The Postproduction Guide For Care And Handling Of Foliage Plants For Interiors

INTRODUCTION

The useful lifespan of a foliage plant can be broken down into four phases. **Production** is by growers, including such specialities as tissue culture laboratories, plant propagators, and plant finishers.

T. M. Blessington

Postproduction storage is carried out by shippers and wholesalers. Interior plantscapers, florists, garden centers, and mass market distributors are responsible for the **retail handling** of plants. The final phase is called **consumer care**, where interior keeping quality is determined by the practices of the consumer alone or by a plant maintenance company. These phases are significantly distinct by function and chronological order within the plant's lifespan; but, they are not independent of each other. The keeping quality of a plant is determined not only by the conditions encountered during any one phase, but is influenced at any one point in time by the interactions of the present phase with all proceeding ones. Decisions made within each phase affects potentials for success in the other phases.

Pamela C. Collins

PRODUCTION FACTORS

The production phase includes propagation and growth of the plant to a finished, saleable condition. Healthy, high quality plants at this point are not only an attractive commodity, but they also maintain quality better throughout the stresses of storage, transport, and placement indoors. Production factors that influence interior keeping quality of a foliage plant are light, temperature, nutrition, water, medium, problems of disease or pests, and cultural disorders.

Light—Recommendations for production light levels are determined by genetic composition of the species and by interior light conditions to which the plant must adjust. Some species are naturally adapted to heavy shade of forest floors and perform well under low light levels. Other species require high light levels to grow properly and are seldom used in interior settings unless sufficient direct sunlight is available. A third group of plants can adapt to reduced light if they are produced or acclimatized under specific light levels. As production light level is decreased, these plants become increasingly tolerant to marginal lighting. Physical changes such as growth habit, leaf size, leaf color, and trunk caliper usually accompany the acclimatization process. These changes may or may not be desirable to the producer or designer/retailer. If major changes in growth habit are not acceptable, some plants can be produced under high light levels and then placed under shaded conditions until the foliage is fully acclimatized. This process may take six weeks to six months or even longer, depending on species and size of specimen. Even then, these converted plants are not as fully conditioned to low light situations as those produced entirely under shade (1).

Temperature—Plant species chosen for use in interiors are mostly tropical plants, although a few subtropical and temperate climate plants also perform well indoors. Therefore, most recommended greenhouse minimum temperatures range from 60-70°F (16-21°C) to assure constant, uniform growth rates. Ability to sustain short periods of cool, non-freezing temperatures without chilling injury varies considerably by species. Likewise, ability to tolerate high temperatures without damage or reduction in growth rate is quite variable. Careful selection of temperature tolerant crop species can be important where economy in fuel consumption or lack of heat control is a major consideration. The acclimatization process itself is only minimally affected by production temperature (2,3).

Nutrition—Fertilization during the production phase definitely influences interior keeping quality of foliage plants. Overfertilization decreases acclimatization effectiveness indoors, either by increasing respiration rate or by root damage from high soluble salts. Low levels of nutrition reduce plant growth and quality. The most efficient fertilizer rate and ratio depends on many factors. Extreme pH imbalances in potting media block availability of essential elements. Where clay-containing soil is used in a potting medium, a 1:1:1 fertilizer ratio is recommended to assure adequate availability of phosphorus and potassium. In soilless media, a 3:1:2 ratio is suggested to decrease soluble salt levels and costs of fertilizer components. Most potting media require the addition of micronutrients. Most recent research reports recommend the omission of superphosphate completely from the growing medium, as foliage plants do not show a specific need for the amendment. In fact, several genera of important foliage plants are sensitive to fluoride present in superphosphate. Fertilizer rates also depend on production light levels. Recommended fertilizer and light levels are based on a balance of good growth and acclimatization needs. Plants produced under high light levels may require increased fertilizer rates, while plants produced under heavy shade will need less fertilization to maintain a balanced growth. In addition, temperature affects fertilizer application decisions. Less fertilizer is needed during the cool seasons, and more fertilizer is required during warmer times of the year due to difference in growth rates. Temperature levels similarly affect the release rate of encapsulated fertilizers. Where heavy rainfall or overhead irrigation is a frequent occurrence, upward adjustment in fertilizer application must be considered (1).

Thomas M. Blessington
Pamela C. Collins
Texas A&M University,
Agricultural Research and Extension Center,
2415 East Highway 83,
Weslaco, TX 78596

Water—Perhaps the best general recommendation for irrigation practices is to avoid extremes. Plants experience stress when watered either too much or too little. Frequent irrigations stimulate fragile succulence, and excessive water retention in the medium reduces root growth and resistance to soil-borne diseases. Insufficient water or excessive drying of the medium between waterings reduce growth and stimulate leaf abscission. Most plants maintain good growth and quality when irrigation schedules allow slight drying between thorough waterings. A few species require special considerations due to environmental adaptations to climates with high humidity and constant moisture or to climates with low humidity and dry soils.

Media—Water retention, cation exchange capabilities, and drainage characteristics of potting media all contribute to health, growth, and keeping quality of foliage plants. Many medium components are now used such as bark, peat, sand, vermiculite, perlite, styrofoam, cypress shavings, and even clay soil. Mixtures of various components are designed for the special needs of a species and in response to the economics of component availability and transport costs. Soluble salts, fluoride levels, and any other suspected elemental imbalance should be checked in all medium components before incorporation into the finished mix. Most foliage plants require a pH adjustment of 5.5-6.5 to grow well. Potting media usually require micronutrient amendments as discussed under nutrition. Careful attention to the medium preparation before planting may avoid costly cultural disorders caused by deficiencies, toxicities, and poor root development (1).

Problems—All foliage plants show susceptibility to some disease or pest, although considerable variability exists among species. Good cultural technique, consistent sanitation practices, and careful observation may reduce the need for heavy chemical control applications. Where chemical use is mandated, test a block of plants with the selected pesticide for symptoms of toxicity or for undesirable deposits on the foliage. Good disease and pest control during production not only provides a quality plant for sale, but improves the probability that quality will be maintained during shipping. The crowded, enclosed environment imposed on plants during transit and storage is not only detrimental to an infested plant, but increases the likelihood of spreading problems to healthy plants and compounding economic losses.

Disorders—Some plant disfigurements are not caused by attacking organisms, but by physiological responses to internal imbalances or environmental conditions. Susceptibility to injury varies considerably. Most ferns develop phytotoxic responses to a broad spectrum of pesticides, limiting the use of chemicals in their production. Several important genera of foliage plants are sensitive to fluoride or boron in either potting media, atmosphere, or water. Palms can display poor, stunted growth when deficient in manganese, iron, or zinc. Production under light levels exceeding recommendations produces bleached, light-green foliage color in some plants, while too much shade destroys normal varigation patterns and stimulates weak, elongated growth. Chilling injury is a major problem in several species. The final result of such disorders is economic loss of unsalable, poor quality plants. These plants hurt all of the foliage plant industry because they do not ship or store well, and they require extra regrowth time and maintenance attention in interior locations.

POSTPRODUCTION FACTORS

The postproduction phase exists from the time that plants leave production ranges in shippers' vehicles and are possibly warehoused by wholesalers until they reach retail locations. The prime goal for shippers and wholesalers is to deliver plants with minimum deterioration in quality. Factors that affect keeping quality of plants during this period of shipping and storage are storage light, temperature, exposure to gasses, lasting qualities during storage, and care and grooming of the plants prior to packing.

Light—Transport under dark conditions is currently the most practical method of shipment. When plants travel a long distance, a recovery period is sometimes necessary to recoup quality lost during the extended period of stress. In addition, wholesalers sometimes need to hold a shipment of plants for a time before distribution. Specially equipped greenhouses or environmental rooms are ideal places for plant holding. Recommended light levels for these locations at 500 to 1,000 fc (5.4 to 10.8 klx). Temperature, irrigation, and relative humidity should approximate normal levels found indoors to retain acclimatization conditioning (4).

Temperature—Shipping temperature specifications have changed considerably with the development of guidelines for extended overseas transit. For many foliage plants, shipping durations can be increased when temperatures are reduced to levels that slow down physiological processes but do not cause chilling injury. Recommendations for some plants are very specific for different storage durations, depending on sensitivity to injury over a long period of time. Where the new long-term guidelines are not available, existing recommendations are given (4).

Gases—Ethylene is the gas most frequently generated by plant material during transit; however, foliage plants are not particularly heavy producers. Avoid mixed shipments with fruits or vegetables, which release significant amounts during the ripening process. Plant damage is generally not a problem with storage below 65°F (18°C), as gas evolution and activity is inhibited by low temperature. Ethylene at levels greater than 1 to 2 ppm may cause damage if plants are held in storage for a long time above 65°F (18°C) (4,5).

Lasting qualities—Stress avoidance is the key to plant keeping quality during shipping and storage. Best quality retention is obtained with the shortest transit time. Most prepared and packaged plants tolerate 7 days of travel without significant quality loss. Ability to survive longer durations depends on the species and shipping conditions. Some plants can be shipped up to 4 weeks without significant deterioration when held under carefully controlled conditions of temperature, relative humidity, and moisture. Keeping

quality is also influenced by conditions encountered during the production phase. Plants produced within recommended ranges of light and fertilizer ship better than unacclimatized material. Winter- or spring-produced plants tolerate lower shipping temperatures than summer-grown stock (4).

Care and Grooming—Keeping quality during the postproduction phase may be improved if plants are well prepared and packaged before shipment. Fertilization should be discontinued at least a week prior to shipping, especially when slow-release forms are used. Loose granules shift during handling and fall between the soil ball and container. Schedule the final irrigation so that the potting medium is moist, or approximately 50% of capacity. Extremely wet or dry medium conditions are detrimental to plant health during the storage period. Development of diseases may be reduced if the foliage is dry during storage. When wet foliage is unavoidable at packing time, lower shipping temperatures may help retard disease development. The shipping industry has developed advanced equipment and handling procedures designed to move delicate, perishable items such as plants. Growers may improve protection of their commodity by using moisture-resistant boxes or specially developed shipping racks. Large specimens may be protected with sleeves that envelop the canopy and are closed at the top. Maintenance of high relative humidity levels of 80 to 90% reduce desiccation during storage time. These levels may be achieved by boxing or by placing the reefer (refrigerated van) air controller in the closed position. The objectives of such careful packing procedures are to avoid physical breakage and reduce desiccation during shipment (4).

RETAIL HANDLING

The retail phase begins with delivery by shipper or wholesaler and continues until sale to the consumer or installation into a permanent interior location. Retailers may be interior plantscapers, florists, garden centers, or mass market businesses. Shipping durations and provisions for poststorage care determine the condition of foliage plants upon delivery. Length of stay of inventories depends largely on the nature of the business. Regardless, basic plant care is based on environmental demands of an interior location.

Light—Plants may require a recouperative period upon arrival, and the ideal location is in a holding greenhouse or room with light levels of 500 to 1,000 fc (5.4 - 10.8 klx). Temperature, irrigation, and relative humidity should approximate normal levels found indoors to retain acclimatization conditioning. Where such facilities are not available, provide at least the minimum sustaining light levels given under each plant listing. Plants held under less than minimum light will be unable to maintain quality for very long (4).

Temperature—Most tropical foliage plants maintain good quality with temperature and relative humidity levels that are comfortable for humans. A few subtropical and temperate climate species have special preferences for somewhat cooler night temperatures or higher humidities.

Water—Foliage plants usually perform best indoors when the potting medium is moist, but well-drained. Extremely wet or dry medium conditions stress plants and cause loss in quality. A few species require special moisture recommendations based on adaptations to native climates of high moisture and humidity or of low moisture and dry soils.

Disorders—The major problems with foliage plants at this stage are due to stress from shipping and storage. Most are temporary and correct themselves with a little recouperation time in a holding greenhouse or room. More severe losses are incurred when latent diseases or disorders from the production and postproduction phases are passed on to the retailer.

CONSUMER CARE

The useful lifespan of a foliage plant within its permanent interior location depends largely on the successful matching of a plant to the environmental conditions of a space and on the care provided by either the consumer or maintenance service. Any latent problems brought from earlier phases will reduce keeping quality under interior environmental stress and increase the effort necessary to maintain an acceptable appearance. Factors that affect the keeping quality of foliage plants after interior installation are temperature, location, watering practices, grooming, disorders, and cultivar selection.

Temperature—Most tropical foliage plants maintain good quality with temperature and relative humidity levels that are comfortable for humans. A few subtropical and temperate climate species have special preferences for somewhat cooler night temperatures or high humidities.

Location—Successful installations occur when plant selections are matched carefully with interior locations. Some locations have severe environmental limitations, where plant choices are few in number. The limiting factor is usually light, or rather the lack of light. Plants with natural or acclimatized adaptation to low light levels are the most successful in these circumstances. Ability to tolerate minimum light levels varies even within this group. Changes in growth habit may be expected in time as plants adjust to the location. Under marginal conditions, durability and lifespan are significantly altered. Keeping quality potential improves where light can be increased. As lighting conditions approach the natural range of a plant, growth and quality reach peak capabilities. At this level, maintenance becomes a matter of keeping growth in bounds rather than an effort to retard senescence. Variety in species and cultivar selections also increases as lighting approaches moderate levels. In locations that have direct sunlight, marginal interior plant selections requiring high levels may be used with good keeping expectations. Specific guide recommendations list both optimum light ranges and minimum/maximum tolerances where the information is known.

Water—Foliage plants usually perform best indoors when the potting medium is moist, but well-drained. Extremely wet or dry medium conditions stress plants and cause loss in quality. A few species require special moisture recommendations based on adaptations to native climates of high moisture and humidity or of low moisture and dry soils.

Grooming—Under most interior conditions, maintenance efforts to preserve existing quality levels is required more often than growth control maintenance. Plants are not static objects, and therefore growth and/or decline is inevitable. Specific recommendations attempt to identify expected trimming and repotting needs. Less fertilization is necessary under interior conditions. Specific recommendations are listed where known.

Disorders—Weak, damaged, or diseased plants will not survive long if placed indoors. Healthy, high quality plant material is better able to resist the stresses of suboptimal interior conditions. Problems that develop after placement indoors most often are caused by low light, low humidity, drafty locations, or air pollutants. Poor maintenance contributes to quality loss when plants are overwatered, underwatered, undusted, poorly fertilized, and otherwise neglected. Stressed plants are more susceptible to attack by pests and diseases. Considerable variability exists between different foliage plant species.

Cultivars—The foliage plant industry has a wide range of species to provide variety in texture, color, size, and cultural adaptability. In addition, numerous cultivars are available that have marketable attributes such as increased foliage color, interesting variegation, or growth habit, disease or pest resistance, or improved ability to tolerate specific interior conditions. Plant introduction or breeding programs and tissue culture laboratories are continually adding new cultivars to the market. Each new cultivar should be thoroughly tested to develop guidelines that produce a high quality plant with good interior keeping capabilities. All available cultivars cannot be discussed within this current guide, but where possible, commercially available related species and cultivars of the listed plants are briefly described.

SOURCES OF INFORMATION

1. Conover, C. A. and R. T. Poole. 1984. Light and fertilizer recommendations for production of acclimatized potted foliage plants. Foliage Digest 7(8):1-6.
2. McConnell, D. B., R. W. Henley, and R. L. Biamonte. 1981. Commercial foliage plants, p. 544-593. In: J. N. Joiner (ed.). Foliage plant production. Prentice-Hall, Inc., Englewood Cliffs, N. J.
3. Conover, C. A. and R. T. Poole. 1984. Acclimatization of indoor foliage plants. Horticultural Reviews 6:119-154.
4. Conover, C. A. and R. T. Poole. 1986. Factors influencing shipping of acclimatized foliage plants. ARC-Apopka Research Rpt. RH-86-11. Univ. of Florida.
5. Conover, C. A. and R. T. Poole. 1983. Handling and overseas transportation of acclimatized foliage plants in reefers. Foliage Digest 6(5):3-4.

Canadian Floriculture Imports Into The United States

As a way of introduction, allow me to relate a little about our firm. We grow in excess of 40 acres of holiday blooming plants and azaleas on eastern Long Island. Most of the production is under glass with some plastic. The operation is spread through five locations. Additionally, we have 12 acres of production of glass and saran on the west coast of Florida.

Russell Weiss

We are located directly in the middle of the region serviced by Ontario, Canada growers; an area north and south from Boston, Massachusetts to Virginia and as far west as Chicago. We have competed with the Canadians for the last 20 years in varying degrees. Speaking for myself, and I am sure for most growers in the northeastern United States, I wish that Niagara Falls were a lot higher, wider, and deeper. To say that the Canadians are good trading partners, and that we have opportunity here in the northeast to do business in both directions with them, would be a complete fabrication. Our 20 year association with the Canadians has been totally one sided with the United States in many cases being a dumping ground.

Russell Weiss
Kurt Weiss Florist, Inc.
95 Main Street
Center Moriches, NY 11934

I think it is important to understand why Canadians have been so successful with their products in the United States in the past, what the situation is at present, and what we can do in the future. **If we as growers bemoan the fact that the Canadians have unfair advantages and look for U. S. government intervention and protection, we will be out of business.** Nothing has come from our government in the way of assistance in the last 20 years, and it is not likely to come in the next 20 years. Canadian floricultural imports are a very small part of the trade between the United States and Canada. As a nation as a whole, the United States probably ships more merchandise to Canada than we receive. Agricultural products, and specifically floricultural products, are allowed into the United States free of duty or at very low rates in order to appease our foreign trading partners. This system of relegating agriculture to a secondary position in our society has been going on for a very long time, and will not likely change in the future.

Historically, however, Canadian products would not have come into the United States at any price were there not a need. As the floriculture industry in the United States grew, America growers did not fill the gap. Canadian growers **were** there, in the past, with acceptable quality at good prices. I, however, emphasize **was** there, with good and many times better quality. Later I will go into what exists at present and what I believe the future could hold.

In the past, Canadians were better growers than their U. S. counterparts. Along with being better growers goes being better businessmen, better marketers, better packagers, and better shippers. Canadian exports from Ontario to the United States have