of water, fertilizers, labour and energy.

Hence, standardization of optimum doses of fertilizers through drip irrigation is required for improving the fertilizer use efficiency in tuberose. Keeping in view, the above facts, the experiment was conducted to study the influence of doses of water soluble fertilizers through drip irrigation on

Materials and Methods

Investigation was carried out during March 2016 to January 2018 at Model Floriculture Centre, G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of doses of water soluble fertilizers through drip irrigation in tuberose cv. Prajwal. The soil at the experiment site was sandy loam soil with a pH of 6.68 and EC of 0.43 dS/m. The experiment was laid out in Randomized Block Design (RBD) comprising seven treatments with three replications. The treatments consists of T_1: 75% of RDF with Water soluble fertilizers (WSF), T_2: 100% of RDF with WSF, T_3: 125% of RDF with WSF, T_4: 75% of RDF as WSF + 25 % of RDF as straight fertilizers (SF), T_5: 50% of RDF as WSF + 50% of RDF as SF, T_6: 25% of RDF as WSF + 75% of RDF as SF, T_7: 100% of RDF as SF (control). Recommended dose of fertilizers per hectare was 200:200:200 kg of NPK was applied through fertigation and manual help as per the treatment. At last ploughing 50 kg of FYM per hectare as basal were applied uniformly for all the treatments.

The field was divided into raised beds of height of 25 cm and width of 90 cm for allotment of various treatments. A spacing of 30 cm between the beds was provided for separation of treatments and replications and also for easy inter-cultural operation. Double row planting system was adopted with the spacing of 120 X 40 X 40 cm (row/plant). The drip irrigation system and *venturi* injector fertigation unit were installed as per the experimental layout and treatment plan. Water soluble fertilizers and straight fertilizers were applied as per the treatment combinations. Fertigation was given as per the schedule at different plant growth stages. Observations for growth and flowering characters were collected and subjected to statistical analysis under simple RBD using ANOVA.

Results and discussion

The data pertaining to growth, floral characters and yield of bulbs are presented in Table 1 and Table 2, respectively.

The growth parameter *viz*., plant height at critical stages such as at 30 and 60 days after bulb sprouting and at spike emergence stage was found to be invariably influenced by fertigation levels and found to be higher at higher doses of fertigation (125 per cent dose of fertigation) in comparison to lower level of fertigation doses which might be due to frequent application of fertilizers at regular interval of time, enhancing the available nutrient status in the root zone which might be taken up by the plants affecting the growth and development of the plant. The different fertigation levels gave non-significant results for the number of leaves counted at 30 days after sprouting but had significant effects for the number of leaves at 60 days after sprouting and at spike emergence stages. At 30 days after sprouting the maximum number of leaves (18.98) were with T_3 and minimum number of leaves (13.8) were with T_7 i.e. control. The T_3 treatment gave the maximum number of leaves (42.82 and 55.69) which was at par with T_4 (41.77 and 53.39), T_2 (41.77 and 53.26), T_1 (40.75 and 53.09) and T_5 (40.60 and 49.70) at 60 days after sprouting and at spike emergence, respectively. The above results are in accordance with the research findings by Bhattacharjee *et al.* (1994) [1] who found significant difference with respect to growth parameters like plant height (35.60 cm) and number of leaves (56.9 per plant) in tuberose cv. Single at highest level of NPK (20:40:50 g NPK/m^2) as compared to lower levels; Munikrishnappa (1996) [6] and Shashidhar (2004) [9] who studied the influence of fertigation on the growth and yield of tuberose. Higher fertilizer level increased the number of leaves significantly due to the vital role of nitrogen as it is an important component of chlorophyll molecule which traps and converts solar energy into chemical energy in plants and produce starch from carbon dioxide and water. Nitrogen is also a major component of protein and thus influences the biochemical reactions of plants by incorporating into the enzymatic system of plant such as IAA which induces cell division and cell elongation. Other than that, nitrogen itself is a structural component of ATP (Adenosine triphosphate), the “energy currency of the cell”, nucleic acids such as DNA (the genetic material of cell) which allows a cell to reproduce. Sharma and Mohammad (2004) [8] also justified the above results in their findings in tuberose cv. Mexican Single. Findings by Ganesh *et al* (2014) [3] was also in similar trend who optimized the fertigation schedule for cut chrysanthemum.

Significant results were obtained for floral characters in both the years of experiment and simultaneously in the pooled data. Among all the treatments, the treatment T_1 i.e. 75 per cent of RDF using WSF significantly reduced the days to spike emergence (94.73, 80.67 and 87.70 days) which was at par with treatment T_4 (101.47, 85.57 and 93.52 days) and first floret opening (20.63, 19.50 and 20.07 days) which was statistically at par with treatment T_4 (22.07, 20.93 and 21.50 days) in both the years of study and in the pooled data, respectively. The maximum spike length was found in treatment T_1 (84.80, 93.70 and 89.30 cm) in first year, second year and in the pooled mean of both the years of study which was at par with treatment T_4 (83.20, 92.50 and 87.80 cm). The pooled mean of both years of experiment represented that T_4 (15.10 days) gave the maximum vase life for spikes which was statistically at par with T_1 (14.90 days). The minimum vase life was observed in T_3 (11.30 days) which was at par with T_7 i.e. control. Highest number of spikes per plant and per m^2 area in the first year (5.63 and 35.21) was obtained in T_1 which is at par with T_4 (5.53 and 34.58). In the second year and in the pooled mean, T_1 had maximum number of spikes per plant (6.97 and 6.30) which was at par with T_2 (6.10 and 5.80) per m^2 area (35.21, 43.54 and 39.38) was obtained in treatment T_1 with the same trend followed in calculated yield of spikes for one m^2 area. The result obtained might be due to the reduced N doses which impart earliness in flowering in tuberose. On the other hand, increasing the dose of N to 125 per cent showed negative effect on floral characters as more N supply enhances the vegetative growth of the plant resulting in less yield of spikes per plant and per m^2 area. Among the treatments, fertigation with 100 per cent and 75 per cent of RDF through WSF resulted in improved vase life probably due to role of P and K in modifying the translocation of assimilate in tuberose resulting in increased vase life. P and K are among the most important nutritional element and much essential for all biological processes that occur in plant. P is a vital component of DNA, the genetic “memory unit” of all living things. It is also a component of RNA, the bio-compound that reads the genetic code to build the proteins and other compounds that sustain the life and hence affecting the growth and development attributes. Also, the structures of both DNA and RNA are linked together by phosphorus bonds. The application of higher doses of fertigation with 125 per cent of RDF with WSF resulted in negative effect due to fertilizer application beyond the threshold demand by the crop as drip fertigation reduces the loss of fertilizer due to leaching and increases the fertilizer use efficiency by accumulating the fertilizer near the root zone area which increases the absorption of fertilizers by the plant. Plants stop responding to fertilizers beyond the threshold value and it’s a wastage of fertilizer resulting in increased cost and also hampering the soil health adversely. These results of the investigation were in accordance with that of Ganesh *et al* (2014) [3] in chrysanthemum, Shadhishar (2004) in tuberose, Selim *et al* (2017) [7] in tuberose and Kurakula *et al* (2018) [5] in marigold.

The maximum bulb yield per plant and per m^2 were found in T_3 (309.87 g and 1,936.67 g) treatment which was at par with T_4 (299.23 g and 1,870.21 g) and T_2 (293.98 g and 1,837.40 g). The minimum values were found in T_7 i.e. control (159.17 g and 994.79 g). The above results showed that increasing the fertilizer dose through drip irrigation exhibited the positive effect in bulb and bulblets yield due to increased amount of photosynthates as in accordance with increase in leaf area and number of leaves due to higher N application. Also, increased doses of P increases the availability of nitrogen in the soil for plant uptake. Phosphorus is an important plant nutrient responsible for various chemical reactions such as facilitating starch and protein synthesis as an important constituent of DNA, RNA and protein (Carbera *et al*., 1996). The results also showed efficiency of drip fertigation using water soluble fertilizer over application of straight fertilizers. The results were in accordance with Kabariel (2015) [4] in tuberose.

Conclusion

From the above study, it can be concluded that 75 per cent of recommended dose of fertilizer through water soluble fertilizers using drip fertigation system in tuberose cv. Prajwal can be recommended in order to get early and long flowering spikes with higher yield per m^2 area. For maximum bulb yield, 125 per cent of recommended dose of fertilizer through water soluble fertilizers under drip irrigation system in tuberose cv. Prajwal can be recommended.

Table 1: Effect of straight and water soluble fertilizers and their combinations on plant height at 30 and 60 days after sprouting and at spike emergence of tuberose cv. Prajwal

Treatments	Plant height (cm)								
	at 30 days after sprouting			at 60 days after sprouting			at spike emergence		
	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean
T_1	17.50	20.10	18.80	28.80	31.80	30.30	30.50	34.30	32.40
T_2	17.60	20.70	19.20	28.90	30.10	29.50	32.30	35.40	33.90
T_3	18.20	21.40	19.80	31.10	32.40	31.70	33.50	34.30	33.90
T_4	17.60	21.90	19.70	29.70	33.30	31.50	34.00	34.90	34.50
T_5	17.30	20.00	18.60	28.10	30.90	29.50	31.90	33.30	32.60
T_6	17.00	18.50	17.80	27.70	29.50	28.60	29.90	30.70	30.30
T_7	16.20	17.60	16.90	25.80	28.60	27.20	28.10	29.60	28.90
CD at 5%	NS	2.70	NS	2.60	2.90	2.40	1.80	2.10	1.20
SEm±	1.18	0.87	0.79	0.82	0.93	0.76	0.58	0.68	0.39

Table 2: Effect of straight and water soluble fertilizers and their combinations on number of leaves at 30 and 60 days after sprouting and at spike emergence of tuberose cv. Prajwal

Treatments	Number of leaves								
	at 30 days after sprouting			at 60 days after sprouting			at spike emergence		
	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean
T_1	16.43	20.90	18.67	36.53	44.97	40.75	51.76	54.43	53.099
T_2	14.17	21.30	17.73	38.67	44.87	41.77	52.28	54.25	53.26
T_3	15.37	22.60	18.98	39.43	46.20	42.82	54.54	56.83	55.69
T_4	17.19	20.37	18.78	38.17	45.37	41.77	53.08	53.70	53.39
T_5	15.47	19.40	17.43	33.00	40.60	36.80	49.18	50.23	49.70
T_6	11.77	16.27	14.02	30.85	36.90	33.88	43.60	44.99	44.30
T_7	12.13	15.47	13.80	25.63	29.87	27.75	40.89	42.93	41.91
CD at 5%	NS	NS	NS	8.75	7.98	7.06	7.56	5.54	6.01
SEm±	1.60	2.11	1.60	2.81	2.56	2.27	2.43	1.78	1.93

Table 3: Effect of straight and water soluble fertilizers and their combinations on days to spike emergence, first floret opening and spike length of tuberose cv. Prajwal

Treatments	Days to spike emergence (days)			Length of spike (cm)		
	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean
T_1	94.73	80.67	87.70	84.80	93.70	89.30
T_2	105.90	87.37	96.63	82.90	90.40	86.70
T_3	117.60	92.03	104.82	76.20	81.60	78.90
T_4	101.47	85.57	93.52	83.20	92.50	87.80
T_5	112.00	96.63	104.32	81.30	90.20	85.80
T_6	121.90	102.97	112.43	79.00	81.70	80.40
T_7	123.37	109.37	116.37	74.40	75.40	74.90
CD at 5%	7.88	4.59	4.34	6.11	4.53	4.84
SEm±	2.53	1.47	1.39	1.96	1.45	1.55

Table 4: Effect of straight and water soluble fertilizers and their combinations on vase life of cut spikes and number of spikes per plant and per m^2 area of tuberose cv. Prajwal

Treatments	Vase life of spikes (days)			Number of spike per plant per year			Number of spike per m^2 per year		
	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean
T_1	13.80	16.00	14.90	5.63	6.97	6.30	35.21	43.54	39.38
T_2	13.90	14.40	14.15	5.50	6.10	5.80	34.38	38.13	36.25
T_3	10.30	12.30	11.30	4.23	4.87	4.55	26.46	30.42	28.44
T_4	14.70	15.40	15.10	5.53	6.00	5.77	34.58	37.50	36.04
T_5	12.50	14.20	13.40	5.38	5.53	5.46	33.63	34.58	34.10
T_6	12.13	13.70	12.90	4.27	5.23	4.75	26.67	32.71	29.69
T_7	10.30	13.20	11.70	4.13	4.97	4.55	25.83	31.04	28.44
CD at 5%	0.72	1.86	0.93	1.17	1.31	1.07	7.30	8.17	6.66
SEm$\pm$	0.230	0.598	0.299	0.38	0.42	0.34	2.34	2.62	2.14

Table 5: Effect of straight and water soluble fertilizers and their combinations on number of bulbs per plant and per m^2 area of tuberose cv. Prajwal

Treatments	Bulb yield per plant (g)			Bulb yield per m^2 (g)		
	2016-17	2017-18	Pooled mean	2016-17	2017-18	Pooled mean
T_1	229.73	313.07	271.40	1435.83	1956.67	1,696.25
T_2	256.10	331.87	293.98	1600.63	2074.17	1,837.40
T_3	264.40	355.33	309.87	1652.50	2220.83	1,936.67
T_4	252.37	346.10	299.23	1577.29	2163.13	1,870.21
T_5	226.10	298.63	262.37	1413.13	1866.46	1,639.79
T_6	199.93	252.83	226.38	1249.58	1580.21	1,414.90
T_7	141.13	177.20	159.17	882.08	1107.50	994.79
CD at 5%	76.81	62.61	35.51	480.05	391.29	221.91
SEm$\pm$	24.65	20.10	11.40	154.09	125.60	71.23

References

1. Bhattacharjee SK, Mukharjee T, Yadav LP. Standardization of agro-techniques in tuberose (*Polianthus tuberosa* L.). Indian perfumer. 1994; 38(4):144-152.
2. Cabrera RI, Evans RY, Paul JL. The uptake of nitrate and ammonium by greenhouse roses. Acta Horticulturae, 1996; 424:53-57.
3. Ganesh S, Kannan M, Jawaharlal M. Optimization of fertigation schedule for cut chrysanthemum (*Dendranthema grandiflora* L.). HortFlora Research Spectrum. 2014; 3(4):344-348.
4. Kabariel J. Standardization of fertigation levels, irrigation regimes, micronutrients and growth promoter for improved growth, yield, quality and bulb production in tuberose (*Polianthes tuberosa* L.) cv. Prajwal. Ph.D. (Hort.) Thesis, Tamil Nadu Agricultural University, Coimbatore, 2015.
5. Kurakula D, Girwani A, Vijaya D, Prasanth P. Influence of levels of fertigation and sources of nutrients on flowering and yield characters of marigold (*Tagetes erecta* L.) cv. pusa Narangi Gainda, International Journal of Chemical Studies. 2018; 6(4):1674-1678.
6. Munikrishnappa PM. Influence of fertigation with major and micronutrients on growth, yield and oil content in tuberose (*Polianthus tuberosa* L.) cv. Single. M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Bangalore, 1996.
7. Selim SM, Matter FM, Hassanain MA, Youssef SM. Response of growth, flowering, concrete oil and its component of *Polianthes tuberosa* L. cv. Double to phosphorus fertilizer and gibberellic acid. International Journal of Current Microbiology and Applied Sciences. 2017; 6(9):1639-1652.
8. Sharma RK, Mohammad S. Influence of graded levels of nitrogen and sulphur on growth, flowering and essential oils content in tuberose cultivar Mexican Single. Journal of Ornamental Horticulture. 2004; 7(1):52-57.
9. Shashidhar H. Effect of different levels of fertigation on growth and yield of tuberose (*Polianthes tuberosa* L.) hybrids. M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Bangalore, 2004.