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Plantain: Production, Uses, and Nutritional Value

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Abstract

To the consumer, 'banana' (*Musa* spp.) is the common name for the numerous yellow, arc-shaped "hands" of fruit marketed for fresh, uncooked consumption and 'plantain' (*Musa* spp.) for the larger, dark green, angular shaped fruit intended for cooking but also edible raw when fully ripe. In some countries, there is no distinction between plantains and bananas. They are simply rated as to whether they are best for cooking or for dessert. The following is a review of the production, uses, and nutritional value of the plantain.

History and Distribution

Plantain is native to southeast Asia and is a close relative to the banana. Plantain has been cultivated longer than most other food-producing plants. The crop was distributed around the world by early 16th century navigators. The Portuguese introduced plantain to the Canary Islands, and soon after it reached the New World. Since plantain is susceptible to frost, it is not commercially grown beyond the warm subtropics. Plantain thrives best in the humid tropical regions (6) and constitute an important dietary component for people living in tropical countries (1).

Plantains flourish under uniformly warm conditions, roughly the area between latitudes 30°N and 30°S (6) (Figure 1). They require protection from frost and strong winds. The plant is injured at 28°F or below, and may be killed to the soil surface. However, when cold injury occurs, new growth usually occur as sprouts from the underground rhizome with the return of warm weather. A suitable climate would have a mean temperature of 80°F (6). Protection against low temperatures and wind damage are important in Florida. Wind breaks can be planted to provide some protection from cold and wind. Wind damage can vary from shredded leaves, twisted/distorted crowns, breakage of petioles, to uprooting of the entire plant. About 4 inches of rain per month is necessary for adequate plant growth and development. Periods of low rainfall can retard growth (8).

Plant Description

The plantain is a fast-growing herbaceous plant consisting of a rhizome-like stem and a stalk or pseudostem formed by upright concentric layers of leaf sheaths which constitute the functional stem. Plantain leaf sheaths range in color with pink to red or dark-brown with some having colored midribs. Normally, plantain are resistant to Panama and Sigatoka disease (3), but are susceptible to borers and nematodes (5). Plant height can reach 20-25 feet (4). The characteristically large leaf blades are extensions of the pseudostem and are joined to the pseudostem by fleshy, deeply grooved, short petioles. Flowers occur spirally along the axis of the inflorescence in groups, covered by fleshy bracts, which shed as development progresses. Fruit can range in size from 2-1/2 to 12″ in length and 3/4 to 2″ in width and are somewhat curved and hornlike. Plantain are considered seedless with minute vestial seeds visible as brown specks in the pithy center (Figure 3).

Varieties

Most plantain varieties are hybrids of *Musa acuminata* and *Musa balbisiana*, two wild species which are starchy

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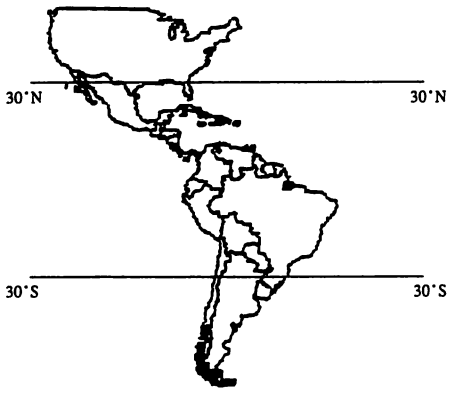

Figure 1. Acceptable plantain climate includes a mean temperature of 80°F with a mean rainfall of 4 inches per month. The dry season should not exceed 3 months, roughly the countries between latitudes 30°N and 30°S.

and are cooked before eaten. 'French Plantain' and 'Horn Plantain' are two popular sub groups. The major commercial cultivars are 'Pelipita,' resistant to Black Sigatoka and Moko Disease and low in culinary quality; 'Saba,' resistant to Black Sigatoka and low in culinary quality; and 'Macho,' most often grown in Florida (6). The 'Horse Plantain' which is tolerant to drought is also popular in South Florida home gardens (8).

Propagation and Planting

Propagation is accomplished with pieces of the rhizome and/or suckers. Large suckers are the preferred planting material. Suckers develop around the main stem forming a clump or stool with the oldest sucker replacing the main plant which dies after fruit are harvested. The suckers are removed from vigorous clumps with a spade when they are 4-5 feet tall (6). Most of the leaves are also removed. Suckers to be planted should have many healthy roots, without symptoms of nematode or borer damage. In South Florida, March, April, and May are suitable planting periods if irrigation is available; otherwise, planting should be delayed until the onset of rain in June.

Planting holes should be large and filled with either compost or a sand-peat potting mixture. A heavy layer of mulch placed around the suckers immediately after planting is recommended. The mulch will conserve moisture, suppress weed growth, and reduce leaching of fertilizer.

Fertilization

Plantain plants need fertile conditions and an abundance of soil moisture. Plant development in the first 3 to 4 months determines the weight of the bunch and number of hands. Young plants should be initially fertilized with 1 pound of 6N-2P-12K fertilizer per plant, every two months. Fertilizer rates are increased gradually to 5-6 pounds during flowering and fruiting growth stages (14-19 months later). In Florida, at least one nutritional spray containing Mg and Zn is recommended annually (6). In soils with low fertility, plantains should be fertilized more frequently (with an 8N-10P-8K or similar fertilizer). Fertilizer application rates depend on stalk size, age, and stalk number per clump.

Cultivation

About 14-19 months after planting, plantains are ready to harvest. A plantain stem produces fruit only once. After harvest, the stem is cut off. The plantain suffers from root competition, so there must be ample space between plants (8') and between rows (12') to avoid crowding and competition for water, light, and nutrients. For maximum root development, the water table should be maintained at 14-19 inches below ground level (4). Weed control is essential. Geese can be used as natural weeders as they do not eat the fruit (6). Nutgrass and nutsedge can compete for nitrogen causing potentially lower yields.

Plants are pruned (de-suckered) to prevent competition by: wrenching by hand; cutting at the soil level with a knife; cutting at the soil level and

Table 1. Nutritional value of Plantain.

Nutritional Components	Ripe	Ripe (Cooked)	Green	Dried (Green)
Calories	111-156	77	91-146	359
Moisture (g)	52.9-77.6	79.8	58.7-74.1	9
Protein (g)	0.80-1.60	1.3	1.16-1.47	3.3
Fat (g)	0.10-0.78	0.1	0.1-0.12	1.4
Carbohydrates (g)	25.5-36.8	18.1	23.4-37.61	83.9
Fiber (g)	0.30-0.42	0.2	0.4-0.48	1
Ash (g)	0.63-1.40	0.7	0.63-0.83	2.4
Calcium (mg)	5.0-14.2		10.01-12.2	50
Phosphorous (mg)	21.0-51.4		32.5-43.2	65
Iron (mg)	0.4-1.5		0.56-0.87	1.1
Beta Carotene (mg)	0.11-1.32		0.06-1.38	45
Thiamine (mg)	0.04-0.11		0.06-0.09	0.10
Riboflavin (mg)	0.04-0.05		0.04-0.05	0.16
Niacin (mg)	0.48-0.70		0.32-0.55	1.9
Ascorbic Acid (mg)	18.0-31.2		22.2-33.8	1
Tryptophan (mg)	8-15		7-10	14
Methionine (mg)	4-8		3-8	
Lysine (mg)	34-60		37-56	

[z]Based on 100 g of edible portion.
[y]From Julia F. Morton, 1987.

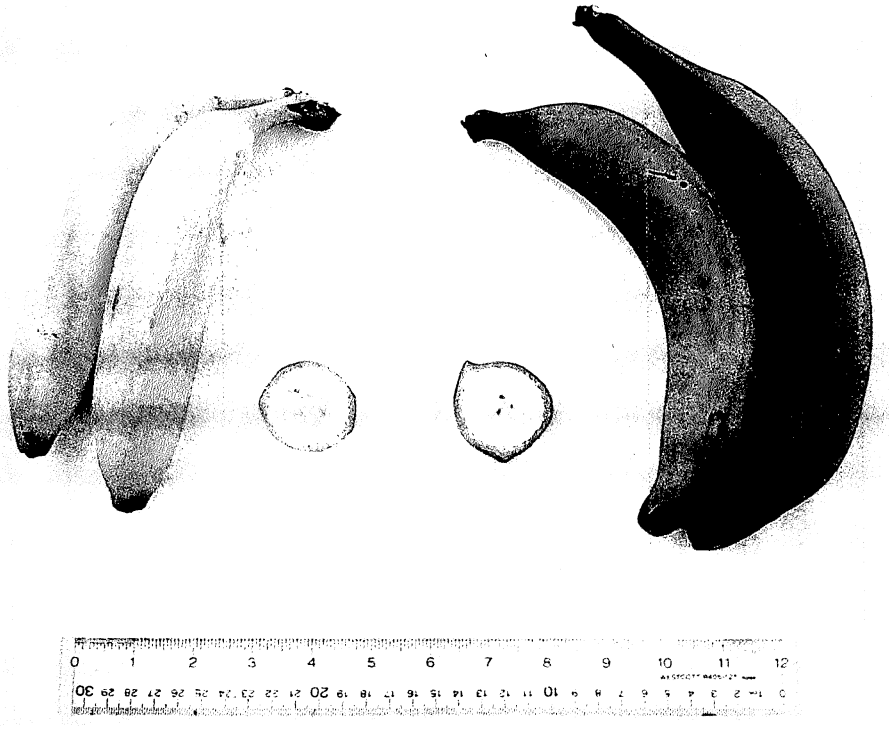

Figure 2. 'Gros Michel' bananas (left) and green plantains (right).

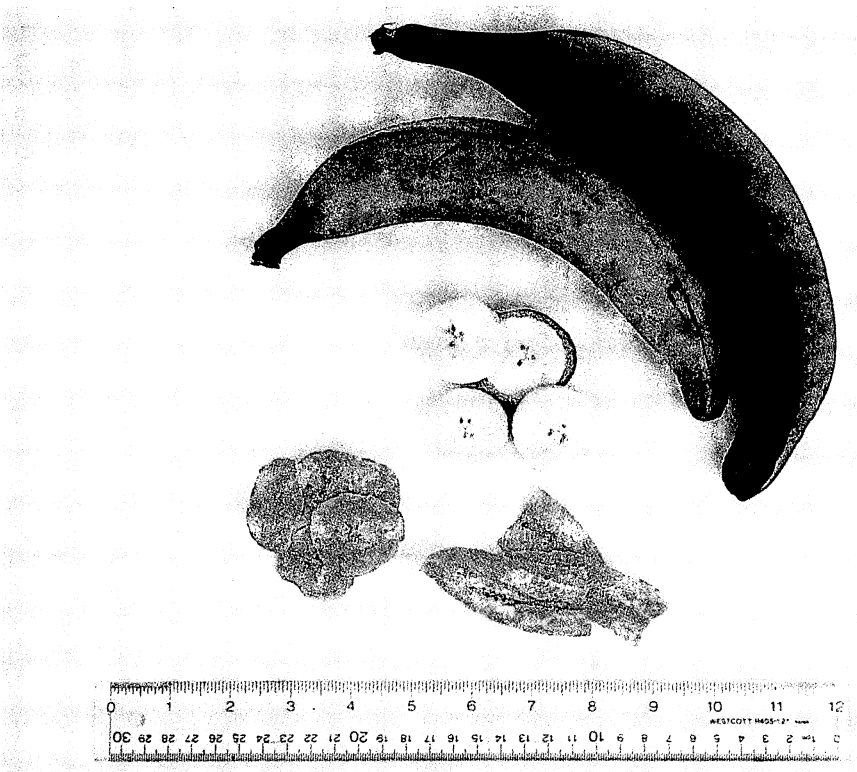

Figure 3. Plantains on the market may be green or yellow with dark spots developing. Plantain chips are a unique, filling snack.

filling the base with kerosene; and cutting at the soil level and killing the underground terminal bud by thrusting in and twisting a gouging tool (6). Older, decaying leaves should be removed since they interfere with spraying. Shade suckers cause blemishes on fruit, harbor disease, insects, and other pests, and constitute a fire hazard.

Fruit bunches should be propped to protect them from premature breakage and bruising. Yields are influenced by soil and agronomic practices, the cultivar planted, spacing, type of propagating material, and management of sucker succession. During the average harvest season, 51,000 individual fruits are harvested per acre planted.

Harvesting and Handling

Commercially, plantains are harvested when fruits are 75% mature. The fruits are harvested with a curved knife then hung to ripen and shipped to market. Plantains are stored at 56-72°F for 4-5 days at 95-100% relative humidity, and then exposed to a single dose of 1:1000 ethylene gas (6). Fruits are then graded for size, quality characteristics, and are packed in layers in special ventilated cartons with plastic padding to minimize bruising (6). Ripe fruit can be held another 6 days at 56°F and still be acceptable for processing.

Pests

Major diseases of plantain are Sigatoka (caused by the fungus *Mycosphaerella musicola*), Panama disease (caused by the fungus *Fusarium oxysporum* f. sp. *cubense*), and Moko disease (caused by the bacterium *Pseudomonas solanacearum*). Sigatoka and Panama disease

can be controlled by selecting tolerant cultivars (9), such as 'Pelipita' which is tolerant to both (6). However, Moko disease is the chief disease of the plantain and the 'Pelipita' should be considered when choosing cultivars for use in infested soil.

In Florida, the spiral nematode is especially prevalent during hot, rainy summers and can be controlled with the nemacide, ethoprop (Mocap). The banana root borer, Cosmopolites sordidus (Germar), attacks the base and tunnel upward through the stem. To ensure healthy plants and fruit, all planting material and utensils must be properly disinfected with 131°F water, a Nemagon solution, or by applying fensulfothion (Dasanit) to ensure healthy plants and fruit.

Food Uses

Ripe plantains, held until the peel has turned mostly or wholly black (Figure 4), are commonly peeled, sliced diagonally, and fried in olive oil (2). This somewhat resembles French-fried potatoes. In school-lunch desserts, the plantain can be found peeled, quartered, infused with orange juice, frozen, and provided to students as a fruit equivalent. The nutrition content of plantain is quite high (Table 1). Plantains also can be used as flour. Plantain flour can be used 50:50 with wheat flour to make cupcakes. Dried green plantains, ground fine and roasted, have been used as a substitute for coffee (7).

Other Uses

In developing countries, plantain meal has been used to feed chickens (6). The leaves, fruit stalks, and peels after chopping, fermentation, and drying, produce a meal somewhat more nutritious than alfalfa meal and is fed to cattle. In the tropical zones of Colombia, fruits and plants furnish essential feed for domestic animals (6). Plantain fiber also can be used in rope, table mats, handbags, and paper. The peel is used in soap and dyes. All parts of the plantain have been found to have some medicinal use—relief for diabetics, diarrhea sufferers, and skin afflictions to name a few. The plantain was thought to have hallucinogenic and aphrodisiac affects (6), but this has not been scientifically proven.

The plantain provides an attractive landscaping component to any lawn. In Florida, a few small commercial plantation producers furnish the local markets. The majority of plantains are found in the home gardens and landscape.

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