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Tennessee's Competitive Position in Producing and Marketing Strawberries

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Tennessee's Competitive Position In Producing and Marketing Strawberries

WILLIAM E. GOBLE

THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
JOHN A. EWING, DIRECTOR
KNOXVILLE

SUMMARY

● Production of strawberries has increased in the United States rather consistently over the period 1946-1959: 50 percent for the fresh market and about 350 percent for processing.

● Strawberry production in Tennessee has fluctuated considerably since 1925, varying from 939,000 crates in 1925 to a low of 480,000 crates (all 24-quart crates) during 1945. Production declined sharply during World War II. In 1955 a production of 660,000 crates was almost 1.4 times the post-war low. California now maintains the leadership in strawberry production.

● The average annual per capita consumption of fresh strawberries has consistently declined from 4.2 pounds during the 1920's to 1.5 pounds during the 1950's. The sharp decline in the per capita consumption of fresh strawberries is partly explained by the consistent increase in per capita consumption of frozen strawberries during the period 1946-1959.

● The average yield per acre of strawberries was 62 (24-quart) crates in Tennessee for the 10-year period, 1948-57 inclusive. The United States average yield for the corresponding period was 90 crates per acre. The yields in selected states for the 10-year period were: California, 332 crates; Washington, 117 crates; Oregon, 112 crates; Michigan, 93 crates; Kentucky, 57 crates; and Louisiana, 55 crates.

● A long harvest period is advantageous because yields per acre are usually greater than in a short season. A long season facilitates obtaining a dependable labor supply and reduces costs by extending fixed costs over a longer period with higher yields. Furthermore, with a long season, more expensive and more efficient equipment may be installed which may lower unit processing costs.

● The major cost determinants are the life of the strawberry planting, acreage handled per operator, investment per bearing acre, labor requirements, and yield per acre.

● Analysis of the factors affecting price of strawberries showed

that production, disposable personal income, and consumption of strawberries explained 66 percent of the variation in farm price.

● Eighty-two percent of the variation in U. S. strawberry acreage was "explained" by price per pound (fresh and processing market), disposable personal income, consumption of strawberries, average income per acre of competing crops, and average income per acre of strawberries. In the Mid-Spring group, which includes Tennessee, 67 percent of the variation in acreage was "explained" by these variables.

● The "cobweb" analysis presents evidence that producers base output 2 years ahead of current price. Acreage of strawberries was increased or decreased in response to price increases and decreases.

● The average cost of establishing strawberries per acre for 188 Tennessee growers was estimated to be \$202.83. Based on a random sample and an assumption of a normal distribution, the chances are 95 out of 100 that the first year's cost of establishment ranges from \$160 to \$243.

● The average production, harvesting, and marketing costs per acre for 52 growers producing for the fresh market with an average yield per acre of 123 (24-quart) crates was estimated to be \$543.48 in 1959. Based on the sample of the 52 growers interviewed, the chances are 95 out of 100 that these costs would range from \$497 to \$595 per acre.

● The average production, harvesting and marketing costs per acre for 94 growers for processing strawberries was estimated to be \$402.77. Based on the sample of 94 growers interviewed, the chances are 95 out of 100 that these costs would range from \$378 to \$526 per acre.

ACKNOWLEDGEMENT

The author acknowledges the assistance and cooperation given in this study of production and marketing costs by 188 Tennessee producers, and personnel of the Agricultural Economics and Horticultural Departments.

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Tennessee's Competitive Position In Producing and Marketing Strawberries

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INTRODUCTION

Strawberries amounted to 25.3 percent of the total marketable value of all fruits and vegetables produced in Tennessee during the period 1950-58, with an average annual farm value of \$4,073,000. During 1959 and 1960 strawberries furnished 17.7 percent of the farm value of all fruits and vegetables in Tennessee. Strawberries had an average annual farm value of \$3,209,000 for the years 1959 and 1960 (Table 1).

Table 1. Cash Value at the Farm of Strawberries and Other Fruits and Vegetables in Tennessee for the periods, 1950-58, 1959-60.

	1950-58		1959-60	
	Value	Percent of total	Value	Percent of total
	\$ 1,000		\$ 1,000	
Strawberries	4,073	25.3	3,209	17.7
Apples	2,181	13.6	4,130	22.7
Peaches	514	3.2	485	2.7
Pears	158	1.0	185	1.0
Irish potatoes	2,478	15.4	2,603	14.3
Sweet potatoes	2,847	17.7	2,408	13.2
Snap beans	1,699	10.5	2,262	12.4
Tomatoes	1,123	7.0	1,447	8.0
Cabbage	306	1.9	314	1.7
Other vegetables*	704	4.4	1,145	6.3
Total	16,083	100.0	18,188	100.0

* Green lima beans, sweet corn, green peas, greens, green pepper, pimientos, okra, and squash.

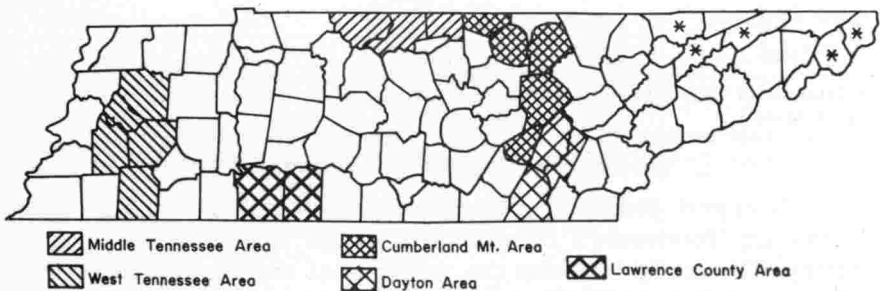
Source: Cash Receipts from Farming and Value of Productions for Crops, Federal-State Co-op. Crop Reporting Service, Nashville, Tennessee

This report presents information which will be of help in determining Tennessee's competitive status in the strawberry industry. The study includes the patterns of strawberry production, yields and prices for Tennessee and selected competing states, and production and marketing costs to the first buyer.

The most outstanding development in the strawberry industry within the past 15 years has been the freezing technique. Since Tennessee has 23 freezer plants where strawberries are marketed for processing, producers in the state need information on trends, production, and marketing costs for the freezing industry in competitive states. Similar information is needed for the producers who sell on the fresh market. Producers who are considering strawberries as one of their enterprises need information on their competitive position if their investments are to be made on a sound plan. Acreage restrictions on other crops have made it necessary for growers to search for additional sources of cash income. If technological improvements in strawberry production in some competing areas have made their operations more efficient, it will be more difficult for Tennessee farmers to compete.

Objectives of Study

The specific objectives of this report are: 1) to present the trends in utilization and consumption of strawberries in the United States; 2) to determine whether there have been shifts in the pattern of production, acreage, and yield for the strawberry industry in Tennessee and selected competing states and regions; 3) to compare prices of Tennessee strawberries with those in competing states; 4) to analyze the factors affecting demand and supply of strawberries; 5) to compute the cost of production and marketing (to the first buyer) for strawberries in Tennessee and to show production costs for competing states; and 6) to determine the seasonal distribution of labor for the production and marketing of strawberries.



* Data were not obtained from these counties in which there is some commercial production.

Figure 1. This map shows five of the major strawberry-producing areas in the state which were used for compiling the data in this report.

Procedure

To obtain production and marketing cost data, interviews were conducted with 188 growers in five production areas of the State during May and June, 1954. A representative random sample of growers was obtained within each of the five areas (Fig. 1). Information obtained in the survey of 188 growers included direct and indirect costs. The direct costs included those for labor, fertilizer, plants purchased, spray materials, horse work, tractor operation, and containers. The indirect costs were those for use of land, buildings, equipment, farm truck, and tractor.

Trends on acreage, yields, production, price, and value were compared for Tennessee and major competing states. Brief comparisons were made between the trends in the major seasonal groups of states (Table 2). The principal factors that affect demand and supply were determined.

Table 2. Strawberry Producing States, Classified by Seasonal Groups.

Winter	Early spring	Mid-spring	Late spring
Florida	Alabama	Arkansas	California
	Georgia	California	Connecticut
	Louisiana	Delaware	Indiana
	Texas	Illinois	Iowa
		Kansas	Maine
		Kentucky	Massachusetts
		Maryland	Michigan
		Missouri	New Jersey
		North Carolina	New York
		Oklahoma	Ohio
		South Carolina	Oregon
		Tennessee	Pennsylvania
		Virginia	Utah
			Washington
			Wisconsin

PRODUCTION, CONSUMPTION, AND UTILIZATION

Total production of strawberries has increased in the United States rather consistently over the period 1946-59 for both the fresh and processing markets. During this time, production for the fresh market increased 50 percent and production for the processing market increased about 350 percent (Fig. 2).

The average annual per capita consumption of fresh strawberries was 4.2 pounds during the 1920's and 3.5 pounds during the 1930's. The sharp decline in the per capita consumption of fresh strawberries brought the rate down to 1.9 pounds during the

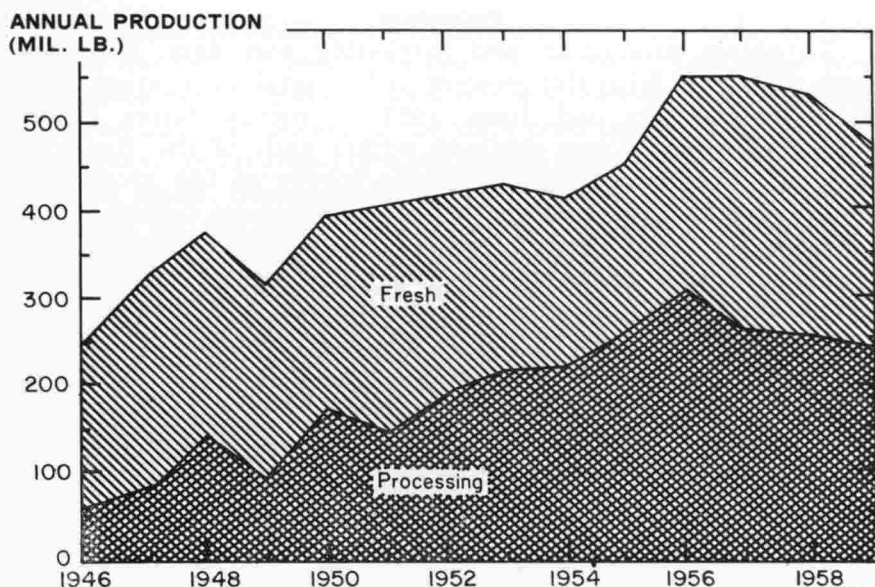


Figure 2. Annual strawberry production in the United States, 1946-1959.

Source: Reports of Agricultural Marketing Service, U.S.D.A.; Vegetables — Fresh Market, Mimeographed Report No. 217, California Agricultural Experiment Station, March, 1959.

1940's and 1.5 pounds during the 1950's. It can be noted in Figure 3 that the consumption of frozen strawberries has increased consistently from 1946 to 1957. The total per capita consumption increased slightly for the period 1946-57.

Although strawberry utilization has shown an increasing trend towards processing since the mid-30's the sharpest increases in such utilization have occurred since 1947. Several factors have favored this trend; distance of high-producing areas from the major markets, high perishability of the crop, the desire of consumers to have strawberries available throughout the year, the comparability of quality of the fresh and frozen product, and the convenience of the frozen product.

Table 3 shows the quantities of strawberries sold on the fresh and processing markets in Tennessee from 1950 through 1959. Much of the crop was sold on the freezer-processor market during the 1950-57 period, ranging from a low of 44.6 percent during 1953 to a high of 82.6 percent during 1952.

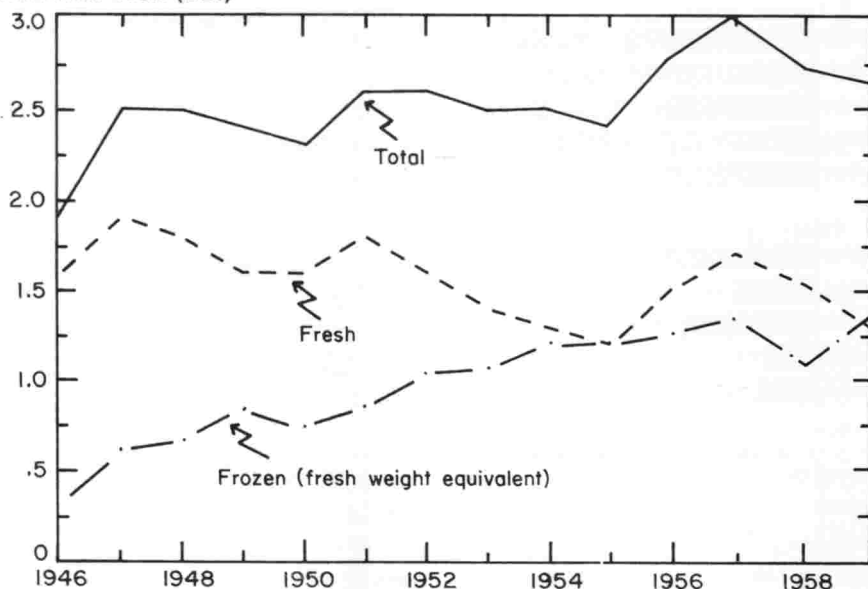
ANNUAL PER-CAPITA
CONSUMPTION (LB.)

Figure 3. Per-capita consumption of strawberries; total, fresh and frozen, U. S., 1946-1959.

Source: U.S.A.M.S. Supplement for 1956 to Consumption of Food in the United States, 1909-1952; Agricultural Handbook No. 62, Vegetables—Fresh Market, 1940-1958, Mimeographed Report No. 217, California Agricultural Experiment Station, March, 1959.

Table 3. Utilization of Strawberries for Processing and Fresh Market, Tennessee, 1950-59.

Year	Fresh Market		Processing	
	1,000 crates ¹	Percent of total	1,000 crates ²	Percent of total
1950	110	20.0	440	80.0
1951	212	26.1	600	73.9
1952	130	17.4	618	82.6
1953	286	55.4	230	44.6
1954	285	51.8	265	48.2
1955	310	47.0	350	53.0
1956	221	18.5	971	81.5
1957	206	32.7	424	67.3
1958	203	51.5	191	48.5
1959	694	64.3	386	35.7

1. 24-quart crates with 32 pounds each

2. 24-quart crates with 35 pounds each

Source: Annual Summary, Vegetables-Fresh Market, A.M.S., U.S.D.A., Washington, D.C., 1950-59.

TENNESSEE STRAWBERRY PRODUCTION

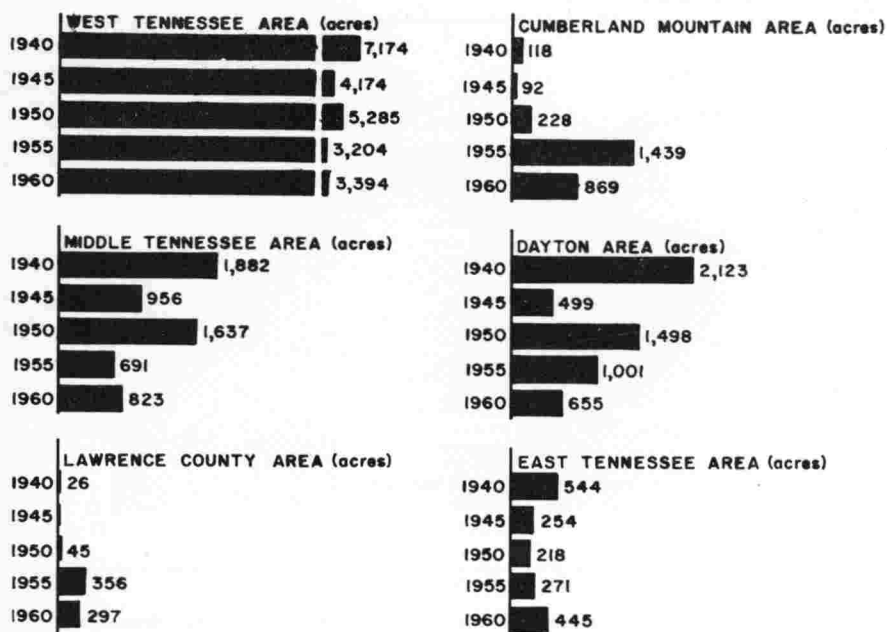


Figure 4. Acres in strawberries for the six areas of Tennessee by 5-year periods, 1940-1960.

Source: United States Census of Agriculture, 1940, 1945, 1950, 1954, 1959, United States Government Printing Office (Washington, D.C., Superintendent of Documents).

ACREAGE TRENDS

Tennessee's commercial acreage of strawberries is shown by areas in Figure 4 by 5-year periods from 1940 to 1960. It can be seen that the acreage of strawberries had increased in some areas, particularly in the Cumberland Mountain area.

Competing states' acreages have changed considerably over the years. California's acreage was less than 4,000 in 1925, compared with an increase to 14,000 in 1955 and a decrease to about 13,200 in 1959 (Table 4). The trend in strawberry acreage in the United States as a whole has been sharply downward since 1928, when about 207,000 acres were planted. When World War II ended, the total acreage in the United States was only 72,000, whereas the acreage in 1959 was 98,450.

Acreage of Strawberries Per Farm

In 1954, the average acreage per farm in Tennessee was 1.4 and in the adjoining states was 1.3, but in the Pacific Coast area it was 4.3 acres (Table 5). The average acreage of strawberries in the United States was 1.5.

Table 4. Acres of Strawberries, Tennessee and Principal Competing States 1925-59.

States	Year							
	1925	1930	1935	1940	1945	1950	1955	1959
	Acres							
Arkansas	14,940	15,300	10,400	13,900	6,500	14,700	3,800	7,600
California	3,170	4,050	4,960	5,850	1,000	5,700	14,000	13,200
Kentucky	4,260	4,250	8,200	8,500	3,000	5,300	3,500	2,400
Louisiana	10,340	24,600	18,800	23,000	12,700	13,300	8,800	7,400
Michigan	6,450	7,220	10,800	14,300	4,500	8,400	11,000	9,000
Oregon	5,930	9,450	12,400	13,400	6,000	14,000	18,200	15,400
Tennessee	18,780	12,600	16,800	19,500	6,000	10,000	11,000	7,700
Washington	5,430	7,500	9,000	8,000	3,500	7,200	8,500	7,000

Source: Agricultural Yearbook, 1925, 1930, 1935; Agricultural Statistics, 1941, 1946, 1951, 1956; Vegetables—Fresh Market, 1959, A.M.S., U.S.D.A., Washington, D. C.

Table 5. Average Acres of Strawberries Per Farm, by Regions of the United States for Census Years 1940, 1945, 1950, and 1954.

Area or state	1940	1945	1950	1954
	Average acres per farm reporting			
Tennessee	1.4	1.4	1.6	1.4
East South Central	1.2	1.0	1.2	1.3
East North Central	0.4	0.3	0.6	1.1
West North Central	0.3	0.2	0.5	0.6
West South Central	2.4	1.5	1.7	1.9
New England	0.5	0.4	0.5	0.6
Middle Atlantic	0.6	0.6	0.8	0.9
Mountain	0.5	0.4	0.8	0.9
South Atlantic	1.1	0.6	1.1	1.0
Pacific	1.8	1.4	3.1	4.3
United States	0.8	0.5	1.1	1.5

Source: United States Census of Agriculture, 1940, 1945, 1950, 1954 (Washington, D. C., Superintendent of Documents, United States Government Printing Office.)

Seasonal Groups

From the standpoint of seasonal groups, acreage in the Late Spring group fluctuated the least (Fig. 5). The Winter group acreage has declined relatively more than any other seasonal group since

1940, declining by about 80 percent during World War II. Tennessee falls in the Mid-Spring group, whose acreage has fluctuated considerably.

ACRES — THOUS.

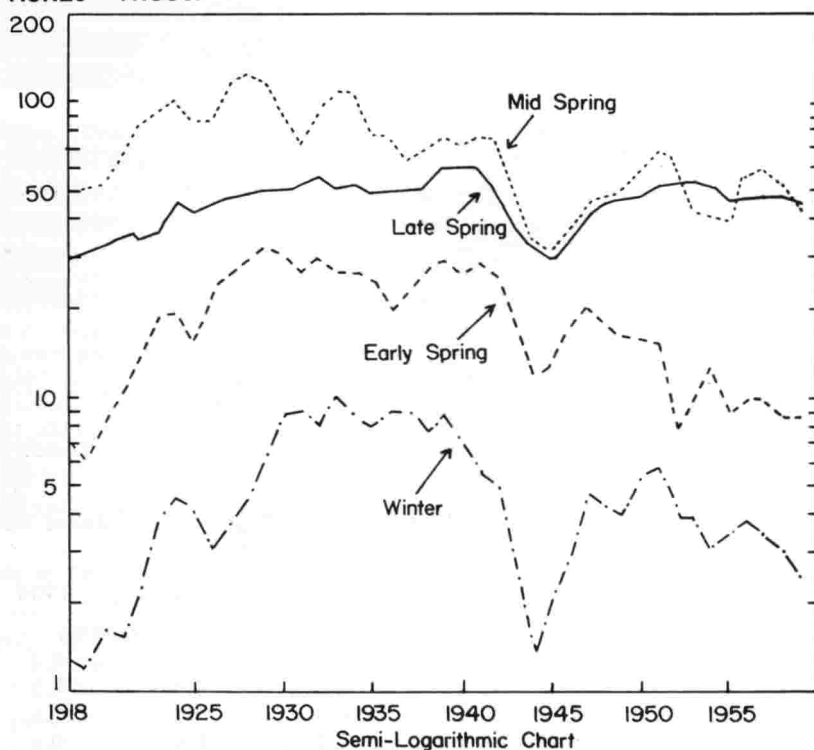


Figure 5. Harvested acreage of strawberries, seasonal groups, 1918-1959.

Source: Truck Crop Reports 1918-27, 1927-41, U.S.D.A., B.A.E., Commercial Vegetables for Fresh Market 1939-50, Annual Summaries 1950-58, A.M.S., U.S.D.A.

PRODUCTION TRENDS AND SEASONS

Strawberry production in Tennessee has fluctuated considerably since 1925, varying in the pre-war years from 939,000 crates to a low of 572,000 during 1959. California maintains the leadership in strawberry production. By 1959, California's production was about 27 times greater than during 1945. Washington's and Oregon's production almost doubled from 1940 to 1959 (Table 6).

Strawberry production in each of the four seasonal groups of states, expressed as a percentage of the total U.S. strawberry production, has varied considerably from 1920 to 1959. The largest

Table 6. Strawberry Production, Tennessee and Competing States, 1925-59.

States	Year							
	1925	1930	1935	1940	1945	1950	1955	1959
	Production in 1,000 crates							
Arkansas	538	474	395	667	358	882	152	400
California	632	869	656	945	174	2,024	4,410	4,865
Kentucky	142	217	484	510	165	344	262	117
Louisiana	431	1,181	771	1,014	712	665	352	423
Michigan	134	455	756	1,573	338	1,008	990	874
Oregon	543	567	774	1,233	480	1,260	2,457	2,552
Tennessee	939	617	823	682	480	550	660	572
Washington	317	338	810	712	438	684	1,148	1,280

Source: Agricultural Yearbook, 1925, 1930, 1935; Agricultural Statistics, 1941, 1946, 1951, 1956; Vegetables—Fresh Market, 1959, A.M.S., U.S.D.A., Washington, D.C.

PERCENT

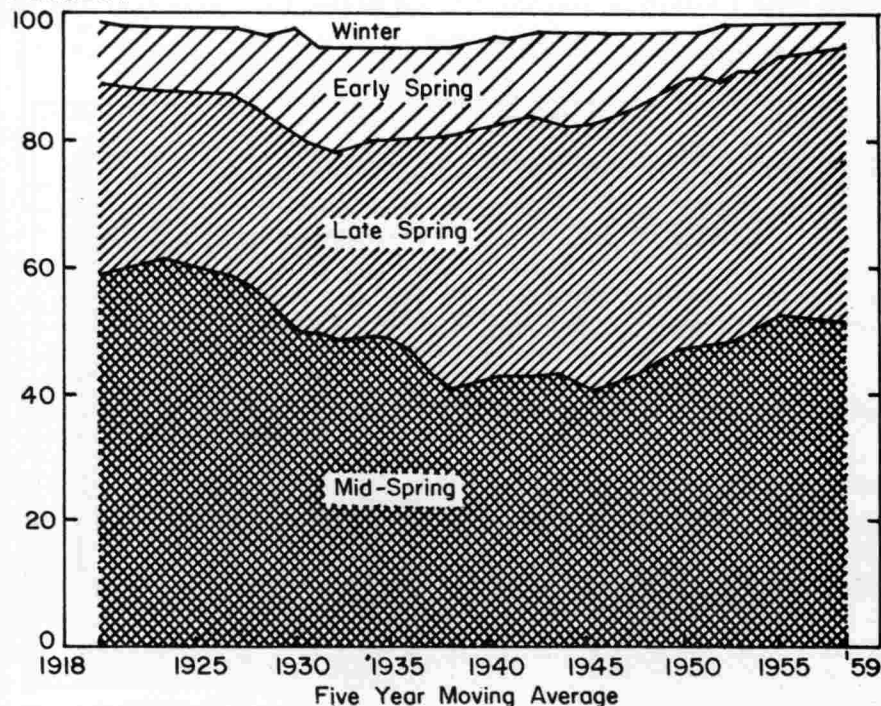


Figure 6. Percentage of U. S. total strawberry production, by season, 1918-1959.

Source: Truck Crop Reports 1918-1941, U.S.D.A., B.A.E.; Commercial Vegetables for Fresh Market 1939-1950, Annual Summaries 1950-1959, U.S.D.A., B.A.E.

seasonal category, the Mid-Spring states, which includes Tennessee, accounted for about 48 percent of the total production in 1959. However, this same group of states accounted for 60 percent of the total production in the early part of the 1920's. Production in the Early Spring states has decreased from about 16 percent in 1932 to about 6.6 percent of total production at present (Fig. 6).

MARKETABLE YIELDS PER ACRE

Per acre yields of strawberries averaged 62.2 crates in Tennessee for the 10-year period, 1948-1957 inclusive. The United States average yield for the corresponding period was 90 crates per acre. In 1946, 1947, and 1948, the yields in Tennessee were 89, 90, and 80 crates, respectively. For the next 7 years the yields were comparatively low until 1956, when the average yield was 98 crates per acre.

Figure 7 shows comparison of Tennessee's average yield per acre with California and the United States for the period 1947-52

AV. YIELD/ACRE (THOUS. LB.)

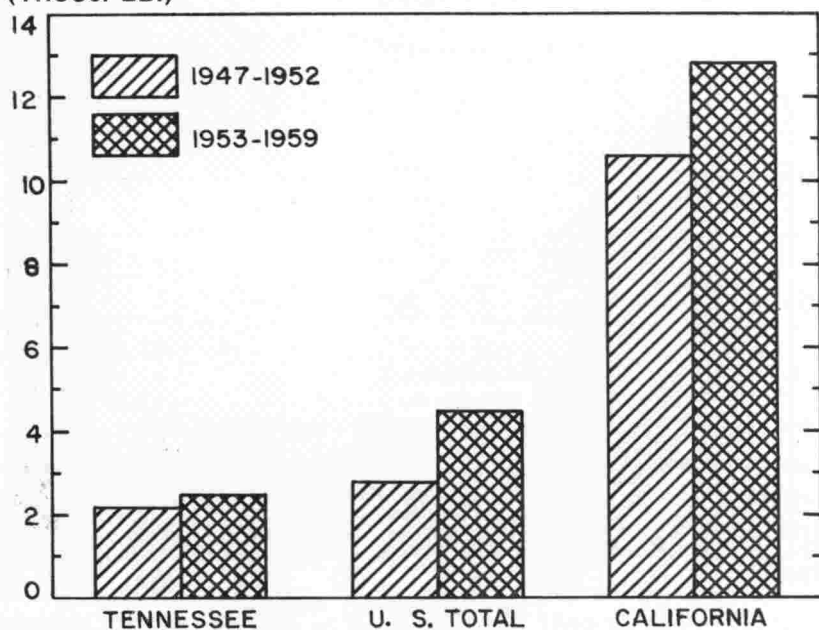


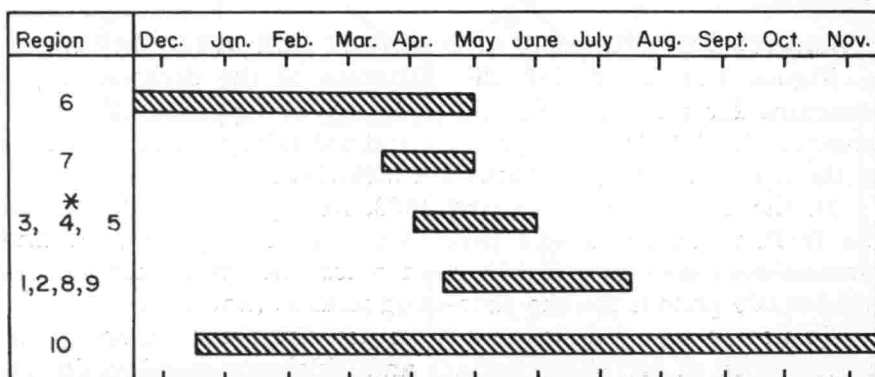
Figure 7. Comparison of strawberry yields, 1947-1952 and 1953-1959.

Source: Agricultural Statistics, U.S.D.A., 1947-1957 (U.S. Government Printing Office, Washington, D.C.); Reports of Agricultural Marketing Service, U.S.D.A., Vegetables—Fresh Market, A.M.S., U.S.D.A., 1959.

and 1953-59. Yields increased in Tennessee, but the increase in yield in California and in the United States was relatively much greater, especially in California.

HARVESTING SEASON

The harvesting season is important from the standpoint of date of harvest and length of the harvest period. Both the date and length of harvesting are associated with the price of strawberries (see Fig. 8 for usual harvesting seasons for specified states).



*Tennessee, Kentucky and Illinois

Legend: 6, Florida; 7, Louisiana, Texas, Alabama; 3, 4, 5, Arkansas, Missouri, Oklahoma, Kansas; 1, 2, 8, 9, New York, Pennsylvania, Connecticut, Massachusetts, Maine, Michigan, Ohio, Indiana, Wisconsin, Iowa, Washington, Oregon; 10, California.

Figure 8. Usual harvesting seasons for strawberries, by regions.

Source: Agricultural Statistics, U.S.D.A. (U.S. Government Printing Office Washington, D.C.), 1957.

Although both production and marketing costs are high, fresh strawberries are marketed from Florida when prices are high. From the standpoint of costs this state could not successfully compete with other regions that process strawberries at relatively much lower prices.

California has been able to compete successfully on both the fresh and processing markets, since the season extends over 10 months. When strawberry prices are relatively high, the fresh market outlet is used, while the processing market outlet is used when prices are relatively low.

A long harvest period is advantageous because yields per acre

are usually greater than in a short season. California has a long season, while Tennessee and adjacent states have a very short harvesting period. Furthermore, inclement weather may cause the crop to be almost destroyed during a short season. A long season facilitates obtaining a dependable labor supply and reducing unit costs by extending fixed costs over a longer period with higher yields. In addition, more efficient and expensive equipment may be installed in a processing plant which will reduce unit costs if the season is longer. Processors located in a short season area must adopt the less costly techniques because of the lower volume handled.

ANALYSIS OF DEMAND AND SUPPLY FOR STRAWBERRIES

Figure 9 shows a simplified diagram of the demand-supply structure for strawberries. The diagram in Appendix Figure 1 presents the details of the primary and secondary factors involved in the demand-supply structure for strawberries.

In the United States during 1960, 51.7 percent was sold on the fresh market and 48.3 percent was sold to processors. The amount sold was 242,849,000 pounds for the fresh market and 226,610,000 pounds for the processing market (Table 7).

California was the leading state for the fresh market with a production of 85,780,000 pounds and Oklahoma was low with a production of 800,000 pounds. Tennessee produced 6,500,000 pounds of the nation's fresh market strawberries and ranked ninth of the 28 states; this amount was 1.4 percent of the U.S. total production.

In production of strawberries for the processing market, Tennessee was fourth of 12 states with 16,220,000 pounds of strawberries. California was the largest producing state of processing berries (71,000,000); Louisiana, the only producing state of processing market strawberries in the Early Spring group, was lowest (508,000 pounds).

Price per crate of strawberries for the fresh and processing markets are shown in Table 8 for the Winter, Early Spring, Mid-Spring, and Late Spring Groups.

Average prices for the 10-year period, 1949-58 showed the lowest price per crate of fresh market strawberries was received by the Mid-Spring group in which Tennessee is located. Average price of strawberries for processing for the same period was lowest for the Late Spring group. The greatest total value for fresh market and processing strawberries was in the Mid-Spring group for the 10-year average.

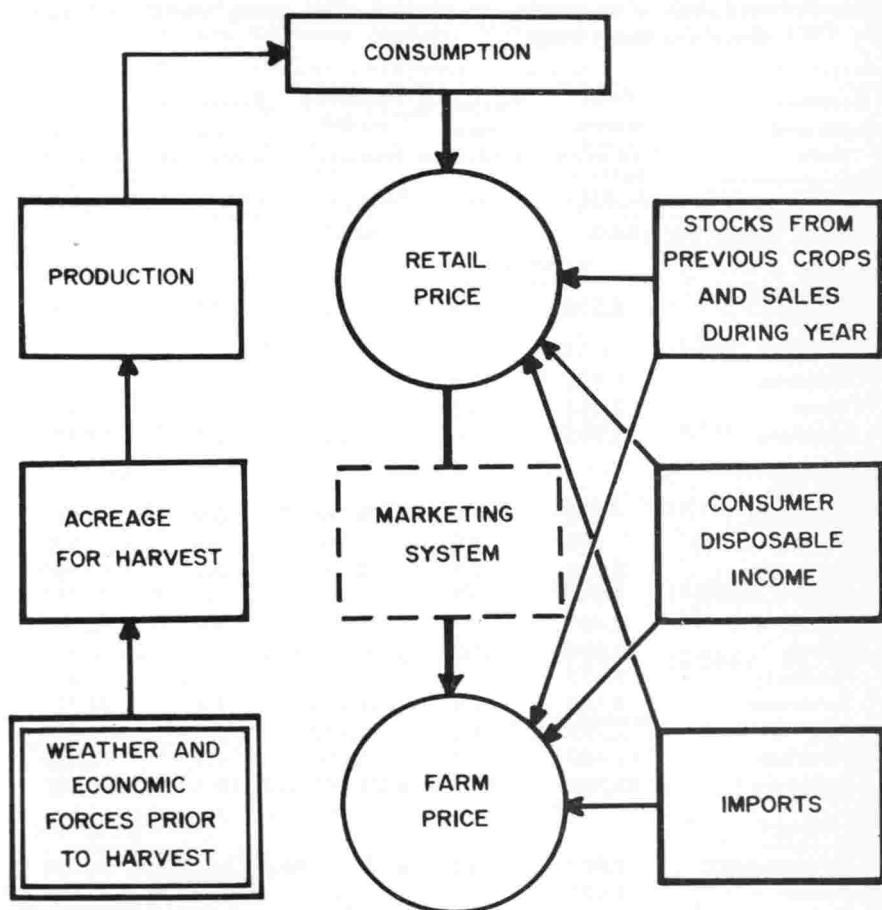


Figure 9. Demand and supply structure for strawberries.

Factors Affecting the Demand of Strawberries

The farm price of strawberries is the average price received per pound by producers at the local fresh and processing markets. Farm prices of strawberries in the United States varied from 22 to 16 cents per pound between 1948 and 1958.¹

Three variables — production, disposable personal income, and consumption of strawberries — “explained” or were associated with 66 percent of the variation in farm prices. A 1-percent change

1. Agricultural Statistics, U.S.D.A., 1959, p. 200.

Table 7. Production of Strawberries for Fresh and Processing Market by Seasonal Group and State, 1960.

Seasonal group and state	Fresh market	Percent of total production	Processing market	Percent of total production	Total production
	Production		Production		
	Pounds (000)		Pounds (000)		Pounds (000)
Winter:					
Florida	6,538	1.4	602	0.1	7,140
Early Spring:					
Alabama	1,995	0.4	—	—	1,995
Texas	2,450	0.5	—	—	2,450
Louisiana	13,982	3.0	508	0.1	14,490
Mid-Spring: ¹					
Oklahoma	800	0.2	4,260	0.9	5,060
Kansas	990	0.2	—	—	990
Kentucky	2,300	0.5	2,380	0.5	4,680
North Carolina	3,250	0.7	—	—	3,250
Maryland	3,485	0.7	—	—	3,485
Illinois	5,500	1.2	—	—	5,500
Missouri	5,670	1.2	—	—	5,670
Tennessee	6,500	1.4	16,220	3.4	22,720
Virginia	7,290	1.5	1,210	0.3	8,500
Arkansas	12,480	2.7	5,000	1.1	17,480
California	85,780	18.3	71,000	15.1	156,780
Late Spring: ²					
Massachusetts	1,500	0.3	—	—	1,500
Maine	1,620	0.3	—	—	1,620
Utah	1,634	0.3	—	—	1,634
Connecticut	2,145	0.4	—	—	2,145
Oregon	3,150	0.7	70,350	15.0	73,500
Wisconsin	3,300	0.7	—	—	3,300
Washington	3,300	0.7	39,480	8.4	42,780
Indiana	4,030	0.9	—	—	4,030
Pennsylvania	4,760	1.0	—	—	4,760
Ohio	5,440	1.2	—	—	5,440
New York	12,500	2.7	3,100	0.7	15,600
New Jersey	13,600	2.9	—	—	13,600
Michigan	26,860	5.7	12,500	2.7	39,360
All states	242,849	51.7	226,610	48.3	469,459

1. Delaware and South Carolina did not report any production.

2. Iowa did not report any production.

Source: Vegetables—Fresh Market, 1960, Annual Summary.

Table 8. Season Average Price Received by Growers and Value, Strawberries for Fresh and Processing Markets, 10-Year Average 1949-58, 1959 and 1960.*

Seasonal group and state	Price per 24-quart crate			Value		
	10-year average 1949-58	1959	1960	10-year average 1949-58	1959	1960
	Dollars			1,000 dollars		
	Fresh Market					
Winter						
Florida	9.79	13.76	12.90	2,243	1,347	2,635
Early Spring						
Group total	9.25	8.83	9.28	5,391	4,540	5,347
Mid-Spring**						
Group total	6.46	6.98	7.26	25,565	31,748	30,488
Late Spring						
Group total	6.69	6.78	6.98	15,805	14,951	18,290
Average all states	6.85	7.14	7.49	49,004	52,586	56,760
				Processing Market		
Winter						
Florida	5.65	5.04	5.54	254	23	93
Early Spring						
Group total	6.05	4.68	4.32	785	215	61
Mid-Spring**						
Group total	5.65	4.97	5.36	16,201	13,684	14,929
Late Spring						
Group total	5.44	4.82	4.97	14,718	18,661	17,359
Average all states	5.54	4.90	5.15	31,958	32,583	32,442

*See Appendix Table I and II for details.

**Includes Tennessee

in production and consumption was associated with a 0.06- and a 0.7-percent change in price in the opposite direction, respective-

ly, but a 1-percent change in disposable income was associated with a 0.82-percent change in price in the same direction. From the standpoint of variation in price explained by the independent variables disposable personal income per capita was significant at the 1 percent level of probability with a standard error of 0.21.²

Factors Affecting Supply of Strawberries

The cobweb theorem is an attempt to explain recurring cycles in the production and price series for particular commodities. Traditional economic theory assumes that under static conditions of pure competition, market-price tends to be established at the intersection of the demand and supply curves. Where there is a considerable time lag of production to a change in price, however, the price and production may not return to the original equilibrium point; instead they may circulate around it. Three possible cases of the cobweb theorem are distinguished by Shepherd.³

The farm price for the crop season is adjusted for changes in price level by dividing by the index of the wholesale price level.

2. In analyzing U. S. strawberry farm prices (1929-41 and 1948-58), all variables were expressed as first difference of logarithms. The regression line, expressed in algebraic form, was $\text{Log } X_1 = -0.0170 - 0.0595 \log X_2 + 0.8175^{**} \log X_3 - 0.6958 \log X_4$

(0.3003) (0.2077) (0.3626)

$$R^2 = 0.6624$$

$$S = 0.0047$$

where X_1 = average farm price of strawberries (cents per pound).

X_2 = production of strawberries in pounds.

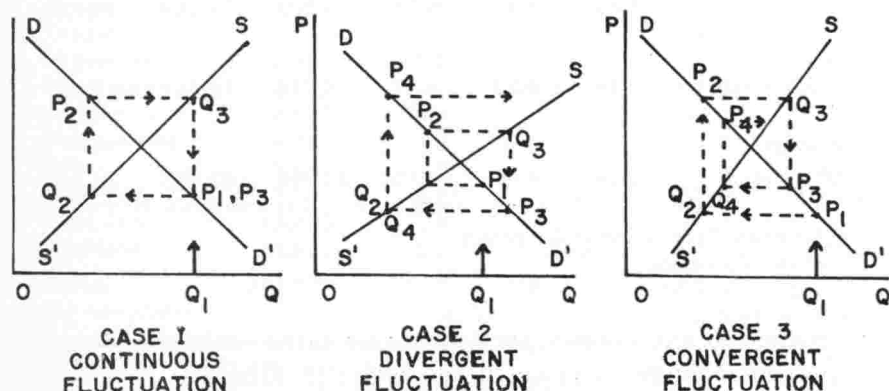
X_3 = disposable personal income per capita.

X_4 = consumption of strawberries per capita.

** Significant at the 0.01 probability level.

3. Shepherd, Geoffrey S., *Agricultural Price Analysis*, The Iowa State College Press, Ames, Iowa, 1947, pp. 30-36, and Third Edition, 1950, pp. 32-35.

Three Possible Cases Illustrating the Cobweb Theorem



The relation of these deflated prices, both to acres of the current year and to acres 2 years later, is shown in Figures 10 and 11. These figures show two points for each year, one point as a dot and the other as a hollow square. The dot labeled "30," for example, has for coordinates the 1930 price and the 1930 acres for harvest; the hollow square labeled "32" has for coordinates the 1930 price and the 1932 acres for harvest. The dots should indicate the demand curve and the squares the supply curve (for simple

CENTS
(DEFLATED)

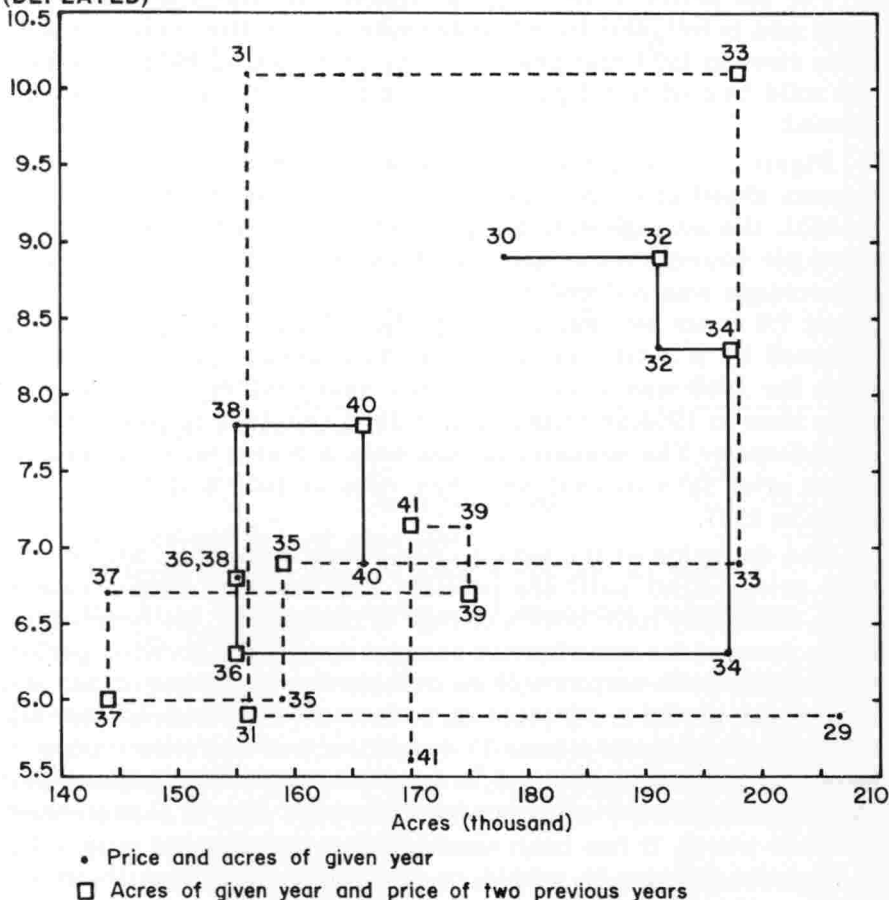


Figure 10. Cycles in price and production of strawberries, United States, 2-year lag, 1929-1941.

analysis). Two price-output lines are presented for the periods 1929-1941, 1948-1960.

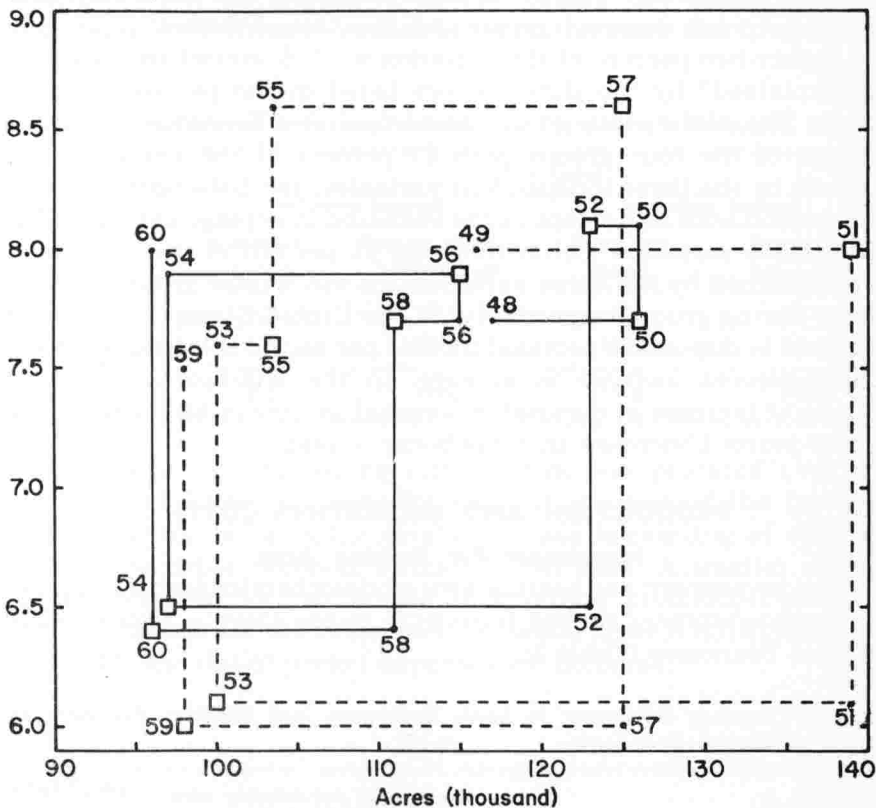
The data are presented according to a 2-year response. It is assumed that producers base output in period $t + 2$ entirely on prices in period t . Figure 10 shows evidence that producers do base output 2 years ahead of current prices for a given period. For example, during 1929 the acreage of strawberries was slightly over 207,000 with a price of almost 5.9 cents per pound. Two years later the acreage was reduced to 156,190 with an average price of about 10.1 cents per pound.

For the period 1929-1941, the broken line starts with a 3-year cycle and is followed by a 2-year cycle. In the first cycle, relative price rises in 1931 and price declines in 1933 and 1935. Although the solid line of this figure shows price variations, no cycles are formed.

Figure 11 also presents evidence that producers base output 2 years ahead of current prices for a given period. For example, in 1951, the average deflated price of strawberries was about 6.1 cents per pound with an acreage of about 139,120. Two years later the acreage was reduced sharply to about 99,600 with a price of about 7.6 cents per pound. Along the solid line is a 2-year cycle followed by a 3-year cycle. In the first cycle, a rise in relative price for 1950 was associated with a sharp fall in 1952. Relative price rises in 1954 and then falls in 1956 and 1958 to complete the second cycle. The broken line has only a 3-year cycle where relative price falls in 1951 and then rises in 1953 and 1955 to fall again in 1957.

The deviation of the actual price-output path from the theoretical price-output path are possibly explained by three reasons. First, there may have been a change in demand for the commodity. If the demand for strawberries changes during the growing period, the regular price-output will be broken. A contraction in demand during the period from planting to harvest would mean that Q_3 , as shown in footnote 4 (case 1), would not sell at P_2 but rather at some lower price, P_3 . Second, it has been implicitly assumed that the planned quantity of output would in each case be just realized. In other words, it has been assumed that the planned output Q_1 , in footnote 4 (case 3), would in fact be realized. But there are numerous reasons why this might not happen. Weather is perhaps the most important reason. Weather fluctuations may result in a larger or smaller output than was originally planned. Third, a

CENTS
(DEFLATED)



- Price and acres of given year
- Acres of given year and price of two previous years

Figure 11. Cycles in price and production of strawberries, United States, 2-year lag, 1948-1960.

change in plans to renovate or not to renovate the strawberries during the period from setting to harvest, perhaps caused by changes in the prices or other reasons, may result in an irregular price-output path. Again, in terms of footnote 4 (case 2), this would mean that P_1 would not induce quantity Q_2 , but rather would induce some output greater than Q_2 .

The three factors which were used to explain the changes in strawberry acreage were: 1) price per pound of strawberries (deflated and lagged 2-years), 2) disposable personal income per capita, and 3) consumption of strawberries per capita. Appendix

Table III shows the coefficient of multiple determination and the effect of a 1 percent change in these variables and their standard errors for each seasonal group and the United States' total.

Eighty-two percent of the variation in U. S. strawberry acreage is "explained" by the three factors listed in the preceding paragraph. The Mid-Spring group, which includes Tennessee, was the highest of the four groups with 67 percent of the variation explained by the three independent variables; the Late Spring group was second with 48 percent of the variation in acreage explained by these same variables. Thirty-nine and 21 percent of the variations are explained by the three variables for the Winter group and the Early Spring group, respectively. In the United States, a 1-percent increase in disposable personal income per capita is associated with a 0.78-percent increase in acreage. In the Mid-Spring group, a 1-percent increase in disposable personal income is associated with a 1.16-percent increase in strawberry acreage.

PRODUCTION AND MARKETING COSTS

Investment Per Bearing Acre

The investment per bearing acre of strawberries for land, buildings and equipment ranged from \$171 in the Dayton area to \$285 in West Tennessee (Table 9).

Table 9. Average Investment in Land, Equipment, and Buildings Per Acre of Bearing Strawberries.

Area of state	Investment per bearing acre			
	Land	Equipment	Buildings	Total
Dayton	\$ 97.00	\$ 62.06	\$12.40	\$171.46
Cumberland Mts.	100.00	115.34	23.04	238.38
Middle Tenn.	135.00	112.74	15.48	263.22
Lawrence County	85.00	104.82	10.16	199.98
West Tenn.	155.00	119.24	11.56	285.80
Average	\$114.40	\$102.84	\$14.53	\$231.77

Labor

Although mechanization has been employed in the land preparation and in some cultivation operations, strawberries continue to demand a considerable amount of hand labor for chopping, weeding, and harvesting. The cost of harvesting both fresh and

processing strawberries is about three times the cost of growing the strawberries up to time of harvest (Table 10). These figures indicate slight differences in cost between the fresh and processed strawberries.

Table 10. Labor Costs of Strawberry Production, 146 Producers in Tennessee, 1959.

Type of market	Labor Costs			
	Excluding harvest		Including harvest	
	Cents per pound	Percent of non-harvest cost	Cents per pound	Percent of total cost
Fresh	2.3	47.0	8.9	87.0
Processing	2.8	45.0	10.3	82.0
Average	2.6	46.0	9.6	84.5

Labor cost in establishing strawberries was prorated over a 3-year period. Labor accounts for most of the cost. If the family provides all the labor in the production and harvesting of strawberries, then labor becomes a flexible cost item. A smaller wage may be accepted by the family to continue production in the short-run period. On the other hand, if family labor is not available, then additional out-of-pocket expenses are incurred.

Costs

Total Cost

The total cost of producing and marketing strawberries consists of four parts: production, harvesting, market preparation, and transportation to the first buyer. The production expenses consist of charges for land and labor, materials and equipment used in establishing and caring for the plants up to the time of harvest, and renovation after harvest.

The cost of establishing strawberries averaged \$202.83 per acre on 188 farms in Tennessee in 1959 (Table 11). Based on a random sample of 188 producers, the chances are 95 out of 100 that the range of the first year's cost of establishing strawberries extends from \$160 to \$243.

There was a significant difference in the cost of establishing strawberries in the Dayton, Cumberland Mountain and West Tennessee areas. There was less expense for labor in Middle and West Tennessee, where the terrain is smoother than it is in the

Table 11. Average Cost of Establishing an Acre of Strawberries, 188 Farms, Tennessee, 1959.

Items	Av. cost per acre	Percent of total
Labor, power and machinery		
Cut stalks, bogging & subsoiling	\$ 1.07	
Plowing	5.11	
Discing	3.87	
Harrowing	2.24	
Fertilizing	5.05	
Setting	12.78	
Cultivating	18.96	
Hoeing	50.69	
Mulching	2.07	
Supervising	12.00	
Miscellaneous	1.79	
Total	\$115.63	57.0
Material		
Plants	\$ 30.47	
Fertilizer	25.08	
Mulch	7.41	
Spray	1.23	
Total	\$ 64.19	31.7
General expenses		
Machinery repair	\$ 1.36	
Property taxes, motor license, and ins.	1.75	
Total	\$ 3.11	1.5
Depreciation		
Machinery	\$ 5.00	
Buildings	3.00	
Total	\$ 8.00	3.9
Interest on investment		
Machinery	\$ 5.50	
Land investment and buildings	6.40	
Total	\$ 11.90	5.9
GRAND TOTAL	\$202.83	100.0

Cumberland Mountain and Dayton areas. Expenses for materials in Middle and West Tennessee exceed those in the Cumberland Mountain and Dayton areas. General expenses, depreciation and

interest on investment were only slightly different between areas (see Fig. 1 for details).

The costs of producing, harvesting and marketing an acre of strawberries for the fresh market was approximately \$140 higher than for processing strawberries (Table 12). This difference primarily represented the costs of crates which were provided by producers selling on the fresh market. Regardless of the market outlet, the establishment cost for strawberries was prorated over a 3-year period.

Cost Per Pound

The effect of the yield of strawberries per acre on the total cost per pound is emphasized in Table 13 by data from 146 farms. When the yield per acre was 2,000 pounds or less, averaging about 37 (24-quart) crates (assuming the same costs used in this study and constant returns), the cost per pound was 19.5 cents. When the yield was 6,000 pounds or more per acre, or an average of about 217 (24-quart) crates, the cost per pound was 8.5 cents. When the price of strawberries is 10 cents per pound, the grower will have a loss when the yield is less than 4,000 pounds per acre. When the price per pound is 15 cents, the grower will suffer a loss when the yields is less than 3,000 pounds per acre. When the price is 20 cents per pound, practically all growers will have a net profit.

Cost Per Crate

Fresh market. Table 14 shows the costs and gross returns for 52 producers for the fresh market and 94 producers for the processing market who cultivated 346 acres of strawberries. The producers who sold on the fresh market averaged 123 24-quart crates per acre. The average cost per acre for these 52 producers was \$543.48, or \$4.42 per 24-quart crate or 13.8 cents per pound. Assuming an average yield of 123 24-quart crates per acre, the net returns would have been \$145.32 per acre based on an average price of 17.5 cents per pound for the 9-year period, 1949-57. Based on the 1959 average price of 18.6 cents per pound, the net returns per acre would have been \$188.62.

Processing market. The 94 producers who sold strawberries on the processing market reported an average yield of 91 24-quart

Table 12. Average Production, Harvesting, and Marketing Costs Per Acre for Fresh Market¹ and Processing² Strawberries, Tennessee, 1959.

Items	Fresh market		Processing	
	Cost per acre	Percent of total	Cost per acre	Percent of total
Establishing				
Planting cost (amortized over 3 yrs.)	\$ 70.81		\$ 67.08	
Cultivating	10.61		10.61	
Hoeing	36.37		26.80	
Fertilizing	2.03		2.09	
Supervising	12.00		12.00	
Miscellaneous*	.96		.52	
Total	\$132.78	24.4	\$119.10	29.5
Harvesting				
Picking	\$171.40		\$185.64 (8.5c/qt.)	
Hauling pickers	4.84		4.81	
Supervising (owner's & trucker's time)	30.00		30.00	
Shed help	8.33		8.33	
Transporting berries to market	8.59		10.37	
Crates	144.82		—	
Total	\$367.98	67.7	\$239.15	59.4
Materials				
Picking containers	\$ 10.00		\$ 10.00	
Fertilizer	8.55		9.44	
Miscellaneous*	1.07		1.10	
Total	\$ 19.62	3.6	\$ 20.54	5.1
General expenses				
Machinery repair	\$ 1.39		\$ 1.39	
Property taxes, motor license, and insurance	1.81		1.81	
Total	\$ 3.20	0.6	\$ 3.20	0.8
Depreciation				
Machinery	\$ 5.00		5.00	
Buildings	3.00		3.00	
Total	\$ 8.00	1.5	\$ 8.00	2.0
Interest on investment				
Machinery	\$ 5.50		6.28	
Land investment and buildings	6.40		6.50	
Total	\$ 11.90	2.2	\$ 12.78	3.2
GRAND TOTAL	\$543.48	100.0	\$402.77	100.0

1. 52 farms, 134 acres; with yield of 123 (24-quart) crates per acre.

2. 94 farms, 212 acres; with a yield of 91 (24-quart) crates per acre.

*Mulching and spraying.

Table 13. Costs and Returns from Strawberries at Various Yields and Prices Received, 146 Farms, Tennessee, 1959.

Yield per acre	Number of farms	Av. yield per acre	Cost excepting harvest labor		Total cost	Returns per pound					
			Per acre	Per pound		10 cents		15 cents		20 cents	
					Loss	Gain	Loss	Gain	Loss	Gain	
		Pounds	Dollars	Cents							
2000 lb. or less	30	1,316	163.14	12.4	19.5	9.5		4.5			0.5
2001-3000 lb.	28	2,564	223.34	8.7	16.0	6.0		1.0			4.0
3001-4000 lb.	34	3,477	192.51	5.5	11.9	1.9			3.1		8.1
4001-5000 lb.	19	4,489	178.18	4.0	9.8		0.2		5.2		10.2
5001-6000 lb.	11	5,509	185.29	3.4	9.1		0.9		5.9		10.9
6000 or more lb.	24	7,612	209.29	2.7	8.5		1.5		6.5		11.5
Average		3,822	192.74	6.7	13.2	3.2			1.8		6.8

Table 14. Net Income, 1949-1957 Average, Costs and Returns from Strawberries by Sales Outlet, 1959, 146 Farms, Tennessee.

Sales outlets	Av. yield per acre	Av. cost per acre	Av. cost per crate	Av. cost per pound	per acre		Net income per crate		Net income per pound	
					Net income		9-year average		9-year average	
					9-year average	1959	1949-57	1959	1949-57	1959
	24-quart crates			cents						cents
Fresh market (52 growers)	123	\$543.48	\$4.42	13.8	\$145.32	\$188.62	\$1.18	\$1.53	3.7	4.8
Processing (94 growers)	91	402.77	4.43	12.3	127.94	23.11	1.41	0.25	3.9	0.7
Average	107	\$473.13	\$4.42	13.1	\$136.63	\$105.87	\$1.30	\$0.89	3.8	2.8

crates per acre. The average cost per acre was \$402.77.⁴ The cost per 24-quart crate was \$4.43 or 12.3 cents per pound. Assuming an average yield of 91 crates per acre, the net returns would have been \$127.94 per acre based on an average price of 16.2 cents per pound for the 9-year period, 1949-57. Based on the 1959 average price of 13 cents per pound, the net returns per acre would have been \$23.11.

SEASONAL DISTRIBUTION OF LABOR

Establishing

Approximately 53 percent of the labor of establishing strawberries was performed during March, April, and May (Fig. 12). About 90 percent of the total labor was used from March through September. The total direct labor was 154.3 hours and the indirect labor was 21.6 hours per acre. (See Appendix Table IV for details).

Renovation, Cultivation, Harvesting, Marketing

Harvesting required 92 percent of the man labor per acre for strawberries during May. During the 6-month period from April through September, about 24 percent of the man labor per acre was utilized to cultivate, hoe, apply fertilizer, and spray strawberries (Fig. 13). (See Appendix Table V for details.)

4. Carleton C. Dennis, *The Location and Cost of Strawberry Production*, California Agricultural Experiment Station, A.M.S., U.S.D.A., Mimeographed Report No. 217, p. 22. The sample for his study included only 24 Tennessee growers, who sold primarily on the processing market, and a comparatively small number in the other states. Significance test using the Student's test showed there was not a significant difference between the cost per pound for producing and marketing Tennessee processing strawberries as computed by Dennis and as shown in this report for 94 growers selling on the processing market.

AV. HOURS/ACRE

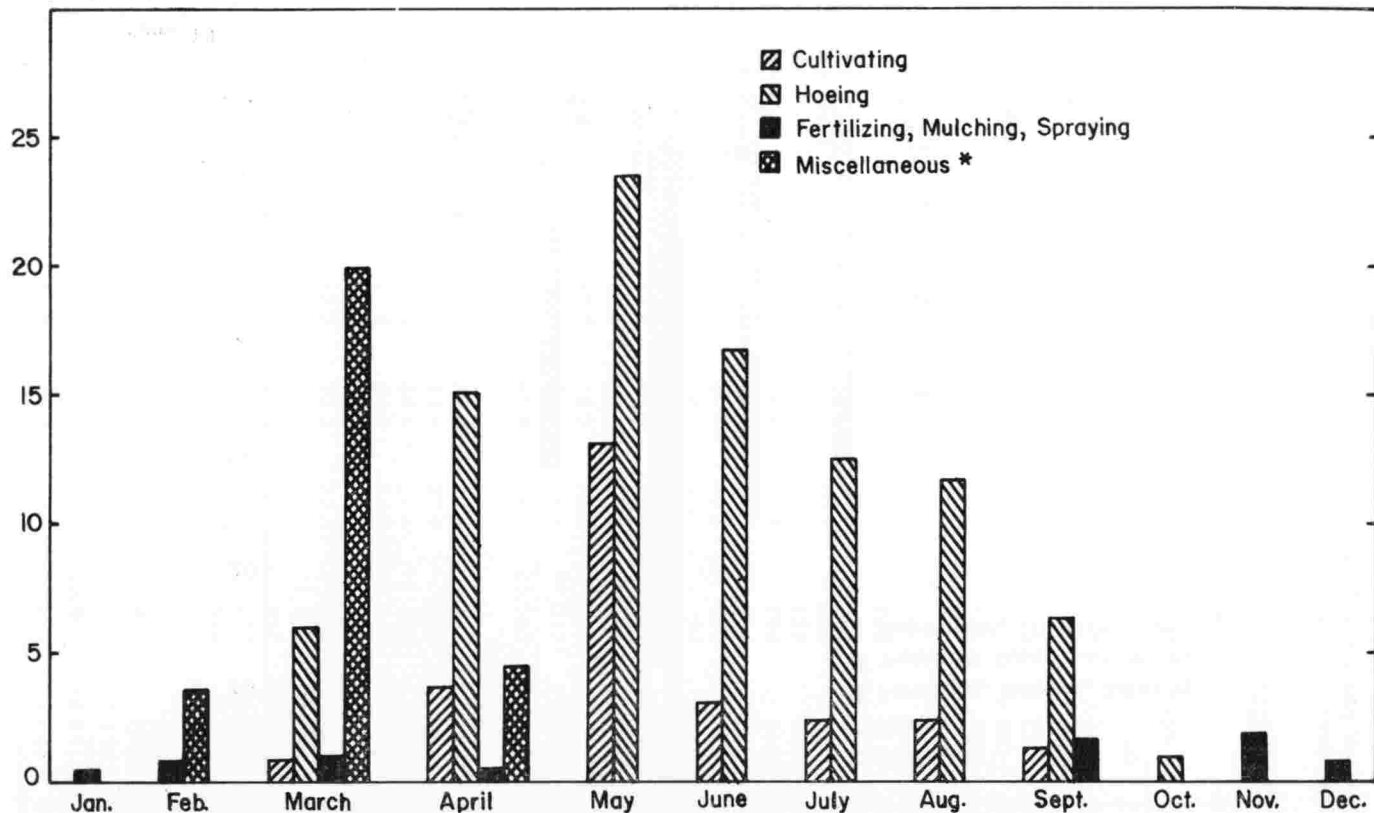


Figure 12. Distribution of labor in establishing strawberries, by months, five areas of Tennessee.

AV. HOURS/ACRE

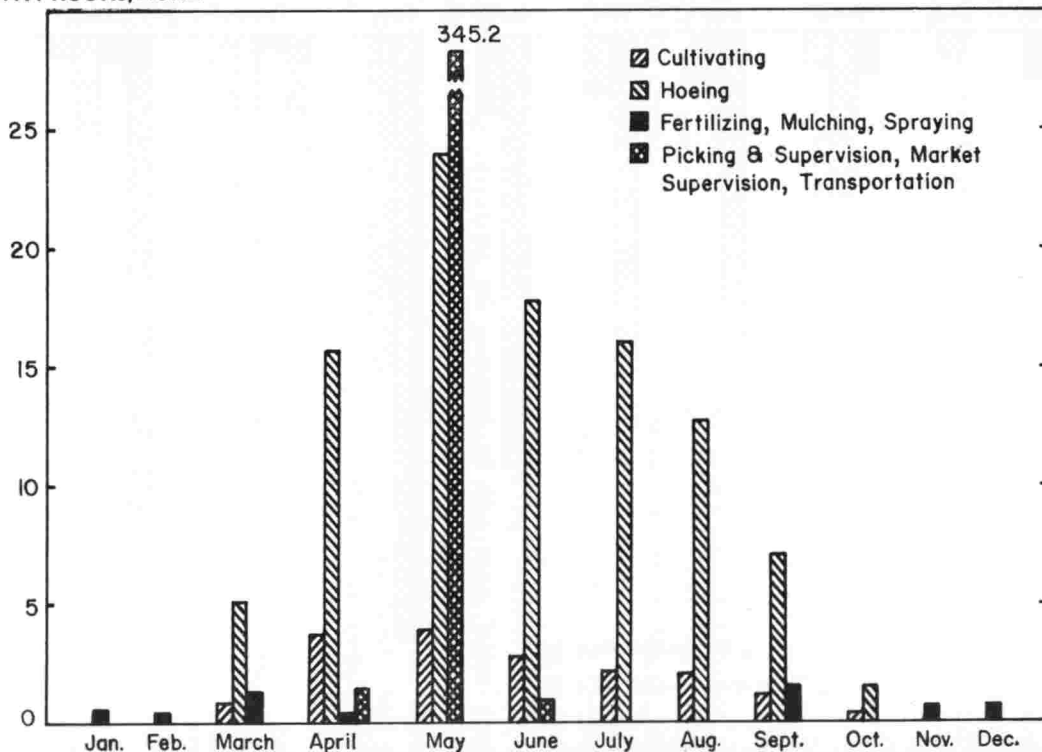


Figure 13. Distribution of man labor in producing and harvesting strawberries, by months, five areas of Tennessee.

APPENDIX A

Appendix Table 1. Season Average Price Received by Growers and Value, Strawberries for Fresh Market, 10-Year Average 1949-58, 1959 and 1960.

Seasonal group and state	Price per pound			Value		
	10-year average 1949-58	1959	1960	10-year average 1949-58	1959	1960
Winter:		Cents			\$1,000	
Florida	30.6	43.0	40.3	2,243	1,347	2,635
Early Spring:						
Alabama	21.1	21.3	19.6	355	379	391
Louisiana	30.3	28.5	30.1	4,690	3,802	4,209
Texas	23.7	27.2	30.5	346	359	747
Group total	28.9	27.6	29.0	5,391	4,540	5,347
Mid-Spring:						
Illinois	18.7	19.9	19.0	769	915	1,045
Missouri	22.0	16.0	20.5	1,483	1,080	1,162
Kansas	20.7	18.2	20.1	230	255	199
Delaware	18.7	—	—	128	—	—
Maryland	18.5	19.4	19.4	798	610	676
Virginia	19.4	20.9	19.8	1,034	1,253	1,443
North Carolina	23.3	26.3	30.5	962	1,326	991
South Carolina	23.7	—	—	99	—	—
Kentucky	20.7	22.0	21.1	1,260	528	485
Tennessee	17.5	18.6	18.5	1,141	1,138	1,202
Arkansas	20.1	17.8	19.9	2,416	2,403	2,484
Oklahoma	18.0	16.0	16.0	233	96	128
California	20.7	23.0	24.1	15,012	22,144	20,673
Group total	20.2	21.8	22.7	25,565	31,748	30,488
Late Spring:						
Maine	28.1	35.5	27.4	482	227	444
Massachusetts	25.4	33.4	27.9	583	254	418
Connecticut	27.4	34.4	27.4	489	397	588
New York ¹	21.8	24.5	24.2	2,693	3,094	3,025
New Jersey	20.8	20.6	21.4	1,815	2,031	2,910
Pennsylvania	22.7	23.2	22.6	924	891	1,076
Ohio	22.8	24.3	25.0	1,131	1,089	1,360
Indiana	19.6	19.0	19.0	830	616	766
Michigan	19.3	17.0	19.0	4,157	3,740	5,103
Wisconsin	19.3	19.7	21.7	828	591	716
Iowa	25.2	—	—	157	—	—
Utah	23.3	21.0	22.5	346	360	368
Washington	19.3	18.5	21.7	835	555	716
Oregon	20.3	26.2	25.4	535	1,106	800
Group total	20.9	21.2	21.8	15,805	14,951	18,290
ALL STATES	21.4	22.3	23.4	49,004	52,586	56,760

1. Short-time average, 1956-58.

Source: Vegetables—Fresh Market, 1960 Annual Summary.

Appendix Table II. Season Average Price Received by Growers and Value, Strawberries for Processing, 10-Year Average 1949-58, 1959, and 1960.

Seasonal group and state	Price per pound			Value		
	10-year average 1949-58	1959	1960	10-year average 1949-58	1959	1960
	Cents			\$1,000		
Winter:						
Florida	15.7	14.0	15.4	254	23	93
Early Spring:						
Alabama	16.7	20.3	—	125	41	—
Louisiana	16.6	11.9	12.0	660	174	61
Group total	16.8	13.0	12.0	785	215	61
Mid-Spring:						
Virginia	15.3	13.0	13.0	416	188	157
Kentucky	16.6	13.9	14.6	491	234	347
Tennessee	15.8	13.0	14.0	2,543	1,807	2,271
Arkansas	15.8	13.2	13.9	1,006	660	695
Oklahoma	16.0	13.6	14.0	448	435	596
California	15.9	14.0	15.3	11,297	10,360	10,863
Group total	15.7	13.8	14.9	16,201	13,684	14,929
Late Spring:						
New York ¹	10.7	13.5	14.2	368	223	440
Michigan	16.0	16.0	16.7	1,868	1,648	2,088
Washington	15.3	13.7	14.4	4,104	5,727	5,685
Oregon	15.1	13.0	13.0	8,378	11,063	9,146
Group total	15.1	13.4	13.8	14,718	18,661	17,359
ALL STATES	15.4	13.6	14.3	31,958	32,583	32,442

1. Short-time average, 1956-58.

Source: Vegetables—Fresh Market, 1960 Annual Summary.

Appendix Table III. Strawberries: Summary of Analysis of Factors That Affect Year-to-Year Changes in Acreage.¹

Seasonal group	Coefficient of multiple determination	Constant term	Effect on acreage of a 1 percent change in—		
			Price per pound ²	Disposable personal income ³	Consumption of strawberries ⁴
Winter	0.3890	-0.0143	0.1198 (0.3140)	1.0737** (0.3209)	0.1015 (0.2885)
Early Spring	0.2082	-0.0224	0.1944 (0.2742)	0.3657 (0.2776)	-0.2521 (0.1357)
Mid-Spring ⁵	0.6739	0.0073	0.1689 (0.2236)	1.1582** (0.2167)	-0.7931** (0.1921)
Late Spring	0.4817	0.0025	-0.1926 (0.1868)	0.5422** (0.1563)	0.0127 (0.1964)
United States	0.8244	0.0031	0.0391 (0.1169)	0.7755** (0.0929)	-0.6741** (0.1091)

1. Computed from analyses based on logarithms for the years 1946-58.

2. Deflated, 2-year lag.

3. Per capita basis.

4. Per capita basis.

5. Includes Tennessee.

** Significantly different from zero at the 1 percent probability level.

Numbers in parentheses are standard errors.

Appendix Table IV. Regional Harvest, Nonharvest, and Total Strawberry Production Costs Per Pound.

Region	State	County	Cost per pound		
			Harvest	Nonharvest	Total
				Cents	
1	New York	Eire and Chautauqua	7.1	6.7	13.8
2	Michigan	Berrien	9.2	4.7	13.9
2	Michigan	Manistee	7.2	4.3	11.5
3	Virginia	Accomac and Northampton	9.6	3.0	12.6
4	Tennessee	Cumberland	7.5	4.2	11.7
4	Tennessee	Macon	7.7	3.9	11.6
4	Tennessee	Madison	9.2	3.1	12.3
5	Arkansas	White	10.0	6.7	16.7
6	Florida	Hillsborough	15.1	10.0	25.1
7	Louisiana	Tangipahoa	10.5	12.6	23.1
8	Washington	Whatcom	4.8	4.7	9.5
9	Oregon	Yamhill	6.6	3.1	9.7
10	California	Monterey and Santa Cruz	4.5	5.1	9.6
10	California	Stanislaus	6.7	6.7	13.4

Source: Carleton C. Dennis. *The Location and Cost of Strawberry Production*, California Agricultural Experiment Station, Agricultural Marketing Service, U.S.D.A. Mimeographed, March 1959, p. 18.

Appendix Table V. Distribution of Man Labor for Establishment of an Acre of Strawberries by Operations and Months, Five Areas*, Tennessee, 1957.

Operation	Av. hrs. per acre	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Plowing and marking rows	1.5	—	1.0	.5	—	—	—	—	—	—	—	—	—
Discing	1.3	—	.6	.7	—	—	—	—	—	—	—	—	—
Harrowing	1.1	—	—	.6	.5	—	—	—	—	—	—	—	—
Fertilizing	3.4	—	.8	1.0	—	—	—	—	—	1.6	—	—	—
Setting	24.2	—	2.1	18.1	4.0	—	—	—	—	—	—	—	—
Cultivating	26.6	—	—	.9	3.6	13.1	3.1	2.3	2.3	1.3	—	—	—
Hoeing	92.5	—	—	6.0	15.1	23.4	16.6	12.5	11.6	6.3	1.0	—	—
Spraying	.5	—	—	—	.5	—	—	—	—	—	—	—	—
Mulching	3.2	.5	—	—	—	—	—	—	—	—	—	1.9	.8
Total direct labor	154.3	.5	4.5	27.8	23.7	36.5	19.7	14.8	13.9	9.2	1.0	1.9	.8
Total indirect labor	21.6 ¹	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Total labor per acre	175.9	2.3	6.3	29.6	25.5	38.3	21.5	16.6	15.7	11.0	2.8	3.7	2.6
Total labor per planting	528	7	19	89	77	115	64	50	47	33	8	11	8
Average size of planting (2.6 acres) (188 cases)													

* Lawrence County

Dayton Area: Bradley, Hamilton, Meigs, and Rhea Counties

West Tennessee: Gibson, Madison, and Crockett Counties

Middle Tennessee: Macon, Robertson, and Sumner Counties

Cumberland Mountain: Bledsoe, Clay, Cumberland, Fentress, and Overton Counties

1. Indirect labor of the operator is the share of his general farm upkeep and maintenance work which was charged to strawberries. This labor is arbitrarily distributed by months over the whole year.

Appendix Table VI. Distribution of Man Labor Per Acre of Strawberries for Fresh and Processing Markets by Operation and Months, Five Areas*, Tennessee, 1957.

Operation	Av. hrs. per acre	Months											
		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cultivating	17.6	—	—	0.9	3.7	4.0	2.9	2.3	2.1	1.3	0.4	—	—
Hoeing	100.5	—	—	5.2	15.7	24.0	17.9	16.1	12.8	7.2	1.6	—	—
Fertilizing	3.1	—	0.4	1.1	—	—	—	—	—	1.6	—	—	—
Mulching	2.3	0.6	—	0.3	—	—	—	—	—	—	—	0.7	0.7
Spraying	0.4	—	—	—	0.4	—	—	—	—	—	—	—	—
Picking and supervision	312.2	—	—	—	1.5	309.7	1.0	—	—	—	—	—	—
Market preparation	11.5	—	—	—	—	11.5	—	—	—	—	—	—	—
Transporting berries to mkt.	24.0	—	—	—	—	24.0	—	—	—	—	—	—	—
Total direct labor	471.6	0.6	0.4	7.5	21.3	373.2	21.8	18.4	14.9	10.1	2.0	0.7	0.7
Total indirect labor	21.6 ¹	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Total labor per acre	493.2	2.4	2.2	9.3	23.1	375.0	23.6	20.2	16.7	11.9	3.8	2.5	2.5
Total labor per planting	1,480	7	6	28	69	1,125	71	61	50	36	11	8	8
Average size planting (2.4 acres) (146 cases)													

* Lawrence County

Dayton Area: Bradley, Hamilton, Meigs, and Rhea Counties

West Tennessee: Gibson, Madison, and Crockett Counties

Middle Tennessee: Macon, Robertson, and Sumner Counties

Cumberland Mountain: Bledsoe, Clay, Cumberland, Fentress, and Overton Counties

1. Indirect labor of the operator is the share of his general farm upkeep and maintenance work which was charged to strawberries. This labor is arbitrarily distributed by months over the whole year.

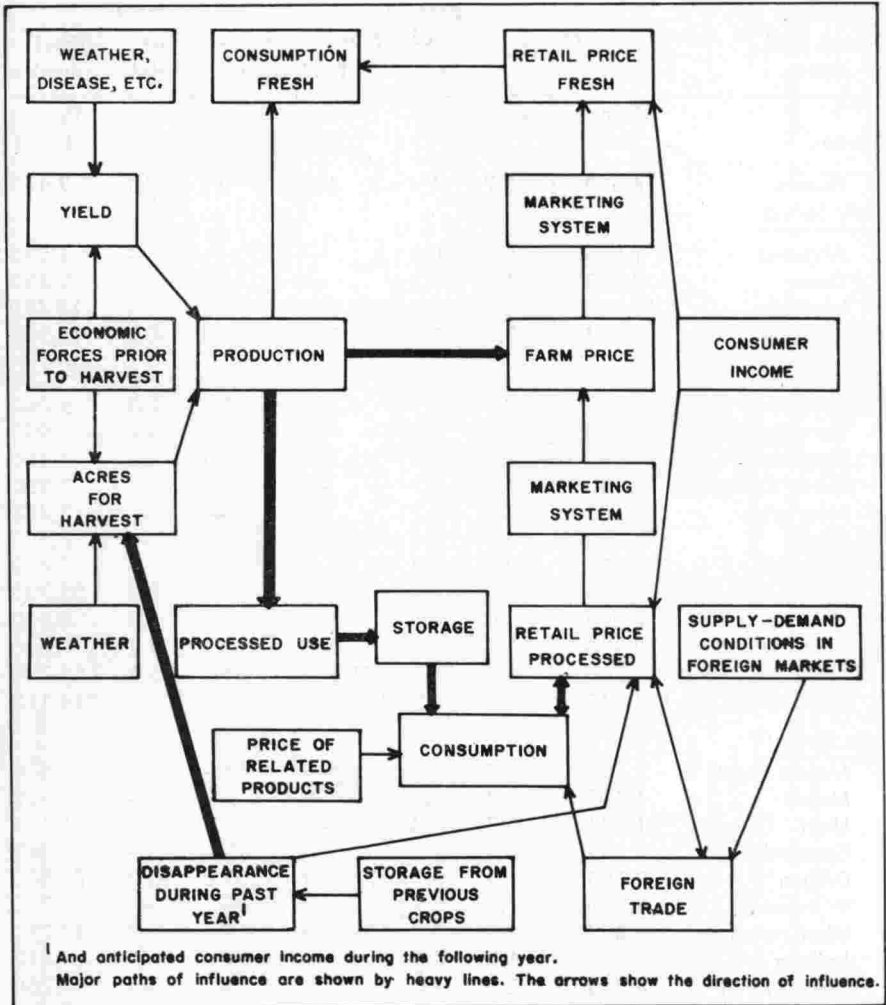
Table VII. Production of Strawberries for Fresh and Processing Market by Seasonal Group and State 1960.

Seasonal group and state	Fresh market		Percent of total		Processing market		Percent of total		Total production
	Production				Production				
	Pounds (000)	%			Pounds (000)	%			Pounds (000)
Winter:									
Florida	6,538	2.7	1.4		602	0.3	0.1		7,140
Early Spring:									
Alabama	1,995	0.8	0.4		—	—	—		1,995
Texas	2,450	1.0	0.5		—	—	—		2,450
Louisiana	13,982	5.8	3.0		508	0.2	0.1		14,490
Group total	18,427	7.6	3.9		508	0.2	0.1		18,935
Mid-Spring: ¹									
Oklahoma	800	0.3	0.2		4,260	1.9	0.9		5,060
Kansas	990	0.4	0.2		—	—	—		990
Kentucky	2,300	1.0	0.5		2,380	1.1	0.5		4,680
North Carolina	3,250	1.3	0.7		—	—	—		3,250
Maryland	3,485	1.4	0.7		—	—	—		3,485
Illinois	5,500	2.3	1.2		—	—	—		5,500
Missouri	5,670	2.4	1.2		—	—	—		5,670
Tennessee	6,500	2.7	1.4		16,220	7.2	3.5		22,720
Virginia	7,290	3.0	1.5		1,210	0.5	0.3		8,500
Arkansas	12,480	5.1	2.6		5,000	2.2	1.1		17,480
California	85,780	35.3	18.3		71,000	31.3	15.1		156,780
Group total	134,045	55.2	28.5		100,070	44.2	21.4		234,115
Late Spring: ²									
Massachusetts	1,500	0.6	0.3		—	—	—		1,500
Maine	1,620	0.7	0.3		—	—	—		1,620
Utah	1,634	0.7	0.3		—	—	—		1,634
Connecticut	2,145	0.9	0.5		—	—	—		2,145
Oregon	3,150	1.3	0.7		70,350	31.0	15.0		73,500
Wisconsin	3,300	1.3	0.7		—	—	—		3,300
Washington	3,300	1.3	0.7		39,480	17.4	8.4		42,780
Indiana	4,030	1.7	0.9		—	—	—		4,030
Pennsylvania	4,760	2.0	1.0		—	—	—		4,760
Ohio	5,440	2.2	1.2		—	—	—		5,440
New York	12,500	5.1	2.7		3,100	1.4	0.6		15,600
New Jersey	13,600	5.6	2.9		—	—	—		13,600
Michigan	26,860	11.1	5.7		12,500	5.5	2.7		39,360
Group total	83,839	34.5	17.9		125,430	55.3	26.7		209,269
All states	242,849	100.0	51.7		226,610	100.0	48.3		469,459

1. Delaware and South Carolina did not report any production.

2. Iowa did not report any production.

APPENDIX B



Appendix Figure 1. Primary and secondary factors associated with the demand and supply structure for strawberries.

(3M/12-61)