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## B738: Costs and Returns in Lowbush Blueberry Production in Maine, 1974 Crop

Homer B. Metzger

Amr A. Ismail

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**COSTS AND RETURNS  
IN LOWBUSH BLUEBERRY  
PRODUCTION IN MAINE,  
1974 CROP**

*Homer B. Metzger and Amr A. Ismail*

**LIFE SCIENCES AND AGRICULTURE EXPERIMENT STATION  
UNIVERSITY OF MAINE AT ORONO**

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# COSTS AND RETURNS IN LOWBUSH BLUEBERRY PRODUCTION IN MAINE, 1974 CROP

Homer B. Metzger and Amr A. Ismail<sup>1</sup>

## SUMMARY

Financial information related to producing and harvesting the 1974 crop was obtained by personal interviews from 27 blueberry growers located throughout the State. These growers represented approximately 4 percent of all growers and 8 percent of blueberry acreage in the State. The average blueberry grower in the study operated 118 acres of blueberry land and harvested 55 acres in 1974.

Nearly half of the gross income of these growers was obtained from the sale of blueberries. Average income per grower from blueberries amounted to \$6,779 in 1974. Individual growers harvested from 2 to 240 acres of blueberries. Half the growers harvested 30 acres or less; 20 percent harvested over 90 acres. The average yield of blueberries per acre ranged among growers from 115 to 1,700 pounds. Total yields per grower varied from 600 to 150,000 pounds.

Production and harvesting practices were performed primarily by the growers. Nine growers performed all operations except application of insecticides. Seven growers contracted for two or more practices and eleven contracted for three or more.

The blueberry enterprise represented an investment of \$39,000 per grower varying from \$10,000 per small-size grower to \$100,000 per large-size grower. An average of 675 pounds of blueberries was sold per acre at a price of 20 cents per pound, or a gross return of \$133 per acre. Financial results of the blueberry enterprise in 1974 indicated that average income per grower exceeded operating expenses by \$71, leaving little or no return for the growers' labor or investment. After allowing wages for unpaid family labor and interest on net worth, the average grower had a negative return for his labor of \$-2,287.

The average cost for producing and harvesting blueberries was \$182 per acre or 34 cents per pound. These costs include a charge for the operator's time of \$3 per hour and a charge for the operator's investment of 7 percent per year. Nearly half the growers had costs ranging between 17 cents and 25 cents per pound.

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<sup>1</sup>Professor of Agricultural and Resource Economics and Associate Professor of Horticulture, respectively.

Variable costs of blueberry production and harvesting amounted to 21 cents per pound and fixed costs were 13 cents per pound. Average cash costs of blueberry production amounted to 18 cents per pound.

Labor accounted for 42 percent of average total production and harvesting costs or 14.3 cents per pound. Costs per pound of other expense items were: materials 2.3 cents, contracted services 4.1 cents, equipment 1.4 cents, land and buildings 2.5 cents, interest 9.3 cents, and miscellaneous expenses 0.3 cents.

The average cost of production alone amounted to \$83 per acre. A predominate number of growers had costs ranging between \$50 and \$69 per acre. Average production costs per acre for the principal production practices were: \$3 for cutting, \$6 for mowing, \$21 for burning, \$2 for fertilizing, \$8 for pesticide application, \$2 for pollinating with bees, and \$41 for other production activities (primarily charges for land, buildings, interest and miscellaneous expenses).

The average cost of harvesting alone amounted to \$98 per acre. A predominate number of growers had costs of \$50 to \$99. Average costs per acre for the principal harvesting practices were: \$4 for stringing fields, \$66 for raking berries, \$2 for winnowing berries, \$4 for hauling berries, \$1 for hauling rakers and boxes, \$5 for crew supervision, and \$16 for other harvesting activities. The predominate wage paid per 22 pound box to rakers ranged from \$2.00 to \$2.24.

Yield per acre and acres harvested per grower accounted for much of the variation in per acre costs. Seven growers with lowest yields per acre (averaging 212 pounds) had costs of \$105 per acre compared with \$253 per acre for seven growers with highest yields per acre (averaging 1217 pounds). However, costs per pound declined substantially as yield per acre increased. The cost per pound averaged 51 cents for the lowest yield group and 21 cents for the highest yield group.

Growers with small-size operations (averaging 6 acres) had costs of \$195 per acre compared with \$156 per acre for growers with large-size operations (averaging 152 acres). Although yield per acre declined as the size of operation increased, costs per pound declined as the acreage harvested increased. The cost per pound averaged 37 cents for the small-size operations and 29 cents for the large-size operations. Substantially lower labor costs per pound offset the higher equipment, land, building, and interest charges of the large-size operations.

Comparisons of costs for production and harvesting among those firms contracting for several services, and those contracting only for applying pesticides, indicated that the former had higher harvesting costs and lower production costs than the latter. There were no statistical differences in overall costs.

Management practices explained some of the differences in production costs but were not a good predictor of costs per acre. Weather and variables other than management practices appeared to influence yield per acre. Management practices were not a reliable basis for predicting blueberry yields of the 27 operations studied.

## CONCLUSIONS

Blueberry production is primarily a part time enterprise with a wide variation in acreages per grower and a modest investment per acre.

Blueberry growers recovered cash costs and most of the variable costs of producing and harvesting the 1974 crop. For a competitive return on investment and a modest wage, the average grower would have had to receive 35 cents rather than 20 cents per pound, considering the yields obtained in 1974. To be reasonably assured of adequate returns, a grower should achieve yields of over 1,000 pounds per acre.

## INTRODUCTION

Lowbush blueberry production provides income for over seven hundred growers throughout the state of Maine. Most production is concentrated in Washington and Hancock counties with other eastern and western counties providing small to modest production. Maine produces approximately 18 million pounds of berries annually. Almost all of the production is processed either by freezing or canning. Producers receive a gross income of 3 to 5 million dollars annually from sales to processors. Harvesting and processing operations provide substantial seasonal employment for residents of Washington, Hancock and several other counties.

The vagaries of weather and economic conditions have recently combined to accentuate the cost and risk elements in blueberry production. Twenty nine million pounds of berries were harvested in 1967 compared to 12 million pounds in 1975. Rapidly rising costs of all items used in production, inventory build-up in 1974, and drought in 1975 resulted in serious financial stress on blueberry growers. The average price per pound at harvest reported by the Maine Department of Agriculture was 18.5 cents in 1974, and 26.8 cents in 1975. Although prices improved in 1975, drought conditions reduced the crop from the average 18 million to 12 million pounds.

In recent years land values in Maine have increased due primarily to pressure for recreational uses. This has influenced blueberry land values, resulting in higher opportunity costs (i.e. more income foregone by using land for blueberry production instead of recreation) and pressures to convert some of the land to other uses.

This study of blueberry production costs was undertaken as part of research on the potential for rural economic development in Maine. The specific objective of the study was to determine the costs and returns in lowbush blueberry production and the factors influencing them. The broader objectives were to aid growers in making adjustments which would result in more profitable enterprises and to inform others of the economic feasibility of blueberry production. The ultimate goal to which the study should contribute is the achievement of a well managed and prosperous blueberry industry.



## METHOD AND SCOPE OF STUDY

Information for this study was obtained through personal interviews with blueberry growers during the summer of 1975. In all, 27 interviews were completed.

### Sample Selection

Growers for the study were selected from among 115 who responded to a statewide mail survey conducted in the fall of 1974.<sup>2</sup> Based upon size of operation and geographic distribution, these growers represented well the over 700 growers in the State.<sup>3</sup> A sample of 27 growers was drawn from the 115 growers to provide representation of (1) three sizes of operation (small, medium, large) (2) an equal number of growers performing practices themselves as compared with contracting with outside firms to perform most practices and (3) statewide geographic distribution of growers. Alternates were selected to meet the sample criteria as needed. Of 27 blueberry enterprises in the final sample, 6 were subsequently designated small size (10 acres or less harvested in 1974) 15 were designated medium size (11 to 75 acres) and 6 were designated large (over 75 acres). The management practices, other than spraying for insect control were performed entirely by the grower in nine operations. Among the other operations, seven had one practice other than spraying insecticides done by contract and 11 had two to four practices done by contract. The number of growers in the sample by county location was:

County	Number of Growers	Percent
Washington	14	54
Hancock	5	18
Penobscot	2	7
Waldo	2	7
Knox	2	7
Oxford	2	7
	<u>27</u>	<u>100</u>

<sup>2</sup>Metzger, Homer B. and Amr A. Ismail. *Management Practices and Cash Costs in Low-bush Blueberry Production*, Life Sciences and Agriculture Experiment Station, University of Maine, Bulletin 723, January, 1976.

<sup>3</sup>Ismail, Amr A. et al. *Bird Damage to Blueberry Fields in Maine*, Life Sciences and Agriculture Experiment Station, University of Maine Research in the Life Sciences, Vol. 21, No. 12, June, 1974.

### Questionnaire Content

The questionnaire used in the personal interview asked for information on land use, acreage and yield of blueberries, detailed itemization of expenditures, and sources and amounts of income both on and off the farm. Information requested included labor and power equipment use; wages paid and contractual payments made by operators; valuations on land, buildings and equipment at the beginning and end of the year. Estimates were requested on percentage of buildings and equipment used for blueberry operations. Requested information also included the amount and cost of materials; expenditures for repairs, taxes, insurance and miscellaneous operating expenses; and amounts of labor and equipment used in various blueberry production activities along with data needed to allocate costs to the blueberry enterprise and to operations within the enterprise.

### Cost Concepts

In this study a total costs concept was adopted. Thus costs included variable costs for materials, labor and services and fixed costs for machinery, land and buildings. In addition, non-cash costs, or opportunity costs, have been recognized by inputting costs for unpaid family labor, operator labor, and owned capital invested.

Since blueberry production is often part of a multi-product operation, allocation of joint costs and investments was carried out as appropriate. Costs were summarized as direct: clearly assignable to blueberries, and as indirect: not clearly assignable to one enterprise. Costs were summarized as cash and non-cash. Also costs were summarized by major items of expense and by major functions.

Costs were computed on a per acre and per pound basis. The costs per unit were based upon the acres harvested and blueberry yield in 1974. The information obtained was intended to reflect costs incurred for the 1974 crop. Costs to some degree reflect situations in 1973 when some production practices were performed as well as 1974 when both production and harvesting activities occurred. The calendar year 1974 was used for purposes of land, building and equipment inventory valuation. The valuations reflected current market values. The specific procedures in developing the various segments of cost are outlined below.

*Labor Costs.* Labor included hired wages at levels actually paid, plus unpaid family labor at \$2 per hour, plus operator labor at \$3 per hour. The imputed wage rates were intended to reflect prevailing wage rates for semiskilled and skilled farm labor.

*Materials Costs.* Materials included fertilizer, pesticides, motor fuel (gasoline, oil, grease) burning fuel (hay, straw, oil, gas), other materials (string, boxes) and bee hives. Except for motor fuel, expenses for all these items were directly chargeable to the blueberry crop. Costs for motor fuel were allocated to the blueberry crop based upon the grower's judgment as to the time or mileage that power equipment was employed on blueberry lands.

*Equipment Costs.* Equipment costs included machinery repairs, machinery depreciation and equipment rental charges. Machinery repairs expense was allocated to the blueberry crop on the basis of the grower's estimate. Depreciation charges were derived by allocating the machinery investment between blueberry crop and other farm enterprises, based upon the grower's estimate of the percent each piece of equipment was used in blueberry operations, then applying this percentage to the change between beginning and ending inventory valuations (as made by the grower) for each item of equipment.

*Land and Building Costs.* Land and building costs included expenditures for building repairs, property taxes and insurance, and the depreciation of farm buildings used primarily for blueberry operations. In each category of expense, the grower's judgment was used in assigning a percentage of the expenses to the blueberry crop. Building depreciation reflected a percentage of the change in inventory values at the beginning and end of the year as established by the operator. Buildings included housing for rakers and other laborers and barns for equipment storage, farm shop, etc.

*Contract Services Expense.* Contract services expenses included all direct payments to an outside firm hired to perform production and harvesting functions. These activities included cutting bushes, mowing, burning, spraying, hauling berries, raking berries, providing bees for pollination, and land maintenance.

*Interest Costs.* Interest costs included interest paid to lending agencies for borrowed funds, and an imputed interest charge on the net worth of the blueberry enterprise. The imputed rate of interest was 7 percent.

*Miscellaneous Costs.* Miscellaneous cost items included electricity, telephone, organization dues, and general hauling expenses. In each instance these overhead expenses were allocated to the blueberry crop on the basis of the grower's estimate of the percent chargeable to blueberry production.

### **Procedures for Making Functional Cost Estimates**

The above cost items were allocated to several practices or activities comprising production and harvesting functions. For production, these practices were: cutting bushes, mowing fields, burning fields, applying pesticides, fertilizing, pollinating, and other production activities. For harvesting these practices were: stringing fields, winnowing berries, hauling rakers, boxes or berries, crew supervision, and other harvesting activities.

The allocation of labor costs to the various practices was based upon the grower's report of time spent on each practice by hired and family help and himself. The allocation of material costs was easily made directly to functions except for motor fuels. Motor fuels were allocated to functions using the combined tractor time, truck miles and auto miles devoted to each enterprise as reported by the grower. Estimated fuel usage was used as the common denominator in combining tractor, truck and auto uses. Fuel consumption rates were: tractor 2.0 gal/hr, truck .125 gal/mile, and auto .066 gal/mile. The allocation of equipment costs to various functions was made on the basis of estimated usage of equipment employed on each practice.

The allocation of land and building costs, interest, and miscellaneous expenses between production and harvesting was made on the basis of estimated motor fuel usage. The allocations were made only to other production practices and other harvesting practices. Thus, such practices as burning, spraying, etc., had no charges for land and building costs.

The allocation of contract services was made directly to each practice as these service costs were reported for each of the practices by growers.

### **Limitation of Cost Estimates & Cost Studies**

There are three major limitations which must be recognized in any cost estimate: (1) the degree to which they can explain prices received (2) the dependence of unit cost estimates on yield per acre, and (3) the bias from allocating joint costs.

In some years only direct costs are covered by prices received yet blueberry production continues. It does so only if in the longer run total costs will be met. This means primarily that costs associated with owning equipment used in production and harvesting must be paid for out of returns. If blueberry production efficiency or prices remain low and blueberry land continues to rise in market value, this land will go out of production due to the low returns for its use.

Variations in yield per acre substantially influence costs per pound. The limitation of yield per acre in this study was that modest yields were

obtained which resulted in a higher unit cost than might otherwise occur. The 1974 crop yield was somewhat below average on the operations studied. Higher than average yields would result in lower costs per unit.

Methods of allocating joint costs among several enterprises influence total and unit costs of a particular enterprise. Reasonable care and accepted methods were used in allocating joint costs for labor, equipment, and overhead costs among blueberries and the other enterprises in which most growers participated. Alternative allocation procedures if employed would provide slightly different results.

Finally, operating costs and returns are not a complete accounting of the overall financial return to land enterprises. Land may be profitably held when appreciation in value offsets the losses from operations.

## DESCRIPTION OF GROWER OPERATIONS

Most blueberry growers were engaged in various non-farm activities in addition to producing blueberries. Only four, or less than 20 percent, considered themselves farmers. The major land holdings and sources of income reported by growers attest to this.

### **Land Use**

Land holdings of blueberry growers were primarily blueberry fields and woods. The amount of land managed per grower was 437 acres. Of this, 301 acres were in woodland, 118 acres in blueberries, 9 acres in hayland, 3 acres in pastureland, less than an acre in vegetables and orchard, and 5 acres in non-crop uses or wasteland, table 1.

### **Income Sources**

Approximately 44 percent of the gross income of blueberry growers came from the blueberry crop and about 13 percent from other farm sources, primarily wood. Hence, about 43 percent of the blueberry growers' income in 1974 was obtained from non-farm sources. Wages or salaries from off farm employment accounted for 75 percent of non-farm income and pension/social security payments for most of the remaining income, table 2.

TABLE 1

Land Use by Size of Blueberry Operation, 27 Blueberry Growers, 1974

Crop Use	Blueberry Acres Harvested Per Grower			
	1 - 10.5	11 - 75.5	76 or Over	All
		— acres per grower —		
Blueberry <sup>1</sup>	10	68	353	118
Vegetables	*	*	0	*
Orchard Land Used	*	*	0	*
Hay	12	11	4	9
Pasture	10	1	0	3
Woodland	143	387	245	301
Other	1	7	4	5
Total Land Used	176	473	607	437

<sup>1</sup>Total blueberry acreage managed; crop and new burn land.

\*Less than .51 acre

When growers were divided into size groups based upon acres of blueberries harvested, the relative importance of sources of income changed substantially from small to large-size growers. Growers harvesting 10 acres or less obtained less than 10 percent of their income from blueberries. This compared with growers harvesting over 75 acres who obtained 75 percent of their income from blueberries, table 3. Sales of berries to processors was the major outlet for all growers. Fresh blueberry marketing was a minor source of income and conducted only by some medium and large size growers.

The average gross income from blueberries for the 27 growers was \$6,761 in 1974, table 2. Small-size growers' gross income averaged \$483, compared with \$4,677 for medium-size and \$17,199 for large-size growers. Income from all sources did not vary appreciably between small and medium size growers and amounted to about \$13,000. This compared with about \$23,000 for large-size growers, table 3.

TABLE 2

Gross Annual Income Per Grower, by Sources of Income,  
27 Blueberry Growers, 1974

Source of Income	Amount	Percent
Field Crop Sales		
Blueberries		
Processing	\$6,554	43
Fresh from field	58	*
Fresh from roadside	149	1
Total	6,761	44
Other crop sales	18	*
Total crop sales	6,779	44
Other Sources		
Farm		
Livestock & Products	479	3
Wood	1,561	10
Government payments	12	*
Total	2,052	13
Non Farm		
Off farm employment	4,700	31
Trucking blueberries	140	1
Pension, soc. security	1,692	11
Misc.	36	*
Total	6,568	43
Total other income	8,620	56
<b>TOTAL ALL SOURCES</b>	<b>\$15,399</b>	<b>100</b>

\*Less than 0.5 percent

TABLE 3

Gross Annual Income Per Grower by Sources of Income and Size of Blueberry Operation, 26 Blueberry Growers, 1974

Item	Blueberry Acres Harvested Per Grower			
	1 - 10.5	11 - 75.5	76 or Over	All
Number of Growers	5	15	6	26
Crop Sales				
Blueberries (for processing)	\$ 483	\$ 4,406	\$16,981	\$ 6,554
Blueberries (fresh from field)	0	12	218	58
Blueberries (fresh from roadside)	0	259	0	149
Other crop income	17	14	29	18
Total crop sales	500	4,691	17,228	6,779
Total other income	12,778	8,328	5,886	8,620
<b>TOTAL ALL INCOME</b>	<b>13,278</b>	<b>13,019</b>	<b>23,114</b>	<b>15,399</b>

### Grower Time Devoted to Blueberry Enterprise

Some blueberry growers reported devoting little or no time and others reported devoting as much as seven months to the blueberry enterprise. The average time devoted was 2.4 months. Other income earning activities accounted for 9.1 months of time. Some growers were retired and did not devote time to other income earning activities.

The distribution of time to the blueberry enterprise of the 27 growers was as follows:

Number of Months	Number of Growers	Percent
0.1 - 0.5	3	11
1 - 2.5	14	52
3 - 4.5	6	22
5 - 7	4	15
	<u>27</u>	<u>100</u>

### Acres of Blueberry Land

The total amount of blueberry land managed in 1974 by growers participating in this study was 3194 acres. The average amount of blueberry land managed per grower was 118 acres. Individual growers managed



from 2 to 700 acres. Half the growers managed 60 acres or less. About 20 percent managed over 200 acres. The distribution of total acres managed was as follows:

Acres	Number of Growers	Percent
2 - 10	4	15
11 - 30	7	26
31 - 60	3	11
61 - 90	3	11
91 - 120	3	11
121 - 210	2	7
211 - 700	<u>5</u>	<u>19</u>
	27	100

The total amount of blueberry land harvested in 1974 by growers in the study was 1493 acres. The average amount of blueberry land harvested per grower was 55 acres. Individual growers harvested from 2 to 240 acres. Half the growers harvested 30 acres or less. About 20 percent harvested over 90 acres. The distribution of harvested acres was as follows:

Acres	Number of Growers	Percent
2 - 10	6	22
11 - 30	8	30
31 - 60	3	10
61 - 90	5	19
91 & over	<u>5</u>	<u>19</u>
	27	100

### Quantity of Blueberries Harvested

About 1,000,000 pounds of blueberries were harvested by growers participating in the study, or about 34,000 pounds per grower. Total yields per grower ranged from 600 to 150,000 pounds. Nearly half the growers harvested 10,000 pounds of berries or less. About 15 percent harvested over 80,000 pounds.

The average yield of blueberries per acre harvested per grower ranged from 115 to about 1700 pounds. About 25 percent of the growers had yields averaging 500 pounds per acre or less. About 40 percent had yields between 500 and 700 pounds per acre while only 15 percent had yields

over 1300 pounds per acre. The distribution of various yields of blueberries per acre was as follows:

Blueberry Yield Pounds/Acre	Number of Growers	Percent
115 - 500	7	26
501 - 700	11	41
701 - 900	2	7
901 - 1,100	3	11
1,101 - 1,300	0	0
1,301 & over	<u>4</u>	<u>15</u>
	27	100

### Production and Harvesting Practices

*Production Practices.* Except for the application of insecticides, which was performed under contract, most production management practices were performed by the grower or his hired employees. Some growers included in the sample contracted for mowing, burning, bees for pollinating and road maintenance. The average number of acres which received various practices by the grower and a contractor is shown in table 4. Of 1377 acres harvested, about two-thirds was burned by the grower and one-third by contractors. Insecticides were applied on eighty percent of the acres by contractors. Of 486 acres where bees were used for pollination, the bees were provided under contract for one-third of the acres. Application of herbicides was done almost exclusively by the growers. Cutting brush and mowing fields was a grower activity on 80 and 95 percent of the acreage cut or mowed, respectively.

*Harvesting Practices.* Most growers performed all of the harvesting practices themselves or with their own crew. Although only about 20 percent of the growers contracted for harvesting operations, these growers accounted for approximately one-third of the acreage.

Berries were hauled at the expense of the grower from 60 percent of the acreage, with the balance picked up by the processor. About one-third of the hauling done by the grower was under contract.

*All Practices.* For nine enterprises no contracted services, other than the application of insecticides, were performed. Two-thirds of the growers contracted for two or more practices and 11 growers contracted for three or more.

TABLE 4

Number of Acres Per Grower on Which Management Practices Were Performed, by Agent Performing Service, 1974 Crop

Practice	Agent	
	Grower	Contractor
	— acres per grower <sup>1</sup> —	
<b>Production</b>		
Cut brush	27	8
Mow	36	2
Spread hay	14	0
Burn	34	17
Fertilize	12	0
Apply insecticide	11	46
Apply herbicide	27	*
Apply fungicide	1	0
Pollinate — Bees	12	6
Other	3	*
<b>Harvest</b>		
String fields	35	16
Rake	36	17
Winnow	33	17
Haul berries	22	12
Supervise crew	20	17

<sup>1</sup>Fifty five acres harvested per grower. Differences between 55 acres and sum of grower and contractor acres represents acreage on which the practice was not performed.

\*Less than 1 acre

## FINANCIAL ANALYSIS

The financial results of the blueberry enterprise were analyzed by compiling income and expense data to compute operator labor income; by computing production factors such as yields per acre and costs of practices per acre; and by computing various measures of investment in the enterprise.

### Income Analysis

Net income per grower in this study averaged \$71 for the 1974 crop. After adjusting net income for changes in inventories, allowing a return of 7 percent on net worth and a wage of \$2 per hour for family labor, the average amount earned per grower was -\$2,287, table 5. Thus, in 1974,

the average grower neither received a return for his labor or a return on his investment. Similar analyses for each of three groups of growers, based upon acreage harvested, indicated that in none of the size groups did growers receive a return for their labor. The returns to growers in the larger size group did not cover operating costs, table 5.

### **Investment Analysis**

The blueberry enterprise represented a total investment of about \$39,000 per grower in the study. This investment varied from about \$10,000 for the small grower to \$100,000 for the large grower, table 5. Investment per acre averaged about \$1,000 for all growers and varied from about \$600 for large growers to \$2,000 for small growers. The investment per dollar of receipts varied from \$28 for small size enterprises to \$6 for large size enterprises. After allowing \$3 per hour for the growers' time in the blueberry operations the average return on investment per grower was negative for all size groups.

### **Production Analysis**

An average of 675 pounds of blueberries was sold per acre at a price of 20 cents per pound. An average of 55 acres was harvested per grower with a gross return of \$133 per acre, table 5. Primarily because of differences in yield, but also due to variations in prices received, returns per acre varied from \$159 for small-size enterprises to \$111 for large-size. Yields per acre varied from 836 pounds for small size to 570 pounds for large-size operations.

Cash costs for hired labor and contracted services used in performing selected production operations amounted to an average of \$2 per acre for mowing, \$14 per acre for burning, and \$4 per acre for spraying. Harvesting labor amounted to \$62 per acre and nine cents per pound. There were no differences in harvesting costs per pound among the three grower size groups. Total harvesting costs varied with the yield.

TABLE 5

Income Analysis, Production Analysis, and Investment Analysis,  
by Acres Harvested Per Grower, 27 Blueberry Enterprises, 1974 Crop

Item	Acres Harvested Per Grower			All Growers
	1 - 10	11 - 75	76 & over	
Number of Growers	6	15	6	27
Income Analysis				
Acres harvested per grower	5.5	36.3	152.2	55.3
Berries sold per acre (lbs.)	836	652	570	675
Average price per pound (\$)	\$ .19	.21	.19	.20
Value of Berries/acre	\$159	131	111	133
Total receipts	\$977	4,770	17,593	6,777
Total expenses	795	4,687	17,661	6,706
Net income	182	82	-68	71
Change in inventory	-12	9	4	3
Interest on net worth	151	1,481	6,557	2,313
Value unpaid labor	101	45	0	48
Operator labor income	-87	-1,435	-6,621	-2,287
Production Analysis				
Cost of mowing/acre <sup>1</sup>	2.22	2.05	2.67	2.23
Cost of burning/acre <sup>1</sup>	16.41	12.32	15.46	13.93
Cost of spraying/acre <sup>1</sup>	4.75	4.20	4.10	4.30
Cost of harvesting/acre <sup>1</sup>	79.44	58.72	51.86	61.80
Cost of harvest/pound	.09	.09	.09	.09
Investment Analysis				
Total investment	\$9,660	\$25,830	\$100,226	\$38,769
Invest./hvstd acre	1,920	862	598	1,039
Invest./dollar receipt	28	9	6	12

<sup>1</sup>Cash costs for labor and contracted services only.

## COSTS OF PRODUCTION

### Total Costs

The average cost for producing and harvesting blueberries was \$182 per acre for the 27 growers. Their costs amounted to 34 cents per pound, table 6. These costs were a simple average of individual grower costs.

Costs per acre varied widely. They ranged from \$71 to \$368 and individual grower costs were widely distributed within this range. The distribution of costs per acre was as follows:

Cost per Acre	Number of Growers	Percent
\$ 71 - 120	7	28
121 - 150	5	18
151 - 180	5	18
181 - 210	0	0
211 - 240	5	18
241 & over	<u>5</u>	<u>18</u>
	27	100

Costs per pound varied widely. They ranged from 17 cents to 97 cents. However, most individual grower costs were 35 cents or less. Nearly half the growers had costs between 17 and 25 cents. The distribution of costs per pound was as follows:

Cost per Pound	Number of Growers	Percent
\$.17 - .25	12	45
.26 - .35	7	26
.36 - .45	2	7
.46 - .55	3	11
.56 - .65	1	4
.66 & over	<u>2</u>	<u>7</u>
	27	100

Extremely high costs per pound resulted primarily from near crop failure, often due to factors beyond the growers' control.

### Direct and Indirect Costs

Direct costs comprised expenditures chargeable directly to the blueberry enterprise. Direct costs included allocations of labor and power equipment based upon the direct use of these resources to blueberry land. Direct costs amounted to \$180 per acre and \$.339 per pound, table 6.

Indirect costs were identified as miscellaneous expenditures for telephone, electricity, organization dues and general hauling; a portion of which was charged to the blueberry enterprise according to each grower's estimate. These expenditures totaled \$2 per acre or \$.003 per pound.

Direct costs were divided into variable and fixed costs. Variable costs amounted to \$119 per acre or 21 cents per pound. Fixed costs were \$61

per acre or 13 cents per pound, table 6. Variable costs constituted costs incurred only when a crop was under management (primarily labor, pesticides, fuel, contracted services); fixed costs were costs incurred regardless of whether or not the land was managed for crop production. Direct fixed costs and indirect costs represent the overhead cost for the blueberry enterprise. For profitable operation, they must be recovered over a period of years. Direct variable costs must be recovered almost annually or the grower may discontinue production. On the average, the 27 growers would have needed about 21 cents per pound for their berries to recover direct variable costs for the 1974 crop.

TABLE 6  
Costs of Producing and Harvesting Blueberries Per Grower,  
Per Acre and Per Pound by Direct and Indirect Cost Categories,  
27 Growers, 1974 Crop

Cost Item	Cost Unit		
	Per Grower	Per Acre	Per Pound
Direct Variable Costs			
Labor	\$3,532	\$ 82	\$.143
Materials	771	13	.023
Contracted services	1,611	24	.041
Total	\$5,914	119	.207
Direct Fixed Costs			
Equipment	510	8	.014
Land and buildings	591	12	.025
Interest	2,471	41	.093
Total	\$3,572	61	.132
Direct Costs Total	\$9,486	180	.339
Indirect Costs			
Miscellaneous	52	2	.003
TOTAL COSTS	\$9,538	182	.342

### Cash and Non-Cash Costs

A further distinction in the kinds of costs incurred in blueberry production is that between cash and non-cash. Cash costs amounted to \$112 per acre or 18 cents per pound. This compared with non-cash costs of \$70 per acre or 16 cents per pound, table 7. Growers normally expect at the minimum to recover cash costs incurred. Thus this becomes especially important in year-to-year business decisions. Cash costs do not recognize the imputed charges for operator labor, depreciation, and interest on investment. However, fixed charges which are paid in cash such as repairs, rent, taxes, insurance and interest are recognized.

TABLE 7

Items of Cost in Producing and Harvesting Blueberries Per Acre, and Per Pound by Cash and Non-Cash Cost Categories, 27 Growers, 1974 Crop

Cost Item & Category	Cost Unit	
	Per Acre	Per Pound
<b>Cash Costs</b>		
Hired labor	\$ 58	\$.086
Materials	13	.023
Contracted services	24	.041
Equipment — repairs, rent	3	.005
Land and Building repairs, taxes, insurance	11	.022
Interest — notes, mortgages	1	.002
Miscellaneous	2	.003
Total Cash	112	.182
<b>Non-Cash</b>		
Family and Operator labor	24	.057
Equipment — depreciation	5	.009
Building — depreciation	1	.003
Interest — net worth @ 7%	40	.091
Total Non-Cash	70	.160
<b>TOTAL COSTS</b>	182	.342

### Cost Items

Seven major cost categories in blueberry production were identified and the expense items associated with them compiled in further analyzing production and harvesting costs. These were: labor, materials, contracted services, equipment, land and buildings, interest, and miscellaneous. Of these, labor was the largest category of expense amounting to \$82 per acre. Next in dollar importance was interest (both paid on borrowed funds and imputed on net worth) which amounted to \$41. The third major category was contracted services which totaled \$24 per acre. Other cost category amounts per acre were materials \$13, land and buildings \$12, equipment \$8 and miscellaneous \$2. The expense items associated with each of the categories are indicated in table 8 and discussed in the following sections.

*Labor.* Hired labor accounted for 70 percent of the labor expense, the operator 25 percent and family labor 5 percent. Labor was 42 percent of total costs amounting to \$82 per acre or 14.3 cents per pound. Most of this expense was incurred in harvesting.



*Materials.* Materials expense was comprised primarily of burning fuel (oil, gas, hay) motor fuel and bee hives. These cost items constituted 46 percent, 15 percent and 15 percent of material costs, respectively. Other items, each accounting for 8 percent of material costs, were: fertilizer, pesticides and other materials (string, stakes, etc.). Materials expense was \$13 per acre, and represented 7 percent of total costs, or 2.3 cents per pound.

*Contracted Services.* Hiring of a complete service, including labor, material, equipment and supervision, was a major expense item for many growers. Half of these service costs were for raking berries. Burning and pesticide application operations each accounted for 17 percent of contracted services costs with mowing, cutting bushes and other land maintenance services accounting for 8 percent. Contracted services were 13 percent of all costs, amounting to \$24 per acre or 4.1 cents per pound.

*Equipment.* Equipment expenses included machinery rental, repairs and depreciation (fuel costs were included in materials expenses). Depreciation was the principal equipment cost accounting for 60 percent of the cost with repairs and rental fees following in importance. Equipment was a relatively small cost in blueberry production. It represented 4 percent of total costs and was \$8 per acre, or 1.4 cents per pound of berries harvested.

*Land and Buildings.* Taxes and insurance were the principal expenses in land and building costs, representing 60 percent and 25 percent of these cost categories, respectively. Repairs and depreciation on buildings accounted for 15 percent of these costs. Land and buildings costs were 7 percent of total production and harvesting costs, amounting to \$12 per acre or 2.5 cents per pound.

*Interest.* Interest charges combined actual payments of interest on outstanding debt plus a computed charge of 7 percent on net worth. Indebtedness was small, resulting in an insignificant amount of actual interest expense.

Interest charges were the second largest expense category, accounting for 23 percent of total costs and totaling \$41 per acre or 9.3 cents per pound.

*Miscellaneous.* Miscellaneous charges combined electricity, telephone, organization dues, general hauling and general supplies expenses. General supplies were about one third of the miscellaneous costs, with other items ranging from 10 to 20 percent. Miscellaneous costs were only 1 percent of all costs and amounted to \$2 per acre, or 0.3 cents per pound.

TABLE 8

Costs of Producing and Harvesting Blueberries by Cost Items  
Per Grower, Per Acre and Per Pound, 27 Growers, 1974 Crop

Cost Item	Cost per Grower	Cost per Acre	Cost per Pound
<b>Labor</b>			
Hired	\$2,928	\$ 58	\$.086
Family @ \$2.00/hr.	48	3	.002
Operator @ \$3.00/hr.	556	21	.055
Total	\$3,532	\$ 82	\$.143
<b>Materials</b>			
Fertilizer	101	1	.002
Pesticides	62	1	.002
Motor fuel	106	2	.006
Burning fuel	358	6	.009
Other material (string, etc.)	29	1	.001
Bee hives	116	2	.003
Total	\$ 771	\$ 13	\$.023
<b>Contracted Services</b>			
Cut bushes	3	*	**
Mow	22	1	.002
Burn	348	4	.006
Spray pesticides	229	4	.007
Haul	92	2	.002
Rake	856	12	.022
Other	61	1	.002
Total	\$1,611	\$ 24	\$.041
<b>Equipment</b>			
Machinery repairs	129	2	.004
Machinery Depreciation	338	5	.009
Rental	43	1	.001
Total	\$ 510	\$ 8	\$.014
<b>Land and Buildings</b>			
Repairs	51	1	.002
Depreciation	97	1	.003
Taxes	357	7	.015
Insurance	86	3	.005
Total	\$ 591	\$ 12	\$.025
<b>Interest</b>			
Borrowed funds (actual)	157	1	.002
Net worth @ 7%	2,314	40	.091
Total	\$2,471	\$ 41	\$.093

Cost Item	Cost per Grower	Cost per Acre	Cost per Pound
Miscellaneous			
Elec. Tel. Dues, Hauling, Supplies	52	2	.003
Total	\$9,538	\$182	\$.342

\*Fifty cents or less.

\*\*Five hundredths of one cent or less.

### Cost Functions

Costs of various production and harvesting practices (operations or functions) were compiled by allocating expense items to each practice. Computations of costs by functions were made only on a per acre basis. Those expenditures not clearly chargeable entirely to one practice, were allocated among practices using labor and equipment hours devoted to the practices. Not all expenditures were allocated to each practice. Materials, equipment and contracted services expenses were allocated to each practice or function. Since land, building, interest and miscellaneous expenses were not easily identifiable with specific practices they were charged to the "other" practices category for both production and harvesting functions.

*Production.* Production functions included the following practices: cutting bushes, mowing fields, burning fields, fertilizing, spraying, pollinating with bees, and other practices including such activities as road maintenance and bird control. The average cost of production amounted to \$83 per acre, table 9. Production costs of individual growers ranged from \$5 to \$201 per acre. One third of the growers had costs between \$50 and \$69. The distribution of production costs per acre were as follows:

Cost per Acre	Number of Growers	Percent
\$ 5 - 49	3	11
50 - 69	9	33
70 - 89	6	22
90 - 109	4	15
110 & over	5	19
	27	100

Average production costs per acre were comprised of \$3 for cutting, \$6 for mowing, \$21 for burning, \$2 for fertilizing, \$8 for spraying, \$2 for pollinating, and \$41 for other production activities, table 9. (Included in

charges for other production was a pro rata share of land, buildings, interest and miscellaneous expenditures).

*Cutting Bushes.* The \$3 per acre cost of cutting bushes was almost entirely labor expense. Only 16 cents were spent for materials and equipment used, table 9.

*Mowing Fields.* The \$6 per acre cost of mowing fields included over \$2 each for labor and equipment and nearly \$1 for materials (primarily tractor fuel). The contracted services for mowing amounted to nearly \$1 per acre for all growers.

*Burning.* The \$21 per acre cost of burning was comprised of \$6 for materials (hay, oil, gas) nearly \$8 for labor, \$2 for equipment and \$4 for contracted services. Burning was performed under contract more often

TABLE 9

Per Acre Costs of Producing and Harvesting Blueberries by Function,  
Practice and Cost Item, 27 Growers, 1974 Crop

Practice/Function	Cost Item							Total
	Labor	Materials	Equip.	Contract	Lnd-Bldg	Interest	Misc.	
	— cost per acre harvested —							
<b>Production</b>								
Cut	\$ 2.80	\$ .02	\$ .14	\$ .01				\$ 2.97
Mow	2.30	.77	2.39	.86				6.32
Burn	7.61	6.38	2.25	4.38				20.63*
Fertilize	.27	1.32	.13	.00				1.72
Spray	2.21	1.21	.74	3.79				7.95
Pollinate	.18	1.93	.06	.00				2.17
Other Prod.	1.12	.13	.47	1.30	\$6.57	\$30.51	\$1.22	41.32*
Total	\$16.49	\$11.76	\$ 6.18	\$10.34	\$6.57	\$30.51	\$1.22	\$83.08*
<b>Harvest</b>								
String	3.23	.58	.07	.00				3.89*
Rake	53.06	.09	.20	12.56				65.90*
Winnow	2.29	.01	.04	.00				2.34
Haul rakes	.14	.06	.32	.00				.51*
Haul boxes	.21	.03	.12	.00				.36
Haul berries	1.21	.48	.85	1.51				4.05
Crew supervise	5.01	.03	.05	.00				5.09
Other harvest	.18	*	.05	.00	5.23	10.63	.40	16.49
Total	\$65.33	\$ 1.28	\$ 1.70	\$14.07	\$5.23	\$10.63	\$ .40	\$98.63*
<b>Production &amp; Harvest Total</b>	<b>\$81.82</b>	<b>\$13.04</b>	<b>\$ 7.88</b>	<b>\$24.41</b>	<b>\$11.80</b>	<b>\$41.14</b>	<b>\$1.62</b>	<b>\$181.71</b>

\*Subtotal values do not add to total value due to rounding.

than cutting and mowing. Thus the costs were a composite of direct material and labor costs and payments to contractors.

*Fertilizing.* Less than \$2 per acre was expended on the average for fertilizing blueberries by the 27 growers. Materials applied were 75% of the cost. Few growers engaged in fertilizing practices, including the application of sulphur, for the 1974 crop.

*Spraying.* The average expenditure for the application of all insecticides, fungicides and herbicides was \$8 per acre. About half this amount was for contracted services for insecticide application. The remainder was charges for grower and hired labor of \$2 plus \$2 for materials and equipment used by the grower.

*Pollinating.* The use of bees for pollinating resulted in expenditures of \$2 per acre almost all of which was for the rental of bee hives. Labor and equipment expenses in connection with pollinating activities were about 25 cents per acre. The cost is likely understated because a few growers contracted for pollinating services which were included as a part of other production expenses.

*Other Production Practices.* Costs for other production practices amounted to an average of \$41 per acre. Of this amount \$31 was interest charges, \$7 land and building charges and \$1 miscellaneous expenses. The remaining \$2 was for labor, materials, equipment and contracted services costs incurred for activities or practices such as road maintenance.

*Harvesting.* Harvesting practices included stringing fields, raking and winnowing berries, hauling rakers, boxes and berries, crew supervision, and other harvesting activities. The average cost of harvesting was \$98 per acre, table 9. Harvesting costs of individual growers ranged from \$24 to \$248 per acre. Differences in costs reflected primarily variations in the blueberries harvested per/acre. Costs were normally distributed. Nearly half had costs between \$50 and \$99 per acre. The distribution of harvesting costs per acre was as follows:

Cost per Acre	Number of Growers	Percent
\$24 - 49	5	19
50 - 99	12	44
100 - 149	5	19
150 - 199	3	11
200 & over	<u>2</u>	<u>7</u>
	27	100

Average harvesting costs per acre were comprised of \$4 for stringing fields, \$66 for raking berries, \$2 for winnowing berries, \$4 for hauling berries and \$1 for hauling rakers and boxes, \$5 for crew supervision and \$16 for other harvesting activities, table 9. Other harvesting activities comprised time and equipment devoted to obtaining crews but included primarily a pro rata share of land and building, interest and miscellaneous expenses (rather than allocating these expenses to the major harvesting practices).

*Stringing fields.* Stringing fields was done at a cost of \$4 per acre. Over \$3 of this cost was labor expense, with materials accounting for most of the additional expense, table 9.

*Raking berries.* The average cost per acre was \$66. Labor of the grower and hired employees amounted to \$53 and charges of contractors for raking amounted to \$13. Material and equipment costs were negligible. Of 22 growers hiring raking crews, 17 paid between \$1.50 and \$2.20 per 22 pound box for raking. Most paid \$2.00 per box. The distribution of wages per box was as follows:

Amount per Box	Number of Growers	Percent
\$1.00 - 1.49	2	9
1.50 - 1.74	2	9
1.75 - 1.99	4	18
2.00 - 2.24	11	50
2.25 - 3.00	<u>3</u>	<u>14</u>
	22	100

*Winnowing berries.* Costs allocated to winnowing amounted to \$2 per acre. Expenses other than for labor were negligible. However, detailed allocation of expenses associated with the winnowing machine were not made which resulted in somewhat understating the equipment and materials costs for this practice. In addition, contracted services were not allocated between raking, winnowing and related field harvesting activities.

*Hauling.* The costs for hauling were \$5 per acre of which \$4 was for hauling berries and the balance about equally divided between hauling rakers and boxes. Hauling costs for berries were divided about equally between charges for contracted services, labor of the grower or hired employees, and materials and equipment.

*Crew supervision.* The \$5 per acre for crew supervision consisted almost entirely of labor charges. These costs may have been underesti-

mated because contractor charges for crew supervision were included in the raking.

*Other harvesting practices.* Costs for this activity were \$16 per acre and included little other than the pro-rated costs for land and buildings, interest and miscellaneous expenditures. Several growers designated some labor and equipment time to the activity which presumably included time spent rounding up crews and equipment for harvesting.

## FACTORS AFFECTING COSTS

Many factors cause production costs to vary from firm to firm. Some are under the control of the grower, some are not. For example, climatic and soil conditions can seldom be controlled but size of business and management practices are to a large degree controllable. Several controllable factors were examined in this study to determine if they explained differences in costs. These were: yield per acre, acres harvested, agent performing management services, and management practices.

### Yield Per Acre

Three groups of growers were selected to represent enterprises with yields of (1) 500 pounds per acre or less, (2) 501 to 900 pounds per acre, and (3) 901 to 1700 pounds per acre. Seven growers in the low yield group had average yields of 212 pounds per acre. Thirteen growers in the medium yield group had average yields of 631 pounds per acre, and seven growers in the high yield group had average yields of 1217 pounds per acre.

Total costs per acre increased substantially from the low yield to the high yield group. Total costs per acre averaged \$105 for the low, \$184 for the medium and \$253 for the high yield groups, table 10. Labor and contracted services costs increased directly with yield. This was primarily due to added harvesting expenses as yields per acre increased. The average number of acres harvested per grower was 42, 80, and 24 for each yield group, respectively.

TABLE 10

Per Grower, Per Acre, and Per Pound Costs of Producing and Harvesting  
Blueberries by Cost Item and Yield Per Acre,  
27 Growers, 1974 Crop

Cost Item	Yield Per Acre (lbs.)			All Growers
	101-500	501-900	901-1700	
	Cost Per Acre			
Labor	\$ 41	\$ 75	\$134	\$ 82
Materials	5	16	16	13
Equipment	5	9	9	8
Contracted Services	10	22	42	24
Land and Buildings	11	10	16	12
Interest on Investment	32	50	34	41
Miscellaneous	*	2	2	2
Total	\$105	\$184	\$253	\$182
	Cost Per Pound			
Labor	\$ .217	\$ .118	\$ .112	\$ .142
Materials	.028	.031	.014	.026
Equipment	.022	.014	.008	.014
Contracted Services	.062	.035	.031	.041
Land and Buildings	.053	.016	.013	.025
Interest on Investment	.181	.080	.027	.093
Miscellaneous	.002	.004	.001	.003
Total	\$ .566	\$ .299	\$ .207	\$ .344
	Cost Per Grower			
Labor	\$1,400	\$4,653	\$3,570	\$3,529
Materials	343	1,173	476	777
Equipment	298	731	311	510
Contracted Services	356	2,954	371	1,611
Land and Buildings	442	832	290	591
Interest on Investment	1,368	3,671	1,343	2,471
Miscellaneous	14	87	25	52
Total	\$4,220	\$14,101	\$6,387	\$9,540

\*Less than 50¢

Costs per pound of blueberries harvested declined substantially from the low yield group to the high yield group. The average total cost per pound was 57 cents for the low yield group, 30 cents for the medium yield and 21 cents for the high yield group, table 10. While labor costs per pound declined sharply from low yield to medium yield the principal cost item affected by yields was land and buildings expenses and interest on investment, which were the major fixed operating charges.



Costs per acre for the various cost items were determined separately for production and harvesting functions. Harvesting costs per acre increased directly with increases in yields. The low yield group had costs of \$56 per acre compared with \$171 for the high yield group, table 11. Labor and contracted services increased directly with yield increases. None of the other harvesting costs showed a consistent relationship.

TABLE 11  
Per Acre Costs of Producing and Harvesting Blueberries  
by Item, Function, and Yield Per Acre,  
27 Growers, 1974 Crop

Function & Item	Yield Per Acre (lbs.)			All Growers
	101-500	501-900	901-1700	
Production				
Labor	\$ 14	\$ 18	\$ 16	\$ 16
Materials	4	15	14	12
Equipment	3	8	6	6
Contracted Services	6	8	18	10
Land and Buildings	5	8	5	7
Interest on Investment	17	43	22	31
Miscellaneous	*	2	1	1
Total Production	\$ 49	\$102	\$ 82	\$ 83
Harvesting				
Labor	\$ 27	\$ 56	\$118	\$ 66
Materials	1	1	2	1
Equipment	2	1	3	2
Contracted Services	4	14	25	14
Land and Buildings	7	2	10	5
Interest on Investment	15	7	13	11
Miscellaneous	*	1	*	*
Total Harvesting	\$ 56	\$ 82	\$171	\$ 99
Production and Harvesting				
Labor	\$ 42	\$ 75	\$134	\$ 82
Materials	5	16	16	13
Equipment	5	9	9	8
Contracted Services	10	22	42	24
Land and Buildings	11	10	16	12
Interest on Investments	32	50	34	41
Miscellaneous	*	2	2	2
Total Production & Harvesting	\$105	\$184	\$253	\$182

\*Less than 50 cents

Production costs per acre increased with increases in yields except that the medium yield group had higher costs than the high yield group. The low yield group had total costs of \$49 per acre compared with \$82 for the high yield group, table 11. The combined labor, material, equipment and contracted services costs were \$27 per acre for the low yield group and \$54 for the high yield group. Thus, while yields per acre increased six fold variable expenses per acre doubled. Because of the comparatively modest increases in costs per acre associated with higher yields, costs of production per pound declined as yields increased.

### Acres Harvested

Three groups of growers were selected to represent different sizes of operations based upon acres harvested in 1974. These were: (1) less than 10 acres, (2) 11-75 acres and (3) 76 acres and over. Six growers were in the small size group, 15 in the medium size group and six in the large size group. The average number of acres harvested per grower in these groups was 6, 36 and 152, respectively.

Total costs per acre declined as the acreage per grower increased. Total costs were \$195 per acre for the small size group, \$187 per acre for the medium size group, and \$156 per acre for the large size group, table 12. Labor costs and contracted services costs per acre declined as the acreage harvested increased. Much of this change was associated with harvesting costs as the yield per acre also declined as harvested acres per grower increased. Small-size growers averaged 836 pounds per acre, medium-size 652 pounds per acre and large-size 570 pounds per acre.

Costs per pound of blueberries harvested declined as the acres harvested increased. Small-size growers costs were 37 cents per pound compared with 36 cents for medium-size and 29 cents for large-size growers, table 12. The major differences in costs per pound were in labor costs. Large-size operations had substantially lower labor costs per pound.

When costs per acre were determined separately for production and harvesting functions, it was evident that production costs per acre were 50 percent higher for large operations than for small, table 13. On the other hand, harvesting costs per acre were substantially lower for large compared with small operations. Lower costs for labor and contracted services for harvesting resulted in per acre costs of harvesting being sufficiently low so as to offset higher production costs of the large size growers. As indicated in table 12, despite lower yields, the large growers had lower costs per pound than medium and small size growers. The higher production costs per acre of large size growers were primarily due

to differences in expenditures for equipment, land and buildings and interest on this investment. Differences in costs between medium and large size growers were negligible, except for labor costs, and interest charges, table 13.

TABLE 12

Per Acre and Per Pound Costs of Producing and Harvesting  
Blueberries by Cost Item and Acres Harvested Per Grower,  
27 Growers, 1974 Crop

Cost Item	Acres Harvested Per Grower			All Growers
	1-10	11-75	76 and over	
	Cost Per Acre			
Labor	\$ 88	\$ 92	\$ 50	\$ 82
Materials	7	15	14	13
Equipment	4	10	7	8
Contracted Services	54	11	29	24
Land and Buildings	12	12	12	12
Interest on Investment	29	45	43	41
Miscellaneous	2	2	1	2
Total	\$195	\$187	\$156	\$182
	Cost Per Pound			
Labor	\$ .185	\$ .145	\$ .090	\$ .142
Materials	.019	.028	.027	.026
Equipment	.006	.019	.012	.014
Contracted Services	.051	.034	.050	.041
Land and Buildings	.019	.028	.024	.025
Interest on Investment	.092	.097	.081	.093
Miscellaneous	.001	.003	.002	.003
Total	.374	.355	.286	.344
	Costs Per Grower			
Labor	\$ 663	\$3,322	\$6,911	\$3,529
Material	77	494	2,185	777
Equipment	21	406	1,260	510
Contracted Services	203	441	5,943	1,611
Land and Buildings	43	339	1,760	591
Interest on Investment	151	1,522	7,162	2,471
Miscellaneous	15	34	133	52
Total	\$1,173	\$6,558	\$25,360	\$9,540

TABLE 13

Per Acre Costs of Producing and Harvesting Blueberries by Item,  
Function, and Acres Harvested,  
27 Growers, 1974 Crop

Function and Item	Acres Harvested			All Growers
	1-10	11-75	76 and over	
Production				
Labor	\$ 14	\$ 20	\$ 10	\$16
Materials	6	13	13	12
Equipment	3	7	7	6
Contracted Services	15	9	10	10
Land and Buildings	5	6	11	7
Interest on Investment	16	33	40	31
Miscellaneous	1	1	1	1
Total Production	60	89	91	83
Harvesting				
Labor	74	72	40	66
Materials	1	2	1	1
Equipment	1	3	*	2
Contracted Services	39	2	19	14
Land and Buildings	7	6	2	5
Interest on Investment	13	13	3	11
Miscellaneous	*	*	*	*
Total Harvesting	135	98	65	99
Production & Harvesting				
Labor	88	92	50	82
Materials	7	15	14	13
Equipment	4	10	7	8
Contracted Services	54	11	29	24
Land and Buildings	12	12	12	12
Interest on Investment	29	45	43	41
Miscellaneous	2	2	1	2
Total Production & Harvesting	195	187	156	182

\*Less than 50 cents

### **Contractual Services**

Growers were segregated into those who contracted for some services other than applying pesticides and those who contracted only for pesticide application. There were 19 growers who contracted for two or more services and 8 who contracted for pesticide application only.

Comparison of total costs for production and harvesting indicated no appreciable differences between the two groups. Costs per acre were \$181 for those contracting for services compared with \$184 for those performing services themselves (operator using hired or family help and own equipment and materials), table 14. Higher harvesting costs of contracting growers (\$104 vs. \$86) were offset by lower production costs. Production costs were \$77 per acre for growers contracting services compared with \$97 for growers performing services themselves. Average expenditures for all production cost items except contracted services and equipment were higher for the group of growers performing practices themselves. As anticipated, the major cost difference was for labor. Because of variations among costs per acre among growers, the difference of \$20 per acre in total production costs was not statistically significant. Thus these data indicate that who performs the production and harvesting practices is not a major factor influencing costs of production and harvesting.

TABLE 14

Per Acre Costs of Producing and Harvesting Blueberries by Cost Item and Agent Performing Practices or Services, 27 Growers, 1974 Crop

Item	Performing Agent		All Growers
	Contractor <sup>1</sup>	Operator <sup>2</sup>	
Number of Growers	19	8	27
.....			
Production			
Labor	10	28	16
Materials	10	15	12
Equipment	7	5	6
Contracted Services	14	3	10
Land and Buildings	6	8	7
Interest on Investment	29	35	31
Miscellaneous	1	3	1
Total Production	77	97	83
.....			
Harvesting			
Labor	67	59	66
Materials	1	2	1
Equipment	2	3	2
Contracted Services	20	0	14
Land and Buildings	5	7	5
Interest on Investment	9	14	11
Miscellaneous	*	1	*
Total Harvesting	104	86	99
.....			
Production & Harvesting			
Labor	78	92	82
Materials	12	17	13
Equipment	9	6	8
Contracted Services	34	3	24
Land and Buildings	11	14	12
Interest on Investment	38	49	41
Miscellaneous	1	4	2
Total Production & Harvesting	181	184	182

<sup>1</sup>One or more operations in addition to pesticide application performed by contract.

<sup>2</sup>No operations other than pesticide application performed by contract.

\*Less than 50 cents

### Management Practices

*Influence on Production Costs.* Using regression analysis, nearly 60 percent of the variation in costs of production per acre was accounted for by the eight management practices: mowing, burning, applying sulphur, fertilizer, fungicides, and herbicides, cutting bushes, and pollinating with bees. Of these practices, mowing accounted for 12 percent and the application of fungicides accounted for 19 percent of the total variation in costs. The remaining practices each explained from two to nine percent of the variation.

Coefficients for variables in the regression equation were statistically significant only for mowing and fungicide application.

The regression equation was as follows:

$$Y = \$23 + \$46(X_1)^* + \$20(X_2) - \$96(X_3) + \$18(X_4) + \$128(X_5)^{**} + \$6(X_6) + \$22(X_7) - \$24(X_8)$$

(\$33)    (\$17)    (\$28)    (\$55)    (\$19)    (\$38)    (\$16)    (\$15)    (\$16)

Y = Cost per acre in dollars

X<sub>1</sub> = mow (1) yes (0) no

X<sub>2</sub> = burn (1) yes (0) no

X<sub>3</sub> = apply sulphur (1) yes (0) no

X<sub>4</sub> = apply fertilizer (1) yes (0) no

X<sub>5</sub> = apply fungicide (1) yes (0) no

X<sub>6</sub> = cut bushes (1) yes (0) no

X<sub>7</sub> = apply herbicides (1) yes (0) no

X<sub>8</sub> = pollinate with bees (1) yes (0) no

r<sup>2</sup> = .57

n = 27

\*significant at 5% level

\*\*significant at 1% level

( ) standard error of coefficient

Three other variables were included in the regression analysis that did not appear in the final equation. Spraying for insects was not an explanatory cost variable because it was universally practiced. Irrigation and bird control were closely correlated with the use of fungicides and did not add sufficiently to the r square value to be included in the final equation.

Production cost per acre estimates resulting from using the equation could vary substantially from true costs. Chances are two out of three that estimates would be within \$33 per acre of true costs. Thus management practices did not appear to be a good predictor of costs per acre.

*Influence on Yield Per Acre.* Using regression analysis, only 20 percent of the variation in blueberry yields per acre was accounted for by eight management practices; burning, mowing, application of herbicides, fungicides, fertilizer, and sulphur, cutting bushes and pollinating with bees.

The regression equation was as follows:

$$Y = 77 + 611(X_1) + 146(X_2) - 61(X_3) + 71(X_4) - 67(X_5) - 121(X_6) - 72(X_7) - 154(X_8)$$

(437) (366) (225) (246) (721) (205) (197) (212) (504)

Y = Yield per acre in pounds

X<sub>1</sub> = burn (1) yes (0) no

X<sub>2</sub> = mow (1) yes (0) no

X<sub>3</sub> = apply fertilizer (1) yes (0) no

X<sub>4</sub> = apply sulphur (1) yes (0) no

X<sub>5</sub> = cut bushes (1) yes (0) no

X<sub>6</sub> = apply herbicides (1) yes (0) no

X<sub>7</sub> = pollinate with bees (1) yes (0) no

X<sub>8</sub> = apply fungicides (1) yes (0) no

r<sup>2</sup> = .18

n = 26

( ) standard error of coefficient

Insecticide application, bird control and irrigation were not explanatory variables because of the universal insecticide spraying practice and the high correlation with other practices. Of the explanatory variables, burning accounted for 12 percent of yield variation, mowing 3 percent and herbicides application 2 percent. Other variables accounted for less than one percent of yield variation. Coefficients in the regression equation were not significantly different from zero.

The standard error of the yield estimate based on the equation indicated chances were two out of three that the predicted yield would vary by 437 pounds from the true yield. Thus, under 1974 field conditions, and practices used by growers, management practices did not provide a good indicator of blueberry yields. Weather conditions and other variables not considered presumably were important major influencing factors. The limited number of observations in the analysis also influenced the results.