J. Hortl. Sci.
Vol. 7(1):94-97, 2012

Short communication

Effect of various irrigation methods on growth, flowering and yield of tuberose (*Polyanthes tuberosa* Linn.)

M.R. Deshmukh
Precision Farming Development Centre, Dr. A.S. College of Agricultural Engineering,
Mahatma Phule Krishi Vidyapeeth, Rahuri-413722, India
E-mail: mrdesh101@yahoo.co.in

ABSTRACT

Tuberose flower has very good fragrance and is suitable for loose and cut flowers. Although crop improvement has been researched upon in various institutes and state agricultural universities, irrigation management in this crop has not been given much emphasis. This factor is important and crucial in crop production. A field trial was conducted at Precision Farming Development Centre, Rahuri, with the objective of studying performance of tuberose cv. Suvasini Double under three irrigation systems, viz., drip, micro-sprinkler and surface irrigation (conventional method). Irrigation through drip and micro-sprinkler was applied at 0.85 PE; and in the conventional method of irrigation, the interval was set at 60 mm CPE with 6 cm depth of irrigation. Micro-sprinkler system proved to be the best and gave a flower yield of 6.77 lakh spikes/ ha with better flower quality, than drip or surface method of irrigation. B:C ratio was also higher under micro-sprinkler (2.68).

Key words: Tuberose, micro-sprinkler, drip

Tuberose is an important flower crop grown in India for its beautiful and fragrant flowers. Flower spikes have varied uses in bouquets and vases, while loose flowers are used for making garlands/ '*venis*' and other floral arrangements. Maharashtra enjoys a congenial climate for tuberose cultivation.

Tuberose (*Polyanthes tuberosa* Linn.) needs an improved package of practices for better yield and quality of flowers. Irrigation schedule and quantity of water applied are important factors deciding production. Scarcity of water has compelled the stakeholders to think seriously about water management in the crop. Pressurized irrigation system comprises drip, micro-sprinklers, spray guns, etc. The suitability of a method depends upon the crop and its planting density. To study the performance of tuberose under different irrigation systems, a trial was conducted at the Precision Farming Development Centre, M.P.K.V., Rahuri.

The experiment was conducted at the experimental farm of Precision Farming Development Centre, Rahuri. Three treatments, *viz.*, Drip irrigation, Micro-sprinkler and Surface irrigation (conventional) were studied. The experiment was laid out in Randomized Block Design, with seven replications. Tuberose cv. Suvasini (Double) was planted at 40 x15 cm spacing in 1.60x12.0 m size beds. Recommended dose of 200:300:300 kg NPK / ha was applied. Before planting, the bulbs were treated with 0.2% Carbendazim for 30 minutes. Irrigation through drip and micro-sprinkler was applied at 0.85 PE and, in the surface-method of irrigation, the interval was set at 60 mm CPE with 6 cm depth of irrigation water. Details of the irrigation methods are as under:

Irrigation system/ parameters	Drip	Micro-sprinkler	Surface method
Lateral size	16mm	16mm	Border irrigation,
Lateral spacing	2.2 m	2.2 m	Size of border
Emission spacing	60 cm	2.0 m	= 12x 1.6 m
Average discharge	4 LPH	44 LPH	
Operational pressure	1 kg/cm^2	1 kg/cm^2	
Uniformity coefficient	90%	94%	

Average discharge and emission uniformity were computed by the formula of by Keller and Karmelli (1974). Recommended dose of fertilizer was given in 30 splits. Irrigations were scheduled for every alternate day. Depth of water to be applied per plant was calculated using the equation

Table 1. Performance of tuberose under various irrigation methods

Parameter	Year	(T1) Drip (Microtube)	(T2) Micro-sprinkler	(T3) Conven-tional method	CD at 5%
Average plant height at bud stage (cm)	99-00	59.179	63.439	50.619	4.859
	00-01	59.107	64.446	49.909	0.288
	01-02	59.158	63.978	48.460	0.236
	pooled	59.148	63.954	49.663	1.695
Average no. of leaves/plant at onset of flowering	99-00	96.094	106.136	91.800	6.140
	00-01	95.766	108.129	90.978	0.349
	01-02	96.032	107.663	89.944	0.459
	pooled	95.964	107.309	90.907	2.181
No. of flowers/spike	99-00	49.206	55.460	44.381	2.053
	00-01	49.259	55.617	44.421	0.596
	01-02	49.618	56.184	43.972	0.412
	pooled	49.494	55.986	44.124	0.212
Average spike length (cm)	99-00	107.774	110.374	99.456	3.086
	00-01	107.970	111.316	99.689	1.768
	01-02	107.869	110.989	99.446	0.161
	pooled	107.880	111.009	99.485	0.450
Length of rachis (cm)	99-00	48.571	51.570	41.857	2.997
	00-01	49.353	52.010	35.809	0.473
	01-02	48.842	51.915	38.786	0.336
	pooled	48.922	51.832	38.817	4.365
Wt. of spike (g)	99-00	36.226	39.143	30.803	3.126
	00-01	36.796	39.934	30.657	0.692
	01-02	36.637	39.799	30.378	0.448
	pooled	36.677	39.829	30.466	0.238
Yield of bulbs (t/ha)	99-00	36.106	45.201	31.039	8.731
	00-01	37.803	47.564	31.073	2.709
	01-02	36.967	46.469	30.865	0.252
	pooled	36.973	46.477	30.867	0.160
Yield of bulblets (t/ha)	99-00	13.641	16.147	10.034	4.032
	00-01	14.256	17.144	9.910	1.256
	01-02	13.930	16.669	9.758	0.139
	pooled	13.934	16.674	9.760	0.009
Spike yield (lakh/ha)	99-00	5.241	6.650	4.423	0.760
	00-01	5.241	6.817	4.530	0.314
	01-02	5.192	6.763	4.390	0.112
	pooled	5.198	6.767	4.395	0.007
Duration of opening of flowers from 1st to last On the spike in field (days)	99-00	20.071	22.500	19.071	0.750
	00-01	19.960	22.453	18.976	0.425
	01-02	19.997	22.532	18.840	0.310
	pooled	19.993	22.504	18.906	0.151
Bulb diameter (cm)	99-00	2.689	3.140	2.090	0.268
	00-01	2.683	3.339	2.019	0.247
	01-02	2.692	3.254	1.967	0.128
	pooled	2.690	3.252	1.995	0.007
Average amt. of water applied/year (cm)	—	156.97	156.97	196.0	—

$D = PE \times Kc \times Kp$

Where

D = depth of water to be applied (mm)

Kc = Crop co-efficient (0.8, 1.0 and 1.2 for 3 months, respectively)

Kp = Pan factor (0.7)

PE = Sum of pan evaporation for two days (mm)

Volume of water to be applied for the treatment was computed by the equation

$V = D \times A \times N$

Where

V = volume of water (l)

Table 2. Cost economics in tuberose cultivation

Cost economics	Drip (Microtube)	Micro- sprinkler	Conventional
Fixed cost (Rs./ha)	40000	85000	—
a) Life (seasons)	7	7	—
b) Depreciation	5143	10929	—
c) Interest	5600	11900	—
d) Repairs & Maintenance	800	1700	—
e) Total (b+c+d)	11543	24529	—
Cost of cultivation (Rs./ha)	55391	55391	55391
Seasonal total cost (1e + 2) (Rs./ha)	66934	79920	55391
Water used (mm)	1569.7	1569.7	1960.0
Yield of produce (spikes/ha)	519800	676700	439500
Selling price (Rs./ spike)	0.15	0.15	0.15
a) Income from produce (5 x 6) (Rs.)	77970	101505	65925
b) Income form bulbs (Rs.)	93750	112500	75000
c) Total (a + b)	171920	214005	140925
Net seasonal income (7-3) (Rs.)	104986	134085	85534
Additional area cultivated due to saving of water (ha)	0.25	0.25	—
Additional expenditure due to additional area (3rd x 9th) (Rs.)	16734	19980	—
Additional income due to additional area (7 x 9) (Rs.)	42980	53501	—
Additional net income (11 - 10) (Rs.)	26246	33521	—
Gross cost of production (Rs.) (3+ 10)	83668	99900	55391
Gross income (7+11) (Rs.)	214900	267506	140925
Gross B:C ratio (14/13)	2.57	2.68	2.54
Net extra income due to irrigation system over conventional (12 + 8 drip - 8th conventional) (Rs.)	45698	82072	—
Net profit per mm water used (8/4)	66.88	85.42	43.64
WUE (5/4) (spikes/ha - mm)	331.15	431.10	224.23

D = depth of water (mm)

A = area of one plot (m^2)

N = number of plots or replications per treatments

Time of operation (hr) of drip irrigation system for each treatment was calculated using the equation

To = V / q. Eu.n. N

Where

To = Time of application of the operation of drip irrigation unit for the respective treatment (hr)

V = Volume of water to be applied for each application for all three replications of treatment (l)

q = Average discharge of emitters in the respective treatments (lph)

Eu = Emission uniformity of the drip irrigation unit

n = Number of emitters per treatment

N = Number of plots per treatment

Observations on plant height, number of leaves, number of flowers per spike, average spike length, length of rachis (cm), weight of spike (g), yield of bulbs (t/ha), yield of bulblets (t/ha), spike yield, days for opening of flowers and, diameter of bulb (cm) were recorded.

Results presented in Table 1 depict significant effect of various irrigation systems on growth and yield in tuberose cv. Suvasini. Pressurized irrigation, viz., sprinkler and drip, proved better than the surface method of irrigation. Micro-sprinkler was the best and gave significantly better values [mean plant height at bud stage (63.95 cm), number of leaves per plant at onset of flowering (107.30), number of flowers per spike (55.98), spike length (111.00 cm), length of rachis (51.83 cm), weight of spike (39.82 g), yield (6.76 lakh spikes / ha), yield of bulb (46.47 t/ha) and bulblet yield (16.67 t/ha) and bulb diameter (3.25 cm)]. Flower spikes lasted longer under micro-sprinkler irrigation. Results obtained in micro-sprinkler were superior over the other irrigation systems because of maximum area wetted and better microclimate. The active root zone in tuberose lies at 30 cm soil depth. Micro-sprinkler created favourable conditions for bulb development, bulblet multiplication, better growth and yield of spikes, etc. These results are in agreement with Beattii *et al* (1993) who reported very marked differences in response to irrigation methods in Asiatic lilies.

Overhead method of irrigation produced plants with greater height and good yield. Similar results were reported by Shillo (1992) who stated that tuberose was a popular garden plant besides its use on cut flower; each rhizome of the plant has a potential to produce one flower; but, flowering percentage is related to rhizome size and the irrigation method. In field trials on cv. Pearl, it was observed that plants irrigated with micro-sprinklers had maximum height and number of leaves. Each spike had as many as 60 flowers/ spike and averaged 115 cm in length. Performance of tuberose under drip irrigation was found to be better than in conventional irrigation system. Low performance of these systems compared to that with micro-sprinkler can be attributed to the growing conditions and soil water status which, in these methods, is not as congenial. Ramaswamy *et al* (1979) also reported similar results in their study on influence of various methods of irrigation on flowering and yield in tuberose.

Total amount of water applied through micro-sprinkler and drip was 156.97 cm/ year as against 196.0 cm /year in the surface method of irrigation. Cost economics presented in Table 2 reveal that maximum B:C ratio of 2.68 was obtained with micro-sprinkler method of irrigation.

REFERENCES

Beattie, D.J., Blodgett, A.M. and Holcomb, E.J. 1993. Effects of root removal, irrigation methods and ancymidol on flowering of Asiatic lilies. Plant growth regulator society of America (*Quarterly)* **21**:64-72

Keller, J. and Karmeli, D. 1974. Trickle irrigation design parameters. Part II, *Hort. Rev.*, **17**:678-684

Ramaswamy, N., Paulraj, C. and Chocklingam, P. 1979. Studies on the influence of different irrigation methods on flowering and yield of tuberose (*Polyanthes tuberosa* L.). *Annamalai. Univ. Agri. Res. Annua*, **7:**29-33

Shillo, R. 1992. The tuber community holds the answer to flowering problems in *Polyanthes tuberosa*. *Acta Hort.,* **325:**139-148

(MS Received 03 August 2010, Revised 17 April 2012)