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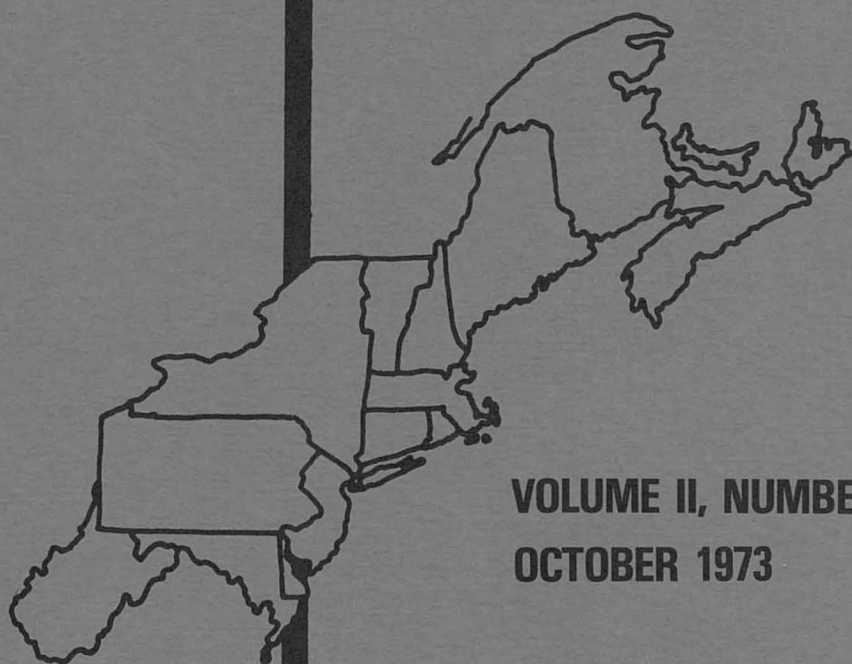
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COSTS AND RETURNS FROM PRODUCING
AND MARKETING MAINE APPLES*

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Apple production in Maine has averaged slightly over 1.6 million bushels per year during the five year period 1966-1970, and annual cash receipts averaged about \$4.1 million for the same five year period. This \$4.1 million of cash receipts represents only about 2 percent of Maine's total agricultural receipts, but it is a major source of income for the relatively small number of producers involved.

The purpose of this study was to collect data relative to the costs of growing, harvesting, storing, and packing apples in Maine, to analyse the factors affecting costs and returns, and to provide Maine apple producers with current information for adjusting farm resources to achieve optimum efficiency in production under rapidly changing economic conditions.

A total of 170 farms were surveyed in the summer of 1971. Of these, 145 were actively engaged in the production of apples and 25 were retired or no longer engaged in apple production. The farms actively engaged in apple production were categorized, based on the number of apple acres operated, as follows: less than 20 acres = Hobby, 20 to 49 acres = Small, 50 to 99 acres = Medium, 100 acres or more = Large.

The survey showed that the 1970 apple crop amounted to 1,681,822 bushels and generated \$4,757,380 of gross income for Maine apple growers. Table 1 presents the apple production and income by farm sizes and the average production per bearing acre. The important point to note is that the large farms accounted for only 14 percent of the total number of farms, but they accounted for 53 percent of the total acreage, 54 percent of the total production, and 62 percent of the gross income to apple farmers.

*This paper is a product of Research Project H-252

Table 1
 Number and Sizes of Farms, Total Harvest and Gross
 Income by Size of Farm, and Production Per
 Bearing Acre for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Number of Farms	63	37	25	20
Total Acres	513	1,096	1,575	3,517
Bearing Acres	408	973	1,307	2,837
Bushels Harvested	101,949	273,136	400,319	906,408
Production Per Acre	250	281	306	320
Gross Income	\$203,482	\$608,843	\$995,765	\$2,949,290

There are six major varieties of apples harvested in Maine. Of the 1970 apple crop, McIntosh was by far the most important as it accounted for 65.2 percent of the total harvest. In order of importance, the other five varieties were Red Delicious, Cortland, Golden Delicious, Early McIntosh, and Northern Spy.

Table 2 illustrates the 1970 marketings of Maine apples for various uses by farm size. Of the 1970 marketings, 61.2 percent were shipped for out-of-state use, 23.1 percent were shipped in-state, and roadside sales, cider, and pick your own accounted for the remaining 15.7 percent.

In analyzing the marketings of Maine apples it may be noted that for the hobby and small farms a very small amount was marketed out-of-state. However, the hobby and small farms accounted for 56 percent of the roadside marketings and 95 percent of the pick your own marketings for Maine apples. In contrast, the medium and large farms had a high proportion of their crop being marketed out-of-state. The medium and large farms accounted for 89 percent of the out-of-state marketings and 67 percent of the in-state marketings for orchard run or packed apples. This indicates that the hobby and small farms were not directly competing with the medium and large farms for various market outlets. The two groups were dealing with almost entirely different consumers.

Table 2
Marketing of Maine Apples, 1970-71

Use	Orchard Size				Total
	Hobby	Small	Medium	Large	
- Bushels -					
In-State					
Orchard Run	36,999	56,496	26,656	94,050	210,201
Packed	7,089	19,750	15,500	107,368	149,707
Out-State					
Orchard Run	2,000	35,510	22,325	53,000	112,835
Packed	13,796	53,115	221,500	553,733	842,144
Roadside Sales	25,920	62,947	38,900	30,911	158,678
Pick Your Own	6,890	7,740	500	200	15,330
Cider	7,885	23,330	14,015	25,088	70,318
Total	100,579	258,888	335,396	864,350	1,559,213

Investment

There were three major investment categories to be considered on Maine apple farms; machinery and equipment, apple storage buildings, and land and trees. Table 3 shows the average total investment and average total investment per acre for the various farm sizes.

Table 3
Average Total Investment and Average Total Investment
Per Acre for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Machinery and Equipment	\$4,559	\$10,738	\$19,755	\$ 53,928
Apple Storage Buildings	1,808	4,138	19,667	40,037
Orchard	3,248	12,090	27,216	105,175
Average Total Investment	\$9,615	\$26,964	\$66,638	\$199,140
Average Total Investment Per Acre	\$1,202	\$ 899	\$ 1,058	\$ 1,138

In analyzing the machinery and equipment investment the major items in this category were trucks, tractors, refrigeration equipment, and boxes and bins. As the size of the operation increased, refrigeration equipment and boxes and bins accounted for an increasing portion of the total machinery and equipment investment.

Costs

Fixed costs are defined as those costs that do not change as production changes. For the purposes of this study fixed costs included all those costs that are necessary to maintain the operation regardless of yields or production changes.

Table 4 illustrates the average fixed costs for Maine apple farms by size categories. The average fixed cost ranged from \$1,727 on the hobby farms to \$18,547 on the large farms. One point to note was that the difference in average fixed cost for the hobby and small farms was very small, while the difference between small and medium and medium and large farms was considerable.

Table 4
Average Fixed Costs on Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Machinery Depreciation	\$ 290	\$ 672	\$1,419	\$ 3,573
Business Taxes	404	530	1,164	4,157
Business Insurance	209	356	1,032	4,263
Orchard Depreciation	42	209	330	1,369
Building Depreciation	203	573	1,235	3,580
Real Estate Repairs	544	190	271	799
Land & Orchard Rent	13	69	328	457
Tree Replacement	22	98	305	349
Average Total Fixed Cost	\$1,727	\$2,697	\$6,084	\$18,547

Variable costs are defined as those directly related to the amount of output. The level of these costs was dependent upon the level of output. Table 5 illustrates the average variable costs for Maine apple farms by farm size categories. The average variable cost ranged from \$2,028 on the hobby farms to \$84,279 on the large farms. As farm size increased, the average total variable cost increased very dramatically.

The most costly item for all farm size categories was labor (regular plus part-time). On the hobby farms, it accounted for 35 percent of the total variable cost; on the small farms, it accounted for 53 percent, and

on the medium and large farms, it accounted for 65 and 63 percent of the total variable cost, respectively.

Table 5
Average Variable Costs on Maine
Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Spray & Dust Material	\$ 401	\$1,463	\$ 2,885	\$ 8,223
Fertilizer and Lime	232	501	1,050	3,635
Fuel and Oil	269	393	754	3,378
Machinery Hire	72	18	369	417
Machinery Repair	97	261	479	1,867
Truck and Tractor	50	159	388	897
Phone	45	108	236	537
Electricity	60	198	593	2,016
Auto (Farm Share)	26	47	191	137
Dues	2	9	44	62
Interest	18	424	1,325	5,668
Office Supplies	4	93	38	343
Bee Rental	4	28	72	325
Regular Hired Labor	65	660	4,145	16,630
Part-time Hired Labor	647	3,326	12,420	36,390
Employee Insurance	19	81	169	1,493
Employee F.I.C.A.	18	134	451	2,261
Total Average Variable Costs	<u>\$2,028</u>	<u>\$7,456</u>	<u>\$25,609</u>	<u>\$84,279</u>

Table 6 presents the average total variable cost and the average total fixed cost on a per acre basis for the four size categories. The average variable cost per acre ranged from \$249 per acre on the small farms to \$482 per acre on the large farms. There was very little difference in the average variable cost per acre between the hobby and small operations, but there was considerable difference between the hobby and small, medium and large operations.

Table 6
Average Variable and Average Fixed Costs Per Acre
for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Average Number of Acres	8	30	63	175
Average Total Variable Cost	\$2,028	\$7,456	\$25,609	\$84,279
Average Variable Cost Per Acre	\$ 254	\$ 249	\$ 406	\$ 482
Average Total Fixed Cost	\$1,727	\$2,697	\$ 6,084	\$18,547
Average Fixed Cost Per Acre	\$ 216	\$ 90	\$ 97	\$ 106

The average fixed cost per acre was the highest on the hobby farms at \$216 per acre and lowest on the small farms at \$90 per acre. There was very little difference in the average fixed cost per acre on the small, medium, and large farms with their values being \$90 per acre, \$97 per acre, and \$106 per acre, respectively.

In addition to these fixed and variable costs that the apple grower incurs for production and harvesting there are two other major costs, storage and marketing costs. Also for purposes of analysis, it is convenient to separate the harvesting costs from the regular production costs.

Table 7 illustrates the average harvest, storage, and marketing costs per bearing acre and per bushel. As shown, the marketing cost is the most expensive item on the medium and large farm operations. This is mainly due to the expense of packing apples and the commissions on sales for these two farm categories.

The average total harvesting, storage, and marketing cost per bearing acre increased continually as farm size increased. It ranged from \$251 per bearing acre on the hobby farms to \$529 per bearing acre on the large farms.

The average total harvesting, storage, and marketing cost per bushel harvested had two distinct ranges. The cost per bushel on the hobby and small farms was almost identical being \$0.93 and \$0.92 respectively. And the cost per bushel on the medium and large farms was quite similar being \$1.45 and \$1.66, respectively.

Table 7
Average Harvest, Storage and Marketing Costs
Per Bearing Acre and Per Bushel

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Average Bearing Acres	6	26	52	142
Average Bushels Harvested	1,618	7,382	16,013	45,320
Average Total Harvesting Cost	\$ 696	\$2,827	\$ 6,325	\$17,983
Average Total Storage Cost	248	2,078	6,159	12,661
Average Total Marketing Cost	559	1,875	10,759	44,427
Average Total Harvesting, Storage & Marketing Costs	\$1,503	\$6,780	\$22,243	\$75,071
Average Total Harvesting, Storage & Marketing Costs per Bearing Acre	\$ 251	\$ 261	\$ 447	\$ 529
Average Total Harvesting, Storage & Marketing Costs per Bushel Harvested	\$ 0.93	\$ 0.92	\$ 1.45	\$ 1.66

The average total cost was a summation of all the expenses incurred on the apple operation for the year. The total cost increased substantially as farm size increased, ranging from \$4,581 on the hobby farms to \$152,911 on the large farms. Table 8 illustrates the average total cost on a per acre and per bushel basis for the various farm sizes.

Table 8
Average Total Cost Per Acre and Per Bushel
for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Average Total Cost	\$4,581	\$13,976	\$47,532	\$152,911
Average Number of Acres	8	30	63	175
Average Total Cost Per Acre	\$ 572	\$ 466	\$ 754	\$ 874
Average Bushels Harvested	1,618	7,382	16,013	45,320
Average Total Cost Per Bushel	\$ 2.83	\$ 1.89	\$ 2.97	\$ 3.37

The average total cost per acre and per bushel was the lowest on the small farms being \$466 per acre and \$1.89 per bushel. The cost per acre and per bushel were the highest on the large farms being \$874 per acre and \$3.37 per bushel. The hobby and medium size farms were in the middle of these extremes being \$572 per acre and \$2.83 per bushel; and \$754 per acre and \$2.97 per bushel, respectively.

Returns

The average net return was computed by subtracting the average total cost from the average gross returns. Table 9 illustrates the average net returns for the four farm categories and also shows the net return per acre and per bushel.

The average net returns were negative for three of the farm size categories in 1970. The average net return ranged from -\$5,448 on the large farms to +\$2,936 on the small farms.

The average net return per acre ranged from +\$98 on the small farms to -\$54 on the hobby farms. Likewise, the average net return per bushel ranged from +\$0.40 on the small farms to -\$0.26 on the hobby farms.

Table 9
Average Net Returns Per Acre and Per Bushel
on Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Average Gross Returns	\$4,153	\$16,912	\$47,417	\$147,465
-Average Total Costs	4,581	13,976	47,532	152,911
=Average Net Returns	-\$ 428	+\$ 2,936	-\$ 115	-\$ 5,448
Average Number of Acres	8	30	63	175
Average Net Returns Per Acre	-\$ 54	+\$ 98	-\$ 2	-\$ 31
Average Bushels Harvested	1,618	7,382	16,013	45,320
Average Net Returns Per Bushel	-\$ 0.26	+\$ 0.40	-\$ 0.01	-\$ 0.12

Price and Supply Implications

The fact that 61.2 percent of Maine's apple marketings were out-of-state indicates a heavy influence of external market conditions. The majority of the apples marketed outside Maine are competing with the New York and Michigan apples for market outlets. There is very little competition within New England as most of the New England apple crop is packed under one distributor's name and are shipped to points within and outside New England as a standard product.

The 1970 Maine apple crop was somewhat unique. The total production was of average output, but the price received was the lowest in the four year period, 1968-1971. This low price was due to several factors. First, the total New England crop was larger than the 1968-1971 average. Secondly, the supply of New York and Michigan apples, the major New England competitors, was the largest during the 1968-1971 period. ^{1/} Last was the lower quality of the Maine apples in 1970, due to early frosts and severe local hail storms during the production season.

Given the costs for producing and marketing Maine apples, as determined by this study, a comparison was made to show the effect of the depressed 1970 price on the average net returns of the apple growers. The comparison uses the average price received for the 1968-1971 period and the 1970 price as found in this study. Table 10 illustrates the 1970 average net returns, as determined by this study, compared to the 1968-1971 equivalent average price received per bushel by Maine apple growers.

Table 10
1970 Net Returns Compared to the Net Returns
Using the 1968-1971 Average Price Received

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Average Net Returns, 1970	-\$ 428	+\$2,936	-\$ 115	-\$5,448
Average Net Returns Based on 1968-1971 Equivalent Price ^{a/}	-\$ 24	+\$4,650	+\$4,694	+\$9,155

^{a/} Based on prices received 1968-1971 converted to per bushel price, from Agricultural Statistics 1970 and 1971.

As may be seen from Table 10 the difference in actual net returns and the net returns based on the 1968-1971 average price are quite significant. The 1970 price received per bushel was 10 percent below the 1968-1971 average equivalent per bushel. If the 1970 price would have been "normal", the average net returns on Maine apple farms would have improved significantly.

^{1/} Agricultural Statistics 1970 and 1971, United States Department of Agriculture, U.S. Government Printing Office, Washington, D.C.

The "normal" returns appear to be as might be expected, with the Hobby farms being the least profitable and the Large farms having the highest average net returns. There is very little difference between the Small and Medium farms. This may be due to the fact that the Small farms are a one-man operation and appear to be efficient, whereas the Medium farms are a two-man operation and may not have reached the point of optimum efficiency.

Summary

The purpose of this study was to determine the costs and returns for growing, harvesting, storing and packing apples in Maine and to provide Maine apple producers with current economic information for adjusting farm resources.

The study found that the average net returns on the four size categories for Maine apple farms were negative on the hobby, medium, and large farms. The only category having a positive average net return was the small farm category.

The average net returns ranged from +\$2,936 on small farms to -\$5,448 on large farms. On a per bushel basis, the average net returns ranged from +\$0.40 per bushel on the small farms to -\$0.26 per bushel on the hobby farms.

There was no clear pattern of economic efficiency increasing as the farm size increased. Using the average net returns per acre as a measure of economic efficiency, the results showed that the small farms were the most efficient and the hobby farms were the least efficient, with the medium and large farms in the middle of the two extremes.

The study also found that the number of apple trees in the State of Maine has increased over the past several years, even though total acreage has decreased. This is mainly due to the tremendous increase in semi-dwarf and dwarf tree varieties being planted.

Another important point to note was the fact that 61.2 percent of Maine's apple harvest was marketed outside the state, either in packed or orchard run form. This indicates that Maine is a surplus producer of apples and relies very heavily on external markets to buy the apples produced in Maine.

The major cost factor on all farm sizes was the variable costs. In this category, the single most important item was hired labor. The hired labor costs, as a proportion of the average total cost, ranged from 16 percent on the hobby farms to 35 percent on the medium and large farms. The hired labor cost was 29 percent of the average total cost on the small farms.

The average total investment required for apple production was quite high on all four farm size categories. The average total investment ranged from \$9,615 on the hobby farms to \$199,140 on the large farms. On a per acre basis, the average total investment ranged from \$899 per acre on the small farms, to \$1,022 per acre on the hobby farms, with the medium and large farms having average total investments per acre of \$1,058 and \$1,138, respectively. The largest investment item on all farm categories, except the hobby farms, was the orchard (land and apple trees).

Implications

The fact that the average net returns on three of the four farm categories was negative is cause for concern. However, this study dealt with only one production and marketing year. As with other agricultural products, yearly production and price fluctuations are not uncommon.

In trying to determine if there was any one major reason for these negative returns, it was noted that production during this period was the largest on record for the nation. As a result, average prices received were depressed. ^{2/} This bears out the point that the market value of Maine's apple crop is strongly influenced by the national supply of apples due to the fact that a large portion of Maine's apples are marketed outside the state.

It was also noted that the 1970 apple crop in Maine was affected by adverse growing conditions throughout the year. There had been an early frost in the fall and there had been several widespread hail storms in Maine during the summer months. These two factors resulted in a lower quality apple being harvested in Maine.

The net effect of these conditions were a large national supply, a stable supply in Maine, but a lower quality apple. Therefore, the prices in Maine were somewhat depressed due to the large national supply as well as the low quality of apples available at the local level.

The outlook for the Maine apple industry is favorable even though the 1970 crop year was not one of general prosperity. Maine's apple production has remained steady over the past ten years, while apple production in most New England states has declined. A very important reason that the outlook for Maine's apple industry is favorable is that demand for both fresh apples and processed apples has been increasing steadily over recent years.

^{2/}Apple Marketing Research in the Seventies, by O'Rourke, Greig and Harrington, Washington Agricultural Experiment Station, Bulletin 754, Washington State University, April 1972.

In order for the Maine apple industry to maintain its current position of strength in the New England region, several areas must receive serious attention. The major area of concern among all commercial growers is the high cost of labor and the difficulty in finding sufficient labor for the harvest season. Another area of concern is the marketing and packing of apples. Most producers pack only a very small percentage of their own crop. More research is needed in the area of optimum efficiency and location for apple packing facilities within Maine and New England on a whole.

Another concern of many of the apple growers in Maine is the lack of centralized promotional activities to establish a quality image for Maine apples. Many of the other apple producing regions have centralized promotional activities for their products in order to expand demand. The fund raising alternative that most areas and other commodities use is a tax on production. If Maine wants to expand the demand for its apples and establish a quality reputation, some form of centralized organization is necessary to carry out this task.

The results of this study should provide some general guides for the Maine apple industry. There are numerous measures of efficiency that may be applied to the Maine apple industry that yield varying results. There is a definite relationship between size and absolute production, as farm size increased the yields per acre increased. However, from a cost standpoint, this is not the case. There is not a direct relationship between size and cost efficiency that may be determined. The costs for harvesting apples was virtually the same for all apple farms, except the hobby farms which were slightly higher. The situation thus appears to be a problem of marketing rather than production. The various marketing alternatives and methods must be looked at much closer. Also, small changes in price and supply both locally and regionally, must be further studied to understand their full impact on the Maine apple industry.

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