



# 2010 Cost Estimates of Producing Bartlett Pears in the Yakima Valley, Washington

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## Preface

Production costs and returns vary greatly for any particular orchard operation due to case-specific:

- Capital, labor, and natural resources
- Crop yields
- Type and size of machinery implements
- Input prices
- Cultural practices
- Commodity prices
- Operation size
- Management skills

Cost estimation also varies with the intended use of the enterprise budget. The information in this publication serves as a general guide for a modern, well-managed Bartlett Pear orchard in Yakima Valley, Washington, as of 2010. To avoid drawing unwarranted conclusions about any particular orchard or group of orchards, the reader is asked to closely examine the assumptions made and adjust the costs and/or returns as appropriate for the situation.

## Bartlett Pear Production in Washington

Pears are the third major tree fruit crop in Washington, following apples and cherries. In 2009-2010, gross crop sales reached \$251 million for all fresh and processed markets and all varieties produced in the Pacific Northwest (Pear Bureau Northwest, 2010). The two leading pear varieties are Bartlett and Anjou. Most Bartlett Pears are produced in the Yakima Valley, accounting for nearly half of Washington's total Bartlett acreage (USDA National Agricultural Statistics Service (NASS) 2009). Under Washington's growing conditions, the Bartlett variety requires cross pollination (Hinman et al. 1989). In this study, Anjou Pears are used as pollinating trees.

The total bearing acreage of Bartlett Pears in Washington has not varied significantly in the past 10 years, averaging around 11,200 acres (NASS 2010). The 10-year average from 2000 to 2009 shows 67 percent of the crop was processed, and the remainder was marketed fresh or used for juice production (Table 1). Average annual production during the same period was 172,940 tons (Washington-Oregon Canning Pear Association 2010). Annual yield fluctuations

have been attributed to winter injury, spring frosts, and other environmental factors.

## Study Objectives

The study estimates: (1) the costs of the equipment, buildings, materials, supplies, and labor required to establish and produce Bartlett Pears; and (2) price and yield ranges at which Bartlett Pear production would be profitable.

The data used in this study were gathered from a group of experienced pear growers in the Yakima Valley. Their production practices, input requirements, and views about the latest developments in production methods form the basis for the assumptions in this study.

The data in this publication represent what knowledgeable area growers anticipate over an orchard's life, if no unforeseen failures occur. Also, note that many factors affect production costs, packout, and returns. Individual growers should use the blanks provided on the budget's right-hand column (Table 3) to estimate their own costs and returns.

The primary value of this report is in identifying inputs, costs, and yields considered to be typical of well-managed Bartlett Pear orchards. This publication does not necessarily represent the average grower and is not intended to be a guide to production practices. It describes current industry trends and, as such, can be helpful in estimating the physical and financial requirements of comparable plantings.

## Budget Assumptions

1. This budget and production cost items in Tables 3–8 are based on a 10.5-acre pear block within a 100-acre orchard enterprise. Half an acre of the pear block is dedicated to roads, irrigation system, ditches, and so on. Therefore, the total productive block area is 10 acres. Block specifications are listed in Table 2.
2. Irrigation water is available from a public irrigation district. A dual irrigation system (under-tree solid

set sprinkler and drip) costs \$2,100 per acre. The annual water and electricity charges are \$80 and \$135 per acre, respectively.

3. Labor is done by hand and ladders, without platforms.
4. The processed pear assessment fee is \$7 per ton.

## Summary of Results

Table 3 shows annual requirements and costs for establishing and producing Bartlett Pears. The study assumes that a Bartlett Pear orchard can be fully established in six years. The total cost during full production is estimated at \$8,785 per acre, given the assumptions listed above. Production costs are classified into: *variable costs*, which comprise labor, application of fertilizer and chemicals, machinery maintenance and repairs, overhead, and interest on operating capital; and *fixed costs*, incurred whether or not pears are produced, that include depreciation on capital, interest, taxes, management, processed pear assessment fee, and other dues. Management is treated as a fixed rather than a variable cost because either one uses or loses management skill during production.

The calculated net returns in Table 3 represent what the grower may receive from investment in land and management after accounting for all costs, including labor the grower contributed to crop production. Breakeven returns to the grower for different enterprise cost levels are presented in Table 4.

The *breakeven return over total variable costs* implies that if the return received by a grower does not equal or exceed the variable cost breakeven return, it is uneconomical to produce Bartlett Pears. This condition applies even in the short run, because added production costs are greater than added returns.

The *breakeven return over total cash costs* is that necessary to economically produce in the short run, assuming no interest on debt or land rent.

The *breakeven return over total cash costs and depreciation*, on the other hand, is what must be received to stay in business over the long run. Given the study's assumptions, this particular breakeven return is lower than the assumed return of \$255 per ton. This means that the grower can contribute *some* toward his/her opportunity costs from investments in the pear orchard, machinery, equipment, and buildings.

However, only when the *total cost breakeven return* is received can the grower recover all out-of-pocket expenses plus realize a competitive return on equity capital invested in land, trees, machinery, equipment, and buildings. Total cost includes cash, depreciation, interest, and management costs. Failure to obtain this breakeven return means that the grower will not receive a return on capital contributions equal to what could be earned in alternative uses of resources. Attainment of a return above the total cost breakeven level means that in addition to covering all cash and opportunity costs, the grower will receive a return on management and on the financial risk assumed in producing Bartlett Pears.

Note that crop yield varies among different orchards, and Bartlett Pear prices fluctuate from year to year. Potential investors should carefully examine the assumptions underlying the estimates in the enterprise budget. To further help users in evaluating potential production scenarios, Table 5 illustrates likely per-acre net returns given various prices and yields.

Most of the budget values in Table 3 are based on more comprehensive underlying information presented in Tables 6 to 9. Annual capital requirements for a 10-acre Bartlett Pear block are listed in Table 6. Table 7 provides detailed machinery and building requirements for the entire 100-acre orchard. Interest and depreciation costs are listed in Tables 8 and 9, respectively. Interest and amortization costs assume a 7 percent interest rate. Interest costs represent the opportunity cost or forgone earnings for investing money in the orchard, machinery, equipment, and buildings rather than in alternative activities. These costs also represent interest on funds borrowed to finance the orchard's operation and physical capital.

Amortized establishment costs assume a total productive life of 35 years (6 years to establish the orchard and 29 years of full production). These represent costs incurred less revenue during the establishment years, which must be recovered during the full production years. The accumulated cost for Bartlett Pears over a 6-year establishment period (\$24,306.61) is amortized over 29 years at 7 percent interest, totaling \$1,979.74 per acre. This amount must be added to the full production per-acre costs each year.

Depreciation costs include the annual replacement cost of machinery and buildings. Replacement prices may overstate costs growers experience, but they indicate the earnings needed to replace depreciable assets. Recent increases in prices paid for machinery and equipment mean that depreciation claimed on older purchases substantially understates the capital required to replace them. When looking at long-term enterprise viability, it is important to consider the ability to replace depreciable assets on a replacement cost basis.

An Excel® spreadsheet version of the Bartlett Pear budget (Table 3), as well as associated data underlying the per-acre cost calculations (Tables 6–9 and two other tables with establishment and full production costs), is available at the Washington State University School of Economic Sciences' Extension website: [http://extecon.wsu.edu/pages/Enterprise\\_Budgets](http://extecon.wsu.edu/pages/Enterprise_Budgets). Growers can modify select values and thus use the Excel workbook for collecting and analyzing their own cost data to make informed decisions about cost structures in operating an existing Bartlett Pear planting.

## References

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**Table 1. Production of Bartlett Pears in Washington, 2000-2009**

Year	Bearing Acreage <sup>[1]</sup>	Production (tons) <sup>[2]</sup>	Utilization (tons) <sup>[2]</sup>			Quantity of Canned Bartlett Pears as a Percent of Total Production
			Fresh	Canned	Other	
2000	11,200	170,647	42,992	122,215	5,440	71.6%
2001	11,300	191,366	43,442	140,787	7,137	73.6%
2002	11,300	157,955	40,315	109,876	7,764	69.6%
2003	11,500	177,317	52,580	118,794	5,943	67.0%
2004	11,500	167,364	45,964	115,221	6,179	68.8%
2005	11,200	164,457	53,738	107,562	3,158	65.4%
2006	11,000	180,044	48,156	124,489	7,400	69.1%
2007	11,000	177,502	59,754	110,432	7,316	62.2%
2008	11,000	160,170	55,307	96,814	8,049	60.4%
2009	11,000	182,576	60,500	116,661	5,415	63.9%
<i>Average</i>	<i>11,200</i>	<i>172,940</i>	<i>50,275</i>	<i>116,285</i>	<i>6,380</i>	<i>67.2%</i>

Sources: <sup>[1]</sup> NASS (2010); <sup>[2]</sup> Washington-Oregon Canning Pear Association (2010).

Note: "Other" is generally juice production from packing house culls not included in "Fresh" tons. "Canned" tons include all tons received on the cannery processing line.

**Table 2. Bartlett Pear Block Specifications**

<b>Architecture</b>	Modified central leader, freestanding
<b>Row Spacing</b>	8 by 14 feet
<b>Orchard Size</b>	10 acres
<b>Life of Planting</b>	35 years
<b>Tree Density</b>	389 trees per acre; 10 percent of the planted trees are pollenizers (Anjou)

**Table 3. Costs and Returns Per Acre of Producing Bartlett Pears on a 10-Acre Orchard Block**

	Establishment Years						Full Production	Your Costs
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	
Estimated Production (tons per acre) <sup>[1]</sup>			5.50	11.00	16.50	27.50	30.25	
Estimated Price (per ton)			\$255.00	\$255.00	\$255.00	\$255.00	\$255.00	
<b>Total Returns</b>			\$1,402.50	\$2,805.00	\$4,207.50	\$7,012.50	\$7,713.75	
<b>Variable Costs (per acre):</b>								
<i>Establishment</i>								
Soil Preparation	\$1,040.00		\$50.00					
Trees (including labor, plants, and materials)	\$2,647.95							
<i>Orchard Activities</i>								
Pruning and Training	\$300.00	\$300.00	\$300.00	\$400.00	\$450.00	\$450.00	\$600.00	
Chemical Application <sup>[2]</sup>	\$325.00	\$400.00	\$550.00	\$650.00	\$750.00	\$850.00	\$870.00	
Fertilizer Application <sup>[2]</sup>	\$165.00	\$165.00	\$165.00	\$165.00	\$165.00	\$165.00	\$150.00	
Beehives			\$45.00	\$45.00	\$90.00	\$90.00	\$90.00	
General Farm Labor <sup>[3]</sup>	\$350.00	\$350.00	\$350.00	\$350.00	\$350.00	\$350.00	\$350.00	
Irrigation and Electricity Charges	\$215.00	\$215.00	\$215.00	\$215.00	\$215.00	\$215.00	\$215.00	
<i>Harvest Activities<sup>[3]</sup></i>								
Picking Labor			\$140.14	\$280.28	\$420.42	\$700.70	\$770.77	
Other Labor (checkers, tractor drivers, and hauling)			\$100.10	\$200.20	\$300.30	\$500.50	\$550.55	
<i>Maintenance and Repairs</i>								
Machinery Repair	\$170.00	\$170.00	\$170.00	\$170.00	\$170.00	\$170.00	\$170.00	
Fueling and Lubrication	\$215.00	\$215.00	\$215.00	\$215.00	\$215.00	\$215.00	\$215.00	
Wind Machine Maintenance and Fueling				\$150.00	\$150.00	\$150.00	\$150.00	
<i>Other Variable Costs</i>								
Overhead (5% of variable costs)	\$271.40	\$90.75	\$115.01	\$142.02	\$163.79	\$192.81	\$206.57	
Interest (7% of variable costs) <sup>[4]</sup>	\$398.95	\$133.40	\$169.07	\$208.78	\$240.77	\$283.43	\$227.74	
<b>Total Variable Costs</b>	<b>\$6,098.30</b>	<b>\$2,039.15</b>	<b>\$2,584.32</b>	<b>\$3,191.28</b>	<b>\$3,680.27</b>	<b>\$4,332.44</b>	<b>\$4,565.63</b>	
<b>Fixed Costs (per acre):</b>								
<i>Depreciation</i>								
Irrigation System	\$54.00	\$54.00	\$54.00	\$54.00	\$54.00	\$54.00	\$54.00	
Wind Machine				\$56.25	\$56.25	\$56.25	\$56.25	
Machinery and Buildings Annual Replacement Cost	\$525.00	\$525.00	\$525.00	\$525.00	\$525.00	\$525.00	\$525.00	
<i>Interest</i>								
Land	\$350.00	\$350.00	\$350.00	\$350.00	\$350.00	\$350.00	\$350.00	
Machinery and Buildings	\$143.07	\$143.07	\$143.07	\$143.07	\$143.07	\$143.07	\$143.07	

**Table 3 (continued). Costs and Returns Per Acre of Producing Bartlett Pears on a 10-Acre Orchard Block**

Irrigation System	\$80.85	\$80.85	\$80.85	\$80.85	\$80.85	\$80.85	\$80.85
Wind Machine				\$77.00	\$77.00	\$77.00	\$77.00
Establishment Costs (7%)		\$559.53	\$874.08	\$1,153.33	\$1,408.46	\$1,620.21	
<i>Other Fixed Costs</i>							
Land and Property Taxes	\$117.00	\$117.00	\$117.00	\$117.00	\$117.00	\$117.00	\$117.00
Insurance Cost (on entire farm)	\$85.00	\$85.00	\$85.00	\$85.00	\$85.00	\$85.00	\$85.00
Management Cost	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00
Other Services <sup>[5]</sup>	\$40.00	\$40.00	\$40.00	\$40.00	\$40.00	\$40.00	\$40.00
Processed Pear Assessment Fee			\$38.50	\$77.00	\$115.50	\$192.50	\$211.75
Amortized Establishment Costs <sup>[6]</sup>							\$1,979.74
<b>Total Fixed Costs</b>	<b>\$1,894.92</b>	<b>\$2,454.44</b>	<b>\$2,807.49</b>	<b>\$3,258.49</b>	<b>\$3,552.13</b>	<b>\$3,840.87</b>	<b>\$4,219.66</b>
<b>TOTAL COSTS</b>	<b>\$7,993.22</b>	<b>\$4,493.59</b>	<b>\$5,391.81</b>	<b>\$6,449.77</b>	<b>\$7,232.40</b>	<b>\$8,173.31</b>	<b>\$8,785.28</b>
<b>ESTIMATED NET RETURNS</b>	<b>-\$7,993.22</b>	<b>-\$4,493.59</b>	<b>-\$3,989.31</b>	<b>-\$3,644.77</b>	<b>-\$3,024.90</b>	<b>-\$1,160.81</b>	<b>-\$1,071.53</b>
<b>Accumulated Establishment Costs</b>	<b>\$7,993.22</b>	<b>\$12,486.81</b>	<b>\$16,476.12</b>	<b>\$20,120.90</b>	<b>\$23,145.80</b>	<b>\$24,306.61</b>	

<sup>[1]</sup> The following are assumed yield in bins per acre multiplied by 0.55 to get tons per acre: Year 3 = 10 bins/ac.; Year 4 = 20 bins/ac.; Year 5 = 30 bins/ac.; Year 6 = 50 bins/ac.; full production year = 55 bins/ac.

<sup>[2]</sup> Includes labor.

<sup>[3]</sup> Labor costs include wages, industrial insurance, Social Security taxes, and federal and state unemployment insurance.

<sup>[4]</sup> Interest expense is calculated for the full year during establishment years and for three-quarters of a year during full production.

<sup>[5]</sup> Includes legal and accounting services.

<sup>[6]</sup> Represents the costs incurred during the establishment years (minus revenues) that must be recovered during full production years.

**Table 4. Breakeven Return Per Ton to Cover Production Cost**

	Cost Per Acre	Breakeven Return Per Ton
1. Total Variable Costs	\$4,565.63	\$150.93
2. Total Cash Costs <sup>[1]</sup> = Total Variable Costs + Land and Property Taxes + Insurance + Other Services + Assessment Fee	\$5,019.38	\$165.93
3. Total Cash Costs + Depreciation of Irrigation System, Machinery, Equipment, and Buildings	\$5,654.63	\$186.93
4. Total Cost = Total Cash Costs + Depreciation + Interest <sup>[2]</sup> + Management Cost	\$8,785.28	\$290.42
Assumed Yield Per Acre (tons) =		30.25

<sup>[1]</sup> If there are other cash costs on an individual's orchard, these costs must be identified and included in the cash cost breakeven return calculation.

<sup>[2]</sup> Interest costs include some actual cash interest payments.

**Table 5. Estimated Net Returns Per Acre at Various Price and Yield Levels During Full Production<sup>[1]</sup>**

Yield (tons per acre)	Price (per ton)				
	\$250	\$275	\$300	\$325	\$350
10	-\$5,166.03	-\$4,916.03	-\$4,666.03	-\$4,416.03	-\$4,166.03
20	-\$3,218.75	-\$2,718.75	-\$2,218.75	-\$1,718.75	-\$1,218.75
30	-\$1,271.46	-\$521.46	\$228.54	\$978.54	\$1,728.54
40	\$675.82	\$1,675.82	\$2,675.82	\$3,675.82	\$4,675.82
50	\$2,623.10	\$3,873.10	\$5,123.10	\$6,373.10	\$7,623.10

<sup>[1]</sup> Includes amortized establishment costs.

**Table 6. Summary of Annual Capital Requirements for a 10-Acre Bartlett Pear Block**

	Establishment Years						Full Production Years 7 to 35
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
<b>Annual Requirements</b>							
Land (10.5 acres)	52,500.00						
Irrigation System	21,000.00						
Wind Machine				20,000.00			
Operating Expenses	68,403.02	27,811.53	33,648.20	40,102.79	45,377.71	52,669.41	55,193.75
<b>Total Requirements</b>	141,903.02	27,811.53	33,648.20	60,102.79	45,377.71	52,669.41	55,193.75
<b>Receipts</b>			14,025.00	28,050.00	42,075.00	70,125.00	77,137.50
<b>Net Requirements</b>	141,903.02	27,811.53	19,623.20	32,052.79	3,302.71	-17,455.59	-21,943.75

**Table 7. Machinery, Equipment, and Building Requirements<sup>[1]</sup> for a 100-Acre Orchard**

	Purchase Price	Number of Units	Total Cost
70-Horsepower Tractor	\$28,000	2	\$56,000
Utility Trailer	\$3,000	1	\$3,000
Four-Wheel Drive ATV	\$5,000	2	\$10,000
100-Gallon Sprayer	\$3,500	1	\$3,500
PTO Sprayer	\$17,000	1	\$17,000
Gopher Machine	\$1,100	1	\$1,100
Pickup	\$25,000	1	\$25,000
Nine-Foot Rotary Mower	\$7,000	1	\$7,000
Forklift	\$23,000	1	\$23,000
Backfork	\$1,000	1	\$1,000
Flail	\$10,000	1	\$10,000
Housing for Supervisor	\$45,000	1	\$45,000
Housing for Employee <sup>[2]</sup>	\$90,000	1	\$90,000
Shop and Farm Tools	\$20,000	1	\$20,000
Machine Shed and Shop	\$60,000	1	\$60,000
<b>Total Cost</b>			<b>\$371,600</b>

<sup>[1]</sup> Purchase price corresponds to new machinery, equipment, or buildings.

<sup>[2]</sup> H-2A Program; assumed housing cost is \$6,500 per employee for 20 employees.

**Table 8. Interest Costs Per Acre for a 10-Acre Pear Orchard**

	Total Purchase Price	Salvage Value	Number of Acres	Total Interest Cost	Interest Cost Per Acre
Land	\$52,500	\$52,500	10.5	\$3,675	\$350.00
Machinery and Buildings	\$371,600	\$37,160	100.0	\$14,307	\$143.07
Irrigation System	\$21,000	\$2,100	10.0	\$809	\$80.85
Wind Machine	\$20,000	\$2,000	10.0	\$770	\$77.00

Note: Interest Rate = 7%; Salvage Value = 10%. Salvage value is not applied to land because land is not a depreciable asset.

**Table 9. Depreciation Costs Per Acre for a 10-Acre Pear Orchard**

	Total Purchase Price	Number of Acres	Total Value Per Acre	Years of Use	Depreciation Cost Per Acre
Irrigation System	\$21,000	10	\$2,100	35	\$54.00
Wind Machine	\$20,000	10	\$2,000	32	\$56.25
Machinery and Buildings Annual Replacement Cost <sup>[1]</sup>					\$525.00

<sup>[1]</sup> An estimate of average annual replacement costs, rather than depreciation costs, is used for all machinery, equipment, and buildings. The use of replacement prices may overstate costs fruit growers experience, but they indicate the earnings needed to replace depreciable assets. Recent increases in prices paid for machinery and equipment mean that depreciation claimed on older purchases substantially understates the capital required to replace assets. When looking at long-term enterprise viability, it is important to consider the ability to replace depreciable assets on a replacement cost basis.



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