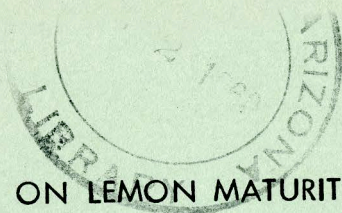


Report No. 172

August 1958



REPORT ON LEMON MATURITY STUDIES
IN 1957

By

R. H. Hilgeman and E. D. Pfenninger

Department of Horticulture

630.72

A71m

no. 172

copy 2

Arizona Agricultural Experiment Station
University of Arizona
Tucson

REPORT ON LEMON MATURITY STUDIES
IN 1957

By R. H. Hilgeman and K. D. Pfenninger
Department of Horticulture

With the establishment of the 30 percent juice by volume requirement for lemon maturity by the Fruit and Vegetable Standardization service in 1957, a need for information on changes in the physical and chemical characteristics of lemons during the harvest period became necessary.

Such changes were followed between Sept. 23 and Dec. 30. Samples consisting of 24 lemons were taken at each location as follows: (1) Rancho Santa Maria, Block 24 A (South of the well), Eureka variety; (2) Arrowhead Ranch (North of farm building area), Villafranca variety; (3) Burgher grove, (South block large trees), Eureka variety; (4) Tyler-Nickolson grove (South of farm building), Eureka variety; (5) U. of A. Citrus Experimental Station (Block D), Eureka variety.

The intent in sampling was to select fruit of the same size throughout the season, thus simulating commercial picking conditions. In practice the average diameter of all fruit sampled on a given date ranged from 2.17 to 2.33 inches. This system of sampling did not take into consideration growth of the fruit. Since the fruit grows rapidly during the fall, the sample procedure actually involved selecting the largest most mature fruit early in the season, and the more immature smaller fruit later in the season.

GROWTH OF FRUIT

Growth of Lisbon lemons at the Citrus Experiment Station is shown in Chart 1. In the absence of further data, it is assumed this growth is fairly typical of lemons throughout the Salt River Valley in 1957. However, it is possible that the Eureka and Villafranca varieties did not grow quite as rapidly. Lemon growth is closely associated with temperatures. When minimum temperatures drop below 32°, little or no growth takes place.

Consequently, any estimations of growth during November and December in future years must take into consideration possible low temperature effects not encountered in 1957.

PERCENTAGE OF JUICE

The results of the maturity tests on the fruit are set forth in Tables 1 and 2. The percentage of juice by volume ranged from a low of 36 percent in September to a maximum of 45 percent in November. These values are so much higher than the minimum required by the present regulation that it appears that no difficulties will be encountered in shipping fruit in any year.

The percentage of juice by volume reported by the Fruit and Vegetable Standardization service from Yuma during November are as follows: Lisbon variety-38, 39.5 and 32.5; Eureka variety-35.5, 41, 40, 37.5, 40. These values are materially lower than the Salt River Valley values, but are sufficiently above the minimum requirements that no difficulty in passing the requirement apparently will be encountered in the Yuma area.

Juice content was also computed by weight and converted to gallons per ton. These data show the juice content gradually increased from 97 to 98 gallons per ton in September to 108 to 109 gallons per ton in November. There is some indication that the December picked fruit, which was small and immature in September, did not attain as high a juice content as the major portion of the crop harvested in November.

YIELD OF CITRIC ACID PER TON

The percentage of citric acid in the juice did not change or tended to increase slightly during September and October and decreased gradually during November and December. The amount of citric acid per ton of fruit attained its maximum in mid-October and decreased steadily thereafter (Figure 2). This brings

up the matter of the proper time to harvest for maximum returns from by-product fruit. Since by-product returns are based on pounds of citric acid per ton, the data shows that the maximum yield per ton will be obtained during the last half of October. However, in 1957 the size of the fruit (volume) increased 31 percent between Nov. 1 and Dec. 31. Calculations pertaining to yields of citric acid and costs of picking and delivering the fruit to the cannery on Nov. 1 and Dec. 31 are set forth in Table 3.

These calculations show that the additional harvesting and shipping costs encountered by allowing the fruit to attain a large size on the tree in December are not offset by the increase in yield of citric acid. Thus, in 1957 under the estimated harvesting costs used, the cost of delivering a pound of citric acid to the cannery is about 11¢ higher on Dec. 31 than it is on Nov. 1.

SUMMARY

This study indicates that lemons produced in Arizona will pass the required minimum standard of 30 percent juice by volume as soon as the fruit is sufficiently mature to withstand shipping in late September or early October.

The percentage of citric acid attained its peak in October and declined rather uniformly during November and December.

The maximum yield of citric acid per ton of fruit was obtained in late October.

The increase in size of the fruit during November and December increased the gross yield of citric acid from 53 to 60 pounds per ton. This 7 pound increase was not sufficient to offset the increased costs of harvest and shipping. The lowest cost of delivering a pound of citric acid to the cannery occurred in late October.

TABLE 1

CHANGES IN PHYSICAL CHARACTERISTICS OF FRUIT

Date	Percentage of juice by volume						Average of the five groves			
	Rancho Santa Maria	Arrow-head	Burgher	Tyler Nick	Citr. Expt. Sta.	Ave.	% juice wt.	Spec. Gravity	Dia. fruit	gal. per ton
Sept. 13	36	41.	36	37	37	37	42.1	.940	2.22	98.0
Sept. 23	36	41.	39	38	38	38	41.6	.919	2.24	96.9
Oct. 7	39	43.	43	42	44	42	46.1	.934	2.24	107.5
Oct. 25	41	46.	41	42	45	43	46.6	.952	2.24	108.7
Nov. 4	38	43.	44	42	45	42	46.2	.941	2.32	107.4
Nov. 18	39	45.	42	41	45	42	47.1	.929	2.33	109.0
Dec. 2	36	46.	42	41	43	42	45.6	.939	2.32	106.1
Dec. 16	38	45.	44	38	38	41	45.8	.912	2.22	106.7
Dec. 30	38	42.	45	41	42	42	47.2	.922	2.17	109.8

TABLE 2

CHANGES IN CHEMICAL COMPOSITION OF THE FRUIT

Date	Percentage of Citric Acid						Average of the five groves			
	Rancho Santa Maria	Arrow-head	Burgher	Tyler Nick	Citr. Expt. Sta.	Ave.	lbs. citr. acid/T.	% solids	Vit. C mg. pH	100 ml.
Sept. 13	5.55	5.82	5.88	5.77	5.80	5.76	50.9	8.76	2.4	
23	5.75	5.92	5.97	5.53	5.87	5.81	48.3	8.80	2.51	
Oct. 7	5.60	5.50	6.18	5.67	5.70	5.73	52.7	8.90	2.5	
23	5.73	5.90	6.26	5.80	6.00	5.94	55.4	8.94	2.5	
Nov. 4	5.18	5.58	5.99	5.38	5.90	5.61	51.8	8.92	2.6	55
18	5.04	5.26	5.74	5.40	5.70	5.42	51.0	8.56	2.7	51
Dec. 2	5.00	5.40	5.50	5.35	5.66	5.38	49.1	8.67	2.7	50
16	4.98	5.27	5.45	5.15	5.63	5.30	48.6	8.40	2.7	53
30	4.65	4.85	5.28	4.75	5.55	5.02	47.4	8.34	2.5	53

TABLE 3

Effect of time harvest on cost of citric acid
delivered at cannery in California

<u>Yield of Citric Acid</u>	Yield and costs if Picked Nov. 1	Yield and costs if Picked Dec. 31
Pounds of fruit	2000	2580*
Pounds of citric per ton	53	46.5
Total pounds of citric acid	53	60.00
<hr/>		
<u>Cost of Delivery to Cannery</u>		
Pick & haul per ton	18.50 ^a	24.80 ^b
Overhead \$10 per ton	10.00	12.80
Freight \$8 per ton	8.00	10.32
Total	\$36.50	\$47.92
Citric acid: cost per pound	68.8¢	79.9¢

*Obtained from increase in volume corrected for decrease in specific gravity, Chart 1 and Table 1.

- a. Calculated at 37 boxes per ton @ 50¢ per box.
b. Calculated at 38½ boxes per ton @ 50¢ per box.

Freight and packing house overhead are estimated.

Shippers can substitute their own specific values for overhead freight, picking and hauling costs. Citric acid in January 1958 was worth about 66¢ per pound.

Chart 1

Growth of Lisbon Lemon Fruit at Citrus Experiment Station

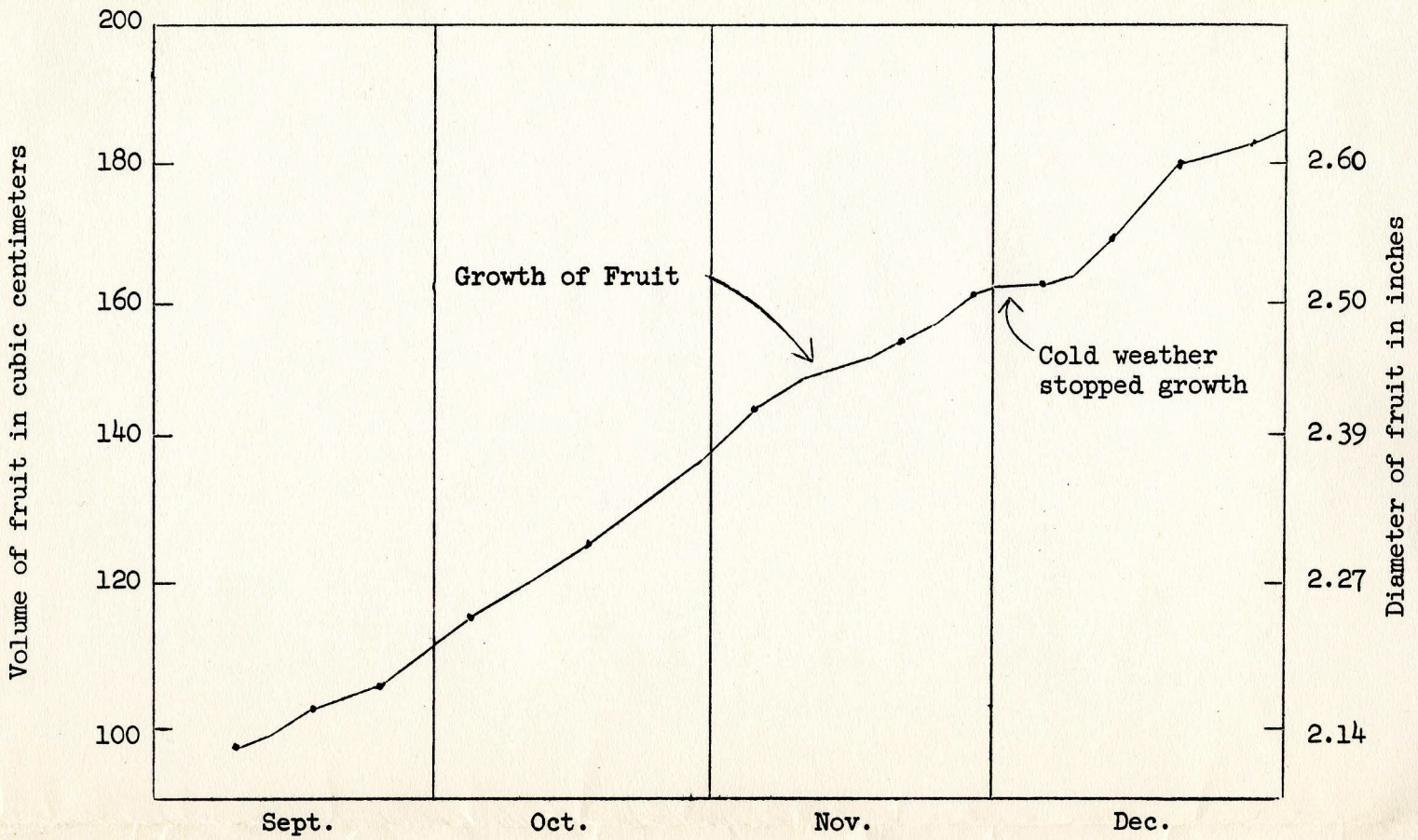


Chart 2

Change in Citric Acid in Fruit Tested

