Research Article

Effect of Different Growing Media on Bulb Production of LA Hybrid Lily

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Abstract

The present investigation entitled, 'Effect of different growing media on bulb production of LA hybrid lilies' was carried out at the experimental farm of Department of Floriculture and Landscape Architecture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P) during 2014-2015. The experiment was laid out in a Completely Randomized Design (factorial) consisting of two cultivars i.e. 'Batistero' and 'Courier' and seven growing media M_1-sand+soil+FYM, (1:1:1, v/v)**,** M_2-sand+soil+FYM (2:1:1;v/v)**,** M_3-cocopeat+FYM (1:1;v/v)**,** M_4-cocopeat+soil+FYM (1:1:1;v/v)**,** M_5-M_1+cocopeat (1:1;v/v), M_6-M_1+vermicompost (2:1;v/v) and M_7-M_1+ vermicompost + cocopeat (2:1:1;v/v). Findings revealed that, number of bulbs, diameter of bulb, weight of bulb, number of bulblets, diameter of bulblet and weight of bulblet was recorded best when LA hybrids bulbs were grown in M_1-sand+soil+FYM, (1:1:1, v/v). For bulb/bulblet multiplication in LA hybrid lilies growing medium containing sand+soil+FYM, (1:1:1, v/v) is suitable.

Keywords: Sand, Soil, FYM, Cocopeat, Vermicompost

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Introduction

Lilium is one of the most beautiful and popular ornamental bulbous flowers. The genus Lilium belongs to family Liliaceae and comprises of about 100 species. Netherlands is the leading producer of Lilium bulbs [1] and it ranks fourth in the hierarchy of the top ten cut flowers of the world. These hybrid lilies being exceptionally beautiful are extensively used as cut flowers and also as pot plants [2].

They have been admired long for their aesthetic quality and have often been depicted as a symbol of purity and regality Lilies are native to Northern hemisphere in Asia, Europe and North America. Lilies have been found to grow from sea level to an altitude up to 2000 metres, covering alkaline, acidic and other types of soils. As far as their distribution is concerned, about 50-60 species are reported in Asia, 24 in North America and 12 in Europe [3]. Lilies are wonderful ornamental plants used as commercial cut flower owing to their magnificent colours. These are also used as a border plant, pot plant and in landscaping. Lilies are known to be grown on a variety of soils. For quality cut flower production, however a good growing medium should be used. Lilies have non-tunicated tender bulbs and require porous, airy well drained growing medium with good quality of humus or organic matter. Characteristics of different materials used as substrates have the direct and indirect effects on plant growth and crop production.The characteristics of ideal growing medium for its successful cultivation are porous with better aeration, well drained, good water holding capacity and cheap too. Therefore, standardization of a suitable growing medium for its cultivation is of utmost importance.

Material and Method

The experimental farm is located at an altitude of 1270 m above mean sea level at a latitude of 32° 52´ N and longitude of 77° 11´ 30´´ E. Climate of Nauni, in general, is sub-temperate to sub-tropical and characterized by mild summer and cool winters. Uniform sized lilium bulbs (12/14 size) were selected for the experimentation. Before planting, bulbs were treated in solution comprising of Bavistin (0.1%) and Dithane M-45 (0.2 %) for 30 minutes. LA hybrid cultivars; 'Batistero' and 'Courier' were selected for the studies used different growing media and their combinations. M_1- sand+soil+FYM, (1:1:1; v/v)**,** M_2- sand+soil+FYM (2:1:1;v/v)**,** M_3- cocopeat+FYM (1:1;v/v)**,** M_4- cocopeat+soil+FYM (1:1:1;v/v)**,** M_5- M_1+cocopeat (1:1;v/v)**,** M_6- M_1+vermicompost (2:1;v/v)**,** M_7- M_1+ vermicompost + cocopeat (2:1:1;v/v)**.** Number of replications three and Completely Randomized Design (Factorial) were used.

Result and Discussion

Number of bulbs per plant

A perusal of data in **Table 1** reveals that more number of bulbs per plant was recorded in cultivar 'Courier' (1.05) as compared to 'Batistero' (1.04). Number of bulbs was significantly affected by different growing media. Maximum number of bulbs per plant (1.14) was observed in M_1 (sand + soil + FYM; 1:1:1; v/v). It was, however, found to be at par with bulbs grown in M_2 (1.07) (sand + soil + FYM; 2:1:1; v/v). On the other hand, minimum number of bulbs (1.00) was recorded in M_3 (cocopeat + FYM ; 1:1;v/v) and M_4 (cocopeat + soil + FYM; 1:1:1; v/v).

Table 1 Effect of growing media on number of bulbs per plant of LA hybrid cultivars 'Batistero' and 'Courier'

Growing media	Cultivars		Mean
	Batistero	Courier	
M_1-sand+soil+FYM, (1:1:1, v/v)	1.10	1.16	1.14
M_2-sand+soil+FYM (2:1:1,v/v)	1.08	1.05	1.07
M_3-cocopeat+FYM (1:1,v/v)	1.00	1.00	1.00
M_4-cocopeat+soil+FYM (1:1:1,v/v)	1.00	1.00	1.00
M_5-M_1+cocopeat (1:1,v/v)	1.05	1.05	1.05
M_6- M_1+vermicompost (2:1,v/v)	1.03	1.05	1.04
M_7- M_1+ vermicompost + cocopeat (2:1:1,v/v)	1.00	1.05	1.02
Mean	1.04	1.05	-
$CD_{0.05}$ for:			
Cultivars	NS		
Growing media	0.07		
Growing media x Cultivars	NS		

Although interaction between cultivar and growing media was non-significant, yet data shows that maximum number of bulbs per plant was found when bulbs of LA hybrid 'Courier' (1.16) and 'Batistero' (1.10) were grown in M_1 (sand + soil + FYM; 1:1:1; v/v). In contrast, minimum number of bulbs was observed when bulbs of 'Batistero' (1.00) were grown in M_3 (cocopeat + FYM; 1:1; v/v), M_4 (cocopeat + soil + FYM; 1:1:1; v/v) and M_7 (M_1+ vermicompost + cocopeat (2:1:1,v/v) and in case of cv. 'Courier' grown in M_3 (cocopeat + FYM; 1:1; v/v) and M_4 (cocopeat + soil + FYM; 1:1:1; v/v)

Number of bulbs/plant seems to be influenced by the genotype with cv. 'Courier' producing more bulbs per plant than cv. 'Batistero'. Our results are supported by Krause (1996) [5] who studied the reproductive ability of some *Lilium longiflorum* varieties propagated from bulb scales. Results indicated that reproductive ability depended almost entirely on cultivar. Our findings are also supported by Matsuo and Arisumi (1979) [5] in *Lilium longiflorum* cultivars; Singh (2002) [10] in Asiatic cultivars, Sharma *et al*. (2007) [9] in Oriental lilies and Seyedi *et al*.2012 [8] in the LA hybrid lily and Wazir *et al.* (2009) in Alstroemeria[12].

Maximum bulb multiplication was attained in M_1 (sand + soil + FYM; 1:1:1; v/v) i.e. soil amended with sand and FYM. It can again be attributed to higher translocation of carbohydrates to the underground portions contributing more towards bulb multiplication in the medium. A study on Asiatic hybrid lily 'Navona', Moghadam *et al.* 2012[5] also reported more number of bulbs per plant in medium amended with different doses of vermicompost.

Bulb diameter (cm)

A perusal of data in **Table 2** reveals that variation due to cultivars and growing media had a significant effect on bulb diameter (cm) in LA hybrid cultivars. More bulb diameter was recorded in cv. 'Batistero' (4.75 cm) as compared to cv. 'Courier' (4.31 cm). Among different growing media, largest bulb size (5.19 cm) was observed in M_1 (sand + soil + FYM; 1:1:1; v/v). It was, however, found to be at par with bulb size obtained in M_2 (5.08 cm) (sand + soil + FYM; 2:1:1; v/v), M_5 (4.73 cm) (M_1 + cocopeat; 1:1; v/v), M_6 (4.46 cm) **(**M_1 + vermicompost; 2:1; v/v) and M_7 (4.73 cm) (M_1 + vermicompost + cocopeat; 2:1:1; v/v). On the other hand, minimum bulb diameter (3.67 cm) was recorded in M_3 (cocopeat + FYM; 1:1; v/v). Although interaction between cultivars and growing media was non-significant, yet data shows that maximum bulb diameter (5.66 cm) was found when bulbs of LA hybrid 'Batistero' were grown in M_2 (sand +soil + FYM; 2:1:1; v/v). On the other hand, minimum bulb diameter was observed when cv. 'Courier' (3.52 cm) was grown in M_3 (cocopeat + FYM; 1:1; v/v). Larger size bulbs were obtained from lilium grown in M_1 (sand + soil + FYM; 1:1:1; v/v) irrespective of the cultivar.

Table 2 Effect of growing media on bulb diameter (cm) of LA hybrid cultivars 'Batistero' and 'Courier'

Growing media	Cultivars		Mean
	Batistero	Courier	
M_1-sand+soil+FYM, (1:1:1, v/v)	5.57	4.80	5.19
M_2-sand+soil+FYM (2:1:1,v/v)	5.66	4.50	5.08
M_3-cocopeat+FYM (1:1,v/v)	3.82	3.52	3.67
M_4-cocopeat+soil+FYM (1:1:1,v/v)	3.78	3.98	3.88
M_5-M_1+cocopeat (1:1,v/v)	5.20	4.26	4.73
M_{6-} M_1+vermicompost (2:1,v/v)	4.43	4.49	4.46
M_7- M_1+ vermicompost + cocopeat (2:1:1,v/v)	4.78	4.68	4.73
Mean	4.75	4.31	-
$CD_{0.05}$ for:			
Cultivars	0.43		
Growing media	0.80		
Growing media x Cultivars	NS		

In bulbous crops development of bulbs depends upon the translocation of photosynthates from above ground portion of the plant to the underground bulbs which acts as a sink. In the present studies, the bulbs grown on M_1 produced less number of flower buds per plant and showed least flowering duration, hence consuming less carbohydrates for flowering and in turn making large quantity of carbohydrates available for translocation to bulbs resulting in increased bulb size.

Similar results were, however, obtained in bulbs grown in M_2 (sand + soil + FYM; 2:1:1; v/v) and M_5 and M_7 (M_1 + vermicompost + cocopeat; 2:1:1; v/v) also. The superiority of cocopeat and vermicompost amended media for growth and flowering in lilium has already been established in the present studies and reported by many workers. Increased bulb size (perimeter) in cocopeat as a media has been reported by Nikrazm, *et al.* (2011) [7] in lilium. Better quality bulb diameter in Oriental lilies has been reported in media containing cocopeat in combination with other constituents (Treder, 2005) [11].

Weight of bulbs per plant (g)

A perusal of data in **Table 3** reveals that variation due to cultivars, growing media and their interaction had a significant effect on weight of bulbs in LA hybrid cultivars. Heavier bulbs were recorded in cv. 'Batistero' (45.88 g) as compared to 'Courier' (34.36 g).

Table 3 Effect of growing media on weight of bulb per plant (g) of LA hybrid cultivars 'Batistero' and 'Courier'

Growing media	Cultivars		Mean
	Batistero	Courier	
M_1-sand+soil+FYM, (1:1:1, v/v)	52.86	38.95	45.91
M_2-sand+soil+FYM (2:1:1,v/v)	50.50	37.64	44.06
M_3-cocopeat+FYM (1:1,v/v)	40.28	26.02	33.15
M_4-cocopeat+soil+FYM (1:1:1,v/v)	41.47	26.59	34.03
M_5-M_1+cocopeat (1:1,v/v)	43.39	31.68	37.53
M_{6-} M_1+vermicompost (2:1,v/v)	46.45	36.63	41.54
M_7- M_1+ vermicompost + cocopeat (2:1:1,v/v)	46.21	42.98	44.59
Mean	45.88	34.36	-
$CD_{0.05}$ for:			
Cultivars	1.02		
Growing media	1.91		
Growing media x Cultivars	2.70		

Among different growing media, maximum weight of bulb (45.91 g) was observed in M_1 (sand + soil + FYM; 1:1:1; v/v). Similar results were, however, obtained with bulbs grown in M_2 (44.06 g) (sand + soil + FYM; 2:1:1; v/v) and M_7 (44.59 g) (M_1+ vermicompost + cocopeat; 2:1:1; v/v). On the other hand, minimum weight of bulb (33.15 g) was obtained when grown in M_3 (cocopeat + FYM; 1:1; v/v).

Interaction between cultivar and growing media shows that bulbs of LA hybrid 'Batistero' grown in M_1 (sand + soil + FYM; 1:1:1; v/v) recorded maximum weight of bulb (52.86 g). Similar results were obtained with bulbs of 'Batistero' (50.50 g) grown in sand + soil + FYM; 2:1:1; v/v (M_2). However, LA hybrid 'Courier' observed maximum weight of bulb (38.95 g) when grown in M_1 (sand + soil + FYM; 1:1:1; v/v). In contrast, minimum bulb weight was recorded when cv. 'Courier' was grown in M_3 (26.02 cm) (cocopeat + FYM ; 1:1; v/v).

The increased weight of bulb per plant observed in LA hybrids 'Batistero' and 'Courier' in bulbs grown on M_1 (sand + soil + FYM; 1:1:1; v/v) could be attributed to the corresponding highest bulb diameter (Table 2) in the same medium, which could further be attributed to higher translocation of photosynthates to the bulbs in the medium.

Similar results, were, however found in M_7 also. Klasman *et al.* (2002) [3] in his study on cultivation of lilium Asiatic hybrids in three substrates have reported maximum bulb size in soil amended + FYM; 2:1:1; v/v).

Number of bulblets per plant

A perusal of data in **Table 4** reveals that cv. 'Courier' showed better bulblet multiplication (1.56) as compared to 'Batistero' (0.87).

Among different growing media, maximum number of bulblets (2.13) was observed in M_1 (sand+soil+FYM; 1:1:1,v/v). Similar results were obtained when bulbs were grown in M_2 (1.64) (sand+soil+FYM; 2:1:1;v/v). On the other hand, number of bulblets were recorded minimum in M_3 (0.45) (cocopeat+FYM; 1:1;v/v).

Table 4 Effect of growing media on number of bulblets per plant of LA hybrid cultivars 'Batistero' and 'Courier'

Growing media	Cultivars		Mean
	Batistero	Courier	
M_1-sand+soil+FYM, (1:1:1, v/v)	1.58	2.68	2.13
M_2-sand+soil+FYM (2:1:1,v/v)	1.40	1.88	1.64
M_3-cocopeat+FYM (1:1,v/v)	0.11	0.80	0.45
M_4-cocopeat+soil+FYM (1:1:1,v/v)	0.17	0.87	0.52
M_5-M_1+cocopeat (1:1,v/v)	0.79	1.69	1.24
M_6- M_1+vermicompost (2:1,v/v)	0.93	1.41	1.17
M_7- M_1+ vermicompost + cocopeat (2:1:1,v/v)	1.11	1.61	1.36
Mean	0.87	1.56	-
$CD_{0.05}$ for:			
Cultivars	0.34		
Growing media	0.63		
Growing media x Cultivars	NS		

Although interaction between cultivars and growing media was non-significant, yet data shows that maximum number of bulblets in cv. 'Courier' (2.68) and 'Batistero'(1.58) were obtained in M_1 (sand + soil + FYM; 1:1:1; v/v). In contrast, minimum number of bulblets was observed when 'Batistero' (0.11) was grown in M_3 (cocopeat + FYM; 1:1; v/v) (Plate 4).

Number of bulblets/plant seems to be influenced by the genotype with cv. 'Courier' producing more bulblets per plant than cv. 'Batistero'. The genotypic differences among the cultivars could be accounted for this variation. Our findings are also supported by Matsuo and Arisumi (1979)[5] and Krause (1996) [4] in *Lilium longiflorum* cultivars; Singh (2002) [10] in Asiatic cultivars and Sharma *et al*. (2007) [9] in Oriental lilies

Bulblet multiplication was found better in bulbs grown in M_1 (sand + soil + FYM; 1:1:1; v/v) in both the cultivars. Similar results were, however obtained in M_2 also. Increased bulblet multiplication in M_1 and M_2 could again be attributed to higher translocation of carbohydrates to the underground portions contributing more towards bulb per bulblet multiplication in the medium.

Bulblet diameter (cm)

A perusal of data in **Table 5** reveals that bulblets with larger size were obtained in cultivar 'Batistero' (1.58 cm) as compared to 'Courier' (1.09 cm). Although different growing media could not induce significant difference on bulblet diameter, yet maximum bulblet diameter (1.90 cm) was observed in M_1 (sand + soil + FYM; 1:1:1; v/v). On the other hand, minimum bulblet diameter (0.88 cm) was recorded when bulbs were grown in M_4 (cocopeat + soil + FYM; 1:1:1; v/v).

Table 5 Effect of growing media on bulblet diameter (cm) of LA hybrid cultivars 'Batistero' and 'Courier'

Growing media	Cultivars		Mean
	Batistero	Courier	
M_1-sand+soil+FYM, (1:1:1, v/v)	2.48	1.31	1.90
M_2-sand+soil+FYM (2:1:1,v/v)	1.96	1.25	1.61
M_3-cocopeat+FYM (1:1,v/v)	1.06	1.22	1.14
M_4-cocopeat+soil+FYM (1:1:1,v/v)	0.55	1.22	0.88
M_5-M_1+cocopeat (1:1,v/v)	1.75	0.95	1.35
M_6- M_1+vermicompost (2:1,v/v)	1.56	0.88	1.22
M_7- M_1+ vermicompost + cocopeat (2:1:1,v/v)	1.71	0.80	1.26
Mean	1.58	1.09	-
$CD_{0.05}$ for:			
Cultivars	0.30		
Growing media	NS		
Growing media x Cultivars	0.80		

Interaction data also shows that maximum bulblet diameter (2.48 cm) was found when bulbs of LA hybrid 'Batistero' were grown in M_1 (sand + soil + FYM; 1:1:1; v/v). It was, however, found to be at par with bulbs grown in M_2 (1.96 cm) (sand + soil + FYM; 2:1:1; v/v), M_5 (1.75 cm) (M_1 + cocopeat; 1:1; v/v) and M_7 (1.71 cm) (M_1 + vermicompost + cocopeat; 2:1:1; v/v). In case of, LA hybrid 'Courier' maximum bulblet diameter (1.31cm) was also found when grown in M_1 (sand + soil + FYM; 1:1:1; v/v). In contrast, bulblet diameter was observed minimum when cv. 'Batistero' (0.55cm) was grown in M_4 (cocopeat +soil + FYM; 1:1:1; v/v).

Bulblet size was also found maximum in M_1 (sand + soil + FYM; 1:1:1; v/v) in both the cultivars. Soil amended with sand and FYM has beneficial effects on bulblet size. It could be attributed to the diversion of more carbohydrates to underground prtions due to less flowering parameters resulting into production of larger sized bulblets.

Weight of bulblet (g)

A perusal of data in **Table 6** reveals that more weight of bulblet was recorded in cv. 'Courier' (3.42 g) as compared to 'Batistero' (2.25 g). Among different growing media, maximum bulblet weight (4.35 g) was observed in M_1 (sand + soil + FYM; 1:1:1; v/v). Similar results were obtained with bulbs grown in M_2 (3.47 g) (sand + soil + FYM; 2:1:1; v/v). On the other hand, minimum bulblet weight (1.58 g) was recorded in M_3 (cocopeat + FYM; 1:1; v/v).

Table 6 Effect of growing media on weight of bulblet (g) of LA hybrid cultivars 'Batistero' and 'Courier'

Growing media	Cultivars		Mean
	Batistero	Courier	
M_1-sand+soil+FYM, (1:1:1, v/v)	3.82	4.87	4.35
M_2-sand+soil+FYM (2:1:1,v/v)	2.98	3.96	3.47
M_3-cocopeat+FYM (1:1,v/v)	1.00	2.15	1.58
M_4-cocopeat+soil+FYM (1:1:1,v/v)	1.16	2.68	1.92
M_5-M_1+cocopeat (1:1,v/v)	1.76	3.83	2.80
M_6- M_1+vermicompost (2:1,v/v)	2.33	3.29	2.81
M_7- M_1+ vermicompost + cocopeat (2:1:1,v/v)	2.67	3.17	2.92
Mean	2.25	3.42	-
$CD_{0.05}$ for:			
Cultivars	0.58		
Growing media	1.08		
Growing media x Cultivars	NS		

Interaction between cultivars and growing media shows that maximum weight of bulblet (4.87 g) was found when bulbs of LA hybrid 'Courier' were grown in M_1 (sand + soil + FYM; 1:1:1; v/v). LA hybrid 'Batistero' also observed maximum weight of bulblet (3.82 g) when grown in M_1 (sand + soil + FYM; 1:1:1;v/v). However, minimum weight of bulblet was observed when bulbs of 'Batistero' (1.00 g) were grown in M_3 (cocopeat + FYM; 1:1; v/v). Increased bulblet weight in M_1 could be attributed to the corresponding larger bulblet diameter obtained in this medium.Maximum bulblet weight was attained in M_1 i.e. soil amended with sand and FYM. It can again be attributed

to higher translocation of carbohydrates to the underground portions contributing more towards bulblet formation in the medium.

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