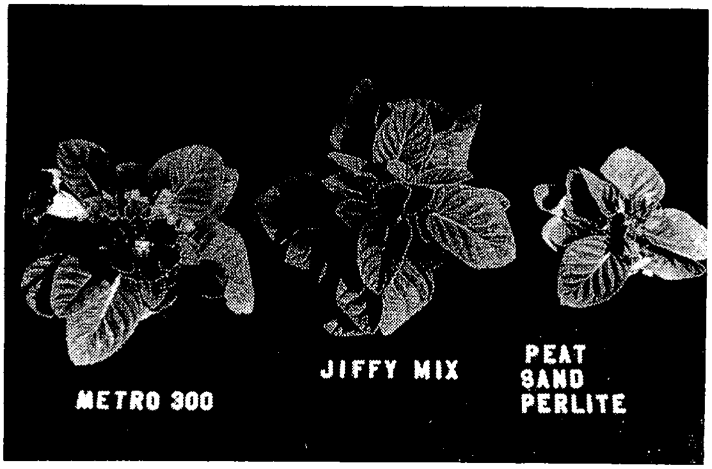

Fig. 1. The effect of three growing media on the growth and flowering of gloxinia cv. 'Red Velvet'. Jiffy Mix produced largest plants. Peat:sand:perlite (1:1:1) resulted in smaller plants, and light green color of leaves.

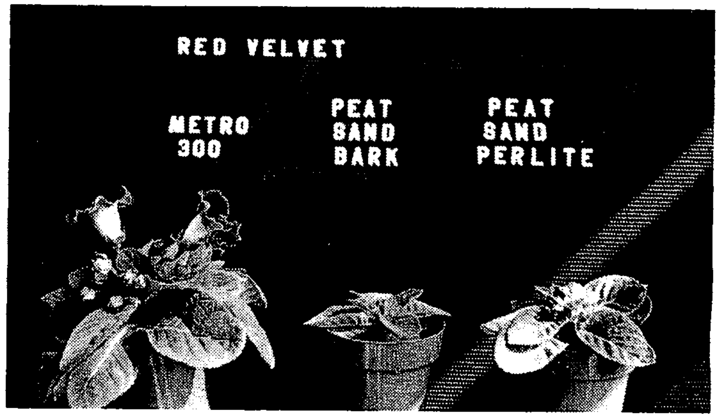

Fig. 2. The effect of three growing media on the growth and flowering of gloxinia cv. 'Red Velvet'. Metro Mix produced the best specimen. Peat:sand:bark (1:1:1) resulted in smallest plants, delayed flowering and caused extreme yellowing of leaves. Peat:sand and perlie (1:1:1) resulted in smaller plants and greenish yellow leaves.

with a water holding capacity of 80% appear to be ideal for gloxinia, whereas, a water holding capacity of less than 50% had an adverse effect on plant growth. The peat:sand: bark mixture was found to be high in total soluble salts.

The number of days to flowering was also affected by the media. When water holding capacity of the medium was less than 40% (Table 1) there was a significant increase in the number of days to flower. Plants grown in peat: sand: bark flowered almost 3 weeks later than plants growing in other media.

This experiment indicates that there is a great deal of growth variability on gloxinia which seems to depend on the medium in which it is grown. Whether these growth effects are primarily the direct result of the amount of water that the medium is capable of holding or the composition of the material within the medium itself is not resolved in this investigation and should be a interesting subject for further studies.

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EVALUATION OF 40 ORNAMENTAL PLANTS FOR A MASS MARKETING SYSTEM UTILIZING SEALED POLYETHYLENE PACKAGES[1]

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Abstract. **Forty species of ornamentals were evaluated for potential use in a simulated mass marketing system utilizing sealed polyethylene packages. Major problems which reduced marketability were physiological breakdown or disease, flower abscission and decay, internodal elongation, and rapid wilting when plants were removed from packages. In general, foliage plants and succulents were best suited to this system, while woody ornamentals, flowering pot plants, and bedding plants showed increasing numbers of problems, respectively.**

Aluminum plant (Pilea cadierei), **purple passion** (Gynura sarmentosa), **and fibrous begonia** (Begonia semperflorens) **were further evaluated under simulated marketing conditions for up to 60 days. Marketability differed only slightly between packaged and unpackaged aluminum and purple passion plants. After 30 days fungus gnat larvae and decay of abscised flowers reduced marketability of packaged begonias compared to unpackaged plants.**

The potential for retailing ornamentals in mass market outlets has been reported and the practice has become increasingly popular (1, 7, 8, 9, 10, 12, 13), but mass market outlets seldom have trained personnel or adequate display areas where good maintenance practices can be implemented (1, 3, 5, 11, 12). Work on packaging, displaying and servicing cut flowers has shown that growers can improve the quality of flowers delivered to the markets or facilitate servicing (2, 12). Pressurized sealed packages can be used to eliminate the need for watering pot mums during transit and merchandising (4). Prepackaged mums were accepted by consumers (6) and were profitable in the produce department of supermarkets (5).

The objectives of this study were to evaluate 40 ornamental plant materials for mass marketing systems utilizing sealed polyethylene packages and to compare packaged and unpackaged plants under conditions that may occur during distribution and marketing practices. Plant materials selected represented foliage, succulents, woody ornamentals, flowering pot plants and bedding plants.

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Materials and Methods

See-Pak(R) packages (3 mil-3 in. x 3 in. x 10 in. co-extruded polyethylene-propylene) were used to evaluate the effect of packaging on the 40 plant materials listed in Table 1. Six to ten plants of each biotype were selected from local growers and drenched with a solution containing 1 teaspoon per gallon Benlate plus 1 teaspoon per gallon Truban 24 hrs before packaging. Plants were placed in the package, the top was heat-sealed, and then air injected to make a sealed, slightly pressurized container.

All plants were stored in the dark for 2 days at 60°F (16°C) to simulate trucking conditions and then held for 30 days under 100-150 foot candles (ft-c) at 70-75°F to simulate market outlet conditions. Light was supplied by cool-white fluorescent tubes. Plants were evaluated and rated for degree of chlorosis, internodal elongation, physiological breakdown and disease, overall marketability, and wilt when removed from package. Plants were rated on a 1-4 scale, where 1 = excellent, 2 = marketable but showing symptoms, 3 = not marketable due to symptom being evaluated, and 4 = severe symptoms including dead plants. Plants showing disease symptoms were sampled, tissue excised, surface sterilized, and plated on potato dextrose agar in petri dishes to help determine the causal organisms.

Table 1. Evaluation of 40 ornamental species sealed for 30 days in polyethylene packages and held at 150 ft-c, 70-75° F.

	Chlorosis[z]	Internodal elongation[z]	Physiological breakdown or disease[z]	% Marketable[y]	Wilt[x]
Foliage plants					
1. *Aglaonema modestum* 'Frasner'	1.0	1.0	1.6	100	1.0
2. *Asparagus sprengerii*	2.4	1.2	1.7	44	1.0
3. *Caladium humboldtii*	1.0	2.0	1.0	100	3.5
4. *Caladium* 'Red Flash'	1.0	2.0	1.3	90	3.5
5. *Dracaena sanderiana*	1.0	1.0	2.0	100	1.0
6. *Fittonia argyoneura*	1.0	2.0	1.3	100	2.1
7. *Gynura sarmentosa*	1.2	1.0	1.5	90	2.2
8. *Peperomia obtusifolia variegata*	1.0	1.0	1.5	100	1.0
9. *Philodendron oxycardium*	1.3	1.0	1.0	100	1.0
10. *Pilea cadierei*	1.0	1.0	1.0	100	1.0
11. *Plectranthus australis*	1.4	2.1	1.0	100	1.8
12. *Scindapsus aureus*	1.0	2.0	1.3	100	1.0
13. *Tradescantia zebrina*	1.0	3.0	1.2	0	2.0
Succulents					
1. *Aloe confusa*	1.0	1.0	1.2	100	1.0
2. *Cereus* (grafted)	1.0	1.0	1.2	90	1.0
3. *Crassula argentea*	1.0	1.2	1.0	100	1.0
4. *Kalanchoe diagremontiana*	1.4	1.9	1.2	100	1.0
5. *Kalanchoe fedtchenkoi*	2.0	2.0	1.0	100	1.5
6. *Kalenchoe pinnata*	1.2	1.5	1.0	100	1.0
7. *Sansevieria trifasciata*	1.0	1.0	1.0	100	1.0
8. *Zygocactus* sp.	1.0	1.0	1.0	100	1.0
Woody ornamentals					
1. *Araucaria heterophylla*	1.4	1.0	1.0	100	1.0
2. *Azalea simsii*	1.0	1.0	1.0	100	1.0
3. *Codiaeum variegatum pictum*	1.0	1.0	2.5	75	2.3
4. *Coffea arabica*	1.3	1.0	1.0	100	2.1
5. *Ficus benjaminia*	1.0	1.0	2.5	50	1.0
6. *Gardenia jasminoides*	1.0	1.0	1.0	100	1.0
7. *Schefflera actinophylla*	1.4	1.0	1.1	90	2.5
Flowering pot plants					
1. *Aeschynathus* sp.	1.3	1.0	1.0	100	1.0
2. *Begonia semperflorens*					
a. 'Scarletta'	1.2	1.1	1.1	100	1.0
b. 'Viva'	1.9	1.0	2.3	40	2.2
3. *Chrysanthemum morifolium*					
a. 'Baby Tears'	2.0	1.0	2.0	100	2.0
b. 'Roll Call'	4.0	1.0	4.0	0	4.0
c. 'Fireside Cushion'	4.0	1.0	4.0	0	4.0
4. *Impatiens sultani*	1.2	1.7	1.4	100	1.0
5. *Sinningia* hybrid (miniature)	1.0	1.0	1.2	100	1.0
6. *Sinningia speciosa*	1.5	1.1	1.7	80	1.0
Bedding plants					
1. *Capsicum frutescens*	4.0	4.0	4.0	0	4.0
2. *Coleus blumei*	1.0	1.0	2.9	30	2.0
3. *Lobularia maritima*	4.0	3.0	4.0	0	4.0
4. *Lycopersicon esculentum*	4.0	4.0	4.0	0	4.0
5. *Viola tricolor*	3.0	3.0	3.5	0	4.0
6. *Vinca rosea*	2.4	1.0	2.2	50	2.6

[z]Plants were rated while packaged on a 1-4 scale, where 1 = excellent, 2 = marketable but showing symptom, 3 = not marketable due to symptom being evaluated, and 4 = severe symptoms to include dead plants.
[y]Percentage of plants that were rated marketable while packaged.
[x]Rating of plants 24 hrs after they were removed from the package with respect to degree of wilt, where 1 = no wilting, 2 = noticeable but not damaging, 3 = permanent damage, 4 = complete desiccation of tissue or death.

Pilea cadierei, Gynura sarmentosa and *Begonia semperflorens* were selected for further study. Packaging, warehouse, transportation, and mass market conditions were variables arranged in a 2 x 3 x 3 x 3 factorial experiment. Plants of each species were drenched with fungicides as before and placed in the dark for 2 days at 60°F (simulating shipping of plants to a warehouse). Five packaged and 5 unpackaged plants were placed at 50 ft-c for 0, 14 or 28 days at 70-75°F (21-24°C) (simulating warehouse conditions). Each lot was subsequently placed in the dark at 60°F for 0, 2, or 4 days (trucking to outlet), and then placed at 150 ft-c for 0, 14 or 28 days at 70-75°F (mass market outlet). There were a total of 54 treatments. Thus, plants were subjected to a variety of conditions which might arise in a mass marketing system for periods of 2 to 60 days. The unpackaged plants were watered every 3 days. Plants were evaluated and rated for marketability at the end of each of the possible 54 treatments, and again 1 week later to show effects of removal from package. Plants were rated on a 1-5 scale, where 1 = excellent, 3 = showing undesirable symptoms but considered marketable, and 5 = dead.

Results and Discussion

Table 1 represents the evaluation of the 40 ornamentals tested. Foliage plants and succulents consistently were rated higher than the other plant commodities tested. Problems with foliage plants were exemplified by *Tradescantia, Caladium,* and *Asparagus springerii. Tradescantia* was not considered marketable due to internodal elongation, while a combination of chlorosis, leaf drop, and decay reduced acceptability of *Asparagus springerii.* Although *Caladium* was rated high while packaged, severe wilting occurred after removal from the package. Leaves of these plants abscised or developed necrotic leaf margins. Diseases or physiological breakdown symptoms reduced marketability in croton and *Ficus*. Croton, coffee, and schefflera also exhibited extreme wilting upon removal from the package. Most new leaves that developed during the 30 day test either became completely desiccated, or abscised when the plants were removed from the package. Plants resumed normal growth when placed in the greenhouse.

Flowering pot plants and bedding plants in general were not suited to this packaging system. Although the foliage of the flowering pot plants usually was not injured, the flowers were a problem. For instance, a gray fungus was visible on the petals of 'Roll Call' and 'Fireside Cushion' chrysanthemums. Begonia, sultana and miniature gloxinia flowers abscised quickly. Furthermore, abscised flowers remained moist in the humid atmosphere of the package and provided a site for fungal growth. Decaying flowers were, of course, very unsightly within the package. None of the bedding plants tested did well in this package. Coleus was unique among the bedding plants; it initially dropped most of its leaves, but resumed normal growth toward the end of the 30 day test. Again, the abscised leaves were ideal for fungal growth but the intact plant appeared unharmed in most cases. Wilting after removal from the package was most severe in the bedding plant category and some plants collapsed competely within a few hours.

Although bacteria, *Botrytis, Fusarium,* and *Pythium* species were isolated from samples taken from plants showing disease symptoms, the evidence was inconclusive in determining whether these organisms were pathogenic or were secondary invaders. Physiological disorders caused by low light or other stresses appeared to be a more serious problem than disease organisms, and symptoms of the two syndromes could not be separated conclusively.

In the 2-60 days simulated marketing test, no significant differences were found between packaged and unpackaged *Pilea* plants (Table 2). Both packaged and unpackaged plants were rated high throughout the test. However, differences were evident with *Begonia* and *Gynura*. Packaged *Begonia* plants developed a soft, necrotic tissue at the base of the leaves and wherever the leaves touched the side of the package. Microscopic examination showed that fungus gnat larvae were feeding on the leaves. In normal unpackaged conditions, the larvae would be in the soil and would not cause foliar symptoms. But, within the protected and humid conditions of the package, the larvae did considerable damage to the foliage. Since the effects of the fungus gnat larvae were still visible 1 week after plants were removed from the package, differences between packaged and unpackaged plants were still present at the 1-week-later evaluation. Abscised flowers were also a problem with packaged begonias because the flowers sometimes stuck to the package and fungal mycelium grew on the decaying flowers.

Table 2. Influence of packing on marketability[z] of 3 ornamental species under a simulated mas marketing system. Main effects of packaging under warehouse (0, 14, or 28 days at 50 ft-c), transportation (0, 2, or 4 days at 0 ft-c) and mass market (0, 14, 28 days at 150 ft-c) conditions are represented[y].

	Rating upon removal from package		Rating 1 week after removal
		Pilea	
Packaged	1.2a[x]		1.0a
Not packaged	1.1a		1.0a
		Gynura	
Packaged	1.7a		2.1a
Not packaged	2.0b		2.1a
		Begonia	
Packaged	2.9b		2.9b
Not packaged	1.1a		1.1a

[z]Plants were rated on a 1-5 scale, where 1 = excellent, 3 = showing an undesirable symptom but considered marketable, and 5 = dead.
[y]Each value represents the mean of 135 observations.
[x]Means followed by different letters within a treatment group are significant at the 0.01 level.

The results with purple passion indicated that the packaging actually improved marketability ratings compared with unpackaged plants (Table 2). However, the 1-week-later evaluation showed no significant difference because some plants wilted and collapsed after removal from the package. Botrytis was consistently isolated from the samples taken from plants having disease symptoms in both packaged and unpackaged plants. The humid atmosphere did not increase the incidence of disease but rather appeared to favor growth of the *Gynura* over the fungus. When the plants were removed from the package, some developed symptoms similar to the unpackaged plants that had died earlier and the average numbers of dead plants became equal.

In summary, tests comparing packaged and unpackaged plants under simulated marketing conditions for up to 60 days showed that packaging may be beneficial in a mass marketing system for some species. The biggest advantage is that no store personnel would have to water the plants. Thus, if proper lighting was available, the plants would be virtually maintenance-free in transit and at the mass market outlets.

However, this packaging system had unique problems, such as fungus gnat larvae and severe wilting of plants after removal from the package. Additional research might be able to broaden the application of this system to the different plant commodities.

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MARKETING PRACTICES OF WOODY ORNAMENTAL PRODUCERS IN NORTH CENTRAL FLORIDA

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Abstract. **Woody ornamental production and sales represent a viable and growing segment of the Florida ornamental horticulture sector. During 1975, dollar sales of woody plants were estimated to be over 45 million dollars. This study represents an effort to document the entry, exit and survival characteristics of woody ornamental firms. In addition, current marketing activities are summarized by firm size category. Firm growth characteristics based on Markov chain analysis suggest that small firms have only a 69% probability of surviving in business for 10 years compared with an 87% chance for large firms. Other conclusions suggest that small producers tend to market their produce locally via direct contact with individual consumers. Large firms ship their produce to distant markets and deal mainly with wholesalers. All firms consider year-round supply, delivery and care instructions to be important grower-provided marketing services. Marketing management expertise is quite important since woody ornamental producers for all sized firms are required to participate in merchandising and marketing activities.**

As part of a rural development project for North Central Florida, a woody ornamental market feasibility study (2) was conducted during the fall of 1975 and spring of 1976. An essential component of this study, by the Food and Resource Economics Department, IFAS, was a survey to determine market outlets and practices for existing woody ornamental producers. Also, the study was designed to determine firm growth and entry and exit characteristics by size category.

Data for the study were obtained from two sources. For examining the growth characteristics by firm size, secondary information on firm numbers by size categories was obtained from the Division of Plant Industry of the Florida Department of Agriculture and Consumer Services. Basically, the data consisted of numbers of firms in 10 size categories over a 5 year period. Size categories were based on the number of plants on inventory at the first plant inspection after the start of each fiscal year in July. Nursery data were gathered for 27 counties in North and North Central Florida as shown in Figure 1.

Primary data were obtained from a personal interview survey of a sample of nurseries drawn from the total population of nurseries in the 27 counties as listed by the Division of Plant Industry. A random sampling procedure was used to select firms to be interviewed from each of 6 size categories. Survey results were utilized to compile summary information on the marketing practices of nurseries classified as small, medium and large.

Nursery firm growth patterns were evaluated using a Markov Chain analysis. Each firm size category was defined as a "state of nature". The probability that a firm of a given size at the beginning of a time period would change to another size category during the time period is assumed to be a function only of the 2 size categories involved. This implicitly assumes that all the economic factors possibly affecting a firm's growth are strongly correlated with size (1). Transition probabilities, that is, the probability of moving from size i to size j during one period of time, were estimated using Division of Plant Industry data on individual nursery inventories over a 5 year period.

This paper summarizes the study results by firm size category. The intent is to provide information on the dynamic growth characteristics and marketing practices of woody ornamental nurseries operating in North Central Florida.

Small Nurseries

Small woody ornamental nurseries are defined as those firms having average plant inventories of between 5 and 50 thousand plants. Firms smaller than this were discarded from the study based on the assumption that they are too small to represent independent viable commercial enterprises.

Based on the survey results, small nurseries sell mostly in local markets to individual consumers. The product is sold at the nursery with very little overt marketing activity. Prices are generally not published but are simply quoted to the buyer. Small nurseries consider an available year-round

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