# A Comparison of Light Acclimatization Methods for Reduction of Interior Leaf Drop in *Ficus* spp.[1]

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## Abstract

Two acclimatization methods at 5 light intensities were investigated for indoor maintenance of *Ficus benjamina* and *F. stricta*. Plants were either grown at 5 production shade levels of full-sun (1685 $\mu Em^{-2}s^{-1}$) to 80% shade (340 $\mu Em^{-2}s^{-1}$) for 8 wks then placed directly into a simulated interior environment for 12 wks, or were grown in full-sun for 8 wks then acclimatized for 6 wks at 5 post-production shade levels prior to placement indoors. Photosynthetically active radiation (PAR) in the interior was set at 10.5 $\mu Em^{-2}s^{-1}$ (78 ft-c). For *F. benjamina*, the full-sun treatment caused the highest degree of defoliation and as production or post-production shade level increased, defoliation decreased. *F. stricta* showed similar effects under post-production shade, but under production shade levels there was a poor correlation between percent shade and leaf drop. There appeared to be two or three periods of leaf drop after placement indoors as opposed to a constant rate of defoliation.

**Index words:** *Ficus benjamina, F. stricta*, fig, interior environment, abscission

## Introduction

Light acclimatization is the process required to cause morphological and physiological changes enabling plants to withstand low light environments (11). Recent findings have shown that light acclimatization of foliage plants prior to placement indoors improves their survival and quality (3, 5).

Workers have investigated the effects of light acclimatization on foliage plants (2, 3, 4, 5, 6, 7, 8, 9, 10), often with conflicting results. In studies of the light acclimatization potential of *Ficus benjamina* L., Fails *et al.* (6) noted a net increase in leaf numbers after 12 weeks in an interior environment for both full-sun grown and shade-grown acclimatized plants. This contrasted sharply with the findings of Conover and Poole (3, 4), who reported significantly greater leaf drop for sun compared to shade-grown *F. benjamina* plants. The objective of this study was to compare the effectiveness of two acclimatization methods in reducing leaf drop after placement in a simulated interior environment.

## Materials and Methods

Rooted cuttings of *F. benjamina* L. and *F. stricta* Miguel were potted in 3.8 liter (#1) containers of peat:perlite (1:1 by vol), amended with 0.36 $kg/m^3$ (0.35 $oz/ft^3$) dolomitic limestone, 33.86 $g/m^3$ (0.33 oz/10 $ft^3$) $FeSO_4$, 0.35 $kg/m^3$ (0.35 $oz/ft^3$) gypsum, and 0.66 $g/m^3$ (0.07 oz/100 $ft^3$) fritted trace elements (1). Plants were placed in a greenhouse under the various shade treatments in a randomized block design with 5 replications per treatment. Plants were irrigated as needed with 300 ppm N: 132 ppm P: 264 ppm K throughout production, with pots leached weekly.

The two methods tested were 1) production under various shade levels prior to placement in the interior environment, and 2) production in full sun followed by an 8 wk acclimatization period under various post-production shade levels prior to placement in the interior environment.

*Production shade levels:* Plants were grown for 8 wks (May 26 to July 27) under 5 light attenuation levels (measured at 2 pm on a cloudless day using a Li-Cor® Solar Monitor LI-1776 with an attached pyranometer sensor and calconnector): 0% shade (full sun) = 1685 $\mu Em^{-2}s^{-1}$ (8610 ft-c); 20% shade = 1340 $\mu Em^{-2}s^{-1}$ (6847 ft-c); 40% shade = 1015 $\mu Em^{-2}s^{-1}$ (5187 ft-c); 60% shade = 670 $\mu Em^{-2}s^{-1}$ (3424 ft-c); and 80% shade = 340 $\mu Em^{-2}s^{-1}$ (1737 ft-c). The shade levels were obtained by using multiple layers of neutral (white) shade cloth.

*Post-production shade levels:* Plants were grown in 0% shade (full-sun) at 1685 $\mu Em^{-2}s^{-1}$ (8610 ft-c) for 8 wks (May 26 to July 27), followed by a 6-wk post-production acclimatization period at the 20–80% shade levels.

After the shade treatments, the plants were moved into a 3.05 × 3.66 m (10 × 12 ft) simulated interior environment for 12 wks. Leaf drop was recorded weekly and expressed as percent defoliation of the original number of leaves present at the start of placement indoors. Photosynthetically active radiation (PAR) was 10.5 $\mu Em^{-2}s^{-1}$ (78 ft-c) at plant height provided by 4 Westinghouse cool-white fluorescent bulbs for a 12 hour photoperiod (6 a.m.–6 p.m.). Temperature was maintained at 25°C ± 2°C (77°F ± 3°F). Plants were fertilized weekly with 200 ppm N: 88 ppm P: 132 ppm K incorporated into the irrigation water, and pots were leached monthly.

## Results and Discussion

*Production shade level treatments: F. benjamina* produced under shade exhibited a lower percent defoliation at the end of 12 wks than those grown under full-sun (Fig. 1). However, percent defoliation and percent shade were poorly correlated ($r^2$ = 0.07) for *F. stricta* (Fig. 1). *F. stricta* plants produced under 20% shade (1340 $\mu Em^{-2}s^{-1}$) had the lowest percent defoliation, whereas plants produced un-

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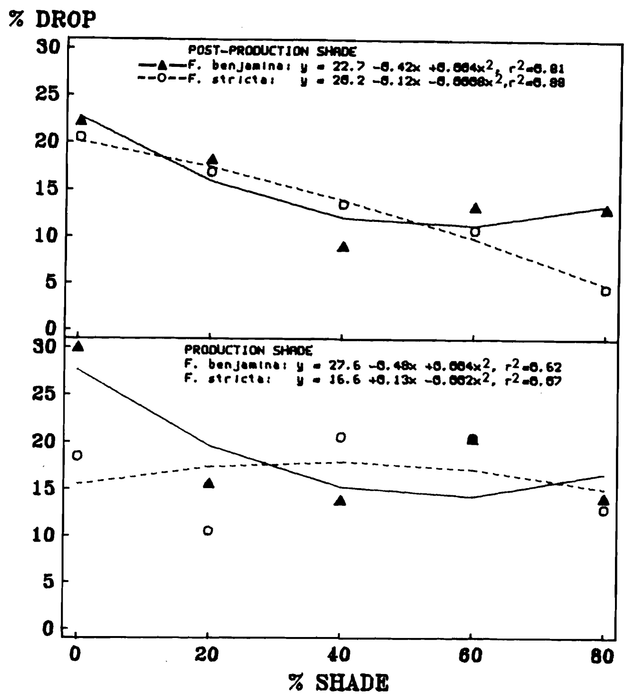


Fig. 1. **Cumulative percent leaf drop of *F. benjamina* and *F. stricta* grown at 5 light intensities under production or post-production scheduling, followed by placement in the interior.**

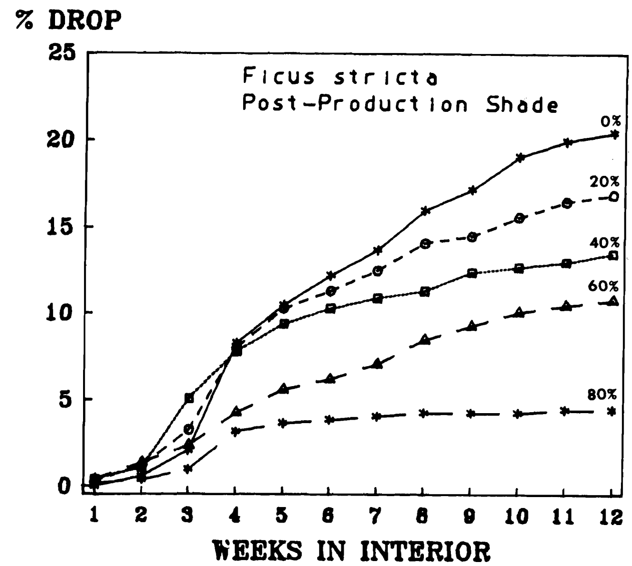


Fig. 2. **Cumulative percent defoliation of *F. stricta* grown for 8 wks under full sun, placed under 0–80% shade for 6 wks, then moved into an interior environment for 12 wks.**

der 40 and 60% shade (1015 $\mu Em^{-2}s^{-1}$ and 670 $\mu Em^{-2}s^{-1}$) had the highest percent defoliation, and sun-grown *F. stricta* had 18.5% defoliation.

*Post-production shade level treatments:* Both *F. benjamina* (Fig. 1) and *F. stricta* (Fig. 1, 2) exhibited consistently decreased defoliation at the end of 12 wks with increasing shade levels.

Both methods of acclimatization reduced defoliation of *F. benjamina* indoors as compared with full sun-grown plants. These findings are in general agreement with Conover and Poole (3, 4) who reported *F. benjamina* acclimatized under 40 or 80% shade (75.3 and 26.9 klx) were of much higher quality after 10 wks in the interior than plants receiving no acclimatization. However, our results differ from those of Fails *et al.* (6) who reported no visual signs of deterioration between full sun and shade grown plants after 12 wks in an interior environment of 20 $\mu Em^{-2}s^{-1}$ and a 16 hour photoperiod. The lack of differentiation between full-sun and shade-grown plants in the Fails *et al.* (6) study may have been due to either the relatively high light intensity in the interior environment (20 $\mu Em^{-2}s^{-1}$ for 16 hr) and/or the relatively low light intensity of the sun-grown plants which were grown during the winter months in Virginia.

The present study demonstrated that leaf drop can be managed by reduction of light levels during both production and post-production of *F. benjamina.* Sun-grown *F. stricta* and *F. benjamina* consistently exhibited greater defoliation than plants receiving various levels of shade. In general, defoliation steadily decreased when plants were grown at increasing shade levels (Figs. 1 and 2).

The effects of acclimatization did not become apparent until about the 4th to 5th week of the interior treatment (Fig. 2). The rate of defoliation in both species appeared to occur in 2 or 3 phases (Fig. 3). Defoliation during the first 4 wks was rapid in all treatments as indicated by the slopes of the lines. A period of lesser defoliation occurred, followed by a second period of increased defoliation between the 7th and 9th wk. Leaf drop during this period was not as rapid as in the first period. In some treatments, a third period of slightly increased defoliation may have occurred at 10–12 wks. These results may suggest a cyclic mechanism or more than one mechanism causing leaf drop; one mechanism that has an initial rapid phase, and a second or third characterized by a later and less rapid phase. It was during these later phases of defoliation that the effects of acclimatization became most apparent. Plants grown in full sun continued to exhibit a rapid rate of defoliation, whereas the peaks in rate of defoliation by acclimatized plants began to decrease.

In subsequent studies (Neary, B. C. and D. W. Reed, unpub. data), two periods of leaf drop were observed in *F. benjamina* acclimatized at different post-production shade levels, but not when grown under different shade levels. The possibility of 2 or 3 periods and mechanisms of leaf drop warrants further study.

## Significance to the Nursery Industry

These findings indicate that growers may reduce or avoid interior defoliation of *F. benjamina* by using higher shade levels during production or post-production. *F. stricta* reacted similarly with the post-production shade method, but under production shade levels, defoliation was highest under the greatest shade. The data did not reveal an optimum shade level or cut-off value that can be recommended to minimize defoliation, rather decreased defoliation generally occurred at increasing shade levels. Both methods tested yielded comparable results with neither being superior nor minimizing defoliation; however, the post-production shade method tended to give more consistent results.

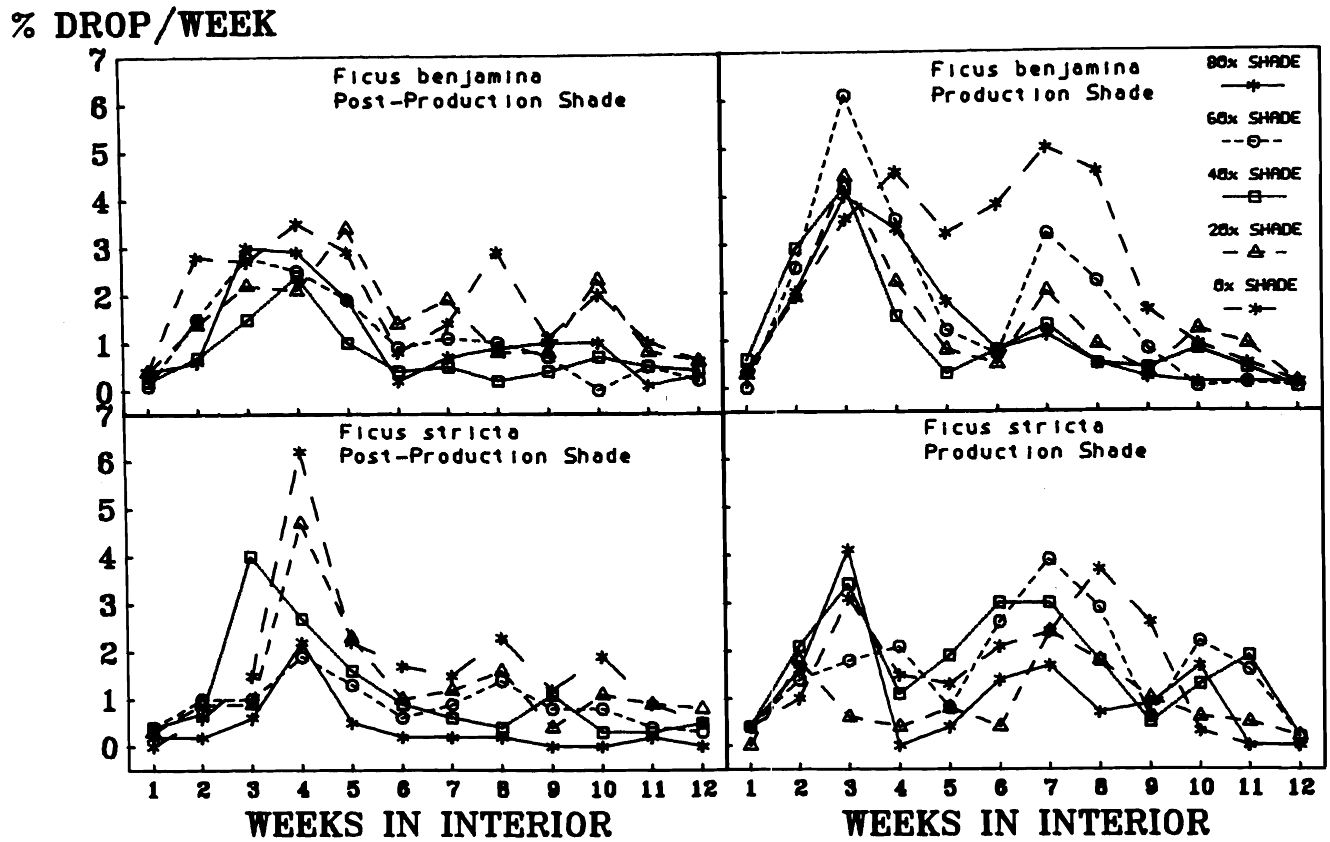


**Fig. 3. Percent defoliation per week of *F. benjamina* and *F. stricta* plants grown at 5 light intensities during production or post-production and placed in an interior environment.**

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