WASHINGTON SWEET CHERRY CHARACTERISTICS: FRUIT SIZE AND CULLAGE RATES

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BACKGROUND

During the 1980s the Washington sweet cherry industry began a concerted effort to adapt to changing market conditions. Real fresh prices, with the exception of the years 1977-79, had been steadily declining. The growing array of products being offered in retail produce sections was creating greater competition for cherries. There was concern within the industry that lack of change would result in a decline in the industry. Two possible solutions were suggested by industry members: increased niche marketing and higher grade standards.

The niche marketing advocates argued that greater segregation of cherries by fruit size would generate better grower returns. The predominant practice in the industry has been to market fruit in two size categories. The bulk of the fresh shipments have been of the size category classified as 12-row and larger. These fruit are bulk packed in 20-lb. boxes. The other size category is 13-row and container size for these cherries is 12 lbs. There are some deviations from the predominant practice with respect to size of fruit and size of container, but the norm continues to be 12-row and larger, and 13-row fruit packs.

Row size is determined by the number of fruit placed shoulder to shoulder that are needed to cover the distance across a 20-lb. container. The width of that container traditionally was 10.5 inches. It follows that a 10 1/2 row cherry is essentially 1 inch in diameter. Twelve-row fruit are smaller because 12 cherries are required to fill that 10.5 inch distance.

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1 See for example, Schotzko, R.T., et.al. Demand for Fresh Sweet Cherries, Research Bulletin XB 1007. College of Agriculture and Home Economics Research Center, Washington State University, Pullman, WA. 1989

During the discussion of the value of offering a greater number of size categories for sale, a question arose as to the volume of fruit in the various size categories. No data had been accumulated on a regular basis to determine the distribution of fruit size and the implications that distribution would have for marketing.

Since niche marketing by fruit size was legal within the grade standards, the industry began to actively evaluate the level of occurrence of various defects and their causes while the value of niche marketing continued to be debated. The Washington Cherry Marketing Committee funded the evaluation of defect levels at the receiving point in the New York metropolitan market.³

During this period the marketing committee also increased the minimum fruit size allowed to be shipped fresh. There were two reasons for this change. Previously the actual allowable diameters associated with 13-row fruit were less than the diameter associated with row size as defined above. The idea was to make the legal row size the "true" row size. The other reason was that eating quality (as yet undefined by the industry) was assumed to be positively correlated with size. Increasing the minimum allowable diameters was assumed to marginally improve eating quality of fresh marketed fruit.⁴

Also during this period, research was also conducted at shipping point to determine the causes of the major defects and methods of reducing current defect levels. Given the information collected at receiving point, the research at shipping point could be used to reduce the occurrence of defects.

While the shipping point research is generating very useful information that can be used by packers to improve handling methods, it cannot be extrapolated to reflect industry wide impacts. No effort has been made to systematically collect cullage data on a broad basis in the industry. Baseline data are needed for evaluation purposes should the industry change generally acceptable handling and packing methods or change grade standards to reduce defect levels at receiving point.

³ The Washington Cherry Marketing Committee is composed of cherry producers and shippers, and is responsible for administering the cherry market order. The committee has the authority to fund research. Details of the authority of the committee are available from the Cherry Marketing Committee office in Yakima, Wa.

⁴ This is based on personal observation by the author at marketing committee meetings.
This report describes information on fruit size distribution and cullage rates for five crop years. Seven firms (with a total of 10 packing sheds or distinctly identified growing areas) were identified that measured the size of the fruit in samples taken from each lot of fruit delivered to the shed. When this survey began, the participating firms were the only firms identified by industry personnel that systematically collected detailed size information. Those firms agreed to provide information that included pounds of fruit by row size, cullage, the volume of briners, and total fruit handled. This information was provided on a pool by pool basis. Pools in this case are returns pools and are based on date of delivery of field run fruit to the packing house.

The amount of time associated with each pool (number of days) varies from house to house. However, most pools are 3 to 7 days long, except for weather related pools. There has been a tendency over time for the pool periods to be lengthened. In 1983, the number of days used per pool period when the individual house data were combined was three. In 1987, seven days per pool period were used.

The figures containing information by pool period have been adjusted chronologically so that the dates are approximately the same across years. Five years of data were accumulated covering the time period 1983 to 1987, inclusive. Three firms are located in Yakima and four in Wenatchee.

The firms typically used roller sizers, making size comparisons and combining of data valid. The shape of cherries, particularly larger fruit, influences the measurement of size. Large fruit are not round, but are rather oval shaped at the shoulders (the point of greatest diameter). Roller sizers (two long rollers placed side by side and tilted so that one end of the rollers is higher and the distance between the rollers widens from top to bottom) measure the minimum distance across the oval at the shoulders of the fruit—the smallest diameter at the shoulders. The other common method of measuring size is the use of plastic cards with holes of various sizes. This method measures maximum diameter of each fruit. Since all cooperators used roller sizers, the data are consistent across firms.

There are, however, biases in the 9-row data and 13-row data. Not all firms reported the volume of 9-row fruit or the volume of 13-row fruit. Where the firm did not separate out 9-row fruit, 9- and 10-row fruit are combined, so that for those firms the actual volume of 10-row fruit is overstated by the unknown amount of 9-row fruit in the samples.
For those firms that did not record 13-row fruit there is an inherent bias in the percentages of fruit in all the size categories. This is caused by the reduction in the total volume of row size fruit. The percentages were determined by the amount by weight of fruit in each size category divided by the total weight of fruit that was sized. Culls and brines were not included in the total unless size was explicitly specified by the firms. If 13-row fruit are not included in the denominator, the percentages for each row size will be greater because the denominator is smaller than it should be. Because of the small volumes of 13-row fruit the bias is not severe.

The volume commercially shipped fresh by all growers in the Washington market order area and the volume of fresh market fruit from the sample firms is compared in Table 1. Percent of total volume shipped fresh that came from the sample firms ranged from 32.7% in 1985 to 44.3% in 1987. With the exception of 1985, all samples during this time period represented at least one third of the commercially marketed fresh fruit.

Table 1: Washington Commercial Fresh Cherry Volume and Sample Size

<table>
<thead>
<tr>
<th>Year</th>
<th>Fresh Volume Tons*</th>
<th>Sample Tons</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>59,986</td>
<td>21,925</td>
<td>36.6</td>
</tr>
<tr>
<td>1984</td>
<td>38,788</td>
<td>13,315</td>
<td>34.3</td>
</tr>
<tr>
<td>1985</td>
<td>18,557</td>
<td>6,063</td>
<td>32.7</td>
</tr>
<tr>
<td>1986</td>
<td>39,660</td>
<td>16,141</td>
<td>40.7</td>
</tr>
<tr>
<td>1987</td>
<td>45,105</td>
<td>19,961</td>
<td>44.3</td>
</tr>
</tbody>
</table>

* Source: Washington Cherry Marketing Committee

FRUIT SIZE

Average fruit size for each of the five years in the study and the five-year average are shown in Figure 1. Average fruit size is calculated in the following manner:

\[
\text{Average size} = \frac{(9 \times \%9\text{-row fruit}) + (10 \times \%10\text{-row}) + (11 \times \%11\text{-row}) + (12 \times \%12\text{-row}) + (13 \times \%13\text{-row})}{100}
\]

Each percent in the equation is calculated by dividing the weight of fruit in each row size by the total volume of row sized fruit. Given that method of measuring average fruit size the lower the number the larger the fruit.
The 1986 crop had the largest average fruit size for the five-year period (Figure 1). The year 1987 ranked second. The 1985 crop had the smallest fruit. The 1983 and 1984 crops were between 1985 and the average for the five years.

Weather is a factor in determining average size. Weather during the 1984 and 1985 growing seasons was less conducive to large fruit.

While the weighted average row size is one measure of fruit size, it does not show how the fruit are distributed around that average nor is it immediately obvious how sensitive average size as calculated here is to changes in that distribution. The distribution becomes important in an explicit fashion should a greater number of shippers begin to offer more row size categories for sale. The distribution provides an indication of the volume of fruit available by size category.

The fruit size distribution for each of the five years is shown in Figure 2. In all years, the peak fruit size (the size category with the greatest volume of fruit) was 11-row (Table 2). However, the distribution around that peak size fluctuated substantially from year to year. The 1983 record volume crop had a supply of 10-row fruit that was greater than the volume of 12-row fruit. The weather affected years of 1984 and 1985 had a relatively short supply of larger fruit. Less than 20% of the volume was 10-row or larger. In 1986 and, to a lesser extent, 1987, fruit size was large and the volume of 10-row fruit was higher than in earlier years. The volume of 10-row and larger fruit ranged from 15.7% in 1984 to 39.3% in 1986.

Table 2: Percent of Sized Volume by Row Size*

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>9 row</td>
<td>1.2</td>
<td>.4</td>
<td>.8</td>
<td>3.1</td>
<td>1.5</td>
</tr>
<tr>
<td>10 row</td>
<td>24.4</td>
<td>15.3</td>
<td>18.0</td>
<td>36.2</td>
<td>26.8</td>
</tr>
<tr>
<td>11 row</td>
<td>44.9</td>
<td>51.7</td>
<td>46.2</td>
<td>42.4</td>
<td>44.7</td>
</tr>
<tr>
<td>12 row</td>
<td>23.8</td>
<td>27.8</td>
<td>27.6</td>
<td>15.6</td>
<td>22.4</td>
</tr>
<tr>
<td>13 row</td>
<td>5.7</td>
<td>4.9</td>
<td>7.4</td>
<td>2.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Avg. row size</td>
<td>11.09</td>
<td>11.21</td>
<td>11.23</td>
<td>10.78</td>
<td>11.02</td>
</tr>
</tbody>
</table>

*The numbers are rounded and may not add to 100.

One must be careful about looking at patterns over time in terms of the change in the distribution that appears to have occurred because of the weather
effects in 1984 and 1985. A simple projection suggests that average fruit size has been increasing over time. However, the number of years included in this survey are inadequate to truly determine whether, in fact, an increase in size has actually occurred.

Average row size by pool period is contained in Figure 3. Fruit size tends to decline very early in the season and then increases until later in the season. Then size again tends to decline. In Figure 3, this is shown by the way the curve increases (moves upward) early in the season and then begins to drop toward the horizontal axis. After the initial decline in size, the curve has an approximate U shape.

Figure 4 shows the daily shipments for 1985, 1986, and 1987. Note how shipments start out slowly, accelerate, reach a peak, and then decline as the season progresses. The beginning of harvest changes from year to year depending on weather conditions. However, the geographic sequence of harvest is the same from year to year.

Given current marketing conditions, there is strong economic justification to explain the change in average size through the season. Growers in those districts where the fruit mature in the earliest part of the harvest will tend to allow their fruit to hang on the tree to be sure that the bulk of the fruit will have minimum size and color. Then other growers in the early districts who do not have the earliest harvest dates will tend to rush harvest in hopes of having their fruit marketed before the usual price decline begins. (See Figure 5 for a graphical representation of those price patterns.)

Moving through the season, prices go through their typical decline and growers in mid-season tend to delay harvest to increase yield. At the very tail end of the season, prices do not usually recover to early season levels as supplies dwindle and retailer interest shifts to other summer fruits, so growers tend to harvest without waiting for additional size.

The other factor that may play a role in the difference in size between early and late season is that shippers in the Wenatchee area generally market a larger number of row size categories and grower returns are more heavily influenced by fruit size distribution than in the Yakima Valley.\(^5\)

The 5-year average fruit size distribution for each packing house is shown in Figure 6. The first five packing houses from the left are located in Yakima;

\(^5\) Based on personal observation of packing operations and discussions with industry personnel.
the rest are in Wenatchee. Generally speaking, those houses in Wenatchee have a greater percentage of 10-row fruit than do those in Yakima.

The difference in average fruit size for that 5-year period between Yakima and Wenatchee is shown in Figure 7. It is obvious from this figure that Wenatchee District growers have larger fruit to market than do Yakima Valley growers, on the average.

The early season price decline adversely affects grower returns in the Yakima Valley, particularly in the earliest districts. That early price decline in the recent past has occurred in only a few days. By the time harvest is in full swing most of the price decline has occurred.⁶ (See Figure 5)

A recent unpublished study analyzed the potential effect on grower returns in the earlier districts of leaving the fruit on the tree longer to improve size.⁷ Because of the rapid decline in market price that occurs during the early part of the season, a grower who delays harvest to improve size generally will receive lower returns than one who harvests as soon as his fruit makes grade. There is one exception to this finding. There is a small market window during the earlier part of the season when it appears that waiting for larger fruit can generate better returns for the grower. Identifying precisely when that period exists is not possible because it tends to change from year to year. There does appear to be a relationship between the entrance of The Dalles, Oregon, fruit into the market and the closing of that window. So, while one may correctly infer that fruit size from the Wenatchee district is larger than Yakima fruit, it is not economically rational to assume that the Wenatchee district approach to marketing is suitable for the early districts in the Yakima Valley. It should be noted that the focus of this survey was fruit size and no attempt was made to correlate size with quality. To the extent that quality is positively correlated with fruit size, the evaluation of the data provided in this report would need to be altered to recognize explicitly that correlation.


CULLAGE

Percent cullage of the sample firms as a group for each of the five years and the 5-year average is shown in Figure 8. The weather effects of 1984 and 1985 are immediately obvious.

There was a long cold spring in 1984 and by the time harvest started (the first pool period in 1984 was for cherries shipped prior to June 19), the fruit were physiologically mature and had less shelf life than normal. In 1985, major frosts hit in late April and early May nearly wiping out the crop in the Yakima Valley and shortening the crop in the Wenatchee District. Cullage was substantially higher than normal in each of those two years. Conversely, the 1983 crop, which had very good growing conditions and record volumes, had low cullage. In 1986, a crop with very large fruit, cullage was almost as low as in 1983.

The percent cullage by pool period is shown in Figure 8. It is difficult to identify a typical cullage pattern during the market season. Cullage is expected to fall during the early part of the season because the earlier districts tend to harvest as soon as possible resulting in increased cullage due to lack of color and size. That is not always true as evidenced by the 1984 crop. Cullage actually started out low relative to the middle part of the season and increased until very late in the season when it dropped off.

The 1983 crop had very low cullage early in the season and during the heaviest movement period, and then moved up substantially as some rain damage occurred in the Wenatchee District. The effect of those small volumes with high cullage is quite small on the overall average. Other than the tendency for cullage to drop as one moves into the middle of the season, there is no major discernible pattern.

The other comparison that can be made is cullage between regions (Figure 10). In 1983, Yakima had slightly less cullage than Wenatchee although both districts had very low cullage rates. In 1984, both districts had high cullage rates. Again, 1985 reflects the major frost damage that occurred in Yakima that year. The 1986 and 1987 cullage rates were lower, again reflecting the better growing conditions that existed for those two crop years.
SUMMARY

The primary purpose of this report has been to describe cherry fruit size as measured by seven firms in the industry and, secondarily, to report fruit cullage for the five years for which the data were collected.

In three years out of five, the volume of 10-row and larger fruit was at least 25%. However, two of the five years had less than 20% 10-row and larger fruit. The range in percentages for the large fruit (18.8% to 39.3%) suggest enough variation in volume from year to year to be a potential problem in developing industry-wide marketing strategies in support of selling larger fruit separately.

Average fruit size increases from early to mid-season, and then declines late in the season. Increasing the minimum allowable size would have the biggest effect on growers in the earliest and latest districts. A likely response by growers in the early districts would be to delay harvest to increase fruit size. The result of that delay would be an increased volume of fruit to be marketed. Heavier supplies could well result in lower mid-season prices. Results of the study by Schotzko, et. al. suggest that each 1% increase in fresh volume reduces price by 1.8%. Although small incremental increases on the minimum size would have small price effects, some price decline would occur (assuming constant quality).

Tightening the grade standards would likely increase the cullage rate, at least in the short run. Based on the data reported here, it seems likely that growers in the Yakima Valley would see a greater increase in cullage. Although the higher cullage rates may cause growers to assume returns are lower, the opposite may be the case. Just as a 1% increase in volume reduces price 1.8%, a 1% reduction increases price by 1.8%. Since the change in price is greater than the change in volume, the end result is an increase in total revenue to the industry. The distribution of the increased revenues may favor growers in Wenatchee because of the anticipated smaller increase in cullage in that producing region.

Changing marketing strategies or tightening defect levels on the market order standards have different implications for returns to the industry and the distribution of those effects. Because of these differential effects, making changes to improve market returns may be difficult. Equitable treatment of all growers may require research to identify more precisely the direction of the effects of changes and the magnitude of those effects.
FIGURE 1: SAMPLE AVERAGE FRUIT SIZE
Row Size by Year

Row Size

11.5
11.3
11.1
10.9
10.7
10.5


Year

Ave. Row Size
FIGURE 2: PERCENT OF SAMPLE FRUIT by Row Size

Year


Percent

60% 50% 40% 30% 20% 10% 0%

9 row 10 row 11 row 12 row 13 row
FIGURE 3: SAMPLE FRUIT SIZE
By Pool

Average Size

Pool

5 Yr. Ave.
FIGURE 4: FRESH SWEET CHERRY SHIPMENTS
By Day

No. of 10,000 lb. Units

Date

June 10 10 20 20 July 10 20

1985 1986 1987
FIGURE 5: DAILY FRESH SWEET CHERRY PRICE

Source: USDA, AMS, Market News Service
FIGURE 6: ROW SIZE DISTRIBUTION BY HOUSE
Five Year House Ave.

Yakima | House | Wenatchee
--- | --- | ---
9 Row | 10 Row | 11 Row | 12 Row | 13 Row
Percent

0 10 20 30 40 50 60
FIGURE 7: SAMPLE FRUIT SIZE
By Region

Percent

Row Size

0% 10% 20% 30% 40% 50%

9 10 11 12 13

Wenatchee  Yakima
FIGURE 8: AVERAGE CULLAGE
By Year

Percent

Year


Cullage
FIGURE 9: CULLAGE BY POOL PERIOD

Percent

Pool

FIGURE 10: CHERRY CULLAGE
By Region

Percent

Year

Wenatchee Yakima Average