Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 2441-2444
Received: 10-09-2018
Accepted: 12-10-2018

J Swetha
College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem. West Godavari, Andhra Pradesh, India

T Suseela
Associate Professor, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

AVD Dorajeerao
Professor, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

DR Salomi Suneetha
Professor, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

RV Sujatha
Assistant Professor, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

Correspondence
J Swetha
College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem. West Godavari, Andhra Pradesh, India

Effect of spacing and nitrogen on bulb formation of Asiatic lily cv. tressor under shade net condition

J Swetha, T Suseela, AVD Dorajeerao, DR Salomi Suneetha and RV Sujatha

Abstract
A field trial was conducted to study the influence of spacing and nitrogen on bulb formation of Asiatic lily cv. Tressor. The experiment comprises of three spacing viz. 15 cm x 15 cm, 25 cm x 15 cm and 30 cm x 15 cm in combination with the three levels of nitrogen viz. 100 kg ha^{-1}, 150 kg ha^{-1} and 200 kg ha^{-1} were tested in Factorial Randomized Block Design. Data revealed that plant spacing of 30 cm x 15 cm and 200 kg ha^{-1} nitrogen level showed resulting in a significant effect on number of bulbs per plant, number of bulblets per plant, bulb diameter, bulb weight, bulb yield per plant and bulb yield per plot.

Keywords: Asiatic lily bulb, Asiatic lily bulblets, spacing and nitrogen

Introduction

Lilium is one of the most handsome and popular ornamental bulbous plants. The appearance, beauty and colour of the bloom are very spectacular and attractive. It is one of the six major genera of flower bulbs produced worldwide (Hertogh and Le Nard, 1993) [4]. In the floral language, lily is the symbol of purity and innocence. Lilium deserves to be called as aristocrat of the plant world. Lilium belongs to the family Liliaceae and native to the Northern Hemisphere. Lilies are wonderful ornamental plants with varied uses, grown in border, beds, pots and are excellent cut lowers of magnificent appearance & beautiful colors. The lily bulb is an underground storage organ composed of scales and a basal plate.

The Netherlands, Japan and USA are the prime production centres of both cut flowers and bulbs. In India, Kashmir becomes first place in Asia to produce Lilium bulbs. Though the demand of Lilium flower in Indian market has risen considerably during the last few years, but the growers are facing problem in getting good planting material at reasonable rates. Every year, Lilium bulbs are imported in large quantities from the Netherland at a very high price *i.e.* ranging from Rs. 13.00 to Rs. 34.00 per bulb depending on the cultivar and bulb size, thereby, increasing the cost of production of this flower crop.

The current interest in growing Asiatic lily commercially is gaining movement in India. The information regarding spacing and nitrogen for bulb production under shade net conditions is lacking under coastal A.P, which is of prime concern. The cut flower trade of Asiatic lily is lagging behind in this region, owing to the non-availability of quality planting material at larger scale. Therefore, the present study was undertaken to study the response of spacing and nitrogen levels on bulb production of Asiatic lily cv. Tressor under shade net condition.

Materials and Methods

The present investigation was conducted at College of Horticulture, Dr. Y.S.R Horticultural University, Venkataramannagudem during 2016-2017. Which is located at 16˚ 63’ 120” N latitude and 81˚ 27’ 568” E longitude and 34m above MSL. It experiences hot humid summer and mild winters. The experimental soil was red sandy loam with good drainage and moderate water holding capacity with sand 70% of sand, silt 20% and clay 10%. The soil pH is 6.32 and E.C. is 0.18 dS m^{-1}. The experiment was conducted in a factorial randomized block design involving four levels of spacing *i.e.* S_1 (15 cm x 15 cm), S_2 (25 cm x 15 cm) and S_3 (30 cm x 15 cm) and three levels of nitrogen *viz.* N_1 (100 kg ha^{-1}), N_2 (150 kg ha^{-1}) and N_3 (200 kg ha^{-1}). Each of these factors were composed at three levels involving totally 9 treatment combinations.

Bulbs of Asiatic lily cv. Tressor with uniform size were used for the experiment. The net size of plot was 3.0 m x 0.6 m, accommodating 40, 24 and 20 plants as per treatments. The field was brought to the fine tilth by ploughing and harrowing. Well decomposed farm yard manure at the rate of 100 kg ha^{-1} was applied at the time of land preparation. The fertilizers *viz*., Urea, Single Super Phosphate and Muriate of Potash were taken as the sources of N, P_2O_5 and K_2O respectively. Entire dose of phosphorus and potassium was given basally and half of the nitrogen at different graded levels are applied before planting and remaining dose of nitrogen applied as top dressing at 30 and 45 days after planting to the respective plots. Bulbs of Asiatic lily cv. Tressor were selected treatment wise and planted in the beds on 20th October, 2016. The various observations on vegetative growth, floral, vase life and bulb parameters were recorded on five plants randomly selected from net plot area and tagged. The data collected for all the characters studied were subjected to statistical analysis by adopting 'Analysis of Variance' (ANOVA) technique for factorial randomized block design as suggested by Panse and Sukhatme (1967) [12].

Results and Discussion

The data regarding the effect of different levels of spacing and nitrogen on bulb formation of Asiatic lily cv. Tressor were presented in Table 1 and 2.

The highest number of bulbs per plant (Table 1) (2.26) was recorded by S_3 (30 cm x 15 cm) and the least number of bulbs per plant (1.64) was recorded in S_1 (15 cm x 15 cm). Highest number of bulbs per plant (2.24) was observed in N_3 (200 kg ha^{-1}) and the least number of bulbs (1.64) was recorded by N_1 (100 kg ha^{-1}). Among interaction effects, the combination of S_3N_3 recorded maximum value (2.46) followed by S_3N_2 (2.33) whereas, the minimum value (1.33) was recorded in the combination of S_1N_1.

Based on the results obtained, it can concluded that an increase in the number of bulbs per plant with wider level of spacing might be due to availability of more nutrients and light at wider spacing which ultimately increased the rate of net photosynthesis and translocation of assimilates to the storage organs (Mane *et al.*, 2006) [9]. Similar results were reported by Suseela *et al.* (2016) [20] in tuberose cv. Suvasini.

Increase in number of bulbs per plant with increase in level of nitrogen may be due to the fact that, supplied nitrogen helped in increasing the uptake of more amount of assimilates that are needed for improvement in number of bulbs in tuberose cv. Single (Lily and Singh, 2010) [8].

Regarding to number of bulblets per plant (Table 1), highest number of bulblets per plant (2.06) was recorded by 30 cm x 15 cm (S_3) and the least number of bulblets per plant (1.60) was observed in 15 cm x 15 cm (S_1). The maximum number of bulblets per plant (2.11) was observed in plants supplied with 200 kg N ha^{-1} (N_3) and minimum number of bulblets per plant (1.48) was registered by the application of nitrogen at 100 kg ha^{-1}(N_1). With respect to interactions, the combination of S_3N_3 found to show the maximum number of bulblets (2.33) followed by S_2N_3 (2.06) while minimum number of bulblets (1.20) was recorded by S_1N_1.

The present results indicate that wider spaced plants produced maximum number of bulblets per plant which might be due to availability of more nutrients and light at wider spacings which ultimately increased the rate of net photosynthesis and translocation of assimilates to the storage organs (Sudhakar and Kumar, 2012). These results are in line with the findings of Mukhopadhyay and Yadav (1984) [10] in gladiolus, Bijimol and Singh (2001) in gladiolus, Nair *et al.* (2004) [11] in gladiolus, Shiraz and Maurya (2005) in gladiolus and Suseela *et al.* (2016) [20] in tuberose cv. Suvasini.

The plants supplied with higher dose of nitrogen produce maximum number of bulblets per plant due to the reason that plants grow more vigorously and produce more metabolites which might result in more bulblets per plant (Vedavathi *et al.*, 2014) [21]. Similar results were also expressed by Singh and Mahadevamma (1999) [19] in tuberose.

Data in Table 1 shows that spacing and nitrogen levels had a positive and significant effect on bulb diameter of Lilium. Maximum diameter of bulb (4.98 cm) was recorded by S_3 (30 cm x 15 cm) and the minimum diameter of bulb (4.17 cm) was registered by S_1 (15 cm x 15 cm). Maximum diameter of bulb (4.75 cm) was observed in N_3 (200 kg N ha^{-1}) and the minimum diameter of bulb (4.36 cm) was recorded by N_1 (100 kg N ha^{-1}). Interaction effect was found to be highest in the combination of S_3N_3 (5.35 cm) followed by S_3N_2 (4.89 cm) and least value for bulb diameter was recorded by S_1N_1 (4.05 cm).

The plants spaced with wider levels produced the maximum bulb diameter might be due to availability of more nutrients and light at wider spacings which ultimately increased the rate of net photosynthesis and translocation of assimilates to the storage organs (Dogra *et al.*, 2012) [3]. Maximum diameter of bulb with the supply of higher doses of nitrogen was reported by Kumar and Singh, 1998 in tuberose.

Regarding to bulb weight (Table 2), maximum weight of bulb (42.38 g) was recorded by 30 cm x 15 cm (S_3) and the minimum weight of bulb (25.21 g) was observed in 15 cm x 15 cm (S_1). Maximum bulb weight (37.73 g) was observed with the application of nitrogen at 200 kg ha^{-1} (N_3) and the minimum weight of bulb (29.54 g) was recorded by the application of nitrogen at 100 kg ha^{-1} (N_1). Among interaction effects, combination of S_3N_3 was found to show the maximum bulb weight (47.90 g) followed by S_3N_2 (41.32 g) while least value for bulb weight was registered by S_1N_1 (21.53 g). Similar results were found by Vedavathi *et al.* (2014) [21] in Asiatic lily (*Lilium spp*.).

The wider spaced plants produced maximum bulb weight which might be due to the fact that, availability of more nutrients and light at wider spacing which ultimately increased the rate of net photosynthesis and translocation of assimilates to the storage organs (Dogra *et al.*, 2012) [3]. The similar results were also reported by Suseela *et al.* (2016) [20] in tuberose cv. Suvasini.

The present results indicated that, plants supplied with higher doses of nitrogen produced highest bulb weight which might be due to the reason that, when optimum nitrogen was supplied to a plant, there was a greater translocation of photosynthetic material from leaves to bulbs resulting in the maximum bulb weight (Khalaj and Edrisi, 2012) [5]. Similar observations were noted by Singh (2001) in gladiolus.

With respect to bulb yield (Table 2), maximum bulb yield per plant (60.83 g) was observed in S_3 (30 cm x 15 cm) and the minimum bulb yield per plant (35.04 g) was recorded in S_1 (15 cm x 15 cm). Maximum bulb yield per plant (54.70 g) was observed in N_3 (200 kg ha^{-1}) and the minimum bulb yield per plant (41.04 g) was noticed in N_1 level (100 kg ha^{-1}). The combination of S_3N_3 recorded maximum bulb yield (69.07 g) followed by S_3N_2 (60.74 g) and minimum yield was recorded with combination of S_1N_1 (29.50 g).

Highest bulb yield per plant with application of higher nitrogen dose and spacing (Sheoran *et al*., 2015) [16].

Regarding to bulb yield per plot (Table 2), maximum bulb yield per plot (1.45 kg) was recorded by 30 cm x 15 cm (S_3) and the minimum bulb yield per plot (1.22 kg) was observed in S_1 (15 cm x 15 cm). Maximum bulb yield produced per plot (1.67 kg) was observed in N_3 (200 kg ha^{-1}) and the minimum bulb yield per plot (0.98 kg) was recorded by N_1

(100 kg ha^{-1}). The interaction effect was also found to be significantly superior in the combination of S_3N_3 (1.79 kg) followed by S_2N_3 (1.67 kg) and minimum bulb yield per plot was obtained in S_1N_1 (0.89 kg).
Maximum bulb yield per plot recorded with wider levels of spacing might be due to less competition among the plants for nutrients, air and light as such more translocation of assimilates to the storage organs leads to maximum bulb yield. Based on the results obtained, it might be concluded that an increase in the bulb yield per plot with application of higher doses of nitrogen may be due to the reason that supply of photosynthates to the bulbs increases as external supply of nutrients increased up to a threshold level (Chandana and Dorajeerao, 2014). Similar kind of an increase in bulb yield per plot with the application of higher doses of fertilizers were reported by Khan *et al*. (2012) [6], Shaukat *et al.* (2012) [15], Patel *et al.* (2010) [13], Zubair *et al.* (2007) [22] and Ramesh and Raman (2006) [14] in gladiolus.

Table 1: Number of bulbs per plant, number of bulblets per plant and bulb diameter as influenced by spacing, nitrogen levels and their interaction in Asiatic lily cv. Tressor under shade net condition

Nitrogen (kg ha^{-1})	Number of bulbs per plant				Number of bulblets per plant				Bulb diameter (cm)			
	Spacing (cm)			Mean	Spacing (cm)			Mean	Spacing (cm)			Mean
	S_1	S_2	S_3		S_1	S_2	S_3		S_1	S_2	S_3	
N_1	1.33	1.60	2.00	1.64	1.20	1.40	1.86	1.48	4.05	4.32	4.71	4.36
N_2	1.53	2.13	2.33	2.00	1.66	1.73	2.00	1.80	4.10	4.48	4.89	4.49
N_3	2.06	2.20	2.46	2.24	1.93	2.06	2.33	2.11	4.36	4.54	5.35	4.75
Mean	1.64	1.97	2.26	1.96	1.60	1.73	2.06	1.79	4.17	4.45	4.98	4.53
	S Em±		CD at 5%		S Em±		CD at 5%		S Em±		CD at 5%	
S	0.04		0.12		0.03		0.08		0.04		0.12	
N	0.04		0.12		0.03		0.08		0.04		0.12	
Interaction (S x N)	0.07		0.20		0.05		0.12		0.07		0.20	

N_1 = Nitrogen @ 100 kg ha^{-1} S_1 = 15 cm x 15 cm
N_2 = Nitrogen @ 150 kg ha^{-1} S_2 = 25 cm x 15 cm
N_3 = Nitrogen @ 200 kg ha^{-1} S_3 = 30 cm x 15 cm

Table 2: Bulb weight, bulb yield per plant and bulb yield per plot as influenced by spacing, nitrogen levels and their interaction in Asiatic lily cv. Tressor under shade net condition

Nitrogen (kg ha^{-1})	Bulb weight (g)				Bulb yield per plant (g)				Bulb yield per plot (kg)			
	Spacing (cm)			Mean	Spacing (cm)			Mean	Spacing (cm)			Mean
	S_1	S_2	S_3		S_1	S_2	S_3		S_1	S_2	S_3	
N_1	21.53	29.18	37.93	29.54	29.50	40.94	52.69	41.04	0.89	0.96	1.10	0.98
N_2	25.53	32.16	41.32	33.00	34.28	46.99	60.74	47.33	1.22	1.33	1.46	1.34
N_3	28.56	36.72	47.90	37.73	41.35	53.70	69.07	54.70	1.56	1.67	1.79	1.67
Mean	25.21	32.69	42.38	33.42	35.04	47.21	60.83	47.69	1.22	1.32	1.45	1.33
	S Em±		CD at 5%		S Em±		CD at 5%		S Em±		CD at 5%	
S	0.04		0.12		0.34		1.02		0.67		2.02	
N	0.04		0.12		0.34		1.02		0.67		2.02	
Interaction (S x N)	0.07		0.22		0.59		1.77		1.17		3.51	

N_1 = Nitrogen @ 100 kg ha^{-1} S_1 = 15 cm x 15 cm
N_2 = Nitrogen @ 150 kg ha^{-1} S_2 = 25 cm x 15 cm
N_3 = Nitrogen @ 200 kg ha^{-1} S_3 = 30 cm x 15 cm

Conclusion

Cultivation of Asiatic lily cv. tressor at spacing of 30 x 15 cm with the application of 200 kg/ha N can be recommended for good bulb characters such as number of bulbs per plant, Number of bulblets per plant, Bulb diameter, Bulb weight, Bulb yield per plant and Bulb yield per plot. From these results it can be concluded that Asiatic lily cv. tressor should be sown at spacing of 30 x 15 cm with a nitrogen application rate of 200 kg/ha was found more effective in enhancement of bulb characters.

References

1. Bijimol G, Singh AK. Effect of spacing and nitrogen on flowering, flower quality and post-harvest vase life of gladiolus. Journal of Applied Horticulture. 2001; (3):48-50.
2. Chandana, Dorajeerao AVD. Effect of graded levels of nitrogen and phosphorus on growth and yield of gladiolus (*Gladiolus grandiflorus* L.) cv. White Prosperity in coastal A.P., India. Plant Archives. 2014; 14(1):143-150.
3. Dogra S, Pandey RK, Deep Ji bhat. Influence of gibberellic acid and plant geometry on growth, flowering and corm production in gladiolus (*Gladiolus grandiflorus*) under Jammu agro climate. International Journal of Pharma and Bio Sciences. 2012; 3(4):1083 - 1090.
4. Hertogh A, De, Marcel Le Nard (Eds). The physiology of flower bulbs. Amsterdam, the Netherlands, 1993, 73-85.
5. Khalaj MA, Edrisi B. Effect of plant spacing and nitrogen levels on quantity and quality characteristics of tuberose (*Polianthes tuberosa* L.) under field experiment. International Journal of Agriculture Science, 2012, 2(3):244-255.
6. Khan FN, Rahman MM, Karim AJMS, Hossain KM. Effects of nitrogen and potassium on growth and yield of gladiolus corms. Bangladesh Journal of Agricultural Research. 2012; 37(4):607-616.
7. Kumar S, Singh RP. Effect of nitrogen, bulb size and plant density on growth, flowering and yield of tuberose (*Polianthes tuberosa* L.). Journal of Ornamental Horticulture, New Series. 1998; 1(1):6-10.
8. Lily DK, Singh UC. Effect of nitrogen on growth, flowering and yield of tuberose (*Polianthes tuberosa* L.) cv. Single. Journal of Ornamental Horticulture. 2010; 13:228-232.

9. Mane PK, Bankar GJ, Makne SS. Effect of spacing, bulb size and depth of planting on growth and bulb production in tuberose (*Polianthes tuberosa*) cv. Single. Indian Journal Agriculture Research. 2006; 40(1):64-67.
10. Mukopadhyay TP, Yadav LP. Effect of corm size, spacing on growth, flowering and corm production in gladiolus. Haryana Journal of Horticultural Sciences. 1984; 13:95-99.
11. Nair, Sujatha, Singh, DR. Effect of varieties and spacing on growth and flowering of gladiolus in Andaman. Indian journal of Horticulture. 2004; 61(3):253-255.
12. Panse VG, Sukhatme BV. Statistical methods for agricultural workers. ICAR publication, New Delhi, 1967, 100-161.
13. Patel NM, Desai JR, Saravaiya SN, Patel NB, Patel KA, Patel RB. Influence of chemical fertilizer on growth, quality, corm and cormel production of gladiolus (*Gladiolus grandiflorus* L.) cv. Sancerree under South Gujarat conditions. The Asian Journal of Horticulture. 2010; 5(1):123-126.
14. Ramesh B, Raman DS. Response of nitrogen, phosphorus and corm size on flowering and corm production in gladiolus. Journal of Ornamental Horticulture. 2006; 9(1):66-68.
15. Shaukat SA, Shah SZA, Ishaq Y, Ahmed M, Shaukat SK, Shoukat SW. Influence of phosphorus fertilization on gladiolus corm and flower production. Scientific Journal of Agriculture. 2012; 1(5):105-111.
16. Sheoran SOP, Dudi BS, Beniwal, Dalal RPS. Effect of nitrogen and spacing on flowering and yield of tuberose cv. Prajwal. Annals of Biology. 2015; 31(2):270-274.
17. Shiraz A, Maurya KR. Effect of spacing and corm size on growth, flowering and corm production in gladiolus. Indian journal of Horticulture. 2005; 62(1):95-96.
18. Singh, KP. Response of single or split doses of nitrogen application on growth, flowering and corm production in gladiolus. Advances in Plant Science. 2001; 13:79-84.
19. Singh, KP, Mahadevamma. Production technology of tuberose. In Progressive Floriculture. The house of Sarpan, Bangalore. 1999, 89-100.
20. Suseela T, Chandrasekhar R, Vijaya Bhaskar V, Salomi Suneetha DR, Umakrishna K. Effect of spacing, bulb size and depth of planting on growth, flowering and vase life of tuberose (*Polianthes tuberosa* L.) cv. Suvasini. The Bioscan. 2016; 11(4):2715-2720.
21. Vedavathi RS, Basavanagowda MG, Ravishankar M. Patil, Thipanna KS. Effect of spacing and nitrogen on bulb formation and growth of Asiatic lily under hill zone. Hort Flora Research Spectrum. 2014; 3(4):377-379.
22. Zubair M, Gohar Ayub Wazir FK. Effect of phosphorus levels on yield and quality of corms and cormels of gladiolus cultivars. Sarhad Journal of Agriculture. 2007; 22(4):623-632.