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KEEPING LIFE OF SOME FLOWERING POT PLANTS

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With funds from the Society of American Florists' Endowment, cooperative studies were carried out at Colorado State University and Michigan State University, examining the keeping life and growth of cineraria, gloxinia, kalanchoe, hydrangea and cyclamen. Experiments were started in 1980, and repeated in 1981.

The basic concept was to grow plants as identically as possible at both locations other than differences due to climate. Plant materials for both locations were obtained from the same source, grown in the same potting medium with the same nutrition and dribble tube irrigation system. Potting dates were the same. The CSU water supply, due to its high quality, was modified to conform with MSU water quality and nutrition. Production at MSU was under glass, at CSU, under rigid fiberglass. Night and day temperatures were controlled at the same points.

Plants in flower were removed from the greenhouse and placed in shipping boxes at 1°C (34°F) or 20°C (68°F) for either 2, 4, or 8 days. Plants were then placed in a room at 20°C (68°F) with 7 microeinsteins per sq. meter and sec. (μE m^{-2} sec^{-1}) irradiance (about 50 foot-candles) from cool white fluorescent light. In Michigan, another group of plants were placed at irradiances of 7, 15, 35, and 70 μE m^{-2} sec^{-1} (about 50, 100, 250, and 500 ft-c). Data were collected daily on each species.

General Plant Growth

Growth at the two locations was not the same — as might be expected. For example, the final size of cyclamen produced in Michigan was greater than those grown in Colorado (Tables 1 and 2, Fig. 1), but final size of cineraria, kalanchoe and gloxinia produced in Colorado was larger. However, there was a large period between harvest dates between the two locations for hydrangea and gloxinia. In the case of gloxinia, plants grown at MSU came into flower earlier (Fig. 2). The differences in growth between locations could have been due to differences in water stress caused by the higher radiation and dryer climatic conditions in Colorado.

PLANT RESPONSES IN THE POSTHARVEST ENVIRONMENTS

Keeping Life

Despite numerous phone calls and correspondence, consensus as to what constituted "decorative life" and "keeping life" of a flowering potted plant was not achieved. At CSU, three weeks was felt to be an adequate period for maximum consumer satisfaction. People who kept plants satisfactorily for longer periods would be of a different

Table 1: Fresh weights (grams) of flowering potted plants left in the greenhouse and at the end of decorative life. Plants were placed in simulated shipping for 2 days at 20C (68F) prior to being placed in the postharvest room at 7 μE $m^{-2}sec^{-1}$ (50 ft-c) and 20C (68F).

	CSU		MSU	
Crop	Greenhouse	End of Decorative Life	Greenhouse	End of Decorative Life
Hydrangea	498	325	625	353
Cyclamen	345	211	441	261
Kalanchoe	512	438	320	214
Cineraria	613	385	316	199
Gloxinia	830	679	330	—

[1]Professor, Colo. State Univ., and Assist. Prof., Michigan State Univ., respectively. Note that Royal Heins is a former CFGA scholar from CSU.

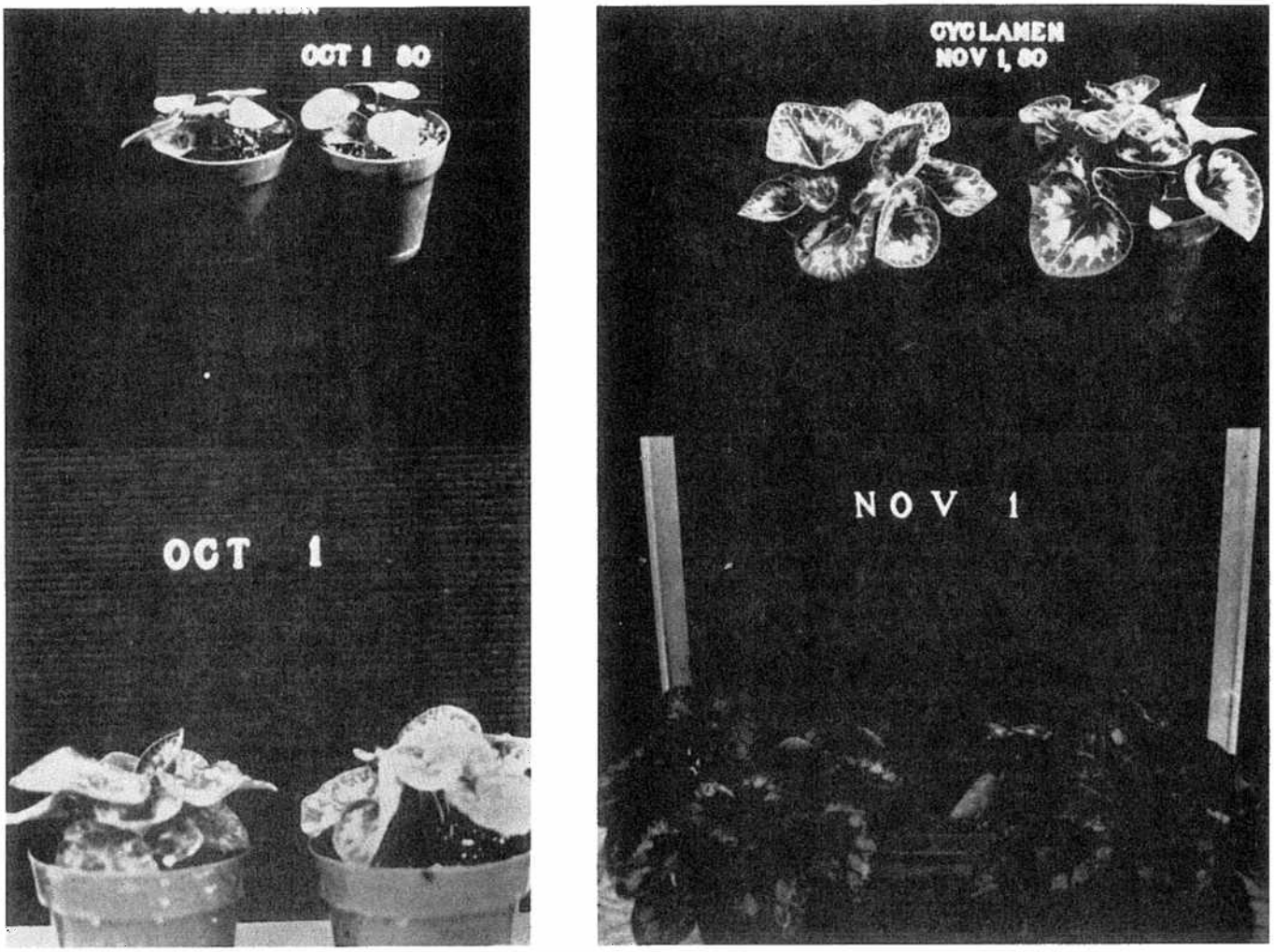

Fig. 1: Comparison of identically treated Cyclamen, upper, grown at CSU, lower, grown at MSU. Seedlings transplanted Sept. 5, 1980.

Table 2: Total volume of representative plants grown at Michigan State University and Colorado State University.

	MSU		CSU	
Crop	Volume (ml)	Date	Volume (ml)	Date
Cyclamen	595	Jan. 21	309	Jan. 15
Kalanchoe	303	Jan. 21	553	Feb. 5
Hydrangea	933	Apr. 2	1046	Mar. 31
Cineraria	531	Mar. 25	1752	Apr. 13
Gloxinia	575	Feb. 15	1832	May 10

type than those who purchase potted plants as decoration for short periods, and provide no special attention. MSU kept plants in excess of 30 days, or to end of "decorative life". This latter term has not been defined. Some have suggested that keeping life is considered to end when the first flower petals senesce — similar to cut flowers. Considering the fact that many pot plants have flowers in many stages of development (bud to open flower) this criterion does not appear reasonable.

The mean keeping life of the species studied at each location is presented in Table 3. Plants at MSU had a longer decorative life than those produced at CSU. The

Fig. 2: Comparison of plant size of identically treated gloxinia; upper, grown at CSU, lower, grown at MSU. Seedlings transplanted Sept. 23, 1980.

Table 3: Decorative life of pot plants subjected to storage at two temperatures, grown in two different locations. With exceptions of location, all other factors are the same.

Storage			
Time (Days)	Temperature (°C)	Michigan State (Days)	Colorado State[1] (Days)
CINERARIA			
2	20 (68F)	17	8
4	20	15	7
8	20	8	7
2	1 (34F)	17	13
4	1	16	12
8	1	15	6
Greenhouse Control		27	19
KALANCHOE			
2	20	32	14
4	20	30	13
8	20	27	10
2	1	33	14
4	1	31	13
8	1	27	10
Greenhouse Control		35	20
HYDRANGEA			
2	20	29	12
4	20	25	6
8	20	27	0
2	1	30	17
4	1	31	12
8	1	22	0
Greenhouse Control		35	15
CYCLAMEN			
2	20	30	15
4	20	30	12
8	20	30	6
2	1	30	11
4	1	30	17
8	1	30	8
Greenhouse control		30	21
GLOXINIA			
2	20	—[2]	19
4	20	—	17
8	20	—	13
2	1	—	0
4	1	—	—
8	1	—	—

[1]Keeping trial for CSU plants terminated at end of 3 weeks.
[2]No keeping trial.

effects of storage on keeping life of plants grown at MSU seemed to be more consistent experimentally than identical trials at CSU. In most cases, differences of 1 to 2 days in keeping life were not statistically significant. There appeared to be an obvious bias between the two locations as to what constituted "decorative" life of plants. At CSU, root rot problems after moving from the greenhouse to low light levels seemed to be more severe, and hydrangeas, which were stored in polyethylene-lined shipping containers had severe botrytis problems when removed from storage, resulting in zero keeping life. Hydrangeas stored at MSU were not sleeved. While not consistent, storage could be highly detrimental to keeping life, particularly under conditions as occurred at CSU. As a general rule, potted plants should not be stored without some air circulation, and coolers should be those which remove moisture from the air.

Gloxinia Damage at Low Temperatures

Gloxinias were severely damaged by simulated shipping at 1C (34F) (Fig. 3). Additional work at different temperatures on seedling gloxinia plants showed that exposure to temperatures of 2.5C (37F) or lower essentially killed all foliage (Table 4). In general, gloxinia should not be exposed to temperatures below 10C (50F) for any significant period.

Root Rot Problems

There was severe root-rot on the cineraria and hydrangea when moved into a low light area. The longer plants were stored in simulated shipping, the worse the root-rot (Fig. 4). As a general rule, a fungicide drench was a good preventive when applied just before marketing. This

Fig. 3. Effect of simulated shipping for 2 and 4 days at 20° C and 8 days at 1° C on gloxinia, compared with check kept in the greenhouse (grnh).

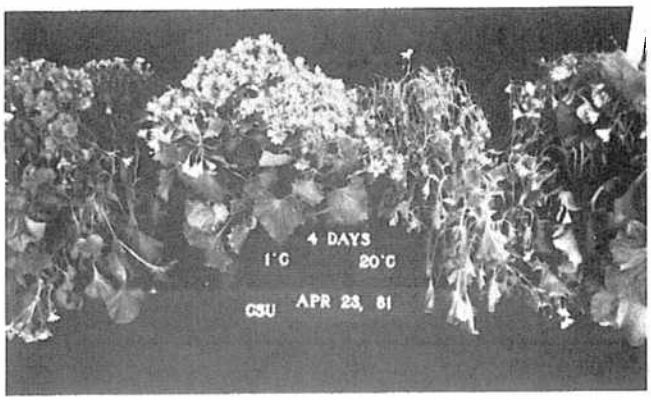

Fig. 4: Effect of 4 days simulated shipping at 1° C and 20° C on cineraria.

practice could provide greater consumer satisfaction. Storage of hydrangea for more than 2 days at 20C (68F) resulted in severe botrytis on petals at CSU. Hydrangeas and similar flowering plants should not be allowed to remain at high temperatures and humidity — as might occur in closed containers — for any significant period.

Loss of Flower Color

Flowering plants placed at low light intensities as may be encountered in the home generally lost color intensity

Table 4: Effect of temperature and exposure time on chilling injury of gloxinia. Expressed as percent of a leaf's area water soaked (MSU).

Exposure (hrs)	Temperature (°C)			
	0	2.5	5.0	10.0
1	1	0	0	0
2	1	0	0	0
4	6	2	0	0
24	100	7	7	0
48	100	100	2	0

(Fig. 5). The effect was apparent within one week after "sale". Work at MSU (Table 5), showed that the usual light intensity in a home or office (7 to 15 microeinsteins per sq. cm. and sec. or about 50 to 100 ft-c) often resulted in a short decorative life. No advantage in decorative life was observed when the irradiance was increased beyond 35 μ E m^{-2} s^{-1} (ca 250 ft-c). The difference in fresh weight of plants kept in the keeping room versus the greenhouse was quite remarkable (Table 1).

Cyclamen plants held in simulated shipping for 4 or 8 days developed flowers with long weak stems (Fig. 6). Most plants held at 7 μ E m^{-2} s^{-1} (50 ft-c) during the experiment developed similar symptoms while plants held at 35 or 70 μ E m^{-2} s^{-1} (250 or 500 ft-c) did not. This response was most likely due to flower stalk elongation under low light conditions.

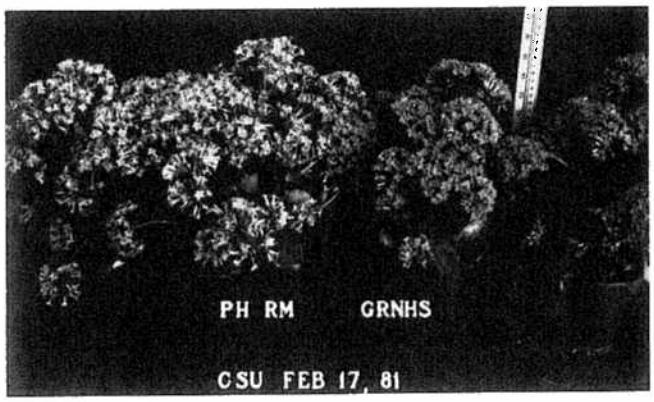

Fig. 5: Effect of low light intensity on flower color in Kalanchoe. Two plants on the left after two weeks in the postharvest physiology room, the two on the right directly from the greenhouse.

Table 5: Effect of Phytosynthetically Active Radiation intensity on decorative life (days) of flowering pot plants. PAR, measured in microeinsteins per sq. meter and second, is the region between wavelengths of 400 and 700 nanometers. The value of "7" represents usual indoor light intensity (about 50 ft-c).

Crop	PAR			
	7	15	35	70
Kalanchoe	33	35	35	35
Cineraria	17	21	26	25
Cyclamen	30	30	30	30
Hydrangea	34	34	35	35
Gloxinia	19	23	32	30

We feel that maximum decorative life of the species examined here requires light intensities of not less than 250 ft-c and preferably 500 ft-c. Consumer care guidelines should include some mention of light requirements.

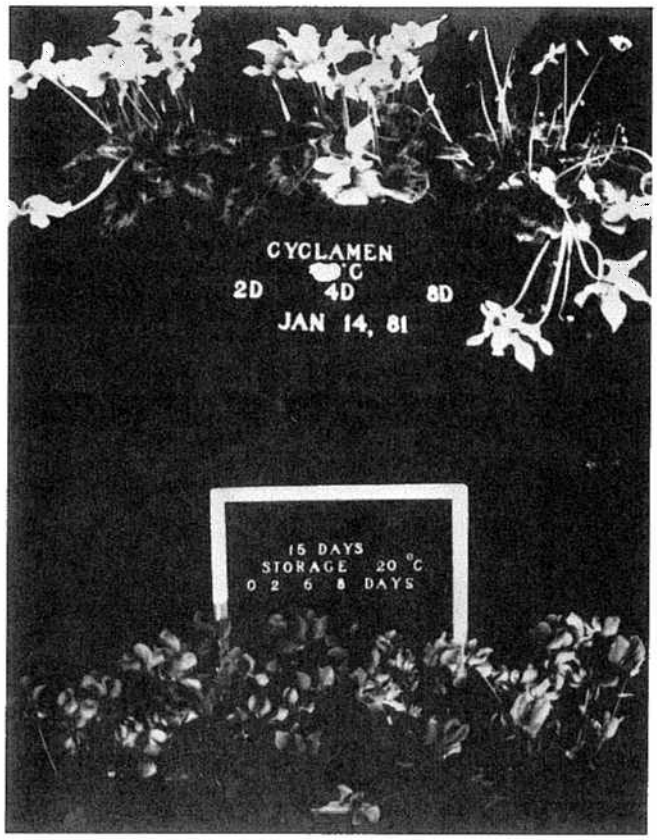

Fig. 6: Effect of simulated shipping at 20° C (68° F) for 4 days on cyclamen 15 days later. Upper, plants from CSU. Lower, plants from MSU.

Summary

The industry should give close attention to some system of standardization for flowering potted plants. Beyond statement of pot size, there is none. There is no means to decide objectively when decorative life is ended. How high, tall, large, heavy should a 4, 6, 8-inch, etc. plant be when sold as a high quality, first class, potted plant? Those of us who have had sufficient experience in the business have each formed our own opinion. An industry which has no standards of quality is severely hampered as we were in this research.

UPDATE ON STUDENTS

Joe J. Hanan

Since the initial article in CGGA Bul. 375 on location of former students, we've had several write with additional information. One commented that his father cut his pay because he didn't think his son graduated! Sorry about that!

Bill Crowley	Grower, Denver
Kevin Grueber	Univ. Minnesota, St. Paul, MN
Barney Hobbs	Fred Gleockner, Michigan
Howard Hopkins	Salesman, Canada
William Hubbard	Pan-American Plant Co.
Don Huitt	DWF, Denver
Larry Irwin	J & L Plants, Canyon, Texas
Donna Norris	Extension, Colorado
Peter Steponkus	Cornell University, Ithaca, NY
George Traeber	Consultant, Denver

Annual Report. 1980. Glasshouse Crops Research and Experiment State, Naaldwijk, The Netherlands. pp 86-87.

Measurements were carried out on the light transmission of insulated cladding in greenhouses in construction as well as in commercial ranges in which crops were growing. The results showed that the glasshouse construction, excluding the glass or other cladding material, is responsible for 19 to 24% light interception. Each heating pipe of 51 mm diameter, fitted overhead, in a 3.2 meter wide bay, takes away about 2% of the light. In plastic clad greenhouses, the measurements generally showed appreciable less light transmission than expected. The cause of this must be the condensation which adheres in large drops to the inside of the plastic cladding. The light transmission of single-glazed glasshouses was between 50 and 72%. Between 51 and 58% of the light was measured in houses clad with double polyethylmethacrylate (PMMA). In houses clad with double polyvinylchloride sheets (PVC), the light transmission was between 36 and 48%, and in double glazed houses, it was between 50 and 58%. The light transmission in a glasshouse clad with coated glass was 51%. This was 8% less than in an identical glasshouse with single glass (59% transmission).

NOTE: The southernmost part of England is about 50° North latitude, whereas Denver is located at 40°N. Holland is around 52°N. Winter days in that location will be shorter than in Denver, and longer in the summer. Also the climatic conditions during winter are commonly overcast and dark.

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