

Postharvest Effects of Dark Storage and Light Source on Keeping Quality of *Ficus benjamina* L.¹

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Abstract. *Ficus benjamina* was maintained 10 weeks in a simulated interior environment (SIE) with a controlled temperature of 21°C ± 1° under either 15 μEm⁻²sec⁻¹ photosynthetically active radiation (PAR) from Cool White fluorescent (CWF) lamps or 15 μEm⁻²sec⁻¹ (PAR) from incandescent (INC) lamps after receiving no light for various time periods (0, 4, 8 and 12 days). Plants held under CWF had a decrease in chlorophyll content and increase in leaf drop with increased days in dark. Quality as determined by leaf retention and plant grade indicated that those plants receiving 8 and 12 days dark storage and held under CWF lamps lost more leaves and were not salable after 10 weeks in SIE. Most plants held under INC lamps had no decrease in chlorophyll content, retained more leaves, and maintained good plant grade regardless of days in dark storage.

Most container grown foliage plants used for interior decoration are sealed in boxes and shipped to their destinations without light, resulting in zero net photosynthesis for several days. The foliage plant industry is concerned with the quality retention of plants both during shipment and subsequent use indoors. Acclimatization of sun-grown plants prior to interior use has been beneficial for several foliage plants (5, 6, 7). Acclimatization efforts have been directed at conditioning sun-grown plants to tolerate low irradiance indoors. Leaf drop of *Brassia actinophylla* Endl. and *F. benjamina* was less when plants were produced under low light levels and moved indoors (5). *F. benjamina* grown under a low light level (60% shade) dropped fewer leaves after 4 weeks of dark storage than those plants produced under a high light level (30% shade) (9).

Two light sources commonly used for display and maintenance of foliage plants are Cool White fluorescent (CWF) lamps and incandescent (INC) lamps. Irradiation emitted from any fluorescent tube alone does not achieve the growth responses observed with CWF + INC combination (4). Cathey et al. (4) showed that the combination of CWF + INC for 12 hr daily increased the fresh weight of 5 of the 8 plant species tested.

Production light intensity, fertilizer levels, temperature and air quality during dark storage have been shown to influence plant quality (8, 9). However, the use of different light sources after dark storage on leaf retention indoors has not been previously reported. Light source after dark storage may affect leaf retention indoors. The objective of this research

was to examine the influence of light source on the performance and appearance of *F. benjamina* after dark storage when held in a simulated interior environment.

F. benjamina explants of 15–17 cm in height were grown for 14 months in 25 cm diameter pots containing a mixture of 1 soil: 2 peat: 1 perlite (v/v/v) amended with 7 kg/m³ of dolomitic limestone and 2.4 g/liter of STEM (micronutrient source). Osmocote 14N-6.2P-11.6K was surface applied after potting and 6 months prior to dark storage using 6 g/pot and with a 240 mg N/pot per week of 20N-8.8P-16.6K. Plants were grown in the greenhouse under 703 μEm⁻²sec⁻¹ maximum light provided by polypropylene shade cloth (60% shade), temperatures were maintained at 21°C minimum to 26° maximum and watered twice each week.

A factorial experiment of 4 dark storage periods and 2 light sources in a completely randomized design was conducted in a light-temperature controlled room. There were 8 replications per treatment with one plant per pot as an experimental unit. Plant height averaged 185 cm with 700–900 leaves. Dark storage treatments (0, 4, 8 and 12 days) were initiated on August 22, 1980, and maintained at a temperature of 21° ± 1°C and a relative humidity of 50% ± 10%. The weekly soluble fertilizer was terminated 1 month before dark storage. Plants were watered thoroughly to

leach salts from the medium before storage. After leaching, the pots were placed in 3 mil polyethylene bags and sealed to prevent moisture loss during dark storage. After removal from dark storage treatments, plants were maintained in a simulated interior environment (SIE) for 10 weeks under 15 μEm⁻²sec⁻¹ (PAR) provided by thirty-two, 1.2 m 40-Watt CWF lamps/11.9 m² and 15 μEm⁻²sec⁻¹ (PAR) from thirty-two 100-Watt INC lamps/11.9 m². The incident quantum flux in the waveband of 400–700 nm (PAR) was measured with a LAMBDA LICOR LIGHT METER (Model LI-188) using a quantum sensor. A light meter reading of 15 μEm⁻²sec⁻¹ was measured weekly for each light source and maintained at plant height for 12 hr daily (0800–2000 CST). A constant temperature of 21°C ± 1° and relative humidity of 50% ± 10% were maintained. All plants were watered once a week (1 liter per pot).

Measurements were made on all plants after dark storage. Number of leaves dropped was determined weekly for the 10 week period in the SIE. Chlorophyll samples were collected from mature leaves about 20 cm from terminals. Chlorophyll determinations were made in mg/cm² following the procedures of Arnon (1). Ten weeks after plants were removed from dark storage chlorophyll content, leaf drop and plant grade were determined. Plants were graded (1 = poor, not salable; 3 = good, salable; and 5 = excellent quality).

After 10 weeks, *F. benjamina* showed a decrease in chlorophyll content when held in dark storage for 8 and 12 days under CWF lamps (Table 1). Previous research (9) has reported a decrease in chlorophyll content after 9 days of dark on *F. benjamina* grown under a high light level (30% shade) after 4 weeks in an interior environment. Chlorophyll content was greater in plants held under CWF lamps in contrast to plants receiving light from INC lamps. The higher chlorophyll content under CWF lamps did not prevent excessive leaf drop and the resultant poor plant grade. Plants held in dark storage for increasing lengths of time had increased leaf drop. Plants held under CWF lamps increased leaf drop for all dark storage periods. The overall leaf drop was much less for plants held under the INC lamps in contrast to those plants held under CWF lamps. Plants did not adapt favorably to the low light level provided by the CWF

Table 1. Influence of dark storage and light source on subsequent chlorophyll content, leaf drop and grade of *Ficus benjamina* after 10 weeks in a simulated interior environment.

Time in dark (days)	Chlorophyll (mg/cm ² × 10 ⁻²)mm ²		Leaf drop (% loss/plant)		Plant grade ^a	
	CWF lamps	INC lamps	CWF lamps	INC lamps	CWF lamps	INC lamps
0	6.1a ^b	5.3a	6.9a	6.1a	3.6a	3.6a
4	5.8ab	4.8a	18.0b	8.1a	3.2ab	3.6a
8	5.3b	4.8a	43.8c	12.0a	2.1c	3.6a
12	4.0c	4.6a	54.6d	19.2b	2.1c	3.0b
Mean	5.3A ^a	4.9B	30.8A	11.4B	2.8A	3.5B

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^a 1 = poor, not salable; 3 = good, salable; and 5 = excellent quality.

^b Mean separation, in columns (lower case), by Duncan's multiple range test, 5% level.

^c Mean separation, in rows (upper case), by Duncan's multiple range test, 5% level.

lamps. These findings are consistent with the recommendations by Cathey (3) that plants should have higher light levels under CWF lamps than an INC light source for plant maintenance. Other research (2) observed minimal leaf drop on 4 species of tropical foliage plants held 6 weeks in a SIE under about $4.5 \mu\text{Em}^{-2}\text{sec}^{-1}$ from INC lamps.

Plants receiving 8 and 12 days dark storage, then held under the CWF light source, were not salable after 10 weeks in the SIE (Table 1 and Fig. 1). Most plants held under INC source maintained good quality (Fig. 2). A light source of INC seems to provide the most effective single portion of the spectrum for maintenance of vegetative growth. For equal amounts of irradiation, the INC light source was more beneficial for leaf retention than the CWF light source. Leaf retention after dark storage was most effective under $15 \mu\text{Em}^{-2}\text{sec}^{-1}$ from INC light source. However, the primary objection to maintaining plants under INC lamps, a red light source, for long durations is the adverse effect that it has on plant morphology. When plants were grown exclusively with red light, internodal length was elongated, the leaves became thin, and branching was inhibited (3) which affected plant grade.

When foliage plants were placed under different light sources following dark storage, better plant quality resulted from INC lamps. The combination of CWF + INC after dark storage shipment may serve to aid in leaf retention and keeping quality. Further investigations on the efficiency of light sources for plant recovery and postharvest quality are needed to overcome the effects of dark storage age.

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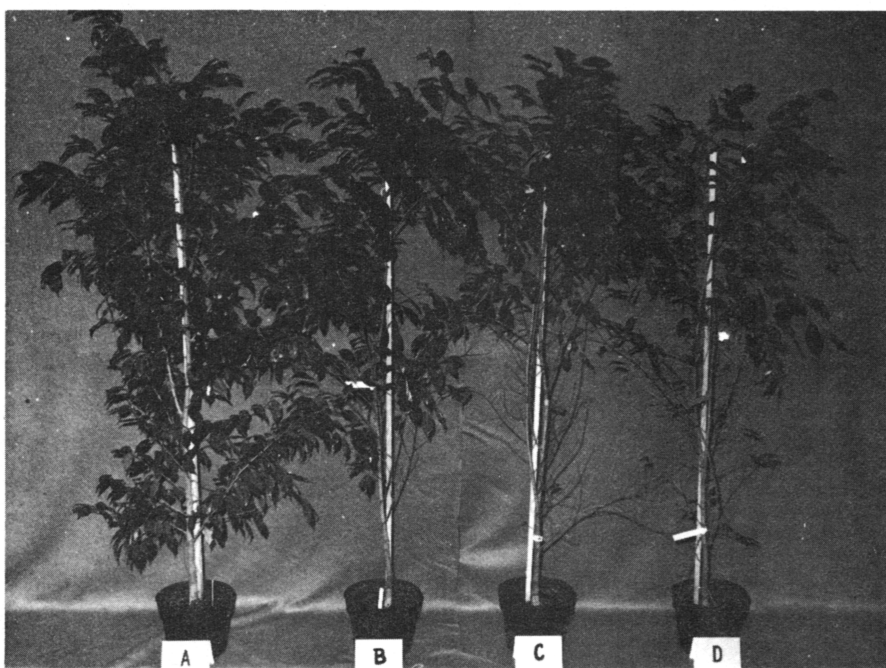


Fig. 1. Postharvest effects when plants were held in SIE 10 weeks under CWF lamps at $15 \mu\text{Em}^{-2}\text{sec}^{-1}$ (PAR) following dark storage treatments. (A) Control; (B) 4 days; (C) 8 days and (D) 12 days.



Fig. 2. Postharvest effects when plants were held in SIE 10 weeks under INC lamps at $15 \mu\text{Em}^{-2}\text{sec}^{-1}$ (PAR) following dark storage treatments. (A) Control; (B) 4 days; (C) 8 days and (D) 12 days.

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