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EVALUATION OF MATURITY INDICES BASED ON PRESSURE-TEST READINGS
FOR EASTERN-GROWN PEACHES, 1954

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SUMMARY

Maturity standards are proposed for 8 commercial varieties of eastern-grown peaches on the basis of two seasons' work. The standards are given in terms of firmness of the pitted cheeks and suture as measured by a pressure tester with a 5/16-inch-diameter plunger at harvest. The maturity was determined from the time required for peaches to ripen at room temperature (70° to 90°F.). From the first season's work it was more or less arbitrarily established that a peach was mature if it ripened to at least an acceptable flavor in 8 days or less. Peaches requiring longer to ripen were scored immature. Peaches of each variety were picked at all stages of maturity and ripened after harvest. The times required by the peaches to ripen after harvest were correlated with the pressure-test readings at harvest on the assumption that the softest peaches at harvest ripened in the shortest time and the hardest ones in the longest time. The pressure-test readings at harvest of the peaches requiring 8 days to ripen (6 days for Golden Jubilee) were taken as the upper limits of the maturity standards. For the 8 varieties the ranges in the proposed standards are 14.0 to 15.0 pounds or less on the suture and 16.5 to 17.0 pounds or less on the cheeks (average). The best proposal that can be made for a common standard for the 8 varieties is 14.5 pounds or less on the suture or an average of 16.5 pounds or less on the cheeks. Peaches firmer than the standard should not be picked for commercial shipment. At present the proposed standards based on firmness (pressure-test readings) are objective indices that should be supplemented by subjective tests of maturity based on ground color, flesh texture and taste, shape, and pit freedom and color.

INTRODUCTION

During the peach seasons of 1953^{1/} and 1954 the U. S. Department of Agriculture made a study of possible tests that might lead to an objective measurement of maturity in peaches. A satisfactory measure or index of maturity would help growers in deciding when to begin picking and enable the Inspection Service to set up more definite standards. It is generally agreed that adequate maturity of peaches is necessary for the attainment of highest quality.

The maturity of peaches is difficult to measure. Growth often continues after the fruit begins to soften along the suture line. The rates of growth and ripening of individual peaches vary from tree to tree, orchard to orchard and year to year and depend upon the weather and growth conditions prevailing. However, we do know that maturity is closely associated with ripening and that

^{1/} Haller, M. H. and Craft, C. C. Maturity indices for peaches. U. S. Dept. Agr. H. T. & S. Office Report 310, 28 pp. 1954. Processed.

ripening accompanies maturation of the fruit on the tree. Thus, with our present knowledge, the measurement of ripening appears to be the best approximation to the measurement of maturity.

It is generally recognized that the more mature peaches are when they are picked, the shorter will be the period required for them to ripen after harvest. Thus, the time required for peaches to ripen after harvest is a good measure of their maturity when picked. In this study we used the time required for peaches to ripen after harvest to distinguish peaches that were mature when picked from those that were not.

The questions then arise: How long does it take mature peaches to ripen at room temperatures and what ripening period in terms of days should be used to distinguish mature from immature peaches? The ideal way to determine these points would be to use a taste panel, since the overall aim of a more exact definition of maturity is fruit of better dessert quality for the consumer. A taste panel is being used in a similar study on western-grown peaches by Paul Rood of our station at Fresno, California. But in our work on eastern-grown peaches this has not been possible because a trained taste panel is not available and not infrequently fruit of borderline maturity from some orchards have had better flavor on ripening than mature fruit from others. Consequently, we have more or less arbitrarily called mature all peaches that ripened 8 days or less after harvest. Peaches requiring longer than 8 days to ripen have been called immature. A period of 8 days should allow ample time for the transportation and marketing of the fruit.

If our reasoning is sound, we are now in a position to know whether a peach was mature or immature 8 days after harvest. However, this information is of little value unless it can be translated into some objective measure that can be used at harvest. Of the many measurements of maturity that have been suggested such as ground color, firmness, pit freedom, pit color, chemical composition and fruit size, form and surface blush, the two that show the most promise are firmness and ground color. Since the measurement of ground color without the use of special instruments is at best partly subjective, the emphasis in our studies has been placed on firmness.

The firmness of the fruit, as measured by the pressure tester, is the most convenient, practical and objective test of maturity. What is needed and what we have attempted to do is to establish a pressure-test value or point that could be used as a standard, above which peaches would be judged immature and below which they would be passed as mature. With a fruit as variable as the peach, we cannot expect to establish any maturity standard so precise that no mature peaches would fail to pass or that no immature lots would pass. However, it should be possible to establish a standard that would keep the worst of the immature fruit off the market without unduly delaying the marketing of peaches that are of satisfactory maturity.

MATERIALS AND METHODS

Peaches for this study were obtained from growers in Georgia, South Carolina, southern Pennsylvania, West Virginia, Maryland, and Virginia. Fruits, representative of all stages of maturity, were obtained by stripping certain trees in the orchards early in the commercial season for the particular variety and by picking samples from reserved trees at 3-day intervals beginning about a week before the normal commercial harvest and continuing after it. In addition samples of commercially picked fruits were obtained from sheds.

The general procedure was to examine part of the sample of fruit at harvest for (1) firmness by using a pressure tester with a 5/16-inch-diameter plunger on both pared cheeks and the pared suture, (2) ground color by comparison with a color chart, (3) percentage of surface colored red, (4) size of fruit, (5) pit color, (6) pit freedom, and (7) color and condition of pit cavity. The remainder of the sample was held in lined bushel baskets at room temperature (70° to 90° F.) for ripening and tested at 2-day intervals for firmness. A peach was considered ripe when the pressure-test reading on the pared cheeks or suture was less than 2 pounds. A pressure tester with a 10-pound spring was used on the soft peaches.

For each sample we established the range in pressure-test readings for peaches requiring different lengths of time to ripen on the assumption that the softest peaches at harvest ripened in the shortest time and the hardest ones in the longest time. The standard for maturity in terms of firmness was taken as the upper limit of pressure-test readings for peaches ripening in 8 days for all varieties except Golden Jubilee, for which a ripening period of 6 days was used.

RESULTS

Dixired - Peaches of the Dixired variety develop red color and start turning yellow while still very hard and apparently immature. Since most of the surface of the fruit of this variety is usually red at harvest and the pit does not become free, the usual subjective tests for maturity are not distinct enough to be satisfactory. The tentative standards for maturity of Dixired peaches in terms of pressure-test readings suggested in 1953 were 14.0 pounds or less on the suture and an average of 16.5 pounds or less on the cheeks. The work in 1954 showed these values to be reliable enough for field trials.

Dixigem - The work in 1954 was extended to include the Dixigem variety. The proposed standards of maturity for this variety in terms of pressure-test readings are 14.5 pounds or less on the suture and an average of 16.5 pounds or less on the cheeks.

Redhaven - Redhaven peaches are similar to Dixired in that they start turning yellow and develop considerable red color while still hard and apparently

immature. In some samples mature and immature fruit could be readily distinguished by ground color, but, in general, ground color differences are not distinct enough to be satisfactory for distinguishing fruit of borderline maturity.

The tentative standards for maturity in terms of pressure-test readings for Redhaven peaches suggested in 1953 were 13.0 pounds or less on the suture and an average of 15.5 pounds or less on the cheeks. Even though peaches of this firmness are harder than many shippers care to handle, the work in 1954 indicated that the standards should be changed to 14.5 pounds or less on the suture and to an average of 16.5 pounds or less on the cheeks, since peaches of this firmness ripened in 8 days or less to at least an acceptable flavor. It should be emphasized that the standards proposed represent the minimum standards for maturity for the use of regulatory agencies. Whether fruits of advanced or borderline maturity are to be handled is a decision to be made by the individual shipper.

Golden Jubilee - Golden Jubilee is another variety that is difficult to pick at the right stage of maturity. Unlike Dixired and Redhaven peaches, the fruits of Golden Jubilee sometime remain green until they become somewhat soft at the suture. The fruits ripen rapidly and unevenly and become very soft when fully ripe.

The tentative standards for maturity of Golden Jubilee peaches in terms of pressure-test readings suggested in 1953 were 14.0 pounds or less on the suture and an average of 17.0 pounds or less on the cheeks. A ripening period of 6 days or less was used as a basis for maturity in this variety in contrast to 8 days or less for the other varieties. The work in 1954 showed that some of the fruit which would be scored as immature by the 1953 pressure-test standards have the capacity to ripen in 6 days or less. However, since these fruits had all the subjective characteristics of immaturity, it is proposed that the pressure-test standards suggested in 1953 remain for field trial. Our experiences with the Golden Jubilee variety in Georgia and South Carolina in 1954 indicated that even mature fruit of this variety often fail to ripen to a desirable flavor after removal from the tree.

Early Hiley - Early Hiley is a white-fleshed variety that is being largely replaced by newer, yellow-fleshed varieties. The tentative standards for maturity of Early Hiley peaches in terms of pressure-test readings suggested in 1953 were 13.5 pounds or less on the suture and an average of 15.0 pounds or less on the cheeks. The work in 1954 indicated that these standards should be changed to 14.5 pounds or less on the suture and an average of 16.5 pounds or less on the cheeks, since peaches of this firmness ripened in 8 days or less to an acceptable, although perhaps not good, flavor.

Halehaven - The tentative standards for maturity of Halehaven peaches in terms of pressure-test readings suggested in 1953 were 15.0 pounds or less on the suture and an average of 17.0 pounds or less on the cheeks. The work in 1954

showed these standards to be reliable enough for field trials.

Sullivan Elberta - The tentative standards for maturity of Sullivan Elberta peaches in terms of pressure-test readings suggested in 1953 were 15.5 pounds or less on the suture and an average of 17.5 pounds or less on the cheeks. The work in 1954 showed that fruit from the early pickings testing 15.5 pounds or above on the suture or 17.5 pounds or above on the cheeks were immature by both subjective tests and ripening response. Because of this, it is suggested that the pressure-test standards for maturity be changed to 15.0 pounds or less on the suture and an average of 17.0 pounds or less on the cheeks. However, fruit picked several days later in the commercial season with pressure-test readings of 15.5 pounds on the cheeks or 17.5 pounds on the suture, while still appearing immature by subjective tests, often ripened in 8 days or less to at least an acceptable flavor.

Elberta - When successive pickings of Elberta peaches are made at intervals of 2 or 3 days from the same trees, there is a progressive change in the ground color from green to light green to yellow. Similarly there are progressive increases in the surface blush, in the filling out of the shoulders, and in the size of the fruit. Inside the peach there are a progressive decrease of the granular appearance of the broken flesh and, in many years, increases in pit freedom and the red coloration of the pit and pit cavity. These changes are usually adequate to enable an experienced individual to separate fruit of medium or advanced maturity from immature fruit. However, these subjective tests are not adequate for separating immature fruit from fruit of borderline maturity and usually any fruit that shows a "break in color" or a slight fading of the dark-green ground color is scored as mature. An additional consistent objective test would be welcomed by the inspector since it would substantiate his grading and make the scorings for immaturity more uniform in different packing sheds.

The tentative standards for maturity of Elberta peaches in terms of pressure-test readings suggested in 1953 were 14.0 pounds or less on the suture and an average of 16.0 pounds or less on the cheeks. The work in 1954 indicated that these standards should be changed to 14.5 pounds or less on the suture and an average of 16.5 pounds or less on the cheeks, since fruit as firm as this ripened in 8 days or less to an acceptable flavor.

DISCUSSION

The pressure-test standards for maturity suggested for the 8 varieties studied are summarized in Table 1. The varieties differ somewhat in the firmness at which they should be picked. The best approximation for a common pressure-test standard that could be used for all the varieties studied, if such a standard is desired, would be 14.5 pounds or less on the suture or an average of 16.5 pounds or less on the cheeks.

The standards suggested were set up more or less arbitrarily, depending on the length of time required for peaches that appeared to be mature to ripen. It has been emphasized that those proposed represent the minimum standards for maturity. A standard based on firmness must be high enough to allow for the normal variation in commercial lots and yet sufficiently low to remove the worst of the immature fruit. If in a given lot as much as 50 percent of the peaches test 14.5 pounds on the suture or an average of 16.5 pounds on the cheeks the fruit would undoubtedly have poor quality when ripened. Certainly peaches of this firmness could be allowed to remain on the trees somewhat longer and still be firm enough for long-distance shipment.

However, in most commercial samples there is a wide range in firmness of the fruit at harvest. Therefore, it is probable that any sample having as high as 50 percent of the peaches on the borderline of maturity also would have over 10 percent of the fruit with pressure-test readings above the standard and would be scored immature. The standards can be made more stringent if the peach industry desires. However, a standard would be of little value if the pickers in the orchard and the graders in the shed cannot provide fruit to meet it.

The work in 1954 was done in close cooperation with the Inspection Service. Maturity evaluations of peaches by experienced inspectors and maturity as determined by the proposed pressure-test standards were compared. The scorings for immaturity as found by the two different standards were sufficiently close to warrant further field trials by the Inspection Service of the pressure tester as a supplementary measure of peach maturity.

In the course of this work data which show the relation between the pressure-test readings at harvest of peaches of different maturities and the times required for them to ripen at room temperature were also obtained (Table 2). This information is of value to those interested in marketing peaches in an advanced stage of maturity, since it gives a measure of the potential life of peaches picked at different degrees of firmness. In examining the data one should realize that if the ripening temperature of the peaches is lowered, by either refrigeration or hydrocooling, the time required for ripening will be increased.

In summary, the standards for maturity in terms of pressure-test readings proposed in this paper should be looked upon as supplementary, and they must be used with judgment and a knowledge of the other factors that affect the growth of peaches. The best evaluation of maturity in a fruit as variable as the peach is, and will undoubtedly continue to be, the decision of an individual experienced with peaches and having good judgment.

Table 1. Pressure-test standards for maturity of 8 peach varieties

Variety	Pressure-test reading on -	
	Cheeks (average) :	Suture
	<u>Pounds</u>	<u>Pounds</u>
Dixired	16.5 or less	14.0 or less
Dixigem	16.5 or less	14.5 or less
Redhaven	16.5 or less	14.5 or less
Golden Jubilee	17.0 or less	14.0 or less
Early Hiley	16.5 or less	14.5 or less
Malehaven	17.0 or less	15.0 or less
Sullivan Elberta	17.0 or less	15.0 or less
Elberta	16.5 or less	14.5 or less

Table 2. Range in firmness, maturity and ripeness of eastern-grown peaches at harvest and time required for them to ripen at room temperatures (70° to 90° F.).

<u>Pressure-test reading on</u> <u>Cheeks (average): Suture</u>		<u>Maturity</u> <u>at</u> <u>harvest</u>	<u>Ripeness</u>	<u>Time required to</u> <u>ripen at room</u> <u>temperature</u>
<u>Pounds</u>	<u>Pounds</u>			<u>Days</u>
Above 16.5	Above 14.5	Immature	Hard-unripe	More than 8
16.5 - 16.0	14.5 - 14.0	Borderline	Hard-unripe	8
16.0 - 14.0	14.0 - 13.0	Mature	Hard-unripe	8 - 6
14.0 - 12.0	13.0 - 12.0	Shipping- mature	Firm-unripe	6 - 4
12.0 - 10.0	12.0 - 10.0	Advanced- mature	Firm-unripe	4 - 2
10.0 - 2.0	10.0 - 2.0	Overmature	Firm-ripe	Less than 2
Under 2.0	Under 2.0	Overmature	Ripe	-

