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EVALUATION OF THE LONGAN AS A POTENTIAL CROP FOR FLORIDA¹

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Abstract. The longan grows well in the soils of southern Florida and makes a handsome tree for home garden plantings. The small amount of fruit produced in orchards can be sold easily and there is interest in expanded commercial production.

Important limiting factors to fruit production include low temperature injury to trees, irregular fruit production and lack of suitable methods for propagation of superior selections.

Recent selections have much better fruit quality than older selections, and show promise of more regular bearing as well. Limited expansion of commercial plantings appears to be economically justified.

Good prices and increasing demand for fruit have created much interest in the planting of orchards of longan in southern Florida during recent years. Unfortunately, some erroneous statements have been made about the regularity of bearing of the longan and about its cold tolerance. There is danger that such misinformation could induce growers to invest in plantings with the expectation of greater profits than they are likely to obtain. This paper presents an assessment of factors that limit longan production in Florida.

History in Florida

The longan is native to Southeast Asia and is cultivated from southern China to India. The first introduction to the United States was by the U. S. Department of Agriculture in 1903 from southern China (6). Trees produced from the original introductions and distributed in Florida came from a limited genetic base and produced fruit of generally inferior quality (6). This caused the longan to be held in very low esteem in Florida (4, 6, 9) and accounted for the small amount of research done on the fruit in this state in the past. People familiar with the longan in the Orient knew it to be a good fruit and encouraged further research to evaluate its potential in Florida (4, 6, 9).

Since the early 1950's the introduction of superior selections by the U. S. Department of Agriculture and private individuals has greatly broadened the genetic base of longan introductions in Florida (5, 6). One of these, the 'Kohala' from Hawaii (11, 12), has given rise to seedlings

superior to anything seen previously at the University of Florida Agricultural Research and Education Center, Homestead (1). Similar results are reported with seedlings from other selections at the U. S. Department of Agriculture Subtropical Horticulture Research Unit, Miami (R. J. Knight, Jr. Personal communication).

Under Florida conditions, seedling trees will flower and fruit in 4 to 6 years after planting in the field, and thus are more precocious than some species, such as the lychee. This greatly facilitates the improvement of longan through seedling selection. There appear to be good possibilities for continued improvement in Florida in the future.

Adaptation to Florida Conditions

The longan grows well in southern Florida (2, 6, 8, 9). Its northward distribution in the state is limited by susceptibility to injury from frosts or freezes which occur in some years during the months of December, January or February. Reports of the effects of freezes on tropical and subtropical species make it clear that the longan is not a cold-tolerant tree (3, 7, 10). Small trees have leaf and twig injury at temperatures 1-2°F below freezing, and are killed by exposure to air temperatures in the high 20's. Larger trees can withstand some frost. They have leaf injury at temperatures of 27-28°F and injury to branches at temperatures of 25-26°F. Trees exposed to temperatures of 24°F or below will have injury to the trunk and major limbs, and may be killed.

Susceptibility to cold injury limits cultivation of the longan to the warm areas of the southern part of the Florida peninsula, roughly from Tampa Bay and Merritt Island southward. In comparative terms the longan tree has about the same cold-hardiness as the lychee and the 'Tahiti' lime, and slightly more than the mango and the West Indian avocado. Opinions that the longan is more cold hardy than these other crops are not substantiated by observations following several severe freezes (3, 7, 10).

The longan grows well in a variety of soil types. The best growth in Florida is obtained in sandy soils of medium acidity and a fair amount of organic matter. Trees grow well also in the calcareous soils of high pH in the southern coastal area. Small trees occasionally have micronutrient deficiencies in these soils, as indicated by leaf chlorosis. Most trees outgrow these symptoms as they develop a good root system, however, and mature trees seldom are chlorotic. Vegetative growth in organic muck soils is good, but the trees do not bloom and fruit well.

Longan trees respond well to fertilizer application in the sandy and calcareous soils of Florida. Formulations similar to those used for citrus fruits are recommended (8).

Water requirements of the longan tree have not been determined. Irrigation during times of dry weather is advisable because trees exposed to very dry conditions do not grow and fruit well. Trees will tolerate occasional flooding without evident injury, but it is not advisable to plant them where the soil is flooded much of the time.

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Flowering and Fruiting

Bloom in Florida occurs in March or April, and fruit matures from early August to early September. The best flowering occurs after relatively cool winters when frost does not occur. Research has not been done to quantify the duration of "chilling" needed, the temperature range which is most effective, or the best timing of the low temperature exposure. Repeated experience indicates, however, that when temperatures in the 30's or 40's occur for relatively long periods during December, January or February and there is not frost injury, there is likely to be a good bloom on longan trees. Bloom usually is poor after warm winters. If a good bloom occurs, there is nearly always a good crop of fruit.

A major problem with longan in Florida and other areas is the irregularity of fruit production (1, 6, 9). Typically trees will bear a heavy crop one year and then a small crop or no fruit at all the next year. Sometimes two years of poor crops occur between years of good crops. The fact that nearly all of the trees in a given area have the same "on-years" and "off-years" in fruiting indicates that climate probably is the most important factor controlling flowering.

There are also great differences between selections in their genetic capability to flower and produce fruit. Under the best of climatic conditions, some selections bloom profusely and produce heavy crops, while others have little bloom or fruit. The cultivar 'Kohala' has been planted in many locations and has borne fruit more consistently than most longan trees do in similar circumstances. Other selections have been propagated vegetatively and appear to have superior bearing characteristics, but need to be tested more.

Little research has been done on ways to induce flowering in longan, or to reduce alternate bearing. Sometimes limb girdling will induce bloom on otherwise unfruitful trees (6). Fruit cluster thinning has been practiced for a long time by growers in the Orient as a means of reducing heavy crops and increasing the chances of fruit production in the following year (6, 9). Limited trials in Florida indicate that fruit thinning may be effective here as well, but since it is done by hand it would be an expensive procedure.

Fruit Quality

Much progress has been made in selection of superior fruit types in Florida. The improvement in local seedling populations owes much to the recent importation of superior germplasm, as discussed above (6). In the past, most trees in Florida bore small fruit with a thick pericarp and a relatively small amount of edible pulp. Table 1 presents data on the size, amount of edible pulp, and sugar content

Table 1. Fruit characteristics of longan seedlings and cultivar 'Kohala', University of Florida AREC, Homestead.

Selection number	Fruit weight	Edible pulp	Sugar content
	g	%	%
Superior types			
1	10.1	78.2	18.0
11	9.6	74.4	17.7
12	10.4	76.2	20.8
15	9.5	76.4	19.5
Common types			
18	5.3	63.2	19.5
22	4.5	59.0	—
27	6.7	66.6	21.5
Kohala	11.6	77.6	19.1

of the "common run" of longan seedlings in the past and those of the cultivar 'Kohala' and of superior seedling selections of the present in Florida.

Fruit size is very important in the marketing of longans in Florida. Buyers prefer only large fruit, and even if they are willing to buy small fruit they do not pay a good price for it. Fruit size is to some extent genetically controlled and some selections have large fruit size even with a heavy crop on the tree. The amount of fruit on a tree can also influence fruit size significantly. When trees have a heavy crop, fruit thinning will cause a considerable increase in fruit size if it is done at an early stage of fruit development. Thinning is generally done by clipping off entire fruit clusters or parts of clusters by hand.

Heavy bearing is of course a very important and desirable characteristic. No extensive yield records have been taken on longan in Florida. In seedling evaluations at the University of Florida AREC, Homestead, some records have been taken, from which generalizations can be made. On trees with a height and spread of about 20 feet, a light crop is in the range of 50 to 100 lb., a medium crop 150 to 250 lb., and a good crop 300 to 500 lb. Occasionally trees of this size will produce 600 to 700 lb of fruit. Larger trees are capable of producing more fruit, but they are so difficult to harvest that it is not practical to let trees get large. Occasional pruning of the trees down to a manageable height is very desirable if they are being grown for commercial fruit production.

Other desirable characteristics now evident in superior selections are a thin peel or pericarp and a light tan, attractive external color of the fruit. Poorer selections have a thick peel and a dull dark brown color.

Propagation

Longan propagation by seed is easy. Fresh seed will germinate and sprout within a few days in a well-drained, moist medium. The seed loses its viability rapidly after removal from the fruit, however, so storage of seed is not feasible. The great disadvantage of growing orchards of seedling trees is their variability in growth and fruiting characteristics. Some of the trees are likely to be unfruitful and others will have inferior fruit. Differences in growth habit and other characteristics make orchard management and fruit marketing difficult.

The obvious alternative is vegetative propagation of superior selections, and therein lies another important problem with the longan in Florida. Vegetative propagation is difficult. The methods commonly used in Florida for similar tree fruits—air layering of small branches or veneer grafting of seedling rootstocks—have not given good results. Some successful method must be found before superior selections can be propagated on a large scale. One hope is the use of tissue culture propagation.

Potential for the Longan in Florida

The longan is an excellent tree for home gardens in Florida. The demand for fruit and the good prices received indicate that it is a good prospect for limited commercial plantings as well. However, there are several important limiting factors to production of the crop in this state. These include:

1. Frosts and freezes, which limit plantings to the coastal regions and warm areas in the interior of the southern half of the Florida peninsula, and will occasionally damage plantings even there.
2. Irregular bearing, which at present limits good fruit production to about one year out of two.
3. Variable and poor fruit quality of seedling trees.

4. Lack of a successful method of vegetative propagation to enable nurserymen to produce large numbers of trees of superior selections.

Growers should consider all of these factors carefully before undertaking the planting of orchards of longan. Small plantings should be profitable under present conditions of demand and price. At this point, however, the longan must be considered a crop of limited potential with important limiting factors to its production. Large plantings probably are not advisable.

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PROCESSING PUERTO RICAN PLANTAINS FOR THE SCHOOL LUNCH PROGRAM

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Abstract. During 1980, the U.S. Department of Agriculture purchased approximately 200,000 Puerto Rican plantains for a taste-test project in three school lunch programs in the United States. In the pilot project, the first commodity development project of its kind for USDA, the Puerto Rican plantains were shipped to the A. Duda and Sons processing facility in Lake Jem, Fla. There the plantains were ripened, peeled, quartered, infused with domestically produced orange juice, frozen and packed in units of 150 quarter-cup servings. The plantains were then distributed to school lunch programs in New York City, Tampa and Ft. Lauderdale, Fla., and served either as a fruit or dessert. The process of ripening and preparing the plantains for the taste-tests is discussed along with the reaction of the students who ate the new product for the first time.

The plantain is a member of the genus *Musa* along with other banana cultivars that bear edible fruit (3, 4). The name "plantain" is usually reserved for cultivars which are cooked before eating. Plantains are of economic importance in much of the Caribbean, Central America and part of Africa. In Puerto Rico, they are cooked in pies and other desserts when ripe and prepared much like potatoes when mature green.

Annual production in Puerto Rico can exceed 300 million plantains when growing conditions are good (1). Although some plantains are harvested year around, most of the production is ready to harvest in the late summer and early fall. This usually results in a surplus which, in some years, exceeds 20 million plantains. Much of the crop is marketed in the fresh form, however, some plantains are processed into products for later consumption. Export of the surplus production has been almost nil because of

high production costs and competition from other Caribbean countries. The Puerto Rican Government has a program to purchase the surplus production, however, and maintains facilities throughout the Island where farmers bring the portion of their crop they do not sell in the open market. Most of the surplus is used by schools, hospitals or various charitable organizations.

Product Development

During 1980, the U.S. Department of Agriculture decided to introduce a product made from Puerto Rican plantains into the school lunch program in the United States. This would assist in reducing the surplus and possibly expand the market for Puerto Rican plantains. Two requirements were placed on the product: (1) that it meet the nutritional standards established for school lunches, and (2) that it be palatable to students from North American backgrounds.

A. Duda and Sons, Inc., Oviedo, Fla. was contacted to determine if a product could be developed which met these specifications. Plantains in their natural state would not maintain their quality during transportation from Puerto Rico through the commodity distribution system to the school food service locations. Also, green plantains have a starchy bland flavor and ripe plantains have the texture, flavor and cooked appearance of sweet potatoes. Neither flavor is highly acceptable to the average U.S. student.

Since plantains have an appearance similar to bananas, which have a high acceptance rate in school lunch programs, it was decided to approach the product as a fruit rather than a vegetable. With this in mind, the plantains were infused with Florida orange juice to give them a sweet, more fruit-like flavor. Freezing the product produced a sherbet-like texture and also enhanced its flavor.

Analysis of the product determined that size specifications could be established so that each plantain could be quartered during processing and meet the nutritional requirements for a 1/4 cup fruit serving in the school lunch program.

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