

FROZEN FRUITS AND VEGETABLES



OHIO AGRICULTURAL EXPERIMENT STATION

Wooster, Ohio

In Cooperation With

**THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO**

S U M M A R Y

Frozen foods cost, on the average, about 50% more per pound than canned foods as determined from a comparison of prices and quality of about 400 samples purchased in Columbus, Ohio stores. Some of the frozen foods were only slightly higher while others were more than twice as high priced as the canned products.

Thirteen percent of the frozen food samples graded below A or B while 30% of the canned samples were below these grades.

Variation in price per pound of the same grade of frozen foods was found to be from 3% to 160% while the variation for canned samples ran as high as 244% in the case of grade A canned peaches. Generally the variation for the same grades was less for frozen than for canned samples.

Not much relation was found to exist between quality and price for either the frozen or canned forms. Only 57 percent of the frozen samples were found to have any positive relation between price paid and quality of the sample. In the case of canned food only 50% of the samples were found to have price and quality related positively. It was evident that price of the items was little guide to the purchaser in determining quality of content in the foods sampled. In many cases it was found that the lower priced samples were far superior to the higher priced samples.

In order that the grower may be fully rewarded for quality production the consumer should be able to rely on better quality being associated with higher price. Apparently little such reliance had been established for the products sampled in the study.

Price and Quality Comparison of Selected Frozen, Fresh, and Canned Fruits and Vegetables

R. W. SHERMAN and WILBUR L. LENOX

Department of Rural Economics and Rural Sociology

and

WILBUR A. GOULD

Department of Horticulture

INTRODUCTION

In the last decade the production, distribution, and sale of frozen foods, especially fruits and vegetables, have had a rapid growth. Naturally, many questions have been raised concerning such food. Two of the most prominent questions have been as to their cost compared with the same foods in fresh and canned forms and as to their comparative qualities. This study is intended to answer in part, at least, these two questions. However, the data used in this study apply only to a limited number of products and only for one short period of time. This should be borne in mind in interpreting the results given.

Data for the price analysis were collected weekly (on Friday) over a period of 11 weeks—from January 30, 1948 to April 16, 1948—from four stores in Columbus, Ohio. One store was a unit of a national chain, one of a local chain, one a large independent store, and the other a small independent store. The samples for grading were purchased from these four stores with the addition of a few samples of frozen food from a fifth store in order to include some brands not otherwise obtainable. These samples were purchased at four different times during the 11 week period.

The grading was based on U. S. Grade Standards of quality.¹ "The U. S. standards may be considered as a yardstick with which the quality of a product is measured. The standards are so established that each grade within the standard represents clearly distinguishable quality differences The U. S. Department of

¹ From "Questions and Answers on Government Inspection of Processed Fruits and Vegetables." Miscellaneous Publication No. 598, U. S. Department of Agriculture, Production and Marketing Administration. April, 1946.

Agriculture has adopted the simple terms of A, B, C, and D, which are easily remembered. The steps between these grades indicate degrees of quality value The common commercial quality terms for canned and frozen foods (Fancy, Choice or Extra Standards, Standard and Sub-Standard) are used synonymously with Grade A, Grade B, Grade C, and Grade D, respectively Grade A processed products are first-rate foods, carefully selected as to size, color, and ripeness or tenderness Grade B products may not be as succulent as Grade A, but this is a suitable quality for general household purposes. They may not be so selected as to size, color, and maturity, but in all these respects, they are entirely satisfactory for most menus. All Grade C products are good, wholesome foods. A large percentage of processed foods are found in this grade and they are considered a 'thrifty buy.' In some instances, the product may not be so tender nor so ripe as Grades A and B, or blemishes may be more apparent than in the higher grades."

Products that fall down on quality into the Grade D range are still good food, but not high in grade. These products may be low in grade because of poor color, not well peeled, excessively mealy, etc. Most products in this range of quality do not reach the consumers' hands.

The differences among fresh, frozen, and canned products are not measured by these standards since each type product (fresh, frozen, and canned) has its own standard of quality and grade. These differences among the different products can best be explained by differences in taste or brightness of color, and these are not compared between the different products since they represent consumer preferences in the main.

There were 208 individual frozen food samples, 190 canned samples, and 16 fresh samples purchased and graded. Except where the items were not available, the test was made two or three times on each item or brand at about three week intervals and in many cases, the identical items were tested from more than one store. The tables included in the brief analysis give in detail by store the results of the tests. No brand names are disclosed.

Due to the fact that from January to April limited amounts of some of the products were available in fresh form and because in almost all cases only one price was quoted by each store for

COMPARATIVE PRICES

A total of 1936 price quotations for 12 products were recorded from the stores mentioned above.

TABLE 1.—NUMBER OF INDIVIDUAL FOOD PRODUCT PRICES RECORDED FROM 4 COLUMBUS, OHIO STORES BY COMMODITY AND FORM, 11 WEEK PERIOD, JANUARY TO APRIL, 1948.

| Commodity | Frozen | Fresh | Canned | Total |
|------------------|--------|-------|--------|-------|
| Peas | 101 | 18 | 255 | 374 |
| Lima Beans | 143 | 11 | 65 | 219 |
| Sweet Corn | 91 | 0 | 218 | 309 |
| Green Beans | 117 | 32 | 148 | 297 |
| Asparagus | 42 | 5 | 55 | 102 |
| Broccoli | 24 | 13 | 0 | 37 |
| Cauliflower | 31 | 20 | 0 | 51 |
| Spinach | 28 | 21 | 23 | 72 |
| Brussels Sprouts | 30 | 9 | 0 | 39 |
| Strawberries | 83 | 9 | 0 | 92 |
| Peaches | 55 | 0 | 182 | 237 |
| Cherries | 36 | 0 | 71 | 107 |
| Total | 781 | 138 | 1017 | 1936 |

each fresh commodity, fewer prices of this form could be recorded than in the case of frozen and canned forms. Prices were recorded so that for the period under study a reliable comparison could be made between frozen foods and other forms readily available to consumers. There was no comparison of canned strawberries, broccoli, brussels sprouts or cauliflower with other forms because such items are not usually canned and none was found in any of the stores in such form.

Prices were recorded for a wide variety of brands in order to get a representative cross-section of what was available to consumers. Each price was adjusted to a per pound basis and the average obtained for each item in each form for ease and accuracy of comparison and analysis. The comparative prices are shown in Tables 2 and 3.

TABLE 2.—HIGHEST AND LOWEST PRICE QUOTATIONS, IN CENTS PER POUND, FOR SELECTED FOODS, BY STORE AND BY FORM, 11 WEEK PERIOD, JANUARY 30 TO APRIL 16, 1948.

| Commodity and Form | Store 1 | | Store 2 | | Store 3 | | Store 4 | | All Stores | |
|--------------------------|----------|---------|----------|---------|----------|---------|----------|---------|------------|---------|
| | High-est | Low-est | High-est | Low-est | High-est | Low-est | High-est | Low-est | High-est | Low-est |
| Peas: Frozen | 42.7 | 30.7 | 42.7 | 25.3 | 42.7 | 32.0 | 38.7 | 33.3 | 42.7 | 25.3 |
| Fresh | 29.0 | 13.0 | 29.0 | 19.0 | ----- | ----- | ----- | ----- | 29.0 | 13.0 |
| Canned | 28.4 | 8.9 | 28.4 | 10.4 | 34.3 | 17.3 | 31.3 | 18.4 | 34.3 | 8.9 |
| Limas: Frozen | 57.3 | 38.7 | 57.3 | 38.7 | 58.7 | 46.7 | 57.3 | 46.7 | 58.7 | 38.7 |
| Fresh | 29.0 | 1.90 | 39.0 | 27.0 | ----- | ----- | ----- | ----- | 39.0 | 19.0 |
| Canned | 34.4 | 32.0 | 33.2 | 33.2 | 41.5 | 28.4 | 29.6 | 29.6 | 41.5 | 28.4 |
| Sweet Corn: Frozen | 41.6 | 30.7 | 41.6 | 30.7 | 41.6 | 25.7 | 36.0 | 33.3 | 41.6 | 25.7 |
| Canned | 24.0 | 17.8 | 24.0 | 19.9 | 29.3 | 21.0 | 24.9 | 24.0 | 29.3 | 17.8 |
| Green Beans: Frozen | 46.4 | 41.6 | 46.4 | 43.2 | 52.8 | 38.4 | 48.0 | 27.2 | 52.8 | 27.2 |
| Fresh | 27.0 | 15.0 | 35.0 | 15.0 | 35.0 | 17.0 | 22.0 | 18.0 | 35.0 | 15.0 |
| Canned | 28.0 | 13.3 | 26.4 | 16.0 | 43.1 | 22.7 | 27.8 | 22.7 | 43.1 | 13.3 |
| Asparagus: Frozen | 76.8 | 59.2 | 76.8 | 54.7 | 72.0 | 44.0 | 46.7 | 22.7 | 76.8 | 22.7 |
| Fresh | 33.0 | 29.0 | 35.0 | 35.0 | ----- | ----- | 36.0 | 33.0 | 36.0 | 29.0 |
| Canned | 56.2 | 32.7 | 50.9 | 35.6 | 62.7 | 44.4 | 50.9 | 44.5 | 62.7 | 32.7 |
| Broccoli: Frozen | 54.4 | 50.5 | 54.4 | 49.6 | 54.4 | 43.2 | 56.0 | 44.8 | 56.0 | 43.2 |
| Fresh | 26.0 | 20.0 | 35.0 | 24.0 | 32.0 | 29.0 | 20.0 | 18.0 | 35.0 | 18.0 |
| Cauliflower: Frozen | 51.2 | 48.0 | 56.0 | 48.0 | 56.0 | 35.7 | 59.2 | 51.2 | 59.2 | 35.7 |
| Fresh | 31.2 | 18.4 | 32.8 | 24.8 | 33.6 | 28.0 | 30.4 | 23.2 | 33.6 | 18.4 |
| Spinach: Frozen | 33.1 | 30.9 | 33.1 | 30.9 | 33.1 | 28.6 | 32.0 | 28.6 | 32.0 | 28.6 |
| *Fresh | 33.3 | 10.0 | 33.3 | 25.3 | 19.0 | 19.0 | 33.3 | 33.3 | 33.3 | 10.0 |
| Canned | 18.5 | 16.0 | 20.9 | 18.5 | 23.4 | 18.5 | 19.7 | 19.7 | 23.4 | 16.0 |
| Brussels Sprouts: Frozen | 53.8 | 52.4 | 53.8 | 52.4 | 57.6 | 51.2 | 62.4 | 51.6 | 62.4 | 51.2 |
| Fresh | 39.0 | 29.0 | 39.0 | 33.0 | ----- | ----- | ----- | ----- | 39.0 | 29.0 |
| Strawberries: Frozen | 59.0 | 44.6 | 61.0 | 41.0 | 60.0 | 49.0 | 59.0 | 49.0 | 61.0 | 41.0 |
| Fresh | 55.7 | 41.4 | 64.3 | 41.4 | ----- | ----- | ----- | ----- | 64.3 | 41.4 |
| Peaches: Frozen | 32.0 | 26.0 | 33.0 | 15.0 | 35.0 | 28.0 | 25.0 | 25.0 | 35.0 | 15.0 |
| Canned | 35.5 | 19.4 | 35.5 | 20.0 | 48.0 | 27.6 | 37.2 | 23.6 | 48.0 | 19.4 |
| Cherries: Frozen | 75.8 | 42.6 | 42.6 | 42.6 | 64.8 | 35.2 | 50.0 | 35.2 | 75.8 | 35.2 |
| Canned | 56.7 | 29.6 | 56.7 | 28.4 | 58.1 | 33.2 | 40.6 | 34.4 | 58.1 | 28.4 |

*Part of sample in bulk and part prepackaged. This accounts for much of the range in price.

FROZEN FRUITS AND VEGETABLES

7

TABLE 3.—AVERAGE PRICE PER POUND FOR 12 SELECTED FOODS PRICED IN 4 COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity and Form | | Store 1 | Store 2 | Store 3 | Store 4 | All Stores |
|--------------------|--------|---------|---------|---------|---------|------------|
| | | Cents | Cents | Cents | Cents | Cents |
| Peas: | Frozen | 37.8 | 33.9 | 38.2 | 36.2 | 36.6 |
| | Fresh | 19.9 | 24.5 | ----- | ----- | 22.2 |
| | Canned | 18.9 | 20.8 | 24.7 | 23.2 | 21.5 |
| Limas: | Frozen | 52.0 | 49.3 | 53.7 | 53.3 | 52.2 |
| | Fresh | 25.4 | 33.0 | ----- | ----- | 29.2 |
| | Canned | 32.6 | 33.2 | 33.9 | 29.6 | 33.0 |
| Sweet Corn: | Frozen | 36.9 | 36.9 | 34.0 | 34.2 | 35.2 |
| | Canned | 21.1 | 21.7 | 25.1 | 24.5 | 22.8 |
| Green Beans: | Frozen | 46.1 | 45.9 | 43.4 | 36.1 | 43.3 |
| | Fresh | 21.8 | 24.1 | 24.1 | 19.8 | 22.4 |
| | Canned | 20.6 | 21.6 | 31.0 | 24.4 | 22.9 |
| Asparagus: | Frozen | 68.0 | 63.7 | 59.5 | 33.6 | 58.1 |
| | Fresh | 31.0 | 35.0 | ----- | 34.5 | 33.5 |
| | Canned | 41.2 | 43.6 | 56.4 | 47.7 | 47.4 |
| Broccoli: | Frozen | 51.8 | 50.5 | 48.9 | 51.0 | 50.4 |
| | Fresh | 23.6 | 31.3 | 30.0 | 19.0 | 25.8 |
| Cauliflower: | Frozen | 49.2 | 50.1 | 48.6 | 55.2 | 49.8 |
| | Fresh | 24.8 | 30.0 | 30.0 | 27.5 | 28.1 |
| Spinach: | Frozen | 32.0 | 31.6 | 30.9 | 30.3 | 31.2 |
| | *Fresh | 20.0 | 30.6 | 19.0 | 33.3 | 24.6 |
| | Canned | 16.8 | 20.2 | 23.1 | 19.7 | 19.6 |
| Brussels Sprouts: | Frozen | 52.7 | 52.7 | 55.4 | 60.4 | 56.0 |
| | Fresh | 37.0 | 37.5 | ----- | ----- | 37.2 |
| Strawberries: | Frozen | 51.8 | 51.5 | 54.7 | 53.8 | 53.7 |
| | Fresh | 48.4 | 52.9 | ----- | ----- | 50.6 |
| Peaches: | Frozen | 29.6 | 22.9 | 30.3 | 25.0 | 25.7 |
| | Canned | 26.0 | 26.2 | 35.6 | 29.8 | 29.2 |
| Cherries: | Frozen | 60.1 | 42.6 | 53.6 | 42.9 | 52.9 |
| | Canned | 40.7 | 35.5 | 42.2 | 37.5 | 34.0 |

*In store 2 and 4 only prepackaged spinach was offered. In store 1 both bulk and prepackaged was offered while in store 3 only bulk was offered. This difference in product accounted for considerable of the variation for fresh spinach price.

The average prices were calculated for each food by first averaging the prices for each brand and then taking the average of these figures. This procedure also was followed for the prices at each store. This method was used in preference to taking the average of all individual quotations which would have given heavier weight to some brands than to others, especially when prices were combined for all stores,

The reader should recognize that, due to the seasonal nature of both supply and price of most fresh fruits and vegetables, any comparison between the fresh and other forms would be applicable only to the particular time of the year when the data were collected. No sweet corn, peaches or cherries were available in the fresh form and a limited supply of fresh strawberries was available for price recording. Comparison of prices in the case of broccoli, cauliflower, and brussels sprouts, all of which were available at all times in fresh form, was entirely between fresh and frozen forms. This was true also for strawberries which were available in fresh form for five or six weeks of the test period but at seasonally high prices.

The seasonal aspect of prices and supply is of much less importance in the case of canned and frozen products.

Although there was some change in prices for the same commodities during the 11 week period almost all of the range in price within each store was accounted for by different prices for different brands. The price ranges in the groups including the two or three brands of peaches and cherries which were being moved at special sales prices were influenced more by price changes than by price differentials between brands. The cost of frozen foods was calculated as percentages of the cost of the same foods in canned and fresh foods to make comparison easier. Quality in no way enters into the price comparison which the percentages represent. Comparison based on quality is made in the second section of the study. Adjustments were made in the prices of those products where stated weight or minimum weights included liquors or juices.

These adjustments were made on the basis of the weight of drained food found in those samples which were weighed when grade tests were made. In the case of frozen peaches the average drained weight was almost identical to the total weight stated on the package. The largest adjustment necessary was for canned

peas where the weight stated on the label includes liquor. In the latter section of this study comparing prices of graded products all comparisons are made on the basis of the actual drained weight of product found in each sample.

Considerable variation existed among stores in the comparisons due to different number of brands offered the public. For instance, in one store a cheap brand of frozen asparagus was offered to the consumer while only comparatively high priced brands of canned asparagus were offered. The result was that in that store for an 11 week period the price of frozen asparagus averaged only

TABLE 4.—AVERAGE PRICES OF SELECTED FROZEN FOODS EXPRESSED IN PERCENTAGE OF AVERAGE PRICES OF THE SAME FOODS IN FRESH AND CANNED FORM, AS DETERMINED FROM PRICES IN 4 COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity and Form | | Store 1 Percent | Store 2 Percent | Store 3 Percent | Store 4 Percent | All Stores Percent |
|--------------------|--------|--------------------|--------------------|--------------------|--------------------|-----------------------|
| Peas: | Canned | 200.0 | 162.9 | 154.6 | 156.0 | 170.4 |
| | Fresh | 190.1 | 138.3 | ----- | ----- | 164.7 |
| Limas: | Canned | 159.5 | 148.6 | 165.8 | 180.2 | 158.2 |
| | Fresh | 204.9 | 149.5 | ----- | ----- | 178.9 |
| Sweet Corn: | Canned | 174.8 | 170.1 | 135.5 | 139.7 | 154.3 |
| Green Beans: | Canned | 223.7 | 212.3 | 140.1 | 147.9 | 189.0 |
| | Fresh | 211.4 | 190.4 | 180.2 | 182.5 | 193.4 |
| Asparagus: | Canned | 165.0 | 146.2 | 105.5 | 70.4 | 122.5 |
| | Fresh | 219.3 | 182.1 | ----- | 97.4 | 173.3 |
| Broccoli: | Fresh | 219.3 | 161.3 | 163.1 | 268.1 | 195.3 |
| Cauliflower: | Fresh | 198.4 | 166.9 | 162.1 | 200.8 | 177.3 |
| Spinach: | Canned | 190.5 | 156.5 | 133.7 | 153.8 | 158.5 |
| | Fresh | 160.0 | 103.3 | 162.6 | 91.0 | 126.9 |
| Brussels Sprouts: | Fresh | 142.5 | 140.4 | ----- | ----- | 153.1 |
| Strawberries: | Fresh | 107.1 | 97.4 | ----- | ----- | 106.2 |
| Peaches: | Canned | 113.9 | 87.4 | 85.1 | 83.8 | 88.0 |
| Cherries: | Canned | 147.7 | 120.0 | 127.1 | 114.4 | 155.5 |

TABLE 5.—NUMBER OF FROZEN AND CANNED FOOD SAMPLES PURCHASED AND GRADED FROM 5 COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Product | Store 1 | | Store 2 | | Store 3 | | Store 4 | | Store 5 | All Stores | |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------------|---------|
| | Fro-zen | Can-ned | Fro-zen | Can-ned | Fro-zen | Can-ned | Fro-zen | Can-ned | Fro-zen | Fro-zen | Can-ned |
| Peas | 6 | 13 | 5 | 10 | 10 | 10 | 3 | 7 | 1 | 25 | 40 |
| Limas | 10 | 7 | 8 | 1 | 10 | 5 | 5 | 3 | 1 | 34 | 16 |
| Sweet Corn | 6 | 12 | 4 | 7 | 8 | 12 | 4 | 6 | 1 | 23 | 37 |
| Green Beans | 10 | 8 | 6 | 7 | 6 | 9 | 4 | 5 | 1 | 27 | 29 |
| Asparagus | 2 | 6 | 1 | 4 | 2 | 6 | 2 | 4 | 1 | 8 | 20 |
| Broccoli | 3 | — | 2 | — | 3 | — | 3 | — | 1 | 12 | — |
| Cauliflower | 2 | — | 2 | — | 6 | — | 1 | — | 1 | 12 | — |
| Spinach | 4 | 4 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 11 | 10 |
| Brussels Sprouts | 2 | — | 1 | — | 8 | — | 2 | — | 1 | 14 | — |
| Strawberries | 4 | — | 5 | — | 6 | — | 4 | — | 1 | 20 | — |
| Peaches | 5 | 9 | 4 | 10 | 3 | 6 | 1 | — | 1 | 14 | 25 |
| Cherries | 4 | 3 | 1 | 3 | 1 | 4 | 2 | 4 | — | 8 | 14 |
| Total | 58 | 62 | 41 | 45 | 65 | 53 | 33 | 31 | 11 | 208 | 191 |

70.4% as much as for canned asparagus. In another store where no such low priced brand of frozen asparagus was offered it averaged 165% as much.

PRICE AND GRADE OF CANNED AND FROZEN GOODS

This section of the report deals with the grade of the products in frozen and canned forms as purchased from the Columbus stores at four periods when price comparisons were being made. A total of 399 samples were purchased and graded according to United States Government standards.

Table 5 is a summary of the number of samples of frozen and canned foods purchased and graded from each store.

As stated before, the number of fresh items priced or tested was limited by the scarcity or complete lack of the fresh items at that time of year. Since only 16 fresh samples were tested this section is limited to an analysis of fresh and frozen samples. A short discussion follows this section in which the grade and price of the fresh samples are considered.

One important comparison to be made among foods of different forms is that of the percentage of each form falling into different grades. A summary of grades of the 399 frozen and canned samples graded for this study shows that there was a considerably higher percentage of the frozen products which graded A and B than for canned products.

It is significant that only three off-grade samples were found among the 208 frozen food samples while eight were found among the 191 canned samples. From these tests it can be seen that there was a slightly better chance of getting higher grade foods in frozen form than in canned foods. As was pointed out in Table 3 however, the average cost of frozen foods was much higher than for canned foods. In a later table the comparative costs of frozen foods and canned foods of the same grade is shown.

Considerable variation was found in the percentage of samples of the different commodities which fell into different grades. Only one of the 14 samples of frozen brussels sprouts failed to grade A while only 2 of 14 samples of frozen peaches graded A. While a higher percentage of peas, lima beans, sweet corn, and green beans in frozen form graded A than for each of these products in canned forms the relation was about the same between

TABLE 6.—DISTRIBUTION BY GRADE OF 399 FOOD SAMPLES TESTED FROM 5 COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Product and Form | | Store 1 | | | | Store 2 | | | | Store 3 | | | | Store 4 | | | | Store 5 | | | |
|-------------------|--------|---------|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|
| | | Grade | | | | Grade | | | | Grade | | | | Grade | | | | Grade | | | |
| | | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| Peas: | Frozen | 2 | 4 | --- | --- | 3 | 2 | --- | --- | 3 | 6 | 1 | --- | 2 | 1 | --- | --- | 1 | --- | --- | --- |
| | Canned | 5 | 5 | 2 | 1 | 3 | 7 | --- | --- | 5 | 5 | --- | --- | 3 | 2 | --- | 2 | --- | --- | --- | --- |
| Limas: | Frozen | 4 | 5 | 1 | --- | 3 | 2 | 3 | --- | 2 | 8 | --- | --- | 1 | 2 | 2 | --- | 1 | --- | --- | --- |
| | Canned | 3 | 4 | --- | --- | 1 | --- | --- | --- | --- | 3 | 2 | --- | --- | 1 | 2 | --- | --- | --- | --- | --- |
| Sweet Corn: | Frozen | 1 | 4 | 1 | --- | --- | 3 | 1 | --- | 3 | 5 | --- | --- | 1 | 3 | --- | --- | 1 | --- | --- | --- |
| | Canned | 2 | 5 | 5 | --- | 1 | 4 | 2 | --- | 2 | 7 | 3 | --- | 2 | 4 | --- | --- | --- | --- | --- | --- |
| Green Beans: | Frozen | 3 | 4 | 3 | --- | 3 | 1 | 2 | --- | 1 | 5 | --- | --- | 1 | --- | 3 | --- | 1 | --- | --- | --- |
| | Canned | 2 | 2 | 3 | 1 | 1 | 4 | 2 | --- | 3 | 6 | --- | --- | --- | 1 | 4 | --- | --- | --- | --- | --- |
| Asparagus: | Frozen | 2 | --- | --- | --- | 1 | --- | --- | --- | 1 | --- | --- | 1 | --- | 2 | --- | --- | --- | 1 | --- | --- |
| | Canned | 4 | --- | 2 | --- | 2 | --- | 2 | --- | 5 | --- | 1 | --- | 3 | --- | 1 | --- | --- | --- | --- | --- |
| Broccoli: | Frozen | 3 | --- | --- | --- | 2 | --- | --- | --- | 3 | --- | --- | --- | 2 | 1 | --- | --- | 1 | --- | --- | --- |
| Cauliflower: | Frozen | 2 | --- | --- | --- | 2 | --- | --- | --- | 3 | 3 | --- | --- | --- | 1 | --- | --- | 1 | --- | --- | --- |
| Spinach: | Frozen | 1 | 3 | --- | --- | 1 | 1 | --- | --- | 2 | --- | --- | --- | 1 | 1 | --- | --- | 1 | --- | --- | --- |
| | Canned | --- | --- | 3 | 1 | 1 | --- | 2 | --- | 1 | --- | --- | --- | 1 | --- | --- | 1 | --- | --- | --- | --- |
| Brussels Sprouts: | Frozen | 2 | --- | --- | --- | 1 | --- | --- | --- | 7 | 1 | --- | --- | 2 | --- | --- | --- | 1 | --- | --- | --- |
| Strawberries: | Frozen | 2 | --- | 2 | --- | 3 | 2 | --- | --- | 1 | 4 | 1 | --- | 1 | 3 | --- | --- | --- | 1 | --- | --- |
| Peaches: | Frozen | 1 | 4 | --- | --- | --- | 2 | 2 | --- | --- | 3 | --- | --- | 1 | --- | --- | --- | --- | --- | 1 | --- |
| | Canned | 1 | 2 | 5 | 1 | 3 | 4 | 2 | 1 | 4 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cherries: | Frozen | 1 | --- | 3 | --- | --- | 1 | --- | --- | --- | --- | --- | 1 | --- | --- | 1 | 1 | --- | --- | --- | --- |
| | Canned | 1 | 1 | 1 | --- | 2 | 1 | --- | --- | 1 | 1 | 2 | --- | 1 | 2 | 1 | --- | --- | --- | --- | --- |
| All Products | Frozen | 24 | 24 | 10 | 0 | 19 | 13 | 9 | 0 | 26 | 35 | 2 | 2 | 12 | 14 | 6 | 1 | 8 | 2 | 1 | 0 |
| | Canned | 18 | 19 | 21 | 4 | 14 | 20 | 10 | 1 | 21 | 23 | 9 | 0 | 10 | 10 | 8 | 3 | 0 | 0 | 0 | 0 |
| Total | | 42 | 43 | 31 | 4 | 33 | 33 | 19 | 1 | 47 | 58 | 11 | 2 | 22 | 24 | 14 | 4 | 8 | 2 | 1 | 0 |

TABLE 7.—DISTRIBUTION BY GRADE AND BY FORM OF 399 SAMPLES PURCHASED IN COLUMBUS STORES, JANUARY 30 TO APRIL 16, 1948.

| Form | Number of Samples | Grade A | | Grade B | | Grade C | | Grade D | |
|--------|-------------------|---------|------|---------|------|---------|------|---------|------|
| | | No. | Pct. | No. | Pct. | No. | Pct. | No. | Pct. |
| Frozen | 208 | 89 | 42.8 | 88 | 42.3 | 28 | 13.5 | 3 | 1.4 |
| Canned | 191 | 63 | 33.0 | 72 | 37.7 | 48 | 25.1 | 8 | 4.2 |
| Total | 399 | 152 | 38.1 | 160 | 40.1 | 76 | 19.0 | 11 | 2.8 |

products in each form. For example, in both forms, about twice as high percentage of peas graded A as was true for sweet corn. These comparisons for canned and frozen samples are shown in detail in Tables 8 and 9.

Sweet and sour cherries were not separated in comparing number of samples of different forms of each product by grade but they were kept separate in comparing price by grade for individual products.

TABLE 8.—CLASSIFICATION, BY GRADE AND COMMODITY, OF 208 FROZEN FOOD SAMPLES PURCHASED FROM COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity | Number of Samples | Grade A | | Grade B | | Grade C | | Grade D | |
|------------------|-------------------|---------|----------|---------|----------|---------|----------|---------|----------|
| | | Num-ber | Per-cent | Num-ber | Per-cent | Num-ber | Per-cent | Num-ber | Per-cent |
| Peas | 25 | 11 | 44 | 13 | 52 | 1 | 4 | ---- | ---- |
| Limas | 34 | 11 | 32 | 17 | 50 | 6 | 18 | ---- | ---- |
| Sweet Corn | 23 | 6 | 26 | 15 | 65 | 2 | 9 | ---- | ---- |
| Green Beans | 27 | 9 | 33 | 12 | 45 | 6 | 22 | ---- | ---- |
| Asparagus | 8 | 4 | 50 | 3 | 39 | ---- | ---- | 1 | 12 |
| Broccoli | 12 | 11 | 88 | 1 | 12 | ---- | ---- | ---- | ---- |
| Cauliflower | 12 | 8 | 67 | 4 | 33 | ---- | ---- | ---- | ---- |
| Spinach | 11 | 6 | 55 | 5 | 45 | ---- | ---- | ---- | ---- |
| Brussels Sprouts | 14 | 13 | 93 | 1 | 7 | ---- | ---- | ---- | ---- |
| Strawberries | 20 | 7 | 35 | 10 | 50 | 3 | 15 | ---- | ---- |
| Peaches | 14 | 2 | 14 | 9 | 64 | 3 | 22 | ---- | ---- |
| Cherries | 8 | 1 | 12 | ---- | ---- | 5 | 63 | 2 | 25 |
| Total | 208 | 89 | 43 | 90 | 44 | 26 | 12 | 3 | 1 |

TABLE 9.—CLASSIFICATION, BY GRADE AND COMMODITY, OF 191 CANNED FOOD SAMPLES PURCHASED FROM COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity | Number of Samples | Grade A | | Grade B | | Grade C | | Grade D | |
|-------------|-------------------|---------|----------|---------|----------|---------|----------|---------|----------|
| | | Num-ber | Per-cent | Num-ber | Per-cent | Num-ber | Per-cent | Num-ber | Per-cent |
| Peas | 40 | 16 | 40 | 19 | 48 | 2 | 5 | 3 | 7 |
| Limas | 16 | 4 | 25 | 7 | 44 | 5 | 31 | --- | --- |
| Sweet Corn | 37 | 7 | 19 | 20 | 54 | 10 | 27 | --- | --- |
| Green Beans | 29 | 7 | 24 | 12 | 42 | 9 | 31 | 1 | 3 |
| Asparagus | 20 | 14 | 70 | --- | --- | 6 | 30 | --- | --- |
| Spinach | 10 | 3 | 30 | --- | --- | 5 | 50 | 2 | 20 |
| Peaches | 25 | 8 | 32 | 7 | 28 | 8 | 32 | 2 | 8 |
| Cherries | 14 | 5 | 36 | 5 | 36 | 4 | 28 | --- | --- |
| Total | 191 | 64 | 33 | 70 | 37 | 49 | 26 | 8 | 4 |

Detailed information on price per pound for each grade of canned and frozen foods tested brings out the fact that in 10 grade groups the average prices of A or B quality were higher than for the next lower grade represented in that product. In 10 of the groups the average prices were lower than for the next lower grade. For canned goods there were 12 cases where the average prices for A or B quality were higher than for the next lower grades and in 7 cases the average prices were lower than for the next lower grades. These comparisons are made on the basis of average prices of all samples falling into each grade and indicate little relation between price and quality.

A more detailed measure of reliability of price as a guide to quality was obtained by comparing the grades of the individual samples of each product with the price paid. This comparison shows for frozen product samples that in 119 cases the prices were accompanied by corresponding grade and in 89 they were not. For canned foods the prices were accompanied by the corresponding grade in 95 instances and in 96 they were not. Summary figures for both frozen and canned samples show that for 214 samples the grade corresponded to price paid and for 185 samples there was a lack of any positive relationship. In other words there was almost as much chance of getting a product of a quality not related to price as there was that the price paid would result in the quality which logically might be expected.

TABLE 10.—HIGHEST AND LOWEST PRICE PER POUND BY GRADE AND FORM OF FOOD SAMPLES PURCHASED IN COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Product and Form | Grade A | | Grade B | | Grade C | | Grade D | |
|------------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|---------|
| | Cents Per Pound | | Cents Per Pound | | Cents Per Pound | | Cents Per Pound | |
| | High-est | Low-est | High-est | Low-est | High-est | Low-est | High-est | Low-est |
| Peas | | | | | | | | |
| Frozen | 41.0 | 28.7 | 42.7 | 24.3 | 37.5 | 37.5 | ----- | ----- |
| Canned | 56.0 | 16.3 | 26.7 | 10.0 | 26.2 | 9.8 | 11.9 | 10.7 |
| Limas | | | | | | | | |
| Frozen | 59.8 | 40.3 | 58.2 | 38.3 | 57.3 | 34.9 | ----- | ----- |
| Canned | 34.5 | 28.8 | 34.2 | 25.0 | 30.5 | 26.7 | ----- | ----- |
| Sweet Corn | | | | | | | | |
| Frozen | 42.0 | 26.0 | 42.0 | 31.5 | 33.9 | 32.8 | -- | ----- |
| Canned | 28.2 | 16.8 | 28.2 | 21.1 | 26.3 | 16.7 | ----- | ----- |
| Green Beans | | | | | | | | |
| Frozen | 46.9 | 36.1 | 46.4 | 41.6 | 49.4 | 26.0 | - | ----- |
| Canned | 34.6 | 17.3 | 38.6 | 13.9 | 28.6 | 14.9 | 14.1 | 14.1 |
| Asparagus | | | | | | | | |
| Frozen | 70.5 | 58.6 | 47.5 | 42.9 | -- | | 57.3 | 57.3 |
| Canned | 60.0 | 30.7 | ----- | ----- | 64.0 | 33.3 | ----- | ----- |
| Broccoli | | | | | | | | |
| Frozen | 55.6 | 34.4 | 58.3 | 58.3 | ----- | ----- | ----- | ----- |
| Cauliflower | | | | | | | | |
| Frozen | 57.9 | 36.1 | 61.7 | 45.9 | ----- | ----- | ----- | ----- |
| Spinach | | | | | | | | |
| Frozen | 30.9 | 19.9 | 34.9 | 29.2 | ----- | ----- | ----- | ----- |
| Canned | 25.8 | 17.8 | ----- | ----- | 20.8 | 14.3 | 19.0 | 15.8 |
| Brussels Sprouts | | | | | | | | |
| Frozen | 59.8 | 42.2 | 55.4 | 55.4 | ----- | ----- | ----- | ----- |
| Strawberries | | | | | | | | |
| Frozen | 63.0 | 50.0 | 60.1 | 38.8 | 56.0 | 41.6 | ----- | ----- |
| Peaches | | | | | | | | |
| Frozen | 27.0 | 25.0 | 33.0 | 27.0 | 33.0 | 12.7 | ----- | ----- |
| Canned | 43.6 | 22.5 | 46.7 | 17.2 | 40.0 | 18.6 | 28.2 | 22.2 |
| Cherries—Sour | | | | | | | | |
| Frozen | ----- | ----- | ----- | ----- | 70.5 | 42.3 | ----- | ----- |
| Canned | 28.3 | 28.3 | 31.9 | 26.7 | 36.2 | 27.3 | ----- | ----- |
| Cherries—Sweet | | | | | | | | |
| Frozen | 68.3 | 68.3 | ----- | ----- | 46.0 | 46.0 | 70.4 | 43.4 |
| Canned | 61.3 | 36.2 | 47.3 | 35.2 | ----- | ----- | ----- | ----- |

The relationship between the high and low price paid for the individual samples which fell into each grade for each product was computed where two or more samples fell into the same grade. This analysis showed that there was much less range in prices paid for the same quality for different samples in the case of frozen foods than for canned foods. For example, some Grade A canned

TABLE 11.—AVERAGE PRICE PER POUND BY GRADE AND FORM OF FOOD SAMPLES PURCHASED IN COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity and Form | | Grade A Cents | Grade B Cents | Grade C Cents | Grade D Cents |
|---------------------|--------|------------------|------------------|------------------|------------------|
| Peas | Frozen | 36.8 | 35.3 | 37.5 | ----- |
| | Canned | 26.2 | 20.2 | 18.0 | 11.3 |
| Limas | Frozen | 55.5 | 50.8 | 46.3 | ----- |
| | Canned | 31.8 | 29.9 | 28.9 | ----- |
| Sweet Corn | Frozen | 34.7 | 36.3 | 33.3 | ----- |
| | Canned | 22.7 | 23.1 | 21.3 | ----- |
| Green Bean | Frozen | 43.0 | 44.2 | 40.5 | ----- |
| | Canned | 26.3 | 24.7 | 21.4 | 14.1 |
| Asparagus | Frozen | 65.6 | 44.3 | -- | 57.3 |
| | Canned | 43.1 | --- | 46.3 | ----- |
| Broccoli | Frozen | 47.1 | 58.3 | -- | -- -- |
| Cauliflower | Frozen | 48.5 | 52.9 | -- | -- |
| Spinach | Frozen | 27.3 | 31.3 | --- | --- |
| | Canned | 20.5 | --- | 16.8 | 17.4 |
| Brussels Sprouts | Frozen | 54.1 | 55.4 | --- | ----- |
| Strawberries | Frozen | 59.0 | 52.0 | 47.7 | ----- |
| Peaches | Frozen | 26.0 | 30.6 | 24.2 | ----- |
| | Canned | 28.9 | 25.7 | 26.3 | 25.2 |
| Cherries (Sour) | Frozen | --- | --- | 61.7 | ----- |
| | Canned | 28.3 | 30.2 | 32.4 | ----- |
| Cherries (Sweet) | Frozen | 68.3 | --- | 46.0 | 56.9 |
| | Canned | 47.7 | 41.3 | --- | ----- |

peas cost almost $3\frac{1}{2}$ times as much as others while for frozen peas the highest price paid was about $1\frac{1}{2}$ times the lowest price for Grade A. The price paid for canned limas was one of the few examples where the spread was less than for the frozen form. The unweighted average of this deviation in price within grade groups was 46% for frozen foods and 79% for canned foods. Part of the difference can be accounted for by the limited number of brands of frozen compared with canned foods on the market with the consequent limiting of brands of frozen foods included in the grading.

The final comparison to be made is that of the cost of frozen commodities with the cost of canned commodities of the same grade. For all commodities with the exception of peaches, the frozen foods cost more than canned foods. At the time samples were being purchased a few brands of peaches and sweet cherries

TABLE 12.—HIGHEST PRICE EXPRESSED AS PERCENTAGE OF LOWEST PRICE, BY GRADE AND FORM OF SAMPLES TESTED FROM COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.*

| Commodity | Frozen | | | | Canned | | | |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Grade A | Grade B | Grade C | Grade D | Grade A | Grade B | Grade C | Grade D |
| Peas | 143 | 176 | | --- | 344 | 267 | 267 | 111 |
| Limas | 148 | 152 | 164 | | 120 | 137 | 114 | - |
| Sweet Corn | 162 | 133 | 103 | --- | 168 | 134 | 158 | --- |
| Green Beans | 130 | 112 | 190 | --- | 200 | 278 | 192 | --- |
| Asparagus | 120 | 111 | --- | --- | 195 | - | 192 | --- |
| Broccoli | 162 | - | --- | --- | - | - | - | --- |
| Cauliflower | 160 | 134 | - | --- | --- | --- | --- | --- |
| Spinach | 155 | 120 | - | --- | 145 | - | 145 | 120 |
| Brussels Sprouts | 142 | --- | --- | --- | --- | --- | --- | --- |
| Strawberries | 126 | 155 | 135 | --- | --- | --- | --- | --- |
| Peaches | 108 | 122 | 260 | - | 194 | 272 | 215 | 127 |
| Cherries (Sour) | - | - | 167 | - | - | 120 | 133 | --- |
| Cherries (Sweet) | --- | --- | --- | 162 | 169 | 134 | --- | --- |

*Where only one sample fell into a grade no comparison was made as it would be meaningless. Blanks indicate that only one or no samples fell into those grades.

TABLE 13.—PRICE OF FROZEN FOODS AS PERCENTAGE OF PRICE OF CANNED FOODS OF THE SAME GRADES.

| Commodity | Grade A | Grade B | Grade C |
|------------------|---------|---------|---------|
| Peas | 140.8 | 174.8 | 203.3 |
| Limas | 174.5 | 169.9 | 160.2 |
| Sweet Corn | 152.9 | 157.1 | 156.3 |
| Green Beans | 163.5 | 179.0 | 189.3 |
| Asparagus | 152.2 | * | * |
| Spinach | 133.2 | * | * |
| Peaches | 90.0 | 119.1 | 92.0 |
| Cherries (Sour) | * | * | 190.4 |
| Cherries (Sweet) | 143.2 | * | * |

No comparisons were possible for grade D products because too few samples fell into this grade.

*No comparisons were possible in these groups where either frozen or canned samples were not represented.

were being sold at low special sales prices, and since these brands were included in the study the results were accordingly affected. The prices of frozen peaches and cherries were much nearer to prices of canned products than was true for most other products.

For all products combined the prices of frozen products were approximately half again as high as the same grade of canned food. This does not mean that there is less for money spent to be obtained from frozen foods than in other form. The acceptance by individuals of tastes of foods in the different forms will decide which form they buy so long as the price range between the different brands is not too great. The matter of acceptable price differentials among frozen and other forms of food will remain one of consumer acceptance rather than one of a mathematically determined relationship based on nutritive value and other measurable data.

PRICE AND GRADE OF FRESH PRODUCTS

The number of fresh items graded for this study was limited by facilities and personnel to do the grading as well as by a scarcity of fresh products at the time of the study. Only 16 samples of such products were graded and it was felt that comparisons with canned and frozen products from this small number of samples might not be reliable. For this reason the results of the grade tests for fresh samples were not included in the section on price and grade of canned and frozen foods. The results of the tests of the 16 fresh samples are given briefly in this section.

Of the 16 samples tested, 5 were Grade A, 8 were Grade B, 1 was Grade C, and 2 were off-grade.

With so few samples graded there were only four cases in which more than one sample of the same product fell into the

TABLE 14.—CLASSIFICATION BY GRADE AND COMMODITY OF 16 FRESH FOOD SAMPLES PURCHASED FROM COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity | Number of Samples | Grade A | Grade B | Grade C | Grade D |
|--------------|-------------------|---------|---------|---------|---------|
| Peas | 4 | | 3 | 1 | - |
| Limas | 2 | 2 | - | - | -- |
| Green Beans | 5 | 2 | 2 | | 1 |
| Asparagus | 1 | | 1 | - | -- |
| Spinach | 1 | | 1 | - | -- |
| Strawberries | 3 | 1 | 1 | - | 1 |
| Total | 16 | 5 | 8 | 1 | 2 |

TABLE 15.—HIGHEST AND LOWEST PRICE PER POUND BY GRADE OF 16 FRESH FOOD SAMPLES PURCHASED FROM COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity | Grade A | | Grade B | | Grade C | | Grade D | |
|--------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| | High- est | Low- est | High- est | Low- est | High- est | Low- est | High- est | Low- est |
| | Cents | Cents | Cents | Cents | Cents | Cents | Cents | Cents |
| Peas | | | 81 4 | 54 3 | 65 7 | 65 7 | | |
| Limas | 55 0 | 37 1 | | | | | | |
| Green Beans | 29 0 | 25 0 | 35 0 | 15 3 | | | 28 4 | 28 4 |
| Asparagus | | | 36 0 | 36 0 | | | | |
| Spinach | | | 23 4 | 23 4 | | | | |
| Strawberries | 53 3 | 53 3 | 60 0 | 60 0 | | | 44 6 | 44 6 |

TABLE 16.—AVERAGE PRICE PER POUND BY GRADE OF 16 FRESH FOOD SAMPLES PURCHASED FROM COLUMBUS, OHIO STORES, JANUARY 30 TO APRIL 16, 1948.

| Commodity | Grade A | Grade B | Grade C | Grade D |
|--------------|---------|---------|---------|---------|
| | Cents | Cents | Cents | Cents |
| Peas | | 69 5 | 65 7 | |
| Limas | 46 0 | | | |
| Green Beans | 27 0 | 25 1 | | 28 4 |
| Asparagus | | 36 0 | | |
| Spinach | | 23 4 | | |
| Strawberries | 53 3 | 60 0 | | 44 6 |

same grade. As a result there was little chance to determine to what extent the price per pound for the same grade varied for each product. The highest price expressed in percentage of lowest in the four cases where more than one sample fell into the grade varied from 116 to 229 per cent.

The price per pound of fresh peas of the same grade was much higher than for the other forms. For some other commodities the comparative price was less, especially for Grade A and B green beans. The price of fresh strawberries was about the same as for frozen of the same grade but fresh strawberries were seasonally high at the time of the study. Grade A fresh lima beans were slightly lower in price than the same grade of frozen limas.

On the matter of price paid being a guide to quality received, it was found that for 7 of the samples the quality corresponded to price paid and for 9 there was the reverse relationship.