2020 COST ESTIMATES OF PRODUCING BARTLETT PEARS FOR CANNING IN WASHINGTON STATE

Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of producing Bartlett pears for canning in Washington State as of 2020. This publication is not intended to be a definitive guide to production practices, but it is helpful in estimating the physical and financial requirements of comparable plantings. Specific budget assumptions were adopted for this study, but these assumptions may not fit every situation since production costs and returns vary across orchard operations, depending on the following factors:

- Capital, labor, and natural resources
- Crop yields
- Type and size of machinery, irrigation, and frost control systems
- Input prices
- Cultural practices
- Pear prices
- Orchard size
- Management skills

Cost estimations in the enterprise budget also vary depending on its intended use. To avoid drawing unwarranted conclusions for any orchard, readers must closely examine the assumptions made in this guide, and then adjust the costs, returns, or both as appropriate for their own orchard operation.

Bartlett Pears for Canning in Washington State

As of 2019, the three largest producers of processed pears in the United States are California with 91,930 tons, followed by Washington with 66,990 tons, then Oregon with 42,010 tons. Washington 2019 production is lower compared to 2018 production at 99,500 tons and 2017 production at 85,900 tons, but it represents 33% to 41% of the total US production of processed pears over the three-year period (USDA NASS 2020). Also, as of 2019, the price of processed pears in Washington is $356 per ton and the total value of production is $23.8 million. According to the latest Agricultural Census, there are 8,437 bearing acres of Bartlett pears, representing 42% of Washington State's total pear-bearing acreage (USDA NASS 2017). Note that the exact wording in the latest Agricultural Census is "processed pears." The present study assumes that all these processed pears are for canning.

Study Objectives

This publication is designed to enable owner-operators to estimate: (1) the costs of equipment, materials, supplies, and labor required to produce canning pears and (2) the ranges of price and yields at which canning pear production would be a profitable enterprise.

The primary use of this publication is in identifying inputs, costs, and yields considered to be typical of well-managed Bartlett pear orchards. This publication does not necessarily represent any orchard operation and is not intended to be a definitive guide to production practices. However, it describes current industry trends and, as such, can be helpful in estimating the physical and financial requirements of comparable plantings.

Information Sources

The data used in this study were gathered from a group of experienced owner-operators of Bartlett pear orchards in Washington State. Their production practices and input requirements form the baseline assumptions that were used to develop the enterprise budget. Additionally, the data represent what these owner-operators anticipate over an orchard's life if no unforeseen failures occur. Given that many factors affect production costs, grades, and returns, individual owner-operators can use the Excel Workbook provided to estimate their own costs and returns.

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Budget Assumptions

1. The area of the total farm operation is 300 acres. Bearing acres include 225 acres of apples (75% of total area), 48 acres of sweet cherries (16%), and 27 acres of pears (9%). Of the 27 acres of pears, 11 acres are dedicated to pears for canning.
2. This budget is based on an 11-acre Bartlett pear block within a 300-acre orchard. It is assumed that 10% of this block is dedicated to roads, pond, loading area, buildings, etc., rather than to fruit production. Therefore, the total productive area for this block is ten acres, composed of nine acres of Bartlett pear trees and one acre of Anjou pear trees (as pollinizers).
3. The pear block is already established. Therefore, this enterprise budget presents the estimated costs and returns during a representative full production year.
4. The total value of land (including water rights) is $18,000 per acre with annual property taxes of $160 per acre.
5. The irrigation system consists of under-tree sprinklers. Water is provided through a public irrigation district.
6. The pond, mainline, and pump already exist, and only the irrigation system and wind machine are newly installed.
7. Cultural practices and harvest activities are done by using a combination of manual labor, ladders, and labor-enhancing equipment. The hourly manual labor rate is calculated using the Washington adverse wage rate for 2020 at $15.83/hour. In this analysis, we add 25% to reflect medical leave and all administrative costs for H2A employees, including housing, amounting to $19.79/hour. Activities such as chemical application, irrigation, and frost protection are assumed to cost $21.04/hour (i.e., base of $15.83/hour plus 25%). Harvest labor rates follow the Department of Labor rates, plus 4% to account for mandated paid rest breaks. These labor rates are assumed to be the same for all years of production.
8. The gross return of Bartlett pears for canning depends on the grade: Grade 1A = $357/ton; Grade 1B = $340/ton; Grade 2 = $210/ton. Fresh-market Anjou pears are sold at $577.50/bin. Bin size is 1,100 lb.
9. The percent distribution of grades for the Bartlett pears for canning in this study is as follows: Grade 1A = 67%; Grade 1B = 27%; Grade 2 = 6%.
10. Ten percent of the production is Anjou pears for the fresh market, with a 90% pack-out.
11. Management is valued at $700 per acre.
12. Interest on investment represents a 5% opportunity cost to the enterprise. These are forgone earnings for investing money in orchard, equipment, and buildings rather than in an alternative activity. This also represents interest on funds borrowed to finance orchard, equipment, and building purchases.

Table 1 presents a set of complementary assumptions.

Summary of Study Results

Table 2 shows the estimated annual cost and returns for a ten-acre block of Bartlett pears for canning in Washington State. Production costs are classified into variable costs and fixed costs. Variable costs comprise orchard operations, harvest activities, materials, maintenance and repairs, packing costs (only for Anjou pears), overhead, and interest on operating capital. Fixed costs are incurred whether or not pears for canning are produced. The fixed costs include depreciation on capital, interest, taxes, insurance, and management. Management is treated as a fixed rather than a variable cost because, like land, management has been committed to the production cycle of the crop.

Based on the assumptions listed above, the total production costs for Bartlett pears for canning during full production are estimated at $11,992 per acre (see Table 2). Total production costs are comprised of the variable costs at $8,324 per acre and fixed costs at $3,668 per acre. The total returns are estimated at $9,854 per acre. Considering all these figures, the net returns generated are negative. Break-even returns are thus calculated to determine the return at which an enterprise will incur neither a loss nor a gain.

Table 1. Bartlett pear for canning block specifications.

In-row spacing	9 feet
Between-row spacing	18 feet
Rootstock	Old Home × Farmingdale (OH×F)
Productive block size	10 acres
Life of planting	25 years
Tree density	269 trees/acre; 10% of the planted trees are pollenizers (Anjou)

Table 2. Costs and returns per acre of producing Bartlett pears for canning.

	Unit	Quantity	Price per Unit[b]	Total	Your Return or Costs
Estimated Net Production[a]					
Bartlett, Grade 1A	ton	14.95	357.00	5,337.15	
Bartlett, Grade 1B	ton	5.75	340.00	1,955.00	
Bartlett, Grade 2	ton	2.30	210.00	483.00	
Anjou, fresh	bin	3.60	577.50	2,079.00	
Total Returns ($/acre)				**9,854.15**	
Variable Costs ($/acre):					
Orchard Activities					
Pruning[c]	acre	1	1,068.66	1,068.66	
Irrigation Labor[c]	acre	1	138.53	138.53	
Chemicals[d,e]	acre	1	1,345.19	1,345.19	
Fertilizer[c,e]	acre	1	319.79	319.79	
Frost Protection (labor)[d]	acre	1	11.15	11.15	
Beehives	acre	1	55.00	55.00	
General Farm Labor[f]	acre	1	150.00	150.00	
Irrigation Water & Electric Charge	acre	1	397.00	397.00	
Harvest Activities[g]					
Picking Labor	acre	1	1,162.45	1,162.45	
Other Labor (checkers, tractor drivers, supervisors)	acre	1	370.55	370.55	
Hauling	acre	1	277.91	277.91	
Warehouse Packing Charges (only for Anjou)[h]	acre	1	1,566.68	1,566.68	
Maintenance and Repairs					
Maintenance & Repair	acre	1	387.00	387.00	
Fuel & Lube	acre	1	300.00	300.00	
Other Variable Costs					
Overhead (5% of variable costs)[i]	acre			377.49	
Interest (5% of variable costs)	acre			396.37	
Total Variable Costs	**acre**			**8,323.76**	
Fixed Costs ($/acre):					
Depreciation					
Irrigation System	acre	1	184.80	184.80	
Machinery, Equipment & Building	acre	1	261.92	261.92	
Wind Machine	acre	1	220.00	220.00	
Interest					
Irrigation System	acre	1	115.50	115.50	
Land[j]	acre	1	900.00	900.00	
Machinery, Equipment & Building	acre	1	92.04	92.04	
Wind Machine	acre	1	137.50	137.50	

	Unit	Quantity	Price per Unit[b]	Total	Your Return or Costs
Interest on Orchard Investment (5%)[k]	acre	1	571.03	571.03	
Other Fixed Costs					
Miscellaneous Supplies	acre	1	100.00	100.00	
Land & Property Taxes	acre	1	160.00	160.00	
Insurance Cost (all farm)	acre	1	225.00	225.00	
Management Cost	acre	1	700.00	700.00	
Total Fixed Costs	**acre**			**3,667.78**	
TOTAL COSTS	**acre**			**11,991.55**	
ESTIMATED NET RETURNS	**acre**			**(2,137.40)**	

[a] Estimated net production considers the assumed grade distribution for canning Bartlett pears.
[b] These prices reflect the return before any expenses are subtracted. Bin size for Anjou is 1,100 lb.
[c] Hand labor rate is $19.79/hour and includes all applicable additional expenses.
[d] Tractor/machinery operators and frost protection labor rate is $22.29/hour and includes all applicable additional expenses.
[e] Includes materials and application labor.
[f] General farm labor rate is a lump sum per acre and applied to miscellaneous activities/all other labor. Rate includes all applicable additional expenses.
[g] Picking rate = $25/bin for Bartlett, $26/bin for Anjou; checkers & tractor drivers' rate = $8/bin; hauling rate = $7/bin (hauling refers to transportation cost from the orchard to the warehouse; it is assumed that warehouse will cover additional transportation expenses [if any] when the orchard is in remote areas).
[h] Packing charges for fresh market Anjou include per-bin and per-box charges.
[i] Captures indirect costs of operations in the orchard that fluctuate with the level of production but are not accounted by the variable costs already identified. Also captures unforeseeable expenses.
[j] Opportunity cost of land is calculated by using the 5% interest rate multiplied by the land value of $18,000 per acre.
[k] This cost represents the interest being paid on the investment in the orchard or returns forgone by investing in the orchard rather than in an alternative investment that would give immediate returns.

A further analysis of break-even returns is presented in Table 3. Four levels of break-even returns are presented, each representing a different level of enterprise costs. Each level includes the assumption that 90% of the yield is for pears for canning and the distribution across the three grades: Bartlett Grade 1A, Bartlett Grade 1B, and Bartlett Grade 2. The break-even returns also include the assumption that 10% of the yields are Anjou pears for the fresh market. Note that the results below are a *set of break-even returns* for each level of enterprise cost. This means that a breakeven for a particular level of enterprise cost will be obtained if all returns (i.e., returns from all three canning Bartlett grades and Anjou) corresponding to that level are used collectively.

1. The *first break-even return* is $302/ton for Bartlett Grade 1A, $287/ton for Bartlett Grade 1B, $177/ton for Bartlett Grade 2, and $488/bin for fresh-market Anjou pears. This is the minimum return for the owner-operator to cover the operation's variable costs. Returns lower than this suggest that it is uneconomical to produce Bartlett pears for canning.
2. The *second break-even return* is $319/ton for Bartlett Grade 1A, $304/ton for Bartlett Grade 1B, $188/ton for Bartlett Grade 2, and $516/bin for fresh-market Anjou pears. This return is needed to cover the total cash costs (the equivalent to total variable costs plus land and property taxes, insurance cost, and miscellaneous supplies). This second break-even return is needed for the operation to be financially viable in the short run.
3. The *third break-even return* is $343/ton for Bartlett Grade 1A, $327/ton for Bartlett Grade 1B, $202/ton for Bartlett Grade 2, and $555/bin for fresh-market Anjou pears. This is the return needed for owner-operators to cover the cash costs plus depreciation of machinery and buildings. This third break-even return is needed for the operation to be financially viable in the long run.
4. The *fourth break-even return* is $434/ton for Bartlett Grade 1A, $414/ton for Bartlett Grade 1B, $256/ton for Bartlett Grade 2, and $703/bin for fresh-market Anjou pears. If this return is realized, the owner-operator would recover all out-of-pocket expenses (cash costs), plus a competitive return on equity capital invested in land, trees, machinery, equipment, and buildings. Failure to obtain this break-even return level means that the owner-operator will not receive a return on capital contributions equal to what could be earned in alternative uses.

Table 3. Break-even return for *all* grades of Bartlett pears for canning given different levels of enterprise costs during full production[a].

			Proportional Cost per Grade ($/acre)[b]	Break-even Return ($/ton for Bartlett, $/bin for Anjou)[c]	Your Cost ($/acre)	Your Break-even Return ($/bin)
1.	Total Variable Costs	Bartlett Grade 1A	4,508.27	301.56[d]		
		Bartlett Grade 1B	1,651.38	287.20		
		Bartlett Grade 2	407.99	177.39		
		Anjou	1,756.12	487.81		
2.	Total Cash Costs[e] = Total Variable Costs + Miscellaneous Supplies + Land & Property Taxes + Insurance Cost	Bartlett Grade 1A	4,770.95	319.13[f]		
		Bartlett Grade 1B	1,747.60	303.93		
		Bartlett Grade 2	431.76	187.72		
		Anjou	1,858.45	516.24		
3.	Total Cash Costs + Depreciation Costs	Bartlett Grade 1A	5,132.06	343.28[g]		
		Bartlett Grade 1B	1,879.87	326.93		
		Bartlett Grade 2	464.44	201.93		
		Anjou	1,999.11	555.31		
4.	Total Cost = Total Cash Costs + Depreciation Costs + Interest Costs[i] + Management Cost	Bartlett Grade 1A	6,494.80	434.43[h]		
		Bartlett Grade 1B	2,379.05	413.75		
		Bartlett Grade 2	587.76	255.55		
		Anjou	2,529.94	702.76		

[a] This table presents a *set of break-even returns* for each level of enterprise cost. This means that a breakeven for a particular level of enterprise cost will be obtained if all returns (i.e., returns from all three canning Bartlett grades and Anjou) corresponding to that level are used collectively.

[b] The break-even return is calculated using the proportional cost for each grade and variety. The proportional cost is based on the percentage of the total returns that each grade and variety exhibits with respect to the total returns: Bartlett Grade 1A is 18%, Bartlett Grade 1B is 7%, Bartlett Grade 2 is 1%, and fresh Anjou is 75%. The distribution of returns by grade and variety is dependent on pack-outs. The baseline pack-out for Bartlett Grade 1A is 67%, Bartlett Grade 1B is 27%, and Bartlett Grade 2 is 6% of the gross yield of Bartlett pears. The pack-out of fresh Anjou is 90%.

[c] The break-even return per grade and variety is obtained as follows: *proportional cost divided by the net yield of each grade and variety*. Net yield is the yield after factoring in the pack-out.

[d] If the return is below this level, Bartlett pears are uneconomical to produce.

[e] If there are other cash costs on an individual's orchard, these costs must be identified and included in the cash cost break-even return calculation.

[f] The second break-even return allows the producer to stay in business in the short run.

[g] The third break-even return allows the producer to stay in business in the long run.

[h] The fourth break-even return is the *total cost break-even return*. Only when this break-even return is received can the grower recover all out-of-pocket expenses *plus* opportunity costs.

[i] Interest costs include some actual cash interest payments.

Most of the budget values given in Table 2 are based on more comprehensive underlying cost data, which are shown in Tables 4 through 7. Table 4 presents the annual capital requirements for a ten-acre block of Bartlett pears for canning. Table 5 specifies the machinery and building requirements for the 300-acre diverse cultivar orchard. Interest costs and depreciation are listed in Tables 6 and 7, respectively. Interest costs represent required return on investments. They can be actual interest payments on funds borrowed to finance farm operations and physical capital investments, an opportunity cost (a return that would have been received if the investment had been in an alternative activity), or a combination of the two. Interest costs assume a 5% interest rate. Depreciation costs are annual, non-cash expenses that are calculated over the asset's useful life. These expenses represent the loss in an asset's value due to use, age, and obsolescence.

The key results of this enterprise budget are formed by production-related assumptions established for the study. Production costs and returns for individual owner-operators may differ; thus, the results cannot be generalized to represent the population of pears-for-canning operations in Washington State. An interactive Excel Workbook, described below, is provided to enable individual owner-operators to estimate their returns based on the costs of their production.

Table 4. Summary of annual capital requirements for a ten-acre canning Bartlett block.

	Full Production ($/ten-acre block)	
	Year 1[a]	Years 2–25[b]
Annual Requirements		
Land (11 acres)[c]	$198,000.00	
Irrigation System	$46,200.00	
Wind Machine	$55,000.00	
Operating Expenses[d]	$11,850.00	$11,850.00
Total Requirements	**$311,050.00**	**$11,850.00**
Receipts	**$98,541.50**	**$98,541.50**
Net Requirements	**$212,508.50**	**-$86,691.50**

[a] Year when the orchard was purchased. The unit for the annual capital requirements is $/ten-acre.
[b] Corresponds to the assumed 25-year period of owning the orchard. The unit for the annual capital requirements is $/ten-acre block.
[c] Includes trees, excludes buildings.
[d] Operating expenses is the sum of the total variable costs, miscellaneous supplies, land and property taxes, insurance cost, and management cost.

Table 5. Machinery, equipment, and building requirements for a 300-acre diverse cultivar orchard.

	Purchase Price ($)[a]	Number of Units	Total Cost ($)
Housing for Manager	135,000	1	135,000
Machine Shop/Shed[b]	150,000	1	150,000
Tractor-70HP, 4WD	45,000	5	225,000
Tractor-40HP, 4WD	25,000	2	50,000
4-Wheeler	7,500	3	22,500
Speed Sprayer	25,000	5	125,000
Weed Spray Boom & Tank	7,000	1	7,000
Mower—Rotary (7 ft)	5,000	1	5,000
Flail Mower	8,000	1	8,000
Fork Lift	25,000	2	50,000

	Purchase Price ($)[a]	Number of Units	Total Cost ($)
Bin Trailer	7,500	3	22,500
Pickup Truck	35,000	1	35,000
Ladder (8 ft)	100	100	10,000
Platforms	40,000	3	120,000
Miscellaneous Equipment[c]	50,000	1	50,000
Shop Equipment[d]	15,000	1	15,000
Total Cost			**1,030,000**

Notes: Machinery, equipment, and building requirements are utilized in growing diverse crops in the 300-acre farm, which includes Bartlett pears. The costs of fixed capital are allocated on the entire farm operation.

[a] Purchase price corresponds to new machinery, equipment, or building.

[b] Includes manager office, restroom, pesticide handling area and storage, dry storage, area for equipment cover, and shop bay for equipment work or repair.

[c] Includes two mobile portable toilet, box blade, straight blade, quick connect loader, mechanical weeder, detachable bucket for loading fertilizer, gopher baiter, soil aerator, utility trailer, and two ladder trailers.

[d] Includes compressor, welder, pressure washer, and miscellaneous tools.

Table 6. Annual interest costs per acre for a ten-acre block ($/acre).

	Total Purchase Price ($)	Salvage Value ($)[a]	Number of Acres	Total Interest Cost ($)	Interest Cost per Acre ($)[b]
Irrigation System[c]	46,200	0	10	1,155	115.50
Land	198,000	N/A	11	9,900	900.00
Machinery, Equipment & Building[d,e]	1,030,000	74,500	300	27,613	92.04
Wind Machine[c]	55,000	0	10	1,375	137.50
Interest Rate	*5.0%*				

[a] Not applied to land because land is not a depreciable asset.

[b] Interest Cost is calculated as: (Total Purchase Price + Salvage Value)/2 × Interest Rate. For land, the calculation is: Total Purchase Price × Interest Rate, because there is no salvage value for land.

[c] The irrigation system and wind machine are used for the direct production of the fruit. Hence, their respective interest costs are divided by the production area (ten acres) to get the interest cost per acre.

[d] Total area of the farm operation is 300 acres, and the machinery, equipment, and building are used in the entire, diverse cultivar farm. Thus, the corresponding interest costs are divided by the total area (300 acres) to derive the interest cost per acre.

[e] See the Excel Workbook (Appendix 2) for a detailed calculation of the salvage value of the machinery, equipment, and building.

Table 7. Annual depreciation costs per acre for a ten-acre block ($/acre).

	Total Purchase Price ($)	Number of Acres	Total Value per Acre ($)	Years of Useful Life	Depreciation Cost per Acre ($/yr)[a]
Irrigation System	46,200	10	4,620.00	25	184.80
Wind Machine	55,000	10	5,500.00	25	220.00
Machinery, Equipment & Building[b]					261.92

[a] The depreciation cost is calculated as straight-line depreciation: (Total Purchase Price – Salvage Value)/Years of Use.

[b] See the Excel Workbook (Appendix 2) for the calculation of the depreciation cost of the machinery, equipment, and building.

Excel Workbook

An Excel spreadsheet version of this enterprise budget (Table 2) as well as associated data underlying the per-acre cost calculations (Tables 4 through 7 and Appendices 1 through 3 for establishment costs, full production costs, calculation of salvage value and depreciation costs, amortization calculator, and production-related data) are available at the WSU School of Economic Sciences Extension website.

Owner-operators can modify select values and thus use the Excel Workbook to evaluate their own production costs and returns.

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