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Microirrigation in Florida: Systems, Acreage and Costs[1]

IFAS Task Force on Microirrigation in Florida[2]

The term "microirrigation" is used to describe irrigation systems which use low flow rate emitting devices (emitters) to place water on the soil surface very near the plants being irrigated or below the surface directly into the plant root zone. Microirrigation systems are extensively used in Florida, both in commercial agriculture as well as in landscape irrigation.

Microirrigation systems are characterized by the use of small diameter, flexible polyethylene lateral pipes, low flow rates per emitter, and operation at low pressures. Normally only a portion of the crop root zone is irrigated. Frequent, small applications are required to keep the water content of the irrigated root zone near field capacity. Smaller volumes of water are typically applied with microirrigation systems as compared to conventional irrigation systems, thus the term "low volume irrigation system" is sometimes used to describe a microirrigation system.

Specific types of microirrigation systems include drip (or trickle), microsprinkler (or microspray), line source, and bubbler systems. To encourage uniformity in terminology throughout the world, the term "microirrigation" has been defined in standards adopted by the International Standards Organization (ISO). This same term has been accepted for use in the United States by standards of the American Society of Agricultural Engineers (ASAE) and in Florida by standards of the Florida Irrigation Society (FIS).

Chemicals are applied through most microirrigation systems to enhance crop growth and to prevent emitter clogging. Fertilizers can be efficiently applied with the irrigation water to meet the plant needs throughout the growing season. Water conditioning and cleaning agents are normally required as a part of a regular maintenance program to prevent clogging of emitters due to chemical precipitation or biological growths.

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Well-designed and well-managed microirrigation systems are very efficient in terms of both water and energy use. Micro systems have been shown to increase crop yields and decrease nutrient losses from leaching because they permit prescription applications of water and fertilizers to be made. Water with higher salinity levels than required by other methods can often be used because micro systems maintain high soil water contents with frequent irrigations, they can be designed to avoid wetting the plant foliage, and salt and water movement is downward away from the plant roots.

Although the characteristics of microirrigation systems often provide advantages, these systems are not applicable to every Florida crop and production system. Several crops can be irrigated more efficiently or equally efficiently but more economically with other types of irrigation systems. Other crops cannot be economically irrigated with micro systems. Therefore, the advantages and limitations of microirrigation in Florida must be evaluated for each specific crop production system. Advantages for some production systems will be disadvantages for others.

In this bulletin, estimates of total and microirrigated acreage of Florida crops are presented, advantages and disadvantages of micro systems are discussed, applications to specific Florida crop production systems are discussed, and microirrigation system costs are estimated.

CROPS AND IRRIGATED ACREAGE

Florida agricultural crops can be classified as fruit crops (Table 1), field crops (Table 2), pasture/hay crops (Table 3), vegetable crops (Table 4), and ornamental/landscape plants (Table 5). Based on irrigated acreage, 41 major crops were identified. Also, crops with only small acreages were grouped in categories of "Other Fruit Crops," "Other Field Crops," and "Other Vegetable Crops," for a total of 44 crop categories. Table 6 summarizes crop acreage from the five classes to obtain state totals.

This bulletin provides December, 1991 estimates of crop acreage, irrigated acreage, microirrigation acreage, potential microirrigation acreage, and the anticipated annual rate of increase in microirrigation acreage. Several sources were used to obtain these data, including the Florida Agricultural Statistics Service, IFAS research and extension specialists, industry representatives, and IFAS publications. A complete list of references is attached as an appendix. Because many sources were "personal communications" rather than published reports, a "List of Contributors" to this document is also appended. In that list, the contributors, their affiliations, and their contributions are acknowledged.

Crop categories are listed in Column 1 of each Table. Estimates of current crop acreage (Column 2) were primarily obtained from reports of the Florida Agricultural Statistics Service and IFAS specialists. The irrigated acreage estimates in the next four columns (Columns 3-6) of each Table were made by the authors of this bulletin based on their knowledge of the specific crop production systems and with inputs from the other sources previously cited.

ADVANTAGES AND DISADVANTAGES OF MICROIRRIGATION

Although microirrigation systems have many advantages, they also have disadvantages which limit their applications in certain crop production systems. General characteristics of micro systems are presented here. Characteristics of specific Florida crop production systems that would affect the use of microirrigation are discussed by crop category in later sections of this bulletin.

Advantages

Microirrigation systems operate at low pressure so that smaller power units and lower energy use are required as compared to sprinkler irrigation systems. The flow rate per emitter is low for micro systems, so that water supplies with limited flow rates (smaller well sizes) can often be used. The low flow rate advantage is lost if the entire irrigation system is operated at once, such as when irrigation systems are designed for freeze protection. In that case, the flow rate requirement may be greater than the flow rate required by conventional irrigation systems.

Well-designed and well-managed microirrigation systems have higher water application efficiencies than other types of irrigation systems for many crops. The actual water savings will vary as a function of the specific production system. Because micro systems apply water near or directly into the crop root zone, a greater fraction of the water pumped is placed in the soil where it is available for crop use. This reduces the amount which must be pumped for irrigation and allows limited water supplies to be used.

Prescription applications of water and fertilizers can be made throughout the crop growing season with microirrigation. As a result, micro systems have been demonstrated to increase crop yields and decrease nutrient losses due to leaching. Microirrigation systems can usually be automated economically. The resulting labor savings and increases in operational efficiencies make automatic systems desirable for a wide range of crops.

Microirrigation systems are frequently used to apply various other agricultural chemicals such as nematicides, herbicides, insecticides and fungicides. The use of microirrigation systems for chemigation can reduce application costs since conventional application equipment such as tractors and sprayers are not needed. The use of chemigation reduces field traffic and compaction in the treated area.

Because they maintain high soil water contents with frequent irrigations and they do not wet the plant foliage, micro systems allow higher salinity water to be used as compared to sprinkler irrigation. Also, in contrast to seepage irrigation where soluble salts accumulate on the soil surface, with microirrigation salts move downward with the wetting front and do not accumulate in the root zone.

Disadvantages

The small orifices in microirrigation emitters are easily clogged by particulate matter, chemical precipitates, and biological growths. Thus, microirrigation requires that systems be regularly flushed and that water be filtered and chemically treated to reduce clogging problems. Some water sources may not be suitable for microirrigation because filtration and chemical treatment costs would be excessive.

Microirrigation systems normally have greater maintenance requirements than sprinkler systems. There are usually many more components, because each emitter covers a much smaller area than a sprinkler. Also, emitters are typically plastic and much more susceptible to wear and breakage than sprinklers made from metal alloys.

Because micro systems normally irrigate only a fraction of the crop root zone and typical Florida soils have very low water-holding capacities, irrigations must be scheduled frequently, sometimes more often than daily. Maintenance requirements and the need to manage high frequency irrigations increase labor requirements and the quality of labor needed to use microirrigation.

The cost of microirrigation systems can be very high with respect to conventional systems for closely spaced plants or crop rows. For example, the initial cost of a microirrigation system is much lower than the cost of a sprinkler system for widely-spaced crops such as citrus, while the initial cost of microirrigation for some types of ornamental nursery production systems is $40,000 per acre. This is approximately 20 times the cost of a sprinkler irrigation system for the same area.

MICROIRRIGATION IN FLORIDA CROP PRODUCTION SYSTEMS

Because there are both advantages and limitations to their use, microirrigation systems are not applicable to all Florida crop production systems. The following sections of this bulletin discuss applications and limitations of microirrigation systems in five crop categories: fruit crops, field crops, pasture/hay crops, vegetable crops, and ornamental/landscape plants.

The cost of microirrigation systems vary widely, depending on the hardware requirements for each specific crop production system. Thus, estimated costs of micro systems are also presented for each of Florida's major crop production systems.

Fruit Crops

Microirrigation is adaptable to many Florida fruit crops (Table 1). Approximately 1/3 of the entire

United States microirrigation acreage is in Florida fruit crops. By far the largest acreage is in citrus, although there is some micro acreage in all major fruit crops.

There are several reasons that micro systems are extensively used to irrigate Florida fruit crops -- the most important is that there are many production and economic benefits of this technology. Microirrigation has been shown to provide a greater degree of freeze protection and more rapid growth of young citrus trees as compared to conventional irrigation methods. Microirrigation also provides an economical means of applying fertilizers with the irrigation water as needed during the growing season.

Microirrigation systems have the advantage of lower initial costs than permanent solid set sprinkler systems for widely spaced tree crops. However, micro systems require more maintenance. Water must be filtered and chemically treated to prevent clogging. The plastic components are more subject to breakage than brass or steel components. Also, because they only irrigate a fraction of the crop root zone, irrigations must be scheduled more often than sprinkler systems. Thus, fruit crop microirrigation systems also require more labor and a higher quality of labor to keep the systems operating properly.

Microirrigation has become the system of choice in the Florida citrus industry. Over half of the existing acreage is in microirrigation, and growers are replacing conventional systems with microirrigation when system replacement is required. Almost all new plantings use microirrigation.

For other fruit crops, the rate of conversion to microirrigation is slower than that of citrus. Many deciduous fruit trees such as peaches and pecans grown in north Florida are not irrigated. Those that are irrigated are usually not irrigated for freeze protection, thus growers do not have the freeze protection incentive to install micro systems in deciduous fruit orchards.

Blueberries are often irrigated for freeze protection of early fruit. This requires sprinkler systems to cover the entire plant. The sprinkler systems are then available for irrigation throughout the growing season. Thus, microirrigation is not often used when blueberries must be irrigated for freeze protection.

Grapes can use microirrigation effectively in Florida. However, there are relatively few acres of grapes in Florida, thus the micro acreage in grapes is expected to increase only very slowly.

The use of microirrigation is expected to increase in avocados, mangos, and other subtropical fruit crops. Currently the majority of acreage in these crops is irrigated with sprinkler systems. There is potential for microirrigation to be used in expanded acreages of these crops and as existing sprinkler systems wear out and are replaced.

Field Crops

Microirrigation is adaptable to few field crops (Table 2). The primary reason is economics, and several factors influence this. General characteristics of field crops are given in the following paragraphs. Exceptions to these general characteristics are then discussed for specific crops.

The typical return per acre for field crop production is low, while the cost of microirrigation systems for field crops is high. The cost of microirrigation is high because field crops are typically grown on narrow row spacings, thus closely spaced laterals are required. Laterals would also need to picked up and stored or replaced between crop seasons because only surface lateral placement can efficiently provide water to the crop root zone in typical Florida deep sandy soils. Permanent buried lateral installations such as those used in some western states are not adaptable to use in deep fine sands.

The typical field crop growing season is only a few months per year, irrigation requirements are small compared to most perennial crops, and alternative efficient sprinkler systems can be used. Thus,

potential benefits of microirrigation in terms of water and energy savings are also small.

Low pressure center pivot irrigation systems can apply water for field crop production as efficiently (in terms of water use) as microirrigation and much more economically than microirrigation. Low pressure center pivot systems operate at about the same pressures as micro systems. These center pivot systems have high water application efficiencies for Florida humid climate conditions, especially for irrigation at night, early morning, and late afternoon.

The initial cost of a center pivot system for field crops would be expected to range from $350-500 per acre as compared to $1000-1300 per acre for a micro system. In addition, operating costs would be much lower because center pivot systems do not require water filtration, chemical water treatment, or annual lateral tube replacement required by micro systems.

Within the next 10 years, microirrigation use on field crops is expected to be limited to sugarcane and tobacco. Currently, 90% of Florida's sugarcane production occurs on muck soils in the Everglades Agricultural Area (EAA), and seepage irrigation is required to minimize soil oxidation and wind erosion on these soils. Thus, at the present time, only an estimated 43,400 acres of sugarcane grown on sandy soils is expected to have potential for microirrigation. However, this number may change if the sugar industry is displaced from muck soil areas because of changes in the management of surface waters in the vicinity of the Everglades National Park.

Sugarcane microirrigated acreage is expected to increase only slowly because micro systems have much higher initial costs and maintenance costs than the seepage irrigation systems currently used. Factors that would increase the rate of conversion to microirrigation are drought or water use regulations which would limit water use permits from the water management districts.

Tobacco is currently irrigated with sprinkler irrigation systems, primarily gun systems. These systems are used because they have low initial costs and they are readily adaptable to the small field sizes and irregular field shapes typical of the tobacco industry. The water application efficiency with guns is lower than that of micro systems, and the cost per unit of water pumped is higher because of the high pressures required to operate guns. However, the cost of the additional pumping required plus the additional energy needed to provide the high pressure is much less than the cost of a micro system.

The incentive for the use of microirrigation for tobacco production is low because the tobacco irrigation season is less than four months per year, and irrigation requirements are typically only 5 to 7 inches per year. Thus, the potential water savings with micro systems is low. For these reasons, the rate of conversion to microirrigation is expected to be low.

The initial cost per acre for sugarcane microirrigation systems are expected to be less than that of tobacco systems because the sugarcane water source is primarily surface water, while tobacco is primarily groundwater from wells. If groundwater is used for sugarcane, the system cost would increase because of the additional cost of the well and pumping system.

Both sugarcane and tobacco microirrigation systems would be expected to use disposable thin-wall drip-tube laterals which would require replacement each year. Laterals would be required for each crop row. This is the primary reason for the annual component cost of $300 per acre for both systems.

In summary, microirrigation of field crops is not expected to increase significantly in Florida because neither economic nor water use incentives currently exist. If significant changes occur, they will likely be dictated by water management policy that impacts sugarcane production in the EAA.

Pasture, Hay Crops

Approximately 260,000 acres of hay and 2.2 million acres of pasture are produced in Florida (Table 3), but only about 1/3 of the hay and less than 10 percent of the pasture are irrigated. Neither of these production systems is microirrigated because these crops cannot economically be irrigated with micro systems. The need to uniformly irrigate the entire soil surface for these crops makes sprinkler or seepage irrigation more economical than microirrigation.

The economics of irrigation of pasture and hay crops is not expected to change to cause microirrigation to be used during the next 10 years. If water shortages restrict the use of seepage irrigation in the future, the irrigation system of choice would be low pressure center pivot or lateral-move systems rather than microirrigation systems.

Vegetable Crops

Almost all the Florida vegetable crops are irrigated, yet only about five percent are microirrigated using drip systems (Table 4). Most vegetables are irrigated with sprinkler or seepage systems. This pattern exists because both sprinkler and seepage have been effective, economical irrigation methods for closely-spaced crops with very limited root systems that are characteristic of many vegetable crops. Only the Florida strawberry and tomato industries are exceptions to this usage pattern.

Approximately 80 percent of the Florida strawberry acreage is drip-irrigated. This pattern has emerged because of production benefits and water conservation obtained from drip irrigation. Strawberries are grown using polyethylene-mulched beds, and drip systems permit both water and nutrient to be efficiently applied directly into the root zone under the mulch throughout the growing season. Drip systems have been demonstrated to increase production and minimize waste of both water and nutrients.

Strawberry growers use dual irrigation systems. Permanent solid-set sprinkler systems are also used to provide freeze protection, crop cooling, and establishment of transplants. This industry is expected to move entirely to dual drip-sprinkler irrigation systems, but because most growers already use these systems, few additional acres remain to be converted.

Approximately 20 percent of the Florida tomato acreage is drip-irrigated. Most is seepage-irrigated. The polyethylene mulch production system described for strawberries is also used for tomatoes. Thus, drip

irrigation provides a means of improving production by application of both water and nutrients under the polyethylene mulch, while conserving both water and nutrients by efficient applications. The tomato industry is expected to convert to drip irrigation as growers gain field experience which documents production benefits and as pressure to conserve water increases.

Relatively few acres of other vegetable crops are microirrigated, but this pattern is expected to change during the next ten years for most vegetables grown on sandy soils. Vegetables grown on polyethylene mulch can be expected to benefit from the ability to control both water and nutrient status under the mulch with drip systems. Where seepage irrigation is traditionally used, additional pressures to convert may come from the need for water conservation.

Subsurface drip irrigation systems currently being studied at the IFAS Gulf Coast Research and Education Center are expected to be used to conserve water as compared to traditional seepage irrigation systems. These subsurface drip systems will only be applicable to poorly drained soils in which water tables can be established for irrigation. Conventional drip irrigation systems will be required on deep sandy soils.

Large acreages of vegetables are grown on muck soils using seepage irrigation. Seepage irrigation is needed to maintain a wet soil surface to prevent oxidation and wind erosion of these muck soils. Thus, as long as vegetables are produced on muck soils, this fraction of the Florida vegetable industry is not expected to be microirrigated.

Ornamental and Landscape Plants

Microirrigation is adaptable to many ornamental and landscape plants (Table 5). However, system costs are much greater than for the other crop categories defined in this publication. The primary reason for these high costs is that the closely-spaced plants require an extensive network of pipelines and emitters. Microirrigation is not adaptable to some ornamental and landscape plants such as turf and ornamental fern because the water application

characteristics of microirrigation are not adaptable to these production systems.

Microirrigation system initial costs range from $4,000 to $40,000 per acre for ornamental and landscape plant production systems. These costs are several times higher than the costs of micro systems for field, vegetable, and fruit crops. These high costs can only be supported by the high cash value of ornamental and landscape crops, however, even on some of these crops the higher cost microirrigation systems cannot be economically justified.

Because of the high costs of microirrigation, alternative highly efficient irrigation systems have been developed for some ornamental and landscape crops. Alternatives include ebb-flow systems for potted plants, where potted plants are placed in an impervious basin which is periodically flooded to allow irrigation water to flow into the pots. Excess water is used for irrigation of the next basin, thus water is used without waste.

Another highly efficient irrigation method is the traveling boom spray system which applies water uniformly and efficiently while traveling above the plants. This system is often used in greenhouse production systems.

Some growers have installed impervious surfaces in greenhouses and nurseries to route and collect runoff and drainage for reuse. This method is highly efficient because excess water from each irrigation is reused on subsequent irrigations. Chemical water treatment is typically required to prevent the spread of disease during water reuse.

Other growers continue to use hand-watering of plants rather than microirrigation in order to avoid the maintenance problems of microirrigation. Micro systems require water filtration and chemical water treatment to prevent emitter clogging. Maintenance costs are generally much higher for micro systems than other irrigation methods, thus making hand-watering an economical alternative to microirrigation in some production systems.

Most bedding and potted flowering plants are sprinkler-irrigated or hand-watered. Some micro systems are used on small pots, however, the cost of microirrigation is very high (up to $40,000/acre) because the plants are small and closely-spaced. This high initial cost and the development of alternative highly efficient irrigation methods limit the potential acreage increase to only 10-20 acres per year.

Most woody ornamental field nurseries use drip irrigation, while some use sprinkler systems. Drip systems can be effectively used because it is not necessary to irrigate the entire root zone of these plants. Fertilizers can be effectively applied through the drip systems and irrigations can be scheduled as necessary without interfering with other nursery operations. Because irrigation water is not applied to the foliage, foliar-applied chemicals are more effective since they are not washed off by irrigation water. This industry has already largely adopted drip irrigation, thus the increase in acreage per year is expected to be relatively low.

Woody container plants are often sprinkler irrigated, although micro systems are commonly used for plants in large containers. Micro systems are expensive, especially for small containers. The potential exists for the use of drip irrigation on about 1/3 of this acreage. Others are expected to use sprinkler systems with recycling of runoff water.

Potted foliage plants are often hand-watered or irrigated with traveling boom spray systems. The potential exists for extensive use of drip irrigation in this production system, especially for larger containers. Traveling boom sprays will be most efficient on closely-spaced containers so that water loss between containers will be minimized.

Cut flowers are primarily irrigated with seepage irrigation systems. This trend is expected to continue because micro systems are expensive (up to $10,000/acre) for this production system. Also, sprinklers cannot be used because of disease or quality problems resulting from frequent wetting of the foliage. When micro systems are used, the aisles between plant beds may become dry, and quality problems may occur due to blowing sand or dirt. This may require the extra expense of a sprinkler system to control sand blowing.

Microirrigation systems are not adaptable to ornamental fern and sod production systems. These crops have continuous lateral root development and canopies which cover the entire soil surface. These crops are most effectively irrigated with sprinkler and seepage systems that distribute water uniformly over the entire surface rather than the partial root zone irrigation that is a characteristic of microirrigation. Lateral water movement from micro systems is limited by the hydraulic characteristics of typical Florida sandy and muck soils.

Ornamental fern is grown under shade -- either oak hammocks or shade houses. Fern is shallow-rooted, but has an extensive lateral network of roots in the upper foot of the soil. These plant and production system characteristics allow sprinkler systems to be highly efficient. Because sprinklers are much less expensive than micro systems, and because they are also required for freeze protection, sprinklers are the best irrigation system alternative for ornamental fern production.

To be effectively harvested and transplanted, sod is grown using irrigation methods which encourage shallow root development. This is accomplished with either sprinkler or seepage systems, using frequent, shallow applications with sprinklers or maintaining high water tables with seepage. Sod cannot be effectively irrigated with microirrigation because micro systems are most adaptable to partial root zone irrigation rather than the continuous shallow root zone required in sod production systems.

IRRIGATED ACREAGE SUMMARY

Table 6 summarizes Florida crop acreage and irrigated acreage for the five major crop classes previously discussed. Over 4.6 million acres of commercial agricultural crops are produced in Florida, and approximately 2 million acres (44 percent) are irrigated. Over 418,000 acres are irrigated with microirrigation systems, and almost 94 percent of these are in fruit crops, primarily citrus.

The potential for microirrigation in Florida is high. Approximately 50 percent of the current 2 million acres are adaptable and may be expected to convert to microirrigation. The rate of conversion is estimated to be about 31,000 acres per year, with most of this occurring in fruit and vegetable crops.

IRRIGATION SYSTEM COSTS

In Tables 1-5, microirrigation system cost estimates for Florida crops were made in December, 1991. Costs were estimated in two categories: initial system cost per acre (Column 7) and annual component costs per acre (Column 8). This approach was required because microirrigation systems require replacement of components on an annual basis in addition to the cost incurred for initial system purchase.

The cost of replacement components varies widely depending on the system design. For example, annual component costs are low for citrus microsprinkler systems in which main pipelines are buried and lateral pipelines with emitters are placed under the trees and left in place for the life of the system. In this case, annual component costs are only the replacement costs of damaged or worn-out components. In contrast, annual component costs are high for vegetable crop drip irrigation systems in which laterals are removed and discarded each year. In this case, annual component costs are high because lateral pipelines and emitters must be replaced when beds are formed each crop year.

The sources of microirrigation system cost information were publications by Prevatt et al. (1992) and Pitts et al. (1989), plus inputs from the authors and other contributors to this bulletin, based on their work with irrigation of Florida crops. Contributors are acknowledged in the "List of Contributors" at the end of this bulletin. Only the authors' best estimates of the average microirrigation system and component costs are shown in this bulletin. In practice, actual individual system and component costs will vary around that average depending on site-specific factors.

SUMMARY

Microirrigation is extensively used in many Florida crop production systems. Forty-four major Florida crops and crop groups were identified in this bulletin. Crops were categorized as fruit crops, field crops, pasture and hay crops, vegetables, and ornamentals. Estimates of both total and microirrigated acreage were presented for each crop and category. Potential microirrigated acreage and rate of conversion to microirrigation were also estimated. Advantages and disadvantages of microirrigation were discussed. Although microirrigation offers many advantages for some production systems, it is not adaptable to all Florida crops. Microirrigation system costs were estimated for each crop adaptable to microirrigation. Both initial system costs per acre and annual component costs were presented.

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Table 1.

Table 1. Fruit crops acreage and irrigation system costs

(1)Crop Type	(2)Total Acres	(3)Irrig. Acres	(4)Micro Acres	(5)Potentl.Micro Acres	(6)MicroIncrease(ac/yr)	(7)InitialSystemCost ($/ac)	(8)AnnualCompon.Cost ($/ac)
Avocado	9,100	7,500	100	9,100	150	1,000	25
Blueberry	2,100	1,680	340	500	25	1,200	30
Citrus*	732,800	690,000	385,000	732,800	20,000	1,000	25
Grapes	580	275	275	580	25	1,200	30
Mango	3,000	2,200	200	3,000	150	1,000	25
Peach	2,000	600	300	2,000	200	1,000	25
Pecan	15,000	4,000	3,000	15,000	200	1,000	25
Other Fruit Crops*	2,700	2,700	1,800	2,700	100	1,000	25
Subtotal	767,280	708,955	391,015	765,680	20,850	-----	-----

*Citrus includes oranges, grapefruit, lemons, limes, tangelos, tangerines, and other citrus fruit.

**Other fruit crops include apples, persimmons and chestnuts in North Florida and other tropical and subtropical fruits in South Florida.

Table 2.

Table 2. Field crops acreage and irrigation systems costs

(1)Crop Type	(2)Total Acres	(3)Irrig.Acres	(4)Micro Acres	(5)Potentl.MicroAcres	(6)MicroIncrease(ac/yr)	(7)InitialSystemCost ($/ac)	(8)AnnualCompon.Cost ($/ac)
Corn	105,000	56,000	0	0	0	-----	-----
Cotton	37,000	6,000	0	0	0	-----	-----
Peanuts	102,000	80,000	0	0	0	-----	-----
Rice	20,000	20,000	0	0	0	-----	-----
Soybeans	80,000	12,000	0	0	0	-----	-----
Sugarcane	434,000	434,000	0	43,400	1,000	750	300
Tobacco	6,900	6,900	0	6,900	100	1,370	180
Wheat	65,000	6,500	0	0	0	-----	-----
Other Field Crops*	20,000	2,000	0	0	0	-----	-----
Subtotal	869,900	623,400	0	50,300	1,100	-----	-----

*Other field crops include field beans, sunflower, sorghum, millet, oats and other small grains.

Table 3.

Table 3. Pasture, hay crops acreage and irrigation system costs

(1)Crop Type	(2)Total Acres	(3)Irrig.Acres	(4)MicroAcres	(5)Potentl.MicroAcres	(6)MicroIncrease(ac/yr)	(7)InitialSystemCost ($/ac)	(8)AnnualCompon.Cost ($/ac)
Pasture*	260,000	90,000	0	0	0	-----	-----
Hay*	2,200,000	140,000	0	0	0	-----	-----
Subtotal	2,460,000	230,000	0	0	0	-----	-----

*Pasture and hay crops include grass, clover, and other forage crops.

Table 4.

Table 4. Vegetable crops acreage and irrigation system costs

(1)Crop Type	(2)Total Acres	(3)Irrig.Acres	(4)MicroAcres	(5)Potentl.MicroAcres	(6)MicroIncrease(ac/yr)	(7)InitialSystemCost ($/ac)	(8)AnnualCompon.Cost ($/ac)
Beans, snap	26,500	26,500	0	5,000	500	1,370	180
Cabbage	14,300	14,300	0	5,000	500	1,070	70
Carrot	9,900	9,900	0	0	0	-----	-----
Celery	8,900	8,900	0	0	0	-----	-----
Corn, Sweet	58,200	58,200	0	20,000	1,000	1,070	70

Table 4.

Table 4. Vegetable crops acreage and irrigation system costs

(1)Crop Type	(2)Total Acres	(3)Irrig.Acres	(4)MicroAcres	(5)Potentl.MicroAcres	(6)MicroIncrease(ac/yr)	(7)InitialSystemCost ($/ac)	(8)AnnualCompon.Cost ($/ac)
Cucumber	17,100	17,100	1,000	10,000	500	1,370	180
Eggplant	2,050	2,050	300	2,050	300	1,200	125
Escarole	4,000	4,000	0	0	0	-----	-----
Lettuce	10,600	10,600	0	0	0	-----	-----
Pepper, Green	23,100	23,100	2,000	23,100	1,000	1,200	125
Potato	45,500	45,500	0	45,500	500	1,070	70
Radish	29,000	29,000	0	0	0	-----	-----
Squash	13,600	13,600	0	5,000	500	1,200	125
Strawberry	5,400	5,400	4,000	5,400	100	1,370	180
Tomato	55,800	55,800	11,450	55,800	3,000	1,200	125
Watermelon	53,000	50,000	2,000	20,000	500	1,370	180
Other Vegetables*	44,695	40,000	2,000	8000	500	1,200	1,200
Subtotal	421,645	413,950	22,750	204,850	8,900	-----	-----

*Other vegetables include cantaloupes, processing cucumbers, and other fresh and processing vegetables.

Table 5.

Table 5. Ornamental crop acreage and irrigation system costs

(1)Crop Type	(2)Total Acres	(3)Irrig.Acres	(4)MicroAcres	(5)Potentl.MicroAcres	(6)MicroIncrease(ac/yr)	(7)InitialSystemCost ($/ac)	(8)AnnualCompon.Cost ($/ac)
Woody Field	3,000	2,700	2,025	3,000	100	4,000	100
Wood Container	7,000	7,000	1,050	4,550	100	5,500	200
Cut Foliage	8,000	7,800	0	0	0	-----	-----
Potted Foliage	3,825	3,825	575	3,825	75	6,500	250
Potted Flowering	520	520	415	520	50	40,000	1,000
Cut Flowers	4,000	4,000	160	1,000	100	10,000	1,000
Sod	65,000	30,000	0	0	0	-----	-----
Bedding	900	900	45	180	10	40,000	1,000
Subtotal	92,245	56,745	4,270	13,075	435	-----	-----

Table 6.

Table 6. Summary of crop acreage and irrigated acreage by major crop categories

(1)Crop Type	(2)Total Acres	(3)Irrig. Acres	(4)Micro Acres	(5)Potentl.Micro Acres	(6)Micro Increase(ac/yr)
Fruit Crops	767,280	708,955	391,015	765,680	20,850
Field Crops	869,900	623,400	0	50,300	1,100
Pasture, Hay	2,460,000	230,000	0	0	0
Vegetable Crops	421,645	413,950	22,750	204,850	8,900
Ornamental Crops	92,245	56,745	4,270	13,075	435
Total	4,611,070	2,033,050	418,035	1,033,905	31,285