

## **An Overview of Florida Sugarcane <sup>1</sup>**

L.E. Baucum, R.W. Rice, and T.J. Schueneman<sup>2</sup>

Sugarcane is a crop that can be grown throughout Florida. In most areas of the state it is grown only as a hobby crop for syrup production or as a source of “chewing cane”. In South Florida, along the shores of Lake Okeechobee, sugarcane is grown commercially for the production of crystal or “white” sugar. This overview was prepared to answer the most frequently asked questions about the commercial Florida sugarcane industry and to describe what is involved in the production of sugarcane and sugar.

### **What is sugarcane?**

Sugarcane is a tropical grass native to Asia where it has been grown in gardens for over 4,000 years. It is the product of interbreeding four species of the *Saccharum* genus and is a giant, robust, sugary plant. Methods for manufacturing sugar from sugarcane were developed in India about 400 BC. Christopher Columbus brought the plant to the West Indies, and today sugarcane is cultivated in tropical and sub-tropical regions throughout the world. Over 75% of the world's sugar comes from sugarcane.

### **Where is sugarcane grown in Florida?**

Sugarcane can be grown anywhere in Florida. The commercial sugarcane industry is located in South Florida around the southern tip of Lake Okeechobee. The sugarcane area is so compact that most Florida visitors never see a sugarcane field. Palm Beach County accounts for approximately 70% of the commercial sugarcane acreage and 75% of the total harvested tonnage. The remainder is grown in the adjacent counties of Hendry, Glades, and Martin.

### **Why is sugarcane grown here?**

The fertile organic soil and the warming influence of Lake Okeechobee are the primary reasons the sugar industry is located here. Killing cold temperatures occur very infrequently near the lake. Adequate water and abundant sunshine are also important factors.

### **Is south Florida a good place to grow sugarcane?**

Fair. The muck soils of the Everglades are rich in nitrogen and support vigorous cane growth. When combined with the favorable climate, growth is sometimes too good, which results in large stalks but with reduced

sugar content. Sporadic sub-freezing temperature conditions damage some cane almost every winter, particularly young growth from newly planted cane or young re-growth from ratoon “stubble” crops. Florida sugar mills are modern and efficient, but labor costs are extremely high by world standards. Underlying high labor costs and other economic factors led to the industry's rapid conversion to mechanical harvesting in the early 1990s.

### **How much sugarcane is grown in Florida?**

In recent years there has been a slight decline in commercial sugarcane production in Florida. Sugarcane acreage has decreased from a high of 454,400 acres (183,727 hectares) in the 2000-2001 crop year to approximately 400,000 acres (161,874 hectares) for the 2004-2005-crop year. The 2000-2001 crop year yielded over 17.3 million U.S. tons (15.7 million metric tons) of stalks and 2.02 million U.S. tons (1.83 million metric tons) of raw sugar. The 2004-2005 crop year yielded 13.4 million U.S. tons (12.2 million metric tons) of stalks and 1.56 million U.S. tons (1.42 million metric tons) of raw sugar. Putting Florida's cane crop into perspective, prior to the Cuban embargo in 1961 Florida had only 50,000 acres (20,234 hectares) of sugarcane.

### **What is the value of Florida's sugar crop?**

Recoverable sugar, by weight, has increased from below 10 percent in 1984 to 11.6 percent in 2000-01. The raw sugar crop and the molasses by-product were valued at approximately \$700 million. Most of the fibrous portion of the cane stalks (bagasse) was burned as fuel for the mills and saved an estimated 113 million gallons of fuel oil or 2.1 billion kilowatt hours of electricity. Sugarcane is Florida's most valuable field crop, worth more than the combined value of the Florida-grown corn, soybean, tobacco, and peanut crops. Only citrus is more important than sugarcane to the agricultural economy of Florida.

### **What is Florida's contribution to the U.S. production of sugar?**

In 2004-05, Florida contributed an estimated 51.3% of the cane sugar and 21.4% of the total (from sugarcane and beets combined) sugar produced in the United States.

### **Where does the rest of the sugar produced in the U.S. come from?**

Florida is the largest producer of sugarcane in the United States followed by Louisiana, Hawaii, and Texas in order of production. Sugar beets are grown in Minnesota, Idaho, North Dakota, Michigan, California, and 6 other states, and these provide approximately the same amount of sugar

as the domestic sugarcane industry. All domestic sugar production combined still falls short of consumption. Almost one-fifth of the sugar consumed in the U.S. is imported.

### **What research facilities support the Florida sugarcane industry?**

Production of improved varieties is the primary mission of the USDA-ARS Sugarcane Field Station at Canal Point. Originally established to produce seed for the Louisiana sugarcane industry, it now has an extensive program for developing and testing varieties adapted to Florida conditions. High sugar, disease resistance, rapid growth, and tolerance to high water tables are among the traits sought in new sugarcane varieties.

The University of Florida Everglades Research and Education Center at Belle Glade cooperates in a variety development program and conducts research on sugarcane nutrition and physiology, pest control, water use, and associated agronomic problems. The University of Florida Southwest Florida Research and Education Center at Immokalee conducts research to meet the needs of sugarcane producers on the mineral soils of southwest Florida. Research results and recommendations (fertilization, weed control, etc.) are presented in reports and meetings sponsored by the University of Florida Cooperative Extension Service.

Major sugarcane companies, including the United States Sugar Corporation, Florida Crystals Corporation, and the Sugar Cane Growers Cooperative of Florida, conduct their own research and also support research programs at University of Florida and USDA facilities.

### **How is sugarcane planted?**

Sugarcane planting takes place from late August through January. Because sugarcane is a multi-species hybrid, sugarcane seeds will usually produce plants that differ significantly from the parents. For this reason, commercial planting of sugarcane using seeds is completely impractical. Instead, a favorable sugarcane variety is planted by using parts of the mother plant, which then produces daughter plants (clones) that are essentially identical to the mother plant variety this is called vegetative propagation. Concerns surrounding high labor costs have supported a growing interest in developing machinery and agronomic practices for the mechanical planting of sugarcane. However, as of 2005, hand planting is still a common practice for planting sugarcane. In this scenario, portions of mature sugarcane fields are reserved for "seed cane" (the cane used to vegetatively propagate the next planted crop). Instead of being mechanically harvested for the sugar mill, stalks of seed cane are hand-cut with machetes, loaded onto wagons, transported to the target field, and dropped horizontally into shallow furrows roughly 3 to 8 inches

deep (8 to 20 cm). Typically, these sugarcane stalks are dropped as pairs for a double line of sugarcane stalks throughout the furrow. To increase sprouting potential, stalks are then cut into shorter segments and then covered with soil. Conventional row spacing for commercial sugarcane production in Florida is 5 feet (1.5 m). Cane stalks have buds (“eyes”) every 2 to 6 inches (5 to 15 cm) and each of these buds has the capability to sprout rapidly when buried in moist soil. Within 2 to 3 weeks shoots emerge and, under favorable conditions, produce secondary shoots to give a dense stand of cane.

### **How often is a cane field replanted?**

Typically, a sugarcane field is replanted every 2 to 4 years. After a field has been harvested, it is maintained free of weeds and a second crop of stalks, called a ratoon, grows from the old plant stubble. The second crop is harvested about one year after the first harvest. On average, 3 annual crops are harvested from one field before the field is replanted. When production declines to an unacceptable level due to insect, disease, or mechanical damage, the old cane plant is plowed under after harvest and the land is prepared for replanting. If this event occurs early enough during the harvest season (say, before January), the field will likely be replanted to sugarcane (termed successive planting). If later, a decision may be made to delay replanting until the following season, and instead plant the fallow field to another crop such as rice or sweet corn (termed fallow planting).

### **Doesn't sugarcane produce seed?**

A sugarcane plant is capable of producing seed, but seeds are not used for commercial planting. Seeds are so small (1,000 seeds per gram or almost 454,000 seeds per pound) that they cannot be planted directly in the field. Furthermore, sugarcane does not breed true, thus seeds from a single plant will produce seedlings that are genetically different from each other. Varietal uniformity within fields is important for commercial production. Finally, only under strictly controlled temperature and day-length conditions will the seed be viable. Under normal Florida conditions sugarcane seed produced in the field will not germinate. That is why only stalks are used as planting material for the vegetative propagation of sugarcane.

### **What are the white or reddish plumes seen in some cane fields during winter and spring?**

Sugarcane plumes are the flowers and seed heads of the cane plant. Each plume consists of several thousand tiny flowers, each flower capable of producing one seed. The cool winter weather in Florida ordinarily

prevents development of the seeds. During breeding for variety development, special precautions are taken in order to produce viable seed.

### **What attention does a cane field require after planting?**

After planting, weeds are controlled with cultivation and herbicides. Water must be pumped out when rainfall is excessive. When the soil gets too dry, the crop is irrigated by allowing the water to flow back into the ditches that are normally used for drainage. Water readily seeps from the lateral field ditches throughout the entire field because the muck soil is so porous.

### **When and how is the cane harvested?**

Sugarcane is harvested from late-October through mid-April. If there are no damaging effects of freezes, sugar yields are typically highest after December. In order to complete the entire south Florida sugarcane harvest within the optimal time period, some fields must be harvested before sugarcane plants have reached maximum yield potential. For this reason, agronomic research that documents variety-specific sugar yields over time is a useful tool for identifying, which varieties should be harvested in early-, mid-, and late-season. Years ago, sugarcane was hand-harvested using cane knives. Improvements in mechanical harvesters have resulted in a total movement away from hand harvesting. Acreage that was machine-harvested increased from 30% in 1987 to 100% in 1993.

### **Why are sugarcane fields burned before harvest?**

The fires burn off dead leaves and other biomass “trash” that would otherwise impede the harvest operation, increase transportation costs to the mill, interfere with milling machinery, and absorb sugar during the extraction process. Absorbed sugar cannot be recovered. Fields are burned immediately before harvest. The fires are rather spectacular but of short duration (a 40-acre field burns in 15-20 minutes). Burning is done only in the daytime (through a permitting process with the Department of Forestry) when dispersal of the smoke by air currents causes minimum nuisance.

### **Once the cane is cut, how does it get to the mill?**

After the fields are burned mechanical harvesters deposit the cut cane directly into field wagons. Four-wheel drive tractors haul 16 tons of cane out of the field with each 4-wagon load. At special ramps near the field, the cane is dumped from the wagon into highway trailers or rail cars for

transport to the mills. Rail cars carry 25 to 30 tons each and highway trailers carry 20 tons per load.

### **How is the industry organized?**

All Florida sugarcane is destined for one of the five sugarcane mills in south Florida. Corporations that grow their own cane and extract the sugar in their own mills produce over 65% of the cane. Independent growers for grower-owned cooperative mills produce another large portion, 25-30%. The remaining cane is grown by independent producers and sold to one of the five mills.

### **What happens to the cane at the mills?**

At the mill, the cane is crushed between heavy rollers to squeeze out the juice. Small amounts of hot water are then added and the fiber is again squeezed to remove as much juice as possible. This is repeated three more times. Lime is then added to the juice to help filter out cane fibers and soil, and prevent conversion of the desirable sugar (sucrose) into other sugar forms that won't crystallize. This sucrose solution is concentrated by evaporating off the water (which is recovered and reused by the mill) until raw sugar crystals form. For each pound of sugar produced, 6.5 pounds or 3 quarts of water must be boiled off. Because sugarcane is over 50% water to start with, enough water is recovered during sugarcane processing that sugar mills actually become producers of water rather than consumers. Most of the "smoke" being emitted from sugar mills is actually water vapor, steam generated from the mill boilers. Raw sugar is a coarse, brownish material containing impurities that must be removed in a separate refining process.

### **What is bagasse? (*baa-gas*)**

Bagasse is the fibrous plant material that remains once all of the juice has been squeezed from the sugarcane stalk. Bagasse consists mostly of stalk fibers but also contains leaves and other biomass components that were brought to the mill by harvest trucks or railcars. Bagasse is about half water and half dry matter (plant material). In Florida, most bagasse is burned as fuel for the mills. Several of the mills burn excess bagasse in order to generate electricity for the public grid.

### **What is blackstrap molasses?**

Blackstrap molasses is the dark, viscous liquid that remains when as much of the sucrose as practical has been removed as crystals from the boiled cane juice. Blackstrap molasses is used primarily as animal feed.

### **What is done with the raw sugar?**

Raw sugar is stored in high piles in large warehouses to await shipment to a refinery. Having the consistency of very coarse sand, it is moved by belt conveyors, front-end loaders, or dump trucks. From there it is loaded into large dump trucks, railcars, barges, or ships for transportation to refineries.

### **Are there sugar refineries in Florida?**

Yes. There are two refineries in the area producing both granulated sugar and liquid sugar. One is in South Bay and the other in Clewiston. The granulated sugar is packaged in consumer-size bags while liquid-sugar is shipped in tanker trucks for use in beverages, processed foods, and bakery goods.

### **Can the sugar mills and refineries be visited?**

Sugarcane milling is an industrial process and, as such, is dusty, noisy, and dangerous. Special interest group tours are available during the milling season at selected mills, but tours must be arranged in advance.

### **How much sugar is there in one stalk of Florida sugarcane?**

An average sugarcane stalk weighs about 3 pounds (1.4 kilograms) and is roughly 85% juice. An average stalk therefore has about 2.6 pounds (1.2 kilograms) of juice, which is roughly 11% sugar by weight. Thus, an average stalk contains about 0.3 pounds (0.12 kilograms) of sugar.

### **Which is better, cane sugar or beet sugar?**

Cane sugar and beet sugar are identical in chemistry and quality. Sugar beets, which provide about 38% of the world's sugar, are grown in temperate areas, whereas sugarcane is grown primarily in the tropics and sub-tropics.

### **How much sugarcane is required to supply one American with sugar for one year?**

Average refined sucrose sugar consumption in the U.S. is approximately 61.5 lbs. per person per year. This could be obtained from roughly 205 stalks of sugarcane. At 30,000 stalks per acre, one acre would supply sugar for roughly 146 Americans for a year.

In 2004, per capita consumption in the USA was 61.5 pounds of refined sugar, 78.1 pounds of corn-derived sweeteners, and 1.3 pounds of honey

and edible syrups, for an annual total caloric-sweetener consumption of roughly 141.0 pounds.

<http://www.ers.usda.gov/Data/FoodConsumption/spreadsheets/sweets.xls>

Per capita sugar consumption has decreased from about 100 pounds in the early 1970's to 61.5 pounds in 2004. While High Fructose Corn Syrup (HFCS) has increased from 2 pounds per capita in the early 70's to 59.2 pounds in 2004.

### **What are the principal ways in which sugar is consumed in the U.S.?**

Sugar is consumed as follows: 32% as packaged sugar, 20% in bakery and cereal products, 15% in confectionery products, 6% in dairy products, 5% in processed foods, and 4% in beverages.

### **What determines the price of sugar?**

Neither Florida nor the entire USA exports sugar, so changes in the Florida crop have little effect on world sugar prices. Worldwide, individual government tariffs and trade policies play a paramount role in determining sugar prices. World demand for sugar is rather constant and, under normal growing conditions, production of sugar matches the demand, resulting in stable raw sugar prices. However, good growing conditions sometimes result in higher-than-normal sugar yields in the major sugar beet and sugarcane producing areas of the world. These are Brazil, India, and the European Union. When surplus quantities of sugar enter the world market, surplus sugar can be purchased well below the normal market price. However, to prevent chaos in our domestic sugar industry, the U.S. government imposes import quotas on foreign sugar. This helps insulate U.S. consumers as well as sugar producers from wild price fluctuations in the world market place.

---

### **Footnotes**

1. This document is SS-AGR-232, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First printed July 1992. Revised July 2002. This publication is also a part of the Florida Sugarcane Handbook, an electronic publication of the Agronomy Department. For more information you may contact the editor of the Sugarcane Handbook, R. A. Gilbert (ragilbert@ifas.ufl.edu). Please visit the EDIS Web site at <http://edis.ifas.ufl.edu>.



2. L. Baucum, regional extension agent II, Hendry County Cooperative Extension Service, R. W. Rice, agronomic crops extension agent III, Palm Beach County Cooperative Extension Service, and T. J. Schueneman (retired extension agent IV, Palm Beach Cooperative Extension Service, Belle Glade, Florida Agricultural Research Stations, Institute of Food and Agricultural Sciences, University of Florida. The use of trade names in this publication is solely for the purpose of providing specific information. It is not a guarantee or warranty of the products named, and does not signify that they are approved to the exclusion of others of suitable composition.

---

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other extension publications, contact your county Cooperative Extension service.

U.S. Department of Agriculture, Cooperative Extension Service, University of Florida, IFAS, Florida A. & M. University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Larry Arrington, Dean.

---

### **Copyright Information**

This document is copyrighted by the University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) for the people of the State of Florida. UF/IFAS retains all rights under all conventions, but permits free reproduction by all agents and offices of the Cooperative Extension Service and the people of the State of Florida. Permission is granted to others to use these materials in part or in full for educational purposes, provided that full credit is given to the UF/IFAS, citing the publication, its source, and date of publication.