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B704: Costs and Returns on Maine Apple Farms

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COSTS AND RETURNS ON MAINE APPLE FARMS

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and

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PREFACE

This study was undertaken to determine the profitability of Maine apple farms, and to determine the current size and scope of the Maine apple industry. The results and implications of this study should be useful to all concerned with the apple industry in Maine and New England.

The authors would like to thank the Maine apple growers for providing the necessary information for this study. We would also like to express our appreciation for the cooperation received from the Maine State Pomology Society, the Cooperative Extension Service, and the Department of Plant and Soil Sciences.

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Costs and Returns on Maine Apple Farms, 1970

Wilbert C. Geiss, Jr.*
and
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INTRODUCTION

Apple production in Maine 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.¹ This \$4.1 million cash receipts from apples was approximately 1.9 percent of the total annual cash receipts from marketing of all farm commodities in the state. Although cash receipts from apple production are a relatively small portion of the total farm receipts, they are a major source of income for the relatively few number of apple producers involved.

In 1970, Maine ranked seventeenth among all states in apple production. Maine produces a surplus of apples and, therefore, must compete for outside markets with the rest of the New England producers as well as those of the midwest and the West. Due to the fact that a large portion of Maine's apple crop is marketed outside the state, the price for Maine apples is closely related to the supplies of apples in other producing areas as well as to the supply within Maine.

The purpose of this study was to collect data relative to the costs of growing, harvesting, storing, and packing apples in Maine, to analyze 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.

PROCEDURE

During the summer and fall of 1971, a survey was conducted to determine the location of apple production in Maine, the quantity of apples sold for various uses, and the costs and returns associated with apple production and marketing. Several mailing lists were consolidated to obtain as nearly as possible a complete survey of all apple growers in Maine.

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¹ Farm Income Supplement, August 1971, U.S.D.A.

Maine apple farms were placed into four categories for purposes of interviewing and data tabulation. The categories used are shown in Table 1.

Table 1
Size Categories of Maine Apple
Farms, 1970

Size Range	Number of Farms	Farm Size Designation
Less than 20 acres	63	Hobby
20-49 acres	37	Small
50-99 acres	25	Medium
100 acres and over	20	Large
Total	145	

Size and Structure of The Survey

Eighty-four percent of the 205 apple farmers contacted responded to the questionnaire. Of the farmers contacted, 72 percent were actively engaged in the production of apples and 12 percent were non-active. Sixteen percent of the farmers surveyed did not respond to the questionnaire. The 12 percent in the non-active category included those persons retired and no longer farming as well as those renting acreage to farmers actively engaged in apple production. Table 2 indicates the responses by counties.

Table 2
Respondents to Maine Apple Survey, by
Counties, 1970

County	Surveyed	Number of Respondents		Number of Non-respondents
		Active	Non-Active	
York	36	22	3	11
Cumberland	16	13	1	2
Oxford	39	25	8	6
Androscoggin	26	21	1	4
Kennebec	19	14	1	4
Franklin	17	12	3	2
Coastal Counties ¹	24	22	1	1
Central Counties ²	28	18	7	3
Total	205	147	25	33
Percent of Total Surveyed	100	72	12	16

¹ Includes Sagadahoc, Lincoln, Knox, Waldo, and Hancock Counties.

² Includes Somerset, Piscataquis, and Penobscot Counties.

The response indicated that apple production was concentrated in the South and Central counties of Maine. Oxford county had the largest number of active farmers with 25, followed by York and Androscoggin counties with 22 and 21 respectively.

APPLE PRODUCTION

Apple production in Maine is concentrated in the Southern and Central portion of Maine, as shown in Figure 1. Based on the survey there were 145 farms actively engaged in the production of apples with a total of 6,701 acres in orchards. The number of respondents was somewhat

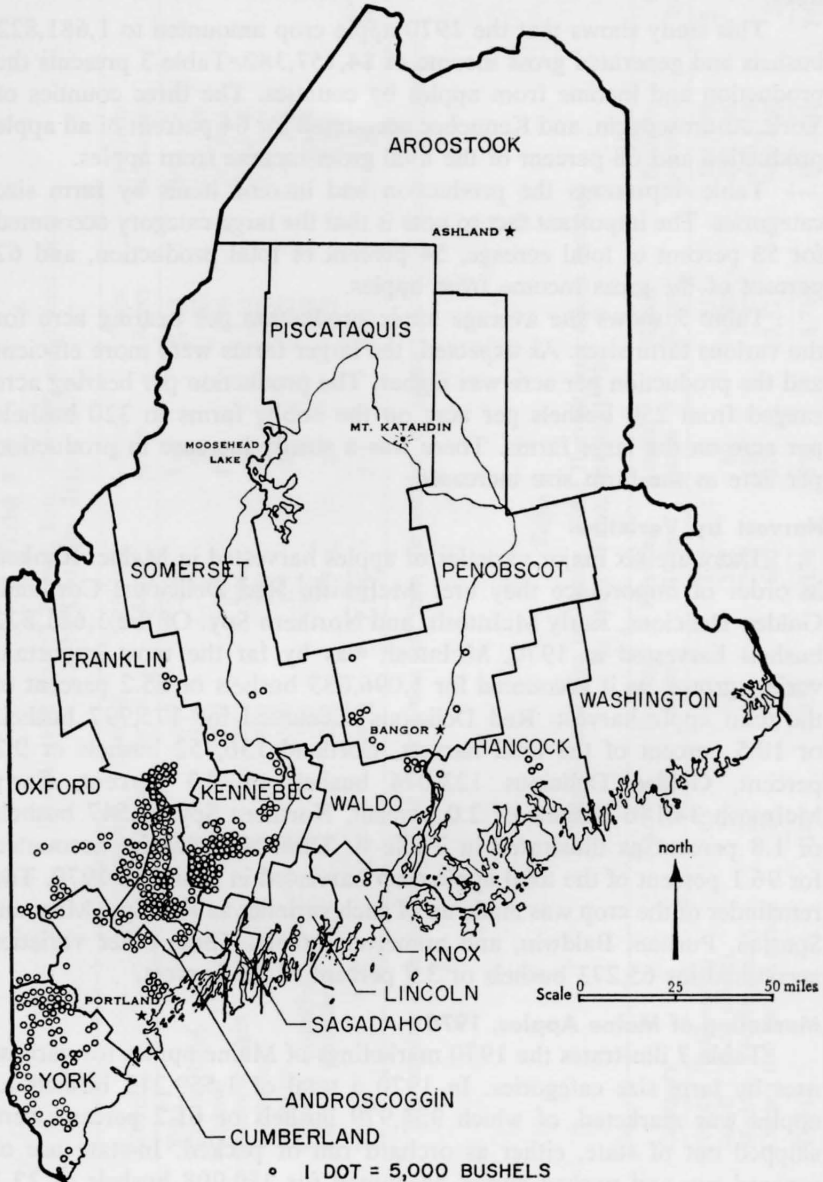


FIGURE 1

larger than the actual number of farms due to partnerships. Of the total 6,701 acres in orchard, 5,525 acres or 82 percent of the total were in bearing orchard. Of the total land in orchards, 573 acres were rented and all rental acreage was in bearing trees. Of the total orchard land in Maine, 1,176 acres, or 18 percent of the total, were in growing or non-bearing trees.

This study shows that the 1970 apple crop amounted to 1,681,822 bushels and generated gross income of \$4,757,380. Table 3 presents the production and income from apples by counties. The three counties of York, Androscoggin, and Kennebec accounted for 64 percent of all apple production and 68 percent of the total gross income from apples.

Table 4 presents the production and income items by farm size categories. The important fact to note is that the large category accounted for 53 percent of total acreage, 54 percent of total production, and 62 percent of the gross income from apples.

Table 5 shows the average apple production per bearing acre for the various farm sizes. As expected, the larger farms were more efficient and the production per acre was higher. The production per bearing acre ranged from 250 bushels per acre on the hobby farms to 320 bushels per acre on the large farms. There was a steady increase in production per acre as the farm size increased.

Harvest by Varieties

There are six major varieties of apples harvested in Maine. Ranked in order of importance they are: McIntosh, Red Delicious, Cortland, Golden Delicious, Early McIntosh, and Northern Spy. Of the 1,681,822 bushels harvested in 1970, McIntosh was by far the most important variety grown, as it accounted for 1,096,033 bushels or 65.2 percent of the total apple harvest. Red Delicious accounted for 175,997 bushels or 10.5 percent of the total harvest, Cortland 156,752 bushels or 9.3 percent, Golden Delicious 123,074 bushels or 7.3 percent, Early McIntosh 34,146 bushels or 2.0 percent, Northern Spy 30,547 bushels or 1.8 percent as illustrated in Table 6. These six varieties accounted for 96.1 percent of the total apple crop harvested in Maine in 1970. The remainder of the crop was made up of such varieties as Red Spy, Macoun, Spartan, Puritan, Baldwin, and numerous others. These other varieties accounted for 65,273 bushels or 3.9 percent of the harvest.

Marketing of Maine Apples, 1970

Table 7 illustrates the 1970 marketings of Maine apples for various uses by farm size categories. In 1970 a total of 1,559,213 bushels of apples was marketed, of which 954,979 bushels or 61.2 percent were shipped out of state, either as orchard run or packed. In-state use of orchard run and packed apples accounted for 359,908 bushels or 23.1

Table 3
Number and Size of Farms, Total Harvest, and Gross Income
by Counties, Maine, 1970

County	Number of Farms	Bearing Acres	Growing Acres	Rented Acres	Total Acres	Bushels Harvested	Gross Income
York	22	1,027	238	148	1,413	364,076	\$ 974,472
Cumberland	13	351	73	58	482	120,299	325,841
Oxford	23 ¹	632	109	145	866	223,093	522,448
Androscoggin	21	1,051	246	46	1,343	374,828	1,340,464
Kennebec	14	902	167	81	1,150	330,855	934,905
Franklin	12	330	177	30	537	96,465	245,827
Coastal Counties	22	361	107	0	468	78,954	200,996
Central Counties	18	298	59	65	422	93,252	212,427
Total	145 ¹	4,952	1,176	573	6,701	1,681,822	\$4,757,380

¹ The number of farms for Oxford County was less than the number of growers surveyed due to partnerships.

Table 4
Number and Size of Farms, Total Harvest, and Gross Income
by Size of Farm, Maine, 1970

Category	Number of Farms	Bearing Acres	Growing Acres	Rented Acres	Total Acres	Bushels Harvested	Gross Income
Hobby (0-19 acres)	63	408	105	0	513	101,959	\$ 203,482
Small (20-49 acres)	37	893	123	80	1,096	273,136	608,843
Medium (50-99 acres)	25	1,124	268	183	1,575	400,319	995,765
Large (100 acres & over)	20	2,527	680	310	3,517	906,408	2,949,290
Total	145	4,952	1,176	573	6,701	1,681,822	\$4,757,380

Table 5
Average Production Per Bearing Acre
for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Total Production (Bushels)	101,959	273,136	400,319	906,408
Total Bearing Acreage	408	973	1,307	2,837
Production Per Bearing Acre (Bushels)	250	281	306	320

percent of the total marketings. The remaining 15.7 percent of the marketings were roadside sales, cider, and pick-your-own.

In analyzing the marketings of Maine apples, it may be noted that for the hobby and small farms only a very small amount was marketed out of state. However, the hobby and small farms accounted for 56 percent of the total roadside sales and 95 percent of the total pick-your-own sales. In contrast, the medium and large farms accounted for 89 percent of all the out-of-state marketings of Maine apples and 67 percent of the orchard run and packed apples for in-state use. This indicates that the hobby and small farms were selling apples to different markets than were the medium and large farms.

Number of Trees

Table 8 illustrates the total tree numbers, number of semi and dwarf trees, and the number of McIntosh trees, both bearing and non-bearing, for the various farms sizes and for all farms.

The 145 farms participating in the survey reported a total of 307,282 apple trees. Of this total, 231,941 were bearing trees and 75,341 were non-bearing trees. The large size apple farms accounted for the greatest portion of total trees, with 55 percent, followed by the medium, small and hobby size farms with 23, 14 and 8 percent of the total number of trees, respectively.

The semi-dwarf and dwarf trees accounted for 20 percent of the 307,282 trees with 60,616 total semi-dwarf and dwarf trees. Of this amount 26,435 or 44 percent were bearing and 34,181 or 56 percent were non-bearing semi-dwarf and dwarf trees. Again, the large farms accounted for the greatest portion of all semi-dwarf and dwarf trees with 62 percent followed by the medium, small and hobby farms with 20, 7, and 11 percent of the total semi and dwarf trees, respectively.

McIntosh trees accounted for 61 percent of all trees with 186,260 trees. Of this number, 73 percent of the McIntosh were bearing trees and 27 percent were non-bearing trees. Following the previous trend, the large farms accounted for the majority of all McIntosh trees with 55 percent followed by the medium, small, and hobby size farms with 25, 12, and 8 percent of all McIntosh trees, respectively.

Table 6
Apple Harvest by Varieties
Maine, 1970

Farm Size	McIntosh	Red Delicious	Cortland	Golden Delicious	Early McIntosh	Northern Spy	Other	Total
Hobby	63,265	8,366	15,753	4,663	1,175	3,201	5,536	101,959
Small	174,549	23,975	32,743	12,571	2,395	7,458	19,445	273,136
Medium	248,991	45,396	33,876	33,899	10,444	14,525	13,188	400,319
Large	609,228	98,260	74,380	71,941	20,132	5,363	27,104	906,408
Total	1,096,033	175,997	156,752	123,074	34,146	30,547	65,273	1,681,822
Percent of Total Harvest	65.2	10.5	9.3	7.3	2.0	1.8	3.9	100.0

Table 7
Marketings of Maine Apples, 1970-71

Orchard Size	In-State Use		Out-State Use		Roadside Sales	Pick Your Own	Cider	Total
	Orchard Run	Packed	Orchard Run	Packed				
Hobby	36,999	7,089	2,000	13,796	25,920	6,890	7,885	100,579
Small	56,496	19,750	35,510	53,115	62,947	7,740	23,330	258,888
Medium	26,656	15,500	22,325	221,500	38,900	500	14,015	335,396
Large	94,050	107,368	53,000	553,733	30,911	200	25,088	864,350
Total	210,201	149,707	112,835	842,144	158,678	15,330	70,318	1,559,213
Percent of Total	13.5	9.6	7.2	54.0	10.2	1.0	4.5	100.0

Table 8
Tree Numbers on Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms	Total Farms
All Bearing Trees	17,952	34,984	52,145	126,860	231,941
All Non-Bearing Trees	7,709	6,246	18,585	42,801	75,341
Total All Trees	25,661	41,230	70,730	169,661	307,282
Semi-dwarf & Dwarf Bearing Trees	597	2,110	6,227	17,501	26,435
Semi-dwarf & Dwarf Non-Bearing Trees	6,060	2,111	5,961	20,049	34,181
Total Semi-dwarf & Dwarf Trees	6,657	4,221	12,188	37,550	60,616
Bearing McIntosh	10,667	19,901	32,570	72,624	135,762
Non-Bearing McIntosh	3,808	3,937	13,310	29,443	50,498
Total McIntosh	14,475	23,838	45,880	102,067	186,260

One point of interest not brought out by Table 8 is the rapid rate of increase in the number of semi-dwarf and dwarf variety trees. In comparing the 1965 and 1970 New England Fruit Tree Surveys, a 166 percent increase in the number of semi-dwarf and dwarf trees compared with a 6 percent increase in standard variety of tree numbers for the state of Maine was noted.¹

INVESTMENT

Machinery and Equipment Inventory

The machinery and equipment inventory is one of the major investments on an apple farm along with land, buildings, and trees. As the size of the orchard operation increased, the machinery and equipment values increased quite rapidly. This was due to the fact that the larger farms need larger equipment and more of these items. Included in the machinery and equipment inventory were the following items: tractors, trucks, sprayers, mowers, fork lifts, trailers, apple boxes and storage bins, refrigeration equipment, storage equipment, grading and packing equipment, shop tools, and picking ladders, bags and buckets.

Table 9 presents the average machinery and equipment inventory values for the various farm sizes. The average total machinery and equipment values ranged from \$4,559 on the hobby farms to \$53,928 on the large farms. As the farm size increased to the next category, there was roughly a doubling of average machinery and equipment inventory value. Not all respondents included complete valuations of machinery and equipment; therefore, the averages shown in Table 9 are based on information from those who responded.

In analyzing the machinery and equipment items shown in Table 9, the proportion that each represented of the total value varied considerably for the different farm sizes. The tractors and trucks accounted for 60 percent of the total value for hobby farms, whereas, the refrigeration equipment and boxes and bins accounted for only 10 percent of the total value on these farms. However, on the large farms, the refrigeration equipment and boxes and bins accounted for 52 percent of the total valuation and tractors and trucks accounted for only 24 percent of the total value.

The one item that increased most as farm size increased was the value of boxes and bins. On hobby farms, the value was only \$298 while on large farms the value was \$18,331. This was explained by the number of boxes and bins that must be on hand to pick and store the apple crop on these various size farms.

¹ *New England Fruit Tree Survey, 1970*, New England Crop Reporting Service, United States Department of Agriculture, 1972.

Table 9
Average Machinery and Equipment Inventory
on Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Tractors	\$1,562	\$ 3,118	\$ 3,328	\$ 6,559
Trucks	1,196	2,226	2,153	6,207
Sprayers	408	795	1,286	2,663
Mowers	231	420	418	795
Fork Lifts	9	389	787	3,095
Trailers	91	177	161	360
Boxes & Bins	298	1,597	4,558	18,331
Refrigeration	128	805	3,922	9,532
Storage Equipment	8	206	806	790
Grading & Packing Equipment	58	194	866	2,937
Shop Equipment	559	519	1,036	1,611
Ladders, Bags & Buckets	110	292	434	1,048
Total Average Value	\$4,559	\$10,738	\$19,755	\$53,928

Apple Storage Building Valuation

The storage facility represents a major investment for the apple grower especially on the larger operations. Table 10 illustrates the average valuation of storage facilities on the four sizes of apple farms.

Table 10
Average Valuation of Storage Buildings
on Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Apple Storage Building	\$1,808	\$4,136	\$19,755	\$40,037

The average storage building valuation ranged from \$1,808 on the small farms to \$40,037 on the large farms. There was very little difference between the storage building valuation for hobby and small apple farms, but very large increases in valuation were evident between small and medium and between the medium and large operations. However, even though the storage building accounted for a very large investment, most of the apple growers still had to rent some storage space for their crop as their own storage capacity was insufficient. The rent expense for storage will be illustrated later.

Orchard Valuation

The orchard valuation included both land and trees. This value was somewhat difficult to determine as it is very abstract. Valuation of land with apple trees may be done in several ways, just as tax valuation may be done in several ways. For purposes of this study, the orchard valuation was based on the current use of the land for apple production, not on its possible uses, such as housing developments.

Table 11 illustrates the average value per acre of land, the apple tree valuation, and the average total orchard valuation for the four farm size categories.

Table 11
Average Orchard Valuation on
Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Average Value Per Acre	\$ 406	\$ 403	\$ 432	\$ 601
Average Acres	8	30	63	175
Average Total Value	\$3,248	\$12,090	\$27,216	\$105,175

The average value per acre ranged from \$403 per acre on small apple farms to \$601 on the large farms with the hobby and medium size farms' values per acre being \$406 and \$432 respectively.

Total Investment

The total investment is the summation of machinery and equipment, apple storage buildings, and orchard values for the various size apple farms. The average total investment and average total investment on a per acre basis are presented in Table 12.

Table 12
Average Total Investment and Average Total Investment Per Acre
For Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Machinery & Equipment	\$4,559	\$10,738	\$19,755	\$ 53,928
Apple Storage Buildings	1,808	4,136	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

The average total investment ranged from \$9,615 per farm on the hobby farms to \$199,140 per farm on the large farms. The average total investment per farm on small and medium apple operations was \$26,964 and \$66,638, respectively. There was a very dramatic increase in the average total investment per farm as the size of operation increased. The effect was more than a doubling of average total investment from one size to the next.

The average total investment on a per acre basis for the farms was lowest on the small apple farms, \$899 per acre, and ranged to a high of \$1,202 per acre on the hobby farms. The medium and large farms had average total investments per acre of \$1,058 and \$1,138, respectively.

COSTS

Fixed Cost Items

Fixed costs are defined as those costs which do not change as production changes. The concept of being fixed is static and meant for a relatively short time period. 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. Items included in the fixed cost category were: machinery depreciation, business taxes, business insurance, orchard depreciation, building depreciation, real estate repairs, land and orchard rent, and tree replacement.

Table 13 illustrates the average fixed costs for Maine apple farms by farm size categories. The average total 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 the average total fixed cost for the hobby and small farms was very small, while the difference between small and medium and medium and large operations was considerable. Average fixed costs were computed from the information provided by respondents.

Table 13
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 and Orchard Rent	13	69	328	457
Tree Replacement	22	98	305	349
Total Average Fixed Costs	\$1,727	\$2,697	\$6,084	\$18,547

Business taxes and business insurance were the most costly items on the large farms, accounting for 45 percent of the total fixed cost. On hobby farms, the most expensive items were real estate repairs and business taxes which accounted for 54 percent of the total fixed cost. The three depreciation items, business taxes, and business insurance were the fixed cost items that increased most rapidly as farm size was increased. This was explained by the fact that as farm size increases, the machinery, buildings, and land necessary increase accordingly.

Variable Cost Items

Variable costs were defined as those directly related to the amount of output. The level of these costs was dependent upon the level of output. Items included in the variable cost category were: spray and dust

materials, fertilizer and lime, fuel and oil, machinery hire, machinery repair, truck and tractor, phone, electricity, auto (farm share), association dues, interest, office supplies, bee rental, regular hired labor, part-time hired labor, employer insurance, and employee Social Security costs (F.I.C.A.).

Table 14 illustrates the average variable costs for Maine apple farms by farm size categories. The average total 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.

Table 14
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 & Lime	232	501	1,050	3,635
Fuel & Oil	269	393	754	3,378
Machinery Hire	72	18	369	417
Machinery Repair	97	261	479	1,867
Truck & 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	\$2,028	\$7,456	\$25,609	\$84,279

The most costly item for all size categories was labor (regular plus part-time). On the hobby farms, it accounted for 35 percent of the total variable cost; on small farms it accounted for 53 percent, and on medium and large farms, it accounted for 65 percent and 63 percent of the total variable cost, respectively.

The next most expensive variable cost items were spray and dust materials, interest on investment, and fertilizer and lime. These three items combined accounted for 32 percent of the total variable cost on hobby and small farms, and 21 percent of the total variable cost on the medium and large farms.

Average Variable and Fixed cost Per Acre

Table 15 presents the average total variable cost and average total fixed cost on a per acre basis for the farm 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 between the hobby and small operations but there was considerable difference between the small and medium and medium and large farms' average variable cost per acre.

Table 15
Average Variable and 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 highest on the hobby farms at \$216 per acre and lowest on the small farms at \$90 per acre. The medium and large farms were in between these at \$97 and \$106 per acre, respectively. It may be noted that there was almost no difference between the average fixed cost per acre for the small, medium, and large size farms.

Harvesting Costs

The harvesting cost was that expense involved in getting the apples picked and to the point of storage. Included in the harvesting cost were labor, trucking and hauling, and other expenses.

Table 16 illustrates the average harvesting cost for the various farm sizes. The average harvesting cost ranged from \$696 on the hobby farms to \$17,983 on the large farms. As farm size increased, the harvesting cost increased substantially. The major portion of the harvesting cost in all cases was the expense for labor. On the hobby and medium farms, labor accounted for 93 percent of the total harvesting cost and it accounted for

Table 16
Average Harvesting Costs for Maine
Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Labor	\$647	\$2,643	\$6,068	\$17,166
Trucking and Hauling	49	118	224	550
Other	0	66	33	267
Total Average Harvesting Cost	\$696	\$2,827	\$6,325	\$17,983
Total Bearing Acres	408	973	1,307	2,837
Average Bearing Acres	6	26	52	142
Average Harvesting Cost Per Bearing Acre	\$116	\$ 109	\$ 122	\$ 127

96 percent and 95 percent of the total harvesting expense on the medium and large farms, respectively.

Also presented in Table 16 is the average harvesting cost per bearing acre. The average harvesting cost per bearing acre ranged from \$109 on the small farms to \$127 on the large farms, with the hobby and medium farms having average harvesting costs per bearing acre of \$116 and \$122, respectively.

Storage Costs

The storage cost involved all the expenses from the time the apples reached the storage area until they were ready to be processed or packed for marketing. Included in the storage costs were: labor, storage rental, fuel for shortage, prestorage treatment or antiscald dip, containers, storage supplies, and other storage costs.

Table 17 presents the average storage costs for the various farm sizes of Maine apple farms. The average storage cost ranged from \$248 on the hobby farms to \$12,661 on the large farms.

Table 17
Average Storage Costs for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Labor	\$ 8	\$ 188	\$ 741	\$ 2,587
Storage Rental	213	1,475	4,345	7,173
Fuel for Storage	17	107	180	1,079
Antiscald Dip	8	161	566	1,066
Containers	2	84	291	407
Storage Supplies	0	0	28	45
Other	0	63	8	304
Total Average Storage Cost	\$248	\$2,078	\$6,159	\$12,661

The single most important item in this group of costs was the rental for apple storage. In all cases, storage rental was the most expensive item and it accounted for 86 percent of the total storage cost on hobby farms, 71 percent on small farms, 71 percent on medium farms, and 57 percent of the total storage cost on large farms.

Two points of interest should be noted in discussing the storage costs involved on Maine apple farms. First, only four farms in the hobby size category reported these items. This was due mainly to the fact that most of the apples from the hobby farms were marketed as orchard run, roadside sales, and pick-your-own. Therefore, very little storage was necessary.

The second point to note was that even though most of the farms in the medium and large category had storage space of their own, many still had to rent storage space for their apples. This indicated that the on-farm storage capacity was insufficient to store the entire crop.

Marketing Costs

The marketing cost included all expenses necessary to prepare the apples for marketing and the actual disposal of the apples in a market. Included in the market costs were: labor, commissions, packing supplies, trucking and hauling, advertising, and other marketing expenses.

Table 18 illustrates the average marketing costs on Maine apple farms for the various farm sizes. The average marketing cost ranged from \$559 on the hobby farms to \$44,427 on the large farms. There was very little difference between the average marketing cost for hobby and small farms, but there was a tremendous difference between the small and medium and the medium and large sizes.

Table 18
Average Marketing Costs for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Labor	\$ 22	\$ 126	\$ 595	\$ 5,233
Commissions	100	359	3,044	9,153
Packing Supplies	324	1,146	5,899	22,471
Trucking and Hauling	81	179	553	4,770
Advertising	26	30	142	867
Other	6	35	526	1,933
Total Average Marketing Cost	\$559	\$1,875	\$10,759	\$44,427

The most important items in this section were commissions and packing supplies. Commissions accounted for 18, 19, 28, and 21 percent of the total marketing cost for the hobby, small, medium, and large farms respectively. Packing supplies accounted for 58, 61, 55, and 51 percent of the total marketing cost for the hobby, small, medium, and large farms respectively.

Total Costs

Total cost was the summation of all expenses incurred on the apple operation for the year. Included were fixed costs, variable costs, and the harvesting, storage, and marketing costs. The labor involved in harvesting, storage, and marketing was subtracted, as total labor was included in the variable cost portion.

The average total cost for Maine apple farms is illustrated in Table 19. The average total cost ranged from \$4,581 on the hobby orchards to \$152,911 on the large size orchards. The variable costs represented the largest portion of total costs in all cases. For the hobby orchards, the variable costs accounted for 44 percent of the total cost, while on small, medium and large orchards the variable costs respectively accounted for 53, 54, and 55 percent of the total costs.

Table 19
Average Total Costs for Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
Fixed Costs	\$1,727	\$ 2,697	\$ 6,084	\$ 18,547
Variable Costs	2,028	7,456	25,609	84,279
Harvesting Costs ¹	49	184	257	817
Storage Costs ¹	240	1,890	5,418	10,074
Marketing Costs ¹	537	1,749	10,164	39,194
Total Costs	\$4,581	\$13,976	\$47,532	152,911

¹ The labor is omitted from these factors as total labor costs were included in the variable costs item.

On the medium and large farms, the marketing costs were the second largest item, accounting for 21 and 26 percent of the total costs respectively. On the small and hobby farms the fixed costs were the second largest item, accounting for 19 and 38 percent of the total costs, respectively.

The single most costly item on all farm categories was the labor expense. The total labor expense may be calculated by referring to Table 14 and adding the regular hired labor with the part-time hired labor. The total labor expense for Maine apple farms ranged from \$712 on the hobby farms to \$53,020 on the large farms, with the small and medium farms having total labor costs of \$3,986 and \$16,565, respectively.

As a portion of the average total cost on Maine apple farms the total labor expense accounted for 16 percent on the hobby farms, 29 percent on the small farms, and 35 percent of the average total cost on both the medium and large farms.

Total Costs Per Acre and Per Bushel

The average total cost per acre was computed by taking the average total cost for the various farm size categories and dividing by the average number of acres per farm for the various farm size categories. The same basic procedure was used to compute the average total cost per bushel. In this case the average total cost for the various farm sizes was divided by the average number of bushels harvested per farm for each of the size categories.

Table 20 illustrates the average total costs per acre and per bushel for Maine apple farms. The average total cost per acre ranged from \$466 on the small apple farms to \$874 on the large farms, with the hobby and medium size apple farms having average total costs per acre of \$572 and \$754, respectively.

Table 20
Average Total Costs 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 bushel showed the same trend, with the small farms having the lowest cost of \$1.89 and the large farms had the highest cost of \$3.37. Again, the hobby and medium farms were in the middle with average total cost per bushel of \$2.83 and \$2.97, respectively.

RETURNS

Net Returns

The average net return was computed by subtracting the average total costs from the Average Gross Returns for the various farm sizes. Table 21 illustrates the average net returns for Maine apple farms by farm size categories.

Table 21
Average Net Returns for 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

The average gross return was simply the gross cash receipts from apple production before any expenses were taken out. The average gross returns ranged from \$4,153 on the hobby farms to \$147,465 on the large farms. As the farm size increased, the average gross returns increased quite rapidly.

The average net return for Maine apple farms in 1970 was negative for three of the farm size categories. The average net return ranged from \$-5,448 on the large operations to \$2,936 on the small apple operations. The hobby and medium size farms had negative net returns of \$-428 and \$-115, respectively. Some of the reasons for these negative net returns or net losses are discussed in the summary of this publication. As shown, the only category of farms with a positive average net return was the small farms.

Net Returns Per Acre and Per Bushel

The average net return per acre for the various size apple farms was determined by dividing the average net return by the average number of acres for the various farm size categories. Likewise, the average net return per bushel was calculated by dividing the corresponding average net return by the average number of bushels harvested for the various farm sizes.

Table 22 presents the average net return per acre and per bushel for the various farm size categories of Maine apple orchards. The average net return per acre ranged from \$+98 on the small farms to \$-54 on the hobby farms. The average net return per acre on the medium and large farms was \$-2 and \$-31, respectively.

Table 22
Average Net Returns Per Acre and Per Bushel on
Maine Apple Farms, 1970

Item	Hobby Farms	Small Farms	Medium Farms	Large Farms
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

The average net return per bushel ranged from \$+0.40 on the small apple orchards to \$-0.26 on the hobby orchards. The average net return per bushel on the medium and large orchards was \$-0.01 and \$-0.12 respectively.

SUMMARY AND IMPLICATIONS

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 semidwarf 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 the New England market 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 for 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.¹ 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 proportion of Maine's apples are marketed outside the state.

¹ *Apple Marketing Research in the Seventies*, by O'Rourke, Grieg and Harrington, Washington Agricultural Experiment Station, Bulletin 754, Washington State University, April 1972.

It was also noted that the 1970 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 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 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.

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.

In conclusion, the future of the Maine apple industry is strong. The fact that 1970 was somewhat of an extraordinary crop year should not totally darken the outlook. Maine apple growers have been quick to adopt modern technology, as indicated by the rapid growth in numbers of semi-dwarf and dwarf trees. The benefits from this adoption have not yet been fully realized. Also, the fact that the demand for apples is increasing is a promising item due to the amount of apples shipped out of the state. Maine has had a rapid increase in apple tree numbers while the other states in New England have had decreases in tree numbers over the past

five years. These factors, when supported by rapid adoption of proven production and marketing techniques, should help the Maine apple industry retain its potential for success in the future.

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