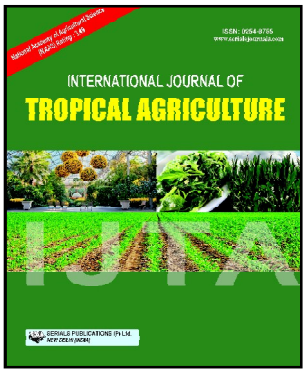

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www.serialsjournals.com

Volume 37 • Numbers 3 • 2019

Study the effect of light condition and height of flower harvesting on bulb and bulblet production of Asiatic hybrid lily

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Abstract: The present investigations entitled "Study the effect of light condition and height of flower harvesting on bulb and bulblet production of Asiatic hybrid lily" was carried out in the Research Farm of Division of Floriculture, CSIR-Institute of Himalayan Bioresource Technology, Palampur, Kangra, Himachal Pradesh during 2012-13 and 2013-14. The treatments consistence of four shade net condition i.e. 30% green shade net (G_1), 50% green shade net (G_2), 75% green shade net (G_3) and open field condition (Control) (G_4) in main plot, four height of flower harvest i.e. 15 cm above ground (H_1), 30 cm above ground (H_2), 45 cm above ground (H_3) and no flower harvest (H_4) in sub plot and three cultivar i.e. Gran Paradiso (V_1), Novecento (V_2) and Adelina (V_3) in sub-sub plot treatments were laid out in split-split plot design with three replications. Comparison was made for the treatments of the crop characters related to number of bulb and bulblet production, circumference (cm) and weight characters. Results revealed that green shade net significantly influenced the bulb and bulblet production and found highest number of bulbs and bulblet per plant with 50% green shade net whereas least number of bulbs was found with open field conditions. No harvesting of the flower produced more number of bulb and bulblet production. Among varieties Gran Paradiso produced more number of bulbs and bulblet per plant while minimum number of bulbs per plant was observed by Novecento. Highest bulb circumference (cm) of bulb and bulblet was found with 50% green shade net condition. The maximum bulb circumference was found in no flower harvesting treatment and minimum with 15cm above ground. The cultivar Gran Paradiso noted maximum bulb and bulblet circumference (cm). Further results indicated that 50% green shade net gave maximum weight of bulbs and bulblet per plant. With regard flower harvesting treatment, maximum weight of bulbs and bulblet per plant per plant was observed with no flower harvesting treatment. Among cultivar, Gran Paradiso produced highest weight of bulbs per plant while cultivar Novecento produced minimum bulbs weight per plant.

INTRODUCTION

Lily, a monocotyledonous species of genus Lilium belongs to the family Liliaceae, is native to northern hemisphere, in Asia, Europe and North America. Lilies occupy prominent positions among the top five flowers of the world (Floraholland.com). In lilies, the Asiatic, Oriental and LA hybrids are commercially important types owing to their very attractive flowers with excellent vase-life, largely traded in the international market. It is widely used in the floral industry as cut flower and potted plants. Lilium respond easily to different methods of propagation. It can be multiplied through seeds, bulb scales, bulb division, stem bulblets & tissue culture. Stem bulblets and bulb divisions are very common propagation methods. Usually one large daughter bulb produces 1 or 3 bulblets every year. Prior to flowering new daughter bulb(s) develop within the mother bulb. It usually initiates, in autumn and winter, from a growing point in the axil of a scale at the base of the stem axis. During next spring, the daughter bulb initiates new scales and leaf primordia at the growing point (Bryan and Griffiths, 1995; McRae, 1998). Newly formed bulblets increase in size during spring and continue throughout summer. The bulblets are usually planted in the field and within a period of 2 to 3 years they become commercial sized bulbs with a circumference of 15-20 cm (Dole and Wilkins, 1999). After flowering of the mother bulb, no more bulblets are produced by the daughter bulbs (Hartmann *et al.* 1993).

Floriculture has emerged as an important agri-business, providing employment opportunities and entrepreneurship in rural areas. Since a large number of farmers in rural areas where floriculture is practiced are already engaged in growing flowers, they have an opportunity to increase their income by modernization in floriculture. During the last decade, there has been a thrust on export of cut flowers, especially roses. The export surplus has found its way in to the local market influencing people in cities to purchase and use flowers in their daily lives. Floriculture in India has a long tradition. It has served the purpose of meeting our socio-cultural requirements since time immemorial. However, with rapid commercialization of agriculture and graduation of farming from subsistence level to commercial level, exposure to newer markets and opportunities have resulted in market segmentation and evaluation of niche markets. The increasing demand of cut flowers thus would require reorientation of farmers and his family members so that they too can avail the multitude of opportunities provided by the modern trends. Value added advantage in floriculture is very high because flowers, especially for the export market, are high value commodities.

The floriculture industry is constantly looking for new product *i.e.*, new species or cultivars with interesting commercial traits, such as different flowering time, plant size, flower colour, bulblets/ bulbils production and pollenless flowers.

MATERIALS AND METHODS

The present investigations entitled "Study the effect of light condition and height of flower harvesting on bulb and bulblet production of Asiatic hybrid lily" was carried out in the Research Farm of Division of Floriculture, CSIR-Institute of Himalayan Bioresource Technology, Palampur, Kangra, Himachal Pradesh during 2012-13 and 2013-14. The treatments consistence of four shade net condition i.e. 30% Green shade net (G_1), 50% Green shade net (G_2), 75% Green shade net (G_3) and open field condition (Control) (G_4) in main plot, four height of flower harvest i.e. 15 cm above ground (H_1), 30 cm above ground (H_2), 45 cm above ground (H_3) and no flower harvest (H_4) in sub plot and three cultivar i.e. Gran Paradiso (V_1), Novecento (V_2) and Adelina (V_3) in sub-sub plot treatments were laid out in split-split plot design with three replications. Comparison was made for the treatments of the crop

characters related to number of bulb and bulblet production, circumference (cm) and weight characters. The experimental data were analysed statistically by applying the technique of analysis of variance (ANOVA) prescribed for the design to test and conclusions were drawn at 5% probability levels.

RESULTS AND DISCUSSION

The various green shade conditions had significant effect on bulb production (Table 1). Plant grown under 50% green shade net produced highest number of bulbs per plant followed by 30 % green shade condition. The no flower harvesting treatment gave higher number of bulbs per plant in present investigation. Cultivar Gran Paradiso produced more number of bulbs per plant followed by Adelina and minimum number of bulbs per plant was observed by Novecento. It is clear that lily cultivar grown under 50% green shade net condition with no flower harvesting produced more number of bulbs. This may be due to availability of better light resulted in higher production of bulbs. This genotypes produced least number of bulb was noted with 75% shade net condition with 15 cm above ground flower harvesting in present investigations. The conformity of the result was reported by Ahlawat *et al.* (2012). Significant difference was observed in bulb circumference (cm) due to green shade net condition, height of flower harvesting and varieties of lily. It found that shading condition gave higher bulb circumference (cm) with use of 50% green shade net condition. However, bulb circumference (cm) was higher in no flower harvesting treatment in the cultivar Gran Paradiso while minimum bulb circumference (cm) was observed by Novecento. The different green shade condition and flower harvest treatment had significant effect on weight of bulbs per plant. The better light condition and proper height of flower harvesting resulted maximum bulb weight by genotypes of lily under 50% green shade net condition with no flower harvesting. Similarly higher bulb weight was recorded by Gran Paradiso followed by Adelina and Novecento under 50% green shade net conditions with no flower harvesting. However, minimum bulblet weight was observed with 75% shade net condition with 15 cm above ground flower harvesting in present investigations. Mandal *et al.* (2009) and Zhang *et al.* (2011) concluded that there were maximum dry matter production in the bulbs, stems and whole plant of *Lilium* cultivated in the shade.

Results postulated in Table 2 indicated that bulblet production was maximum with 50% green shade followed by 30 % green shade condition while minimum number of bulblets was observed under open field conditions. Table indicated that no flower harvested plants produced maximum number of bulblets whereas, flower cut from 15 cm above ground gave minimum bulblets per plant. As concern with cultivar, Gran Paradiso gave maximum number of bulblets per plant followed by Adelina while least number of bulblets per plant was observed by Novecento.

The crop grown under 50% green shade net found highest bulblet circumference (cm) which was significantly higher than other green shade condition and minimum bulblet circumference (cm) was observed under open field conditions. The higher bulblet circumference (cm) was recorded with no flower harvest treatment. Further it is clear that Gran Paradiso cultivar produced maximum bulblet circumference (cm) and minimum bulblet circumference (cm) was observed by Novecento. Kim *et al.* (2007) reported that bulb production, reduced flowering is desired since flowers are generally removed during the outdoor bulb production period

The 50% green shade net found maximum weight of bulblets per plant which was significantly higher than 30 % green shade and 75% green shade conditions. Without cut of flower plants produced maximum weight of bulblets per plant while flower cut from 15 cm above ground found minimum weight of bulblets per plant. Among cultivar, Gran Paradiso gave highest weight of bulblets per plant

Table 1

Effect of light conditions, height of flower harvesting and varieties of Asiatic hybrid lily on No. of bulbs produced per plant (average of two years)

		Bulb production				*Bulb circumference (cm)*				*Bulb weight (g)*			
		V_1	V_2	V_3	*Mean*	V_1	V_2	V_3	*Mean*	V_1	V_2	V_3	*Mean*
G_1	H_1	1.210	1.140	1.210	1.187	14.33	12.90	13.74	13.66	51.35	47.22	49.67	49.41
	H_2	1.275	1.170	1.220	1.222	15.98	16.76	14.31	15.68	54.57	49.02	51.63	51.74
	H_3	1.305	1.225	1.255	1.262	17.19	15.83	17.10	16.71	59.72	51.94	55.31	55.66
	H_4	1.350	1.265	1.310	1.308	19.08	17.79	18.69	18.52	63.89	57.97	61.32	61.06
	Mean	1.285	1.200	1.249	1.245	16.64	15.82	15.96	16.14	57.38	51.54	54.48	54.47
G_2	H_1	1.260	1.205	1.240	1.235	16.04	14.51	15.17	15.24	57.29	51.33	54.75	54.46
	H_2	1.320	1.245	1.315	1.293	19.07	16.86	18.20	18.04	64.54	56.50	60.32	60.45
	H_3	1.390	1.320	1.345	1.352	22.14	20.54	21.54	21.41	72.13	65.63	69.04	68.93
	H_4	1.470	1.370	1.415	1.418	24.17	21.56	22.61	22.78	78.09	69.28	72.52	73.30
	Mean	1.360	1.285	1.329	1.325	20.35	18.36	19.38	19.36	68.01	60.68	64.16	64.28
G_3	H_1	1.125	1.000	1.045	1.057	12.65	11.06	11.54	11.75	43.48	40.32	41.51	41.77
	H_2	1.245	1.075	1.180	1.167	13.26	11.76	12.23	12.42	46.74	41.33	43.70	43.92
	H_3	1.315	1.125	1.255	1.232	14.27	12.35	12.98	13.20	49.84	43.80	46.61	46.75
	H_4	1.355	1.210	1.295	1.287	14.55	13.23	13.76	13.85	51.64	44.04	48.28	47.98
	Mean	1.260	1.103	1.194	1.185	13.68	12.10	12.62	12.80	47.92	42.37	45.02	45.10
G_4	H_1	1.165	1.095	1.140	1.133	12.60	11.70	12.45	12.25	46.17	41.31	44.17	43.88
	H_2	1.250	1.185	1.215	1.217	13.26	13.07	12.90	13.08	50.32	43.94	47.79	47.35
	H_3	1.290	1.195	1.240	1.242	14.42	12.89	13.92	13.74	53.13	45.82	49.06	49.34
	H_4	1.315	1.220	1.275	1.270	15.99	14.54	15.39	15.31	55.82	49.17	53.11	52.70
	Mean	1.255	1.174	1.218	1.215	14.07	13.05	13.67	13.59	51.36	45.06	48.53	48.32
Main effects	Varieties	**1.290**	**1.190**	**1.247**		**16.20**	**21.39**	**15.42**		**56.17**	**49.91**	**53.05**	
	Flower harvesting	1.153	1.225	1.272	1.321	13.23	23.55	16.26	17.61	47.38	50.86	55.17	58.76
	Factors	SE(m)	C.D. at 5%			SE(m)	C.D. at 5%			SE(m)	C.D. at 5%		
	G	0.009	0.031			0.150	0.516			0.327	1.130		
	H	0.007	0.020			0.153	0.444			0.379	1.107		
	GXH	0.014	0.040			0.303	0.888			0.758	2.214		
	V	0.007	0.020			0.141	0.399			0.312	0.882		
	V X G	0.014	NS			0.282	0.798			0.624	NS		
	V X H	0.014	NS			0.282	0.798			0.624	NS		
	V X G X H	0.028	NS			0.564	1.596			1.249	NS		

Table 2

Effect of light conditions, height of flower harvesting and varieties and varieties of Asiatic hybrid lily on number of bulblets produced per plant (average of two years)

Green shade	*Flower harvesting*	*Bulblet production*				*Bulblet circumference (cm)*				*Bulblet weight (g)*			
		V_1	*V_2*	*V_3*	*Mean*	*V_1*	*V_2*	*V_3*	*Mean*	*V_1*	*V_2*	*V_3*	*Mean*
G_1	H_1	4.62	4.03	4.40	4.35	3.50	3.12	3.29	3.30	5.86	5.20	5.57	5.54
	H_2	5.03	4.90	4.58	4.83	3.71	3.23	3.38	3.44	7.09	6.59	6.75	6.81
	H_3	5.54	4.90	5.40	5.28	3.80	3.42	3.66	3.63	8.23	7.57	7.88	7.89
	H_4	6.15	5.53	5.92	5.86	3.87	3.68	3.75	3.77	9.80	9.06	9.55	9.47
	Mean	5.33	4.84	5.07	**5.08**	3.72	3.36	3.52	**3.53**	7.74	7.10	7.44	**7.43**
G_2	H_1	5.13	4.52	4.43	4.69	3.77	3.21	3.50	3.49	7.93	7.15	7.64	7.57
	H_2	6.03	5.25	5.52	5.60	3.95	3.57	3.69	3.74	9.50	8.69	9.13	9.10
	H_3	7.08	6.20	6.72	6.67	4.16	3.84	3.98	3.99	11.92	11.01	11.56	11.49
	H_4	7.73	6.87	7.35	7.32	4.28	3.99	4.17	4.15	14.08	12.95	13.47	13.50
	Mean	6.49	5.71	6.00	**6.07**	4.04	3.65	3.83	**3.84**	10.85	9.95	10.45	**10.42**
G_3	H_1	3.78	3.28	3.50	3.52	2.73	2.48	2.57	2.59	4.00	3.51	3.75	3.75
	H_2	4.14	3.48	3.61	3.74	2.84	2.70	2.70	2.75	4.30	3.83	4.06	4.06
	H_3	4.41	3.70	3.93	4.01	2.96	2.73	2.88	2.86	4.86	4.31	4.52	4.56
	H_4	4.48	4.10	4.24	4.27	3.18	2.79	3.05	3.01	5.34	4.92	5.13	5.13
	Mean	4.20	3.64	3.82	**3.88**	2.93	2.67	2.80	**2.80**	4.62	4.14	4.36	4.38
G_4	H_1	3.96	3.55	3.74	3.75	2.82	2.52	2.66	2.67	4.72	4.33	4.50	**4.52**
	H_2	4.28	3.84	4.09	4.07	2.90	2.54	2.79	2.74	5.15	4.62	4.86	4.88
	H_3	4.65	4.09	4.40	4.38	3.03	2.81	2.91	2.92	5.96	5.22	5.65	5.61
	H_4	5.00	4.48	4.69	4.72	3.38	2.93	3.20	3.17	6.43	5.93	6.14	6.17
	Mean	4.47	3.99	4.23	**4.23**	3.03	2.70	2.89	**2.87**	5.56	5.02	5.29	**5.29**
Main effects	Mean varieties	**5.12**	**4.54**	**4.78**		**3.42**	**3.09**	**3.27**		**7.20**	**6.55**	**6.88**	
	Flower harvesting	**4.08**	**4.56**	**5.08**	**5.54**	**3.00**	**3.15**	**3.36**	**3.51**	**5.35**	**6.21**	**7.39**	**8.56**
	Factors	SE(m)	C.D.			SE(m)	C.D.			SE(m)	C.D.		
	G	0.037	0.128			0.021	0.072			0.039	0.133		
	H	0.025	0.073			0.024	0.072			0.032	0.093		
	GXH	0.050	0.145			0.048	NS			0.063	0.185		
	V	0.029	0.081			0.018	0.048			0.039	0.111		
	V X G	0.057	NS			0.033	NS			0.078	NS		
	V X H	0.057	NS			0.033	NS			0.078	NS		
	V X G X H	0.115	NS			0.023	NS			0.157	NS		

while cultivar Novecento noted minimum bulblets weight per plant.

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