Determining Optimum Length of Bulb Cold Storage for Oriental Hybrid Lilies in Arizona

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ABSTRACT

Bulbs of three varieties of oriental hybrid lilies were stored at 4°C for 6 to 12 weeks prior to greenhouse forcing at 18°C night temperature. Increasing duration of storage reduced the number of days to shoot emergence, visible flower bud, and anthesis for each variety. The number of days from planting to anthesis ranged from 70 to 102 and varied with cultivar and storage duration. Increasing durations of storage had no commercially significant effect on the number of flowers reaching anthesis, number of leaves or aborted flower buds. The varieties used in this study flower earlier than commercially established cultivars and may be successfully forced in Arizona for early spring holidays.

INTRODUCTION

Oriental hybrid lilies (complex hybrids of Lilium speciosum, L. japonicum, and L. auratum) are popular with consumers due to their brilliant pink to purple flower colors and heavy fragrance. Plants are grown from bulbs obtained from domestic or foreign producers. As with the Easter lily (L. longiflorum), oriental hybrid lilies probably require a period of low temperature (4.4°C), moist storage prior to planting for rapid flowering. The purpose of the present work was to evaluate the low-temperature response of three new varieties of oriental hybrid lilies, and to evaluate their potential as potted plants for Arizona growers.

MATERIALS AND METHODS

Three unnamed Lilium hybrids ('101', '202', and '298') were received 25 November 1987 and placed immediately into a 4° ± 1°C storage cooler. Bulbs (15 to 18 cm circumference) were stored in moist peat moss in the original shipping cases. Beginning with week 6 of storage, 20 bulbs of each cultivar were removed from the cooler at two week intervals. Bulbs were potted one per 15 cm diameter plastic container, and placed into a 26°/18° (venting/night) greenhouse at the Campus Agricultural Center in Tucson.

The growth medium consisted of a 1 soil: 2 sphagnum peat: 2 perlite (by volume) mixture amended with 744 g treble superphosphate, 593 g potassium nitrate, 593 g magnesium sulfate, 4.75 kg ground dolomitic limestone, and 74 g Frit Industries Trace Elements No. 555 (Peters Fertilizer Products, W.R. Grace & Co., Fogelsville, Pa.) per cubic meter. The plants were fertilized at each watering with 200 $mg \cdot liter^{-1}$ each of N and K. Fertilizer solution was maintained at 6.0 pH by injecting 75% (w/w) technical grade phosphoric acid into the system, supplying 43 $mg \cdot liter^{-1}$ P at every watering. No chemical height control treatments were made. Other cultural practices, including fungicide and insecticide applications were made following common cultural practices.

Days to shoot emergence, visible flower bud, and anthesis were calculated from the date the bulbs were potted and placed into the greenhouse. The date of anthesis was recorded for each plant when the first flower opened. Plant height (from the soil surface to the top of the inflorescence) was recorded at anthesis. The number of flowers reaching anthesis, the aborted buds, and the leaves were recorded for each plant.

RESULTS AND DISCUSSION

For each cultivar, the days from potting to shoot emergence, visible bud, and anthesis were affected by bulb cold storage duration (Table 1). The time required for plants to emerge, develop visible flower buds, and reach anthesis decreased as the length of bulb storage increased. The number of days to anthesis varied from 70 to 102, depending on cultivar and storage treatment (Table 1).

Using a commercially realistic storage period of 8 weeks, the cultivars flowered in 81 to 98 days, a significant reduction over the typical 110 to 120 day forcing time of many current cultivars. Storage duration affected the number of flowers reaching anthesis for cultivars '101' and '202'. Plants in all storage treatments, however, produced commercially acceptable inflorescences. Plants receiving 8 weeks of cold storage averaged 8.7, 11.1, and 6.3 flowers for '101', '202', and '298', respectively. In contrast, 'Sans Souci', a commercial oriental hybrid cultivar widely used for potted plant production, produced an average of 5 to 6 flowers per plant after 8 to 9 weeks of storage, when 18 to 20 cm bulbs are used.

With all 3 cultivars, storage duration had no effect on the number of aborted flower buds. Cultivar '101' averaged (± SD) 1.4 ± 1.8 aborted buds; cultivar '202' averaged 2.0 ± 2.7; and cultivar '298 averaged 0.3 ± 0.8 aborted buds. Cold storage treatments affected the number of leaves in two of the cultivars (Table 1), although these differences are commercially insignificant. As with most of the currently available oriental hybrid cultivars, foliage quality on the lower portion of the stems (basal 5 to 10 cm portion) was poor. Lower leaves appeared paler green and senesced prior to anthesis for most plants.

At anthesis, most plants were taller than the hypothetical optimum for potted plants; plants receiving 12 weeks of cooling tended to be taller than plants receiving 6 weeks (Table 1). This was unexpected, as bulb storage duration is inversely proportional to height at anthesis, at least in Lilium longiflorum. In our study, photoperiod was not controlled; therefore, plants grown from bulbs stored for longer periods experienced longer average photoperiods. Long days are known to induce elongation of L. longiflorum stems; photoperiod may have contributed to the increased stem elongation seen with longer storage treatments.

Rapid forcing and high quality floral displays were achieved for all 3 cultivars tested after 6 to 8 weeks (commercially feasible durations) of cooling. The earliness of these cultivars is a substantial improvement over most currently available cultivars. According to our results (Table 1), a six week cold storage period followed by a planting date of late December to early January would give flowering plants by March 30 to April 11, early enough for most Easter dates. With additional temperature control, perhaps even earlier flowering dates could be obtained. Research targeting chemical height control is essential, however, prior to widespread commercial acceptance of these oriental hybrid lilies as potted flowering plants.

Table 1. Forcing characteristics and height at anthesis for three oriental hybrid lily cultivars as affected by length of 4.4°C storage prior to greenhouse forcing.[z]

Length of storage (days)	Planting date	Days from planting to emergence	Days from planting to visible bud	Days from planting to anthesis	Date of anthesis	Height at anthesis (cm)	Number of flowers reaching anthesis	Number of leaves
				Variety 101				
42	Jan. 6	16.6 a[y]	36.1 a	83.6 a	Mar. 30	34.3 b	7.3 b	31.2 ab
56	Jan. 20	13.1 b	28.6 b	80.8 a	Apr. 10	45.4 a	8.7 a	33.2 a
70	Feb. 3	11.2 b	26.1 b	76.6 b	Apr. 20	43.8 a	8.5 a	30.7 ab
84	Feb. 17	7.0 c	25.1 b	70.2 c	Apr. 27	41.1 a	6.0 c	28.4 b
				Variety 202				
49	Dec. 30	40.3 a	64.1 a	101.9 a	Apr. 10	35.9 a	11.1 ab	45.9 a
56	Jan. 6	36.5 b	61.0 a	98.4 ab	Apr. 13	33.5 a	11.1 ab	43.9 ab
70	Jan. 20	32.3 c	56.7 b	94.2 b	Apr. 23	41.4 a	9.0 b	39.5 b
84	Feb. 3	29.1 c	51.7 c	86.9 c	Apr. 30	39.0 a	12.7 a	42.9 ab
				Variety 298				
42	Jan. 6	42.9 a	68.6 a	96.4 a	Apr. 11	38.1 ab	5.8 a	28.2 a
56	Jan. 20	32.1 b	52.0 b	84.5 b	Apr. 13	36.5 b	6.3 a	26.3 a
70	Feb. 3	30.1 b	51.4 b	86.2 b	Apr. 29	37.7 ab	6.9 a	27.2 a
84	Feb. 17	24.0 c	40.4 c	72.0 c	Apr. 29	43.4 a	6.4 a	27.4 a

[z]Means based on 20 replicates each.
[y]Means within a variety followed by the same letter are not significantly different at the 5% level, by SNK test.