



2014 COST ESTIMATES OF ESTABLISHING, PRODUCING AND PACKING ORGANIC RED DELICIOUS APPLES IN WASHINGTON

By

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Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of producing organic Red Delicious apples in Washington as of 2014. This publication is not intended to be a definitive guide to production practices, but 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 their 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 and/or returns as appropriate for their own orchard operation.

Organic Red Delicious Apple Production in Washington

Washington leads the nation in the production of certified organic apples with 14,790 acres accounting for 9.7% of Washington apple acres and 72% of the state's total organic tree fruit acreage (Kirby and Granatstein 2012).

Organic apple production is primarily based in central Washington, east of the Cascade Mountains, with nearly two-thirds of certified apple acres located in Grant, Douglas, and Yakima counties (Galinato et al. 2011). Organic Red Delicious acreage represents 10% of the total certified organic apple acres in the state as of 2011 (USDA NASS 2011).

More than 10.13 million boxes of organic apples were sold in 2014. Organic Red Delicious represented 10.87% of total volumes of organic apples sold in the same year. Sales between 2013 and 2014 increased by 28.6%, which is the highest increase among reported varieties over this period: Gala, Fuji, Red Delicious, Golden Delicious, Granny Smith, Honeycrisp, and Cripps Pink.

The price per 40 lb box of organic Red Delicious was \$29.00 in 2014, compared to \$13.87 per 40 lb box of conventional Red Delicious, thus there was a premium of \$15.13 per 40 lb box (Kirby and Granatstein 2015).

Washington organic apple exports were approximately 660,000 boxes in 2014 to 2015. Organic apple exports increased by 39% between 2007 and 2008 and 2014 to 2015 marketing seasons. Organic Red Delicious apples accounted for approximately 14% of the total organic apple exports in 2014 to 2015 (Kirby and Granatstein 2015).

Study Objectives

This publication is designed to enable growers to estimate: (1) the costs of equipment, materials, supplies, and labor required to establish and produce an organic Red Delicious orchard, and (2) the ranges of price and yield at which certified organic Red Delicious 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 organic Red Delicious 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 organic Red Delicious 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 growers anticipate over an orchard's life, if no unforeseen failures occur. Given that many factors affect production costs, pack-out, and returns, individual growers 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 of mixed conventional and organic tree fruits. 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 a 26-acre block within a 300 acre diverse cultivar orchard. It is assumed that 1 acre of this block is not used for the direct production of tree fruit; rather it is dedicated to roads, a pond, loading area, etc. Therefore, the total productive area for this block is 25 acres. Table 1 shows the assumed organic Red Delicious block specifications.
3. The value of bare agricultural land (including water rights) is \$12,000 per acre with annual property taxes of \$120 per acre.
4. 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.
5. The pond is installed in Year 1.
6. Warehouse packing charges assume a 925 lb bin. There is no pre-sorting of apples in the field, thus the grower gets charged for the 925 lb packed bin that will include pack-outs and culls.
7. Cultural practices and harvest activities are done by hand and using ladders (no mechanical aids).
8. Weed control costs in this budget are based on flaming and hand weeding. An alternative weed control method is the use of fabric, which has 8 to 10 years of useful life. Costs are about \$1,200 per acre for materials and installation and \$300 per acre for labor to close and open the fabric during the growing season. If this alternative is chosen, the fabric will be installed during Year 3 of production.
9. Conventional apple production practices are used in the first 2.5 years. Organic production practices begin in August of the third year, so that by the sixth year, the harvested apples will be certified organic.
10. The organic certification process begins in Year 3 with the discontinuation of all prohibited materials before harvest. The application for transition status is submitted in January of Year 4, along with the following fees: \$250 new application fee, \$200 annual fee, and \$20 site fee. The following fees are in Year 5: \$20 site fee, and \$50 transition site fee. In Year 6 and onwards, the renewal fee includes: \$20 site fee; and a certification fee based on a percentage of sales from the reporting period and estimated at $\$2,200 + 0.11\%$ of income for a gross income of more than \$750,000. The determination of applicable fees can be found in the WSDA Organic Certification Fee form for producers (WSDA 2015).

11. Management is valued at \$300 per acre. This value is representative of what the producer group felt as a fair return to an operator's management skills.
12. Interest on investment is 5%.

Summary of Study Results

The estimated annual cost and returns for a 26-acre block of organic Red Delicious apples in Washington is shown in Table 2. The components of the major costs shown in this table are provided in more detail in the Excel Workbook described below. 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. These costs will generally be calculated for the whole farm enterprise and be allocated for the unit of production. 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.

The study assumed that an organic Red Delicious orchard could achieve full production in the sixth year of operation. Based on the above assumptions, the total production costs for organic Red Delicious during full production are estimated at \$25,408 per acre. The break-even price for organic Red Delicious during full production is about \$460 per 925 lb bin or \$20 per 40 lb box (considering 85% pack-out). Table 3 shows the sensitivity of net returns to different price and yield combinations, where positive grower returns can be observed when both prices and yields are at high levels (for example, price at \$500 per 925 lb bin and yield at 51 bins per acre).

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 26-acre organic Red Delicious block. 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, or 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. The amortized establishment costs assume a total productive life of 30 years, which includes 5 years of establishment and 25 years of full production. 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 economic feasibility of investing in an organic Red Delicious orchard is further assessed by using the net present value (NPV) and discounted payback period. NPV is the sum of the discounted cash flows throughout the planting's productive life (i.e., 30 years). NPV provides an indicator of an investment's feasibility by estimating and converting its future profits into present-day dollars given the cost and length of the investment, time value of money, and how long it takes for an investment to return a profit. The discounted payback period gives the number of years it would take to recoup an investment from discounted cash flows.

Discounting is a method used to estimate the present value of future payments. A discount rate of 5% is used in the calculation of NPV and payback periods, and represents the opportunity cost of capital. Given this discount rate, the net present value of the investment is \$2.4 million (Table 8). The estimated discounted payback period for the orchard investment can vary depending on the costs included in the calculation, and ranges from 6.7 to 9.3 years. If one includes total cash costs, which is the sum of total variable costs, miscellaneous supplies, land and property taxes, and farm insurance, the discounted payback period is 6.7 years. Whereas, if one includes all production costs, which is the sum of total cash cost, management cost and fixed capital investment, the discounted payback period is 9.3 years. Table 8 also shows the sensitivity of the NPV calculations to different discount rates—4%, 5% and 6%, which represent the range of the average annual effective interest rates on non-real estate bank loans made to farmers in the past 6 years (2010 to 2015; Federal Reserve Bank of Kansas City 2016). The NPV and payback period calculations are shown in detail in Appendix 6 of the Excel Workbook.

The key results of this enterprise budget are formed by production-related assumptions established for the study. Production costs and returns for individual growers may differ, thus the results cannot be generalized to represent the population of farmers. An interactive Excel Workbook is provided to enable individual growers 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 4 through 7, and Appendices 1 through 6 for establishment costs, full production costs, calculation of salvage value and depreciation costs, amortization calculator, production-related data, and net present value and payback period calculators) are available at the WSU School of Economic Sciences Extension website: http://extecon.wsu.edu/pages/Enterprise_Budgets.

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

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Table 1. Organic Red Delicious Block Specifications

Architecture	Three dimensional central leader
In-row Spacing	4 feet
Between-row Spacing	12 feet
Rootstock	M106
Block Size	25 acres
Life of Planting	30 years
Tree Density	907 trees per acre
Trellis System	Vertical trellis system

Table 2. Cost and Returns per Acre of Establishing, Producing and Packing Organic Red Delicious on a 25-Acre Orchard Block

	Establishment Years					Full Certified Production ^A
	Year 1	Year 2	Year 3	Year 4	Year 5	
Estimated Net Production (bins/acre) ^B			12.75	25.50	42.50	55.25
Estimated FOB Price (\$/bin) ^C			400.00	400.00	400.00	600.00
TOTAL RETURNS (\$/acre)			5,100.00	10,200.00	17,000.00	33,150.00
<i>Variable Costs</i>						
Establishment ^D	6,825.27					
Orchard Activities ^E	1,829.00	2,210.50	2,660.70	2,996.50	3,712.50	3,799.96
Harvest Activities ^F			585.00	1,170.00	1,950.00	2,535.00
Warehouse Packing Charges			2,881.38	5,762.77	9,604.61	12,485.99
Maintenance and Repairs ^G	286.61	286.61	286.61	381.61	381.61	405.61
Other Variable Costs ^H	916.44	255.95	866.88	1,266.34	1,813.47	1,925.36
Total Variable Costs	9,857.32	2,753.06	7,280.57	11,577.22	17,462.19	21,151.92
Total Fixed Costs^I	1,936.37	2,526.06	2,936.10	3,191.93	3,420.39	4,256.52
TOTAL COSTS (\$/acre)	11,793.69	5,279.12	10,216.67	14,769.15	20,882.58	25,408.44
ESTIMATED NET RETURNS (\$/acre)	-11,793.69	-5,279.12	-5,116.67	-4,569.15	-3,882.58	7,741.56

Notes:

A. The full production year is representative of all the remaining years the orchard is in full production (Year 6 to Year 30).

B. Estimated net production considers an average pack-out of 85%.

C. These prices reflect the return before any expenses are subtracted. Bin size is 925 lb.

D. Includes costs of soil preparation and planting (trees and labor).

E. Includes pruning and training, green fruit thinning, irrigation labor, chemicals, fertilizer, weed control, frost protection (labor), beehives, general farm labor, irrigation and electric charge, and organic certification fee (starting Year 4).

F. Includes picking labor, other labor (checkers, tractor drivers), and hauling apples.

G. Includes maintenance and repair, and fuel and lube.

H. Includes crop insurance (starting Year 3), overhead, and interest on operating capital.

I. Includes depreciation and interest on fixed capital, interest on establishment, and other fixed costs (miscellaneous supplies, land and property taxes, farm insurance, management cost, and amortized establishment cost).

Table 3. Estimated Net Returns^A (\$) per Acre at Various Prices and Yields of Organic Red Delicious during Full Production

Net Yield (bins/acre) ^B	FOB Price (\$/bin) ^C							
	\$400	\$450	\$500	\$550	\$600	\$650	\$700	\$750
42.50	-\$4,631	-\$2,507	-\$382	\$1,743	\$3,868	\$5,993	\$8,118	\$10,243
46.75	-\$4,190	-\$1,853	\$484	\$2,822	\$5,159	\$7,497	\$9,834	\$12,171
51.00	-\$3,749	-\$1,199	\$1,351	\$3,901	\$6,450	\$9,000	\$11,550	\$14,100
55.25	-\$3,308	-\$546	\$2,217	\$4,979	\$7,742	\$10,504	\$13,266	\$16,029
59.50	-\$2,867	\$108	\$3,083	\$6,058	\$9,033	\$12,008	\$14,982	\$17,957
63.75	-\$2,426	\$762	\$3,949	\$7,137	\$10,324	\$13,511	\$16,699	\$19,886
68.00	-\$1,984	\$1,415	\$4,815	\$8,215	\$11,615	\$15,015	\$18,415	\$21,815

Notes:

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 (e.g., production expenses and packing costs) have been accounted.

B. Assumes a 925-pound bin. Takes into account an average pack-out equivalent to 85%.

C. Price represents the return before any expenses (including packing charges) are subtracted. One box is equal to 40 lb. To convert price per bin to price per box, multiply by (925/40).

Table 4. Summary of Annual Capital Requirements for a 25-acre Organic Red Delicious Block

	Establishment Years					Full Certified Production ^A
	Year 1	Year 2	Year 3	Year 4	Year 5	
Annual Requirements (\$)						
Land (26 acres)	312,000					
Trellis System	36,525					
Irrigation System	75,000					
Mainline & Pump	17,500					
Pond	7,500					
Wind Machine			62,608			
Operating Expenses ^B	265,308	87,702	200,889	308,305	455,430	547,673
Total Requirements (\$)	713,833	87,702	263,497	308,305	455,430	547,673
Receipts (\$)	0	0	127,500	255,000	425,000	828,750
Net Requirements (\$)	713,833	87,702	135,997	53,305	30,430	-281,077

Notes:

The net yields of organic Red Delicious apples from Year 4 to Full Production are 17 bins/acre, 34 bins/acre, and 55.25 bins/acre, respectively.

A. The full production year is representative of all the remaining years the orchard is in full production (Year 6 to Year 30).

B. 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	32,500	5	162,500
Tractor-40HP, 4WD	25,000	2	50,000
4 Wheeler	7,500	3	22,500
Speed Sprayer	20,000	5	100,000
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
Pick-up	20,000	1	20,000
Ladder (8 ft)	100	100	10,000
Miscellaneous Equipment ^C	50,000	1	50,000
Shop Equipment ^D	15,000	1	15,000
Total Cost			807,500

Notes:

Machinery, equipment, and building requirements are utilized in growing diverse crops in the 300-acre farm, which include organic Red Delicious 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 and repair.

C. Includes mobile portable toilet (2), box blade, straight blade, quick connect loader, mechanical weeder, detachable bucket for loading fertilizer, gopher baiter, soil aerator, utility trailer and ladder trailer (2).

D. Includes compressor, welder, pressure washer and miscellaneous tools.

Table 6. Annual Interest Costs for a 25-Acre Organic Red Delicious Block (\$/acre)

	Total Purchase Price (\$)	Salvage Value (\$)^A	Number of Acres	Total Interest Cost (\$)	Interest Cost Per Acre (\$)^B
Irrigation System ^C	75,000	0	25	1,875	75.00
Land	312,000	N/A	26	15,600	600.00
Machinery, Equipment, & Building ^{D,E}	807,500	52,250	300	21,494	71.65
Mainline & Pump ^C	17,500	0	25	438	17.50
Pond ^C	7,500	0	25	188	7.50
Trellis ^C	36,525	0	25	913	36.53
Wind Machine ^C	62,608	0	25	1,565	62.61
<i>Interest Rate</i>	<i>5.0%</i>				

Notes:

A. Not applied to land because land is not a depreciable asset.

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

C. The irrigation system, 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 (40 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 Appendix 3 of Excel Workbook for a detailed calculation of the salvage value of the machinery, equipment, and building.

Table 7. Annual Depreciation Costs for a 25-Acre Organic Red Delicious Block (\$/acre)

	Total Purchase Price (\$)	Number of Acres	Total Value Per Acre (\$)	Years of Useful Life	Depreciation Cost Per Acre (\$/yr)^A
Irrigation System	75,000	25	3,000.00	30	100.00
Mainline & Pump	17,500	25	700.00	30	23.33
Pond	7,500	25	300.00	50	6.00
Trellis	36,525	25	1,461.00	30	48.70
Wind Machine	62,608	25	2,504.32	30	83.48
Machinery, Equipment, & Building ^B					195.17

Notes:

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

B. See Appendix 3 of Excel Workbook for the calculation of the depreciation cost of the machinery, equipment, and building.

Table 8. NPV and Payback Periods given Different Discount Rates

Discount rate	NPV	Payback period of Total Cash Cost^A (years)	Payback period of Total Cost^B (years)
4%	\$2,946,453	6.62	9.06
5%	\$2,419,691	6.70	9.33
6%	\$1,984,645	6.78	9.63

Notes:

A. Cash cost is the sum of total variable cost, miscellaneous supplies, land & property taxes, and insurance cost. Excludes interest on operating capital.

B. Total cost is the sum of: total cash cost, management cost, and fixed capital investment. Excludes interest on operating capital and interest on fixed capital.



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