Temperature Controlled Floral Induction in Amazon Lily, *Eucharist grandiflora*, Planch[1]

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Abstract. Time and temp requirements for floral induction in the Amazon lily were found to be 12 days at 29.4°C (85°F) or 3 weeks at 19.4°C (67°F). Greater numbers of bulbs flowered, however, when heated for 16 days at 29.4°C or 3 weeks at 20.6°C (69°F). No detrimental effects, as indicated by percent flowering and flowers per scape, were apparent when bulbs were heated for 4, 5, 6, 7, 8, or 9 weeks at 29.4°C. Total production time was increased as treatment period was extended, but appeared to be definitely modified by season. Days after heating to first flower progressively decreased and total flowers per scape increased as growing conditions improved in spring. The fall crop showed an opposite response.

Previous studies have shown that flowering in the Amazon lily can be controlled by manipulation of bulb temp (1). Temp above 21.1°C for 2 weeks or more have been found necessary for floral induction. Heating at 32.2°C for 5 weeks has also promoted flowering without any apparent detrimental side effects.

Our study was designed to determine the min temp and heating duration required for floral induction and the effects of extended heating duration on flowering of leafy bulbs.

Materials and Methods

Bulbs for all studies were grown in 6 inch plastic pots in an 18.3°C greenhouse. After repotting into similar pots with sealed bottoms; bulbs were heat treated by placing the pots in water baths maintained at + or - 1°C of the specified temp. Bulb temp attained were usually 1-2°C below bath temp. To determine min temp for floral induction, 6 plants each were held at 18.3, 19.4, 20.6, 21.7, 22.8, or 23.9°C for 3 weeks and then returned to an 18.3°C greenhouse for flowering. These treatments were repeated on 2/17/70, 4/6/70, and 2/17/71 for a total of 18 pots per treatment. Plants were handled in a similar manner in determining min time requirements. Nine plants each were heated for 4, 8, 12, 16, or 20 days at 29.4°C. These treatments were repeated on 12/1/69, 5/7/70, and 10/13/70 for a total of 27 pots per treatment. Effects of extended heating duration on floral induction was determined by holding 14 plants each at 29.4°C for either 4, 5, 6, 7, 8, or 9 weeks. These treatments were repeated on 7/16/70 and 3/10/71 for a total of 28 pots per treatment.

Results and Discussion

Substantial flowering occurred when leafy bulbs were heated at 19.4°C for 3 weeks; however, a significantly greater number of pots flowered when heated at 20.6°C (Table 1). Although the threshold temp for flower induction is 19.4°C, most bulbs did not flower until 20.6°C was reached. Individual bulb differences in capacity to flower may be explained on the basis of bulb maturity or ripeness to flower. Crops which require vernalization or photoperiodic treatment for flowering are often strongly influenced by plant age in their temp and photoperiodic responses. In general, as plants age the number of hours of cold or number of photoperiodic cycles required for max flowering decreases. Similarly, bulbs which had not flowered for many months might have been more prone to flower than those which flowered 2-3 months before the study began.

If leafy bulbs were held at 29.4°C, a min of 12 days was required for floral induction (Table 2). Increasing the period of treatment to 16 days increased percent flowering. The results indicated that bulbs differ in their physiological readiness to flower and thus require different amounts of stimulation.

Increasing the floral induction treatment from 4 to 9 weeks, lengthened total production time by 48 and 28 days in the autumn and spring series, respectively (Table 3). In the autumn series (started 7/16/70), production time increased approx 9½ days for each 7 days of additional bulb heating over the 4 week min, but in the spring series (started 3/10/71), only 5½ days were added for each 7 days of additional heating. Similarly, the "days after heating to first flower" increased in the autumn series and decreased in the spring series as the heating period was lengthened from 4 to 9 weeks. Average number of flowers per scape tended to decrease in autumn and increase in the spring series with additional heating. In short, as weather conditions became poorer, development time increased and flower production decreased; the reverse was true for the spring

Table 1. Percent of Amazon lily bulbs flowering after being subjected to various bulb temp for 3 weeks and then returned to an 18.3°C (65°F air temp) greenhouse.

	Water bath temp[z]						
	65	67	69	71	73	75	°F
	18.3	19.4	20.6	21.7	22.8	23.9	°C
Number of bulbs flowering	2	7 *	15	13	17	14	
Percent flowering[y]	11	39	83	72	94	78	

[z]Bulb temp usually ran about 1-2°C (2-3°F) below bath temp.
[y]100% equals 18 bulbs flowering.
*Numbers at left significantly different from those at right at 5% level, (Chi square and single degree of freedom).

Table 2. Percent of Amazon lily bulbs flowering after being subjected to 29.4°C (85°F) water bath temp for various periods of time and then returned to an 18.3°C (65°F air temp) greenhouse.

	Heating duration (days)				
	4	8	12	16	20
Number of bulbs flowering	0	0	17 *	24	26
Percent flowering[z]	0	0	63	89	96

[z]100% equals 27 bulbs flowering.
*Numbers at left significantly different from those at right at 5% level, (Chi square and single degree of freedom).

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Table 3. Influence of extended heating period on days to flower and number of flowers produced in Amazon lily.[z]

Bulb heating period weeks	Total production time days[y]	Time heated days	Time after heating to first flower[x] days	Number of flower scapes (Flowers/scape) 3	4	5	6	7	Flowers per scape $\bar{x}$	Pots flowering no.	Flowering %
Autumn series (started 7/16/70 - November)											
4	113	28	85a		2	13	3		5.05	12	85.7
5	120	35	85a		7	16			4.69	14	100.0
6	128	42	86a	1	6	11			4.56	11	78.6
7	142	49	93b		10	5			4.33	11	78.6
8	153	56	95b	5	5	1			3.64	10	71.4
9	161	63	98b	2	9	2			4.00	10	71.4
Spring series (started 3/10/71 - July)											
4	105	28	77c	1	21	10	1		4.33	14	100.0
5	115	35	80d	1	5	16	2		5.04	14	100.0
6	119	42	77c		5	16	9		5.13	14	100.0
7	122	49	73b		7	10	10	2	5.24	14	100.0
8	127	56	71ab		1	5	17	4	5.89	14	100.0
9	133	63	70a		2	17	11	1	5.35	14	100.0

[z]Leafy bulbs heated in 29.4°C (85°F) water bath.

[y]Start of heating to first flower open.

[x]Values within a series followed by the same letter are not significantly different at the 5% level (Tukey's test).

series.

Values for "days after heating to first flower" in the autumn series are statistically divided into two groups. i.e. weeks 4, 5, 6, and 7, 8, 9 respectively (Table 3). This division was probably a result of their physical separation in the greenhouse: consequently they were subjected to slightly different growing temp. We have observed differences in flowering dates of as much as 2 weeks with plants on a single bench spaced only 4 ft apart. Temperature differences were known to be the primary cause of variation in flowering dates of those plants. Development rates in Amazon lilies are very responsive to temp. In the spring series, all pots were kept on the same greenhouse bench throughout the study. Precautions were also taken to eliminate cold drafts.

Our study indicates that Amazon lilies require 21 days at 19.4°C but only 12 days at 29.4°C for flower induction. Earlier studies had shown that a time/temp interaction existed in flower induction (1), but establishment of min values for flower induction are important to commercial producers. Summer greenhouse soil temp are often sufficient to induce flowering and thus eliminate the opportunity to schedule flowering for specific dates in autumn and early winter. Weather conditions were the only substantial variable sufficient to cause the differences we noted in flower number and production time.

Literature Cited

1. Adams, D. G., and W. A. Urdahl. 1971. Influence of bulb temperature on floral initiation in the Amazon lily, *Eucharist grandiflora* Planch. *HortScience* 6:205.

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