METRICATION, MODULARIZATION, AND UNITIZATION
OF SELECTED PRODUCE SHIPPING CONTAINERS

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The produce shipping industry has an excessive variety and number of container sizes. One estimate identified 547 different sizes and types of containers used for shipping fresh fruit and vegetable items. This variety of container types and sizes contributes to rising costs for packaging, handling and transporting faced by shippers, receivers and consumers of fresh fruits and vegetables.

The realization of this problem is not new. Over thirty years ago, L. C. Carey in a report on Containers in Common Use for Fresh Fruits and Vegetables, discussed this problem when he wrote, "Standardization or simplification has been defined as reduction in industrial waste through the elimination of unnecessary sizes, types, and dimensions of manufactured products. Consequently, as a consumer, the average citizen pays a large part of the ultimate aggregate increased costs of marketing fresh fruits and vegetables that are attributable to avoidable waste--waste due to the greater expense of manufacturing a large number of different sizes and types of containers; waste inherent in the handling of odd-sized containers in transportation and in storage; and waste due to damage in transit and in the distributive process..."

The excessive variety of containers can and should be reduced. Because the grocery industry has officially and the produce industry has practically adopted the 48- by 40-inch pallet as a standard, this is a starting point. The standard container sizes should be modular to the surface area of a standard pallet, so that the advantages of unitization can be offered by use of standard and modular container sizes.

In the modern world, with increasing emphasis on international trade in order to favorably effect our balance of payments, this standardization and modularization should be linked to our national move towards metrification. The Organization for Economic Cooperation and Development has recommended an international standard-sized pallet of 120- by 100-centimeters (47.3- by 39.4-inches) which is very similar to the 48- by 40-inch grocery pallet. Any container sizes designed to fit the 120- by 100-cm pallet would also comfortably fit the 48- by 40-inch pallet.

We recently initiated a research project in cooperation with the U. S. Department of Agriculture's Office of Transportation and Science and Education Administration to investigate this problem. The objectives of this project include:

1. Determination of the metric and modular fiberboard container sizes to be considered with consideration given to dimensions, capacity, unitized base utilization and stacking pattern;
2. Comparison of actual capacities of the experimental container sizes to conventional containers for selected fresh fruits and vegetables and to determine the most likely metric replacements for each individual conventional container;

3. Arrangement for industry cooperation that would allow full-scale testing of the metric replacement in handling and shipping operations; and

4. Demonstration that for most containers presently in use there is a metric/modular container having little variance.

In determining the container sizes to be studied, we looked to recommendations of the United Fresh Fruit and Vegetable Association (UFFVA) and the Organization for Economic Cooperation and Development (OECD) and to our own computer analysis for researchable container sizes based on unitization base utilization. We narrowed the field to nine container sizes which used from 90-100 percent of the unitization base. Further consideration reduced the container sizes to five which utilized 100 percent of the unitization base because they offered unitized payloads that were more comparable to floor-loaded payloads. These container sizes were:

1. Box A - 40 x 30 x 30 - cm (15-3/4 x 11-3/4 x 11-3/4 inches)
2. Box B - 50 x 30 x 30 - cm (19-3/4 x 11-3/4 x 11-3/4 inches)
3. Box C - 50 x 40 x 30 - cm (19-3/4 x 15-3/4 x 11-3/4 inches)
4. Box D - 60 x 40 x 30 - cm (23-1/2 x 15-3/4 x 11-3/4 inches)
5. Box E - 60 x 50 x 30 - cm (23-1/2 x 19-3/4 x 11-3/4 inches)

The capacities of these five metric/modular container sizes were compared to conventional containers for selected commodities by actually packing the commodities into each of the metric containers. Measurements for each container were made of weight, count, and bulge. A comparison of dimensions and capacities of the metric and conventional containers was made to demonstrate the similarity and possible interchangeability that exists.

When looking at the over-the-road payloads for each of the five container sizes, it was shown that when compared to six-layer floor-loaded truckloads they can yield from 84 to 95 percent with an average of 93 percent when loaded with 18 unit loads stacked six layers high. With some of the newer vehicles having greater interior width, 20 palletloads can be pinwheel stacked in the vehicle and payloads of 102 to 109 percent with an average of 105 percent of the floor-loaded payloads can be achieved. These container sizes can be unitized with slightly reduced payloads in some cases and slightly increased payloads in other. It does not appear that shipment payload will be affected appreciably.

The capacities of these test containers have been compared to conventional containers for six commodities: lettuce, green peppers, cucumbers, hot peppers, cabbage, and lemons.

**Lettuce**

The conventional lettuce container, which held 24 heads and weighed an average of 52.9 pounds, and measured 55- by 42- by 29-cm was compared to the test containers. The test counts ranged from 12 to 30 heads and weighed from 30.6 to 62.1 pounds. The test container which would be a likely replacement would be the 60- by 40- by 30-cm size which held 24 heads and weighed an average of 51.3 pounds.

**Green Peppers**

The conventional wax-impregnated fiberboard container for green peppers measured 45- by 31- by 31-cm and, on the average, held 75 peppers and weighed 30.7
Table 1.—Truckload estimates for five test container sizes for floor-loaded and unitized loads

<table>
<thead>
<tr>
<th>Type of load</th>
<th>Test containers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A (40 x 30)</td>
</tr>
<tr>
<td>Boxes</td>
<td>1,176</td>
</tr>
<tr>
<td>Floor-loaded, 6 high 1/</td>
<td>1,080</td>
</tr>
<tr>
<td>Unitized (18), 6 high 2/</td>
<td>1,200</td>
</tr>
<tr>
<td>Unitized (20), 6 high 3/</td>
<td></td>
</tr>
</tbody>
</table>

1/ Floor-loaded truckload stacked six layers high.
2/ Two rows of nine unit loads loaded into trailer.
3/ Alternating unit loads along length and across width. This pattern is possible in some of the newer trailers.

Pounds. The test containers ranged in count from 62 to 156 peppers and in weight from 23.8 to 57.3 pounds. The 50- by 30- by 30-cm test container which held an average of 75 peppers and weighed an average of 29.4 pounds would be a likely replacement.

Cucumbers

This product used the same size container as green peppers and held an average of 85 cucumbers and weighed 52.6 pounds. Test container counts ranged from 69 to 159 cucumbers and weights ranged from 43.1 to 101.6 pounds. Again, the 50- by 30- by 30-cm which could accommodate 91 cucumbers at 56.8 pounds would be a likely replacement.

Hot Peppers

The conventional wax-impregnated fiberboard container for hot peppers held one bushel of loose-packed peppers, weighed an average of 22.1 pounds and measured 41- by 31- by 30-cm. The test containers ranged from slightly less than a bushel at 19.9 pounds to more than two bushels at 45.8 pounds. The 40- by 30- by 30-cm size container which is virtually the same size as the conventional container would be a likely replacement.

Cabbage

The wooden wirebound crate used for cabbage held 17 heads, weighed an average of 58.6 pounds and measured 60- by 42- by 27-cm. The test containers held from nine to 23 heads and weighed from 29.8 to 71.6 pounds. The 60- by 40- by 30-cm size which held 18 heads and weighed an average of 58.1 pounds would be a likely replacement.

Lemons

The fiberboard lemon container measured 44- by 30- by 28-cm and held 172 lemons and weighed an average of 37.5 pounds. The test containers' counts ranged from 185 to 427 lemons and weights ranged from 41.3 to 95.3 pounds. The 40- by 30- by 30-cm container size held 185 lemons at a weight of 41.3 pounds and would be a likely replacement.
These comparisons demonstrate that for six commodities there are replacements for the conventional container sizes from among five metric/modular test container sizes that are so similar in dimensions and capacities that their adoption would pose minimal disruption of operations. The majority of produce containers would result in similar conditions. The opportunity that now faces the produce industry to reduce the number of different container sizes from over five hundred to five should be thoroughly investigated. Economies in packaging could help reduce the rising costs facing the industry and its customers.

We are going to continue to measure and compare capacities of conventional containers with the metric/modular sizes for fresh produce. We have entered into Project MUM with the United Fresh Fruit and Vegetable Association and plan to conduct over-the-road test shipments of metric/modular container sizes to demonstrate their practical application in produce shipments.

FOOTNOTES


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Table 2—Capacity comparisons for five test container sizes and conventional containers for selected commodities

<table>
<thead>
<tr>
<th>Product</th>
<th>Conventional container</th>
<th>Test container A</th>
<th>Test container B</th>
<th>Test container C</th>
<th>Test container D</th>
<th>Test container E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count Weight 1/1</td>
<td>Count Weight 1/1</td>
<td>Count Weight 1/1</td>
<td>Count Weight 1/1</td>
<td>Count Weight 1/1</td>
<td>Count Weight 1/1</td>
</tr>
<tr>
<td></td>
<td>Pounds</td>
<td>Pounds</td>
<td>Pounds</td>
<td>Pounds</td>
<td>Pounds</td>
<td>Pounds</td>
</tr>
<tr>
<td>Lettuce</td>
<td>24</td>
<td>30.7</td>
<td>23.8</td>
<td>24</td>
<td>30.3</td>
<td>24</td>
</tr>
<tr>
<td>Green Peppers</td>
<td>75</td>
<td>54.1</td>
<td>43.1</td>
<td>75</td>
<td>44.7</td>
<td>75</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>12</td>
<td>69</td>
<td>54</td>
<td>12</td>
<td>54</td>
<td>12</td>
</tr>
<tr>
<td>Eggplant</td>
<td>12</td>
<td>51.6</td>
<td>42</td>
<td>12</td>
<td>42</td>
<td>12</td>
</tr>
<tr>
<td>Lemons</td>
<td>172</td>
<td>37.5</td>
<td>28</td>
<td>172</td>
<td>28</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>1/ Estimated total shipping weight.</td>
<td></td>
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