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Effects of Shade Level on Growth and Vase Life of Milky Way Aspidistra, Variegated Mondo Grass and Israeli/Holland Ruscus

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Summary: Milky Way (*Aspidistra elatior* Milky Way [*A. elatior* Minor], Milky Way cast-iron plant), Vittatus (*Ophiopogon jaburan* Vittatus , variegated mondo grass), and I/H ruscus (*Ruscus hypophyllum*, Israeli/Holland ruscus) were grown in the open (0% shade) and under panels of shade fabric designed to provide 30%, 50% or 80% shade. Plant growth, as determined by estimating percentage plot coverage, was determined monthly for one year to assess plant establishment/survival, growth and susceptibility to cold damage. After the year of establishment, leaves of Milky Way and Vittatus and stems of I/H ruscus were harvested for vase life evaluations. At each harvest, leaf/stem lengths and weights were determined prior to storage at 40°F [4°C] for two weeks. Shade level only affected the survival of Milky Way , which essentially died in full sun. Growth of Milky Way and I/H ruscus increased linearly with increasing shade level, whereas Vittatus grew equally well at all shade levels. Immature foliage of all three crops was damaged during freezes, but only the mature foliage of Vittatus was damaged. Cold damage to Vittatus increased with decreasing shade level. For all three crops, the response of leaf/stem lengths and weights to shade level peaked in the 50 80% shade range. Vase life averaged across three harvests was 52, 33 and 121 days for Milky Way , Vittatus and I/H ruscus, respectively. Vase life increased linearly with increasing shade for Milky Way and I/H ruscus, but was the same at all light levels for Vittatus . All three of these perennials are durable florists greens.

The foliage of many herbaceous perennials grown in Florida is suitable for use as florists greens; however, the effects of production light levels on growth, leaf size and subsequent vase life have been studied for only a few crops (Stamps, 1995; Stamps and Boone, 1992). Growers are

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interested in getting maximum yield and producing larger leaves/stems of any individual cut foliage crop since florists typically pay more for the premium sizes. The three perennials tested in these experiments (see Table 1, page 2) are clump forming, evergreen and can be used as line items in floral arrangements. In addition, florists use Milky Way as a background material and I/H ruscus as filler material.

Table 1. Botanical names, horticultural names and names used in the cut foliage industry for the three perennial crops tested.

Botanical name[1] (former botanical name)	**Horticultural name(s)**[1,2]	**Cut foliage industry name(s)**
Aspidistra elatior Milky Way (*A. elatior* Minor)	cast-iron plant, bar-room plant, iron plant	Milky Way, Milky Way aspidistra
Ophiopogon jaburan Vittatus (*Mondo jaburan*)	variegated mondo grass[3], jaburan lilyturf, white lilyturf, Aztec grass, variegated Evergreen Giant liriope	variegated Florida bear grass, lily grass, lily turf, ribbon grass
Ruscus hypophyllum	Israeli/Holland ruscus	Florida ruscus, Israeli/ Holland ruscus

[1] The New Royal Horticultural Society Dictionary of Gardening. 1992. The Stockton Press, New York, NY.
[2] Hortus Third a Concise Dictionary of Plants Cultivated in the United States and Canada. 1976. Macmillan Publishing Company, New York, NY.
[3] Fantz, P. R. 1993. Taxanomic problems in cultivated liriopogons. HortTechnology 3:146 150.

The cast-iron plant (*Aspidistra elatior*) is known as a rugged landscape and interiorscape plant with durable leaves that are used, both fresh and dried, in large floral arrangements (Benz and Johnson, 1986; Hunter, 1994). The leaves of Milky Way are dotted with small cream-colored spots and because of their smaller size can be used in a wider variety of arrangements than those of the cast-iron plant.

Vittatus is another popular landscape plant whose leaves are used in decorative arrangements. Although Vittatus is often called variegated Evergreen Giant or simply variegated EG in the nursery industry, EG is actually a cultivar of *Liriope muscari* (Fantz, 1993). Vittatus has narrow (~½″ [1.2 cm]), attractive white and green striped leaves that may exceed two feet [0.6 m] in length. These leaves can add graceful curving lines to arrangements.

I/H ruscus produces red berries that contrast nicely with its *thornless* dark green cladodes (leaf-like stem modifications). Unfortunately, I/H ruscus has been incorrectly labeled in some publications as *R. aculeatus* (Butcher s broom) which does have spines (Stamps, 1992). I/H ruscus has very durable stems that last in arrangements for 4 weeks and longer (Nooh et al., 1986; Stamps and Boone, 1992).

This experiment was conducted to evaluate the effects of production shade level on growth, vase life, and leaf/stem sizes and weights of these three cut foliage crops.

Materials and Methods

This research was conducted at the Central Florida Research and Education Center in Apopka, FL. Plants were obtained about a month prior to planting and held under an intermediate (50%) shade level. Milky Way and ruscus were in 6″ [15-cm] pots and the Vittatus were in 2¼″ [6-cm] rose pots. They were planted on May 7, 1993 in rototilled Tavares-Millhopper fine sand soil that had previously been planted in bahiagrass. Soil pH and organic matter content were 6.2 and 2.6%, respectively. Four plants of each type were planted in a 2′×2′ [0.6 m × 0.6 m] square area in each plot, one plant per square foot [0.09 m^2]. Each shade level was replicated three times in this randomized complete block design experiment. Shade treat-

ments (30%, 50% and 80%) were provided using 8′×12′ [2.4 m×3.7 m] wooden frames covered with shade fabric mounted 4′ [1.2 m] above the soil surface on wooden posts. Full sun plots had no posts and frames. Plots were watered daily for a week after planting, mulched with oak and pine leaves, and hand weeded as needed.

Fertilization in each plot consisted of 1 lb [444 g] of 15 6 15 [15N 2.6P 12.4K] 12 14 month controlled-release fertilizer coated with minor elements (Customblen, Scotts, Milpitas, CA 95035) applied per 32 ft^2 [3 m^2] once a year. This application rate was equivalent to 200 lb N/acre per yr [224 kg N/ha per yr]. Irrigation water was applied overhead individually to each plot using a single spray head sprinkler (8F-FLT, L. R. Nelson, Peoria, IL 61615) mounted on a 2-ft [0.6-m] riser in the center of each plot. Each plot was equipped with a 6″ [0.15 m] tensiometer (model R, Irrometer, Riverside, CA 92516) installed in the center of the plot. Irrigation was initiated when the soil moisture tension reached 12 cbar [12 kPa]. Basing the irrigation of each individual plot on tensiometer readings was intended to remove bias caused by differences in water availability, which might occur because of variable evapotranspiration rates in plots with different shade levels and/or amounts of plant material.

Air temperatures for cold damage assessments were taken at a height of 6′ [2 m] and 1″ [2.5 cm] using unshielded AWG 24 [0.5 mm diameter] type T thermocouple wire (Omega Engineering, Stamford, CT 06907 0047). Using unshielded thermocouples allowed measurement of temperatures similar to those to which the plant foliage was exposed. Survival and visual estimates of the percent of the area of each 2′×2′ square that was covered with each crop under each shade level were made monthly for one year by two independent observers starting on June 9, 1993.

Milky Way and Vittatus leaves and I/H ruscus stems were harvested from each plant in the mornings on June 10, July 8 and Sept. 16, 1994. These are the months when postharvest longevity of cut foliages are generally shortest (Mathur et al., 1982; Poole et al., 1984). Milky Way leaves and I/H ruscus stems were harvested with clippers and Vittatus leaves were harvested by grasping them close to the base and pulling upward. Leaf/stem lengths and fresh weights were then taken and the samples moistened and placed in polyethylene bags. Bags were placed in waxed fiberboard boxes and stored for two weeks at 40°F [4°C]. After storage, petioles/stems were recut 0.4 inch [1 cm] above the base and inserted into florists foam (Smithers-Oasis, Kent, OH 44240) sitting in trays filled with deionized water. Postharvest evaluations were conducted in rooms maintained at 74 ± 4°F [23 ± 2°C] and 45 ± 15% RH, with 12 hours of light/day at ~107 ft-candles [17 $\mu mol \cdot m^{-2} \cdot s^{-1}$] provided by cool white fluorescent lamps. Vase life was terminated when leaves began to show chlorosis (yellowing) or signs of desiccation (graying, curling).

Data were subjected to analysis of variance (factorial interactions) with means separation using Duncan's multiple range test at the 5% level and regression analysis. Signed square root transformations of changes in percentage plot coverage were made prior to statistical analysis. Leaf/stem lengths and vase life were averaged for all samples taken from a given plot at each harvest prior to statistical analysis, making the experimental unit four leaves/stems.

Results and Discussion

Plant survival. Shade level did not affect plant survival but by the end of this study Milky Way plants in the full sun plots were almost dead with only a little live tissue persisting under the mulch layer.

Plant growth *(changes in plot coverage during the first six months after planting and prior to any freezes)*. Milky Way , known as a very shade tolerant crop (Graf, 1968), displayed a linear increase in growth with increasing shade level and essentially no new growth under full sun conditions (Fig. 1). In the 50% and 80% shade plots, where Milky Way growth was greatest, coverage determined prior to the December freeze had increased an average of almost 100% compared to when they were planted. Vittatus grew equally well under all shade levels with increases in plot coverage in the first six months after planting averaging about 765%. Like Milky Way , I/H ruscus growth increased linearly with increasing shade. Coverage in shaded plots increased ~83% and less growth occurred in full sun.

Cold damage. Three radiation freezes occurred at the test site during the winter of 1993 94, one each in December, January and February. During these freezes, minimum average hourly temperatures at six feet were 29.5°, 25.4° and 22.3°F [1.4°, 3.7° and 5.4°C] and at 2.5 cm were 29.9°, 26.2° and 25.2°F [1.2°, 3.2° and 3.8°C], respectively, for the freezes. Milky Way and I/H ruscus had relatively little immature foliage at the time the freezes occurred. That, and the fact that their mature foliage is tolerant of cold temperatures in the ranges encountered, resulted in little overall damage occurring (Fig. 1). However, because the immature leaves present were damaged, it is suggested that growers consider cold protecting these two crops if immature leaves are present *and* temperatures are predicted to fall into the mid-to-low 20°F [6.7°C] or colder range. Although Vittatus grew continuously and equally well under all shade levels, cold damage increased with decreasing shade level probably because more frost formed on the crop and less on the shade fabric.

Leaf/stem size. Since the effects of shade level on leaf/stem size and vase life were similar at each harvest, the overall means are used in the following figures. For all three crops, the response of leaf/stem lengths and weights to shade level were quadratic; length and weight increased with increasing shade and then leveled off or declined at the highest shade level (Fig. 2). For Milky Way , known as a low light plant, both leaf lengths and weights were highest at 80% shade. Leaf lengths and weights for Vittatus were similar at 50% and 80% shade. Stem lengths for I/H ruscus appeared to plateau at between 50% and 80% shade; however, stem weights declined going from 50% to 80% shade.

Vase life. Vase lives of all three crops were excellent, averaging 52, 33 and 121 days across all three harvests for Milky Way , Vittatus and ruscus, respectively. Vase life of Vittatus , whose leaf weight was least affected by shade level, was the same under all shade levels (Fig. 3). Vase life for Milky Way and I/H ruscus increased linearly with increasing shade level, but was more than adequate at the lower shade levels. However, in full sun and 30% shade I/H ruscus stems and Milky Way leaves (Milky Way barely survived in full sun) were of poor quality for florists use due to their pale green color compared to those produced under higher shade.

All three perennials proved to be durable as cut foliages and grew best and produced their largest leaves/stems under 50 80% shade.

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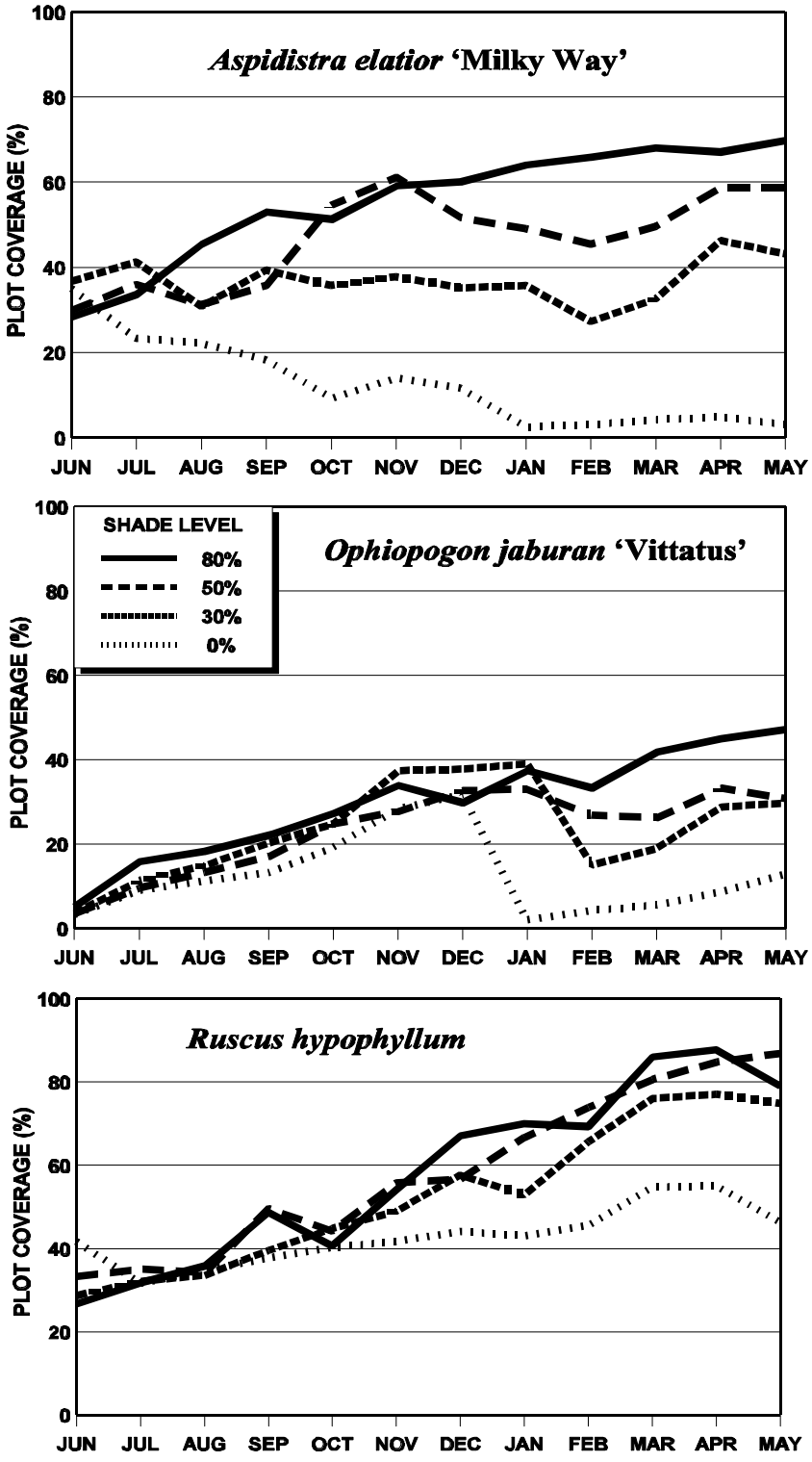

Figure 1. Changes in plot coverage over a 1-year period for three perennial cut foliage crops growing under 0%, 30%, 50% or 80% shade.

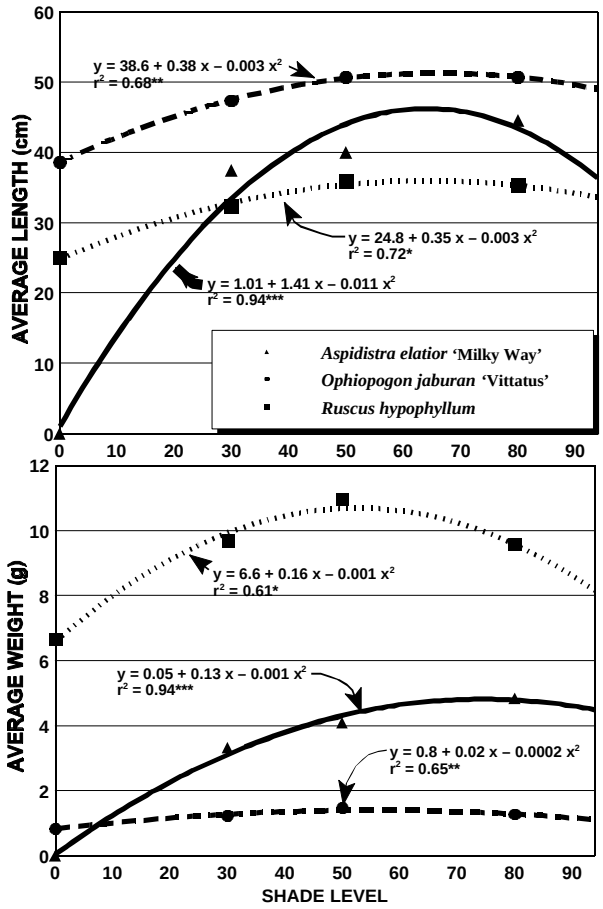

Figure 2. Leaf (Milky Way , Vittatus) and stem (I/H ruscus) lengths and weights of three cut foliage crops growing under 0%, 30%, 50% or 80% shade.

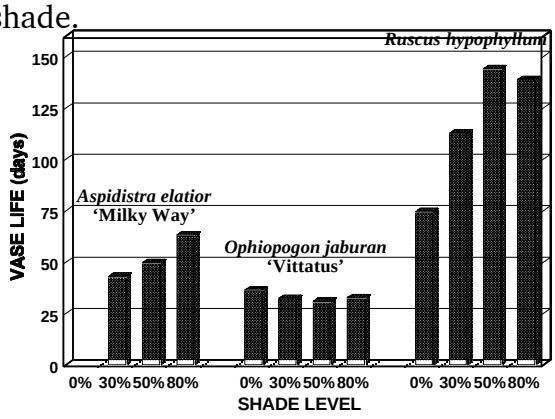

Figure 3. Average vase life of leaves (Milky Way , Vittatus) and stems (I/H ruscus) of three cut foliage crops grown under 0%, 30%, 50% or 80% shade.