driving Speed Sprayers and their use is recommended. The question has been raised in the past as to whether this type of canopy can be used in closely planted groves. The experience of the authors is that it can be used in almost any grove with very little damage to trees and fruit. Certainly, the benefits far outweigh the possibility of losing a few individual fruit.

PRECAUTIONS

Before handling parathion for more than a few days, any individual should have an initial blood test, which will determine his normal blood cholinesterase levels as well as blood protein and hemoglobin content.

Where exposure is to be continued for several weeks, regular blood checks should be made throughout that period to determine if parathion absorption is taking place. If the cholinesterase level drops below 70 percent, the man should be removed from the job.

Exposure periods to parathion should be limited if regular blood checks are not made. Men using hand spray guns or filling supply units and mixing material should be limited to exposure periods of seven to ten days with at least a week off between exposure periods. In the case of Speed Sprayer drivers, the interval can be lengthened safely to two weeks. Where concentrated sprays are used, the exposure period of the man mixing the material should be no longer than three or four days, with a week between exposure periods.

At the end of each work day a good bath should be taken and contaminated clothing replaced by clean clothes.

A mask should be worn at all times during exposure to parathion.

In general, care should be taken where parathion is being handled. Good common sense is the best judge of whether the method being used is a practical one. Avoid any method which increases the amount of parathion particles in the area about the workmen. This material should be handled with extreme care at all times.

Canopies should be placed on all tractors where Speed Sprayers are being used.

A grove sprayed with parathion may be entered for work such as discing, chopping and irrigation after seven days. Operations such as picking or pruning should be delayed for at least two weeks following a spray application.

If a case of possible parathion poisoning occurs, blood samples should be taken by the attending physician in order for positive diagnosis to be made. If the physician should need instructions about preparing and forwarding the blood sample, the Florida Citrus Experiment Station can furnish complete information.

SUMMARY

During the 1951 citrus spray season, 9 cases of parathion poisoning were confirmed by blood cholinesterase determinations. The use of blood tests at periodic intervals during parathion spray operations were demonstrated to be extremely useful in preventing parathion poisoning. The use of concentrated sprays has increased the hazard for the man filling the supply unit.

LITERATURE CITED


FACTORS AFFECTING THE CONSUMER COST OF FROZEN ORANGE CONCENTRATE

F. W. Wenzel2, E. L. Moore3, and C. D. Atkins3
Florida Citrus Experiment Station
Lake Alfred

“Operation Frozen Orange Concentrate” begins with the production of oranges by the Florida Agricultural Experiment Station Journal Series, No. 53.

1—Cooperative publication by the Florida Citrus Experiment Station and the Florida Citrus Commission.
2—Florida Citrus Experiment Station
3—Florida Citrus Commission
and many companies, although some individuals would lead you to believe otherwise. Lack of complete information often causes one group of persons in an industry to think that another group in the same industry is making all of the profit.

**TABLE 1.**

<table>
<thead>
<tr>
<th>Items of cost:</th>
<th>Cost per gallon</th>
<th>Percent of total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>$0.0715</td>
<td>15.9%</td>
</tr>
<tr>
<td>Indirect</td>
<td>$0.0247</td>
<td>5.6%</td>
</tr>
<tr>
<td>Warehouse &amp; Shipping</td>
<td>$0.0182</td>
<td>4.0%</td>
</tr>
<tr>
<td>Total labor</td>
<td>$0.1184</td>
<td>23.4%</td>
</tr>
</tbody>
</table>

Other manufacturing cost:

- Power, lights, water: $0.0496 11.0%
- Maintenance building and equipment: $0.0322 7.1%
- Royalties: $0.0417 9.3%
- Depreciation: $0.0460 10.2%
- Taxes, licenses & insurance: $0.0137 3.0%
- Miscellaneous: $0.0177 3.9%
- Total other manufacturing cost: $0.2009 44.6%

Total processing cost:

- Administrative cost: $0.0955 20.7%
- Advertising stamps, testing & inspection: $0.0229 5.3%
- Total processing cost per gallon: $0.4507 100.0%
- Total cost per 6 ounces: $0.0211

The authors of this paper were asked to discuss the various factors that contribute to the total price the consumer pays for frozen orange concentrate. The information presented indicates what percentage of the money paid by the consumer for the product goes to each segment of the citrus industry and other organizations that make it possible for Florida frozen orange concentrate to be available throughout the United States during every month of the year. Facts are also included to help the grower determine how much concentrate can be produced from his fruit and understand better the various cost factors which the processor has to consider if he is to make the reasonable profit that the grower also wants from his grove investment.

The information relative to cost factors that follows has been secured from various sources and is considered to be indicative of average operations in the industry during 1949, 1950, and 1951. It should be realized that the cost of operations in any manufacturing plant changes from day to day and that costs may vary in different companies and different cooperatives.

**COST OF PROCESSING AND WAREHOUSING FROZEN ORANGE CONCENTRATE**

What is the cost of processing one gallon of orange concentrate? This question is often asked, but before the answer can be supplied, all of the costs for different operations and services that eventually add up to the total processing cost must be determined and defined. A cooperative report by Brooke et al. (1) of several Federal and State agencies lists and defines the various items of cost that are necessary for processing and warehousing frozen orange concentrate. Average cost figures from this report based on the production of approximately 16 million gallons of concentrate by eight Florida firms during the 1949-50 season are presented in Table 1, from

**TABLE 2.**

<table>
<thead>
<tr>
<th>Items of cost:</th>
<th>Cost per case**</th>
<th>Percent of total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(48 6-oz. cans)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cans</td>
<td>$0.8698</td>
<td>44.5%</td>
</tr>
<tr>
<td>Cartons</td>
<td>$0.0830</td>
<td>3.8%</td>
</tr>
<tr>
<td>Total material</td>
<td>$0.9528</td>
<td>47.9%</td>
</tr>
<tr>
<td>Labor, ($0.1324 per gal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Table 1)</td>
<td>$0.2979</td>
<td>15.3%</td>
</tr>
<tr>
<td>Other Manufacturing Cost</td>
<td>($0.2009 per gal.-Table 1)</td>
<td>23.2%</td>
</tr>
<tr>
<td>Total processing and warehouse cost</td>
<td>$1.6542</td>
<td>86.4%</td>
</tr>
<tr>
<td>Administrative cost</td>
<td>($0.0935 per gal.-Table 1)</td>
<td>$0.2104</td>
</tr>
<tr>
<td>Advertising stamps, testing and inspection ($0.0239 per gal.-Table 1)</td>
<td>$0.0698</td>
<td>2.8%</td>
</tr>
<tr>
<td>Total cost per case of 48/6</td>
<td>$1.9484</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total cost per 6 oz. can</td>
<td>$0.0406</td>
<td></td>
</tr>
</tbody>
</table>

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*WENZEL, MOORE, ATKINS: CONCENTRATE COSTS*
warehousing cost of the orange concentrate in a six-ounce can was approximately two cents. When the cost of cans and cartons is included, as shown in Table 2, then the processing and warehousing cost for a case of frozen orange concentrate containing 48 six-ounce cans was 1.95 or approximately four cents for one can. This cost includes only the expenses incurred by the processor from the time he receives the fruit at his plant until he has loaded it from his warehouse into truck or railroad car for shipment elsewhere.

Factors Involved in Consumer Cost of Frozen Orange Concentrate

The factors affecting the consumer cost of frozen orange concentrate are listed in Table 3 and include fruit cost, processing, handling, and marketing costs, and wholesale and retail markups. Processing, handling, and marketing costs include not only costs of processing and warehousing as shown in Tables 1 and 2, but also the costs for fruit picking and hauling to plant, freight to New York City, and selling and advertising. The average figures, shown in Table 3, for the processing, handling, and marketing costs were secured from various sources by Mr. Herman F. Steele of the statistical department of the Florida Citrus Commission and were adjusted to reflect current costs. All of these figures are based on the average 1950-51 yield from a box of fruit, which was slightly over 1.3 gallons of orange concentrate or about 28 six-ounce cans.

To show the relationship between the on-tree price that the grower receives for his fruit and the other costs affecting the ultimate consumer price of orange concentrate, percentage calculations in Table 3 were based on fruit prices of $1.00, $1.50 and $2.00. The total of the wholesale and retail markups, calculated on the retail price, was figured at 30 percent in all instances. At a fruit cost of $1.00, processing, handling, and marketing costs of $2.25, and wholesale and retail markups of $1.39, the total cost of a six-ounce can of frozen orange concentrate to the consumer would be 16.6 cents. At this consumer cost, the grower would receive 3.6 cents or 21.5 percent, the wholesaler and retailer would receive 5.0 cents or 30 percent, and 8.0 cents or 48.5 percent.

### TABLE 3

<table>
<thead>
<tr>
<th>On-tree price of fruit per box</th>
<th>Processing, handling, and marketing</th>
<th>Total retail price N.Y.C. per box</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>$0.40</td>
<td>$4.64</td>
</tr>
<tr>
<td>$1.50</td>
<td>.60</td>
<td>$5.38</td>
</tr>
<tr>
<td>$2.00</td>
<td>.80</td>
<td>$6.07</td>
</tr>
</tbody>
</table>

**—Based on information from Florida Citrus Commission, Lakeland, Florida, as secured from various sources.

**—Based on average yield per box of 28 6-oz. cans for 1950-51 season.

### TABLE 4

<table>
<thead>
<tr>
<th>On-tree price</th>
<th>Total processing, handling, and marketing costs (Table 3)</th>
<th>Wholesale and retail markups of 30 percent</th>
<th>Retail price</th>
<th>Retail price $-oz. can</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>$2.25</td>
<td>$1.18</td>
<td>$3.43</td>
<td>$0.140</td>
</tr>
<tr>
<td>$1.50</td>
<td>$2.25</td>
<td>$1.82</td>
<td>$4.07</td>
<td>$0.180</td>
</tr>
<tr>
<td>$2.00</td>
<td>$2.25</td>
<td>$2.44</td>
<td>$5.64</td>
<td>$0.220</td>
</tr>
</tbody>
</table>

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**—Retail price based on average yield per box for 1950-51 season of 28 6-oz. cans.
percent of the consumer cost would pay for the various processing, handling, and marketing costs.

What happens to the consumer price of frozen orange concentrate when changes occur in either the cost of fruit, the total processing, handling and marketing costs, or the total wholesale and retail markups? Information in Table 4 illustrates the effect of fruit cost on the consumer price of frozen orange concentrate, provided that the total wholesale and retail markups are 30 percent, that the total processing, handling, and marketing costs are $2.25 per box, and that these costs do not change. Thus, if the on-tree price of oranges is 50 cents per box, the consumer would pay 14 cents for a six-ounce can, whereas a fruit price of $3.00 per box would increase the retail price to almost 27 cents a can. It is interesting to note that, when all other costs are constant, a small increase in the retail price should make possible a considerable increase in the fruit price payable to the grower. For example, it is evident from Table 4 that a one-cent difference in retail price between 16 and 17 cents per six-ounce can would yield the grower 20 cents more per box for his fruit.

The difference of 32 cents between $2.25 per box, as shown in Tables 3 and 4, and $2.57 per box as reported by Miller (2) for the total processing, handling, and marketing costs would result in a consumer price difference of 1.2 cents per six-ounce can, since the price per can would be 16.6 and 17.8 cents, respectively, provided the fruit cost was $1.00 per box and the total wholesale and retail markups were 30 percent.

An increase in the consumer price of 2.8 cents per six-ounce can will result if the total wholesale and retail markups are increased from 30 to 40 percent, when the fruit cost is $1.00 per box and the total processing, handling, and marketing costs are $2.25 per box. At a 30-percent, or $1.39, per box markup the consumer price would be 16.6 cents per can, whereas with a 40-percent, or $2.17, per box markup the consumer price would be 19.4 cents per can.

The grower as well as the processor should keep in mind that if the consumer price is forced to an excessive level because of increased costs of any kind, then consumer purchasing will decrease with the result that less concentrate will be sold and ultimately less fruit used for manufacturing this product. This has been pointed out by Wright (3) and more recently has been substantiated by various surveys relative to the effect of retail price on total consumer purchases of frozen orange concentrate. With the desirability for the complete utilization of the total citrus crop in Florida, which now exceeds 100 million boxes each year, it behooves the grower, processor, and all other persons interested in the welfare of the entire citrus industry to strive to provide the consumer with high quality frozen citrus concentrates at as low a price as possible. However, this price must be sufficiently high so that a just and reasonable profit can be realized by all segments of the industry.

**SOLIDS CONTENT OF FRUIT IMPORTANT TO BOTH GROWER AND PROCESSOR**

How much frozen orange concentrate can be made from a box of fruit? The answer to this question depends on both the soluble solids content (°Brix) of the juice and the juice yield or the amount of juice that can be extracted from a box of fruit. The number of gallons of 42° Brix concentrate that will result from processing one box of fruit of different solids contents (°Brix) and different juice yields is shown in Table 5. It is evident that as either the solids content (°Brix) or the juice yield per box increases, the amount of concentrate produced per box also increases.

**Why do processors desire fruit of high soluble solids content?** The answer to this question is that more concentrate is secured from juice of high solids content than from an equivalent amount of juice of low solids content, as
previously pointed out. Also, the amount of concentrate that can be produced per hour in a plant is dependent upon the solids content of the juice that is being concentrated. Figures in Table 5 indicate that if a plant has an evaporation capacity of 20,000 lb./hr. or 2400 gal./hr. of water, then using a 10° Brix juice, 631 gal. of 42° Brix concentrate will be made in one hour, whereas a 12° Brix juice would yield concentrate at the rate of 808 gal./hr. or an increase of 28 percent. Since most of the costs of operating the plant for one hour are the same regardless of the solids content of the juice, the manufacturing cost per gallon of concentrate obviously will be less if the Brix of the juice is higher because then more concentrate will be produced per hour.

How many pounds of juice solids are in a box of fruit? Information in Table 6 shows the variation in the amount of solids per box as either the Brix of the juice or the juice yield varies. A box of fruit yielding 6 gal. of 14° Brix juice will contain 7.39 lb. of solids, whereas only 4.33 lb. of solids will be in a box of fruit that yields 5 gal. of 10° Brix juice. A gallon of 42° Brix concentrate will contain 4.16 lb. of solids. Also shown in Table 6 is the relative value of a box of fruit based upon the amount of solids in the juice obtained from fruit of varying juice yield and solids content. The value of $1.00 for a box of fruit yielding 5.5 gal. of 12° Brix juice was set arbitrarily to facilitate future calculations as the actual price of fruit varies. The number resulting when the juice yield in gallons is multiplied by the Brix of the juice has sometimes been referred to as the “concentrate index,” and thus, the above mentioned juice would have an index of 66. Processors in California and some in Florida pay for fruit on the basis of juice solids content; the soundness of this policy is beyond question.

**Summary**

Information is presented to help growers understand the various costs involved in manufacturing and merchandising Florida frozen orange concentrate. The many factors affecting consumer cost of this product are discussed.

Total solids content of the juice from a box of fruit is important to both the processor and grower, since it may be used as a basis for determining the value of fruit. Figures are presented to illustrate this, as well as to show that total solids content per box of fruit depends upon both the juice yield and the soluble solids content (° Brix) of the juice.

**LITERATURE CITED**

