Six ornamental plant species showed highy significant growth responses to different irrigation application levels. Both green and variegated forms of *Pittosporum* showed similar results with irrigation levels between 1.5 and 2.0 in/week producing maximum growth responses. For hedges and well established plants, lower irrigation rates will decrease growth, which is advantageous in any instances, as the need for excessive trimming is avoided. Common and hybrid *Hibiscus* varieties also showed similar results with irrigation levels of 1.5 in/week producing optimum growth responses. Highly significant differences between growth rates were apparent in May 1988, and, in August 1988, this significance increased. An irrigation rate of 1.5 in/week appeared to be ideal for these plants, as no further significant increase in growth rate occurred if watering was increased to 2.5 in/week. *Nephrolepis* showed minimal growth at irrigation application below 0.75 in/week. This fern also showed no significant increase in growth responses to irrigation rates exceeding 1.0 in/week. *Rhododendron* sp. (azaleas) showed increasing growth responses to irrigation application rates up to a maximum of 2.0 in/week. Above this application level there was no further significant increase in the growth response. "Greenleaf" experiments (1) showed that *Rhododendron* sp. were extremely sensitive to the extra salt levels in reclaimed water and suffered from leaf burn which lead to a slow deterioration and eventual death of the plant. Azaleas are thus not recommended for landscapes that are irrigated with reclaimed water.

This field trial showed that growth responses of half of the selected experimental species appeared to be independent of applied irrigation levels. The other 10 species show a gradation of increased growth responses to different irrigation application levels ranging from very slight to highly significant.

From these results it is recommended that an irrigation rate of 1.5 inches of reclaimed water per week be applied throughout the growing season from March to November to supplement natural rainfall. This rate can be cut back to 1 inch per week from December to February. These application rates will produce adequate growth in most commonly used landscape ornamentals in the Central Florida area.

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AZALEAS AND RECLAIMED WATER

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Abstract. **The growth and development of various cultivars of azaleas was investigated in four test plots at the Pasadena Golf and Country Club, Gulfport, Florida frcm March 1987 to May 1988. The plots received different irrigants or irrigation systems. Potable water from the public distribution system was applied by drip irrigation in one plot and overhead sprayed in another. Reclaimed water from the St. Petersburg distribution system was either drip irrigated or overhead sprayed in the remaining two plots. Monthly growth measurements and health data were recorded for all azalea plants. Analyses of variance and Duncan's multiple means tests were performed on the growth indices to determine statistically significant growth differences. Analyses of the two irrigants showed significantly higher nutrient and chloride levels in the reclaimed water. Southern Indian hybrids grew well when irrigated with potable water. Good growth but higher mortality occurred when these plants were drip irrigated using reclaimed water. Poor growth and high mortality resulted from overhead sprays of reclaimed water. Dwarf hybrids grew well when irrigated with potable water but declined and died when irrigated with reclaimed water regardless of the irrigation method utilized.**

Ever since their first introduction into the United States from Belgium in 1840, azaleas have become ideal landscape ornamental plants in both temperate and subtropical climates. Their evergreen foliage and magnificent flower clusters are responsible for their popularity. Ingram and Midcap (2) describe the main azalea varieties that grow well in Florida and include details on their general culture and requirements.

The City of St. Petersburg is situated at the southern tip of the Pinellas County peninsula and is surrounded by seawater on three sides. Local wells are highly saline and the City obtains it's potable water from wells over 60 miles away in neighboring counties. The City's four wastewater treatment plants process over 45 million gallons of influent wastewater per day and their clarified, disinfected product is known as reclaimed water. Over 20 million gallons of reclaimed water are pumped into a 200 mile irrigation distribution pipeline every day, to satisfy the landscape irrigation needs of city parks, schools, golf courses and over 5,000 residential users. This type of reuse of reclaimed water preserves groundwater supplies by saving potable water, protects surrounding surface waters from contamination and provides extra nutrients for lush vegetative growth of landscape ornamentals (3).

Throughout the growth and development of this reuse system, the Tampa Bay area community experienced climatic conditions which were highly abnormal between

1983 and 1986. Low rainfall was experienced from October 1983 to April 1985, severe freezes oocurred in December 1983 and February 1985 and a hurricane brushed coastal St. Petersburg in September 1985. These factors significantly contributed to an increase in the demand for reclaimed irrigation water, serious damage to many landscape ornamental plants and the death of many delicate species.

Throughout 1985 and early 1986, St. Petersburg experienced a significant increase in the number of complaints received from homeowners regarding damage to ornamental plants and trees. Over 25% of the complaints referred to azaleas and claimed that damage or plant death was directly caused by the use of reclaimed irrigation water.

To ascertain the vality of these complaints and investigate the effects of reclaimed water on the growth and maturation of azaleas, a study was set up in March 1987 at the Pasadena Golf and Country Club using azalea plants supplied by Smith's Nursery.

Materials and Methods

Four separate plots of azaleas were planted around the four corners of the Golf Club Administration building. The plants in the plot at the North corner were irrigated with reclaimed water by a drip system supplying 1 gallon of irrigant per hour to each individual plant. In the plot on the East corner, test plants were irrigated by reclaimed water from 3 overhead lawn sprinklers which each delivered approximately 1 gallon of irrigant per rnute. On the South corner, azaleas were irrigated with potable water frcm overhead sprinklers similar to those at the East corner. Finally, at the West corner, test plants were drip irrigated with potable water using a similar system to the North corner.

The two drip irrigation systems were both set to operate for one hour, three times per week. The two overhead irrigation systems each operated for 30 minutes, three times per week.

The potable water used in this demonstration originated from wells in Hillsborough and Pasco Counties. Analyses of this water showed mean chloride levels of 6 ppm throughout the investigation. The reclaimed water originated mostly fs St. Petersburg's Northwest Wastewater Treatment Plant and chloride levels averaged 300 ppm throughout the study period.

Southern Indian hybrids and dwarf hybrid varieties of azaleas were planted in each of the test plots as shown in Table 1. The numbers of each hybrid that survived to the end of the measurement period in May 1988 are also shown in Table 1.

The initial size index of each azalea plant was determined by multiplying the height by the mean width. To compute the mean width, the greatest visually observed width was first measured. Then the plant width at right angles to the first measurement was determined and the mean of the two measurements was calculated. Size indices of each plant were measured monthly from March 1987 until May 1988. Monthly mean size indices for dwarf hybrids and Southern Indian hybrids were calculated separately for each plot. Any plant that died during the measurement period were recorded as having a zero size index and included in the mean calculations each month. At the end of the measurement period, all calculations were adjusted so that the initial size indices in March 1987 were equal. This removed any increase errors in size indices due to large initial differences.

Analyses of variance were performed on the Southern Indian and dwarf hybrid data for the final month the investigation in May 1988. "F" values for Southern Indian and dwarf hybrid data indicated significant differences between their mean size indices within each plot. Duncan's new multiple means test for unequally replicated means (1) was used to determine significant differences between individual means.

Results and Discussion

Figure 1 shows graphs compiled from the adjusted initial mean growth indices and the increases in these mean indices for Southern Indian hybrid azaleas in each of the 4 plots from March 1987 to May 1988. In May 1988, an analysis of variance showed there was a significant difference between these means ($F = 2.94$, $P = <0.05$). The May 1988 data points in Figure 1 have letters to the right of them on each of the graphs. Data points that are not followed by the same letter are significantly different from each other ($P = <0.05$) as determined by Duncan's new multiple range test for unequally replicated means (1). Figure 1 illustrates that, in May 1988, the mean size index for azaleas irrigated with reclaimed water by the overhead spray method was significantly less ($P = <0.05$) than any of the other three means. Also, there was no significant difference in growth between azaleas irrigated with reclaimed water by the drip method or with potable water by either overhead or drip irrigation method.

Figure 2 shows graphs of the adjusted mean growth indices of the dwarf azalea hybrids. An analysis of variance showed a highly significant difference between the means in May 1988 ($F = 12.39$, $P = <0.01$). Duncan's new multiple range test showed that there was no significant difference in the growth of azaleas irrigated with reclaimed water by either drip or overhead methods (both graphs have "a"'s to the right of the May 1988 data points). Azaleas irrigated with potable water by either method also showed

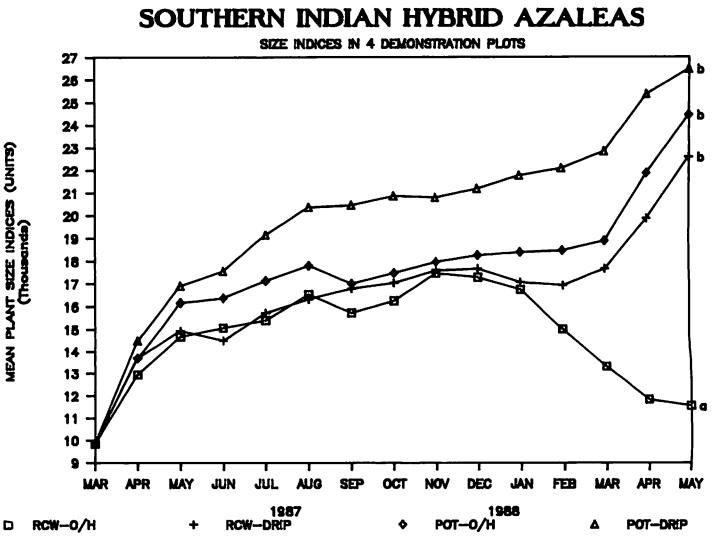

Fig. 1. Rate of increase of growth indices for Southern Indian hybrid azaleas using different irrigants and irrigation methods.

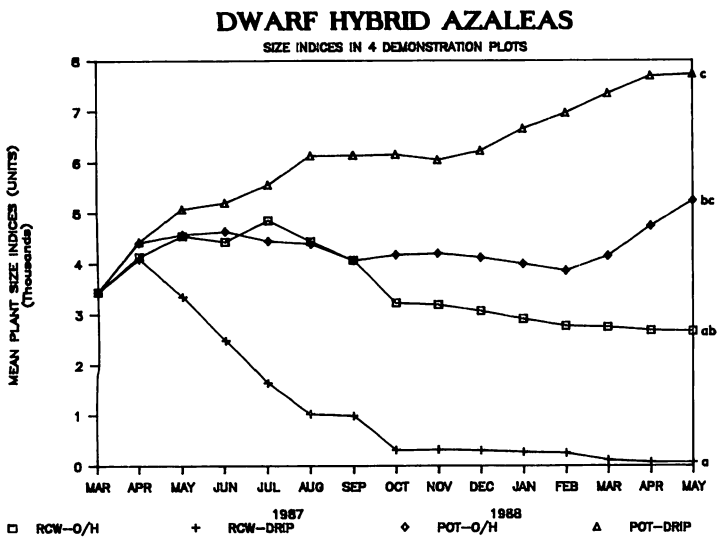

Fig. 2. Rate of increase of growth indices for dwarf hybrid azaleas using different irrigants and irrigation methods.

no significant growth differences (both graphs have "c"'s), but the plants in both of these plots grew significantly better, (P = <0.05), than those irrigated by the drip method with reclaimed water. Finally, there was no significant difference in the growth of dwarf azaleas irrigated by either reclaimed or potable water when the overhead irrigation method was used (both graphs have "b"'s).

The number of plants that survived throughout the test period from March 1987 to May 1988 is shcwn in Table 1. No Southern Indian hybrids died in any of the potable water plots. Nineteen out of 25 initial plants, (76%), survived in the reclaimed water drip application plot and 8 out of 10, (80%), survived in the reclaim water overhead irrigation plot. No dwarf hybrids died in the potable water drip plot and 3 out of 5, (60%), survived in the potable water overhead plot. Mortality of dwarf hybrids was high in the reclaimed water plots as only 2 out of 11, (18%), survived in the drip plot and 6 out of 9, (67%), survived in the overhead plot.

Southern Indian hybrids such as those used in this demonstration grow well in Central Florida when irrigated with potable water. Rapid growth in March and April 1987 was observed (Figure 1) followed by a steady increase in May, June and July. Very little growth then occurred until February 1988 when a pattern of growth similar to that of the previous year began to occur. Whether the irrigant water was applied by the drip or overhead method made no difference to the resulting growth of these varieties of azaleas.

When reclaimed water was used to irrigate Southern Indian hybrid azaleas by means of a drip application system, growth was as good as that seen in plants irrigated with potable water. The extra beneficial nutrients and high chloride levels in the reclaimed water did not significantly increase or decrease the growth of the plants. The mortality of plants that were drip irrigated with reclaimed water, (24%), was however greater than that, (0%), of plants irrigated with potable water.

When Southern Indian hybrid azaleas were irrigated with overhead sprays of reclaimed water, a different growth pattern was seen (Figure 1). Good growth was observed in March and April 1987, but, after this, growth became erratic and, in December 1987, a decline set in which continued throughout the rest of the demonstration period. Twenty percent of the plants died and the rest showed leaf burn symptoms, especially on the young leaves, which were most likely caused by the chloride levels in the reclaimed water.

Southern Indian hybrid azaleas thus appear to be able to better withstand irrigation with reclaimed water provided it does not come in contact with their leaves. Drip application produces a higher plant mortality expectancy, however, when compared with potable water, showing that the root system is also sensitive to reclaimed water.

Dwarf hybrid azaleas such as those used here will survive in Central Florida if irrigated with potable water. There was no significant difference between the growth rates of plants irrigated by drip or overhead sprays, but drip growth indices were always greater than overhead ones. Both forms of dwarfs grew much slower than the Southern Indian hybrids, but the pattern of growth was similar, especially in the drip irrigated plants (see Figure 2).

When reclaimed water was used to irrigate dwarf hybrid azaleas by either drip or overhead methods a significant reduction in growth occurred and plant mortality was high. Leaf burn occurred on most plants in the overhead spray plot and a gradual decline in plant size occurred from July 1987 onwards with a 33% mortality recorded by the end of the measurement period. Although there was no significant difference between the dwarf azalea growth data for potable and reclaim water overhead sprays in May 1988, it can be seen in Figure 2 that the potable water size indices are increasing whereas the reclaimed water ones are decreasing. It would therefore probably not be long before this difference would becopme significant. In the drip application plot the decline in plant size began in April 1987. Many of the plants became extremely chlorotic and 82% had died at the end of the measurement period.

Leaf burn, slow decline in plant size and eventual death of both Southern Indian and dwarf hybrid azaleas will result from the use of reclaimed water provided by overhead irrigation. This irrigant is therefore not recommended for overhead spray use on azaleas in coastal regions of Central Florida.

Most Southern Indian hyrid will survive and grow if irrigated with reclaimed water by a drip application method which avoids all contact between the irrigant and the leaves of the plant. A higher mortality rate can be ex-

Table 1. Layout and fate of azalea plants in four test plots at Pasadena Golf Club.

	Number of azaleas in plots at four corner locations							
	North		East		South		West	
Variety of azalea	Begin	End	Begin	End	Begin	End	Begin	End
George Taber (SI)[y]	11	10	5	4	11	11	1	1
G. G. Gerbing (SI)	5	2	0	0	2	2	10	10
Pride of Dorking (SI)	9	7	5	4	4	4	14	14
Celestine Red (DW)[z]	6	0	5	3	0	0	5	5
Red Ruffles (DW)	5	2	4	3	5	3	5	5
Total	36	21	19	14	22	20	35	35
Irrigant water	Reclaimed		Reclaimed		Potable		Potable	
Irrig. system	Drip		Overhead		Overhead		Drip	

[y]Southern Indian hybrid.
[z]Dwarf Hybrid.

pected under these conditions however, when compared with potable irriation results.

Dwarf hybrid azaleas are sensitive to reclaimed water from coastal regions of Central Florida, even when a drip application system is used which avoids all contact between above ground parts of the plant and the irrigant. The delicate, shallow root system of these plants is highly susceptible to desiccation and is sensitive to high chloride levels in the soil water. Culture methods for these plants are discussed by Ingram and Midcap (2). Reclaimed water is not recommended for use as an irrigant for these plants.

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LEU GARDENS: PAST, PRESENT AND FUTURE

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Abstract. **After its inception in 1961, and the initial 10 year capital improvement program, the 56 acre city-owned Harry P. Leu Botanical Gardens in Orlando went through a long period of physical decline and lack of direction. In 1979, the governing board of trustees produced a study whose aim was to reverse the decline and put the gardens on a solid botanical foundation. The hiring of the present professional staff was completed in 1986, and their work of defining the role of the gardens, and creating the various mechanisms to help them achieve this goal began. Future work centers on raising the necessary funds to construct a multi-purpose building, as well as mapping, documenting and augmenting existing collections, especially the important collection of camellias. Future plans also include developing curriculum-based programs for the school system, providing popular education in botany and horticulture for the many new residents moving into the area, conducting research in the areas of cold damage and frost protection, and conserving not only camellia species and cultivars, but native herbaceous plants with horticultural potential as well.**

Interest in botanical gardens and arboreta is undergoing a world-wide resurgence. New facilities are being built, while moribund institutions are being given new life. Leu Botanical Gardens falls into the second category, and the details of how it is accomplishing its renaissance may be instructive to similar institutions.

Leu Botanical Gardens (LBG) was created from a private estate that had belonged to four different influential Central Florida families. In 1961, the last private owners, Mr. & Mrs. Harry P. Leu gave 47 acres and their house to the City of Orlando to be maintained forever as a botanical garden and natural flora park. The enabling Deed of Trust also specified that the garden, although a division of the City of Orlando, was to be governed via a separate Board of Trustees that was given broad and comprehensive control. Mr. Leu left no endowment, but stipulated that the City, in accepting his gift, pledge itself to maintain the gardens at a level similar to that enjoyed under his ownership.

Following transfer of the property, a landscape design was chosen and the City embarked on a ten-year program of capital improvements that installed most of the Gardens' important physical features. In 1968, an additional 8.8 acres was deeded to the Gardens for a nominal sum.

After all this activity, the Gardens entered into a period of relative neglect during which time the level of maintenance deteriorated, and the modest efforts at record-keeping fell into disuse. The Gardens came to be perceived as merely an urban park.

In 1979, the trustees and other individuals who realized that being called a botanic garden created certain responsibilities for an institution, commissioned a study to determine what needed to be done to put the Gardens on a solid footing as a bona-fide botanical garden. The study resulted in the creation of a Master Program, that called for a return to higher standards of maintenance, the addition to the staff of a professional horticulturist, and the implementation of a membership program, with supporting activities such as classes and publication of a newsletter. Sporadic efforts at developing a membership base, classes and a newsletter were almost immediately begun.

In 1982, a botanist with experience in developing and administering non-profit educational institutions was hired. Special events to increase visibility and raise funds were begun. As a result of a Museum Assessment Program I grant (MAP I) from the Institute of Museum Services, a study of the physical plant, staffing, security, financial condition, and mission of the gardens was made. The most serious flaw pinpointed by the study was rectified in 1985, when the City was persuaded to create altogether new positions for the grounds staff. All new grounds staff, mostly with degrees, were hired, and a new position, that of Education Coordinator, was also filled. Also in 1985, the two-story wood-frame Florida house opened full-time as Leu House Museum.

The new professional staff had to create an identity and focus for the gardens, and create the mechanisms for achieving targeted goals. Among the questions faced were: what would constitute the gardens' collections? Who would be its audience and from what area would they be drawn? What programs would be created and sustained? How would they increase community support? And what would be the short, medium and long-term goals of the institution?