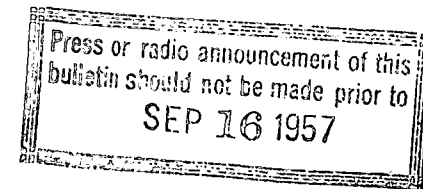


*Cost of Producing*  
**Apples and Pears**  
*in the Hood River Valley, Oregon*

**PROGRESS REPORT X.**

**D. Curtis Mumford**

**Arthur E. Irish**



Agricultural Experiment Station  
Oregon State College  
Corvallis

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# Cost of Producing

## Apples and Pears

*in the Hood River Valley, Oregon*

### PROGRESS REPORT X

D. Curtis Mumford, Agricultural Economist  
Arthur E. Irish, Fieldman

This report is a summary of detailed cost records kept on 20 fruit farms in the Hood River Valley for the year 1956 with comparable data for the 10-year period 1947-56. Cost of production includes all items of expense incurred in producing and delivering the crop to the door of packing house or processing plant. No packing house costs are included.

### Apple Production Costs

The cost of producing apples in 1956 on 19 orchards averaged \$1.19 per loose box and \$1.82 per packed-box basis, exclusive of packing and storage costs (table 1). Assuming packing and handling charges (from \$1.25 to \$1.50\*), the total f.o.b. cost would be \$3.07 or more per packed box.

Table 1. APPLES: Cost of Production  
(Does not include cost of storage, boxes, packing, and shipping)

Item	Year 1956	Ten-year average 1947-1956	Distribution of costs
Number of orchards in study.....	19	22.4	-
Acreage of apples per orchard.....	13.3	15.0	-
Yield per acre, loose boxes.....	411	565	-
Yield per acre, packed boxes.....	268	348	-
Costs per loose box for:	<u>Dollars</u>	<u>Dollars</u>	<u>Per cent</u>
Preharvest labor.....	.35	.28	30.7
Picking.....	.15	.13	14.3
Other harvest.....	.07	.06	6.6
Total labor.....	.57	.47	51.6
Materials.....	.21	.14	15.4
General expense.....	.22	.15	16.5
Depreciation on equipment.....	.07	.06	6.6
Interest on investment (5 per cent) ...	.12	.09	9.9
Total cost per loose box.....	1.19	.91	100.0
Cost per packed-box basis.....	1.82	1.45	-

\* The cost of sorting and handling all apples delivered to the packing house is charged against the packed fruit, which usually comprises from 60 to 85% (by weight) of fruit delivered.

Table 2. APPLE PRODUCTION COSTS  
(Does not include cost of storage, boxes, packing, and shipping)

Item	Man hours		Cost	
	1956	1947-1956	1956	1947-1956
<b>Labor per acre</b>				
Pruning.....	30.3	33.7	\$ 33.74	\$ 34.24
Brush removal.....	3.2	4.4	3.51	4.40
Hand cultivating.....	1.0	1.8	1.00	1.72
Machine cultivating.....	5.6	4.1	6.96	4.51
Fertilizing; mowing.....	2.3	2.0	2.62	2.17
Irrigating.....	10.0	11.5	12.15	12.45
Spraying.....	4.1	9.0	5.16	9.74
Thinning.....	40.9	42.7	42.46	40.35
Propping; cleanup.....	6.6	7.1	7.51	7.30
Maintenance.....	17.0	22.5	21.14	25.10
Supervision.....	6.4	8.6	9.52	11.64
Total preharvest.....	127.4	147.4	\$145.77	\$153.62
Picking.....	61.9	84.5	\$ 61.89	\$ 73.94
Other harvested.....	24.9	30.2	28.54	33.53
Total labor.....	214.2	262.1	\$236.20	\$261.09
<b>Materials per acre</b>				
Fertilizers.....			\$ 17.61	\$ 14.72
Irrigation water.....			7.32	6.21
Sprays.....			41.64	41.19
Miscellaneous supplies.....			19.54	13.21
Total materials.....			\$ 86.11	\$ 75.33
<b>General expense per acre</b>				
Building repair.....			\$ 4.69	\$ 4.52
Machinery repair.....			11.53	10.51
Machine hire.....			4.77	6.28
Gas and oil.....			16.45	13.56
Electricity; water; wood fuel; office.....			9.80	8.37
Liability, fire, and motor insurance.....			10.10	7.90
Property taxes.....			21.27	16.98
Cash to operate.....			10.00	10.00
Total general expense.....			\$ 88.61	\$ 78.12
<b>Depreciation per acre</b>				
Buildings (not including operator's dwelling).....			\$ 8.12	\$ 9.53
Machinery.....			22.14	21.39
Total depreciation.....			\$ 30.26	\$ 30.92
<b>Interest per acre (5 per cent)</b>				
Buildings.....			\$ 7.22	\$ 7.96
Machinery.....			9.14	9.73
Orchard.....			30.93	30.13
Total interest.....			\$ 47.29	\$ 47.82
<b>Total cost per acre.....</b>			<b>\$488.47</b>	<b>\$ 493.28</b>
<b>Cost per loose box.....</b>			<b>\$ 1.19</b>	<b>\$ .91</b>
<b>Cost per packed box.....</b>			<b>\$ 1.82</b>	<b>\$ 1.45</b>
<b>Acres per orchard.....</b>			<b>13.3</b>	<b>14.9</b>
<b>Loose boxes produced per acre.....</b>			<b>411</b>	<b>565</b>
<b>Packed boxes produced per acre.....</b>			<b>268</b>	<b>348</b>

## Pear Production Costs

### Winter pears

The cost of producing winter pears in 1956 on 20 orchards averaged \$0.87 per lug-box and \$0.97 per packed-box basis, exclusive of packing and storage costs (table 3). Assuming packing and handling charges (from \$1.25 to \$1.50), the total f.o.b. cost would be \$2.22 or more per packed box.

Table 3. WINTER PEARS: Cost of Production  
(Does not include cost of storage, boxes, packing, and shipping)

Item	Year 1956	Ten-year average 1947-1956	Distribution of costs
Number of orchards in the study.....	20	23.1	-
Acreage of winter pears per orchard	8.1	9.9	-
Yield per acre, loose-lug boxes.....	580	463	-
Yield per acre, packed boxes.....	518	409	-
<b>Costs per loose-lug box for:</b>	<u>Dollars</u>	<u>Dollars</u>	<u>Per cent</u>
Preharvest labor.....	.21	.27	25.7
Picking.....	.14	.14	13.4
Other harvest.....	.06	.06	5.7
Total labor.....	.41	.47	44.8
Materials.....	.16	.18	17.1
General expense.....	.17	.19	18.1
Depreciation on equipment.....	.05	.08	7.6
Interest on investment (5 per cent)	.08	.13	12.4
Total cost per loose-lug box...	.87	1.05	100.0
<b>Cost per packed-box basis.....</b>	.97	1.18	-

### Bartlett (cannery) pears

The cost of producing cannery pears in 1956 on 20 orchards averaged \$1.58 per lug box and \$71.07 per ton (table 4). See table 6 for itemized costs.

Table 4. BARTLETT CANNERY PEARS: Cost of Production  
(Includes all costs, delivered to the cannery door)

Item	Year 1956	Ten-year average 1947-1956	Distribution of costs
Number of orchards in the study.....	20	22.1	-
Acreage bearing pears per orchard...	5.8	6.2	-
Yield per acre, loose-lug boxes.....	299	300	-
Yield per acre, tons.....	6.6	6.7	-
<b>Costs per loose-lug box for:</b>	<u>Dollars</u>	<u>Dollars</u>	<u>Per cent</u>
Preharvest labor.....	.51	.51	33.3
Picking.....	.13	.12	7.8
Other harvest.....	.07	.07	4.6
Total labor.....	.71	.70	45.7
Materials.....	.30	.26	17.0
General expense.....	.31	.28	18.3
Depreciation on equipment.....	.10	.11	7.2
Interest on investment (5 per cent)	.16	.18	11.8
Total cost per loose-lug box..	1.58	1.53	100.0
<b>Cost per ton.....</b>	71.07	68.44	-

Table 5. WINTER PEAR PRODUCTION COSTS  
(Does not include cost of storage, boxes, packing, and shipping)

Item	Man hours		Cost	
	1956	1947-1956	1956	1947-1956
<b>Labor per acre</b>				
Pruning .....	35.8	41.5	\$ 40.97	\$ 42.70
Brush removal .....	2.7	3.7	2.95	3.75
Hand cultivating .....	1.1	1.5	1.11	1.39
Machine cultivating .....	6.6	3.7	8.01	4.11
Fertilizing; mowing .....	3.0	2.3	3.55	2.49
Irrigating .....	10.7	10.3	12.46	10.98
Spraying .....	4.8	7.4	5.90	8.18
Thinning .....	.3	.3	.30	.31
Propping; cleanup .....	9.6	6.4	10.99	6.60
Maintenance .....	20.1	22.0	25.30	25.05
Supervision .....	5.9	8.5	8.52	11.58
<b>Total preharvest .....</b>	<b>100.6</b>	<b>107.6</b>	<b>\$120.06</b>	<b>\$117.14</b>
Picking .....	83.8	70.6	\$ 83.83	\$ 62.29
Other harvest .....	27.3	25.2	31.66	28.00
<b>Total labor .....</b>	<b>211.7</b>	<b>203.4</b>	<b>\$235.55</b>	<b>\$ 207.43</b>
<b>Materials per acre</b>				
Fertilizers .....			\$ 17.79	\$ 15.16
Irrigation water .....			6.74	6.10
Sprays .....			43.11	41.51
Miscellaneous supplies .....			24.60	16.77
<b>Total materials .....</b>			<b>\$ 92.24</b>	<b>\$ 79.54</b>
<b>General expense per acre</b>				
Building repair .....			\$ 5.66	\$ 4.99
Machinery repair .....			15.98	11.43
Machine hire .....			3.98	5.42
Gas and oil .....			20.50	16.08
Electricity; water; wood fuel; office .....			9.83	8.84
Liability, fire, and motor insurance .....			10.20	8.51
Property taxes .....			22.53	17.61
Cash to operate .....			10.00	10.00
<b>Total general expense .....</b>			<b>\$ 98.68</b>	<b>\$ 82.88</b>
<b>Depreciation per acre</b>				
Buildings (not including operator's dwelling) .....			\$ 8.36	\$ 10.37
Machinery .....			22.22	23.42
<b>Total depreciation .....</b>			<b>\$ 30.58</b>	<b>\$ 33.79</b>
<b>Interest per acre (5 per cent)</b>				
Buildings .....			\$ 6.58	\$ 8.12
Machinery .....			8.53	10.37
Orchard .....			31.65	36.34
<b>Total interest .....</b>			<b>\$ 46.76</b>	<b>\$ 54.83</b>
<b>Total cost per acre .....</b>			<b>\$503.81</b>	<b>\$ 458.47</b>
<b>Cost per loose box .....</b>			<b>\$ .87</b>	<b>\$ 1.05</b>
<b>Cost per packed box .....</b>			<b>.97</b>	<b>1.18</b>
<b>Acres per orchard .....</b>			<b>8.1</b>	<b>9.9</b>
<b>Loose-lug boxes produced per acre .....</b>			<b>580</b>	<b>463</b>
<b>Packed boxes produced per acre .....</b>			<b>518</b>	<b>409</b>

Table 6. BARTLETT PEAR PRODUCTION COSTS  
(Includes all costs delivered to the cannery door)

Item	Man hours		Cost	
	1956	1947-1956	1956	1947-1956
<b>Labor per acre</b>				
Pruning .....	27.0	31.3	\$ 30.50	\$ 32.53
Brush removal .....	2.6	3.1	2.82	3.14
Hand cultivating .....	1.5	3.2	1.57	3.06
Machine cultivating .....	7.2	4.7	8.83	5.22
Fertilizing; mowing .....	2.8	2.4	3.34	2.58
Irrigating .....	11.3	11.7	13.43	12.74
Spraying .....	4.9	7.5	6.18	8.22
Thinning .....	41.9	41.5	45.81	39.98
Propping; cleanup .....	6.1	7.1	7.01	7.35
Maintenance .....	21.4	22.5	25.54	25.68
Supervision .....	5.4	7.6	7.88	10.21
<b>Total preharvest .....</b>	<b>132.1</b>	<b>142.6</b>	<b>\$ 152.91</b>	<b>\$ 150.71</b>
Picking .....	38.4	40.6	\$ 38.36	\$ 35.71
Other harvest .....	18.9	19.4	22.08	21.40
<b>Total labor .....</b>	<b>189.4</b>	<b>202.6</b>	<b>\$ 213.35</b>	<b>\$ 207.82</b>
<b>Materials per acre</b>				
Fertilizers .....			\$ 17.79	\$ 15.88
Irrigation water .....			6.78	5.78
Sprays .....			36.52	38.51
Miscellaneous supplies .....			27.88	17.20
<b>Total materials .....</b>			<b>\$ 88.97</b>	<b>\$ 77.37</b>
<b>General expense per acre</b>				
Building repair .....			\$ 5.86	\$ 5.31
Machinery repair .....			14.51	10.83
Machine hire .....			3.30	5.96
Gas and oil .....			18.56	15.43
Electricity; water; wood fuel; office .....			10.20	9.19
Liability, fire, and motor insurance .....			9.60	8.51
Property taxes .....			21.30	17.49
Cash to operate .....			10.00	10.00
<b>Total general expense .....</b>			<b>\$ 93.33</b>	<b>\$ 82.72</b>
<b>Depreciation per acre</b>				
Buildings (not including operator's dwelling) .....			\$ 7.65	\$ 9.18
Machinery .....			21.71	22.68
<b>Total depreciation .....</b>			<b>\$ 29.36</b>	<b>\$ 31.86</b>
<b>Interest per acre (5 per cent)</b>				
Buildings .....			\$ 6.93	\$ 8.06
Machinery .....			9.06	10.64
Orchard .....			30.88	32.77
<b>Total interest .....</b>			<b>\$ 46.87</b>	<b>\$ 51.47</b>
<b>Total cost per acre .....</b>			<b>\$ 471.88</b>	<b>\$ 451.24</b>
<b>Cost per loose-lug box .....</b>			<b>\$ 1.58</b>	<b>\$ 1.53</b>
<b>Cost per ton .....</b>			<b>\$ 71.07</b>	<b>\$ 68.44</b>
Acres per orchard .....			5.8	6.2
Tons produced per acre .....			6.6	6.7
Loose boxes produced per acre .....			299	300

In general, the higher the yield of fruit per acre -- apples, winter pears, and Bartletts -- the lower was the cost of production.

In 1956 the winter pear orchards yielded more boxes of fruit per acre than did the apple orchards.

Table 7. YIELDS: Effect on Cost of Producing Apples and Pears  
(Does not include costs of storage, boxes, packing, and shipping)

Yield of packed boxes per acre*		Number of orchards	Acres per orchard	Cost per packed box*
Range	Average			
<b>Apples</b>				
Less than 200 boxes....	173.....	5	13.7	\$ 2.59
200 to 399 boxes.....	262.....	11	12.3	1.90
400 or more boxes.....	412.....	3	16.8	1.26
All orchards.....	268.....	19	13.3	\$ 1.82
<b>Winter pears</b>				
Less than 200 boxes....	189.....	1	†	\$ 2.32
200 to 399 boxes.....	354.....	4	15.8	1.18
400 or more boxes.....	628.....	15	6.6	0.89
All orchards.....	518.....	20	8.1	\$ 0.97
<b>Bartlett pears</b>				
Less than 200 boxes....	137.....	5	4.1	\$ 3.47
200 to 399 boxes.....	287.....	10	8.1	1.55
400 or more boxes.....	605.....	5	2.8	1.03
All orchards.....	299.....	20	5.8	\$ 1.58

\* Bartlett pears are figured as standard-lug boxes. (Field-run)

† Acreage not shown because only one orchard in this group.

### Age of the Trees

The orchards typically have trees of varying ages, ranging from a year up to maturity (table 8). The usual practice followed by most growers is to replace any dead or undesirable trees and thus tend to perpetuate the orchards. Depreciation on orchard investment was therefore not included in computing the cost of producing fruit.

Table 8. AGE OF TREES: Distribution on 20 Farms

Age of trees	Apples Per cent	Winter pears Per cent	Bartlett pears	
			Actual total	Adjusted (bearing)
			Per cent	Per cent
Less than 6 years.....	20	23	42	17*
6 to 9 years.....	14	4	17	22
10 years and over.....	66	73	41	61
Total, all trees.....	100	100	100	100

\* Not all young trees (1 to 5 years old) were included in the cost of production calculations because in some instances there was an abnormally high percentage of young Bartletts compared to the other age groups. The general rule was to exclude the young trees from cost of production calculations and, therefore, the acreages in excess of the normal.

Sixty-six per cent of the apple trees were 10 years old or over. Seventy-three per cent of the winter pear trees were 10 years or older. In the case of the Bartlett pears however, only 41 per cent of the trees had come into full bearing. Forty-two per cent of the trees were less than 6 years old. In order to make the 3 orchard enterprises studied more nearly comparable, certain portions of the latter group of trees (less than 6 years old) were excluded in computing cost of production where they comprised an abnormally high proportion of total Bartlett plantings. Thus, 39 per cent of the adjusted acreage of Bartlett pear trees included in the cost study were less than full bearing age (under 10 years) and 61 per cent were in full bearing.

### Varieties

Newtown and Delicious (Red, Striped, and Golden) comprised the major portion of apple acreages on farms studied (table 9). D'Anjou is the principal winter (storage) pear, and Bartlett is the canning pear.

Table 9. VARIETIES OF TREES: Distribution on 20 farms

Apples on farms studied		Winter pears on farms studied	
Variety	Per cent	Variety	Per cent
Newtown .....	34.6	D'Anjou .....	87.4
Delicious .....	59.3	Bosc .....	0.9
Ortley .....	2.7	Easter .....	11.3
Spitzenberg .....	1.6	Other .....	0.4
Other .....	1.8		
Total .....	100.0	Total .....	100.0

### Orchard Investment

The capital value represented by the plantings was estimated by the growers from a conservative, long-term standpoint. Consideration was given in the appraisal to the age and variety of trees, and to the location and character of the land.

Present (depreciated) values of buildings (other than operator's dwelling) and all other equipment were allocated proportionately to the various enterprises according to the use made thereof (table 10).

Table 10. ORCHARD INVESTMENT: Average Value of Capital Investment

Item	Apples		Winter pears		Bartlett pears	
	Value per orchard	Value per acre	Value per orchard	Value per acre	Value per orchard	Value per acre
Orchard	\$ 8,253	\$ 621	\$ 5,151	\$ 636	\$ 3,574	\$ 616
Buildings	1,926	145	1,071	133	803	138
Equipment	2,439	183	1,389	172	1,049	181
Cash for operating	2,668	200	1,628	200	1,158	200
Total investment	\$15,286	\$ 1,149	\$ 9,239	\$ 1,141	\$ 6,584	\$ 1,135



### Apple enterprise

Estimated capital worth, represented by the apple enterprises on the 19 farms in the study, averaged \$15,286 per orchard. More than half of the total capital investment for apple production, or \$621 per acre, was for the plantings.

Buildings (exclusive of the operator's dwelling) averaged \$1,926 per apple orchard. The equipment inventory, averaging \$2,439 per apple orchard, includes irrigation equipment as well as the machinery, tractors, trucks, and small tools. It does not include the automobile (charge for the use of automobiles was computed on a mileage basis).

### Winter pears

Investment for winter pears averaged \$9,239 per orchard. Value of the plantings averaged \$5,151 per orchard or \$636 per acre. Investment in buildings and equipment per acre of pears was similar in amount to that shown for apple orchards in this study.

### Bartlett (canning) pears

Investment for bearing pears averaged \$6,584 per orchard. Plantings represented \$3,574 each or \$616 per acre.

## Land Use

Size of the 20 farms in the study averaged 53.4 acres per farm (table 11). Orchard plantings comprised 31.8 acres per farm. This was 85 per cent of the total tillable land including the farmstead, or 60 per cent of the total farm acreage. Most cropland not in orchard was in hay or used as pasture. Much untillable acreage is steep, rocky, and covered with trees and brush.

Table 11. FRUIT FARMS: Utilization of the Land on 20 Farms\*

Land use	Number of farms	Average per farm reporting	Average acreage per farm	Distribution of total farm area
		Acres	Acres	Per cent
Apples .....	19	14.8	14.0	26
Bartlett pears.....	20	8.2	8.2	16
Winter pears.....	20	9.1	9.1	17
Other .....	5	2.0	0.5	1
Total orchard.....	20	-	31.8	60
Other cropland.....	9	7.2	3.3	6
Farmstead .....	20	2.2	2.2	4
Nontillable .....	16	20.3	16.2	30
Total, all land....	20	-	53.4	100

\* Of the 31.8 acres in orchard, apple trees occupied 14.0 acres per farm. Total pear (winter and canning) acreage slightly exceeded the apple orchards with 17.3 acres per farm.

## Ten-Year Summary

The average annual yields per acre and the costs per box on the farms in this study have been compiled for the 10-year period 1947-1956 (table 12).

**Table 12. COST OF PRODUCING APPLES AND PEARS\***  
(Does not include costs of storage, boxes, packing, and shipping)

Year	Number of farms	Apples			Winter pears			Bartlett pears		
		No. of acres	Boxes /acre	Cost /box	No. of acres	Boxes /acre	Cost /box	No. of acres	Boxes /acre	Cost /box
1947...	24	366	328	\$1.54	256	406	\$1.14	107	263	\$1.64
1948...	25	406	358	1.39	283	363	1.20	126	258	1.64
1949...	21	324	360	1.24	228	388	1.10	119	363	1.24
1950...	23	360	425	1.18	236	556	.82	141	342	1.24
1951...	25	364	323	1.40	261	205	1.92	159	205	1.88
1952...	27	418	424	1.15	306	408	1.10	187	356	1.32
1953...	20	284	254	1.84	182	453	1.12	124	290	1.71
1954...	24	306	399	1.35	191	464	1.07	150	312	1.49
1955...	24	276	343	1.60	188	331	1.36	134	312	1.60
1956...	20	254	268	1.82	163	518	.97	116	299	1.58
<b>Average</b>	<b>23</b>	<b>336</b>	<b>348</b>	<b>\$1.45</b>	<b>229</b>	<b>409</b>	<b>\$1.18</b>	<b>136</b>	<b>300</b>	<b>\$1.53</b>

\* Apples and winter pears are packed boxes; cannery pears are standard lug boxes.

### Effect of Size of Business on Costs

Size of the orchard enterprise had only very slight influence on the cost of production during the 10-year period studied (table 13).

**Table 13. SIZE OF BUSINESS: Ten-Year Results on the Cost Farms**  
(Does not include costs of storage, boxes, packing, and shipping)

Item*	Production †			Cost †		
	Acres	Yield /acre	Total yield	Total	Per box	Range per box
<b>Small farms</b>						
Apples.....	6.8	412	2,802	\$ 4,259	\$ 1.52	\$ .72 to \$ 8.96
Winter pears ..	3.5	485	1,698	2,258	1.33	.48 to 4.18
Bartlett pears .	2.5	297	742	1,373	1.85	.95 to 5.72
Total .....	12.8	410	5,242	\$ 7,890	\$ 1.51	\$ .48 to \$ 8.96
Cost per acre				\$ 616		
<b>Medium farms</b>						
Apples.....	13.3	374	4,974	\$ 7,113	\$ 1.43	\$ .71 to \$ 9.06
Winter pears ..	8.5	476	4,046	4,491	1.11	.47 to 4.26
Bartlett pears .	5.8	340	1,972	2,859	1.45	.88 to 5.51
Total .....	27.6	398	10,992	\$ 14,463	\$ 1.32	\$ .47 to \$ 9.06
Cost per acre				\$ 524		
<b>Large farms</b>						
Apples.....	22.2	320	7,104	\$ 10,372	\$ 1.46	\$ .75 to \$ 5.67
Winter pears ..	15.9	358	5,692	7,530	1.23	.65 to 4.44
Bartlett pears .	8.6	272	2,339	3,649	1.56	.56 to 4.59
Total.....	46.7	324	15,135	\$ 21,551	\$ 1.42	\$ .56 to \$ 5.67
Cost per acre				\$ 461		

\* Small farms had less than 20 acres of orchard; medium farms had from 20 to 39 acres; and large farms had 40 acres or more.

† Apples and winter pears are packed boxes; cannery pears are standard lug boxes.

The small farms (12.8 acres of apples and pears per farm) generally had the highest yields per acre. Good yields usually reduce the cost per box. Individual growers should note the wide range in costs per box and strive to reduce their own costs.

### Purpose and Nature of the Study

The purpose of this study was to obtain information from growers that would provide basic facts on yields and costs of production. This information, when carefully adjusted to reflect changes occurring in yields and in the price level of farm production cost, provides a basis whereby cost of production can be readily estimated for any given year if no changes have occurred in production techniques.

Cost of production reported herein is average-acre cost for all plantings in the study. Thus, man-hours-per-acre (see tables 2, 5, and 6) is a figure applicable to the entire acreage of a crop within an area, such as a county. It indicates the average amount of labor that may be required per acre for all the acreage of that crop in the area, even though each acre may not have been covered by each operation. The same holds true of the other items of cost.

### Acknowledgments

The fine cooperation received from the growers, who kept detailed daily records to provide data for this report, is gratefully acknowledged. Special mention is made of the financial assistance contributed by the Hood River Traffic Association; also, the continuing interest and support of the Hood River Apple Growers Association. Without the active participation of these groups, the study would have been impossible.

Particular mention is made of Dr. G. W. Kuhlman, now deceased, who was instrumental in initiating this cooperative work. The present circular is essentially a revision of his earlier reports, bringing them up to date.