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Costs and Returns in Producing Tomatoes for Processing

94 Farms, Western New York
1954

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INTRODUCTION

Tomatoes are one of the most important vegetables grown for processing in New York. It is an intensive crop requiring relatively large amounts of labor and cash expenditure for each acre produced. In 1954, a little less than 12,000 acres were harvested for processing in New York. Among the producers were a large number of men growing 10 acres or less. The bulk of the crop, however, was produced on the larger tomato enterprises.

Most of the state's production for processing comes from Western New York farms located along Lake Erie in Chautauqua and Erie Counties and south of Lake Ontario in Niagara, Orleans, Monroe, and Wayne Counties. During the last ten years, tomato acreage in the state has declined rather steadily. From a peak of over 27,000 acres harvested in 1946 there has been a rather steady drop to less than half that acreage at present. However, during this same period the U.S. acreage has also declined in somewhat the same fashion as yields have increased. This does not reflect a change in the major area of production but substantial reductions in most of the important producing counties.

Major Areas of Production

California produces nearly half of the tomatoes processed. In 1951 and again in 1954, this one state's production provided slightly more than half of the total pack of whole tomatoes, juice, catsup, chili sauce, puree, and paste. Nearly all of these tomatoes are grown in the central valleys under irrigation. Large enterprises are common and considerable increases in the efficiency of harvesting and handling the crop have been effected in recent years.

From 15 to 20 percent of the national crop is produced in the eastern Corn Belt states of Ohio, Indiana, and Illinois. Very little of this acreage receives supplemental irrigation. The other large producing area outside western New York is the Atlantic coastal belt including parts of New Jersey, Pennsylvania, Maryland, Delaware, and Virginia. About 20 percent of the annual pack has been produced here during the last five years. Supplemental irrigation is becoming more common there.

New York's growers provided only about five percent of the tomatoes processed. However this state has never provided as much as 10 percent of the total pack at any time and the reduction in acreage during the last ten years has not been accompanied by a corresponding drop in total production.

TABLE 1. ACREAGE, PRODUCTION, AND YIELD
IN THE MAJOR TOMATO PRODUCING STATES
(Five Year Averages, 1950-54)

State	Acreage (000's)	Production (thous. tons)	Yield per acre (tons)
California	99.9	1,544	15.4
Indiana	40.8	292	7.1
New Jersey	29.9	253	8.4
Pennsylvania	23.2	181	7.8
Maryland	21.4	149	6.9
Ohio	19.3	184	9.5
New York	17.5	177	10.1
Texas	16.6	31	1.9
Virginia	15.2	64	4.2
Illinois	11.2	103	9.2
All other states	46.8	302	6.5
United States	341.8	3,280	9.6

Trends in Yields

The average yield of tomatoes in New York has tended to increase during the last 15 years. There have been large year to year fluctuations but the general trend has been upward. The average yield for the country as a whole has increased even more rapidly. During the last five years New York yields have been slightly below the national average three times. (See figure 1.) In the previous 30 years it had happened only twice before, in 1923 and 1947.

New York's relative advantage over most other states in tomato yields has been overshadowed by the increasing importance of California's irrigated production. (See table 1.) California is the only major producing area with higher average yields, but the state now produces half of the national crop and the rate of increase in yields there continues to be more rapid than in other areas. Moreover, there is less waste in processing a ton of California tomatoes than for those grown in any other area.

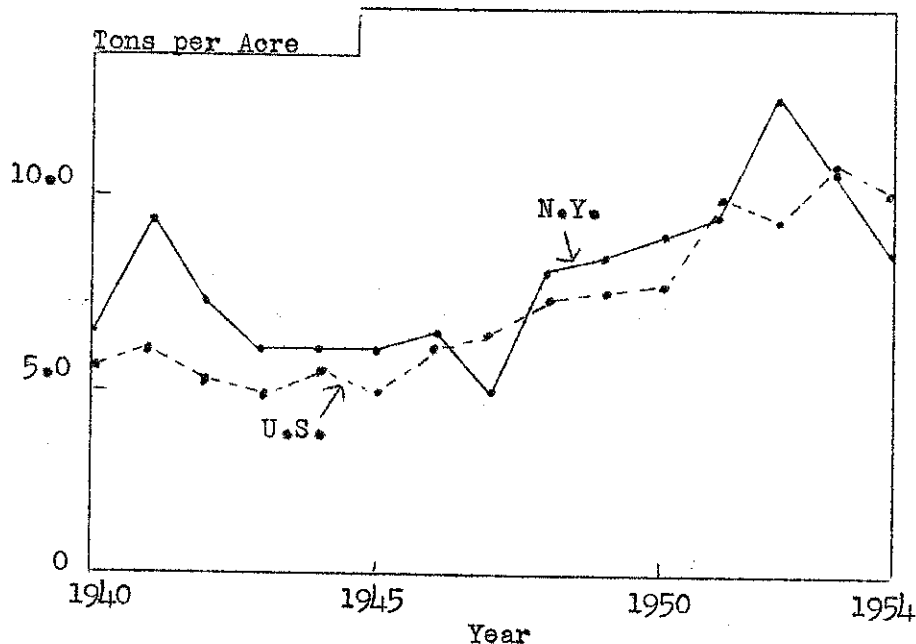


FIGURE 1. AVERAGE YIELD PER ACRE OF TOMATOES FOR PROCESSING (New York and United States)

Organization of Study

This report summarizes a study of costs and returns in producing tomatoes for processing during 1954 in the two major producing areas of New York. Growers in both the Lake Erie and Lake Ontario areas provided information about the operation of their respective enterprises.

Two groups of producers were selected for study. The first group was intended to include the large number of growers who contract relatively small acreages of tomatoes each year. On such farms tomatoes are either a very minor enterprise or one of a few small enterprises on a part-time farm, where the operator earns most of his living away from the farm. These growers might be considered to be the non-commercial producers. The second group included the larger commercial growers. On their farms tomatoes were a major enterprise contributing substantially to farm income.

To identify these two groups of producers lists of farmers contracting to deliver their production from a given acreage of tomatoes were obtained from most of the processors operating in the two producing areas. Growers were classified by the number of acres of tomatoes contracted.

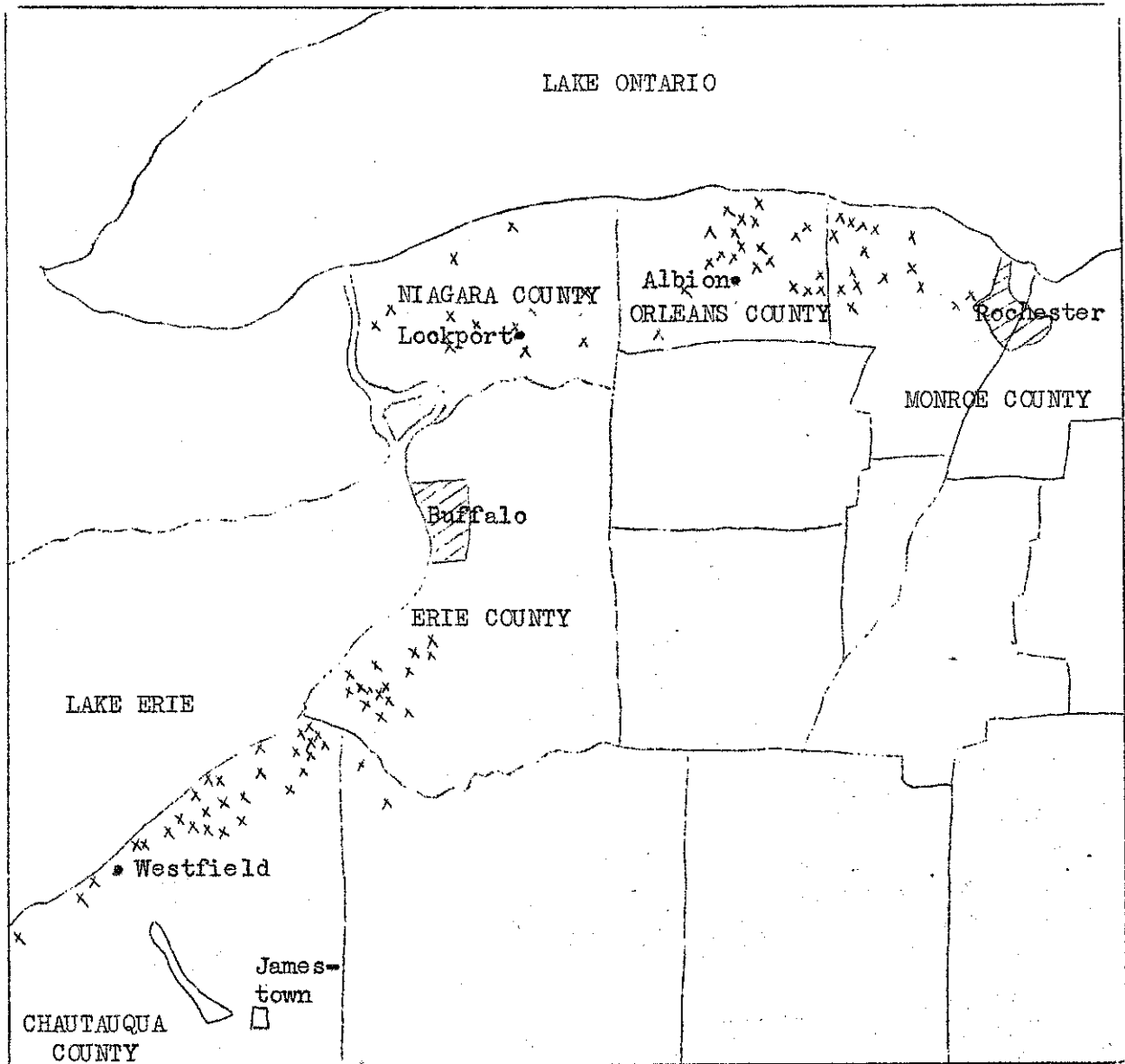


FIGURE 2.

LOCATION OF TOMATO PRODUCERS STUDIED
(94 Western New York Farms, 1954)

An attempt was made to separate the small, non-commercial growers from the larger operators on this basis. It was finally decided that all producers growing less than 10 acres of tomatoes would be included in one population. The rest of the growers, those who contracted 10 or more acres of tomatoes, were considered to be the commercial producers. The first group of small producers included 72 percent of the men contracting, but only 33 percent of the total acreage. The population of commercial growers, as defined above, included only 28 percent of those contracting tomatoes for processing. However this group grew two-thirds of the total acreage.

The small and large growers were studied separately because it was expected that their operations and methods of management would be different. The terms, "commercial" and "non-commercial", may not very well describe the differences in these operations. All of the producers expected to sell nearly all of their respective tomato crops regardless of the acreage planted and were "commercial" enterprises in that sense. However the smaller tomato enterprises were primarily side-lines for most such growers. Success or failure with this acreage of tomatoes was not a key issue in success or failure in their whole business. In this sense they were "non-commercial" enterprises. Hence, this term is used.

From the lists of growers established for each group, stratified random samples were drawn for each of the two populations. The study was limited to producers located in the two major producing areas which include Chautauqua and Erie Counties along Lake Erie and Niagara, Orleans, and Monroe Counties south of Lake Ontario. Records were obtained from 54 men who grew more than 10 acres of tomatoes. They produced about 10 percent of the total pack of tomatoes grown for processing in the state and included nearly 20 percent of the farmers of this size group located in the five counties. Farmers drawn in the sample, who had previously been contacted for similar information about their snap bean or broccoli enterprises, were not asked to report on their tomatoes. Forty records were obtained from producers growing less than 10 acres of tomatoes. They represented a little more than five percent of the total tomato production coming from enterprises of this size. The location of all the producers providing data for this study is shown in figure 2.

Each of these two groups of tomato producers will be described and their operations discussed separately in the sections which follow. Finally a comparison of the two groups will be made and a discussion of the major differences will be presented.

COSTS AND RETURNS IN PRODUCING TOMATOES
FOR PROCESSING BY SMALL ENTERPRISES, 1954

In this section of the report, the operation and management of small tomato enterprises in Western New York during 1954 will be described. Provision has been made for comparison of individual enterprises with the averages obtained for all the farms studied. The general structure of costs and returns as well as an indication of the amount of variability in yields, costs, and production methods will be presented. Each enterprise, regardless of the number of acres of tomatoes grown, has been given the same weight in determining the averages presented.

Description of Farms Studied

The farms studied, on which less than 10 acres of tomatoes were produced, were quite variable in character. Considered as a group they were small farms employing less than two men. About 87 percent of the work load was spent on 77 acres of crops. The remaining 13 percent was on livestock. The individual farms, however, were highly variable in farm organization and therefore are not well described by the averages shown in table 2. Thirteen of the 40 farms were operated by part-time or retired farmers. The other two-thirds were full-time, commercial farms. Of these 27 farms, six had commercial dairy herds (more than 10 cows) and another 13 were primarily fruit farms, growing a few acres of vegetables. The other eight were either general crop farms or market vegetable operations or a combination of the two.

On all of these farms tomatoes for processing were not a major source of income. Every unit had some other more important enterprise, even on the part-time operations. Hence, the management of the tomato enterprise often reflected its lack of importance or priority for the time of the operator.

The 40 farms, on which these tomato enterprises were located, were well distributed in the five counties which make up the two major producing areas in New York. Differences between the two areas were relatively small in terms of yields and management practices for these tomato enterprises. The average yield for the Lake Erie farms was 8.1 tons per acre. The group located south of Lake Ontario averaged 8.3 tons per acre. Both areas had a range in yields from none to 18.0 tons per acre. Since there appeared to be no major differences between the areas in weather conditions or growing season in 1954 the records for all of the smaller non-commercial tomato producers have been summarized together. During 1954 the growing season was of about average length. However it was unusually dry

early in the season and unusually wet later and at the time of harvest. Cracking and consequent low quality of the crop for processing was very common.

TABLE 2. SOME CHARACTERISTICS OF THE FARMS ON WHICH TOMATO ENTERPRISES OF LESS THAN 10 ACRES WERE STUDIED
(40 Western New York Farms, 1954)

	Your farm	Average for all farms
Number of farms		40
Acres of tomatoes		5.0
Acres operated:		
Owned		70
Rented		26
Total operated		96
Use of cropland: (acres)		
Vegetable crops		22
Corn and small grain		21
Fruit		13
Hay, pasture, or idle		21
Total cropland		77
Work units:		
Crops		441
Livestock		64
Total work units		505

Practices and Inputs Used in Producing Tomatoes

Labor - Labor is the biggest item of cost in producing tomatoes, representing between 30 and 50 percent of the total cost of production on most farms. Where an average yield is received the largest share of the total labor bill is for picking and delivering the crop to the processor. However pre-harvest operations require considerable man hours as well. The average grower spent about 40 hours per acre in bringing the crop up to the point of harvest. This represented about 20 to 25 percent of the growing costs. On individual farms there was a wide deviation from this average. Fifteen producers spent less than 30 hours per acre in growing the crop, 10 spent more than 50 hours and the remaining 15 were in the central group of 30 to 50 hours per acre.

Hand weeding accounted for much of the additional labor per acre on the farms reporting over 50 hours for growing. Thirty of the 40 producers reported hand weeding or hoeing. There were 14 who spent more than 10 hours per acre on this job alone. On all of these small enterprises, producers cultivated at least three times. Seventy five percent did the job 3, 4, or 5 times. Insect and disease control was much more variable. Twenty percent reported applying no spray or dust materials during the season. Most of the rest applied these materials 3, 4, or 5 times. Custom services were used for one or more applications by 14 of the 40 growers.

TABLE 3. AVERAGE AMOUNTS OF INPUTS USED TO PRODUCE
ONE ACRE OF TOMATOES FOR PROCESSING
(40 Small Tomato Enterprises, Western New York, 1954)

Input	Your farm	All farms	14 farms with highest yields	13 farms with low yields
Acres of tomatoes		5	6	4
Yield per acre, tons		8.2	14.0	3.0
Man hours (growing only)		39.7	39.0	33.9
Tractor hours		19.6	18.9	18.9
Truck miles:				
Growing		7	6	5
Harvest		68	115	35
Total miles		75	121	40
Tomato plants		3200	3200	3200
Commercial fertilizer, lbs.				
N		72	75	71
P ₂ O ₅		135	158	139
K ₂ O		110	128	106

Power - An average of about 20 hours of tractor power was used to grow an acre of tomatoes on these small enterprises. Only four enterprises deviated from this average by more than 10 hours. Tractor use was not highly variable.

Truck mileage per acre differed widely because of such things as yield per acre, distance from the processing plant, and the source of picking labor. The range in truck use varied between extremes of 10 and 250 miles per acre harvested.

Plants - Half of the growers set between 3,000 and 3,200 tomato plants per acre. Another 10 set between 3,200 and 4,000 plants on each acre. The seven men using supplemental irrigation did not have a higher number of plants per acre than the other producers. The most important variety planted was Long Red grown by 34 growers. Other important varieties grown were Loran Blood (13), Rutgers (10), Red Jacket (9), Moscow (7), and Gem (7). As the numbers indicate most producers grew two different varieties despite their limited acreage.

Fertilizer - Commercial fertilizers were used liberally. The averages shown in table 3 indicate that the equivalent of 900 lbs. of an 8-16-12 fertilizer, if such an analysis existed, was applied. Actually most producers applied some combination of two or more fertilizers. The more common ratios and general types applied are shown below.

TABLE 4. KINDS OF FERTILIZER APPLIED
(40 Small Tomato Enterprises, Western New York, 1954)

Fertilizer ratio or description	Common kinds applied	Percent of total lbs. of all ingredients applied
1-2-2	5-10-10, 8-16-16	70.4
1-2-1	5-10-5, 6-12-6	8.2
1-1-1	10-10-10	7.6
N only	Ammonium nitrate, cyanamid	3.2
P and K only	0-20-20, 0-20-0, 0-0-60	10.0
Starter solution	14-28-24, 15-30-15	.6
		<u>100.0%</u>

There was considerable variation in the amounts of each of the major ingredients applied. Nitrogen applications ranged from 20 to 170 lbs. per acre. Phosphorus was added in amounts ranging from 50 to 250 lbs. per acre. Potash varied from 30 to 225 lbs. per acre. There was no observable general pattern evidenced for the group as a whole.

Manure was plowed down on the acreage used for tomatoes at some time during the last three years by 20 of the 40 producers. Half of the group had added lime to their tomato acreage during the same three year period. Cover crops were an important source of humus and plant nutrients on 15 of the 40 farms as well.

The Cost of Producing One Acre of Tomatoes^{1/}

The average cost of producing a little over 8.2 tons of tomatoes for processing per acre on enterprises of less than 10 acres in Western New York was \$270. in 1954. About two-thirds of this total was spent in growing the crop in most cases. Only four men spent more in harvesting their crop than in growing it and they all had yields of 10 tons per acre or more.

Growing Costs - Tomatoes are an intensive crop. Large expenditures per acre are necessary to produce a high quality, saleable product. The big items of cost in growing this crop are labor and power making up about 30% of the total, fertilizers making up another 25%, and seed and plants which uniformly cost between \$30 and \$40 or about 20% of total growing costs. The other 25 percent of the total is divided between spray and dust materials, land rental, and the use of equipment.

Variations in growing costs between farms were great. A few producers invested less than \$140 per acre and were able to obtain well above average yields. On the other hand 12 of the 40 used more than \$200 worth of inputs, including their own labor, on each acre they grew. As the distribution in table 6 suggests there was no clear cut

TABLE 5. DISTRIBUTION OF GROWING COSTS PER ACRE
(40 Small Tomato Enterprises, Western New York, 1954)

Cost per acre	Number of enterprises
\$100 - 120	2
121 - 140	7
141 - 160	3
161 - 180	9
181 - 200	7
201 - 220	7
over \$220	5

central tendency in the amount invested per acre in growing the crop on these farms. Much of the variation noted can be attributed to the non-cash costs included in the total. Some of the more variable items were the value of the labor of the operator and his family, fertilizers like manure and cover crops, as well as the cash items like commercial fertilizer, and spray or dust materials. The cost of power, plants, the

^{1/} The procedures used and methods of establishing rates charged to obtain these cost of production figures are discussed in more detail in the Appendix.

TABLE 6. THE AVERAGE COST OF PRODUCING ONE ACRE OF
TOMATOES FOR PROCESSING
(140 Small Tomato Enterprises, Western New York, 1954)

	Your farm	All farms	14 farms with highest yields	13 farms with low yields
Acres of tomatoes	_____	5.0	6.0	4.0
Yield per acre, tons	_____	8.2	14.0	3.0
<u>GROWING COSTS:</u>				
Labor and power:				
Man	_____	\$ 39.80	\$ 38.46	\$ 35.40
Tractor	_____	14.61	12.73	15.17
Other power	_____	1.09	1.22	.85
Fertilizers:				
Commercial	_____	33.86	37.63	34.04
Manure	_____	6.02	6.02	6.70
Cover crops	_____	1.54	1.92	.23
Lime	_____	2.20	2.21	2.00
Spray and dust	_____	14.47	18.77	11.44
Plants and seed	_____	36.43	36.40	36.12
Land charge	_____	13.01	14.36	9.35
Use of equipment	_____	11.58	9.44	11.75
Irrigation	_____	2.68	5.43	---
Interest	_____	2.66	2.77	2.45
TOTAL GROWING COST	_____	\$ 179.95	\$ 187.36	\$ 165.50
<u>HARVEST COSTS:</u>				
Labor for picking, hauling and super.	_____	\$ 77.91	\$ 125.24	\$ 38.01
Trucking and other power	_____	11.97	20.30	7.05
Miscellaneous	_____	.17	.16	.13
TOTAL HARVEST COST	_____	\$ 90.05	\$ 145.70	\$ 45.19
TOTAL COST PER ACRE	_____	\$ 270.00	\$ 333.06	\$ 210.69

land charge, and use of equipment showed much more uniformity from farm to farm. The range in the land charge per acre was from \$5 to \$30. However most charged between \$10 and \$15. Seven of the forty cash rented the land on which they grew their tomatoes.

Harvest Costs - Picking, loading, and hauling the tomato crop to processors made up one-third of the total cost of production for small growers with average yields. As yields increased the proportion of total costs required for harvest increased on most farms as well. Picking labor was the biggest item in this total. Despite the fact that these were relatively small enterprises only 12 relied primarily on family or hourly help for picking. The rates paid for picking by the hour ranged between \$.65 and \$1.00. The most common rate was \$.75 per hour. Of the 28, who paid for picking on a piece rate basis, half were paying 10¢ per hamper or about \$6.00 per ton. Most of the rest paid between 11 and 15 cents per hamper with 12¢ the second most common rate.

TABLE 7. DISTRIBUTION OF LABOR COST TO HARVEST AND DELIVER
ONE TON OF TOMATOES FOR PROCESSING
(40 Small Tomato Enterprises, Western New York, 1954)

<u>Cost per ton</u>	<u>Number of enterprises</u>
\$6.00 - 7.99	10
8.00 - 9.99	14
10.00 - 11.99	4
12.00 - 13.99	7
over \$14.00	5

Loading and then hauling the tomatoes to a processing plant was the other major harvest job. At least half of the variation shown in table 7 can be attributed to variations in the time required to load and deliver a ton of tomatoes to a processor. More than half of the growers reported that the labor required to harvest and deliver one ton of tomatoes cost less than \$10.00. Of the 16 with high labor costs per ton to harvest, 11 had below average yields, while the remainder were delivering small loads at some distance from their farms.

Total Returns and Profits per Acre

The gross income per acre received from tomatoes depends on the size and quality of the yield per acre. Total returns on these small enterprises ranged from nothing to over \$570 per acre for yields varying from no saleable crop to over 18 tons per acre. The high average value of this crop per acre and the amount of resources

devoted to producing it emphasize the importance of good management. Relatively large profits or losses per acre are possible and can be expected in the production of such an intensive crop.

Yield per Acre - The most important factor determining the size of gross or net income per acre from tomatoes was the yield actually sold. In 1954 despite the unusual growing season with its early dry period and the late heavy rains, some farmers were able to obtain very acceptable yields. The average yield reported by these 40 small growers was a little more than 8 tons per acre. A little over half of the growers had yields below the average figure. On the other hand

TABLE 8. DISTRIBUTION OF TOMATO YIELDS PER ACRE
(40 Small Tomato Enterprises, Western New York, 1954)

Yield per acre (tons)	Number of farms
0 - 4.0	10
4.1 - 8.0	12
8.1 - 12.0	8
12.1 - 16.0	6
over 16.0	4

there were 10 producers with yields over 12.0 tons per acre. This wide yield variability often occurred on neighboring farms in both areas.

Quality and Price per Ton - Growers received an average price of about \$29.00 per ton for all the tomatoes sold from their respective acreages. In four cases this included some green wraps as well as the processing tomatoes. The range in average prices received by

TABLE 9. RETURNS PER ACRE FROM PRODUCING
TOMATOES FOR PROCESSING
(40 Small Tomato Enterprises, Western New York, 1954)

	Your farm	All farms	14 farms with high yields	13 farms with low yields
Yield per acre, tons		8.2	14.0	3.0
Average price per ton		\$ 29.	\$ 30.	\$ 28.
Total return per acre		\$ 246.53	\$ 421.01	\$ 90.76
Total cost per acre		\$ 270.00	\$ 333.07	\$ 210.69
Net return per acre		\$ -23.47	\$ 87.94	\$ -119.93

different growers for their entire crop ran from \$25. to over \$40. per ton. However, there were only three farmers who averaged over \$35. per ton. Most received between \$27. and \$32. The percentage of No. 1 tomatoes delivered was generally low. Very few growers sold more than 50% of their total tonnage as No. 1's. Quality on many farms was reduced by cracking and poor color resulting from heavy rains during the harvest season.

Net Returns - Costs exceeded returns on 25 of the 40 enterprises. The average grower showed a net loss of over \$23 per acre for a yield of 8.2 tons of tomatoes. Five growers had profits of over \$100 per acre. The average profit of those with the highest yields as shown in table 9 was \$88 per acre. Not all the small growers lost money, but most did considering all their costs. The wide range in net returns per acre illustrates how great a potential for success or failure there is in growing an intensive vegetable crop.

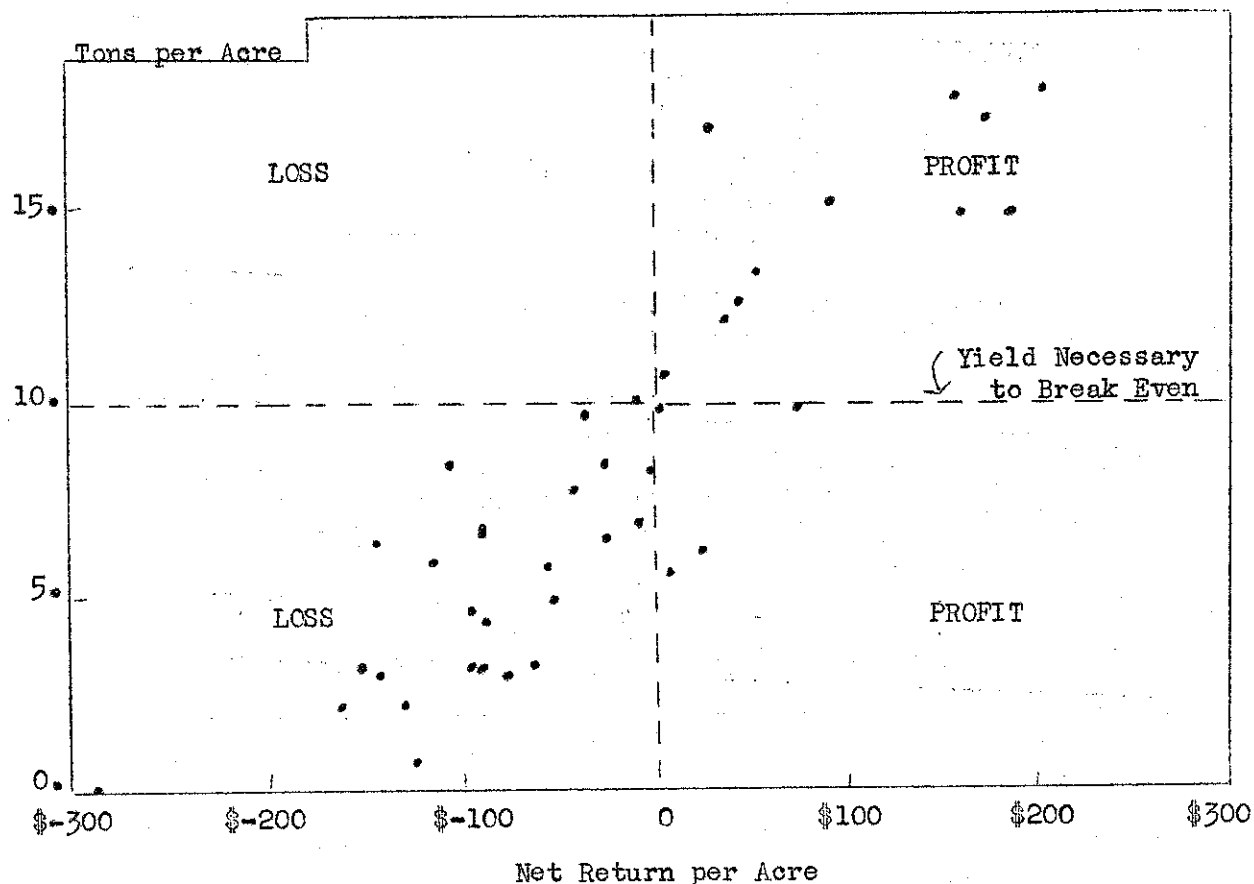


FIGURE 3. THE RELATIONSHIP BETWEEN YIELD AND NET RETURN PER ACRE OF TOMATOES FOR PROCESSING (40 Small Tomato Enterprises, Western New York, 1954)

Yield Necessary to Break Even

In 1954, a yield of 10.0 tons per acre was necessary on these small tomato enterprises to break even. There were two growers with yields of less than 10 tons who made small profits. Likewise, one grower with a yield of slightly more than 10 tons sustained a small loss. All the rest followed the general rule.

The relationship between yield and net return per acre is shown in figure 3. Each dot represents this relationship on a different enterprise. The amount of scatter in these dots indicates that other factors besides yield were important in determining the size of profits or losses per acre. Good husbandry and cost control are very important. Two farmers with yields of over 17.0 tons had profits of \$31 and \$176 per acre respectively. In one case the cost of labor reported to harvest and deliver one ton of tomatoes was nearly \$14, while the other grower did this job for about \$8.00 per ton. Distance from the processing plant, quality of the tomatoes sold, application rates of sprays and levels of fertilization all were important factors in the difference between these two enterprises.

COSTS AND RETURNS IN PRODUCING TOMATOES FOR PROCESSING ON LARGE COMMERCIAL ENTERPRISES, 1954

In this second section of the report, the operation and management of the larger, commercial tomato enterprises in Western New York will be described and discussed. The same type of general information for purposes of comparison, which was presented for the smaller enterprises, will be continued. Each enterprise, regardless of the number of acres of tomatoes grown, has been given the same weight in determining the averages presented.

Description of Farms Studied

All of the large tomato enterprises (10 or more acres) except one were located on full time commercial farms. As a group they averaged nearly 140 crop acres per farm. Over 90% of the work load was spent on crops; less than 10% on livestock (see table 10). Only 6 of the 54 were operating less than two-man businesses. While there was a wide variety of crops grown on this group of commercial farms, most of these units could be classed as fruit and vegetable farms. All but 10 had at least one fruit enterprise. Of the 54 farms, 27 had 20 or more acres of small fruit or bearing orchard. Nearly all these farmers grew at least two other vegetable crops besides tomatoes. Fourteen of the men had dairy herds of 10 cows or more.

On all these farms tomatoes were an important source of farm income. For ten farmers this enterprise provided the largest single source of revenue. Operators could not afford to neglect the management of this enterprise. Enough of their resources were invested in tomatoes to insure priority in their handling and care.

The 54 farms, on which these tomato enterprises were located, were quite well scattered over the two major producing areas. A little more than half were from the area south of Lake Ontario. Differences between the two areas were not relatively great in terms of yields and management practices. The average yield for the 23 Lake Erie farms was 9.3 tons per acre. The group south of Lake Ontario averaged 11.2 tons. The range in yields in both areas was similar as well. Both areas faced unusually dry weather early in the season and unusually wet weather during harvest. There seemed to be no good reason not to summarize the results from the two areas together for 1954.

TABLE 10. SOME CHARACTERISTICS OF THE FARMS ON
WHICH TOMATO ENTERPRISES OF 10 OR MORE ACRES
WERE STUDIED
(54 Western New York Farms, 1954)

	Your farm	Averages for all farms
Number of farms		54
Acres of tomatoes		20
Acres operated:		
Owned		141
Rented		37
Total operated		178
Use of cropland: (acres)		
Vegetable crops		50
Corn and small grain		36
Fruit		26
Hay, pasture, or idle		26
Total cropland		138
Work units:		
Crop		972
Livestock		108
Total work units		1,080

Practices and Inputs Used in Producing Tomatoes

Labor - Labor is the biggest item of cost in producing tomatoes. In 1954 it absorbed from 30 to 50 percent of the money spent in producing the crop. A major share of this labor is used in picking and then delivering the crop to a processing plant. Of course the larger the yield, the greater the share of total costs required for this kind of labor.

Pre-harvest operations also require considerable amounts of labor. To bring tomatoes up to the point of harvest took an average of 33 hours on these large operations. The variation around this average was not very great. All but 10 producers spent between 20 and 50 hours in growing the crop. The big reason for the variation which did exist was the amount of hand weeding and hoeing done. Only 10 of the 54 farmers reported no weeding. Another 22 spent less than 10 hours per acre on this job. However, there were 17 men

who paid for between 11 and 20 hours of weeding per acre, and another 5 producers who required more than 20 hours of hand labor per acre just for weeding and hoeing.

Two of the other operations which varied from farm to farm were cultivation and the application of sprays and dusts. Every producer cultivated at least three times. The most common number of cultivation was four. Yet 23 producers also cultivated five or more times during the growing season. The spray and dust schedules followed were more variable. The total number of applications of either dusts or sprays per farm follow:

<u>Number of times spray or dust applied</u>	<u>Number of farms</u>
0 - 1	14
2 - 3	8
4 - 5	21
6 - 7	10
8 - 9	<u>1</u>
Total	54

These spray and dust schedules also included a variety of different materials. Zerlate, copper and bordeaux were included in most of them. DDT, parathion, manzate, orthocide and orthophos were among the other materials applied.

Power - Tractors were used for an average of 13.5 hours per acre in growing the crop. Only two operators required more than 20 hours of tractor power per acre and there were seven who reported using a tractor less than 10 hours per acre. In general variation in the use of tractor power was relatively small.

Trucks were used to haul fertilizer and labor during the growing season as well as to take the harvested crop to processors in the fall. The range in truck use varied between 10 and 200 miles per acre harvested. Producers with high yields in general had more miles of trucking to do per acre. Distance from the farm to the processing plant, to which the crop was delivered, also was an important consideration.

Plants - Over two-thirds of the growers set between 3,000 and 3,200 plants per acre. Nearly all of the 11 producers, who set 3,500 or more plants per acre, had average or above average yields. Most of them did not irrigate. The extra number of plants, however, did not appear to be an important factor in the kind of results obtained in 1954.

The most important variety planted was Long Red grown by 45 of the 54 growers. Other important varieties were Red Jacket (29), Rutgers (18), Gem (12), and Loran Blood (11). No other variety was grown by as many as five producers. Commonly two or three different varieties were used on each of the larger enterprises.

TABLE 11. AVERAGE AMOUNTS OF INPUTS USED TO PRODUCE
ONE ACRE OF TOMATOES FOR PROCESSING
(54 Large Tomato Enterprises Western New York, 1954)

Input	Your farm	All farms	17 farms with highest yields	16 farms with low yields
Acres of tomatoes		19.9	24.8	18.0
Yield per acre, tons		10.4	15.4	5.5
Man hours (growing only)		33.0	28.8	35.9
Tractor hours		13.4	11.5	15.4
Truck miles:				
Growing		11	6	13
Harvest		53	71	32
Total miles		64	77	45
Tomato plants		3150	3200	3000
Commercial fertilizer, lbs.				
N		86	87	78
P ₂ O ₅		160	177	148
K ₂ O		126	149	112

Fertilizers - Commercial fertilizers were used by all the growers in sizeable amounts. The averages in table 3 show that the equivalent of 1,000 lbs. of an 8-16-12 fertilizer, if there were such an analysis, was applied. In most cases a fertilizer with a 1-2-2 ratio or a 1-2-1 ratio was the primary source of nutrients. Then other fertilizer ingredients were applied separately.

Variations between farms in the amounts of individual ingredients applied were relatively great. Nitrogen applications ranged from 35 to 220 lbs. per acre. Phosphorus varied between 80 and 300 lbs. per acre, while potash was applied in amounts ranging between 50 and 300 lbs. per acre. Despite the size of this variation for the individual fertilizer ingredients, the general level of fertilizer applied was quite steady. Of the 54 producers 34 spent between \$30 and \$50 per acre for commercial fertilizers. Of the 12 who spent less than \$30 per acre, many relied heavily on manure and cover crops.

TABLE 12. Kinds of Fertilizers Applied
(54 Large Tomato Enterprises, Western New York, 1954)

Fertilizer ratio or description	More common kinds applied	Percent of total lbs. of all ingredients applied
1-2-2	5-10-10, 8-16-16	66.0
1-2-1	5-10-5, 8-16-8	8.8
1-1-1	10-10-10	5.3
N only	Ammonium nitrate, cyanamid	4.6
P ₂ O ₅ and K ₂ O only	0-20-20, 0-20-0, 0-0-60	11.1
other	Starter solutions, 4-14-6	4.2
		<u>100.0%</u>

Manure was plowed down on the acreage used for tomatoes at some time during the three previous years by 28 of the 54 growers. Lime had been added during the same period by more than half of the group, 33 of the 54. Cover crops were used to add humus and nitrogen by 26 of the 54 growers.

The Cost of Producing One Acre of Tomatoes^{1/}

The average cost of producing 10.4 tons of tomatoes for processing per acre on enterprises of 10 or more acres in Western New York was about \$270 in 1954. About 60 percent of this total was spent in growing the crop. Five growers spent more money in harvesting their crop than growing it. All of the five, however, had yields of 13 tons or more per acre.

Growing Costs - Tomatoes are an intensive crop to grow. Large expenditures are necessary to produce a high quality, saleable product. Fertilizers were commonly the biggest item of growing cost, making up over 25 percent of the total. Labor and power made up nearly 25 percent and seed and plants took another 20 percent of the total. The other 30 percent of total growing costs was quite equally divided between spray and dust materials, the land charge, and the use of other equipment.

^{1/} The procedures used and methods of establishing rates charged to obtain these cost of production figures are discussed in more detail in the Appendix.

TABLE 13. THE AVERAGE COST OF PRODUCING ONE ACRE OF
TOMATOES FOR PROCESSING
(54 Large Tomato Enterprises, Western New York, 1954)

	Your farm	All farms	17 farms with highest yields	16 farms with low yields
Acres of tomatoes		19.9	24.8	18.0
Yield per acre, tons		10.4	15.4	5.5
GROWING COSTS:				
Labor and power:				
Man		\$ 32.63	\$ 30.29	\$ 33.69
Tractor		10.03	8.70	11.30
Other power		1.49	.79	1.66
Fertilizers:				
Commercial		38.24	41.71	36.54
Manure		4.24	4.82	4.81
Cover crops		1.59	1.81	1.79
Lime		2.19	1.85	2.95
Spray and dust		12.82	17.07	10.20
Plants and seed		35.68	35.92	33.71
Land charge		12.19	11.41	13.41
Use of equipment		9.60	10.03	10.01
Irrigation		2.81	6.59	.43
Interest		2.45	2.56	2.41
TOTAL GROWING COST		\$ 165.96	\$ 173.55	\$ 162.91
HARVEST COSTS:				
Labor for picking, hauling and super.		\$ 93.08	\$ 133.34	\$ 58.04
Trucking and other power		9.34	11.48	6.02
Miscellaneous		1.34	3.77	.18
TOTAL HARVEST COST		\$ 103.76	\$ 148.59	\$ 64.24
TOTAL COST PER ACRE		\$ 269.72	\$ 322.14	\$ 227.15

The variation in the amount spent to grow one acre of tomatoes was quite large. A little over half of the producers spent between \$140 and \$180 per acre. But nearly one-third of the growers used more than \$180 of resources in growing the crop. The items of cost

TABLE 14. DISTRIBUTION OF GROWING COSTS PER ACRE
(54 Large Tomato Enterprises, Western New York, 1954)

Cost per acre	Number of enterprises
Under \$120	4
\$121 - 140	4
141 - 160	15
161 - 180	14
181 - 200	9
201 - 220	4
over \$220	4

which accounted for much of this variation were man labor, spray and dust materials, manure and lime, and the land charge. Variation between farms on these items was relatively great. All but one of the eleven farmers who applied the equivalent of at least one acre-inch of water by irrigation on his tomatoes had above average growing costs and in general more intensive operations.

Of the 54 growers, 21 rented all or most of the land on which they produced tomatoes. The most common rate was \$10 per acre with a range of from \$5 to \$20. The remaining 33 growers, who used their own land for this crop, made charges for the use of this resource of from \$5 to \$35. The most common rates were \$10 and \$15. For the most part those who made high land charges were using supplemental irrigation.

Harvest Costs - Picking, loading, and hauling the tomato crop to the processing plants made up 40 percent of the total cost of production for an average yield of 10.4 tons per acre. With high yields this proportion was occasionally over 50 percent of the total. Labor to pick, load, and deliver the crop was the big item in harvest costs. Variation in the cost of this labor per ton of tomatoes harvested is shown in table 15. Most of those with high labor costs per ton were growers with low yields. A minimum amount of time was necessary for supervision, loading, and hauling regardless of the size of the crop. A variety of rates existed for picking. Two-thirds

of the growers paid for this job on a piece rate basis. The most common rate paid was 10¢ per hamper or about \$6.00 per ton on 21 of the farms. The other third of the growers paid for picking by the hour. Rates of \$.65 and \$.75 per hour were most common with a range from \$.60 to \$1.00 per hour for the job.

TABLE 15. DISTRIBUTION OF LABOR COST TO HARVEST AND
 DELIVER ONE TON OF TOMATOES FOR PROCESSING
(54 Large Tomato Enterprises, Western New York, 1954)

Cost per ton	Number of enterprises
Under \$6.00	3
\$6.00 - 7.99	15
8.00 - 9.99	19
10.00 - 11.99	9
over \$12.00	8

Besides the differences in rates paid for picking, the labor used to load and deliver the crop varied widely. Probably half of the variability shown in table 15 resulted from these differences. The number and size of loads, distance to the plant, and the time spent unloading were all important factors in determining total harvest costs per ton.

Total Returns and Profits per Acre

Gross income from tomatoes depends on the size and quality of the yield produced per acre. Total returns ranged between \$100 and \$600 per acre on these large enterprises in 1954. For an average of 10.4 tons harvested per acre growers were paid \$310 and realized a profit of about \$40 per acre. Both large profits and large losses occurred.

Yield per Acre - The most important factor determining the size of gross or net income from tomatoes was the yield actually sold. In 1954 despite the unusual growing season, a number of producers had very acceptable yields. Very few of the large growers had yields of 4 tons or less per acre where the losses sustained were quite large. (See table 16.) The twenty growers with yields of 12 or more tons per acre were able to make sizeable profits per acre as the data in figure 4 indicates. The differences in yields on neighboring

farms with similar soils and weather conditions emphasize the importance of management in both areas.

TABLE 16. DISTRIBUTION OF TOMATO YIELDS PER ACRE
(54 Large Tomato Enterprises, Western New York, 1954)

Yield per acre (tons)	Number of farms
0 - 4.0	5
4.1 - 8.0	11
8.1 - 12.0	18
12.1 - 16.0	14
16.1 - 20.0	6

Quality and Price per Ton - The average price received for all tomatoes sold was \$30.00 per ton. However this average included some green wraps, sold at a considerably higher price per ton, on seven farms. These green wraps were sold primarily by producers with low yields and low quality who were trying to salvage as much as possible from their acreage. None of these seven producers received as much as one-third of their gross income from green wraps. Actually 36 of the 54 growers received an average price of less than \$30 per ton for their crop.

TABLE 17. RETURNS PER ACRE FROM PRODUCING
TOMATOES FOR PROCESSING
(54 Large Tomato Enterprises, Western New York, 1954)

	Your farm	All farms	17 farms with highest yields	16 farms with low yields
Yield per acre, tons		10.4	15.4	5.5
Average price per ton		\$ 30.	\$ 29.	\$ 31.
Total return per acre		\$ 310.13	\$ 449.26	\$ 168.62
Total cost per acre		269.72	322.14	227.15
Net return per acre		\$ 40.41	\$ 127.12	\$ -58.53

The general quality of the crop was lower than in many previous years. Only 13 of the 54 men sold more than 60 percent of their crop as No. 1's. There were also 13 producers who had less than half of their crop grade as high as No. 1. Cracking and poor color were the most common problems.

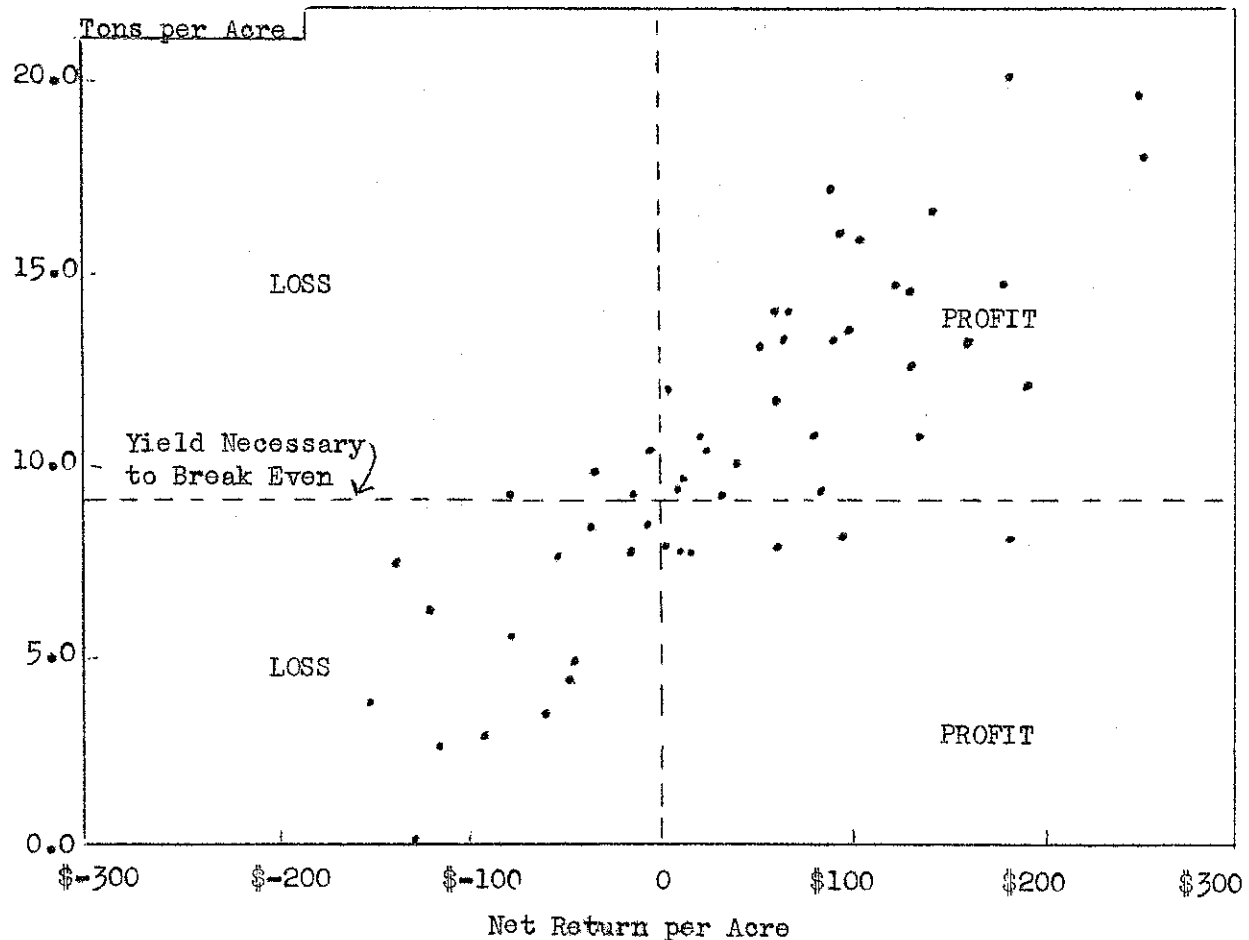


FIGURE 4. THE RELATIONSHIP BETWEEN YIELD AND NET RETURN PER ACRE OF TOMATOES FOR PROCESSING (54 Large Tomato Enterprises, Western New York, 1954)

Net Returns - Two-thirds of the large producers broke-even or made a profit in growing tomatoes for processing in 1954. The range in profits was quite wide. Five growers lost more than \$100 per acre on the crop. On the other hand 13 made more than \$100 per acre with two growers netting over \$250 per acre. The 17 producers with yields of 13 tons per acre or more averaged \$127 per acre in profits. None of them made less than \$50 in profits per acre. (See figure 4.) For the grower with above average yields tomatoes were a profitable crop in 1954.

Yield Necessary to Break Even

A yield of about 9.0 tons per acre was necessary to break even in Western New York for tomato enterprises of 10 or more acres in 1954. There were four growers who lost money with yields greater than 9.0 tons per acre. (All had yields of less than 10.5 tons.) But there were also six producers who showed profits with yields of less than 9.0 tons per acre. The break even point was not clear cut. All but one grower made money with yields of 10 tons per acre. This might be looked upon as the minimum yield which was necessary for nearly all large growers to break even in 1954. The average grower broke even with a yield of 9.0 tons. Some were even able to make money with still smaller yields.

The relationship between yield and net returns per acre on the individual farms demonstrates some of the variability in management and cost control as well. If net returns per acre were completely determined by the size of a producer's yields, all of the dots would have fallen on a straight line running diagonally across the diagram. There was considerable scatter for a great variety of reasons, many of which were not and could not be determined in such a study. However it is clear that when farmers with the same yields differed in profits or losses by as much as \$100 or more per acre, there is room for considerable improvement on at least part of these tomato enterprises in both husbandry and management.

A COMPARISON OF THE PRODUCTION OF TOMATOES FOR PROCESSING BY LARGE AND SMALL GROWERS

The average amounts of materials and resources used in producing tomatoes for processing by two different groups of growers, distinguished from each other on the basis of size, have been presented. Average costs and returns have been determined. A general description of practices followed in 1954 and variations from the averages for each group have been discussed. It was shown that about two-thirds of the larger producers made a profit on every acre grown, while about two-thirds of the small growers studied lost money. A brief comparison will now be made to summarize the differences and similarities between these two groups of producers of tomatoes for processing. This should help to indicate some of the reasons why so many more of the large producers had efficient, profitable enterprises.

Resources Used in Producing Tomatoes

There was a great deal of variation from farm to farm in the organization and operation of the tomato enterprise within each of the two groups of producers studied. It is difficult to make too many general statements about the two groups as a result. However the average rates of resource use and the average results obtained by the growers give some indication of the differences and similarities which existed.

One of the big differences between the large and small producers was the kind of management available for handling the tomato enterprise. There is no objective way to measure this difference except perhaps in the results obtained and the nature of the enterprises. The small producers had an average of only 5.0 acres of tomatoes per farm. The large growers had from 10 to 70 acres to supervise, more nearly insuring prompt attention and careful husbandry, since this enterprise was an important part of the business.

There were some definite economies in the use of labor and power on the larger enterprises. It took an average of seven less man hours and six fewer tractor hours to grow one acre of the crop. Likewise trucks were used 10 less miles per acre even though two more tons of tomatoes were harvested on the average per acre. (See table 18.)

Both groups planted about the same number of plants per acre and used quite similar varieties. The number of cultivations and the spray and dust schedules used were nearly alike. However the average level of fertilization was a little higher on the large farms, especially

considering the use of commercial fertilizers. The large growers used the equivalent of an additional 150 lbs. of an 8-16-8 fertilizer per acre. There was also more variation in the level of application of commercial fertilizers among the small producers than among the larger operators.

TABLE 18. AVERAGE AMOUNTS OF INPUTS USED TO
PRODUCE ONE ACRE OF TOMATOES FOR PROCESSING
(94 Western New York Farms, 1954)

	40 small enterprises	54 large enterprises
Acres of tomatoes	5.0	19.9
Yield per acre, tons	8.2	10.4
Labor and power:		
Man hours (growing only)	39.7	33.0
Tractor hours	19.6	13.4
Truck miles	75	64
Tomato plants	3200	3150
Commercial fertilizer, lbs.		
N	72	86
P ₂ O ₅	135	160
K ₂ O	110	126

Costs and Returns

The average total cost of producing one acre of tomatoes for processing was equal to \$270 per acre for both the large and small producers. Some definite differences existed between the two groups even though the total costs per acre were the same. In the first place the large producers harvested more than two more tons of tomatoes per acre for the same cost. Since harvest costs increase as the tonnage picked increases, harvest costs were a larger proportion of total costs on the large enterprises. The significant differences largely appeared in growing costs and the resulting yields from this expenditure of cash and other resources.

The smaller producers on the average spent \$11 more per acre to obtain yields which were 2.2 tons less than those obtained by the men with large acreages. A direct comparison of the major items of growing

costs are shown in table 19. The chief differences in growing cost were the result of economies in the use of labor, power, and equipment

TABLE 19. AVERAGE COST AND RETURNS FROM PRODUCING ONE ACRE OF
TOMATOES FOR PROCESSING
(94 Western New York Farms, 1954)

	40 small enterprises	54 large enterprises
<u>GROWING COSTS:</u>		
Man labor	\$ 39.80	\$ 32.63
Truck and tractor use	15.70	11.52
All fertilizers	43.62	46.26
Spray and dust	14.47	12.82
Plants and seed	36.43	35.68
Land charge	13.01	12.19
Use of equipment	11.58	9.60
All other	5.34	5.26
TOTAL GROWING COST	\$ 179.95	\$ 165.96
<u>HARVEST COST:</u>		
Labor for picking, hauling	77.91	93.08
Trucking and other power	12.14	10.68
TOTAL HARVEST COST	\$ 90.05	\$ 103.76
Total Cost of Production	270.00	269.72
Gross Returns	246.53	310.13
Net Return	\$ -23.47	\$ 40.41

effected by the larger operators. Such items as fertilizers, spray and dust materials, plants and seed, and the land charge were quite similar for both groups.

The larger growers were also able to obtain some economies in the use of labor and trucking in harvesting the crop. The average harvest cost per ton on enterprises of less than 10 acres was approximately \$11. The larger operators did the same job for one dollar less, or about \$10 per ton. These efficiencies in the use of labor, power, and equipment and the better management which provided an average of two more tons of tomatoes per acre with similar amounts of other resources and a little additional commercial fertilizer made the difference between a profit of \$40 per acre on the large enterprises and an average loss of over \$23 per acre on the smaller ones.

Comparison of Variability Within the Two Groups

There was in general more variability within the group of small producers than among those with enterprises of 10 or more acres. There were a number of full-time farmers with small tomato enterprises (less than 10 acres) who were doing a good job of production and management. The top one-third of the small growers, based on yields, averaged \$88 in profits for the production of 14.0 tons of tomatoes per acre. (See table 6.) But the bulk of the small growers did not do this well. Likewise there was more variability in the amounts of resources used and in costs of production than for the large growers.

A comparison of the amount of variation in yields of tomatoes produced and growing costs per acre illustrate some of the differences between the two groups. The bulk of the growers with small enterprises

TABLE 20. DISTRIBUTION OF TOMATO YIELDS PER ACRE
(94 Western New York Farms, 1954)

Yield per acre (tons)	40 small enterprises (percent of total)	54 large enterprises
0 - 4.0	25	9
4.1 - 8.0	30	21
8.1 - 12.0	20	33
12.1 - 16.0	15	26
16.1 - 20.0	10	11
	<u>100%</u>	<u>100%</u>

were producing between 0 and 12 tons of tomatoes per acre. Most of the large producers had yields between 4 and 16 tons. The median yield for the group of small producers was 7 tons per acre. The median for those with 10 or more acres was 10 tons per acre. The yield distribution in 1954 for the large growers clearly was located at a higher general level.

There was more variability in growing costs per acre within the group of small growers than within the group of large producers. (See table 21.) Over half of the larger enterprises used between \$140 and \$180 worth of resources to grow the crop. There were relatively small numbers of growers at each end of the distribution. On the other hand there were sizeable numbers of those with less than 10 acres of tomatoes at both extremes in growing costs per acre. Consequently using an average to describe growing costs for the small enterprises is not very informative in telling how the group as a whole were using their resources.

TABLE 21. DISTRIBUTION OF GROWING COSTS PER ACRE
(94 Western New York Farms, 1954)

Cost per acre	40 small enterprises	54 large enterprises
	(percent of total)	
Under \$120	5	7
\$121 - 140	18	8
141 - 160	8	28
161 - 180	22	26
181 - 200	18	17
201 - 220	17	7
over \$220	12	7
	100%	100%

Cash or "Out-of-Pocket" Costs vs. Total Costs on the Small Enterprises

Since nearly two-thirds of the small tomato enterprises showed a net loss on every acre produced while the large majority of the large enterprises were making profits, the question can be raised as to why the small producers continue to produce under such unfavorable, competitive circumstances. This question can be answered partially by examining some of the alternatives open to such small producers.

What would many of these small producers do with the land, their own labor, and the equipment which they already have, if they did not grow this small acreage of tomatoes? On small or part-time farms, some or all of these resources very often might not be used in any other productive fashion if tomatoes were not planted. An attempt was made to separate the cash or "out-of-pocket" costs on each of the small enterprises from all of the costs of production. The value of the operator's and his family's labor, the non-cash costs of operating power and equipment, the rental value of land, and similar items were all included at market prices in determining the total cost of producing one acre of tomatoes for processing. However, to find out how much of the cost of producing these tomatoes actually was paid out by the operator in cash during the year, the above items were not included in the calculations.

If the actual "out-of-pocket" expense per acre is subtracted from gross cash income per acre, the result tells the operator how much he got back for the use of his own labor, land, and equipment which otherwise might not have been used. Such calculations were made and are presented in table 22 together with the total cost figures for these resources computed using market prices.

TABLE 22. THE AVERAGE CASH OUTLAYS IN PRODUCING ONE ACRE
OF TOMATOES FOR PROCESSING COMPARED WITH
ALL OF THE COSTS OF PRODUCTION
(40 Small Tomato Enterprises, Western New York, 1954)

	Average cash cost	Average total cost
Acres of tomatoes	5.0	5.0
Yield per acre, tons	8.2	8.2
<u>GROWING COSTS:</u>		
Labor and power:		
Man	\$ 11.71	\$ 39.80
Tractor	7.30	14.61
Other power	.65	1.09
Fertilizers:		
Commercial	33.86	33.86
Manure	---	6.02
Cover crops	.61	1.54
Lime	2.20	2.20
Spray and dust	13.94	14.47
Plants and seed	36.43	36.43
Land charge	1.84	13.01
Use of equipment	4.92	11.58
Irrigation	.80	2.68
Interest	---	2.66
TOTAL GROWING COST	\$ 114.26	\$ 179.95
<u>HARVEST COSTS:</u>		
Labor for picking, hauling and supervision	49.14	77.91
Trucking and other power	8.42	11.97
Miscellaneous	---	.17
TOTAL HARVEST COST	\$ 57.56	\$ 90.05
TOTAL COST PER ACRE	\$ 171.82	\$ 270.00
TOTAL CASH INCOME PER ACRE	\$ 246.53	\$ 246.53
NET RETURN		\$ -23.47
DIFFERENCE BETWEEN CASH INCOME AND EXPENSE	\$ 74.71	

Looking at the small tomato enterprises in this way indicates some of the reasons why many of these small acreages are planted and harvested. It also shows what a large share of the costs on such small acreages are non-monetary in any given year. Even though the small operators averaged a net loss of over \$23 per acre when all the resources they used were valued at going market rates in the area, they averaged a \$75 net return for the use of their land, equipment, and the labor of themselves and their families. In other words, operating as they did, they obtained an average return of 75 percent as much for the use of these resources as other commercial farmers were willing to pay for them in the area. All but 12 of the 40 operators were able to at least recover something for their time, land, and equipment use.

Almost \$100 of the \$270 worth of resources used in producing 8.2 tons of tomatoes for processing were non-cash expenditures. (See table 22.) The operator's labor and that of his family accounted for nearly \$57 of this difference or more than half of the total. The use of power and equipment was charged at nearly \$18 less per acre considering only cash costs such as repairs and gasoline. The land charge was reduced by over \$11 per acre. Most of the other major expenditures were out-of-pocket costs such as fertilizer, plants, picking labor, and spray or dust material.

THE EFFECT OF DIFFERENT PRACTICES ON YIELDS AND NET RETURNS

Without better than average yields, it is usually difficult to make much of a profit in producing most vegetable crops. Tomatoes are no exception to this rule. Regardless of the year there will be variation from farm to farm in yields and net returns. Variation in tomato yields in Western New York was sizeable in 1954 despite the rather abnormal growing season. The unusually dry weather during the early growing period and the cold, wet, harvest season were described by most growers as quite damaging to yields. Yet, a number of growers were able to obtain yields of 15 tons per acre or more. This suggests that many of the yield differences which did occur were the results of management and factors over which individual growers have some control.

Every producer knows that a combination of many different things determines how large his crop will be. No single practice is most important. There are many joint relationships. For example, large amounts of commercial fertilizer are of little value to a crop without adequate amounts of moisture. Some of these relationships in the larger tomato enterprises will be examined in this report to illustrate how management, cost, weather, and yields were inter-related in 1954.

Value of All Plant Nutrients Added

Plant nutrients should be present in the soil in a readily available form in such amounts that plant growth will not be seriously limited by the lack of any one of them. Yields commonly increase as farmers add more plant nutrients to a soil. However, there is usually a point after which yields do not increase rapidly enough to pay for adding more fertilizer. It is at this point that the use of additional amounts of fertilizer or other sources of plant nutrients should be curtailed since they will not be used economically.

In a year when unusual weather conditions prevail it is especially difficult to appraise how effectively fertilizers were used or to draw conclusions from fertilizer and yield data which will have some application for another year. An examination of the relationship of yield responses to the varying amounts of nitrogen, phosphate or potash added from commercial fertilizers indicated very little. There were both high and low yields for nearly any level of N, P₂O₅, or K₂O applied.

The relationship between the value of all plant nutrients added from commercial fertilizers, manure, cover crops, and lime and yields is shown in table 23. Those producers who added the most plant nutrients per acre also had the highest growing costs. But not all of

TABLE 23. THE VALUE OF ALL PLANT NUTRIENTS ADDED
AS RELATED TO YIELD AND OTHER FACTORS
(54 Large Tomato Enterprises, Western New York 1954)

Value of nutrients added	Total cost to grow	Yield per acre
Less than \$35	\$127	9.0
\$35 - 44	168	10.0
\$45 - 54	169	12.0
\$55 and over	192	10.7

these intensive producers obtained additional yields for their increased expenditure on fertilizers. There was some relationship between yields and the value of the nutrients added up to \$50 or \$55 per acre. After this there was little response on the average for the added expenditure.

Total Cost of Growing

The cost of all the resources used in growing an acre of tomatoes indicates the intensity with which growers were trying to use their inputs on each acre. When compared with the yields and net returns which resulted, it shows how effectively these resources were used.

TABLE 24. THE COST OF GROWING TOMATOES AS RELATED
TO YIELD AND NET RETURNS PER ACRE
(54 Large Tomato Enterprises, Western New York, 1954)

Cost per acre	Number of enterprises	Net return	Yield per acre (tons)
Less than \$130	6	\$117.	10.3
\$131 - 150	12	59.	10.0
\$151 - 170	11	34.	9.8
\$171 - 190	12	21.	10.4
over \$190	12	23.	12.2

In 1954, most growers were not able to increase yields enough to pay for the use of more resources in growing each acre. The average yield per acre for each of the cost groups shown in table 24 was very similar. As a result average profits decreased steadily as the amount spent in growing each acre increased. Within each of the cost groups indicated in the table, there was considerable variation in yields. Both high and low yields occurred in every case regardless of the amount spent in growing the crop.

Labor Used in Growing the Crop

Efficiency in the use of labor can make a great deal of difference in the cost of producing a crop. It should not take much more labor to grow a large yield on every acre than to grow a small one. The relationship existing between the hours of labor spent in growing each acre of tomatoes, the net returns resulting, and yields suggests some interesting things about management. (See table 25.)

TABLE 25. HOURS OF LABOR TO GROW AS RELATED
 TO YIELDS AND NET RETURNS
(54 Large Tomato Enterprises, Western New York 1954)

Labor to grow (hours)	Weeding and hoeing (hours)	Net return	Yield per acre (tons)
10 - 20	2.4	\$103.	11.5
21 - 30	5.9	50.	11.2
31 - 40	11.0	41.	11.0
over 40	22.3	8.	9.1

Those producers spending the smallest amount of time per acre in bringing their tomatoes up to the point of harvest, had just as large yields as the groups spending more time in growing the crop. All of the groups shown in table 25 averaged about the same number of acres of tomatoes per enterprise. Much of the extra labor used was required for hand weeding or hoeing. The results suggest that a better job of fitting the land before setting out the tomatoes and a good job of cultivation might save both time and money. Net returns and yields were lowest on the group of farms using the most labor in growing each acre.

Date of Planting

Nearly all of the producers growing 10 or more acres of tomatoes set out their tomato plants between May 20th and May 30th. Only seven men planted before this period and their results were not much different from the rest. There appeared to be no significant relationship between the time of setting out the plants and the yields obtained.

TABLE 26. DATE OF PLANTING AS RELATED TO
YIELD PER ACRE
(54 Large Tomato Enterprises, Western New York Farms, 1954)

Date of planting	Number of farms	Yield per acre (tons)
Before May 20	7	11.4
May 20 - 24	13	9.6
May 25	16	10.8
May 26 - 30	17	10.8

Supplemental Irrigation

Fourteen of the 54 large tomato producers irrigated a major part of their tomato acreage at least once during the 1954 growing season. From one to four acre-inches of water were applied during the season.

TABLE 27. SUPPLEMENTAL IRRIGATION AS RELATED TO
YIELD AND OTHER FACTORS
(54 Large Tomato Enterprises, Western New York Farms, 1954)

Factors	14 farms using irrigation	40 farms with no irrigation
Acres of tomatoes	25	18
Yield per acre, tons	12.3	10.0
Acre inches of water applied	1.5	---
Commercial fertilizer applied, lbs.		
N	89	83
P ₂ O ₅	159	161
K ₂ O	155	115
Value of all plant nutrients added	\$ 48.	\$ 46.
Total cost to grow one acre	\$ 180.	\$ 161.
Net return per acre	\$ 84.	\$ 29.

All of the producers used their irrigation equipment to supplement the moisture available to other vegetable crops or fruit as well. Besides the charge for extra labor to set up and move the irrigation systems, a flat charge of \$7.00 per acre-inch of water applied was made to cover costs of power and the use of this special equipment.

A comparison of some of the more important features of the enterprises on which irrigation was used with all the other large tomato enterprises is shown in table 27. The irrigated acreage included a few larger enterprises than the rest. Average yields were more than two tons higher. Very similar amounts of fertilizer were used except for potash. Growing costs per acre were higher on the irrigated acreage but yields were increased sufficiently to also provide a greater average net return per acre on these enterprises in 1954.

APPENDIX

Method of Obtaining the Data

Cost of production records for the 1954 crop year were obtained by the survey method from 94 tomato producers in Western New York during December 1954 and January 1955. Physical and financial information pertaining to the production and sale of tomatoes for processing, as well as a brief description of the whole farm business, were acquired by direct interview with operators.

The sample of enterprises studied for each of the two populations was selected in the following manner. Processors of tomatoes operating in the Erie - Chautauqua area and in the Lake Ontario area were contacted in the summer of 1954. Lists of growers and their respective contracted acreages were obtained from all who would cooperate. These lists were then assembled and studied, and the two populations described in this report were identified.

The group of small enterprises (less than 10 acres of tomatoes) made up 72% of all the enterprises included on the lists obtained from the processors. However, their total acreage included a little less than one-third of the tomato acreage contracted. Since these small growers were the less important of the two producing groups, only a five percent sample of this population was drawn. Forty-six growers were selected from the lists after they had been stratified by counties. Only 40 records were obtained. Four refused to give the information. One man had moved out of the state since harvest time. Another was found to qualify as a member of the large growers.

Twenty percent of the enterprises with tomato acreages of 10 or more acres were drawn as the sample of large producers. After the lists had been stratified by counties, 55 producers were selected for study using tables of random numbers. One of these growers refused to give a record, leaving 54 completed cost of production schedules for the large tomato enterprises representing about 12 percent of the state's production in 1954.

Prices and Rates Used in Determining Costs of Production

Whenever possible, actual cash costs were obtained directly from the producer at the time of interview. Costs of commercial fertilizers, spray materials and dusts, rented land, and hired labor were easily obtained. Charges for the use of equipment, power, and the operator's land and labor were more difficult. The following procedures and rates were used:

Land: When the acreage planted to tomatoes was rented, the actual cash paid per acre was charged. Producers growing tomatoes on their own land were asked to estimate it's value per acre if it were offered for rent. Since 40 percent of the growers rented part of the land they operated, rental rates were not difficult to establish in most cases.

Labor: Rates per hour for all classes of labor were estimated by each producer. Farmers either indicated their estimate of the price per hour they would have had to pay to replace themselves or their family on the job, or the price per hour actually paid. These estimates were often obtained by estimating average monthly wages and hours worked per month. Four general classes of labor were established with a rate for each: - operators, family, regular hired, and day or special labor. The average of the rates per hour estimated by these producers for each class of labor follow:

<u>Class of labor</u>	<u>Rate per hour</u>	
	<u>Small enterprise</u>	<u>Large enterprise</u>
Operator	\$ 1.15	\$ 1.30
Family	.92	.87
Regular hired	.92	.95
Day or special	.90	.83

Tractors and Trucks: Producers indicated the size of tractors and trucks they owned and estimated how heavily each of these sources of power was used. A schedule of rates for each classification of size and rate of use was developed from New York cost account data and applied accordingly on all farms.

One Plow Tractor

<u>Hours used</u>	<u>Rate per hour</u>
Under 375	\$.75
375 - 525	.60
over 525	.45

Two Plow Tractor

<u>Hours used</u>	<u>Rate per hour</u>
Under 425	\$1.00
425 - 625	.80
over 625	.65

Three Plow Tractor

<u>Hours used</u>	<u>Rate per hour</u>
Under 450	\$1.35
450 - 650	1.10
over 650	.90

Small Truck (1 ton or less)

<u>Miles driven</u>	<u>Rate per mile</u>
Under 5,000	\$.11
5,000 - 7,000	.09
over 7,000	.075

Large Truck (over 1 ton)

<u>Miles driven</u>	<u>Rate per mile</u>
Under 2,750	\$.25
2,750 - 4,250	.17
over 4,250	.13

Lime and Manure: The cost of lime and manure applied to the fields upon which tomatoes were grown in 1954 was pro-rated over a three year period. Fifty percent of the value of manure or lime applied in 1954 was charged to the 1954 crop; thirty percent of that applied in 1953 and twenty percent of that applied in 1952 were also charged to the 1954 crop of tomatoes. The average charge for manure spread on the field was approximately \$3.00 per ton.

Equipment: A flat charge of \$5.00 per acre was made for the use of plows, fitting equipment, and cultivators on all farms. This was derived from average annual costs for such equipment on New York cost account farms. It covers depreciation, interest on investment, repairs, and costs of servicing. An additional charge was made for any special equipment used such as sprayers, dusters, and setters. These costs were individually determined from the farmer's estimate of annual costs of operating the machine and the number of acres on which it was used.

Other: Cover crops such as rye, small grains, or grasses, were charged at the farmer's estimate of their cost per acre. Where such estimates could not be made by the farmer a flat charge of \$3.00 per acre was made for the cover crop plowed down. Horse labor was charged at \$.50 per hour. The use of automobiles was rated at \$.05 per mile. The charge made for irrigation was \$7.00 per acre-inch. This charge did not include the labor for setting up and moving irrigation equipment which was included separately in the labor for growing.