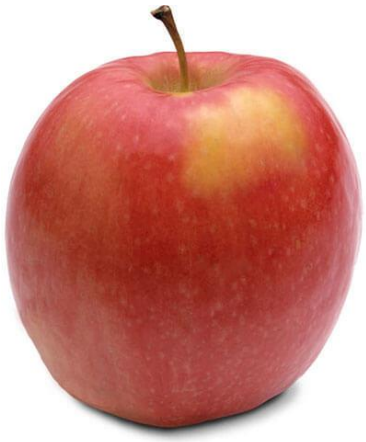
2019 COST ESTIMATES OF ESTABLISHING, PRODUCING, AND PACKING CRIPPS PINK APPLES IN WASHINGTON



Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of producing Cripps Pink apples in Washington State as of 2019. 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
- Apple 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 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.

Cripps Pink Production in Washington State

During 2006–2017, bearing acres of Cripps Pink in Washington State increased by 123%, from 4,006 bearing acres planted in 2006 to 8,923 in 2017. In 2017, Cripps Pink was the sixth largest cultivar in acreage with 5% of Washington State's total apple acreage, after Red Delicious, Gala, Fuji, Honeycrisp, and Granny Smith. Across the state, 40% of the Washington Cripps Pink acreage is grown in the Yakima district, 28% in the Columbia Basin, 29% in the Wenatchee district, and 3% in other areas (USDA NASS 2017).

As of 2018–2019, in terms of fresh apple shipments, Cripps Pink is the sixth largest cultivar grown in Washington State, with 4.4% of total shipments, following Red Delicious, Gala, Fuji, Granny Smith, and Honeycrisp. A total of 5.2 million 40 lb boxes of Cripps Pink were sold in the 2018–2019 season (WSTFA 2020). During the same 2018–2019 season, the average free on board (FOB) price of Cripps Pink was at $32.7/40 lb box; compared with Red Delicious at $17.7/40 lb box, Gala at $25.6/40 lb box, Fuji at $25.7/40 lb box, Granny Smith at $28.8/40 lb box, and Honeycrisp at $53/40 lb box.

Study Objectives

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

The primary use of this report is in identifying inputs, costs, and yields considered to be typical of well-managed Cripps Pink orchards. This publication does not necessarily represent any particular 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 Cripps Pink owner-operators 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, pack-out, and returns, individual owner-operators can use the

Excel Workbook provided to estimate their own costs and returns.

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%).
2. This budget is based on an 11-acre Cripps Pink block within a 300-acre orchard. It is assumed that 5% 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. Table 1 shows the assumed Cripps Pink block specifications.
3. The total value of bare agricultural land (including water rights) is $18,000 per acre with annual property taxes of $170 per acre.
4. The investment in infrastructure, cultural practices, and harvest activities aim to capture state-of-the-art practices in apple production across Washington. However, consider that not all investments are representative for the majority of apple operations. For example, the use of netting is becoming widespread; yet sunburn protectant sprays or overhead cooling are still the predominant sunburn protection methods.
5. The irrigation system consists of overhead cooling and under-tree drip sprinklers with two separate sub-main lines. Water is provided through a public irrigation district.
6. The pond is installed in Year 1.
7. Cultural practices and harvest activities are done by using a combination of ladders and labor-enhancing equipment. The hourly labor rate for 2019 is calculated using the Washington adverse wage rate for 2019 ($15.03/hour), plus 25% to reflect medical leave, payroll taxes, and all administrative costs for H2A employees, including housing, amounting to $18.79/hour. Activities such as chemical application, irrigation, and frost protection are assumed to cost $16.03/hour, plus 25% equals $20.04/hour. Note that pruning and thinning are usually paid on a piece rate basis, but this study uses an hourly equivalent. Harvest labor rates follow the Department of Labor rates, plus 4% to account for mandated paid rest breaks. This study uses a piece rate payment structure for harvest.
8. The gross return is $558/925 lb bin; equivalent to $31/40 lb box.
9. Average pack-out for Cripps Pink is 78% or 18 box/bin.
10. Warehouse packing charges assume a 925 lb bin.
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.

Summary of Study Results

Table 2 shows the estimated annual cost and returns for a ten-acre block of Cripps Pink apples in Washington State. 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 apples are produced. The fixed costs include depreciation on capital, interest, taxes, insurance, management, and amortized establishment costs. 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.

This study assumed that a Cripps Pink orchard could achieve full production in the sixth year. Based on the assumptions listed above, the total production costs for Cripps Pink during full production are estimated at $44,621.75/acre. The break-even price for Cripps Pink apples as of 2019 is estimated at $673.03/925 lb bin or $37.39/40 lb box (considering 78% pack-out; 18 boxes per bin).

Table 3 shows the sensitivity of net returns to different combinations of price and yields. For this analysis, FOB prices range from $465 to $765 per 925 lb bin ($25.83 to $42.5 per 40 lb box), and net yields range from 58.5 to 74.1 bins per acre. Prices above $690/925 lb ($38.33/40 lb box) and yields above 62.4 would result in positive returns.

Table 1. Cripps Pink block specifications.

Architecture	Randomly trained with 18-inch radius from tree center
In-row Spacing	3 feet
Between-row Spacing	10 feet
Rootstock	Dwarf - 9 series
Productive Block Size	10 acres
Life of Planting	20 years
Tree Density	1,452 trees per acre
Trellis System	Vertical trellis system

Table 2. Cost and returns per acre of establishing, producing, and packing Cripps Pink on a ten-acre orchard block.

	Establishment Years					Full Production[a]	Your Costs
	Year 1	Year 2	Year 3	Year 4	Year 5		
Estimated Net Production (bins/acre)[b]			31.20	42.90	54.60	66.30	
Estimated FOB Price ($/bin)[c]			558.00	558.00	558.00	558.00	
Total Returns ($/acre)			17,409.60	23,938.20	30,466.80	36,995.40	
Variable Costs ($/acre):							
Establishment							
Soil Preparation	1,271.44						
Trees (including labor)	14,775.26						
Orchard Activities							
Pruning & Training[d]	563.70	638.86	657.65	469.75	714.02	939.50	
Green Fruit Thinning[d]	281.85	281.85	563.70	657.65	845.55	1,127.40	
Irrigation Labor[e]	200.40	200.40	200.40	200.40	200.40	200.40	
Herbicide[e,f]	88.03	254.77	253.38	300.29	253.38	253.97	
Insecticide[e,f]	0.00	207.51	907.42	855.13	907.42	879.87	
Fungicide[e,f]	578.95	670.29	666.12	668.84	666.12	667.87	
Rodenticide[e,f]	39.62	51.80	51.24	51.60	51.24	51.48	
Sunburn Protection[e,f]			412.29	413.01	412.29	412.75	
Chemical Thinning[e,f]			340.19	341.82	340.19	341.24	
Growth Regulator[e,f]			350.48	350.66	350.48	350.60	
Ripening Regulator[f]			500.00	500.00	500.00	500.00	
Fertilizer[e,f]		86.22	126.30	126.30	126.30	126.30	
Sunburn Protection—Netting[g]			1,200.00	1,200.00	1,200.00	1,200.00	
Frost Protection (labor)[e]			8.02	8.02	8.02	8.02	
Beehives			55.00	55.00	55.00	55.00	
General Farm Labor[h]	100.00	100.00	100.00	100.00	100.00	100.00	
Irrigation Water & Electric Charge	350.00	350.00	350.00	365.00	365.00	365.00	
Harvest Activities[i]							
Picking Labor			1,145.60	1,575.20	2,004.80	2,434.40	
Other Labor (checkers, tractor drivers, supervisors)			320.00	440.00	560.00	680.00	
Hauling Apples			280.00	385.00	490.00	595.00	
Warehouse Packing Charges[j]			9,440.00	12,980.00	16,520.00	20,060.00	
Maintenance and Repairs							
Maintenance & Repair	300.00	300.00	300.00	315.00	315.00	340.00	
Fuel & Lube	300.00	300.00	300.00	300.00	300.00	300.00	
Other Variable Costs							
Overhead (5% of variable costs)[k]	942.46	172.08	926.39	1,132.93	1,364.26	1,599.44	

	Establishment Years					Full Production[a]	
Interest (5% of variable costs)[l]	989.59	180.69	972.71	1,189.58	1,432.47	1,259.56	
Total Variable Costs	20,781.29	3,794.46	20,426.90	24,981.18	30,081.95	34,847.80	
Fixed Costs ($/acre):							
Depreciation							
Irrigation System	140.00	140.00	140.00	140.00	140.00	140.00	
Sunburn Protection—Netting	400.00	400.00	400.00	400.00	400.00	400.00	
Machinery, Equipment & Building	261.92	261.92	261.92	261.92	261.92	261.92	
Mainline & Pump	30.00	30.00	30.00	30.00	30.00	30.00	
Pond	48.00	48.00	48.00	48.00	48.00	48.00	
Trellis	287.50	287.50	287.50	287.50	287.50	287.50	
Wind Machine			117.09	117.09	117.09	117.09	
Interest							
Irrigation System	105.00	105.00	105.00	105.00	105.00	105.00	
Sunburn Protection—Netting	200.00	200.00	200.00	200.00	200.00	200.00	
Land[m]	900.00	900.00	900.00	900.00	900.00	900.00	
Machinery, Equipment & Building	92.04	92.04	92.04	92.04	92.04	92.04	
Mainline & Pump	22.50	22.50	22.50	22.50	22.50	22.50	
Pond	60.00	60.00	60.00	60.00	60.00	60.00	
Trellis	143.75	143.75	143.75	143.75	143.75	143.75	
Wind Machine			87.82	87.82	87.82	87.82	
Establishment Costs (5%)		1,230.60	1,673.39	2,124.70	2,499.87		
Other Fixed Costs							
Miscellaneous Supplies	150.00	150.00	300.00	300.00	300.00	300.00	
Land & Property Taxes	170.00	170.00	170.00	170.00	170.00	170.00	
Insurance Cost (all farm)	120.00	120.00	270.00	270.00	270.00	270.00	
Management Cost	700.00	700.00	700.00	700.00	700.00	700.00	
Amortized Establishment Costs[n]						5,438.33	
Total Fixed Costs	3,830.71	5,061.31	6,009.01	6,460.33	6,835.49	9,773.96	
TOTAL COSTS	24,612.00	8,855.77	26,435.91	31,441.51	36,917.45	44,621.75	
ESTIMATED NET RETURNS	-24,612.00	-8,855.77	-9,026.31	-7,503.31	-6,450.65	-7,626.35	
Accumulated Establishment Costs	24,612.00	33,467.77	42,494.08	49,997.39	56,448.04		

[a] The full production year is representative of all the remaining years the orchard is in full production (Year 6 to Year 20).
[b] Estimated net production considers an average pack-out of 78%; or 18 boxes per bin.
[c] These prices reflect the return before any expenses are subtracted. Bin size is 925 lb.
[d] Hand labor rate is $18.79/hour and includes all applicable taxes and benefits.
[e] Tractor/machinery, irrigation, and frost protection labor rate is $20.04/hour and includes all applicable taxes and benefits.
[f] Includes materials and labor.

[g] Labor cost only.
[h] General farm labor rate is a lump sum per acre and applied to miscellaneous/all other labor. Rate includes applicable taxes and benefits.
[i] Picking rate = $28.64/925 lb bin; checkers' and tractor drivers' rate = $8/925 lb bin; hauling rate = $7/925 lb 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 located in remote areas.)
[j] Packing charges include receiving charges per bin plus total box charges per bin. Pack-out number of boxes per bin is 18.
[k] 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.
[l] Interest expense on full year during establishment years and for three-quarters of a year during full production.
[m] Land cost is approximated by using the 5% interest rate multiplied by the land value of $18,000 per acre.
[n] Represents the costs incurred during the establishment years (minus revenues during those years) that must be recaptured during the full production years. It is calculated as accumulated establishment costs in Year 5 amortized at 5% for 15 years.

Table 3. Estimated net returns ($) per acre at various prices and yields of Cripps Pink during full production[a].

Net Yield (bin/acre)[b]	FOB Price ($/bin)[c]				
	$465	$540	$615	$690	$765
58.5	-$14,373	-$9,985	-$5,598	-$1,210	$3,177
62.4	-$14,083	-$9,403	-$4,723	-$43	$4,637
66.3	-$13,792	-$8,820	-$3,847	$1,125	$6,098
70.2	-$13,502	-$8,237	-$2,972	$2,293	$7,558
74.1	-$13,212	-$7,654	-$2,097	$3,461	$9,018
Overhead cost	*5%*				
Interest cost	*5%*				

Note: Shaded area denotes a positive profit based on the combination of yield and price.
[a] Includes amortized establishment costs. Net return is what the grower receives after all costs (for example, production expenses and packing costs) have been accounted.
[b] Assumes a 925 lb bin. Takes into account an average pack-out equivalent to 78%.
[c] Divide the prices in $/bin by 18 to obtain equivalent prices in $/40 lb box.

Table 4. Break-even return ($/bin) for different levels of enterprise costs during full production of Cripps Pink.

		Cost ($/acre)	Break-Even Return ($/bin)[a]		Your Cost ($/acre)	Your Break-Even Return ($/bin)
1.	Total Variable Costs	34,847.80	525.61	[b]		
2.	Total Cash Costs[c] = Total Variable Costs + Land & Property Taxes + Insurance Cost + Miscellaneous Supplies	35,587.80	536.77	[d]		
3.	Total Cash Costs + Depreciation Costs	36,872.31	556.14	[e]		
4.	Total Cost = Total Cash Costs + Depreciation Costs + Interest Costs[f] + Management Cost	44,621.75	673.03	[g]		

Net Yield (bin/acre) = 66.30

Note: The net price and net yield assumed in the baseline budget (Table 2) was $558/925 lb bin and 66.30 lb/acre.
[a] Break-even return is calculated as cost divided by net yield during full production.
[b] If the return is below this level, Cripps Pink apples 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 ten-acre Cripps Pink block.

	Establishment Years					Full Production[a]
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
Annual Requirements ($)						
Land (11 acres)	198,000					
Trellis System	57,500					
Netting—Sunburn Protection[b]	80,000					
Irrigation System	42,000					
Mainline & Pump	9,000					
Pond	24,000					
Wind Machine			35,128			
Operating Expenses[c]	219,213	49,345	218,669	264,212	315,220	362,878
Total Requirements ($)	629,713	49,345	253,797	264,212	315,220	362,878
Receipts ($)	0	0	174,096	239,382	304,668	369,954
Net Requirements ($)	629,713	49,345	79,701	24,830	10,552	-7,076

[a] The full production year is representative of all the remaining years the orchard is in full production (Year 6 to Year 20).
[b] The use of netting is becoming widespread; however, up-to-date sunburn protectant sprays or overhead cooling are still the predominant sunburn protection methods.
[c] Operating expenses include 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 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
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 include Cripps Pink apples. 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 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 ten-acre Cripps Pink block ($/acre).

	Total Purchase Price ($)	Salvage Value ($)[a]	Number of Acres	Total Interest Cost ($)	Interest Cost per Acre ($)[b]
Irrigation System[c]	42,000	0	10	1,050	105.00
Sunburn Protection—Netting[c]	80,000	0	10	2,000	200.00
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
Mainline & Pump[c]	9,000	0	10	225	22.50
Pond[c]	24,000	0	10	600	60.00
Trellis[c]	57,500	0	10	1,438	143.75
Wind Machine[c]	35,128	0	10	878	87.82
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, netting for sunburn protection, mainline and pump, pond, trellis 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 3) for a detailed calculation of the salvage value of the machinery, equipment, and building.

Table 8. Annual depreciation costs per acre for a ten-acre Cripps Pink block ($/acre).

	Total Purchase Price ($)	Number of Acres	Total Value Per Acre ($)	Years of Useful Life	Depreciation Cost Per Acre ($/yr)[a]
Irrigation System	42,000	10	4,200.00	30	140.00
Sunburn Protection—Netting	80,000	10	8,000.00	20	400.00
Mainline & Pump	9,000	10	900.00	30	30.00
Pond	24,000	10	2,400.00	50	48.00
Trellis	57,500	10	5,750.00	20	287.50
Wind Machine	35,128	10	3,512.83	30	117.09
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 Excel Workbook (Appendix 3) for calculation of the depreciation cost of the machinery, equipment, and building.

A further analysis of break-even returns is presented in Table 4. This analysis shows that the first break-even return is $525.61/925 lb bin ($29.2/40 lb box). This is the minimum return for the owner-operator to cover the operation's variable costs. Returns lower than this figure suggest that it is uneconomical to produce Cripps Pink apples. The second break-even return is at $536.77/925 lb bin ($29.82/40 lb box), 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. The third break-even return is at $556.14/925 lb bin ($30.9/40 lb box), 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. The fourth break-even return is at $673.03/925 lb bin ($37.39/40 lb box). If this return is realized, the owner-operator would recover all out-of-pocket expenses (cash costs) plus realize 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.

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 21-acre Cripps Pink block. Table 6 specifies the machinery and building requirements for the 300-acre diverse cultivar 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. All interest and

amortization costs assume a 5% interest rate—5% is the median of the range of the average annual effective interest rate on non-real estate bank loans made to farmers from 2014 to 2018 (Federal Reserve Bank of Kansas City 2019). The amortized establishment costs must be recaptured during the full production years in order for an enterprise to be profitable. 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 apple 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.

Excel Workbook

An Excel spreadsheet version of this enterprise budget (Table 2) as well as associated data underlying the per-acre cost calculations (Tables 5 through 8 and Appendices 1 through 5 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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