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Costs and Returns in Producing Broccoli for Processing

50 Farms, Western New York 1954

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INTRODUCTION

Broccoli is a relatively new crop to most farmers in New York. A few market gardeners have grown a limited acreage for some time. Most of this production was located on Long Island and the bulk of the crop was sold on the fresh market. During the last ten years, processors have introduced frozen broccoli to consumers and a new market for this vegetable has been developed.

Most of the expansion in broccoli production for processing in New York has occurred during the last five or six years. It was an important vegetable crop on about 100 farms in the state in 1954. Most of these farms are located in the Western New York counties bordering on Lake Ontario: - Niagara, Orleans, and Monroe. However, since the crop is relatively new to this area the extent and location of production is far from stable. Acreage may continue to increase in this area or others in the state. It may decline because of more favorable alternatives.

Major Areas of Production

California produced about half of the broccoli sold for processing and the fresh market in the United States in 1954. Other important producing states are Texas, New Jersey, Pennsylvania, Washington, and Arizona. Information on the amount of broccoli actually processed annually by states is not readily available. The relative importance of this crop as a processing vegetable in different areas is also difficult to appraise. New York and New Jersey seem to be the most important producing states in the East. Nearly all of the acreage grown in the United States is irrigated or can be irrigated supplementally.

Organization of Study

This report summarizes a study of costs and returns in producing broccoli for processing in 1954 in Western New York. Nearly all of the broccoli processed in the state is produced in this area. Lists of broccoli growers contracting acreage were obtained from all the processors operating in the area. From the group of farmers

contracting five or more acres of broccoli, 50 were randomly selected for study.[1] This sample included over half of the enterprises in the area. From a total of nearly 1,000 acres this group sold over 1,700 tons of broccoli or about 60 percent of the crop packed in the area.

The location of the broccoli enterprises, which make up the population described in this report, is shown in figure 1. The farms were quite widely scattered in Monroe, Niagara, and Orleans Counties. Nearly all were situated on high lime soils. There was a wide variety in the structure and permeability of these soils. A significant number of farmers grew part or all of their broccoli on soils which were imperfectly drained.

TABLE 1. SOME CHARACTERISTICS OF THE FARMS ON WHICH BROCCOLI PRODUCTION WAS STUDIED (50 Western New York Farms, 1954)

Characteristic	Average for all farms
Number of farms	50
Acres of broccoli	19
Acres operated:	
Owned	205
Rented	29
Total operated	234
Use of cropland: (acres)	
Vegetable crops	69
Corn and small grain	61
Fruit	18
Hay, pasture, or idle	34
Total cropland	182
Work units:	
Crops	1329
Livestock	149
Total work units	1478

1/ See Appendix for a more complete description of the method of selecting the sample of farms studied.

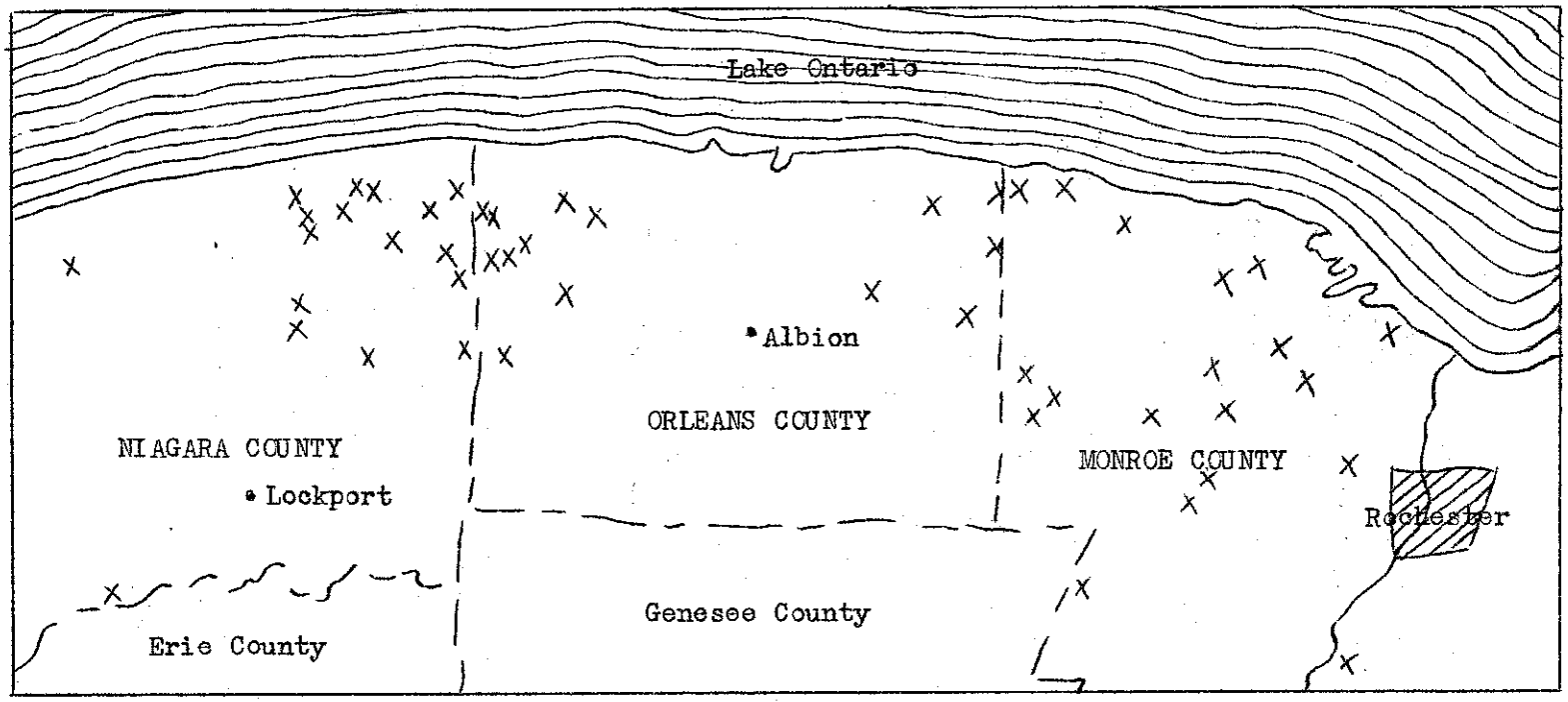

FIGURE 1. LOCATION OF BROCCOLI PRODUCERS STUDIED
(50 Western New York Farms, 1954)

Broccoli was an important source of income on most of the farms growing this vegetable but seldom was it the most important crop grown. All but three of the farmers grew at least one other vegetable commercially besides broccoli. The majority produced from three to five vegetable crops. Cabbage, tomatoes, and snap beans were grown on more than half of the farms. Peas, cucumbers, potatoes, cauliflower and sweet corn were also important.

About 60 percent of the farms studied derived most of their income from the sale of vegetables and grain. Another 25 percent could best be described as fruit and vegetable farms. The remainder had an important livestock enterprise, most commonly dairy cattle, along with either fruit or vegetables. Farmers with experience in producing other vegetables for fresh market or processing were the ones growing this relatively new crop. They were able to combine broccoli production with a surprising variety of other enterprises with varying degrees of success. No general pattern of production or combination of enterprises could be distinguished as most favorable. However, there are some obvious advantages of broccoli production on farms where spray or dusting equipment is already necessary, where supplemental irrigation is available, and where special picking or piece work labor is regularly employed.

All of the men producing broccoli were full time farmers. The husbandry and care required to grow five acres or more of this crop are such that a part-time farmer under most circumstances cannot do a good job of production. Previous experience with other vegetable crops of an intensive nature was thought to be important by most growers. Only three were currently growing no other vegetable crop.

AVERAGE COSTS AND RETURNS IN 1954

It is the purpose of this report to describe the operation and management of broccoli enterprises in Western New York during 1954. The averages presented should be useful to individual producers in making comparisons with their own enterprises as well as indicating the general structure of costs and returns for this crop. An indication of the amount of variability between farms in yields, costs, and production methods will be presented as well. Each enterprise, regardless of its size, was given the same weight in determining the averages presented.

Practices and Inputs Used in Producing Broccoli

General Practices - Although broccoli is a relatively new crop to most producers in Western New York, the production methods followed were quite similar. There were more variations in the amounts of inputs used than in timing of operations or the actual husbandry of the crop. Nearly all the growers produced their own plants for transplanting. Broccoli was set out in early July by most growers. All but 10 of the 50 producers had their crop out of the seed bed and into the fields by July 20. Plants were set with the aid of a regular mechanical setter. Nearly all of the plants were watered when placed in the ground and a high analysis starter solution added. Most growers felt that this starter solution had been very useful in getting the young plants established and growing. About half of the farmers cultivated this row crop three times. Most of the rest cultivated four or five times. Fourteen producers also weeded or hoed part of the acreage at least once.

The spray or dust program, largely to control insects and aphids, was more variable. One third of the producers used only dusts, another third used only sprays, and the last third used some combination of the two. The number of applications of spray or dust materials ranged from one to ten. Three materials were used by

Number of times sprayed or dusted	Number of farms
1 - 4	12
5	11
6	12
7 - 8	11
8 - 10	4

nearly all producers to control aphids and cabbage worms or lupers. These were parathion, DDT, and TEPP.

Labor - Labor is the biggest item of cost in growing, harvesting, and delivering broccoli for processing. The largest share of this total is used in harvesting the crop. The size of the crop therefore is important in determining the cost of labor per acre. Harvest labor was paid on a piece rate basis on 20 farms with $.25 and $.30 per bushel the most common rates. Twenty-five paid for cutting broccoli by the hour. A combination of the two methods were used by the other five operators. The amount of the operators' time required to locate, transport, and supervise this labor was even more variable. There was no common pattern evident.

The amount of labor used to grow the crop was also highly variable. The averages shown in table 2 do not show the extent of this variability but indicate that the number of hours spent in bringing the crop up to harvest had little to do with the size of

yields. Four farmers indicated that they spent less than 20 hours growing their crop; 15 farmers reported using 20 - 29 hours of labor; 14 took between 30 and 40 hours to grow their crop. Seventeen required more than 40 hours.

Power - Tractor power was used between 10 and 20 hours on 70 percent of the enterprises. There were only two enterprises which deviated from the averages by more than 10 hours.

Truck use was much more variable. Distance from the processing plant, the size of yields, and the method of transporting harvest labor were all important considerations. Only one man hired all his hauling done. The other producers operated from one to four trucks of their own. The range in miles was very wide: - from 10 to over 200 miles per acre of crop harvested. Since broccoli is a relatively bulky crop to handle, large yields had a more pronounced effect on trucking costs than is true for most vegetable crops.

TABLE 2. AVERAGE AMOUNTS OF INPUTS USED TO PRODUCE ONE ACRE OF BROCCOLI (50 Western New York Farms, 1954)

Input	Your farm	All farms	25 farms with highest yields	25 farms with lowest yields
Man hours (not including harvest)	_____	35.8	35.0	36.5
Tractor hours:				
Growing	_____	15.3	14.8	15.8
Harvest	_____	1.4	1.5	1.2
Total hours	_____	16.7	16.3	17.0
Truck miles:				
Growing	_____	5.2	6.4	4.1
Harvest	_____	65.6	83.2	48.0
Total miles	_____	70.8	89.6	52.1
Auto miles	_____	5.5	2.3	8.7
Broccoli plants	_____	7390	7730	7050
Commercial fertilizer, lbs.				
N	_____	111	129	94
P_2O_5	_____	104	132	77
K_2O	_____	94	114	74
Acres of broccoli	_____	19	25	13
Tons of broccoli, sold	_____	1.6	2.2	1.0

Plants - Most farmers set between 6,000 and 8,000 plants per acre. However, there were ten men who reported setting more than 8,000. The average number of plants set by the twelve men who used supplemental irrigation was about 8,000 per acre. The two varieties which predominated were Early Green and Waltham. Over half of the growers had plantings of both of these varieties. The only other variety of any importance was Italian Green Sprouting grown by nine men.

Fertilizers - Commercial fertilizers were used liberally. The averages shown in table 2 indicate that the equivalent of 1,000 lbs. of a 10-10-10 fertilizer was used and then supplemented with side dressings of nitrogen. The amounts and kinds of fertilizer used were quite diverse. One enterprise, which used irrigation, applied nearly 250 lbs. of each of the three ingredients per acre. No one applied less than the equivalent of 600 lbs. of a 10-10-10 mixture per acre. There was a range in commercial fertilizer cost of from $15 to $75 per acre. Eighty percent of the farmers side-dressed with nitrogen. A few also applied phosphate and potash with the nitrogen at the time of cultivation.

Cover crops were plowed down on at least half of the acreage used for broccoli by 15 men. Lime was added by half of the group. Manure was used to provide plant nutrients and humus on nearly half of the farms as well.

The Cost of Producing One Acre of Broccoli [1/]

The average cost of producing 3,250 pounds of saleable broccoli per acre in Western New York in 1954 was about $240. The cost of growing the crop was greater than the cost of harvesting it in all but two cases. Two-thirds of the total production costs were commonly used for growing the crop even on farms with high yields.

Growing Costs - Broccoli is an intensive crop to grow. Large amounts of capital are quickly tied up in the crop before harvest. Labor and power make up about 1/3 of the growing costs on most farms. Fertilizers make up another 30 percent of the total. Spray and dust materials are also important cash costs, commonly equaling from 10 to 20 percent of the cost of growing.

Variations in the amount spent to grow the crop, however, are relatively great. One farmer reported investing less than $100 per acre in the crop. Others spent more than $200 to grow an acre

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1/ The procedures used and methods of establishing rates charged are discussed in more detail in the Appendix, pp. 21.

TABLE 3. THE AVERAGE COST OF PRODUCING ONE ACRE OF BROCCOLI FOR PROCESSING (50 Western New York Farms, 1954)

	Your farm	All farms	25 farms with highest yields	25 farms with lowest yields
Acres of broccoli		19	25	13
Yield per acre (tons)		1.6	2.2	1.0
Growing Costs:				
Labor:				
Man		$ 38.13	$ 38.14	$ 38.12
Tractor		11.00	10.89	11.12
Other power		3.07	2.11	4.02
Fertilizers:				
Commercial		35.55	41.80	29.31
Manure		3.62	3.96	3.28
Cover crops		1.27	1.78	.76
Lime		1.77	2.35	1.18
Spray and dust		22.10	26.37	17.82
Plants and seed		14.81	15.31	14.30
Land charge		9.10	11.16	7.04
Use of equipment		10.66	10.89	10.43
Irrigation		4.16	7.70	.63
Interest		2.32	2.59	2.06
Total Growing Cost		$157.56	$175.05	$140.07
Harvest Costs:				
Labor for cutting, hauling, supervise		$ 71.53	$ 96.63	$ 46.42
Trucking and other power		10.67	12.67	8.67
Other		1.12	1.51	.73
Total Harvest Cost		$ 83.32	$110.81	$ 55.82
TOTAL COST PER ACRE		$240.88	$285.86	$195.89

of broccoli. Very often the proportion of the total growing cost spent for such items as commercial fertilizer, spray and dust, and land rent were similar even though the actual dollars spent for these items were quite different. This reflects differences in intensity of production. Some growers were trying to obtain much higher yields per acre by using heavier concentrations of fertilizer, supplemental irrigation, and higher quality land.

TABLE 4. DISTRIBUTION OF GROWING COST PER ACRE
(50 Western New York Farms, 1954)

Cost per acre	Number
Less than $100	1
$100 - 120	7
$120 - 140	5
$140 - 160	15
$160 - 180	9
$180 - 200	8
over $200	5

Half of the growers rented all or part of the acreage on which they grew broccoli. Rental rates ranged from $5 to $25 per acre. The higher charges were for well drained soils which in most cases could be irrigated. The amount spent for adding plant nutrients in all forms ranged from $20 to $80. Even the cost of materials for a spray or dust program was quite variable. Five spent less than $10 per acre for these materials but all had low yields. Some of the men who were protecting much larger crops spent as much as $40 per acre for insect control materials alone.

Harvest Costs - Cutting and hauling broccoli to a processing plant made up from 25 to 50 percent of the total production costs. Harvest labor was the biggest item in the total. Broccoli was cut

TABLE 5. DISTRIBUTION OF LABOR COST TO HARVEST ONE TON OF SALEABLE BROCCOLI
(48 Western New York Farms, 1954) 1/

Cost per ton	Number of farms
$30 - 40	18
$40 - 50	13
$50 - 60	11
$60 or more	6

1/ Two farmers had no saleable crop to harvest.

on both an hourly and piece rate basis. There was a wide range in the amount reported spent to harvest a ton of the crop on both bases. As the frequency distribution in table 5 shows, no general pattern for harvesting has been established. Part of the difference in the cost of cutting a ton of saleable broccoli results from differences in the yield per acre each time over. The amount of time spent cutting spears at the end of the season can also raise harvest costs per ton, even though this may be a profitable operation from the standpoint of the entire enterprise.

Total Returns and Profits per Acre

The gross income received from broccoli depends on the size and quality of the yield per acre. Total returns per acre ranged from nothing to $480 for yields varying from no saleable crop to 3.3 tons per acre. The high average value of this crop per acre and the amount of resources required to produce 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 gross income per acre from broccoli was the yield actually sold. The yield data presented in this report indicate the number of pounds of broccoli for which the producer was paid per acre. Culls are not included. No estimate was made of the crop which was left in some fields unharvested. Therefore the yield information does not give a complete picture of the size of the crop produced, part of which was not delivered to any buyer.

TABLE 6. DISTRIBUTION OF BROCCOLI YIELDS PER ACRE
(50 Western New York Farms)

Yield per acre (tons)	Number of farms
Less than 1.0	9
1.0 - 1.5	12
1.5 - 2.0	17
2.0 - 2.5	5
over 2.5	7

The average yield per acre was 3,250 lbs. of broccoli which graded as either #1 or #2. About 25 percent of the growers sold more than 2.0 tons per acre. The largest group had yields between 1.5 and 2.0 tons. A few of those who had yields of less than 1.0 ton per acre lost part of their crop because of poor aphid and insect control.

Quality and Price per Ton - Farmers received between $140 and $150 per ton for broccoli which graded as #1 and $90 per ton for #2's. Culls made up from 5 to 15 percent of the total crop hauled to the processing plants. An average of better than 80 percent of the remainder graded as #1. There was not a great variation in the average price received by individual farmers. Everyone included in the study sold 60 percent or more of his crop at the higher grade. The lowest average price reported was $128 per ton and the highest $145. This reflects the range in quality under present grading standards.

TABLE 7. RETURNS PER ACRE FROM PRODUCING BROCCOLI FOR PROCESSING (50 Western New York Farms, 1954)

	Your farm	All farms	25 farms with high yields	25 farms with low yields
Yield per acre, tons		1.6	2.2	1.0
Average price per ton		$140.00	$140.00	$140.00
Total return per acre		$228.81	$314.68	$142.93
Total cost per acre		$240.88	$285.86	$195.89
Net return per acre		$-12.07	$ 28.82	$-52.96

Net Returns - Only 18 producers or 36 percent of the total showed a profit on their broccoli enterprises in 1954. The rest ranged from nearly breaking even to losses well over $100 per acre. The information in table 7 and figure 2 indicate most of the farmers with above average yields made a profit. However the variation in net returns was very great for men with very similar yields. It took a combination of relatively high yields and "reasonable" growing costs to make profits on broccoli in 1954. A majority of the producers in Western New York were not able to achieve both.

Yield Necessary to Break Even

The sale of 1.85 tons of broccoli per acre was sufficient to guarantee breaking even on this enterprise on all but two farms in 1954. Three men with smaller yields were also able to make a profit per acre.

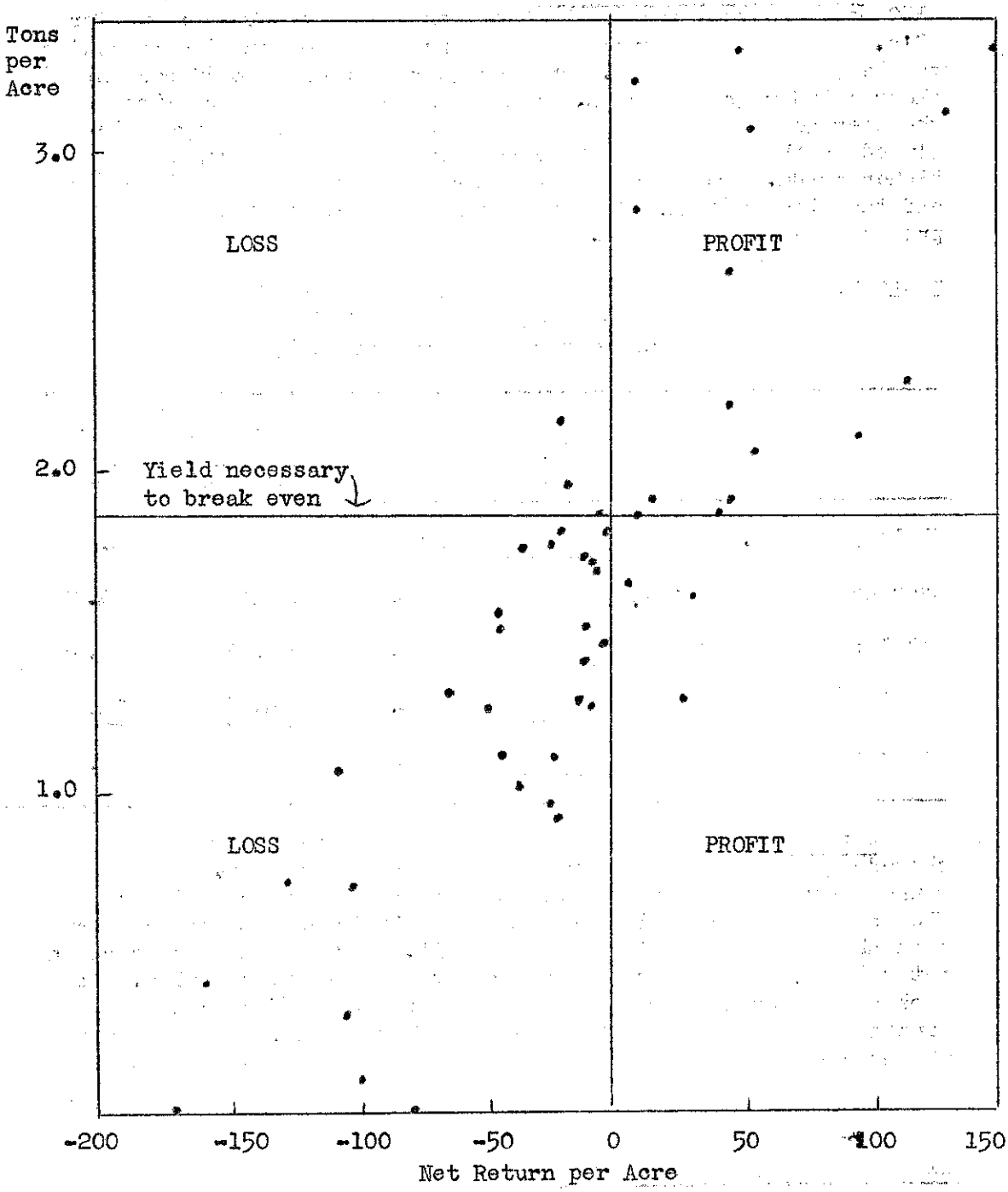

FIGURE 2. THE RELATIONSHIP BETWEEN YIELD AND NET RETURN PER ACRE OF BROCCOLI FOR PROCESSING (50 Enterprises in Western New York, 1954)

The relationship between yield and net return per acre is shown in figure 2. The amount of scatter in the diagram indicates that yield was not the only important factor affecting profits in this enterprise. However it also demonstrates that without a yield of 1.85 tons per acre it was very difficult to make money on this enterprise. Probably a yield of 2.0 tons of saleable broccoli per acre is a good minimum goal to work toward.

Variations from the general trend in the relationship between yield and profits show how important good husbandry and cost management may be for this enterprise. Consider two farmers with quite similar high yields. One showed a profit of less than $10 per acre for a yield of 2.8 tons per acre. The other netted over $130 per acre for his yield of 3.1 tons per acre. Gross returns and yields were acceptable in both cases. However in the first instance both harvesting costs and growing costs were very high. Some of the resources devoted to broccoli were not being used completely or very effectively. High yields can be obtained at too high a cost.

THE EFFECT OF DIFFERENT PRACTICES ON YIELDS AND NET RETURNS

Without better than average yields, it is difficult to show a profit in producing broccoli. Yield variation in Western New York in 1954 was relatively great. That part of the broccoli crop which was not sold on some farms may explain part of this variation, but probably not very much of the total. The weather during the growing season was unusual but quite uniform throughout the area covered by the study. The early summer months were very dry, while the fall months were unusually wet. However, most of the yield differences from farm to farm resulted from differences in management, factors over which individual producers have some control.

It is not enough merely to point out that high yields are profitable and low ones are not. The real question is how can these yields be obtained regularly at a reasonable cost. This kind of report or analysis will not answer this question satisfactorily. However, it can point out some of the more important factors to consider and can show what happened when a group of producers followed different practices.

Every producer knows that a combination of many different things determines how big his crop will be. No single practice is most important. For example, without adequate amounts of moisture, large amounts of commercial fertilizer cannot be fully utilized. Such joint effects as these make it difficult to study yield data and appraise what each practice or condition contributed

to the final result. Hence, the following tabulations must be interpreted with care in studying how to increase yields at a "reasonable cost".

The practices and factors considered will be those over which the producer has some control, and which can be measured with reasonable accuracy. These include (1) the amounts of the major plant nutrients applied from commercial fertilizers, (2) the value of all the different sources of plant food added to the soil such as manure, lime, cover crops, and commercial fertilizers, (3) the total cost of growing per acre, which summarizes in value terms all the inputs used per acre, (4) the size of the enterprise, measured in acres, (5) the date of transplanting, and (6) the use of supplemental irrigation.

Commercial Fertilizers

The important nutrients commonly added to soils through commercial fertilizers are nitrogen (N), phosphate (P_2O_5), and potash (K_2O). Boron was also added in small amounts with the other elements by more than half of the producers. Plant nutrients should be present in the soil in a readily available form in such amounts that plant growth will not be limited by the lack of any one of them. When deciding how much fertilizer to apply, the amounts already present in the soil are important. The nature of the crop, the number of plants per acre and their competition from weeds, as well as the weather have a great deal to do with how rapidly the different nutrients are used. For all these reasons, the amount of commercial fertilizer added in any one year by different producers will give dissimilar results because of other dissimilar conditions before and during the growing season.

Nitrogen - Nitrogen was applied at a wide range of rates. Four producers applied more than 200 lbs. per acre. Besides the nitrogen applied as part of a complete analysis fertilizer before and at planting time, relatively large amounts of ammonium nitrate were added as a side dressing by 80 percent of the growers. Those who used large amounts of nitrogen generally added large amounts of potash and phosphate as well.

There appears to have been some response to additional amounts of nitrogen up to 150 lbs. per acre. However, simply adding large amounts of nitrogen did not guarantee high yields. Five of the eleven producers in the group applying the most nitrogen per acre had below average yields.

TABLE 8. RATE OF NITROGEN APPLICATION AS RELATED TO YIELD AND OTHER NUTRIENTS IN PRODUCING BROCCOLI (50 Western New York Farms, 1954)

Rate of application	N	P_2O_5	K_2O	Yield per acre
	(pounds per acre)			(tons)
30 - 70 lbs.	53	60	57	1.2
71 - 110 lbs.	89	96	87	1.4
111 - 150 lbs.	135	126	108	2.0
over 150 lbs.	175	139	128	1.9

Phosphate - Phosphate was applied in substantial amounts by most growers. The range was from 40 to 260 pounds per acre. The larger amounts of phosphate were generally applied by the larger operators on the higher valued land.

TABLE 9. RATE OF PHOSPHATE APPLICATION AS RELATED TO YIELD AND OTHER NUTRIENTS IN PRODUCING BROCCOLI (50 Western New York Farms, 1954)

Rate of application	P_2O_5	N	K_2O	Yield per acre
	(pounds per acre)			(tons)
40 - 70 lbs.	53	57	50	1.0
71 - 100 lbs.	79	111	78	1.9
101 - 130 lbs.	109	148	98	1.7
over 130 lbs.	175	132	151	2.0

The data do not suggest any clear cut response to additional amounts of phosphate above 70 pounds per acre on these farms in 1954. On many farms in this area soil tests indicate that high levels of phosphate have been built up over the years by adding phosphate through commercial fertilizers that was not used by the crops for which it was intended. The value of taking stock of supplies of available phosphate already present in the soil before adding more seems evident.

Potash - Potash was also applied in liberal amounts by most producers. The extremes were 30 and 260 lbs. per acre. There were equivalent numbers in each of the groups shown in table 10. Those who used large amounts of potash also applied phosphate and nitrogen liberally.

TABLE 10. RATE OF POTASH APPLICATION AS RELATED TO YIELD AND OTHER NUTRIENTS IN PRODUCING BROCCOLI (50 Western New York Farms, 1954)

Rate of application	K_2O	N	P_2O_5	Yield per acre
	(pounds per acre)			(tons)
30 - 60 lbs.	48	68	59	1.1
61 - 80 lbs.	75	104	85	1.9
81 - 110 lbs.	96	145	114	1.6
over 110 lbs.	157	131	159	2.0

As was true in the case of phosphate, these data do not show any definite general response to additional quantities of potash above 60 or 70 pounds per acre. The supply of available potash already present in a soil on which broccoli will be grown should be determined before adding large quantities of this plant nutrient which will not be used immediately.

Cost of All Plant Nutrients Added

Commercial fertilizers are not the only source of plant nutrients which farmers add to their soils. Manure, cover crops, grass or legume sod, plant residues, and lime all contribute plant nutrients or make nutrients already present more readily available. Values were placed on all these sources of plant food and their cost per acre was determined for each enterprise. Variations in the composite value of all these sources of nutrients applied do not appear to explain very much of the variation in yields if at least $30 worth of nutrients were added per acre.

Those who spent the most for plant nutrients per acre tended to be the larger operators and those who had high growing costs. As the analysis of the commercial fertilizer elements suggests, merely devoting a large amount of money to adding plant nutrients does not insure high yields. Supplies of nutrients already present need to be considered first.

TABLE 11. THE VALUE OF COMMERCIAL FERTILIZER, MANURE, LIME AND COVER CROPS AS RELATED TO YIELD AND OTHER FACTORS IN PRODUCING BROCCOLI (50 Western New York Farms, 1954)

Value of nutrients added (per acre)	Acres of broccoli	Total cost to grow (per acre)	Yield per acre (tons)
Less than $30	12	$130.	0.8
$30 - 40	18	$144.	2.0
$40 - 50	20	$165.	1.4
over 50	27	$190.	2.3

Total Cost of Growing

The cost of all the resources used in growing an acre of broccoli for processing indicates the intensity with which growers were trying to use their inputs on each acre. It also shows something of their managerial skills when compared with the yields and net returns which resulted. The main question here is: - did those who spent more money to grow this crop produce enough more broccoli to more than pay for the additional resources? In actual fact some did and still others did not.

TABLE 12. THE COST OF GROWING BROCCOLI PER ACRE AS RELATED TO YIELD AND NET RETURNS (50 Western New York Farms, 1954)

Cost per acre	Average growing cost	Net return (per acre)	Yield per acre (tons)
$100 - 140	$116.	$-20.71	1.0
$140 - 155	$148.	$-12.98	1.5
$155 - 180	$166.	$-12.92	1.7
over $180	$200.	$- .67	2.2

On the average, yields increased and the amount of net loss per acre decreased as more money was spent in growing each acre of broccoli. However, in each of the cost groups shown in table 12, there were both producers who lost money and those who made a profit

on the enterprise. Among those with the lowest growing costs per acre were four who showed profits on their enterprises. Within the high cost group, which showed the smallest loss as a whole, there were only 6 of the 13 producers who did not lose money. One must conclude that increasing intensity will be profitable only if the additional expenditure will have a definite positive effect on yields.

Size of Enterprise

The large broccoli enterprises as a group had somewhat the more efficient operations studied. However, their advantage in production was not clear cut. There was no important difference in the average amount spent per acre to grow the crop among the different size groups. However 9 of the 12 men using supplemental irrigation were among those with the largest acreages. The larger operators were also able to obtain greater efficiency in the use of such specialized equipment as setters, sprayers, and irrigation equipment. Nevertheless, 7 of the 12 largest growers showed a net loss for their operations. There was more variation within each of the size classes shown in table 13 than between the different groups.

TABLE 13. ACRES OF BROCCOLI PRODUCED AS RELATED TO YIELD AND OTHER FACTORS (50 Western New York Farms, 1954)

Acres	Cost of growing (per acre)	Yield per acre (tons)	Net return per acre
4 - 6	$147.	1.4	$-21.22
7 - 10	$163.	1.6	$-33.37
11 - 20	$161.	1.7	$ .66
over 20	$159.	1.8	$ 9.43

Date of Setting Plants

Most growers set out their broccoli during the first three weeks of July. Only one producer who set plants either earlier or after this period in July had above average yields. In 1954 all of the growers who had well above average yields set out at least part of his crop during the first two weeks of July.

TABLE 14. DATE OF TRANSPLANTING AS RELATED TO YIELD PER ACRE IN PRODUCING BROCCOLI (50 Western New York Farms, 1954)

Date of planting	Number of farms	Yield per acre (tons)
Before July 1	3	1.6
July 1 - 10	17	1.9
July 11 - 20	20	1.7
July 21 - 31	6	0.9
after Aug. 1	4	1.0

Supplemental Irrigation

Twelve farmers irrigated their broccoli acreage at least once during the 1954 growing season. From one to four and a half acre-inches were applied. All of these producers used their irrigation equipment for other vegetable crops or fruit as well. Besides the charge for extra labor required to set up and move the irrigation systems, a flat charge of $7.00 per acre-inch applied was made to cover costs of power and the special equipment involved. Actual costs were used on two farms where they had already been determined.

TABLE 15. SUPPLEMENTAL IRRIGATION AS RELATED TO YIELD AND OTHER FACTORS IN PRODUCING BROCCOLI (50 Western New York Farms, 1954)

Factors	12 farms using irrigation	38 farms with no irrigation
Acre inches applied	2.5	---
Acres of broccoli	41	13
Yield per acre, tons	2.0	1.5
Net return per acre	$9.74	$-18.57
Commercial fertilizer applied, lbs.		
N	136	104
P_2O_5	130	96
K_2O	119	87
Value of all plant nutrients added	$ 47.00	$ 41.00
Cost of growing per acre	$173.00	$152.00

Supplemental irrigation was profitable in most cases. Two producers using irrigation had below average yields and net losses. It was the larger growers who were using this technique. The initial cost of the special equipment gives the larger operator the opportunity to obtain some efficiency in its operation and use. Those using irrigation applied relatively large amounts of commercial fertilizer and were intensive producers. Their source of water in most cases were creeks fed from the Barge Canal.

APPENDIX

Method of Obtaining the Data

Cost of production records were obtained from 50 broccoli producers in Niagara, Orleans and Monroe Counties in Western New York by the survey method. Physical and financial information pertaining to the operation of the broccoli enterprise during 1954 on each of these farms was obtained during December 1954 and January 1955 by direct interview. Quantities of broccoli sold were verified with totals from the plants where the crop was delivered.

The sample of enterprises studied was selected in the following manner. With the cooperation of the processors operating in Western New York, complete lists of producers who had contracted broccoli acreage in 1954 were obtained during the summer of 1954. Nearly all of the producers were located in the three counties mentioned above bordering on Lake Ontario. It was decided to study the population of broccoli producers located in these counties who had contracted five or more acres with one or more processors. Men with smaller acreages were eliminated and considered as non-commercial producers.

From the group who qualified as commercial producers in the three counties a quota of 50 growers were randomly drawn. This number was established because it insured including more than half of the population which should lend to stability and a reasonable description of the whole population. There were two refusals from the original quota and two replacements were drawn.

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 broccoli was rented, the actual cash paid per acre was charged. Producers growing broccoli on their own land were asked to estimate it's value per acre if it were offered for rent. Since 22 of the 50 growers rented part of the land they operated rental rates were not difficult to establish. The range was from $5 to $25. The higher rates were largely for acreages which had been or could be irrigated.

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:

Class of labor	Rate per hour
Operator	$ 1.35
Family	.95
Regular hired	.95
Day or special	.95

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

Hours used	Rate per hour
Under 375	$ .75
375 - 525	.60
over 525	.45

Two Plow Tractor

Hours used	Rate per hour
Under 425	$1.00
425 - 625	.80
over 625	.65

Three Plow Tractor

Hours used	Rate per hour
Under 450	$1.35
450 - 650	1.10
over 650	.90

Small Truck (1 ton or less)

Miles driven	Rate per mile
Under 5,000	$ .11
5,000 - 7,000	.09
over 7,000	.075

Large Truck (over 1 ton)

Miles driven	Rate per mile
Under 2,750	$ .25
2,750 - 4,250	.17
over 4,250	.13

Lime and Menure: The cost of lime and manure applied to the fields upon which broccoli was 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 broccoli. 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.