2022 COST ESTIMATES OF PRODUCING AND PACKING FRESH-MARKET ANJOU PEARS IN THE WENATCHEE RIVER VALLEY, WASHINGTON STATE

Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of producing fresh-market Anjou pears in the Wenatchee River Valley, Washington State, in 2022. The primary use of this report is in identifying inputs, costs, and yields considered typical of well-managed Anjou pear orchards. This publication is not intended to be a definitive guide to production practices, but it is intended to be helpful in estimating the physical and financial requirements of comparable plantings. Specific budget assumptions were adopted for this study, but these assumptions may not represent the conditions in all production and marketing situations 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
- Fresh-market Anjou prices
- Orchard size
- Management skills
- Biotic and abiotic orchard variables

Cost estimations in the enterprise budget also vary depending on its intended use. To avoid drawing unwarranted conclusions for any particular 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.

Fresh-Market Anjou Pear Production in Washington State

Washington State is the number one producer of fresh-market pears in the United States. In 2020, the value of production is $136 million, comprising about 42% of the U.S. total value of production for this crop destined for the fresh market (USDA NASS 2022).

Anjou is the major pear variety produced in Washington State. In terms of bearing acreage, Anjou and Bartlett account for 40% and 37%, respectively, of the state's total in 2017. The bearing acres of Anjou pears were 8,436 acres in 2017, distributed between two major production regions—90% in Wenatchee and 8% in the Yakima Valley (USDA NASS 2017). The free on board (FOB) price of fresh-market Anjou in 2021 was $30.03/box. Between 2017 and 2021, the minimum and maximum prices of Anjou were $23.96/box and $30.03/box, respectively. The five-year average FOB price was $26.45/box, which is about 12% lower than in 2021 (WSTFA 2021).

Study Objectives

This publication is designed to enable growers to estimate: (1) the costs of equipment, materials, supplies, and labor required to produce Anjou pears destined for the fresh market, including packing costs, and (2) the ranges of price and yield at which Anjou pear production would be a profitable enterprise.

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Information Sources

The data used in this study were collected from information shared by a group of experienced Anjou pear growers in Washington. 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 would occur over an orchard's life, if no unforeseen failures occur. The pesticide programs considered in this study are based on the specific pest and disease that growers are treating or preventing, as well as the most common products they used for each purpose.

Given that many factors affect production costs, pack-out, and returns, individual growers can use the Excel Workbook (available at the WSU School of Economic Sciences' Crop Enterprise Budgets website) to make necessary modifications and estimate their own costs and returns.

Budget Assumptions

1. The budget is based on a pear orchard with a production area of 100 acres. It is assumed that 1 acre is dedicated to roads, pond, loading area, buildings, etc., rather than to fruit production. Therefore, the total productive area is 99 acres, of which two-thirds of the area is dedicated to fresh-market Anjou pears (66 acres). The remaining one-third of the area (33 acres) is planted with Bartlett pears that are used as pollenizers, and the yield is also directed to the fresh market. Table 1 shows the assumed Anjou block specifications, which are generally accepted across all growers interviewed.
2. The pear orchard is already established. Therefore, this enterprise budget presents the estimated costs and returns during a representative full production year.
3. The total value of land (including water rights and trees) is $25,000 per acre with annual property taxes of $220 per acre.
4. The irrigation system consists of under-tree sprinklers, with one mainline. Water is provided through a public irrigation district.
5. The mainline already exist. Only the irrigation system and wind machine are newly installed.
6. Cultural practices and harvest activities are done using ladders and manual labor. The hourly manual labor rate is calculated using the Washington adverse wage rate for 2022 at $17.41/hour. In this analysis, we add 25% to reflect medical leave and all administrative costs for H2A employees, including housing, amounting to $21.76/hour. Activities such as chemical application, irrigation, and frost protection cost $23.01/hour (i.e., base of $18.41/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.
7. Expected gross yield per acre is 32 bins (1,100 pounds per wood bin), of which Anjou pears are 21 bins and Bartlett pears are 11 bins. The pack-out rate is 87.5%.
8. The gross price or gross return is $27.00 per box for Anjou and $29.68 per box for Bartlett, or $675 per bin and $742 per bin, respectively, given that there are twenty-five 44 lb boxes per bin.
9. Total warehouse packing charges of $263 per bin are included in the variable costs.
10. Management is valued at $450 per acre.
11. 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. Fresh-market Anjou block specifications.

In-row Spacing	10 feet
Between-row Spacing	18 feet
Productive Block Size	66 acres
Tree Density	242 trees per acre
Planting Architecture	No trellis, free standing

Summary of Study Results

The estimated annual cost and returns for a 66-acre block of fresh-market Anjou pears in the Wenatchee River Valley are shown in Table 2. Production costs are classified into variable costs and fixed costs. Variable costs comprise orchard operations, harvest activities, materials, maintenance and repairs, and packing costs. Fixed costs are incurred whether or not Anjou pears are produced. These costs will generally be calculated for the whole farm enterprise and allocated across each unit of production. The fixed costs include depreciation on capital, interest, taxes, insurance, management, and amortized establishment costs. Management is treated as a fixed cost rather than a variable cost because, like land, management has been committed to the production cycle of the crop.

Based on the above assumptions, the total production costs for fresh-market Anjou pears are estimated at $21,625/acre, and the net returns are -$1,975/acre during full production (Table 2). Table 3 shows the sensitivity of net returns to different combinations of price and yields. For this analysis, the FOB prices considered are $600–$750 per 1,000 lb bin, and the net yields of fresh-market Anjou are 13–27 bins per acre, given an 87.5% pack-out. A gross yield-price combination of 40 bins per acre or greater and $675/bin or higher would result in positive net returns for the owner-operator, based on the study's production and cost assumptions.

Table 4 shows the break-even return given different yield levels during full production. This is the return at which production costs and total returns are equal, meaning that the grower would have neither a gain nor loss for their fresh-market Anjou pear enterprise. As of 2022, the first break-even return of fresh-

market Anjou pears is about $536/bin. This is the minimum return needed for the owner-operator to cover the operation's variable costs. Returns lower than this figure suggest that it is more profitable not to operate (shutdown price) to produce Anjou pears for the fresh market. The second break-even return is about $570/bin, which is needed to cover the total cash costs and to be economically viable in the short run. The third break-even return is $613/bin, which is needed to cover the cash costs plus depreciation of machinery and buildings. This return must be realized for the operation to be financially viable in the long run. The fourth break-even return is $785/bin. When this return is received, the owner-operator would recover all out-of-pocket expenses plus realize a competitive return on equity capital invested in land, the Anjou pear orchard, 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.

Most of the budget values given in Table 2 are based on more comprehensive underlying cost data, which are shown in Tables 5 through 8. Table 5 presents the annual capital requirements for a 66-acre Anjou block. Table 6 specifies the machinery and building requirements for the 100-acre pear orchard. Interest costs and depreciation are listed in Table 7 and Table 8, 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. 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 all Anjou pear 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 2. Cost and returns per acre of producing fresh-market Anjou pears on a 66-acre orchard block in the Wenatchee River Valley.

	Unit	Quantity	Price per unit	Total
Net Production[a]				
Anjou, fresh[b]	bin	18.00	675.00	12,150.00
Bartlett, fresh[b]	bin	10.00	742.00	7,420.00
Culls	bin	4.00	20.00	80.00
TOTAL RETURNS				**19,650.00**
Variable Costs:				
Orchard Activities				
Pruning[c]	acre	1	1,654.00	1,654.00
Irrigation Labor[c]	acre	1	207.00	207.00
Chemicals[d,e]	acre	1	2,389.00	2,389.00
Fertilizer[c,e]	acre	1	312.00	312.00
Frost Protection (labor)[d]	acre	1	17.00	17.00
Beehives	acre	1	114.00	114.00
General Farm Labor[f]	acre	1	225.00	225.00
Irrigation Water & Electric Charge	acre	1	130.00	130.00
Harvest Activities[g]				
Picking Labor	acre	1	1,061.76	1,061.76
Other Labor (checkers, tractor drivers, supervisors)	acre	1	384.00	384.00
Hauling	acre	1	96.00	96.00
Warehouse Packing Charges[h]	acre	1	8,416.00	8,416.00
Maintenance and Repairs				
Maintenance & Repair	acre	1	300.00	300.00
Fuel & Lube	acre	1	360.00	360.00
Other Variable Costs				
Crop Insurance	acre			75.00
Overhead (5% of Variable Costs)[i]	acre			787.04
Interest (5% of Variable Costs)	acre			619.79
Total Variable Costs	acre			**17,147.59**

	Unit	Quantity	Price per unit	Total
Fixed Costs:				
Depreciation				
Irrigation System	acre	1	154.00	154.00
Machinery, Equipment & Building	acre	1	469.67	469.67
Wind Machine	acre	1	144.00	144.00
Interest				
Irrigation System	acre	1	96.25	96.25
Land[j]	acre	1	1,250.00	1,250.00
Machinery, Equipment & Building	acre	1	183.67	183.67
Wind Machine	acre	1	90.00	90.00
Interest on Orchard Investment (5%)[k]	acre	1	1,029.76	1,029.76
Other Fixed Costs				
Miscellaneous Supplies	acre	1	190.00	190.00
Land & Property Taxes	acre	1	220.00	220.00
Insurance Cost (all farm)	acre	1	200.00	200.00
Management Cost	acre	1	450.00	450.00
Total Fixed Costs	acre			**4,477.35**
TOTAL COSTS	acre			**21,624.94**
ESTIMATED NET RETURNS	acre			**(1,974.94)**

[a] Net production refers to the number of bins that the packinghouse was able to sell. This figure considers a pack-out percentage of 87.5%.
[b] The prices of Anjou and Bartlett reflect the packinghouse door prices negotiated with retailer. This is not the price the grower receives; this is the gross return or the price before the packinghouse discounts their charges. Bin size is 1,100 lb.
[c] Hand labor rate is $21.76/hour and includes all H2A related expenses plus all applicable payroll taxes and benefits.
[d] Tractor/machinery operators and frost protection labor rate is $23.01/hour and includes all H2A related expenses plus all applicable payroll taxes and benefits.
[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 payroll taxes and benefits.
[g] Picking rate = $33.18/bin; checkers and tractor drivers' rate = $12/bin; hauling rate = $0/bin (hauling cost already included in the receiving/cold storage charge).
[h] Packing charges for fresh-market Anjou and Bartlett 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 $25,000 per acre.
[k] This cost represents the interest being paid on the investment in the orchard or returns foregone by investing in the orchard rather than in an alternative investment that would give immediate returns.

Table 3. Estimated net returns at various prices and yields of fresh-market Anjou pears during full production.

Gross Yield (bin/acre)	Gross Yield, Anjou (bin/acre)	Net Yield, Anjou (bin/acre)[a]	FOB Packinghouse Door Price Equivalent ($/bin)[b]						
			$600	$625	$650	$675	$700	$725	$750
			Estimated Net Returns ($/acre)						
22	15	13	-$5,923	-$5,598	-$5,273	-$4,948	-$4,623	-$4,298	-$3,973
28	19	17	-$4,053	-$3,628	-$3,203	-$2,778	-$2,353	-$1,928	-$1,503
34	23	20	-$2,803	-$2,303	-$1,803	-$1,303	-$803	-$303	$197
40	27	24	-$1,675	-$1,075	-$475	$125	$725	$1,325	$1,925
46	31	27	-$405	$270	$945	$1,620	$2,295	$2,970	$3,645
52	35	31	$1,465	$2,240	$3,015	$3,790	$4,565	$5,340	$6,115
58	39	34	$2,715	$3,565	$4,415	$5,265	$6,115	$6,965	$7,815
64	43	38	$3,843	$4,793	$5,743	$6,693	$7,643	$8,593	$9,543

Notes: Shaded area denotes positive net returns based on the combination of net yield and price.
[a] Net yield refers to the number of bins that the packinghouse was able to sell. This figure considers a pack-out percentage of 87.5%.
[b] Refers to gross return. Bin size is 1,100 lb.

Table 4. Break-even return of fresh-market Anjou pears for different levels of enterprise costs during full production in the Wenatchee River Valley.

		Cost ($/acre)	Break-even Return ($/bin)[a]
1.	Total Variable Costs	17,147.59	535.98[b]
2.	Total Cash Costs[c] = Total Variable Costs + Land & Property Taxes + Insurance Cost + Miscellaneous Supplies	17,757.59	569.87[d]
3.	Total Cash Costs + Depreciation Costs	18,525.26	612.51[e]
4.	Total Costs = Total Cash Costs + Depreciation Costs + Interest Costs[f] + Management Cost	21,627.94	784.72[g]

[a] Break-even return of Anjou is calculated as **BE Return** = [**Cost - (Price of Bartlett × Net yield of Bartlett) - (Price of Culls × Culls)] ÷ Net yield of Anjou**. All variables in this equation are held constant, except for the "Cost," which takes the Total Variable Costs, Total Cash Costs, Total Cash Costs + Depreciation Costs, or Total Costs, depending on the level of enterprise cost that the break-even return is being calculated.
[b] If the return is below this level, fresh-market Anjou pears are uneconomical to produce.
[c] 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.
[d] The second break-even return allows the producer to stay in business in the short run.
[e] The third break-even return allows the producer to stay in business in the long run.
[f] Interest costs include some actual cash interest payments.
[g] 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.

Table 5. Summary of annual capital requirements for a 66-acre fresh-market Anjou pear block.

	Full Production Year 1[a]	Years 2–25[b]
Annual Requirements		
Land (100 acres)[c]	$2,500,000.00	
Irrigation System	$254,100.00	
Wind Machine	$237,600.00	
Operating Expenses[d]	$69,960.00	$69,960.00
Total Requirements	**$3,061,660.00**	**$69,960.00**
Receipts	**$1,296,900.00**	**$1,296,900.00**
Net Requirements	**$1,764,760.00**	**($1,226,940.00)**

[a] Year when the orchard was purchased.
[b] Corresponds to the assumed 25-year period of owning the orchard. The unit for the annual capital requirements is $/10-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 6. Machinery, equipment, and building requirements for a 100-acre pear 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	3	135,000
Tractor-40HP, 4WD	25,000	1	25,000
4-Wheeler	7,500	1	7,500
Speed Sprayer	25,000	3	75,000
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

	Purchase Price ($)[a]	Number of Units	Total Cost ($)
Forklift	25,000	1	25,000
Bin Trailer	7,500	2	15,000
Pickup Truck	35,000	1	35,000
Ladder (10 ft)	210	30	6,300
Miscellaneous Equipment[c]	50,000	1	50,000
Shop Equipment[d]	15,000	1	15,000
Total Cost			**693,800**

Notes: These are the machinery, equipment, and building requirements of growing pears in the 100-acre farm, which include fresh-market Anjou 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 and repair.

[c] Includes two mobile portable toilets, 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 7. Annual interest costs per acre for a 66-acre fresh-market Anjou pear block.

	Total Purchase Price ($)	Salvage Value ($)[a]	Number of Acres	Total Interest Cost ($)	Interest Cost per Acre ($)[b]
Irrigation System[c]	254,100	0	66	6,353	96.25
Land	2,500,000	N/A	100	125,000	1,250.00
Machinery, Equipment & Building[d,e]	693,800	40,880	100	18,367	183.67
Wind Machine[c]	237,600	0	66	5,940	90.00
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 (66 acres) to get the interest cost per acre.

[d] Total area of the pear orchard operation is 100 acres, and the machinery, equipment, and building are used in the entire farm. Thus, the corresponding interest costs are divided by the total area (i.e., 100 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 8. Annual depreciation costs per acre for a 66-acre fresh-market Anjou pear block.

	Total Purchase Price ($)	Number of Acres	Total Value per Acre ($)	Years of Useful Life	Depreciation Cost per Acre ($/yr)[a]
Irrigation System	254,100	66	3,850.00	25	154.00
Wind Machine	237,600	66	3,600.00	25	144.00
Machinery, Equipment & Building[b]					469.67

[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 calculation of the depreciation cost of the machinery, equipment, and building.

Excel Workbook

The enterprise budget (Table 2) as well as associated data underlying the per-acre cost calculations (Tables 5 through 8 and Appendices 1 through 3 for detailed full production costs, calculation of salvage value and depreciation costs, and all production-related data of the fresh-market Anjou pear orchard investment) 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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