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Postharvest Effects of Various Light Sources and Duration on Keeping Quality of *Ficus benjamina* L.[1]

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Abstract. ***Ficus benjamina*** **was held in light-and-temperature-controlled chambers for 12 weeks under 3 light sources of 20 μE m^{-2}s^{-1} incandescent (INC) lamps, 20 μE m^{-2}s^{-1} Cool White fluorescent (CWF) lamps, or 10 μE m^{-2}s^{-1} INC + 10 μE m^{-2}s^{-1} CWF light combination totaling 20 μE m^{-2}s^{-1} photosynthetically active radiation (PAR). Plants also received 4 light durations (6, 12, 18, or 24 hr/day). Growth index was greater for plants held under INC. When plants were held under the light combination, leaf drop was reduced and plant grade was improved. Dry weight and plant grade increased and leaf drop decreased when plants were lighted for 24 hr/day. Chlorophyll content decreased under the light sources in the following order: CWF> light combination >INC.**

Foliage plants must tolerate considerable stress in most interior environments. Research (5) has developed acclimatization procedures that can reduce quality loss when plants are placed indoors. Incorporation of acclimatization procedures in the production phase reduced leaf drop and improved plant quality of *F. benjamina* (6), and decreasing production light level from full sun to 47% shade decreased light compensation point and increased growth (8). However, posthandling conditions also influence keeping quality of foliage plants. Leaf and quality loss due to increasing days of simulated shipping in dark was less when *F. benjamina* was subsequently held under INC lamps compared to CWF lamps (9). Interior maintenance of growth and quality in foliage plants may depend on light duration as well as light composition. Leaf abscission of *Euphorbia pulcherrima* Willd. was reduced by increasing light intensity and light duration to 24 hr/day under interior lighting conditions (11). Other research (4, 7) has been reported on different lamp sources with major emphasis on growth parameters, but has not been directed toward leaf abscission and chlorophyll content under postharvest conditions. The objective of this study was to examine the effects of lamp sources and light duration on the postharvest keeping quality of *F. benjamina*.

Uniform liners of *F. benjamina* were grown for 7 months in 20-cm pots containing a 2 sphagnum peatmoss:1 sand (v:v) media amended with 10.1 kg/m^3 dolomite and 1.7 kg/m^3 Perk, a micronutrient source. Osmocote (14N–6.2P–11.6K) was surface-applied immediately after potting and again 3 months later at the rate of 6 g/pot. A soluble fertilizer (20N–8.8P–16.6K) was applied at the rate of 240 ppm N/pot as a weekly supplement until 1 month before the postharvest phase. Plants were grown in a greenhouse at 21°C minimum to 32° maximum under natural illumination of 830 μE m^{-2}s^{-1} (PAR) maximum light and watered once a week during cool periods and 3 times a week during warm periods.

A 3 × 4 factorial experiment in a completely randomized design was initiated Sept. 16, 1981. Treatments consisted of 3 lamp sources of 20 μE m^{-2}s^{-1} INC, 20 μE m^{-2}s^{-1} CWF, or 10 μE m^{-2}s^{-1} INC + 10 μE m^{-2}s^{-1} CWF light combination and 4 light durations of 6, 12, 18, or 24 hr/day. There were 6 replications per treatment with 1 plant/pot as an experimental unit. After production, plants were transferred to light-and-temperature-controlled chambers and were maintained for 12 weeks at 23 ± 1°C with a relative humidity of 60 ± 10%. Plants were watered once a week. A PAR level of 20 μE m^{-2}s^{-1} was provided at plant height by 100-watt INC lamps or by 40-watt CWF lamps. The light combination treatment was achieved by obtaining 10 μE m^{-2}s^{-1} from each lamp type to provide a total PAR of 20 μE m^{-2}s^{-1} at plant height. Quantum flux density in the wavelengths of 400–700 nm was measured by a LAMBDA LI-188B light meter (Li-Cor, Inc., Lincoln, Neb.) with a LI-190SB Quantum Sensor. Leaf drop was recorded weekly. Growth index (height + width/2), dry weight, and plant grade (1 = poor, 3 = good, and 5 = excellent quality) were determined at the end of the 12-week postharvest holding period. Leaf tissue taken from fully matured leaves 20 cm from stem terminals was analyzed for chlorophyll content by Arnon's (1)

Table 1. Postharvest effects of light source and duration on quality of *Ficus benjamina* held in light-and-temperature-controlled rooms for 12 weeks.

Treatment	Growth index[z] (cm)	Dry wt (g)	Leaf drop (no./plant)	Plant grade rating[y]
Light system				
INC	79.2a[x]	101.8a	54.8a	3.2b
CWF	75.0b	102.6a	61.8a	3.1b
INC + CWF	75.5b	107.7a	42.4b	3.7a
Light duration				
6 hr/day	77.8a	99.6b	74.4a	2.7c
12 hr/day	76.2a	100.8b	54.2b	3.3b
18 hr/day	75.6a	103.8b	58.8b	3.4b
24 hr/day	76.6a	112.0a	24.6c	3.9a

[z]Plant height + plant width/2.
[y]1 = poor, 3 = good, and 5 = excellent quality.
[x]Mean separation within columns within treatment groups by Duncan's multiple range test, 5% level.

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Table 2. Postharvest effects of light source and duration on chlorophyll content of *Ficus benjamina* held in light-and-temperature-controlled rooms for 12 weeks.

Treatment	Chlorophyll content (mg/cm² × 10⁻²)			
	Wk 1	Wk 4	Wk 8	Wk 12
Light system				
INC	4.2a[z]	3.7b	3.9c	3.9c
CWF	4.6a	5.2a	5.6a	6.1a
INC + CWF	4.1a	3.9b	4.4b	4.8b
Light duration				
6 hr/day	4.2a	4.3a	4.4a	4.8a
12 hr/day	4.3a	4.3a	4.5a	4.9a
18 hr/day	4.3a	4.2a	4.6a	5.0a
24 hr/day	4.4a	4.2a	5.0a	5.0a

[z]Mean separation within columns within treatment groups by Duncan's multiple range test, 5% level.

method after weeks 1, 4, 8, and 12 during the postharvest phase.

After 12 weeks indoors, the growth index was increased only when plants were held under INC lamps (Table 1). Dry weight was not influenced by light source but was increased when plants were lighted for 24 hr/day. Plants lighted for 24 hr/day had the least leaf drop, while plants lighted for 6 hr/day had the greatest leaf drop. Plant grade was highest under 24 hr/day light duration and was lowest under 6 hr/day. Plants maintained under the light combination decreased in leaf drop and increased in plant grade. Leaf drop was concentrated in the lower portion of the canopy when plants were held under CWF lamps, probably due to less light penetration downward, since only about 10% of the available light was transmitted to the plant midpoint. Plants under INC lamps lost leaves evenly throughout the canopy since as much as 25% of the light reached the plant midpoint. Other research (10) had reported a high level of transmittance of infrared and far-red radiation through leaves, while only about 10% of incident infrared-free white light was transmitted through the average green leaf. Plants held under the light combination retained foliage better than plants held under either single lamp source and retained more foliage in the lower portion of the plant than CWF alone. New internodes produced under INC lamps were elongated, similar to growth patterns found by others (3) in plants held under INC compared to other lamp sources with a lower red to far-red ratio. Increased light duration improved quality of *F. benjamina* under 20 $\mu E\ m^{-2}s^{-1}$. Other research (11) has shown improved plant performance of *E. pulcherrima* with increased total radiation provided by increased duration or light level.

Chlorophyll content was unaffected by the light source treatments after 1 week in the simulated interior environment (Table 2). Plants held under CWF lamps had the greatest chlorophyll content when sampled after 4 weeks, while content in plants sampled after 8 or 12 weeks decreased under light treatments in the following order: CWF > light combination > INC. Chlorophyll content was unaffected by light duration. Brown et al. (2) found increased Fe^{+3} reduction to Fe^{+2}, important in chlorophyll synthesis, under CWF lamps compared to low-pressure sodium (LPS) lamps containing no radiation below 550 nm. Chlorophyll content in lettuce and cotton was also greater under CWF lamps than under LPS (2). The spectral composition of CWF lamps may have improved production of chlorophyll in this experiment with *F. benjamina*.

The results of this study indicate that a light source composed of 50% INC/50% CWF will improve quality of *F. benjamina* by reducing leaf drop, preventing excessive elongated growth, and providing an adequate chlorophyll level for good foliage color. Under a low level of 20 $\mu E\ m^{-2}s^{-1}$, 24 hr/day light duration reduces leaf drop and increases quality retention.

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Light-induced Basal Branching of *Dracaena marginata*[1]

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Abstract. **Dracaena marginata Lam., grown continuously in full sun, produced an average of 4.3 basal branches per plant, while plants grown under 50% shade produced no basal branches. Acclimatized plants with a maximum number of shoots can be produced in 20-liter containers in 12 months by growing in full sun for 9 months to induce basal branching followed by 3 months in 50% shade for acclimatization.**

Dracaena marginata is grown in large quantities as an interiorscape plant by the foliage plant industry. Since flowering rarely occurs, all commercial propagation is vegetative. Container production of large plants has traditionally involved planting 3 or more rooted terminal cuttings in a large container and growing them under reduced irradiance for 12–18 months. The rooted cuttings often represent the greatest production cost of the plants, while the final value of the finished product depends on the number of canes per pot. Preliminary work indicated a difference in the growth habit of *D. marginata* grown in full sun vs. 50% shade. Basal branching rarely occurred in shade-grown

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