

gradual weight reduction, averaging only 6 percent after 3 weeks.

**Juice content.**—Fruit contained an average of 46.9 percent juice when the test was initiated. The juice content of limes averaged 48.9, 52.0, and 51.0 percent after holding at 70° F. for 1, 2, and 3 weeks, respectively. After storage at 50° for 1, 2, and 3 weeks the average juice content was 49.5, 52.3, and 51.7 percent, respectively. The increase in percentage juice content appeared to be due primarily to the reduced volume displacement of the fruit as a result of the reduction in rind thickness instead of an increase in the amount of extracted juice from the fruit. After 3 weeks at 50° the average amount of extracted juice per lime was approximately the same as before storage. However, after 3 weeks at 70° the average amount of extracted juice decreased from 32.4 to 29.1 ml. per fruit.

#### TEST 2

The physical effects of storing and holding 1½-in. and 2-in. limes at 50° and 70° F. are shown in table 1.

**Diameter.**—Shrinkage of both sizes of unwaxed limes was slight during storage at 50° F. Holding at 70° accentuated the difference between the two sizes, with 1½-in. fruit losing more in diameter than 2-in. fruit.

**Rind thickness.**—Limes of both sizes showed about the same reduction in rind thickness after 3 weeks; however, at 70° F. the rind of 2-in. fruit appeared to desiccate more slowly.

**Weight loss.**—The size of fruit directly affected the weight loss during storage and holding. The percentage weight loss in holding and storage was less for 2-in. than for 1½-in. limes.

**Juice content.**—At both 50° and 70° F., the percentage juice content of both sizes of limes increased from the prestorage levels. After 50° storage the percentage juice content of 2-in. limes increased more than did 1½ in. limes. At 70° no consistent difference in the increase of percentage juice content between the two sizes of fruit was apparent.

Prolonged storage and holding periods and reduced humidity levels should be avoided as much as possible to maintain quality of small limes.

## THOUGHTS ON THE FLORIDA MANGO INDUSTRY

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The mango industry in Florida is made up of several hundred small groves located in the warmer sections of the state especially along the Lower East Coast. A large mango grove in Florida is one of 40 to 50 acres. Most of the mango groves are considerably smaller, generally in the neighborhood of five to ten acres. An estimate of the total mango production acreage in Florida which includes plantings as far north as Brevard County on the east coast and Pinellas County on the west coast is approximately 2,400 acres. Production is estimated at about 200,000 bushels annually.

Immediately after World War II many people who received their military training in South

Florida or had spent some time in the tropical areas during the war migrated to Florida. Some of these people had come to know the mango and because of their like for a tropical climate and interest in tropical fruit they created a sudden spurt of interest in mango production here. The enthusiasm of these people and others who had known the mango in Florida for years was contagious and many things took place which brought about a sudden expansion of mango plantings. Research by the University of Florida, University of Miami and USDA personnel contributed greatly to the mango industry in this period of growth and extended into the early 1950's. Many of the people attracted to the industry had never grown anything in their lives. The backbone of the industry was made up of Floridians who believed in the mango and relished its qualities as one of the outstanding tropical fruits.

In the mango industry one can still find the traditional or classic example of the American independent and individualistic farmer.

A group organized the Florida Mango Forum in the late 1930's to provide a medium for promotion of the mango for the exchange and dissemination of information and to develop a mango industry. The Florida Mango Forum conducted an Annual Festival and annual meetings which were well attended and interest in the mango increased through the combined efforts of all the agencies. For some reason, however, around the mid 1950's interest in the mango as an economic venture sharply declined. The number of interested growers also declined and some small groves were allowed to go out of production. Many things contributed to this decline. Probably one of the most important factors was the lack of an orderly marketing program, and with no Federal grades and standards for the mango, fruit of poor quality were reaching markets when prices were high. This was and still is a complex problem but at the present time through voluntary participation on the part of growers and handlers even though there are no grades and standards for mangos, good quality fruit are available with few exceptions throughout the mango season.

With the number of potential consumers in the State of Florida and the rest of the United States, there are millions of people who have never heard of nor ever tasted the mango. In a few mid-western states the bell pepper is mistakenly called mango. Certainly a consumer education program would be necessary for the expansion of this industry. The recent addition of several hundred thousands of people of Latin American or West Indian heritage to our population provides another area for the consumption of mangos. One dark spot in the consumer education and any advertising program is the problem connected with the allergic reaction of some people in the United States to this fruit. In other tropical areas where mangos are grown this allergy was not known nor recognized until World War II when many American servicemen found to their dismay that they developed a dermatitis from contact with the mango. Research into the problem is in progress and has been for several years in Florida. Undoubtedly the research will provide treatment for prevention of this problem.

Many people have felt that the mango industry was not economically sound and believed

that a person had to be slightly mad to grow mangos. Mango growers have been called "mango maniacs" among the more acceptable terms used. However, as with most other vitally interested people, the mango growers who have survived have been those who have been most dedicated to quality controls voluntarily self-enforced and to the search for new varieties as well as better cultural and post-harvest handling practices.

The mango is reported by many authorities to be eaten by more people of the world than any other fruit. This does not seem reasonable but when one considers that India, the Indo-China area, Indonesia and the Philippines, as well as a small portion of China have the greatest population density in the world and the greatest mango production in the world from both cultivated and wild trees, the mango becomes a commodity of major economic and cultural importance. In addition commercial mango production is developing rapidly on the islands of the Caribbean and within the tropical areas of South America, Central America and Mexico.

The mango growers in Florida have been told by certain authorities on tropical fruits that the highly colorful mango selections in commercial production in Florida are lovely to look at but terrible to eat. This of course is a matter of personal taste and background. It is interesting to note that the competitive production areas to the south of Florida are going into production or are planting our more attractive varieties. Are the tastes for these mangos changing or is the future mango production for the United States going to come to us via supersonic transportation in the near future?

The mango fruit, with varietal differences, is a good source of vitamin A and vitamin C and with the exception of the United States is a significant part of the diets of the peoples of the tropical lands throughout the world where mangos can be grown.

Much of the future of the Florida mango industry will depend on industry's ability to become more efficient in production methods, to exercise greater quality control and deliver to the consumer fruits of outstanding appearance, eating and keeping qualities. The search for new and better varieties must continue. The need for disease resistant varieties must take priority. Perhaps rootstocks may play a role in

mango production in Florida in the future, especially since the best mango lands are generally located in the most desirable areas for urban development and new plantings will be in areas thought to be less desirable.

The mango industry has helped itself through many "bootstrap" programs and many growers have been quick to share their findings or new programs with other members of the industry. Most mango growers would be considered the most venturesome of agricultural business people and some of the wildest extremes in cultural programming and management have been tried with and without success. Many ideas are discarded after results and observations but at least most of these attempts have contributed in one way or another to helping the industry.

The expansion of the mango industry with new plantings was in doubt for several years. However, there are small scattered plantings being established in several untried areas of Dade County. In other counties on the southwest coast interest in mango production has been expressed by several people in those areas and at this time reports of preparations for new plantings have been confirmed. These areas include some environmental conditions that remain to be tested. Temperatures, duration of periods of high relative humidity, and water tables must be considered as questionable environmental factors.

The most recent disaster affecting the mango industry in Florida was Hurricane Inez with next to no rainfall but with a great amount of salt spray from which many mango trees still have not recovered. Exactly what happened or what biochemical reactions took place is not known but the results were and are still evident on the east sides of a majority of the mango trees in Dade County.

Tip and marginal leaf burn, eventual defoliation and dieback on the east sides of the trees was symptomatic. Other Lower East Coast counties north of Dade County suffered more severely when Hurricane Betsy in 1965 blew salt spray over their trees while Dade County producers received wind damage but no salt damage.

Prior to Betsy, Hurricane Cleo in 1964 seriously damaged the mango production area near the bay from Cutler northward in Dade County.

The history of the mango industry when one checks into it appears to be the recovery from

one disaster after another including several successive winters with freezing and sub-freezing temperatures occurring prior to and during the fruit set period.

In spite of these problems the mango industry has managed to maintain itself with some changes in production areas, varieties and cultural practices.

According to the DARE report of 1967, the mango industry will expand slightly by 1975.

Off shore competition could become a serious threat to local producers. According to reports, quarantine regulations which prescribe fumigation in Hoboken of all mangos coming to the East Coast of the United States may in the future be circumvented by fumigation at the point of origin. The fumigation and certification of the fruit at the point of origin will be subject to the presence of an inspector from the United States Department of Agriculture.

Regulations governing the use of many pesticides do not cover mangos because in the eyes of the manufacturer the mango is of minor importance economically and mango growers would not absorb enough of the many new pesticides to justify expenditure of the large funds required for label approval.

The future of the mango industry in Florida will be also directly influenced by availability of labor for harvesting. Fertilizing, spraying and weed controls can be accomplished through mechanical and chemical means with a skilled operator for each operation. A reliable labor supply would have to include those people who have been trained in recognizing certain varieties as well as state of maturity or ripeness. Since many mango growers have a family operation including the harvesting of the fruit this labor problem for harvesting may never come to pass but larger growers must be concerned.

Propagation of mango trees and topworking of older established groves to newer and better varieties is mainly accomplished by the grower himself. The discovery or selection of new varieties of mangos has come mainly from chance seedlings in backyards. However, many of the independent growers have their own seedling program in the search for new varieties. They especially look for varieties to lengthen the season and have a more even movement of fruit to market.

Resistance to anthracnose, the mango disease of all production areas of the world, is another major selection problem. The consumer

and seedling grower look for eye appeal, e.g. a rich blush to deep red color of the surface of the skin. Flesh that is fiber free, yellow to orange in color with a sweet, slightly sub-acid flavor to give it more than just bland sweetness is also desirable. As small a seed as possible is also desirable. Tolerance of harvesting and post-harvest handling with a long shelf life

is also most desirable. Thousands of *seedlings* have been tested to meet these requirements but very few have been made final selections. The seedling search continues. There is still much land available for mangos in Florida if most of these problems and requirements are met and overcome. The mango grower must be and is a believer and an optimist.

## AVOCADO GERM PLASM EVALUATION: TECHNIQUE USED IN SCREENING FOR COLD TOLERANCE

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### ABSTRACT

Cold room facilities for exposing large numbers of individual leaves to sub-freezing temperatures in the U. S. Plant Introduction Station's avocado cold tolerance screening program are described. During early 1967, 467 open-pollinated seedlings from 7 progenies: 1) 'Arue'; 2) 'Capac'; 3) 'Capac' F<sub>1</sub>; 4) 'Dunedin'; 5) 'Itzamna'; 6) Mexican-race; and 7) 'Taylor' with Mexican clone M-18686 as "hardy check" and 'Collinson' P. I. 55509 as "tender check" were tested. Both blade and vein damage were scored on a scale of 1 (total tissue destruction) to 5 (no visible tissue damage). Cumulative scores rank Mexican-race seedlings most cold tolerant, 'Arue' seedlings least tolerant.

### INTRODUCTION

Recent F. A. O. sponsored meetings in Rome stressed the urgency and need for establishing international germ plasm collections of economic crops and in particular, food crops. Reviewed as part of the total program were allied subjects such as plant introduction, plant quarantine, population growth and land use. This last item, land use, relates directly to urban encroachment on agricultural lands in the warmest parts of South Florida. Already a number of avocado and mango groves have given way to urbanization. Others are threatened by it

or by the increased tax assessment on grove lands, an implementing factor leading to urbanization.

The First Research Corporation's 1965 report, "A comprehensive economic evaluation of the south Dade County area"(1), recommends that planning measures provide for this unrelenting expansion by establishing a balance between industry and agriculture—with much of the former as processing for the latter.

The majority of Florida's avocados are grown in a restricted zone where subtropical temperatures prevail over damaging freezes. Furthermore the Florida avocado industry is based on cold susceptible cultivars of: 1) the West Indian race of *Persea americana* Miller (*P. gratissima* Gaertn. f.); 2) the Guatemalan race of the same species; and 3) "hybrids," predominantly natural crosses between cultivars of the two races. A third race, the Mexican, botanically separated from the preceding races as *P. americana* var. *drymifolia* (Schl. & Cham.) Blake, is cold tolerant but in Florida there are neither pure cultivars nor hybrids of the race that are commercially important. In California the cultivars 'Fuerte,' 'Hass,' 'MacArthur,' 'Rincon' and 'Bacon,' all Mexican-Guatemalan interracial hybrids, dominate the industry. (2) In Texas, Mexican seedlings are considered equal to oranges in their cold resistance and in one report (3) where oranges and a Mexican seedling were growing under similar conditions the oranges, following a freeze, showed more twig damage than did the avocado. Individuals of the Mexican race have survived and fruited in the Gainesville area for over 50 years (4), again unquestionable evidence of the existence of stable factors for cold tolerance.