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Effect of Fertigation and Hydrogel on Growth and Flower Yield of Tuberose (*Polianthes tuberosa* L.)

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ABSTRACT: The investigation on "Effect of fertigation and hydrogel on growth and flower yield of tuberose (*Polianthes tuberosa* L) *cv* Mexican single" was carried out at Herbal Garden, college of Agriculture, UAS, Raichur during the year 2021-22. The experiment was comprised with four main treatments and three sub treatments laid out in split plot design with three replications. The results revealed that the treatment F_1 at H_1 (Fertigation with 100% RDF and Hydrogel as bulb dip @ 0.2%) recorded significantly higher plant height (68.82 cm), number of leaves per clump (225.92) and number of tillers per clump (24.51). The same treatment also recorded significantly higher flower yield (10.29 t/ha) was 29.49% increase over control (5.84 t/ha) which was due to increase in yield attributes *viz*, number of spikes per clump (21.76), flowers per spike (58.63), length of flower (6.21 cm), diameter of flower (4.75 cm), weight of 100 flowers (66.74 g) and flower yield per clump (161.99 g) confirmed as best treatment which could be recommended to the farmers for better income. Challenges during the study was proper supply of NPK through fertigation to all plants. It will be overcome with practice of proper maintenance of drippers supply of fresh form of fertilizers.

Keywords: Fertigation, Hydrogel, Tuberose, Mexican single.

INTRODUCTION

Tuberose is a half-hardy, perennial bulbous plant is native to Mexico belongs to the family Amaryllidaceae. It is a popular fragrant flower grown under open condition for loose and cut flowers. Fragrance due to presence of Geraniol, nerol, benzyl alcohol, eugenol and methyl anthranilate. Tuberose is one of the important cut flowers among the top ten cut flowers. Tuberose is commercially propagated by bulbs. The schedule and method of application of fertilizers at critical stages is important for increased quantitative and qualitative yields. The farmers apply nutrients conventionally but the nutrients are subjected to leaching and fixation in the soil and sometimes nutrients reach deeper zones beyond the active root zone and become unavailable to the plant. In many cases, the effective utilization of nutrients by the plants is less than 50 per cent of the fertilizers applied through traditional method. In this context, fertigation has flexibility, cost effective and the potential for improved yield over traditional fertilizer application methods (Jata *et al*., 2013). Fertigation is the precise application of plant nutrients with an irrigation system in the crop root zone as per the demand during the crop growing season. Where fertilizer application is made in a small and frequent dose. The other way to reduced water and fertilizer requirements of the crop is through the use of hydrogel which improves aeration, drainage, improved physical properties of soil and soil less media which helps the plant to withstand prolonged moisture stress. The hydrogel amendment was effective in improving soil moisture availability and thus increased the plant establishment (Akhter *et al*., 2004). Pusa hydrogel is a semi-synthetic, cross-linked, derivatized cellulose-graft-anionic polyacrylate super absorbent polymer. It is recommended to be applied at 2 to 6 inches below the soil and near the root zone.

MATERIAL AND METHODS

A field experiment was conducted during 2021-22 at Herbal Garden, college of agriculture, Raichur, Karnataka. The experiment was laid out in red sandy clay loam soil which had low available nitrogen (196.96 kg ha^{-1}), phosphorus (36.38 kg ha^{-1}) and potassium (263.72 kg ha^{-1}) with pH of 7.25. The experiment was comprised with four main treatments (F_1-Fertigation with 100% RDF, F_2-Fertigation with 75% RDF, F_3-Fertigation with 50% RDF and F_4-Soil application with 100% RDF) and three sub treatments (H_1-Hydrogel as bulb dip @ .02%, H_2-Hydrogel as soil application @ 0.4 g/m² and H_3- No Hydrogel) laid out in split plot design with three replications. The uniform size of tuberose bulbs (2.5–3.5 cm) were used for planting. The bulbs were planted at 5 to 6 cm depth in soil with a spacing of 30 × 30 cm. Before planting, dipping of bulbs in 0.2% hydrogel solution and soil application of 0.4 g hydrogel granules was done according to the treatments on 28th October, 2021. From randomly tagged five plants, plant height, number of leaves and number of tillers were measured. The observation on flowering parameters *viz.*, number of spikes per clump, flowers per spike, length of flower, diameter of flower, weight of 100 flowers and flower yield per clump was recorded. Data analysis and interpretation was done using Fischer's method of variance technique as described by Panse and Sukhatme (1967). The level of significance used in 'F' test was P=0.05.

RESULT AND DISCUSSION

Effect of Fertigation and Hydrogel on Growth and Flower Yield of Tuberose (*Polianthes Tuberosa* L)

A. Plant Height

Among all the interactions, F_1H_1 (100% RDF through fertigation with 0.2% hydrogel as bulb dip) recorded the highest plant height (68.82 cm at 200 DAP) as compared to other interactions (Table 1). Next highest plant height (52.09 cm at 200 DAP) was obtained in the treatment F_2H_1 (75% RDF through fertigation with 0.2% hydrogel as bulb dip). Minimum plant height (43.23 cm at 200 DAP) was observed in F_3H_3 (50% RDF through fertigation and no hydrogel). The possible reason for increased plant height might be due to the application of optimum dose of NPK through fertigation at regular intervals and hydrogel as superabsorbent of water and conserve at root zone. Similar findings of enhanced crop growth was reported by Hemanta *et al*. (2012) in carnation and Rakshit (2017) in ginger.

B. Number of Leaves

Among all the interactions, F_1H_1 recorded the maximum number of leaves per clump (225.92 at 200 DAP) as compared to other interactions (Table 1). Next maximum number of leaves per clump (183.59 at 200 DAP) was obtained in the treatment F_1H_2 (100% RDF through fertigation and hydrogel as soil application). Minimum number of leaves per clump (143.45 at 200 DAP) was observed in F_3H_3 (50% RDF through fertigation and no hydrogel). Maximum number of leaves per clump at all growth stages was because of continuous availability of needed quantity of nutrition through fertigation and withholding moisture and applied nutrients by hydrogel in soil and their utilization in production of more number of leaves. Similar results were reported by Divya *et al.* (2017) in marigold and Vidyashree (2018) in Philodendron.

C. Number of Tillers

Among all the interactions, F_1H_1 recorded the maximum number of leaves per clump (24.51 at 200 DAP) as compared to other interactions (Table 1). Next maximum number of tillers per clump (22.43 at 200 DAP) was obtained in the treatment F_1H_2. Minimum number of tillers per clump (16.38 at 200 DAP) was observed in. Higher number of tillers might be due to more availability of nitrogen due to fertigation. Fertigation at frequent intervals and minimum loss of nitrogen through leaching due to hydrogel effect might have helped to produces more tillers was also reported by Shashidhar *et al.* (2008) in tuberose and Ochoa *et al.* (2009) in carnation.

D. Number of spikes per clump

Among all the interactions, F_1H_1 recorded the maximum number of spikes per clump (21.76 at 200 DAP) as compared to other interactions (Table 2). Next maximum number of spikes per clump (15.77 at 200 DAP) was obtained in the treatment F_1H_2. Minimum number of spikes per clump (14.40 at 200 DAP) was observed in F_3H_3. The continuous availability of both moisture and nutrients to crop at all the growth stages was due to optimum level of fertigation along with presence of hydrogel in root zone might have increased the number of spikes per clump at F_1H_1. This fact is in agreement with Shashidhar (2008) in tuberose and Ochoa *et al.* (2009) in carnation.

E. Number of flowers per spike

Among all the interactions, F_1H_1 recorded the highest number of flowers (58.63 per spike) as compared to other interactions (Table 2 and Fig. 1). Next highest number of flowers (54.18 per spike) was obtained in the treatment F_1H_2. Lesser number of flowers (42.51 per spike) was observed in F_3H_3. Availability of basic nutrients such as NPK in higher dose might have helped in more metabolic transport of nutrients that lead to increase in vegetative growth and in turn the production of maximum number of flowers per spike in the F_1H_1. Similar findings were reported by Divya *et al.* (2017) in marigold and Tarun Kumar (2015) in pot mums.

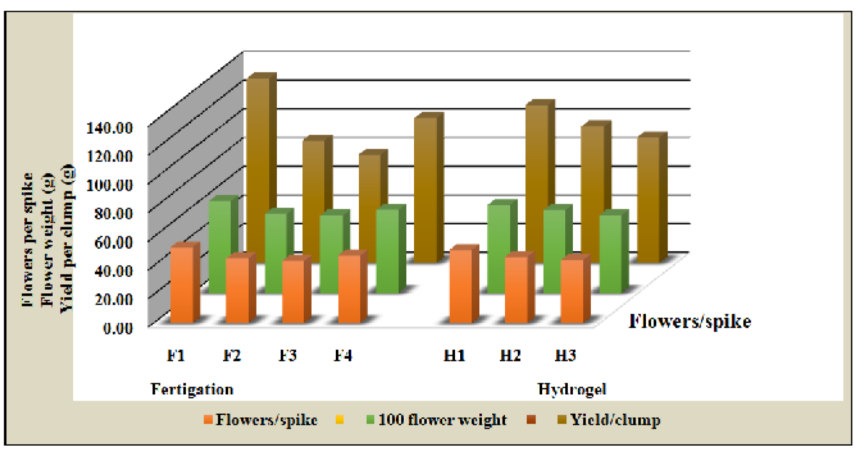

Fig. 1. Effect of fertigation and hydrogel on flowers per spike, 100 flowers weight and yield per clump of tuberose.

Table 1: Effect of fertigation and hydrogel on growth parameters of tuberose.

Treatments	Plant height (cm)	Number of leaves	Number of tillers
Main plot			
F_1	56.45	190.64	22.08
F_2	48.74	163.87	16.99
F_3	44.67	154.34	16.76
F_4	50.45	168.60	19.84
S.Em.±	1.64	5.27	0.45
C.D. @ 5%	5.68	18.23	1.55
Sub plot			
H_1	54.32	184.76	20.02
H_2	49.02	168.53	19.17
H_3	46.90	154.80	17.56
S.Em.±	1.06	3.81	0.34
C.D. @ 5%	3.18	11.40	1.01
Interaction			
F_1H_1	68.82	225.92	24.51
F_1H_2	50.94	183.59	22.43
F_1H_3	49.60	162.43	19.31
F_2H_1	52.09	178.23	17.27
F_2H_2	50.17	164.44	17.08
F_2H_3	43.95	148.93	16.61
F_3H_1	46.30	160.27	17.05
F_3H_2	44.49	159.30	16.85
F_3H_3	43.23	143.45	16.38
F_4H_1	50.06	174.64	21.24
F_4H_2	50.47	166.78	20.33
F_4H_3	50.81	164.38	17.94
S.Em.±	2.85	9.12	0.78
C.D. @ 5%	8.53	27.35	2.33

F_1- 100% RDF through fertigation F_2- 75% RDF through fertigation **F_3-** 50% RDF through fertigation **F_4-** 100% RDF through soil application **H_1-** 0.2% hydrogel as bulb dip **H_2-** 0.4 gm hydrogel as soil application **H_3-** No hydrogel (control)

F. Flower length

Among all the interactions, F_1H_1 recorded the maximum flower length (6.21 cm) as compared to other interactions (Table 2). Next maximum flower length (6.08 cm) was obtained in the treatment F_1H_2. Minimum flower length (4.86 cm) was observed in. The possible reason for the increase in the flower length might be due to the application of optimum dose of NPK through fertigation at frequent intervals and retention of moisture near root zone by hydrogel and their further availability to the plants that increased the flower length. These results are in confirmity with findings of Kabariel (2015) in tuberose and Tarun kumar (2015) in pot mums.

G. Flower diameter

Among all the interactions, F_1H_1 recorded the maximum flower diameter (4.75 cm) as compared to other interactions (Table 2). Next maximum flower diameter (4.01 cm) was obtained in the treatment F_1H_2. Minimum flower diameter (3.08 cm) was observed in F_3H_3. The maximum flower diameter which might be due to availability of more nutrients due to fertigation and hydrogel which might have increased uptake of nutrients and accumulation of maximum photosynthates in flowers leading to increase in the diameter of the flowers. Similar findings were reported by Divya *et al*. (2017) in marigold and Tarun kumar (2015) in pot mums.

H. Weight of 100 flowers

Among all the interactions, F_1H_1 recorded the highest weight of 100 flowers (66.74 g) as compared to other interactions (Table 2 and Fig. 1). Next highest weight of 100 flowers (63.29 g) was obtained in the treatment F_1H_2. Lesser weight of 100 flowers (52.68 g) was observed in F_3H_3. The increased flower weight might be attributed to the better uptake of nutrients especially nitrogen is the chief constituent of protein and protoplasm that lead to cell division, cell enlargement and ultimately resulted in increased plant growth and higher accumulation of dry matter which might have resulted in more diversion of photo assimilates to the developing flower buds leading to increased flower weight. The results are supported by the findings of Divya *et al*. (2017) in marigold and Tarun kumar (2015) in pot mums.

I. Flower yield per clump

Among all the interactions, F_1H_1 recorded the maximum flower yield per clump (161.99 g) as compared to other interactions (Table 2 and Fig. 1). Next maximum flower yield per clump (121.76 g) was obtained in the treatment F_1H_2. Minimum flower yield per clump (71.94 g) was observed in F_3H_3. The interaction F_1H_1 had recorded higher yield per clump. Higher accumulation of photosynthates in tissues of plants correlated with increases in growth parameters and yield attributing parameters like number of leaves, chlorophyll content, leaf area and number of tillers respectively might have led maximum yield per clump. The results obtained are in accordance with the findings of Tejaswini (2017) in chrysanthemum and Vidyashree (2018) in Philodendron.

J. Flower yield per hectare

Among all the interactions, F_1H_1 recorded the maximum flower yield per hectare (10.29 t/ha) as compared to other interactions (Table 2). Next maximum flower yield per hectare (7.73 t/ha) was obtained in the treatment F_1H_2. Minimum flower yield per hectare (4.57 t/ha) was observed in F_3H_3. The interaction F_1H_1 had recorded higher yield per clump which was due to higher accumulation of photosynthates in tissues of plants could be correlated with increases in growth parameters and yield attributing parameters like number of leaves, chlorophyll content, leaf area, number of tillers, number of flowers per spike, flower length, flower diameter, weight of flowers, spikes per clump and yield per clump respectively might have led maximum yield per hectare. The results obtained are in accordance with the findings of Tejaswini (2017) in chrysanthemum and Vidyashree (2018) in Philodendron.

Table 2: Effect of fertigation and hydrogel on flower and yield parameters of tuberose.

Treatments	Spikes/clump	Flowers/ spike	Flower length (cm)	Flower diameter (cm)	Weight of 100 flowers (g)	yield/clump (g)	Yield/hectare (t)
Main plot							
F_1	17.59	52.61	6.11	4.07	63.78	128.42	8.15
F_2	15.29	44.96	5.43	3.66	55.02	85.27	5.41
F_3	14.84	43.18	5.07	3.16	53.84	75.31	4.78
F_4	15.70	46.88	5.69	3.83	57.71	100.82	6.40
S.Em.±	0.47	1.46	0.15	0.11	1.71	3.11	0.20
C.D. @ 5%	1.60	5.04	0.52	0.38	5.92	10.77	0.68
Sub plot							
H_1	17.16	50.82	5.90	3.97	61.15	111.26	7.06
H_2	15.55	46.37	5.46	3.67	57.59	94.79	6.02
H_3	14.86	43.54	5.36	3.39	54.02	86.31	5.48
S.Em.±	0.35	1.03	0.09	0.08	1.08	2.26	0.14
C.D. @ 5%	1.05	3.08	0.28	0.23	3.25	6.77	0.43
Interaction							
F_1H_1	21.76	58.63	6.21	4.75	66.74	161.99	10.29
F_1H_2	15.77	54.18	6.08	4.01	63.29	121.76	7.73
F_1H_3	15.23	45.04	6.03	3.44	61.33	101.51	6.45
F_2H_1	15.54	46.78	5.86	3.81	57.40	88.71	5.63
F_2H_2	15.26	44.35	5.35	3.68	53.83	87.32	5.54
F_2H_3	15.07	43.76	5.09	3.49	53.52	79.77	5.06
F_3H_1	15.13	43.92	5.44	3.26	54.94	77.21	4.90
F_3H_2	15.00	43.11	4.90	3.15	53.90	76.78	4.88
F_3H_3	14.40	42.51	4.86	3.08	52.68	71.94	4.57
F_4H_1	16.20	53.95	6.09	4.07	65.51	117.13	7.44
F_4H_2	16.15	43.85	5.52	3.86	59.37	93.30	5.92
F_4H_3	14.77	42.84	5.45	3.56	48.25	92.03	5.84
S.Em.±	0.81	2.52	0.26	0.19	2.96	5.39	0.34
C.D. @ 5%	2.41	7.56	0.79	0.57	NS	16.17	1.02

F_1- 100% RDF through fertigation F_2- 75% RDF through fertigation **F_3**- 50% RDF through fertigation **F_4**- 100% RDF through soil application **H_1**- 0.2% hydrogel as bulb dip **H_2**- 0.4 gm hydrogel as soil application **H_3**- No hydrogel (control)

CONCLUSIONS

Among the different treatments, the treatment F_1H_1 (100% RDF through fertigation with 0.2% hydrogel as bulb dip) recorded higher yield (10.29 t/ha) which was due to improvement in vegetative and yield parameters. The same treatment was also found better for getting higher flower yield with quality and net returns with higher B:C ratio.

FUTURE SCOPE

Considering the results of the research work conducted on fertigation and hydrogel in tuberose, the following aspects can be considered for future line of work.

— There is a necessity to standardize the micronutrients and liquid bio fertilizers through fertigation.

— The usage of hydrogel with biofertilizers through fertigation can be tried.

—Need to standardize the fertigation schedule and water use efficiency by usage of different concentration of hydrogel.

REFERENCES

Akhter, K., Mahmood, K. A., Malik, A., Mardan, M., Ahmad, M. M. and Iqbal (2004). Effects of hydrogel amendment on water storage of sandy loam and loam soils and seedling growth of barley, wheat and chickpea. *Plant Soil Environ*., *50*(10), 463–469.

Divya, K., Girwani, A., Vijaya, D. and Prashanth, P. (2017). Effect of levels of fertigation on growth and flowering of marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda. *Int. J. Curr. Microbiol. App. Sci.*, *6*(12), 1146-1151.

Hemanta, L., Jayaprasad, K. V., Kumar, D. P., Krishna Manohar, R. and Gopinath, G. (2012). Effect of levels of fertigation on vegetative growth characters of different varieties of carnation (*Dianthus caryophyllus* L.) under naturally ventilated poly house. *Mysore J. Agric. Sci*., *46*(1), 53-58.

Jata, S. K., Nedunchezhiyan, M., Tapas, R. S. and Viswanath, S. (2013). Fertigation in high value tuber crops. *Odisha review*, 68-77.

Kabariel, J. and Kannan, M. (2015). Effect of irrigation regimes and fertigation levels on growth parameters of tuberose (*Polianthes tuberosa*) 'Prajwal' under black polythene sheet mulched eco system. *Life Sci. Leaflets*, *69*, 62-66.

Ochoa, J., Valdes, R., Gonzalez, A., Lopez, J., Conesa, E., Franco, J. A., Fernandez J. A. and Banon, S. (2009). Effects of type of plug and the growing media on evapotranspiration and growth of potted carnations. *Acta Horticulturae,* 843.

Panse, V. G. and Sukhatme, P. V. (1967). *Statistical methods for Agricultural workers*. I.C.A.R., New Delhi. India. 359.

Rakshit, R. (2017). Studies on effect of hydrogel on the performance of ginger (*Zingiber officinale* Rose,) under the southern transition zone of Karnataka. *M. Sc. (Horti.) Thesis*. Uni. of Agri. And Horti. Sci. Shivamogga. Karnataka (India).

Shashidhar, H., Jayaprasad, K. V., Bhoomika, H. R., Santosh, K. G. and Krishnamanohar, R. (2008). Effect of fertigation levels on growth and yield of tuberose hybrids (*Polianthes tuberosa* L.). *Biomed*., *2*(4), 330-336.

Tarun Kumar, A. (2015). Impact of pusa hydrogel incorporated growing media on growth and yield characters of pot mums (*Dendranthema grandiflora* L.) under various irrigation regimes. M. Sc. Thesis, Univ. Y. S. R. Kadapa (India).

Tejaswini, K. (2017). Studies on the influence of different fertigation levels on growth, flowering, pest and disease incidence of chrysanthemum (*Dendranthemum grandiflorum* L.) var. jumbo marigold under open cultivation. *M. Sc. (Horti.) Thesis*. Sri Konda Laxman horticultural university. Telangana (India).

Vidyashree, N. (2018). Studies on the efficacy of media incorporated with pusa hydrogel and vermin wash on growth and foliage quality of *Philodendron martianum* Engl. M. Sc. Thesis, Univ. Agric. Sci. Bengaluru (India).

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