peach leaf rust but did show some activity in the past under a special section 18 label in the subtropical Lower Rio Grande Valley in Texas. The higher incidence of Nova applied at 3-week intervals above other treatments with Nova is unknown, but is possibly due to sampling error. The level of disease at the beginning of the test was not substantially higher than trees of other treatments.

Statistics comparing pruned and non-pruned trees indicated no significant difference in disease incidence. Pruning to remove center vegetation and allow drying of moisture from morning dew and daytime rains apparently had no effect to reduce the leaf rust disease. Summer pruning practiced in some areas for management of vegetative growth and to reduce the amount of winter pruning had no effect on peach leaf rust in this subtropical area of south Florida.

In summary, low-chill peach varieties can be successfully grown and fruited in south Florida for the landscape and are acceptable for commercial and u-pick operations. The primary production problem appears to be premature defoliation during the summer rainy season due to peach leaf rust. It appears there is no difference among current available varieties to susceptibility to the disease. Two fungicide products, Abound (Zenica Ag Products) and Nova (Rohm and Haas), are labeled for control of peach leaf rust and were found in this study to reduce leaf lesions and disease severity.

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IRRIGATION MANAGEMENT SURVEY FOR TROPICAL FRUIT CROPS IN SOUTH FLORIDA

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Abstract. **Irrigation is critical management for tropical fruit production in south Florida. Little is known of current irrigation practices used on tropical fruit crops. A survey of avocado, 'Tahiti' lime, mango, carambola, lychee, longan, mamey sapote, and papaya was conducted to obtain background information on current irrigation practices including system, rates, timing, frequency and perceived information needs. The survey was carried out during the summer and fall of 1998 and the data compiled and analyzed in 1999. Of the 108 surveys mailed, 53 commercial growers responded. Irrigation practices varied widely among commodities and growers. This baseline information will give us the opportunity to design extension and research programs to address the needs of growers.**

Annual average precipitation in south Florida is about 55 inches, two-thirds of which falls between May and October, during the hot, humid, summer growing season. The dry season typically begins and extends through April of the next year. Irrigation is essential for tropical fruit trees during these months. Little is known about grower irrigation practices for tropical fruit crops grown commercially in south Florida. At present, no documentation is available to define current irrigation practices in the tropical fruit industry. This survey information will be critical in the design and implementation of extension and research programs to address the needs of growers on irrigation practices.

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The objectives of this survey were 1) to obtain background information on current irrigation practices for selected tropical fruits (i.e., avocado, lime, mango, carambola, lychee, longan, mamey sapote, and papaya), and 2) to use this benchmark survey information to design and implement extension and research programs to address the needs of the industry and develop or improve irrigation practices.

Materials and Methods

The survey instrument was written and reviewed during spring of 1998. Each questionnaire included 3 sections and 28 questions. Both the first section, which covered general information, and the second section, which dealt with fertilizer practices have been summarized and published (Li et al., 1999). Results from third section pertaining to irrigation practices will be discussed in this paper. The method for this survey has been described in a previous publication (Li et al., 1999). Briefly, the survey was mailed to 108 growers during August 1998. Introductory letters were included to describe the nature of the survey. Announcements of the survey were made at local extension meetings. Follow-up phone calls were made and some surveys were resent during the intervening 9 months to encourage more participation. Of the 108 surveys sent, 49% (53) usable surveys were returned and during April and May the results were placed in a database, compiled and summarized.

Results and Discussion

Irrigation System. More than forty percent of the respondents have high volume sprinklers either over trees (13%) or under trees (28%). The output for the high volume irrigation systems ranged from 0.1 inch to 0.75 inch per hour. Eight percent indicated that high volume systems were only used for cold protection. Twenty-nine percent of growers surveyed have micro-sprinklers alone, whereas 21% have micro-sprinklers used in combination with high volume systems. Only about 9% of responses had drip systems. Drip systems were used for carambola, lychee, longan and mamey. Delivery rates were 2-30 gallons per hour (gph) for low volume micro-sprinklers and 1-6 gph for drip systems.

Most (44%) of the growers use diesel or gas engines to run the irrigation systems only. Twenty-five percent have electrical pumps and 31% have two types of system either with diesel or gas plus electric pumps. High volume sprinklers and diesel or gas pumps are recommended for cold protections for most tropical fruits in south Florida. Using micro-sprinklers and drip systems can increase irrigation efficiency and prevent over irrigation. They also provide potential means for fertigation. Forty-three percent of the growers have automated irrigation control systems.

Irrigation Scheduling, Rate and Frequency. When asked what factors influence their decision to irrigate, 73% of the growers indicated the amount and frequency of rainfall was the most important factor. Other growers listed the most important factors as: crop growth stage and appearance (44%), and time of year (29%). Some growers (15%) mentioned soil moistures were the critical factor for their decision. Methods to determine soil moisture include tensiometers, multiple-sensors (Enviroscan), dig and squeeze soil, kick soil, pull weeds, etc. One grower uses evapotranspiration (ET) data for his irrigation scheduling. The grower responses also summarized based on the frequency and order of importance ranked by growers (Fig. 1).

The frequency and duration of irrigation varied for all systems. High volume irrigation was reported to be used 1 to 3 times per week and 1 to 12 hours for each application. The most frequent irrigation duration was 1-2 hours. Irrigation amounts were calculated based on duration and system delivery rate. Application volumes ranged from 29-608 gallon per tree per application. Micro-sprinklers were used from 1 to 7 days per week, with 4 days being the average interval. The runtime ranged from 0.5 to 7.5 hours per application. Irrigation amounts for micro-sprinkler systems were 5-90 gallon per tree per application. Drip systems were reported to be run 7 days per week for 2-6 hours per application, which is equivalent to about 2-12 gallon per tree per application. All of growers except one adjusted their irrigation based on rainfall.

Average estimated ET is about 0.13 inches per day in south Florida and for most tropical crops which translates to about 20-60 gallon per trees per day for a mature trees. Most surveyed tropical fruit crops (87%) were planted on gravelly soils, which have very low water holding capacity (8-10% volume basis). Growers with high volume systems generally do not operate them frequently enough to maintain adequate soil moisture. However, they often run their systems too long (4-12 hours) and over irrigate crops. Under-irrigation is common for micro-sprinkler and drip systems. Research and extension programs are necessary to compare efficiency of systems and to determine optimal irrigation rates.

System Maintenance. The mobile irrigation laboratory (MIL), South Dade Soil and Water Conservation District, provides free services to evaluate irrigation systems for growers in Miami-Dade County. However, only 31% respondents from this survey have had the Mobile Irrigation Lab test the efficiency of the irrigation system. Some growers do not even know delivery rate for their sprinklers. An extension program to introduce MIL to growers is in progress.

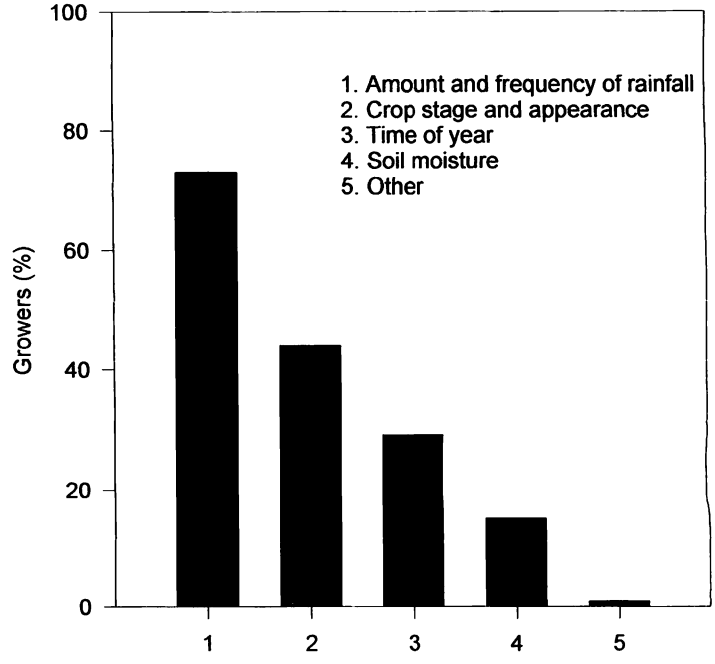

Figure 1. Ranking of factors used for determining when and how much irrigation to apply (n = 56).

Micro-sprinklers require more maintenance than high volume systems. Thirty-one percent of growers indicated they checked their micro-sprinkler emitters less than once a month (Fig. 2), 36% checked every 1 to 4 months and 17% checked every 4-6 months. Only 16% checked their systems less frequently than every 6 months. All the growers except two indicated they conduct the emitter maintenance themselves. The cost of field checks ranged from $2 to $150 per acre, with the average of $28/acre.

Eighty-eight percent of growers reported having plugging problems caused by algae, particulate matter, insects, and precipitates. However, only 22% of the growers reported maintaining or cleaning out the irrigation lines every 2-6 months. Four growers cleaned with water, 5 with chlorine, and one with acid. Most growers just partially solve plugging with their treatments. Only one grower indicated a 100% satisfaction with chlorine treatment for algae plugging. One third of growers with micro-sprinkler systems have no pre-filter (i.e., slotted pipe or sand separator before the pump), 42% have a fixed or movable slotted pipe and 12% have a grate. Over 74% growers with micro-sprinkler or drip systems use a screen as the primary filter (between pump and irrigation line), 15% use a spin cleaner, sand or disc/water, and four of the growers have no primary filter.

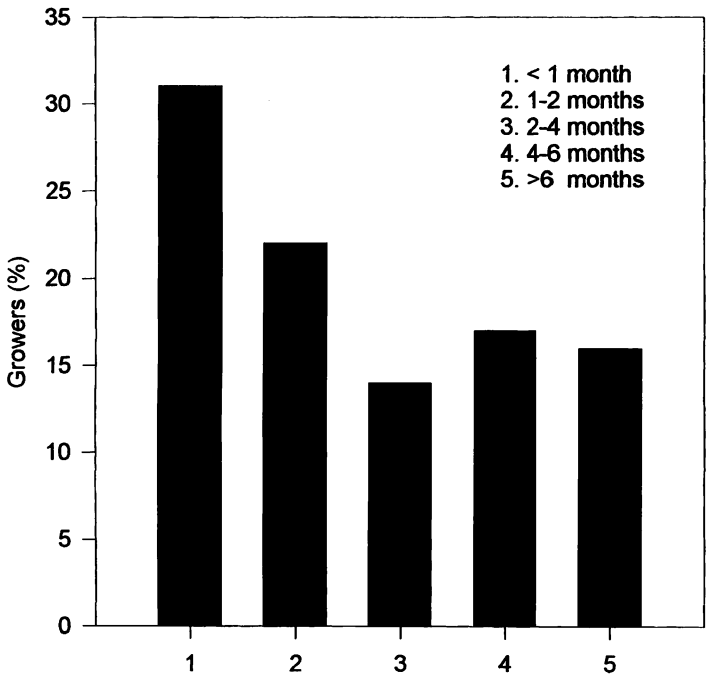

Figure 2. Frequency of growers perform micro-sprinkler and drip emitter maintenance (n = 40).

Selected grower comments and suggestions. Survey participants were asked for additional comments. They include:

1. Research needed to determine best way to keep emitters clean.
2. Research needed to determine the necessary irrigation that lychee trees need to be fruitful and healthy.
3. I would like to know how irrigation during fruit development affects the size of individual fruits at harvest.
4. Lychee: Reduce irrigation to avoid beginning growth in Dec., Jan., Feb., and March.
5. It would be desirable to know which fertilizer/irrigation management methods yield the best results.

Summary

Most producers have a high volume system and consider it is the essential component in cold protection, but also use it for irrigation. Some growers have two systems, with a high volume system for cold protection and micro-sprinklers or drip systems for irrigation. Micro-sprinklers were more common than drip systems. This reflects the general knowledge that the volume of soil wetted by drip systems in the rock-based soil is inadequate compared to the surface area covered by most micro-sprinklers. Most producers with low volume systems indicated they are experiencing clogging problems in the irrigation lines and/or the emitters. Interestingly, most producers reported conducting emitter maintenance. Many growers in the survey have not had the Mobile Irrigation Lab assess the efficiency of their irrigation systems.

The frequency and duration of irrigation varied among irrigation systems, crops, and even growers of the same crop. This indicates a general lack of information of crop water use under climate and soil conditions of south Florida. When asked what factors influence their decision to irrigate, all producers indicated the amount and frequency of rainfall. Next in importance was time of year and crop growth stage and appearance. A few producers mentioned soil appearance ("kick the dirt"), age of the trees, and utilizing tensiometer readings.

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