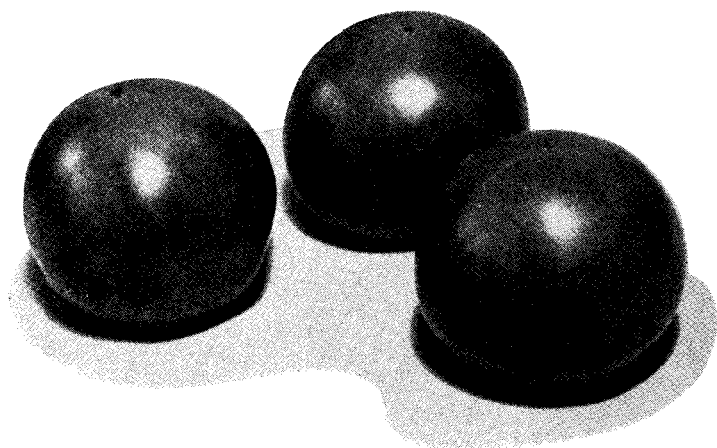


OCT 22 1953

Marketing ...

TENNESSEE TOMATOES

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AGRICULTURAL EXPERIMENT STATION
THE UNIVERSITY OF TENNESSEE
KNOXVILLE

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Marketing Tennessee Tomatoes

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INTRODUCTION¹

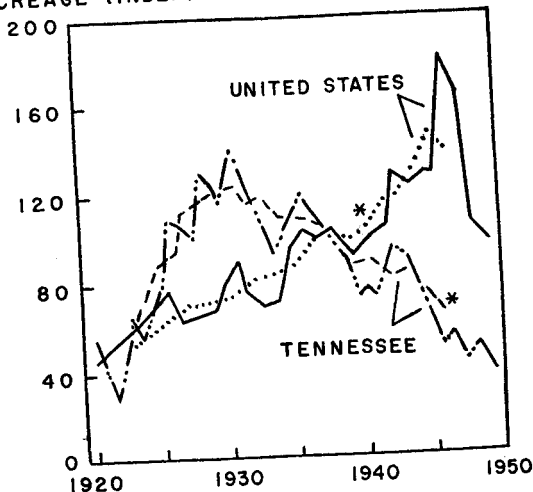
The Problem and Importance of the Study

The production of green-wrap tomatoes for fresh market is an important cash enterprise in limited areas of West Tennessee. In 1952 producers received a cash income of \$975,000 from the sale of green-wraps. The average income from this crop for the 10-year period, 1941-1950, was \$1,378,000.

Green-wrap tomatoes are grown chiefly in the Humboldt area comprising most of Gibson County and adjoining parts of Crockett, Madison, and Carroll Counties, the bulk of the production centering in an area some 30 miles in diameter. Small quantities of green-wraps are produced in Lauderdale County in the Ripley area, but the major part of the fresh market crop in Lauderdale County is marketed as pink tomatoes.

Tennessee's relative importance as a producer for the green-wrap market has fluctuated sharply during the last three decades, ranking 17th in 1919, 7th in 1929 and 17th again in 1950. A relative comparison of the trend of tomato production in the United States and Tennessee from 1920 through 1949 indicates that Tennessee's acreage has been declining sharply since 1929 compared to the trend in U. S. acreage which was upward through 1947 (Figure 1).

ACREAGE (INDEX)



* 5-YEAR MOVING AVERAGE

Figure 1.—Trend of tomato acreage, Tennessee and United States, 1920-1949 (1935 - 1939 acreage = 100 percent).

Source: United States Department of Agriculture, *Annual Summaries of Truck Crops*, Mimeographed Reports (Washington, D. C., Bureau of Agricultural Economics, 1920-1949).

¹This sub-project was part of the Southern Regional SM-3 tomato marketing project conducted under the Research and Marketing Act of 1946. Arkansas, South Carolina, Florida, Kentucky and Texas participated in various phases of the project.

In addition to the green-wrap area in West Tennessee, where tomatoes are sold for processing after the green-wrap season is terminated, small acreages of tomatoes are produced in numerous other counties of Tennessee. The tomatoes which are produced for the fresh market in the counties outside the green-wrap area are usually sold on the produce markets of Memphis, Nashville, Chattanooga, Knoxville, and other cities of Tennessee (Figure 2).

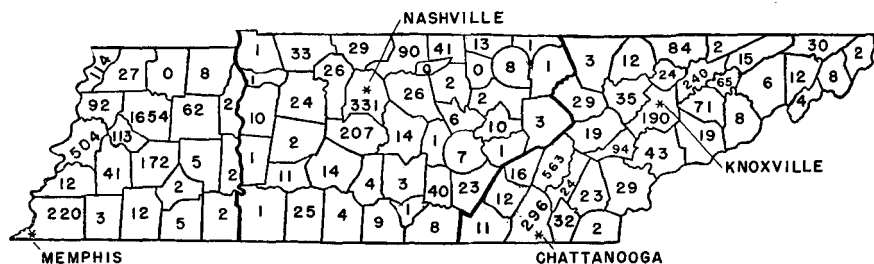


Figure 2.—Acreage per county of farms producing tomatoes for fresh market and processing in Tennessee during the 1949 season.

Source: United States Census of Agriculture, 1950 (Washington, D. C., Superintendent of Documents, United States Government Printing Office.)

Several factors probably have contributed to Tennessee's decline, since 1929, in relative importance as a producer of tomatoes for the fresh market. More opportunities to shift into other enterprises providing a better return may have developed in Tennessee than in other competing states. Wide fluctuations in tomato prices from year to year compared to relatively stable prices for storable crops may have been an important factor. Moreover, technological advances in tomato production may have been more adaptable to conditions in these other states than in Tennessee. However, it may be that the principal explanation for this decline in Tennessee's relative importance lies: (1) in her failure to produce and deliver to the consumer tomatoes having the characteristics the consumer prefers, and (2) in the continued existence of improper methods of production and marketing, which result in tremendous wastage of product, and consequently, in lower returns to growers.

Evidence available from an earlier study and from an early phase of this study seemed to substantiate the above conclusion and, as a result, influenced greatly the conduct of this study. A report published in December, 1947, of a study of the acceptability of Tennessee tomatoes in the Detroit market emphasized that tomatoes shipped from Tennessee had been harvested before ma-

turity.² A report from the same study released in February, 1949, stated that greater care should be exercised in the handling of tomatoes at every step of marketing from field picking to the consumer.³

Analysis of an early phase of this present study showed that somewhat over one-half of the tomatoes **actually on the vine** never reached the consumer, having been wasted either on the vine as they approached the picking stage or between the vine and consumer.⁴ Thus the two circumstances of a weakening demand (due to the failure to produce tomatoes meeting the consumers' requirements) and heavy costs of exorbitant wastefulness in production and marketing processes appeared to operate like the twin blades of scissors to cut the profit out of the farmers' tomato growing enterprise. As a result, farmers were shifting toward other enterprises, thereby reducing the relative importance of Tennessee as a producer of green-wrap tomatoes.

Specific Objectives

The specific objectives of this study are:

(1) To ascertain: (a) where Knoxville's tomatoes originate; (b) the type of stores utilized for tomato purchases; (c) who buys tomatoes at local outlets; (d) the days when most tomatoes are purchased.

(2) To determine consumer preferences: (a) bulk and packaged tomatoes; (b) brand names; (c) size of purchases; (d) varieties; (e) size preferences for shipped-in and home-grown tomatoes and to compare, where applicable, the relative value of the interview and actual purchase experiment methods as a means of determining consumer preferences; to determine whether U.S.D.A. size specifications coincide with the consumers' concept of what the terms "small," "medium," "large," and "very large" imply; (f) grades; (g) ripeness.

(3) To delineate the specific factors which consumers consider most important when buying tomatoes.

(4) To measure the effects of family size, income, and tomato prices as they relate to the consumption of tomatoes, and to determine consumer demand for grades A, B and C tomatoes.

²Arthur C. Meyer, **Report on Tomatoes in the Detroit Market** (Knoxville, Tennessee: Agricultural Experiment Station, University of Tennessee, Circular No. 79, December 1947), p. 4.

³Arthur C. Meyer, **Report on Tomatoes in the Detroit Market** (Knoxville, Tennessee: Agricultural Experiment Station, University of Tennessee, Circular No. 82, February 1949), p. 7.

⁴William E. Goble, Master's Thesis, **Practices Affecting the Marketable Yield and Quality of Tomatoes in West Tennessee** (Knoxville, Tennessee: University of Tennessee, December 1950), p. 9.

(5) To obtain preferences of retailers and wholesalers for packaged and bulk tomatoes, for size, grade, ripeness, market preparation, and storage methods.

(6) To determine needed adjustments in both production and marketing practices of producers and marketing practices of wholesalers and retailers as revealed by preferences of consumers.

(7) To determine whether tomato producers are following recommended production and marketing practices.

(8) To determine the effects of specified production and marketing practices on the marketable yield and quality of tomatoes.

Method of Procedure and Source of Data

This study is comprised of three separate phases, covering four years' work. The first phase, conducted in 1949, involved a study of the production and marketing practices affecting the marketable yield and quality of tomatoes in West Tennessee. The counties of the Humboldt and Ripley areas were selected on the basis of all tomato acreage.⁵ The second phase was concerned with consumers' preferences regarding desired qualities and characteristics of tomatoes. The interviews for the second phase of the study were conducted during the summer of 1950 in Knoxville. This phase served as a pilot study for the third phase. The universe for the survey in the second phase was 39,143 households in the city of Knoxville, 545 retail grocers, and 23 wholesale grocers.⁶ The third phase, conducted during the summers of 1951 and 1952, consisted of controlled experiments in four Knoxville retail grocery stores.⁷ The consumer preference study, based upon interviews in consumers' homes, was used as a pilot study. The store experiments made it possible to examine the behavior of consumers when confronted with actual alternatives among which to choose. It was felt that patterns of consumer preference so revealed in an actual choice-making situation might differ substantially—and be more meaningful—than mere expressions of preferences in interviews by consumers not involved in actual choice-making processes. Inasmuch

⁵The sample was distributed proportionately over the selected counties by selecting Civil Districts on the basis of their total tomato acreage. A grid with numbered squares was placed over each Civil District section of a General Highway and Transportation map of each county. A random sample was taken, the number drawn being proportionate to the acreage of tomatoes for the particular district. Data for this study were obtained by personal interview with 129 producers with one-half acre or more of tomatoes in five West Tennessee counties and 19 packers-buyers in the same area.

⁶The city was divided into three rental areas based upon the average monthly rental paid within the area. The survey covered a cross-section sample of the private households in the universe, ten percent of the merchants, and all of the wholesale tomato dealers in Knoxville.

⁷Three of the stores were selected on the basis of income areas used as a basis of classification in the former study. Market acceptance for selected quality factors was determined by actual purchases of consumers.

as most attempts at studying consumer preferences are of the latter type, it was felt that the reliability of evidence so obtained should be put to some kind of objective test.⁸

Basically, the study consists of two parts, paralleling the two basic forces which it is believed operate to reduce the profitability of Tennessee tomato production. Part I (which combines phase 2 and 3 of the study) is an analysis of factors affecting consumer acceptance of Tennessee tomatoes, as revealed by interviews with 100 consumers, 57 retailers, and 23 wholesalers, and as revealed by actual store experiments involving four stores and the purchase decisions of several thousand consumers, 910 of whom were given brief supplementary interviews. Part II, which chronologically was conducted first, and so referred to above as phase 1, consisted of a study of the more important factors causing wastage of Tennessee produced tomatoes with the resultant great reduction in the profitableness of green-wrap tomato production in the state.

Origin of Fresh Tomatoes

Figure 3 indicates that the West Tennessee green-wrap producers market substantial quantities of fresh tomatoes in Knoxville. Production areas in 11 other states and in Mexico also furnish a considerable volume of tomatoes to the Knoxville market. The Tennessee producers' interest is chiefly focused on the summer season, inasmuch as most of their tomato crop is produced during this season.

Tomato acreage for fresh market in the Knoxville production area declined sharply from 2,370 to 1,496 acres from 1940 to 1950. The density of production in the Knoxville area is indicated in Figure 4.

CONSUMERS' BUYING BEHAVIOR PATTERNS AND PREFERENCES

Some Factors Influencing Tomato Consumption

Seasonal Pattern and Level of Consumption—To the extent that average monthly rent reflects differences in consumer income,

⁸The point at issue really is whether the circumstances which play upon an interviewee in a non-choice-making situation are the same as in a situation where he is actually making a choice and thereby committing himself to its consequences. The authors felt that general cultural suasions operate much more powerfully relative to personal preferences in an interview than in actual choice-making situations. An interviewee may be inclined to state a preference for "medium" size tomatoes because that seems more "proper," but actually buy large tomatoes, thinking of the greater ease of preparation. Such an inconsistency does not reflect dishonesty or ignorance of her preference on the part of the interviewee; it suggests only that different motivating factors play upon her in an interview than in an actual choice-making situation.

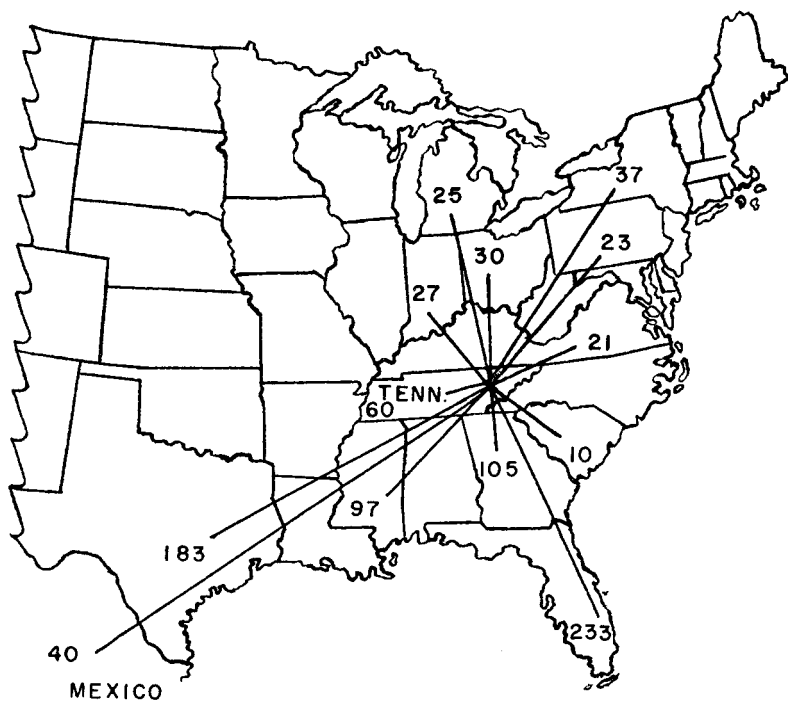


Figure 3.—Origin of fresh tomatoes received in Knoxville by carlot equivalents, July 1949 - July 1950.

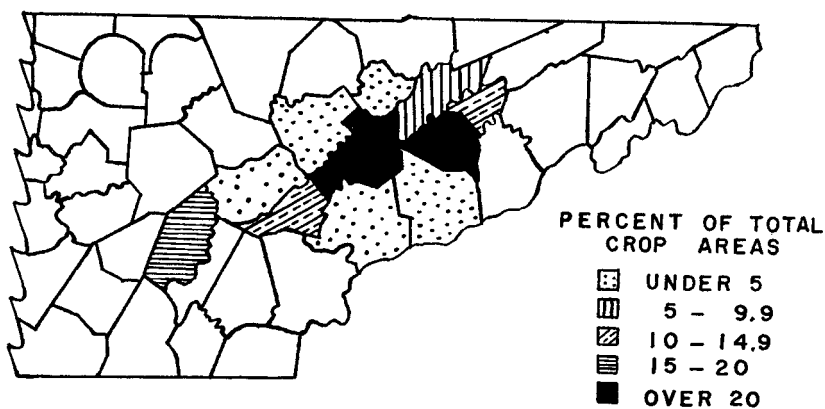


Figure 4.—Density of tomato production for fresh market in the Knoxville area.

Source: 1950 Census of Agriculture, Preliminary Report (Washington, D. C., Bureau of the Census, U. S. Government Printing Office).

the seasonal pattern of tomato consumption is independent of income, according to evidence obtained from 100 consumers in three different rental areas in Knoxville. However, the level of consumption is a function of income (Figure 5), at least in that the

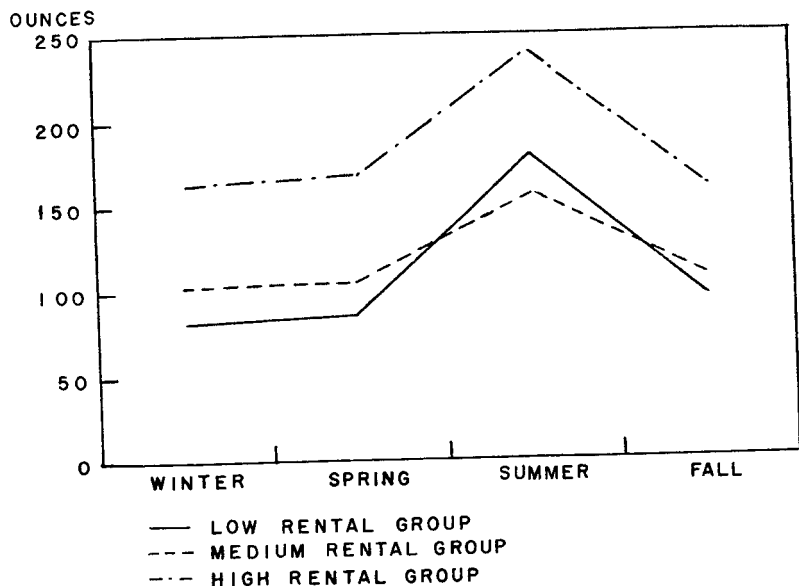


Figure 5.—Average family consumption of fresh tomatoes in Knoxville, by rental areas, retail weight, July 1949 - July 1950.

high rental group consumes more tomatoes than do the other two rental groups.

This survey indicates that per capita tomato consumption in Knoxville was 21.3 pounds, or 2 pounds less than the national average, for the period July 1949 to July 1950. The trend of tomato consumption in the United States increased sharply from 1928 to 1945 (see Appendix Figure 1 for details).

Seasonal Influence of Income and Size of Family on Consumption—Since consumption of tomatoes varies materially from one locality to another, it is of interest to isolate as accurately as possible the factors influencing tomato consumption in different areas where Tennessee tomatoes are sold.

It was found that consumer income and family size have very little influence on the consumption of tomatoes during the summer when tomatoes are plentiful. On the other hand, 30 percent of the

variation in tomato consumption in the spring, and 25 and 22 percent of the variation in the fall and winter respectively were accounted for by variation in income and size of the consumer's family. Further analysis indicated that income variation accounted for about three times the changes in tomato consumption as size of family. (For additional information see Appendix Table I).

Place of Purchase

Almost half of the 100 customers interviewed in their homes said that they usually purchased tomatoes in independent stores; two-fifths of them said they usually made purchases in corporate and local chain stores; the remaining buyers said they obtained tomatoes from local curb markets and from hucksters who sold vegetables in residential areas.

Who Does the Buying

Wives made nearly four-fifths of the purchases and husbands about one-tenth. The remaining purchases were made by children and domestic employees. Improvements in quality and grades should be made to meet preferences of housewives, since they make most of the purchases.

Time of Purchase

Purchases of tomatoes varied widely during the week. More than half the purchases were made on Saturday and Friday, nearly 30 percent of the week's total on Saturday. The fewest were made on Monday and Wednesday (Table 1). By adjusting the volume of tomatoes in storage to consumer demand, wholesalers may prevent gluts on the market and meet demands for maturity more accurately.

Table 1.—Days fresh tomatoes are most frequently purchased by 100 consumers*

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
Number	17	28	17	25	44	53	184
Percent of total	9.2	15.2	9.2	13.6	23.9	28.9	100.0

*Some consumers reported purchases on more than one day.

Size of Purchase

Approximately two-fifths of the tomato purchases were reported in interviews to be from one to two pounds and about the same proportion ranged from two to three pounds (Table 2). To

Table 2.—Size of each tomato purchase according to 380 consumer interviews in 3 retail grocery stores, August, 1951

Size of Purchase	Number of Consumers	Percentage of Consumers
Pounds		
Less than 1	9	2.4
1 to 2	168	44.2
2 to 3	166	43.7
3 to 4	26	6.8
4 to 5	10	2.6
5 and over	1	.3
Total	380	100.0

serve as an additional check on information given in a non-choice-making situation, a representative number of observations were made of the actual amount of tomatoes purchased by consumers. The average amount purchased per customer was 1.9 pounds. The size of purchase has a direct bearing on the packing of home-grown tomatoes. Should it be practicable to sell home-grown tomatoes in small cartons or baskets in retail stores, it is apparent that their capacity should not be over two to three pounds. Furthermore, if a durable package can be manufactured, consideration might be given to selling shipped tomatoes in two- or three-pound containers.

An additional check was made of the weekly size of tomato purchases by 87 consumers. The modal group reported they purchased two pounds per week. In some cases (how many we do not know) the weekly purchase is equal to the amount purchased at one time (Table 3).

Table 3.—Size of tomato purchases as reported by 87 consumers in Knoxville, Tennessee, June, 1950

Size of Purchase During Last Seven Days	Number of Consumers	Percent of Total Consumers
Pounds		
1	14	16.1
2	29	33.4
3	23	26.4
4	10	11.5
5	4	4.6
6	3	3.4
7	4	4.6
Total	87	100.0

Grades and Varieties Purchased

Two-fifths of the customers reported they did not know the grades of tomatoes purchased. Since a large percentage of the tomatoes sold by farmers on the produce market and by retailers have not been graded, it is natural that consumers are not yet grade-conscious.

Likewise, the consumer who distinguished varieties in the retail store was an exception.

Form of Purchase (Bulk or Cartons)

Considerable developments have taken place in the prepackaging of many foods formerly sold in bulk and packaged at the time of sale. In the case of tomatoes, cartons holding three to five tomatoes came into general use. These cartons, made of cardboard and usually having cellophane tops, are commonly referred to in the trade as "tubes." Such prepackaging of food often results in economies of labor in merchandising, in adding to the attractiveness and sales appeal of the product and, in some cases—such as tomatoes—in a sharp reduction in waste due to handling of the product by consumers. To determine whether these savings outweigh the additional costs of these display cartons, the costs to the wholesaler and retailer of packing and handling bulk as compared with cartoned tomatoes were computed by making case studies with two wholesalers and two retail grocery stores. The case studies give a comparison of the cost of materials and labor⁹ for packing 20- and 40-pound cardboard boxes in which tomatoes are ordinarily packed for bulk sales and 14-ounce consumer cartons for two wholesalers in Knoxville. To the labor cost is added one-fourth of the cost of the 20- and 40-pound cardboard boxes, since they are ordinarily used four times. The average cost, so computed, was .3 of a cent per pound for bulk, as compared to 2.8 cents per pound for the 14-ounce cartoned tomatoes, representing a 2.5 cents per pound differential. The wholesalers from whom the data were obtained sold cartoned tomatoes at the same price per carton as the price per pound of bulk tomatoes. The additional cost of 2.5 cents per pound for packaging tomatoes in cartons was offset by the fact that the consumer cartons must hold a minimum of only 14 ounces or slightly under a pound of tomatoes. (This weight will range from a minimum of 14 ounces to 16 ounces.) Moreover, evidence to be presented later suggests that some repackers sell cartoned tomatoes at a net discount per pound because they pack lower quality or smaller tomatoes in consumer cartons than are usually sold in bulk* (Table 4).

⁹The data were obtained from the wholesalers by observing the actual packing operations in the repack room. The labor time for packing was determined with a stop watch. The labor time required for a clerk to sort tomatoes left from the previous day, arrange the display, weigh and place the tomatoes in paper bags was computed in two retail grocery stores.

*See pages 13 and 14.

Table 4.—Comparison of the wholesalers' and retailers' cost of materials and labor for packaging tomatoes, 20- and 40-pound containers and consumer cartons, 2 wholesalers and 2 retail grocery stores, July 11, 14, and 15, 1952

Specified Items	Cost of Labor and Cartons Cents
WHOLESALEERS	
Bulk Tomatoes	
40-pound cardboard box ($\frac{1}{4}$ total price)	7.5
Labor cost of packing	3.3
Total	10.8
Average cost per pound .3 of a cent	
20-pound cardboard box ($\frac{1}{4}$ total price)	4.0
Labor cost of packing	1.7
Total	5.7
Average cost per pound .3 of a cent	
Consumer Cartons	
46 (14-ounce) cartons	90.0
Wood carrier	15.0
Labor cost of packing	8.0
Total	113.0
Average cost per pound 2.8 cents	
RETAILERS	
Bulk Tomatoes	
Average cost of sorting tomatoes on display from previous day and arranging display	9.0
Losses due to bruising and deterioration of 1.2 pounds per day; 27 cents per pound	32.0
Losses from selling overripe and bruised tomatoes at reduced price, 1.6 pounds; 13.5 cents per pound	22.0
Labor cost for handling 40 pounds of bulk tomatoes for customers	13.0
Twenty paper bags per 40 pounds of tomatoes	8.6
Total	84.6
Average cost per pound 2.1 cents	
Consumer Cartons	
Arranging display 46 (14-ounce) cartons	8.0
Loss of about $\frac{1}{2}$ pound of tomatoes per day	14.0
Total	22.0
Average cost per pound .6 of a cent	
Total Wholesalers' and Retailers' Cost Per Pound	
Bulk tomatoes	2.4
Cartoned tomatoes	3.4
Cost advantage of bulk tomatoes	1.0

Merchandising tomatoes in bulk and consumer cartons at the retail level had different labor and material requirements as well as different amounts of wastage. The preceding table reveals that the average retailer's cost of handling bulk tomatoes, including labor costs, wastage, and the cost of the paper bags was 2.1 cents

per pound. Comparatively, the average cost of labor and wastage of selling tomatoes in consumer cartons was .6 of a cent per pound. For the total wholesaler and retailer costs, therefore, we find a net saving of one cent per pound from selling tomatoes in bulk as compared with consumer cartons.

Consumers and grocery managers believed that home-grown tomatoes would be less bruised if they were packed either in 12-pound baskets or in 20- or 40-pound cardboard containers for delivery from the farm to the retailer or produce market instead of in the round bushel baskets usually used. Furthermore, consumers complained that the top layer of tomatoes in bushel baskets in many cases contain superior quality tomatoes of the proper degree of maturity and of the desired size, while the lower layers in the same containers are sometimes of inferior quality, of mixed sizes and less maturity. On the basis of information received from a major tomato producer who sold home-grown tomatoes on the Knoxville market, it was not possible to sell small tomatoes of approximately $1\frac{3}{4}$ inches in diameter, during the summer season.

To determine consumers' preferences for cartoned or bulk tomatoes during the summer, a test was run for 16 days from mid-June into July in one retail grocery store.

In this experiment tomatoes of approximately the same size, quality and cost were displayed in cartons and in bulk. Cartoned sales during this 16-day period comprised 36.5 percent of the total sales despite the fact that 60 percent of the consumers, in a non-choice-making situation, expressed preference for tomatoes in cartons.

Fifty consumers were interviewed to determine the reasons cartoned and bulk tomatoes were purchased. Nineteen of the consumers stated they preferred to purchase tomatoes in cartons because of the economy in shopping time. All except two of the consumers reported that the quality of bulk tomatoes far exceeded that of tomatoes sold in cartons.

Possible Advantage from Change in Carton Design

As stated previously, consumer interviews disclosed customer resistance was developing toward buying cartoned tomatoes. Retailers, too, were becoming aware of this resistance. In both cases the problem seems to center in the consumers' apprehension of finding poor tomatoes in cartons. Because of this situation both the retailers and the consumers showed considerable interest in the

development of a new type of consumer carton. Based on the assumption that higher quality tomatoes would be packed in cartons designed to show the stem ends in the bottom of the carton and that consumers would buy cartoned tomatoes more willingly if they could see the tomatoes better, a carton of this type was designed¹⁰ (Figure 6). An experiment was conducted for 16 days

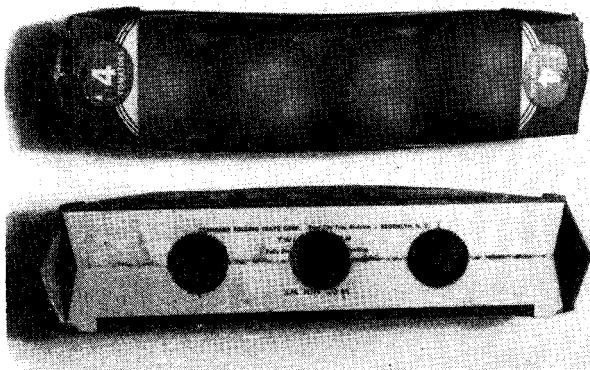


Figure 6.—Experimental type of carton used in experiment, Chapman Highway retail grocery store, June 13 - July 2, 1952.

to test consumer acceptability of such an experimental type of 14-ounce unsealed carton with a cellophane top and three circular openings in the bottom of the carton. While the consumers were observing the display of both the experimental carton and the solid bottom type of carton their opinions were obtained. The consumers thought the new carton was an improvement over the usual type. However, if the experimental type is adopted later for commercial use, the bottom openings should be somewhat larger. The consumers believed that the experimental type would readily enable them to observe most of the tomato defects. Furthermore, it appeared that preference for the experimental type of carton increased with time.

Sealed and Unsealed Consumer Cartons

Two types of cartons are in common use—the sealed and unsealed types. The sealed carton has the advantage of preventing bruising of tomatoes incurred from handling by customers. In a 5-day test 133 of the sealed cartons were sold compared with 234 of the unsealed cartons. In the experiment only two of the sealed tubes were opened by the customers. From the results of the

¹⁰The experimental consumer carton as shown in Figure 6 was designed through the cooperative efforts of this department and the Standard Folding Trays Corporation, Brooklyn, New York.

experiment it appears that most consumers wish to examine the tomatoes more closely than can be done in the sealed carton. This suggests again that the development of a sealed consumer carton with openings in the bottom might do much to overcome consumer resistance and restore confidence in packaged tomatoes.¹¹

Brand Names

With the development of packaging, consumer identification of tomatoes by brand names becomes possible. Through advertising, many products have become so differentiated by brand names that the consumer buys on that basis almost entirely. The value of advertising as a means of expanding the demand for tomatoes, say from some particular producing area, depends very largely upon its ability to differentiate its product.

Of the consumers interviewed, 79 percent stated that they could not remember the brand names of the cartoned tomatoes they had purchased. Obviously, then, the majority of consumers had made no differentiation of brand names. In fact, only five of the 100 consumers specified any brand preference. This suggests that consumers select tomatoes on the basis of observable qualities rather than by brand names.

Shipped-In Versus Home-Grown Tomatoes

Consumers overwhelmingly favored home-grown tomatoes when available. Flavor, freshness, and degree of maturity appeared to be major factors in this preference for home-grown tomatoes. The consumers' preference is important because sales of Tennessee home-grown tomatoes are terminated earlier in the season than is, perhaps, necessary. The season might be extended for the Knoxville trade territory by planting earlier and later varieties, by irrigation, or by raising additional tomatoes in the Cumberland Plateau or other sections of the state which may be adapted to later seasonal tomato production.

Size

It is common knowledge that one basis upon which consumers select their tomatoes is the size of the individual tomatoes. If consumers have a strong preference for tomatoes of some given

¹¹There has been some research on developing a carton of this type by the Standard Folding Trays Corporation. According to information received from this company, an experiment was run on a sealed carton with bottom openings at a Birmingham, Alabama, tomato packing plant. The results showed tomatoes were scorched on the stem ends as the cartons moved over the sealing machine.

size range, it is important that this be known so that producers can direct their efforts to producing tomatoes of that size, by means of variety selection and various cultural practices. It is also possible that plant breeders might direct their efforts to developing tomatoes of the preferred size. Likewise, it is possible that various marketing agencies may wish to sort their tomatoes by size and sell them at different prices as dictated by their relative supplies and demand.

Since most size-preference data were obtained by consumer interview, it was thought advisable to ascertain how precise is the agreement among consumers as to the size connoted by the class names "small," "medium," "large," and "very large." This would provide a basis for evaluating the usefulness of size-preference data so obtained. It would also provide a basis for determining whether or not the size limits of the standard classes should be adjusted to fit better the consumers' ideas of the connotations of the class names.

To determine the sizes of tomatoes included in the consumers' concepts of "small," "medium," "large," and "very large," customers were asked to identify the different sizes. There were considerable differences among definitions given by customers in different groups in the Central, Broadway, and Kingston Pike stores. Table 5,

Table 5.—Percentage of consumers who identified tomatoes of specified sizes as small, medium, large, and very large according to 279 consumer responses in 3 retail grocery stores, Knoxville, Tennessee

Size ¹ Specifications	Weight of Tomato (Ounces)	Diameter (Inches)	Proportion of Each Size Identified As:				Total
			Small	Medium	Large	Very Large	
(Based Upon U.S.D.A. Standards)			Percent	Percent	Percent	Percent	Percent
Small	2.2	1¾	93.9	6.1			100.0
	2.5	2.0	98.3	1.7			100.0
	2.9	2¼	97.8	2.2			100.0
Medium	4.3	2½	75.1	24.9			100.0
	5.3	2¾	14.4	85.6			100.0
	5.9	3.0	5.2	93.9	.9		100.0
Large	8.2	3¼	.4	61.0	38.2	.4	100.0
	9.0	3¾		26.6	73.4		100.0
	9.9	3½		10.5	87.3	2.2	100.0
Very Large	12.0	3¾		.4	57.1	42.5	100.0
	14.0	4.0			29.3	70.7	100.0
	16.0	4¼			1.7	98.3	100.0

¹According to U. S. Consumer Standards of October 10, 1948, published by the Production and Marketing Administration, the small tomato weighs less than three ounces, the medium size tomato from 3 to 6 ounces, the large size from over 6 to 10 ounces, and the very large size over 10 ounces. Raymond L. Spangler, *Preparation of Fresh Tomatoes for Market*, (Washington, D. C., United States Department of Agriculture, United States Government Printing Office,) pp. 31-32. Based upon these weights, diameters have been established for comparable weights.

which is a total of the size identifications obtained from all three stores, reveals that most of the consumers identified the tomato with a diameter range from $1\frac{3}{4}$ to $2\frac{1}{2}$ inches as "small." The sizes for which consumers' definitions were most indecisive were $3\frac{1}{4}$ and $3\frac{3}{4}$ inches which fall between medium and large, and large and very large respectively. Although the small size, according to U.S.D.A. specifications terminates with a tomato with a weight of 2.9 ounces, or a diameter of $2\frac{1}{4}$ inches, the consumers identified a small tomato to include any with a weight of 4.3 ounces, or a diameter of $2\frac{1}{2}$ inches. Similarly, consumers identified the upper limit of the medium tomato to include any with a weight of 8.2 ounces, or a diameter of $3\frac{1}{4}$ inches. The upper limit of the large tomato was identified by consumers to include a tomato weighing 12 ounces, or having a diameter of $3\frac{3}{4}$ inches. Since consumers as a whole tended to include the lower limits of each successive size in their identification of tomato sizes, a reappraisal of present U.S.D.A. specifications might be in order.

Whereas Table 5 gave the range over which the size identifications were spread, Table 6 indicates the proportion of consumers

Table 6.—Percentage of consumers properly identifying tomatoes according to U.S.D.A. Standards

Size Classification	Percent Properly Identifying Each Size
Small	96.8
Medium	67.9
Large	65.4
Very Large	69.9

who identified each size properly. The consumer experienced little difficulty in identifying the small tomato, but only about two-thirds of the medium, large, and very large sizes were identified accurately.

Evidence collected in this phase of the study discloses that the following class definitions would be more acceptable to a majority of the consumers:

Small	—	$1\frac{1}{4}$ through $2\frac{1}{2}$ inches
Medium	—	$2\frac{3}{4}$ through $3\frac{1}{4}$ inches
Large	—	$3\frac{3}{8}$ through $3\frac{3}{4}$ inches
Very Large	—	4.0 through $4\frac{1}{4}$ inches

Size Preference for Shipped-In Tomatoes

The size of shipped-in tomatoes which consumers preferred was not determined by direct consumer interviews, but by retailer

preference, which may or may not be an accurate expression of consumer preference. In some cases retailers' and consumers' preferences may not be reflected in purchases because tomatoes meeting these preferences may not be available. A majority of the retailers preferred cartons of four tomatoes, each tomato weighing about 3.9 ounces. However, the number of tomatoes per carton preferred by consumers varies directly with the price of tomatoes, ranging from four and five when prices are high to three when prices are low.¹²

Size Preference for Home-Grown Tomatoes

Preference for each size of home-grown tomatoes was obtained by interview with customers purchasing them. Almost 75 percent of the respondents expressed preference for tomatoes with a diameter of $2\frac{3}{4}$ to $3\frac{3}{8}$ inches, which correspond to the upper two-thirds of the medium and the lower two-thirds of the large U.S.D.A. size classes (Figure 7).

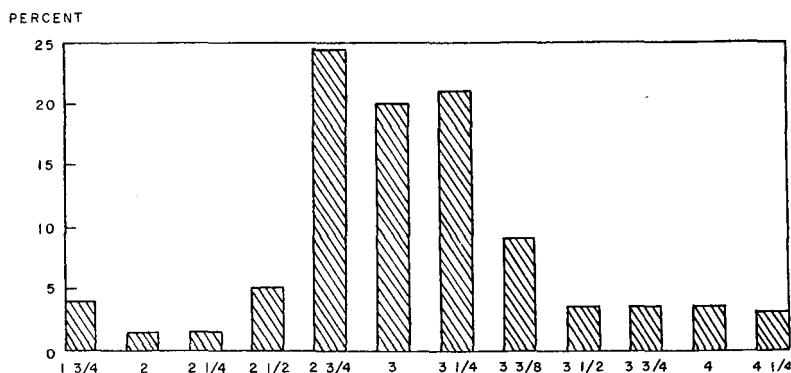


Figure 7.—Preference for each tomato size, irrespective of use, as a percentage of 910 interview responses obtained in 3 retail grocery stores, August 22, 23, 24, 1951.

Two different experiments were conducted to determine the different sizes of tomatoes consumers actually prefer to buy, as compared with their **stated** preferences. The first experiment conducted in three retail grocery stores was to determine the proportion of small, medium, large, and very large tomatoes purchased when the different sizes were mixed in one bin and sold at the same

¹²Three tomatoes per consumer carton would include the 6 x 6 size (6 rows each way in a thirty-pound lug or 3 tomatoes weighing about 5 ounces each). Four tomatoes per consumer carton would include the 6 x 7 size (6 rows one way and 7 rows another way in a thirty-pound lug or 4 tomatoes weighing $3\frac{1}{2}$ to 4 ounces each). Five tomatoes per consumer carton would include the 7 x 7 size (7 rows each way or 5 tomatoes weighing about 3 ounces each).

price. Table 7 gives the results of this test which indicate only minor differences in the amount purchased of the different sizes in the three stores. The second experiment was to determine the proportion of small, medium, large, and very large tomatoes purchased when the different sizes were sold from separate bins (Table 7). The results, similar to those of the first experiment, showed

Table 7.—Proportions (by weight) of various sizes of home-grown tomatoes purchased when the different sizes were displayed in one bin and in separate bins, 3 retail grocery stores, August 13 and 14, 1951

A & P Stores	Tomato Sizes				Total
	Small	Medium	Large	Very Large	
	1¾- 2¼ in.	2½- 3.0 in.	3¼- 3½ in.	3¾- 4¼ in.	
	Percent	Percent	Percent	Percent	Percent
One-Bin Display					
Central	7.2	27.7	33.9	31.2	100.0
Broadway	7.0	32.2	33.1	27.7	100.0
Kingston Pike	9.0	27.4	37.4	26.2	100.0
Ave., All Stores	7.7	29.1	34.8	28.4	100.0
Separate Bin Display					
Central	4.0	33.1	35.2	27.7	100.0
Broadway	17.1	43.2	22.9	16.8	100.0
Kingston Pike	8.5	24.7	42.0	24.8	100.0
Ave., All Stores	9.9	33.7	33.4	23.0	100.0

only minor differences in the amounts purchased of the different sizes—meaning that the type of display is not important to the customer, but that tomato size is one of the important factors influencing purchase decisions. Also, some differences of importance did exist between the preferences for sizes as stated in an interview and the preference for sizes as demonstrated by purchases in the three stores (Table 8).

Table 8.—Consumer preferences as stated in interviews in the home compared with preferences as demonstrated by purchase, in 3 retail grocery stores, August 13 and 14, 1951

Sizes (Diameter Measurement)	Preference Stated in Interview	Preference Demonstrated by Purchase
	Percent	Percent
1¾ - 2¼ in. (small)	7.0	9.3
2½ - 3.0 in. (medium)	49.5	31.9
3¼ - 3½ in. (large)	33.5	33.7
3¾ - 4¼ in. (very large)	10.0	25.1
	100.0	100.0

Methods of Serving Tomatoes of Different Sizes

The uses for the different sizes of tomatoes were closely related to the preferences of consumers. Approximately 75 percent of the respondents expressed preference for a tomato of $2\frac{3}{4}$ to $3\frac{3}{8}$ inches in diameter, which corresponds to the upper two-thirds of the medium and the lower two-thirds of the large tomato sizes based on the U.S.D.A. size specifications. (See page 18 for details.) The question naturally arises, why was the preference for this tomato size so great? Table 9 reveals that a large percentage of the tomatoes in this size range were served in three common ways: sliced, whole stuffed, and quarters for salads.

Table 9.—Percentage of each size of tomato related to use as reported by 172 consumers buying in 3 retail stores, August, 1951*

Size of Tomatoes Inches	Whole Percent	Sliced Percent	Whole Stuffed Percent	Quarters (Salads) Percent	Total Percent
Small ($1\frac{3}{4}$ - $2\frac{1}{4}$)	45.0	0.0	33.0	22.0	100.0
Medium ($2\frac{1}{2}$ - 3)	10.0	63.0	16.0	11.0	100.0
Large ($3\frac{1}{4}$ - $3\frac{1}{2}$)	2.0	76.0	14.0	8.0	100.0
Very Large ($3\frac{3}{4}$ - $4\frac{1}{4}$)	0.0	87.0	7.0	6.0	100.0

*As each customer purchased tomatoes, the sizes were recorded; then each was asked to state the use that would be made of his purchase.

Consumers who used small tomatoes disclosed that about half of the tomatoes were utilized as whole tomatoes, about one-third of them were whole stuffed, and the rest were quartered for salads. Over sixty percent of the medium sized tomatoes were sliced, as were 76 percent of the large tomatoes, and 87 percent of the very large.

Demand for Grades B and C Tomatoes

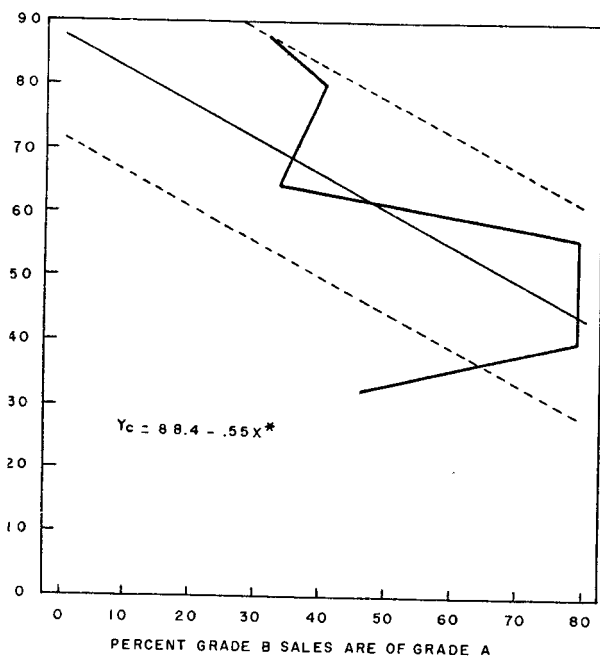
An experiment on consumers' preferences for different grades of home-grown tomatoes was conducted in the three retail stores.¹³ Table 10 gives the aggregate demand schedule. A short-run demand curve was prepared from the data (Figure 8) showing the deviations from a straight line with grades B and C sales expressed as a percent of grade A sales. The relative prices of grades B and C tomatoes were likewise computed as a percent of grade A prices.

¹³The prices of the grades B and C tomatoes were changed twice daily for three days with the price of grade A remaining constant throughout the three-day period.

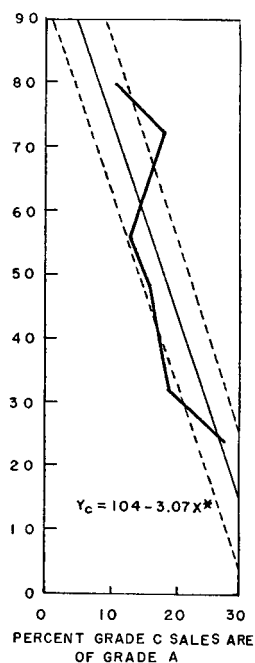
Table 10.—Aggregate demand schedule for fresh home-grown tomatoes by grades, 3 retail grocery stores, August 22, 23, and 24, 1951

August 22, 23, and 24, 1951							
Date	Time	Grade A		Grade B		Grade C	
		Pounds Sold	Price Per lb.	Pounds Sold	Price Per lb.	Pounds Sold	Price Per lb.
Kingston Pike and Central Street Stores							
Aug. 22	8:30-2:30	40	.12½	12¾	.11		
Aug. 22	2:30-6:00	59¼	.12½	24	.10		
Aug. 23	8:30-2:30	68½	.12½	23	.08		
Aug. 23	2:30-6:00	79½	.12½	63¼	.07		
Aug. 24	8:30-2:30	73	.12½	57¾	.05		
Aug. 24	2:30-6:00	72¼	.12½	32¾	.04		
Broadway Store							
Aug. 22	8:30-2:30	34¾	.12½			3¾	.10
Aug. 22	2:30-6:00	56½	.12½			10	.09
Aug. 23	8:30-2:30	23¼	.12½			3	.07
Aug. 23	2:30-6:00	59	.12½			9¼	.06
Aug. 24	8:30-2:30	133	.12½			25	.04
Aug. 24	2:30-6:00	269	.12½			71¾	.03

PERCENT GRADE B PRICE IS OF GRADE A



PERCENT GRADE C PRICE IS OF GRADE A



*SEE APPENDIX TABLE II FOR ADDITIONAL INFORMATION ON STATISTICAL CALCULATIONS.

Figure 8.—Demand curve for grades B and C tomatoes expressed as a percentage of grade A, 3 retail grocery stores, August 22, 23, and 24, 1951.

The shortness of the period in which the experiments providing the data for the construction of the demand curves were run limits the confidence to be placed in them. Not only did this limit the size of the sample, but also, and more importantly, did not allow time for consumer knowledge of the relative values of the various grades to develop. This probably explains the turning backward of the demand for grade B tomatoes at the lowest price point; the consumers probably sharply distrusted the quality of tomatoes because they were priced so low.

The general relationship, however, is clearly that which would be expected—a substantial price elasticity of demand for grade B tomatoes and a very inelastic demand for grade C. Grade B tomatoes can be substituted for grade A in most uses, while grade C substitutes for grade A in a very limited number.¹⁴

In determining the relative value of grade A, B, and C tomatoes, the relative amount of food in each is obviously very important. Accordingly, 20 pounds of representative tomatoes of each grade were peeled, the waste removed, and the edible remainder weighed. The results are given in Table 11.

*Table 11.—Amount of edible fruit in three grades of home-grown tomatoes**

Grades	Initial Weight	Waste	Amount Edible Tomatoes	Lbs. of B and C Grade Required to Equal 20 lbs. Grade A (Retail Weight Unpeeled)
	Lbs.	Lbs.	Lbs.	Lbs.
A	20	2.59	17.41	
B	20	4.07	15.93	21.85
C	20	5.70	14.30	24.35
Total	60	12.36	47.64	

*The two experiments were performed by the Department of Foods, College of Agriculture and Home Economics, University of Tennessee. Uniform methods of peeling on the three grades of tomatoes were employed to insure accurate results. The difference in amount of labor and time required to prepare grades B and C tomatoes over that required for grade A was not considered in these experiments.

Degree of Ripeness

Consumers disclosed in interviews that they had difficulty finding tomatoes of the proper degree of ripeness when shopping in retail grocery stores. As a consequence, an experiment on ripeness

¹⁴The experiment demonstrates the feasibility (and low cost) of analyzing the elasticities of substitution of different grades of a commodity sold at retail. Also, the retailer faced with the problem of disposing of perishables of low grade has to act in the framework of such a "short run" situation as this.

Such an analysis when carried out to a point where confidence in the shapes of the demand curves for the different grades is established would have several important implications with respect to production, pricing, and marketing policies. For obvious reasons, discussion of these is beyond the scope of this study.

preference was run. The evidence indicated that consumer preferences as revealed by interviews were in wide contrast to preferences as revealed in an actual choice-making situation (Table 12).

Table 12.—Comparison of expressed preferences as revealed by interviews and as revealed by actual purchases in the Chapman Highway retail grocery store

Maturity Desired	Preferences Revealed by Interview		Preferences Revealed by Actual Purchase	
	Number	Percent	Number	Percent
Slightly Pink and Pink	52	52	8	17
Ripe and Very Ripe	48	48	39	83
Total	100	100	47	100

Retailers with sufficiently rapid turnover probably could increase their sales by handling somewhat riper tomatoes. On the other hand, retailers with slow or uncertain turnover who buy tomatoes only two or three times weekly would want only a small percentage of them to be ripe on the day of purchase.¹⁵

Quality Factors

Because of their obvious importance to consumers, retailers, and wholesalers, an effort was made to ascertain the factors which in the minds of consumers determine quality of tomatoes. The 93 consumers who answered this question believed that the most important factors were: firmness, color, taste, and freedom from blemish (Table 13).

Table 13.—Factors that determine quality of tomatoes as indicated by 93 consumers*

Factors Determining Quality	Consumers Reporting	
	Number	Percent
Firmness	57	28.9
Color	48	24.4
Taste	42	21.3
Freedom from blemish	30	15.2
Other factors	20	10.2
Total	197	100.0

*Some consumers reported more than one factor.

Frequent comments by consumers suggest that the acceptability of tomatoes would be much improved by better grading, handling, and packing. A smaller percentage suggested a need for

¹⁵Only two classifications of ripeness were used, in order to achieve uniformity between the two phases of the consumer preference studies. However, according to an experiment on ripeness preference at one retail grocery store, August 28 and 29, 1951, the preferences for the four degrees of ripeness were: slightly pink, 5.1 percent; pink, 11.9 percent; ripe, 47.4 percent; and very ripe, 35.6 percent.

improving tomato marketing by the use of larger consumer packages and packages designed to reveal more adequately the characteristics of the tomatoes. Their comments were that the consumer packages should be more strongly constructed, that retailers should keep tomatoes cooler, and that green-wrap tomatoes should be harvested at a mature stage and that locally grown tomatoes should be harvested in a slightly pink and pink stage of ripeness.

RETAILERS' BUYING BEHAVIOR PATTERNS AND PREFERENCES

Since most tomatoes are ultimately sold through retail stores, the preferences of the retailers, as well as the consumers, are important to tomato producers. Consequently the buying practices of the retailers were studied.

Frequency of Purchase

About half of the stores purchased tomatoes six times per week. The percentage of tomatoes lost from wastage decreased as the number of purchases made per week increased (Table 14).

Table 14.—Number of purchases made per week by retailers as related to wastage of fresh tomatoes

Purchases Per Week	Number Retailers Reporting	Percent Retailers Reporting	Percent of Wastage Reported
Two	9	15.8	6.6
Three	13	22.8	6.3
Four	4	7.0	6.0
Five	5	8.8	5.1
Six	26	45.6	4.4
Total	57	100.0	

Form of Purchase (Bulk or Package)

National and local chain stores purchased more of their tomatoes in consumer packages than did the independent stores studied (Table 15).

Table 15.—Pounds of fresh tomatoes purchased annually in bulk and consumer packages, by type of store, 57 retailers, Knoxville, Tennessee

Type of Store	Method of Sale		Total
	Bulk	Consumer Packages	
	Percent	Percent	Percent
National Chain Store	21.7	78.3	100.0
Independent Store	57.9	42.1	100.0
Local Chain	27.8	72.2	100.0
All Stores	38.3	61.7	100.0

Effect of Variety on Purchases

Some retailers expressed a slight preference for Marglobe variety; but a large majority of the retailers did not express preference for any variety. The Marglobe, Rutgers, and Grothen Globe were the principal varieties sold on the Knoxville market (Table 16).

Table 16.—*Preference for variety, degree of maturity, 57 retailers, June - July 1950*

Preference Factors	Percent of Total
Varieties	
Marglobe	7.8
Ponderosa	2.4
No preferences	89.8
Total	100.0
Degree of Ripeness	
Slightly pink	30.1
Pink	46.6
Ripe	23.3
Total	100.0

Degree of Ripeness

Degree of ripeness is of importance to retailers for two reasons: first, the tomatoes should be purchased ripe enough to meet the consumers' preferences; and, second, the tomatoes should not be overripe so that deterioration will occur before the tomatoes are sold. Table 16 discloses that slightly over three-fourth of the retailers expressed a preference for slightly pink and pink tomatoes. This preference stated by retailers in interviews contrasted sharply with consumers' purchases of only 17 per cent of slightly pink and pink tomatoes in an experiment performed in a retail store. (See Table 12). Part of the difference between the retailers' and consumers' preferences may be explained by the fact that the sample of retailers contained several small independent stores which sold only a small volume of tomatoes daily. These small store operators would prefer tomatoes less ripe so that one or two 60-pound baskets would last them three or four days.

Market Preparation (Waxing and Wrapping)

Over half of the retailers desired waxed tomatoes principally because those with a protective film of wax have better eye appeal and do not shrivel as soon as the unwaxed ones. Moreover, small

Table 17.—*Specified information concerning preferences for green-wrap tomatoes, 57 retailers, Knoxville, Tennessee, 1949*

Method of Purchase	Percent
Waxed	62.1
Unwaxed	37.9
Total	100.0
Wrapped when bought in lugs	
Yes	0.0
No	100.0
Total	100.0
Pack	
Straight	93.0
Bridge	7.0
Total	100.0

openings resulting from slight damage may be closed and disease prevented, or at least delayed, by waxing (Table 17).

All of the 57 retailers reported they purchased unwrapped tomatoes chiefly for their lower cost. The major part of the out-of-state tomatoes sold on the Knoxville market were purchased in field crates in which the jumble pack was used. Upon arrival, the tomatoes are stored until they ripen satisfactorily for re-sale to retailers, making it, in general, unnecessary and impracticable to buy them wrapped.

Quality of Tomatoes in Cartons

Since interviews with consumers had disclosed that considerable resistance had developed toward buying tomatoes in cartons, retailers were asked whether consumers had made complaints to them, particularly about finding low quality tomatoes in cartons. Slightly over half of the 57 retailers reported that they had.

Quality Factors

The factors associated with quality of tomatoes as reported by retailers included color, texture, and shape. There were only slight differences in quality factors reported by retailers serving the large, medium, and high rental groups interviewed in this study.¹⁶

¹⁶In his book, *Quality as a Determinant of Vegetable Prices*, Frederick V. Waugh reported (concerning the Boston Market of 1929) that marketing factors affected tomato prices more than production factors did. The three most important factors were condition, growth cracks and pack, of which growth cracks is the only production factor. Size and color have some effect on price but the relation is not so marked.

WHOLESALEERS' BUYING BEHAVIOR PATTERNS AND PREFERENCES

Form of Purchase (Type of Container)

Sixty-pound boxes of wood composition similar to field crates and, in some cases, beer boxes were the predominant type of container used by nearly three-fourths of the wholesalers when purchases were made. The additional cost of tomatoes purchased in lugs was a reason why some dealers preferred to make their purchases in the field crates (Appendix Table III).

Grades and Sizes Preferred

About one-third of the wholesalers expressed a preference for U. S. No. I tomatoes, about one-tenth preferred No. II's and the remainder did not report on this point. More wholesalers preferred tomatoes of the size used in the 6 x 6 pack than any other size (Appendix Table III).

Effects of Variety on Purchases

Over half of the wholesalers purchased the Rutgers variety because of its good shipping quality. The Marglobe and Grothen Globe varieties also found satisfactory acceptance among them. (Appendix Table III).

Degree of Ripeness

Over half of the wholesalers preferred to handle mature-green tomatoes.¹⁷ Much more risk is involved in handling tomatoes in the pink stage as a time period is necessary for repacking and distributing through the retailers to the consumer (Appendix Table III). The criteria for determining the proper degree of ripeness necessary for tomatoes when purchased in production areas were the distances shipped and the season of the year when shipments were made.

¹⁷According to the requirements of the U.S.D.A. standards for fresh tomatoes, a tomato is considered mature-green when the seed cavities have developed a jellylike or glucelike consistency and the seeds are well developed. In the practical test a sharp knife should be used and the tomato cut crosswise of the seed cells. If the pulp that surrounds the seeds has become jellylike and the seeds give way before the edge of the knife, and are not cut in slicing, the tomato is considered mature enough to be shipped. For some varieties the presence of light colors or a whitish area on the blossom end of the fruit is considered a fairly reliable index of the picking maturity. The size of tomato fruits is not a proper guide. For additional information, see *Farmers' Bulletin*, No. 1291, U.S.D.A., p. 9.

Market Preparation (Waxing and Wrapping)

A majority of the wholesalers purchased waxed tomatoes. They said that waxing tomatoes improved eye appeal, reduced decay to a minimum and retarded shrinkage.

Less than one-tenth of the wholesalers expressed a desire for wrapped tomatoes. They thought the additional cost of wrapped tomatoes was an unnecessary expense (Appendix Table IV).

Type of Pack

The straight pack was purchased by about two-fifths of the dealers and the bridge pack¹⁸ by about one-tenth of them, but almost half of the dealers did not know which type of pack they purchased. Since a large volume of the tomatoes sold on the Knoxville market are purchased in "field crates" the jumble pack was obviously the type of pack which most of them purchased (Appendix Table IV).

Refrigeration

Some dealers made the comment that truck shipments were faster than rail transportation. Moreover, truck shipments arrived in satisfactory condition provided refrigeration was used for long hauls. They thought there was less deterioration and more uniform ripening under refrigeration. Almost three-fourths of the dealers used truck transportation.

Three of the 13 wholesalers who supplied this information used mechanical refrigeration in the transportation of tomatoes. (An advantage claimed for mechanical refrigeration units on trucks is that they occupy less space than ice.) Three others used ice, but over half of them reported no refrigeration used because of the cost. (Appendix Table IV).

Table 18 shows almost half of the storage room temperatures ranged from 76° F. up. Results of an experiment have shown that open air fruit cannot be stored without injury for more than about 6 days at 40° F., 14 days at 45° F., or 21 days at 50° F. The results indicate that it is possible to hold a supply of ripe fruit of good quality over a period of 40 to 60 days by keeping the tempera-

¹⁸ The term "bridge pack" is used to describe the style of pack having three full layers and part of a fourth. It is employed mostly for tomatoes of the smaller sizes where three layers will not fill the lug to the required height and weight. For additional information on other packs, see *Farmers' Bulletin*, U.S.D.A., *Preparation of Fresh Tomatoes for Market*, Revised, February, 1948.

Table 18.—Average temperature of storage rooms and method of control, 13 wholesalers, Knoxville, Tennessee, 1940

Temperature	Number
55° and below	1
56° - 65°	2
66° - 75°	4
76° - 85°	3
86° and above	3
Total	13
Method of Control	
Fans	2
Refrigerator	4
None	7
Total	13

ture at 55° F. By holding at 65° F. this period was approximately halved.¹⁹ Ripening temperatures should range from 55° to 72° F., varying with market demand. Where maximum speed in ripening is desired because of an active market, temperatures of 70° to 72° F. may be used. It should be understood, however, that where such high temperatures are used considerably more decay will develop and the tomatoes may not hold up well. According to Wright and Gorman, the coloring is likely to be uneven or blotched at 80° or above.²⁰ A large number of consumers, when interviewed, stated that they frequently purchased tomatoes of uneven coloring. When speed in ripening is not desired, and a firm product of good color and maximum quality is wanted, a ripening temperature of near 60° should be utilized. The lowest temperature at which tomatoes will color satisfactorily is about 55° F.

FARM PRACTICES AFFECTING QUALITY AND YIELD

It seems reasonable that one cause of Tennessee's decline in tomato production is the continued use of obsolete production and marketing practices. Thus tomato production has gradually lost its competitive advantage and has been replaced by other enterprises.

On the average, producers interviewed in this study reported that, for the year of the survey, they actually sold only about 49 percent of the tomatoes actually on the vine. Twenty-five percent

¹⁹C. R. Furlong, *The Storage and Ripening of Green Tomatoes* (London, Block 4, Bickenhall St., The Journal of The Ministry of Agriculture, October, 1946), p. 313.

²⁰R. C. Wright and E. A. Gorman, *The Ripening and Repacking of Mature Green Tomatoes* (Washington, D. C., U.S.D.A., U. S. Government Printing Office, Circular No. 566, June, 1940), p. 4.

were not harvested because they were too badly damaged by insects and/or disease; 9 percent were not harvested because prices were too low; 7 percent were not harvested because of flood damage; and 10 percent were harvested and hauled to market, but were not accepted by buyers.

The average market yield per acre of tomatoes, for the farmers reporting, was 143 bushels; the range in market yields was from 20 to 400 bushels. With the data reported, an attempt was made to weigh the relative importance of the following variables in determining the quantity of marketable tomatoes produced: (1) the quantity of commercial fertilizer applied per acre, (2) the number of applications of insecticides and/or fungicides, (3) the use of recommended harvesting standards with regard to maturity, size, and cracks, and (4) the use of recommended handling practices while harvesting, loading, hauling, unloading, and packing. The following weights were assigned:²¹

Commercial fertilizer .160

Insecticides and fungicides .490

Use of recommended harvesting standards .309

Use of recommended handling practices .116

These weights give some indication of the areas in which economies of increasing (or decreasing) yields are likely to be found. Apparently, insect and disease control rate first consideration, with the use of harvesting standards (maturity, size, and cracks) rating second. However, the data from which these weights were obtained only cover one crop year. Before conclusive results can be obtained, data from controlled experiments should be compiled over a period of several years. The moisture conditions which vary greatly from year to year may materially affect the relative weights of the commercial fertilizer factor compared with that of insecticides and fungicides. The rainfall was excessive during the period in which the crop was grown and there was excessive damage from insects and diseases.

²¹These weights, which represent the beta coefficients with decimal points removed, were arrived at by fitting the equation: $Y = a + bX_1 + cX_2 + dX_3 + eX_4$; in which Y = bushels marketed per acre, X_1 = number of applications of insecticides and/or fungicides made, X_2 = use of recommended harvesting standards (yes = 1, no = 0), X_3 = use of recommended handling practices (yes = 1, no = 0), X_4 = cwt. pounds of commercial fertilizer applied per acre. The multiple determination coefficient was 0.73. In these data all of the independent variables were related to each other. Until reasonable joint correlation terms can be established, these regression coefficients may be misleading.

Insects and Diseases

Growers reported the major losses from insects were caused by the tomato fruit worm and the Colorado potato beetle. The major diseases reported were early and late blight (Table 19).

Table 19.—Insects and diseases damaging tomatoes as reported by 100 producers in the Humboldt area and 29 producers in the Ripley area during 1949

Areas	Insects				Diseases				
	Tomato Fruit Worm	Colorado Potato Beetle	Tobacco Worm	Cutworm	Blight	Buckeye Rot	Nail Head Spot	Soil Rot	Sack Rot
Percent of Farmers Reporting									
Humboldt	37	34	0	12	28	10	2	2	3
Ripley	24	15	6	8	25	4	0	0	0

Apparently the heavy loss from insect and disease damage was due to lack of an effective dusting and spraying program in both areas.²² Failure to control insects and diseases was due chiefly to an insufficient number of applications rather than the utilization of unadapted materials. About one-fourth of the growers in the Humboldt and approximately one-half of the growers in the Ripley area reported that neither insecticides nor fungicides were applied.²³

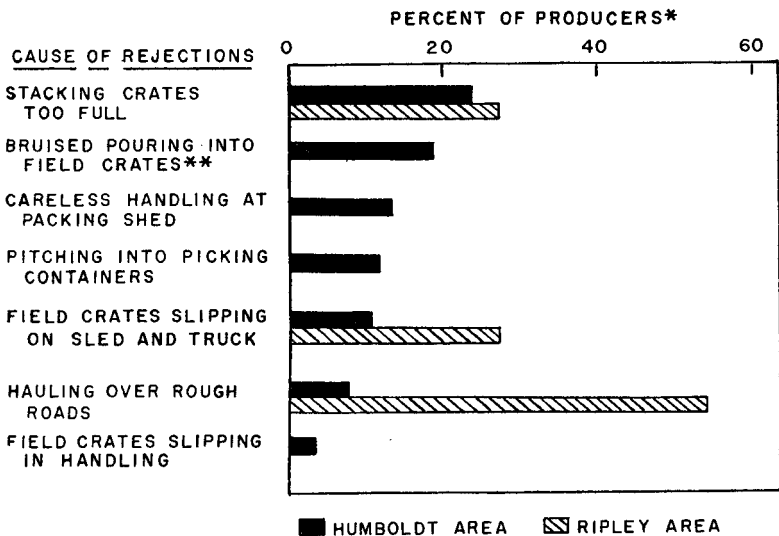
Why Buyers Rejected Tomatoes

Since 10 percent of the 1949 tomato crop was rejected at the packing shed, it is very important that the specific causes of this rejection be determined. Figure 9 shows the principal reasons reported by growers for rejection. Damage could, of course, occur before or during harvesting, during transportation or when tomatoes are being handled at the packing sheds.

The reasons reported by packer-buyers for their rejection of tomatoes differed substantially from those given by producers in that they attributed most rejections to quality defects caused by poor production practices, such as ineffective insect and disease control (Figure 10). Reasons reported by the growers are suspect, since our analysis indicated that variations in handling practices

²²See Leaflet 98 (reprint) April, 1950, Tennessee Agricultural Extension Service and U.S.D.A. for detailed information on an insect and disease control program.

²³John W. Carnerosse and Allen G. Waller, **Economic Factors in Processing Tomato Production** (New Brunswick, New Jersey, New Jersey Agricultural Experiment Station, June, 1959), p. 9. Twenty-three farmers whose yields were 5.6 tons per acre averaged spending \$9.00 per acre; twenty-two farmers whose yields were 8.5 tons per acre averaged spending \$19.00 per acre; twenty-two farmers whose yields were 13.5 tons per acre averaged \$42.00 per acre for insect control.



*34 PRODUCERS DID NOT REPORT ANY CAUSES OF REJECTION.

**ON THOSE WITH ONE BAR, THERE WAS NO AVAILABLE COMPARISON.

Figure 9.—Causes of rejection of tomatoes at packing shed, as reported by 129 producers, Humboldt and Ripley areas, Tennessee, 1949.

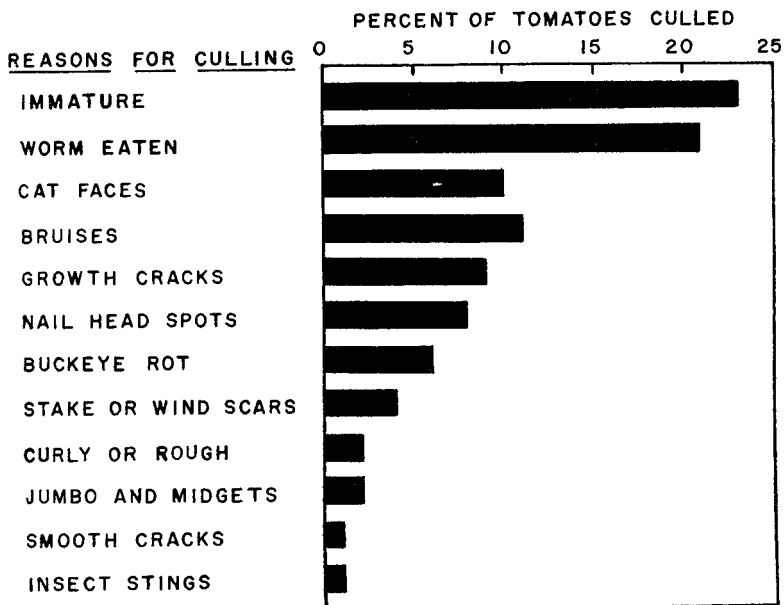


Figure 10.—Reasons for culling tomatoes at packing shed, 19 packer-buyers, Humboldt and Ripley areas, Tennessee, 1949.

were probably not correlated with the market yield. (See footnote 21).

Effect of Low Prices

Tomatoes unsold due to low prices may have contained low quality factors. Poor quality fruit brings lower prices; consequently, it is less likely to be harvested and marketed. Early settings contribute to early maturity, when high prices normally prevail.

Flood Damage

Since floods destroyed seven percent of the 1949 crop, careful consideration must be given toward eliminating losses from flooding. Improvements may be made by selecting land that provides natural surface and internal drainage. However, this may result merely in shifting the loss from tomatoes to some other crop.

Variety Preference

In a previous study made at this station Meyer reached the conclusion that the Tennessee green-wrap area is not producing the type of tomato that should be grown for city markets. He held the opinion that the Rutgers and Marglobe varieties were too large. The first fruits that ripen are the largest of the season and these cannot readily go into the fresh fruit market. As a consequence, the Tennessee picking season is well advanced before any volume of fruit is acceptable to that outlet. Meyer's report indicated that it seemed desirable to develop a type of tomato which will be more satisfactory for this use.²⁴ A majority of the producers' preferences in both areas was for the Rutgers variety. The major reasons given by producers for preferring the Rutgers variety was the belief that this variety produced higher yields, had less stem crack and was slightly smaller than the Marglobe variety. (Appendix Table V). Percentage differences in the acreage planted to the various varieties, by the size of the tomato enterprise, and by areas are presented in Figure 11.

Source of Plant Supply

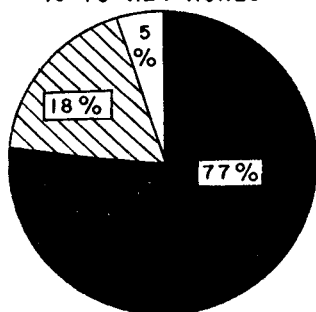
The purchasing of plants by about half of the producers might be attributed to their dislike of constructing a plant bed because of the small scale of the enterprise (Appendix Table VI). L. J. Fenske

²⁴Meyer, *op. cit.*, p. 5.

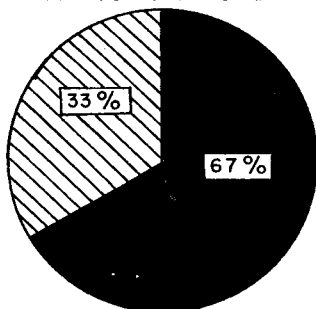
of the Tennessee Agricultural Experiment Station, reported in 1942 that the cost of producing plants averaged \$2.30 per 1,000 plants compared with a cost of \$2.25 per 1,000 plants purchased. From the standpoint of earliness, large plants are usually available from Georgia and Florida earlier than plants grown in Tennessee, enabling growers to produce an earlier crop of tomatoes under normal conditions. Beyond consideration of the availability of early plants from nearby states and the cost of producing tomato plants, it is highly important to consider the yields from home-grown and shipped-in plants. Seaton and Strong reached the conclusion that

HUMBOLDT AREA

ACREAGE GROUP
.5 TO 1.24 ACRES

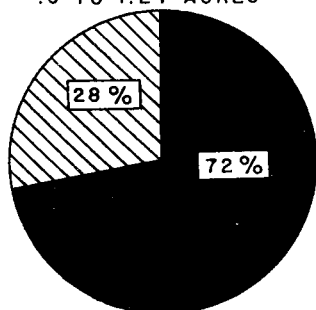


ACREAGE GROUP
1.25 TO 4.00 ACRES



RIPLEY AREA

ACREAGE GROUP
.5 TO 1.24 ACRES



ACREAGE GROUP
1.25 TO 4.00 ACRES

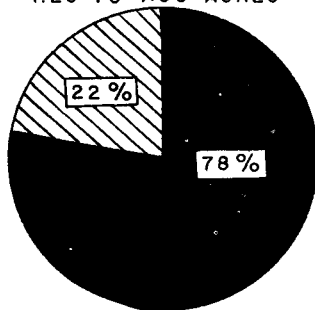


Figure 11.—Distribution of varieties of tomatoes planted by size of enterprise, Humboldt and Ripley areas, Tennessee, 1949.

shipped-in plants were only 42 percent healthy compared with 100 percent for home-grown plants; and the home-grown plants produced a yield of 29 tons compared to 13.87 tons for shipped-in plants.²⁵ Inasmuch as high yields and high quality are closely correlated,²⁶ tomatoes sold from farms producing high yields should be more acceptable to consumers. To obtain more assurance of getting disease free plants most economically, one grower might raise plants for several producers.

Fertilizer Practices

An analysis of the small, medium, and large acreage groups by areas revealed considerable differences in the quantities of fertilizers used; the small acreage group in the Humboldt area averaged using 934 pounds per acre compared with 400 pounds in the Ripley area; the medium acreage group averaged 1,000 pounds per acre in the Humboldt area compared with 250 pounds in the Ripley area. Reasons for these differences are yet to be determined. Do the soils of the Ripley area give less response to fertilizer? Are Ripley area farmers underestimating the relationship between fertilizer and yields and quality? Do Humboldt area farmers overestimate this relationship?

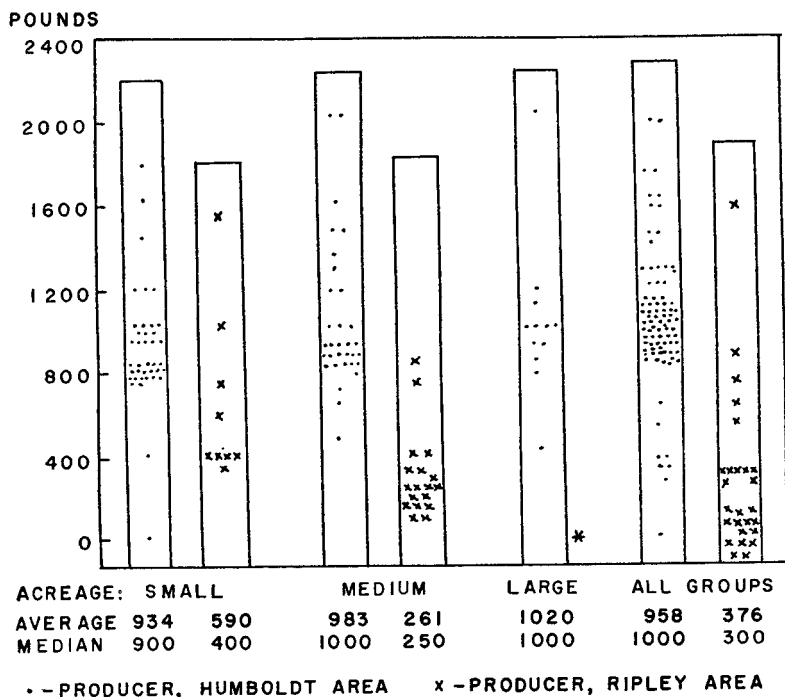
Figure 12 indicates that most producers of both areas used some fertilizer with the analysis and rates varying widely from farm to farm. Preference for the 4-8-8 analysis was definitely established in both areas.

The effect of the use of nitrate of soda as a side dressing is controversial. Some buyers believe excessive use of nitrate of soda causes puffiness of the tomatoes. Tests at an experiment station do not agree with this idea.²⁷ Appendix Table VII gives the pounds of side dressing applied by growers in both areas studied. Although data showing the effect of nitrogen on tomato quality are unavailable from Tennessee experiments, data are available on input-output relationship of nitrogen to tomatoes as Table 20 indicates.

²⁵H. S. Seaton and M. C. Strong, *The Quality Bulletin* (East Lansing, Michigan: Agricultural Experiment Station, Michigan State College, Vol. 20, No. 3, February, 1938), pp. 136, 137, and 138.

²⁶J. B. Hester and Harry F. Hall, *Quality Tomatoes Through Sound Farming Practices* (Riverton, New Jersey, January, 1942, Bul. 4), p. 7.

²⁷John A. Campbell and G. B. Ramsey, *Influence of Source of Nitrogen on Carrying Qualities of Mississippi Tomatoes* (State College Mississippi: Mississippi Agricultural Experiment Station, Information Sheet 415, October, 1948), pp. 1-2. Conclusions of Campbell and Ramsey indicate that tomatoes receiving up to 156 pounds of total nitrogen not only produced a higher yield but also held up as well as tomatoes treated with 192 pounds of total nitrogen per acre. Insofar as it can be determined, definite conclusions have not been reached on this problem by all authorities. According to Paul Work on p. 31, *The Tomato* (New York: Orange Judd Publishing Company, 1945) nitrate of soda does not injure tomatoes until a concentration in the soil is reached which is strong enough to withdraw water from plants by osmosis.



*SINCE THERE WAS ONLY ONE PRODUCER IN THE RIPLEY AREA, THERE WAS NO BASIS OF COMPARISON FOR THE LARGE ACREAGE GROUP.

Figure 12.—Pounds of fertilizer applied per acre by individual producers, by size of enterprise, 129 producers, Humboldt and Ripley Areas, Tennessee, 1949.

Table 20.—Average yields of tomatoes from different applications of nitrogen, West Tennessee Experiment Station, Jackson, 1930

Rate of Application	Yields
	Bushels
No nitrate of soda plus 100 lbs. 16% phosphate	102.3
50 lbs. nitrate of soda plus 100 lbs. 16% phosphate	140.5
100 lbs. nitrate of soda plus 100 lbs. 16% phosphate	202.0
150 lbs. nitrate of soda plus 100 lbs. 16% phosphate	216.0
200 lbs. nitrate of soda plus 100 lbs. 16% phosphate	235.6
300 lbs. nitrate of soda plus 100 lbs. 16% phosphate	240.5
400 lbs. nitrate of soda plus 100 lbs. 16% phosphate	228.5
600 lbs. nitrate of soda plus 100 lbs. 16% phosphate	171.7

Staking and Pruning

The advantages claimed for pruning and training were earliness, ease of cultivating and spraying, ease of picking, and a higher quality fruit. The results of research by Thompson indicate that

quality is improved by pruning.²⁸ The disadvantages are the higher cost of labor in staking plus the additional cost of the stakes. The results of research by Brooks and Spurlock at the University of Florida give the man-hours required for staking and pruning in one area.²⁹ According to Table 21, about three-fourths of the Humboldt producers staked and pruned during 1948 and 1949, but only about one-fourth of the Ripley producers followed these practices, possibly because of later harvest dates and different soil characteristics.

Table 21.—Number and percent of producers reporting staking and pruning of tomatoes, 129 producers, Humboldt and Ripley areas, Tennessee, 1948 and 1949

Year	Humboldt Area		Ripley Area		Total for Both Areas	
	Number	Percent	Number	Percent	Number	Percent
1948	70	70.0	5	17.2	75	58.1
1949	83	83.0	7	24.1	90	69.9

MARKETING PRACTICES

Method of Determining Maturity

Meyer, in a report on the acceptability of Tennessee tomatoes in the Detroit market, emphasized that tomatoes shipped from Tennessee had been harvested before maturity.³⁰ Green-wrap tomatoes picked prior to the mature-green stage do not ripen well. Therefore it is important that tomatoes for the green-wrap market be picked at the proper stage of maturity. The principal criterion used to judge maturity by farmers in the Humboldt area was a dark green color. In the Ripley area, the principal method of determining maturity was by size and by dark green color (Figure 13).

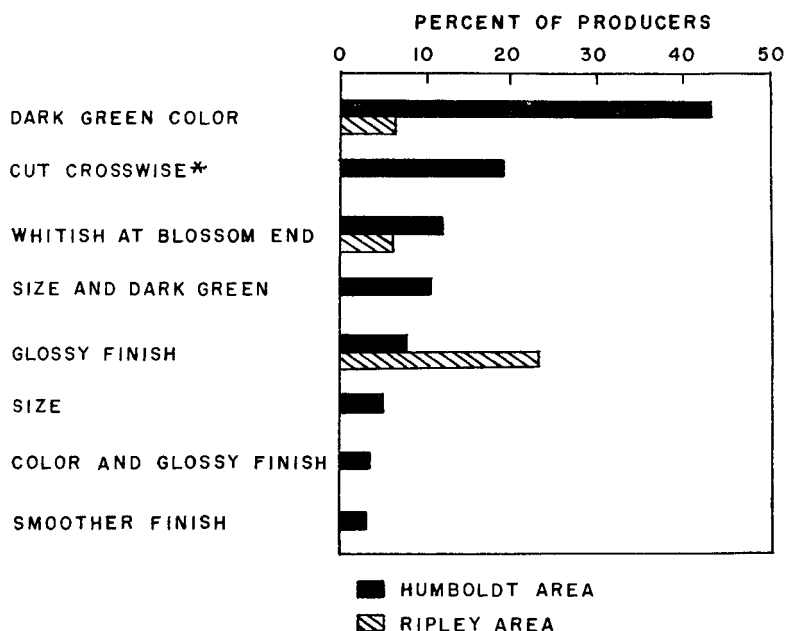
Frequency of Harvesting

About half of the Humboldt growers harvested three times per week. In contrast, a majority of the producers of the Ripley area

²⁸The results of six years of experiments by Thompson show that the yield of Grade I fruit was slightly higher from pruned than unpruned plants. The main advantage was the increased early yield. For pruning to be profitable, the gross returns must be increased considerably over the returns from unpruned plants. The reduced cost of harvesting partly offsets the added cost of pruning and staking. H. C. Thompson, *Pruning and Training of Tomatoes* (Ithaca, New York: Agricultural Experiment Station, Cornell University, Bulletin 580, Jan., 1934), p. 12.

²⁹Donald L. Brooks and A. H. Spurlock, *Labor and Material Requirements, Costs of Production and Returns on Florida Tomatoes*, (Gainesville, Florida, Florida Agricultural Experiment Station, September, 1950), p. 19. This study indicated 124 man-hours were required per acre for staking in the Manatee Rusin area. The cost of labor at \$.50 per hour would be \$62.00 and a conservative estimate for annual depreciation on stakes spread over a four-year period would be \$35.00 making the cost of labor and stakes \$97.00 per year.

³⁰*op. cit.*, p. 4 (December, 1947 report.) If mature-green tomatoes are cut crosswise the pulp that fills the cells is jellylike. Seeds are dragged aside by the knife and not cut through. In immature tomatoes, seeds are easily cut and the jellylike consistency of the pulp is underdeveloped. This test ruins the tomato, but it serves to test one's judgment until experience is gained. One learns, however, to recognize a heightened gloss and a more whitish green as tomatoes reach the mature-green stage. The darkening of the "eye" or ring where the stem parts from the fruit is an unreliable guide.



ON THOSE WITH ONE BAR, THERE WAS NO AVAILABLE COMPARISON.

* CUT DIRECTLY ACROSS THE TOMATO TO AN IMAGINARY PERPENDICULAR LINE FROM THE STEM END TO THE TOP OF THE TOMATO.

Figure 13.—Criteria for determining maturity of green-wrap tomatoes, 110 producers, Humboldt and Ripley areas, Tennessee, 1949.

harvested twice weekly. According to an Indiana study, the farmer can be guided by the grade obtained as to the frequency of picking.³¹

Containers Used for Harvest

Approximately 70 percent of the growers in the Humboldt area used buckets and field crates in harvesting (Appendix Table VIII). About one-tenth of them reported using containers with rough edges, which is an objectionable practice because the fruit may be cut or bruised. Use of linings for containers was limited to about one-fourth of the growers. A majority of the Ripley growers used 16-quart round baskets as picking containers. Some growers believe the use of containers of this size or larger results in the bruising of fruit because of excessive weight. In many cases field crates

³¹John H. MacGillivray, *Profits in Tomato Picking* (Lafayette, Indiana: Agricultural Experiment Station, Leaflet 18, April, 1936).

were constructed of rough lumber and there were large cracks in them.

Cover for Harvested Tomatoes

Table 22 indicates that growers provided few field shelters for shading harvested tomatoes. Covering tomatoes with a sheet while

Table 22.—Specified information concerning cover for harvested tomatoes, Humboldt and Ripley areas, Tennessee, 1949

Practices Followed	Humboldt Area		Ripley Area	
	Number of Producers	Percent of Producers	Number of Producers	Percent of Producers
Have field shelter for shading tomatoes after picking	6	6.0	1	3.4
No. covering tomatoes with a sheet	80	80.0	6	20.7
No. hours tomatoes left in sun after picking				
Less than 1 hour	80	80.0	16	55.2
1 - 1.9 hours	11	11.0	7	24.1
2 - 2.9 hours	7	7.0	6	20.7
3 - 3.9 hours	0	0.0	0	0.0
4 - 4.9 hours	2	2.0	0	0.0

awaiting transportation to the packing shed was a common practice in the Humboldt area but not the Ripley area. No specific data were obtained to correlate the effects of cover on sunscald. A shelter or cover of some kind is an important consideration, since the practice of leaving tomatoes in the sun until sunscald occurs seriously affects the marketable yield and quality of tomatoes. Most growers in both areas reported leaving tomatoes in the sun for about an hour after picking. Since sunscald does not show immediately, fruit packed when apparently sound may develop lesions in transit. Such lesions disfigure the fruit and also open the way for rot-producing fungi.³²

WHERE TOMATO PRODUCERS OBTAIN INFORMATION ABOUT IMPROVED PRACTICES

Farmers have a problem in making a decision to adopt an improved farm practice. The process of adopting a practice may involve hearing of the practice, discussing its advantages and disadvantages with other farmers or agricultural specialists, making the decision to carry out the practice and obtain the information needed. To determine the relative importance of the different

³²Glen B. Ramsey and George K. K. Link, *Market Diseases of Fruits and Vegetables* (Washington, D. C.: U.S.D.A., Miscellaneous Publication No. 121, March, 1932), pp. 28-29.

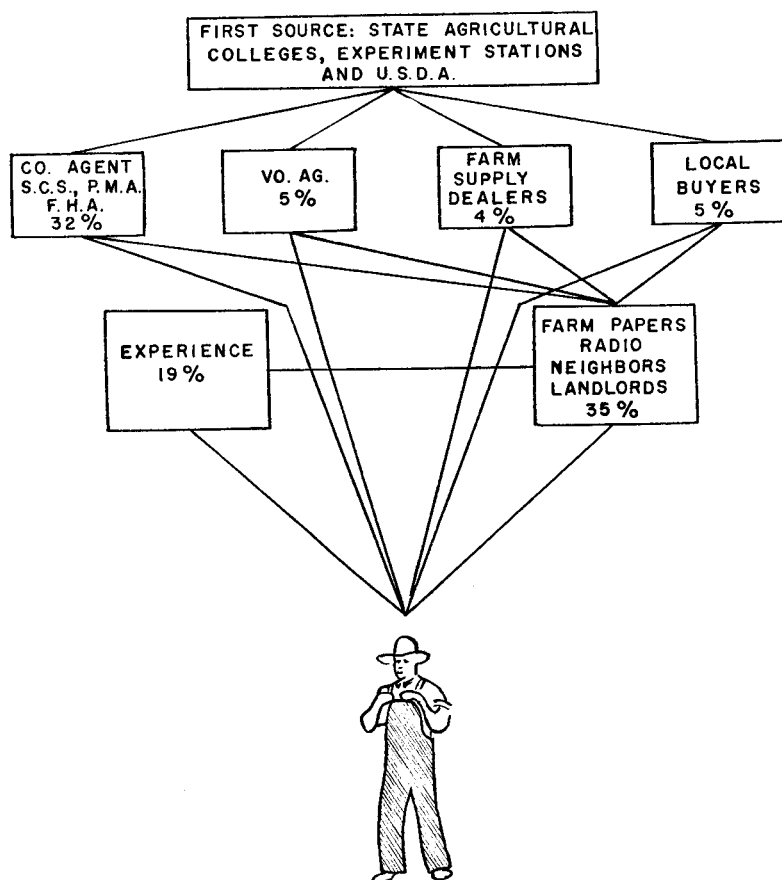


Figure 14.—Sources of information about improved practices of tomato production.

agencies or factors in influencing production practices, producers were asked to give the source of their information. Figure 14 indicates the sources as reported by the producers interviewed. Nearly two-fifths of the sources through which information was disseminated included the County Agents, S.C.A., P.M.A., and F.H.A., and Vocational Agricultural Teachers (including the Veteran Farm Training Instructors). Farm supply dealers and local buyers accounted for nine percent of the sources of information reported by producers. These sources cannot be dismissed as unimportant. Farm papers, radio, neighbors, and landlords made important contributions according to about one-third of the producers. Exper-

ience was reported as an important means of learning which practices are best adapted to local conditions.

SUGGESTIONS FOR IMPROVEMENT OF TOMATO MARKETING PRACTICES AND QUALITY

Improvements Suggested by Producers and Packer-Buyers for Tomato Marketing

The first suggestion of importance made by producers was to reduce expenses of sorting and packing at the packer-buyers' shed. Producers believed the expenses at the packing shed could be reduced by employment of a larger number of local packers and by shipping a larger volume of tomatoes by truck. Secondly, producers suggested that the harvesting of mature tomatoes be given more careful consideration (Appendix Table IX). One-third of the packer-buyers suggested that harvesting of mature green-wrap tomatoes would improve quality. Furthermore, they believed passage of a state tomato maturity law would result in the harvesting of a higher percentage of mature tomatoes (Appendix Table X.) The attitude of producers on enactment of this law is shown in Appendix Table XI.

Pricing Plans

Several pricing plans have been employed in both tomato producing areas of West Tennessee. However, the four plans that have been used by a majority of the buyers were: (1) a specified price per bushel field run; (2) a specified price per lug packed; (3) a specified price per estimated bushel Number I's and II's combined after grading; (4) a certain price per bushel Number I's and II's separate after grading.

A majority of the producers expressed preference for pricing plans one and three; about one-fifth preferred plan four. Inasmuch as plan four would be based upon clearly defined grades, it is believed that it would be most satisfactory for both growers and buyers since it would compensate growers more adequately when good quality tomatoes are marketed and would encourage the production of good tomatoes.

CONCLUSIONS IN BRIEF

The failure of the Tennessee tomato industry to provide consumers with tomatoes meeting their preferences and the heavy costs of wasteful production and marketing practices combined to work against the economic welfare of the industry.

This study showed that 51 percent of the tomatoes **actually on the vine** never reached the consumer, having been wasted either on the vine as they approached the picking stage or between the vine and the consumer. Farmers estimated that 25 percent of the crop was unsalable because of insect and disease damage; 10 percent was culled by dealers; 9 percent was left in the field because low prices made it unprofitable to harvest them; and 7 percent were lost from flooding. The average market yield per acre of tomatoes for the farmers reporting was 143 bushels. The range in yield was from 20 to 400 bushels. Correlation analysis indicated that the number of applications of insecticides and fungicides had more influence on yield than any of the other variables considered. Experimental research indicates that over two-thirds of the damage from insects and diseases might be prevented with proper control. This wastage and associated lowering of quality is so great as to indicate clearly that farmers should take corrective measures to reduce these losses by carrying out recommended production and marketing practices.

It is recognized that reducing tomato wastage increases total supply. However, a more satisfactory allocation of resources may be obtained by diversion of land to other uses than by permitting wastage of tomatoes.

Recommendations for Economic Improvement of Tennessee Tomato Industry

What Producers Can Do.

1. Insect and Disease Damage. Economic loss from these causes may be reduced greatly by an effective dusting and spraying program. Leaflet No. 98 (reprint) April, 1950, Tennessee Agricultural Extension Service and U.S.D.A., gives detailed recommendations.

2. Maturity. Producers of tomatoes for the **green-wrap market** should harvest their tomatoes at the proper stage of maturity in order to achieve better consumer acceptance of their product. There appears to be a tendency on the part of growers to harvest tomatoes

while still too immature. **Home-grown** tomatoes sold to retail grocers for whom a bushel may be adequate for two or three days sales should be picked so that approximately one-half of the tomatoes will be pink and the remainder be mature-green. However, if the sales are made to a store with a large volume of sales daily, most of the tomatoes should be nearly ripe.

3. Size. Growers should produce as many tomatoes as possible of the size most preferred by consumers. In two experiments performed in three retail grocery stores, purchases of tomatoes of different sizes were in the following proportions: small ($1\frac{3}{4}$ - $2\frac{1}{4}$ in.) 9.3 percent; medium ($2\frac{1}{2}$ -3.0 in.) 31.9 percent; large ($3\frac{1}{4}$ - $3\frac{1}{2}$ in.) 33.7 percent; very large ($3\frac{3}{4}$ - $4\frac{1}{4}$ in.) 25.1 percent.

4. Containers. Growers harvesting green-wrap tomatoes should use smooth containers free from cracks and nails. Field crates should have cleats on them to avoid bruising tomatoes when crates are stacked. Home-grown tomatoes would be less bruised in handling if producers packed them either in smaller baskets or cardboard containers instead of in the round bushel baskets usually used.

What Packer-Buyers Can Do.

1. Price Incentives. Tomato buyers should provide price incentives for high quality tomatoes of proper degree of maturity in line with the greater value of these tomatoes. Conversely, prices of low quality and immature tomatoes should be properly discounted.

2. Handling Equipment. Any projections or rough edges of handling equipment should be well padded with soft material to avoid bruising tomatoes. Packing bins also should be adequately padded.

What the Wholesale-Repacker Can Do.

1. Price Incentives. Incentives should be provided for high quality tomatoes of the proper degree of maturity in accordance with the greater value of these tomatoes. Conversely, prices of low quality and immature tomatoes should be properly discounted.

2. Refrigeration. Adequate refrigeration should be provided for tomatoes hauled long distances in hot weather. Ripening temperatures in warehouses should range from 52° F. to 72° F. varying with market demand. (The temperatures of over half of the storage rooms surveyed ranged from 76° F. to 95° F.)

3. Repacking Good Tomatoes. Good quality tomatoes should be packed in consumer cartons and perhaps cartons with bottom openings, which enable consumers to observe the stem ends of tomatoes should be put into use in order to restore consumer demand for cartoned tomatoes. The major reason that consumer preference has shifted away from cartoned tomatoes appears to be that consumers consistently found defective tomatoes in consumer cartons.

What the Retail Grocer Can Do.

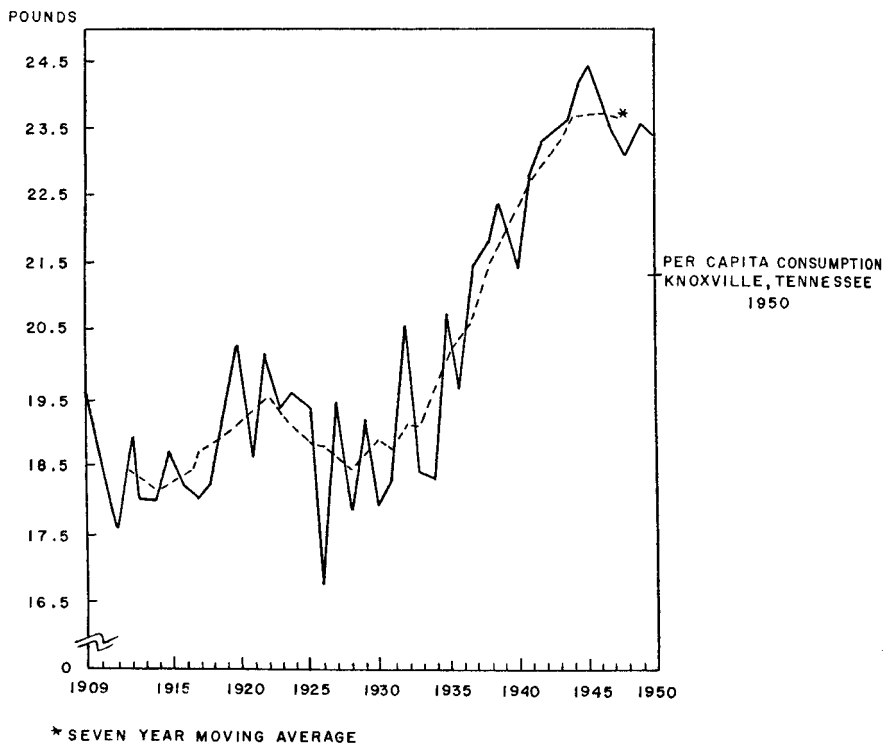
1. Price Incentive. Differentials should be made in prices paid for tomatoes of different qualities in line with their salability. This should serve to encourage producers and handlers to follow practices which result in higher quality tomatoes reaching the consumer.

2. Ripening. When tomatoes are held in retail stores long enough to require it, provisions should be made for controlled ripening at proper temperatures. Retailers with slow or uncertain turnover who buy tomatoes only two or three times weekly would want only a small percentage of them to be ripe on the day of purchase. Retailers with sufficiently rapid turnover could increase their sales by handling somewhat riper tomatoes inasmuch as consumers in a store experiment purchased 83 percent of their tomatoes in a ripe and very ripe stage.

3. Use of Consumer Cartons. The possibility of using consumer cartons enabling consumers to get a more complete view of the tomatoes should be explored. Farmers should be encouraged to use the conventional cardboard containers with liners between each layer of tomatoes for delivery of tomatoes to the retail stores.

4. Size. Retailers should attempt to sell tomatoes which correspond as nearly as possible to the sizes preferred by consumers. (For size specifications see above section 3 under "What Producers Can Do").

Appendix



Appendix Figure 1.—Per capita consumption of fresh tomatoes, retail weight, United States, 1909-1950 and U. S. comparison with Knoxville, Tennessee, 1950¹.

Appendix Table I.—Coefficients of multiple correlation, determination, standard error of estimate, corrected R, betas, and F test

Coefficients	Values			
	Spring	Summer	Fall	Winter
Coefficient of multiple correlation*	.5592	.2381	.5234	.4862
Coefficient of multiple determination	.3127	.0567	.2739	.2364
Standard error of estimate	1.6708	3.2298	1.8636	1.7428
Corrected R ²	.2981	.0262	.2584	.2203
Betas:				
(Income)	.4823	.2373	.4378	.4517
(Number in family)	.1603	.0031	.1644	.1590

*According to the "F" test, there is little (1/100) chance that the correlation observed for the spring, fall and winter seasons is due to sampling chance, while there is a high probability that the correlation observed for the summer is due to sampling chance.

¹U. S. D. A., *Consumption of Food in the United States, 1909-1948* (Washington, D. C., U. S. D. A., Bureau of Agricultural Economics, U. S. Government Printing Office, Miscellaneous Publication No. 691), p. 115.

Appendix Table II.—Summary of original data on demand for grades A, B, & C tomatoes with varying price levels

Grades X	Price Y	X ²	Y ²	XY	Equation for the best fitting straight line is:
31.9	88.0	1071.61	7744.0	2807.20	
40.5	80.0	1640.25	6400.0	3240.00	Y = 88.4 - .55 X r = -.55 $\sigma_{y.x} = 16.70$
33.6	64.0	1128.96	4096.0	2150.40	
79.6	56.0	6336.16	3136.0	4457.60	
79.1	40.0	6256.81	1600.0	3164.00	
45.3	32.0	2052.09	1024.0	1449.60	
310.0	360.0	18485.88	24000.0	17268.80	
X ₁	Y ₁	X ₁ ²	Y ₁ ²	X ₁ Y ₁	Equation for the best fitting straight line is:
10.5	80.0	110.25	6400.0	840.00	
17.7	72.0	313.29	5184.0	1274.40	Y ₁ = 104.34 - 3.07 X ₁ $\sigma_{Y_1.X_1} = 12.29$
12.9	56.0	166.41	3136.0	722.40	
15.7	48.0	246.49	2304.0	753.60	
18.8	32.0	353.44	1024.0	601.60	
26.7	24.0	712.89	576.0	640.80	
102.3	312.0	1902.77	18624.0	4832.80	

The data under X represents grade B sales expressed as a percent of grade A sales. Under Y the data represents grade B prices expressed as a percent of grade A prices. Likewise, under X₁ grade C sales are expressed as a percent of grade A sales. Under Y₁ grade C prices are expressed as a percent of grade A prices.

Appendix Table III.—Preferences of wholesalers and jobbers on type container, size, grades and preparation for market, June 1950

Preferences	Number	Percent
Type Containers:		
Field crates	16	69.7
20-40 lb. lugs	5	21.7
Bushel baskets	2	8.6
Total	23	100.0
Size:		
5 x 5	4	17.4
5 x 6	4	17.4
6 x 6	10	43.5
6 x 7	5	21.7
Total	23	100.0
Grades:		
U. S. No. I	8	34.8
U. S. No. II	3	13.0
Field Run	12	52.2
Total	23	100.0
Varieties:		
Rutgers	12	52.2
Marglobe	7	30.4
Grothen Globe	4	17.4
Total	23	100.0

(Table continued, page 48)

Ripeness:

Mature-green	14	60.9
Slightly pink	4	17.4
Pink	5	21.7
Ripe	0	0.0
Total	23	100.0

Appendix Table IV.—Preferences of wholesalers and jobbers on preparation of tomatoes for market, type of pack and refrigeration method

	Number	Percent
Preparation for market:		
Waxed	9	64.2
Unwaxed	5	35.8
Total	14 ¹	100.0
Unwrapped	13	92.9
Wrapped	1	7.1
Total	14 ¹	100.0
Type Pack:		
U. S. Straight	9	39.1
Bridge	3	13.1
Do not know	11	47.8
Total	23 ¹	100.0
Refrigeration Method:		
Mechanical	3	21.4
Ice	3	21.4
None	8	57.2
Total	14 ¹	100.0

¹Nine of the jobbers purchased tomatoes from repackers.

Appendix Table V.—Reasons for preferring different varieties of tomatoes, 129 producers, Humboldt and Ripley areas, Tennessee, 1949

Reasons for Preferring Different Varieties of Tomatoes	Humboldt Area			Ripley Area		
	Rutgers	Marglobe	Total	Rutgers	Marglobe	Total
	Number Producers			Number Producers		
Disease resistant	7	1	8	---	---	---
Size and shape	14	4	18	7	2	9
Higher yield	14	6	20	1	---	1
Carrying	4	1	5	2	2	4
Color	2	1	3	---	---	---
Better shipper	2	---	2	1	---	1
Less stem cracks	15	2	17	2	---	2
Smoother	9	1	10	2	---	2
Less bunchy	---	2	2	---	---	---
No preference	---	---	15	---	---	10
Total	67	18	100	15	4	29

Appendix Table VI.—Source of plant supply and production practices, 129 producers, Humboldt and Ripley Areas, Tennessee, 1949

Practices	Humboldt Area		Ripley Area	
	Number of Producers	Percent of Producers	Number of Producers	Percent of Producers
Source of Supply:				
Purchasing plants	41	41.0	20	68.9
Growing plants	59	59.0	9	31.1
Total producers	100	100.0	29	100.0

Appendix Table VII.—Pounds of nitrate of soda applied as a side dressing per acre of tomatoes, 46 producers, Humboldt and Ripley areas, Tennessee

Item	Humboldt Area		Ripley Area	
	Number	Percent	Number	Percent
Farms reporting	100	---	29	---
Farms using nitrate of soda	38	38.0	8	28.0
Pounds used per acre:				
0- 49	4	10.5	1	12.5
50- 99	4	10.5	2	25.0
100-149	13	44.7	3	37.5
150-199	10	26.3	2	25.0
200 and over	7	18.5	0	---
Total	38	100.0	8	100.0

Appendix Table VIII.—Growers reporting types of picking containers, 129 producers, Humboldt and Ripley areas, Tennessee, 1949

Types of Containers Used	Capacity	Humboldt Area		Ripley Area		Total Number Reporting
		Number Producers	Percent Producers	Number Producers	Percent Producers	
Buckets	8 qt.	1	1.0	1	3.4	2
	10 qt.	7	7.0	---	---	7
	12 qt.	32	32.0	---	---	32
	14 qt.	5	5.0	---	---	5
	16 qt.	7	7.0	2	6.9	9
Field crates	1 bu.	18	18.0	---	---	18
Baskets (round)	1 bu.	4	4.0	---	---	4
Baskets (round)	16 qt.	10	10.0	21	72.4	31
Coal scuttles	15 qt.	6	6.0	---	---	6
Hamper	5/8 bu.	10	10.0	---	---	10
Climax basket	---	---	---	5	17.3	5
Total		100	100.0	29	100.0	129

Appendix Table IX.—Tomato marketing improvements suggested by 129 producers, Humboldt and Ripley areas, Tennessee, 1949

Suggested Improvements	Humboldt Area		Ripley Area	
	Number of Producers	Percent of Producers	Number of Producers	Percent of Producers
Reduce packing shed expense	29	29.0	0	
Local packers should not purchase immature tomatoes	7	7.0	3	10.3
Farmers should harvest mature tomatoes	15	15.0	0	
Need improvement in grading at packing shed	3	3.0	4	13.8
Market tomatoes pink	5	5.0	0	
Farmers should know price before sale	1	1.0	0	
Acreage allotment	4	4.0	0	
Control of disease and sell in central markets	4	4.0	0	
Too many small buyers and no government subsidies	2	2.0	0	
Produce higher quality tomato, more local buyer competition	3	3.0	9	31.0
Omit use of nitrate of soda and more careful handling by packer	5	5.0	0	
Operate marketing associations and reduce middlemen's profits	9	9.0	13	44.9
Earlier tomato and more price stability	5	5.0	0	
None	8	8.0	0	
Total	100	100.0	29	100.0

Appendix Table X.—Suggestions for improving the marketing of tomatoes, 19 packer-buyers, Humboldt and Ripley areas, Tennessee, 1949

Suggestions Made by Packer-Buyers	No. of Packer-Buyers Making Suggestions
Producer raise plants	2
Proper use of insecticides	1
Grade properly	1
Pick mature tomatoes	6
Reject culls, buy tomatoes by pound	1
Ship pink tomatoes	1
Reduce amount of nitrate of soda	4
Stake tomatoes	1
Use more potash and less nitrogen	1
Detail inspectors well acquainted with grades	2
Too much bulk in one package	2
Passage of a tomato maturity law	6
Increase truck load limit	2
Grow higher quality tomatoes	2
Use padded containers	1
Purchase tomatoes by weight	1
Buyers and growers responsible for immature tomatoes	1
Restrict shipments to capacity of market	1
Teach growers grade standards and quality	1
Use more lime, phosphate and potash	2
Revamp inspection system	1
Grow larger acreage and cultivate properly	1
Careful harvesting of tomatoes	3

The suggestions do not total 19 because some buyers gave more than one suggestion.

*Appendix Table XI.—Attitude on enactment of a state tomato maturity law, 129
Producers, Humboldt and Ripley areas, Tennessee, 1949*

Attitude of Producers	Humboldt Area		Ripley Area	
	Number of Producers	Percent of Producers	Number of Producers	Percent of Producers
Favoring passage:				
Better quality would be marketed	43	43.0	5	17.2
Better quality tomatoes would sell better	11	11.0	9	31.0
Oppose passage:				
Too difficult to determine maturity	9	9.0	—	—
Would be too many culls	8	8.0	—	—
Present tomato law should be enforced	6	6.0	1	3.5
Don't know	23	23.0	14	48.3
Total	100	100.0	29	100.0