PHYSICAL RESPONSES OF SMALL LIMES DURING HOLDING AND STORAGE

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ABSTRACT

Physical responses of minimum-sized limes to holding and storage temperatures of 70° and 50° F. were studied. The diameter of fruit and the thickness of the rind decreased after storage at 50°; this decrease was more pronounced after holding at 70°. Limes of 2-in. diameter appeared to desiccate more slowly than those of 1⅞-in. Percentage weight loss reflected the loss of moisture from the rind tissue. Holding and storage resulted in appreciable increases in percentage juice coontent of limes by volume at 70° and 50°. However, juice content per lime remained unchanged at 50° and decreased slightly at 70°. To maintain quality of small limes, prolonged storage and holding periods and reduced humidity levels should be avoided.

INTRODUCTION

The Persian (Tahiti) lime, unlike most Florida citrus, blooms several times during the year and fruits of several stages of maturity are frequently available at the same time. The shipper is thus faced with the problem of selecting a maturity standard which will insure fruit of satisfactory quality for marketing throughout the year. The industry, which operates under a Federal Marketing Order,[1] has met this problem by specifying a minimum diameter in conjunction with a minimum percentage juice content. These minimum specifications are sometimes adjusted during the year but are usually set at 1⅞-in. diameter and 42 percent juice.

Members of the industry are concerned with the quality of small limes which barely pass the minimum standards and which will possibly fail to pass during holding or storage. Lynch in 1942,[2] reported on weight loss and changes in juice content of limes after holding periods at room temperature (approx. 78.5° F). Mustard and Stahl in 1948,[3] as part of a packaging experiment, reported on weight losses at room temperature (65-75°) and at 45°. In 1963, at the request of several members of the Lime Administrative Committee, tests were initiated to investigate the quality of minimum-sized limes after various storage and holding periods.

MATERIALS AND METHODS

Two temperatures were used in these tests: 50° F. which corresponds with the recommended storage temperature of 48°-50° for limes,[4] and 70° to simulate terminal market holding. The relative humidity in the chambers ranged between 80-90 percent at 50° and between 65-75 percent at 70°, as measured by an electrical hygrometer.

TEST 1

In August 1963, commercially packed waxed limes of size "275" were obtained from a local packinghouse. This size represented the smallest fruit being packed at that time and approximated the minimum size of 1⅞-in. diameter allowed in the grade standards. The fruit was initially weighed, measured for diameter, rind thickness, and percentage juice content (by volume). Five lots of 10 limes each were measured for diameter and percentage weight loss after 48 hours, and 1, 2, and 3 weeks at 70° F. and after 1, 2, and 3 weeks at 50°.

Three lots of 10 limes each were measured for rind thickness and percentage juice content after 1, 2, and 3 weeks at 50° and at 70° F.

TEST 2

In September 1963, unwaxed limes with diameters of at least 1⅞-in. but less than 2-in. (classed 1⅞-in.), and fruit of at least 2-in. but

1United States Standards for Persian (Tahiti) Limes. 1958. U.S. Dept. of Agr., Agricultural Marketing Service.

2S. J. Lynch. 1942. Some analytical studies of the Persian lime. Univ. of Fla. Agr. Expt. Sta. Tech. Bul. 368. 24 pp.

3A. L. Stahl and M. J. Mustard. 1948. Consumer packaging of Tahiti (Persian) limes. Proc. Fla. State Hort. Soc. 61: 242-250.

4R. C. Wright, D. H. Rose, and T. M. Whiteman. 1954. The commercial storage of fruits, vegetables, and florist and nursery stocks. U. S. Dept. Agr. Handb. 66. 77 pp.

less than 2⅛-in. (classed 2-in.) were harvested from a local grove. Lots of 10 limes of each class were measured for diameter and rind thickness (in millimeters), percentage weight loss, and percentage juice content (by volume) after 1, 2, and 3 weeks at 50° and at 70° F.

Results

Test 1

Diameter.—Limes held at 70° F. rapidly decreased in diameter. After holding for only 48 hours the diameter decreased from an initial average of 1 15/16-in. to an average of 1⅞-in. Initially, as well as after holding at 70° for 48 hours, diameters of 8 percent of the fruit were less than 1⅞-in. which was within the 10 percent tolerance allowed for undersized fruit in the grade standards. After holding at 70° for 1, 2, and 3 weeks 38, 68, and 84 percent undersized limes were present, respectively. The average diameter of the fruit after 3 weeks was 1 13/16-in.

As expected, storing limes at 50° F. which was at a higher humidity level resulted in a slower shrinkage rate than in those held at 70°. Twelve percent of the limes were under the 1⅞-in. minimum diameter at the start of the test. After storage at 50° for 1, 2, and 3 weeks 22, 44, and 52 percent undersized limes were found, respectively. The average diameter of the fruit after 3 weeks was 1⅞-in.

Rind thickness.—The reduction in the diameter of limes placed at 70° and 50° F. was due primarily to the shrinkage of the rind of the fruit. The average rind thickness was initially 2.3 mm. After holding at 70° for 1, 2, and 3 weeks the rind thickness averaged only 2.0, 1.7, and 1.5 mm., respectively. After storage of fruit at 50° for 1, 2, and 3 weeks, rind thickness averaged 2.2, 1.9, and 1.9 mm., respectively,

Weight loss.—Percentage weight loss during the various holding and storage periods apparently reflected the loss of moisture from the rind tissue. After holding for 48 hours at 70° F., fruit averaged 1 percent loss in weight and after 3 weeks at the same temperature the loss was 15 percent. Storage at 50° resulted in a

Table 1--Physical responses of small limes during holding at 70° F. and storage at 50° for various periods (test 2)

Temperature and time of storage and holding	Diameter[1]		Rind thickness[1]		Weight loss[1]		Juice content[2]	
	Class 1 7/8-in.	Class 2-in.	Class 1 7/8-in.	Class 2-in.	Class 1 7/8-in.	Class 2-in.	Class 1 7/8-in.	Class 2-in.
	mm.	mm.	mm.	mm.	Pct.	Pct.	Pct.	Pct.
Prestorage	48.7	52.0	2.1	2.2	---	---	48.4	49.0
50° F.								
1 week	48.3	51.9	2.0	2.0	2.0	1.0	49.8	51.7
2 weeks	47.4	51.7	1.9	1.9	3.3	2.0	48.9	51.1
3 weeks	48.2	51.3	1.8	1.9	3.8	2.1	50.9	54.2
70° F.								
1 week	47.3	50.8	1.7	2.1	4.1	3.4	51.2	52.6
2 weeks	47.1	50.8	1.7	1.8	7.1	5.3	51.8	54.8
3 weeks	46.3	50.5	1.5	1.6	10.7	7.6	55.7	51.3

1/ Data based on averages of 10 limes for each size, at each storage and holding period. Rind thickness was measured on each lime in triplicate.

2/ Data for percentage juice content by volume were based on a composite sample of 10 limes for each size at each storage and holding period.

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 1⅞-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 1⅞-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 1⅞-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 1⅞ in. limes. At 70° no consistant 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

SEYMOUR GOLDWEBER

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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.