2019 COST ESTIMATES OF PRODUCING FRESH AND PROCESSING POTATOES IN WASHINGTON

Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of producing potatoes in the Columbia Basin as of 2019, with a capital and machinery endowment suited to a 1,000-acre potato enterprise. 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 farm operations, depending on the following factors:

- Capital, labor, and natural resources
- Crop yield
- Cultural practices
- Input prices
- Prices of potatoes
- Management skills
- Size of the operation
- Type and size of machinery and irrigation system

Costs can also be calculated differently depending on the intended use of the budget. To avoid unwarranted conclusions for any particular farm, readers must closely examine the assumptions made in this study, and then adjust the costs and returns as appropriate for their operation.

Potato Production in Washington

Washington is the second largest producer of potatoes in the United States. In 2018, Washington growers harvested 165,000 acres of potatoes, representing 16.1% of total U.S. acres and 23.2% of total production (USDA NASS 2019). Potato production acreage has increased over the past decade, from 143,000 acres in 2009 to 165,000 acres in 2018.

As of 2018, the majority of potato acres in Washington (71.5%) are planted to processing varieties, where the top three are Russet Burbank (29.6%), Umatilla Russet (14.8%), and Clearwater (8.8%). About 12.6% of total planted acres is for fresh potatoes and is primarily planted to the Russet Norkotah variety (8.1%). Other varieties for fresh or processing make up the remaining 15.9% (USDA NASS 2018).

Study Objectives

This study provides information on (1) the variable and fixed costs required to produce potatoes, for the fresh or processed markets, under center pivot irrigation, and (2) the ranges of price and yield levels at which potato production would be a profitable enterprise. An Excel workbook has also been developed, which allows the user to estimate production costs and examine the impact of different input assumptions, yields, and price scenarios.

Information Sources

The data used in this production cost budget were obtained from a group of Washington potato growers. These growers represented both fresh and processing potato production in the Columbia Basin. Their production practices and requirements for labor and capital are the basis for the assumptions used in this study and represent a consensus of current production methods.

Due to the method used to generate this potato production budget, the values reported in this budget represent what growers can anticipate as their average cost of production over several years, assuming no major crop loss. However, crop loss should be considered as part of a risk management plan, and we recommend that growers use the Excel Workbook provided to evaluate their own production costs and returns.

Budget Assumptions

The following assumptions were made in developing the potato enterprise data:

1. The enterprise budgets reported are for potatoes grown under a 125-acre center pivot irrigation system and in a crop rotation following alfalfa.
2. The varieties used in this budget are Russet Burbank potatoes that are planted for the processing market and Russet Norkotah potatoes that are planted for the fresh market.
3. Fumigation is one ground application of metam sodium per acre and one ground application of 1,3-dichloropropene on 50% of the acre.
4. Detailed information on machinery costs, such as maintenance, interest costs, and depreciation, are not listed in these budgets. The costs of various field activities (planting, chemical application, irrigation, and harvest) are based on purchased custom services. These services include the materials and labor for each activity, and the prices are assumed to reflect depreciation, maintenance, and interest costs.
5. The rental rate of irrigated cropland is $850 per acre. This rental agreement assumes the landowner furnishes the center pivot irrigation system and the grower pays the water and power charge. The rental rate also includes property taxes and insurance.
6. Annual payable yield is estimated to be 31.5 tons per acre for processing potatoes and 30.5 tons per acre for fresh potatoes. Payable yield is measured by subtracting dirt, rot, foreign material, and storage shrinkage from the harvested yield.
7. The price of potatoes represents the annual payable value. This enterprise budget accounts for potatoes that are stored until delivery in April. Thus, the estimated price of potato is also tied to the April delivery out of the grower's storage.
8. The management charge is $175 per acre. This value covers the annual salary, benefits, social security, etc. for management and administration personnel as well as overhead that includes office supplies, professional services, and other business expenses (insurance, etc.).
9. Interest on investment is 5%.

More information about soil fumigation in the Pacific Northwest, including timing of application and the efficacy of products, can be found in Murray et al. (2020). Potato growers should follow the product label directions when applying products to manage diseases, weeds, nematodes, and insects in the soil. The product application rates vary by grower and other factors, such as crop history, nematode count, and adjacent properties.

Summary of Results

Costs of production are broken down into variable and fixed costs. The variable costs reflect costs that are incurred when production takes place in a given year. They are categorized into soil preparation and planting, chemical and fertilizer application, irrigation, harvest, storage, and other variable costs.

Other variable costs include the interest expense incurred for a short-term operating loan or the opportunity cost of using cash from the enterprise to pay for production costs prior to selling the crop.

Fixed costs represent the costs that are incurred by the grower whether or not they decide to produce in a given year. Fixed costs include management, administration and overhead costs, fees associated with regulation compliance, and the rental rate of cropland. While fixed costs cannot be avoided within a production year, they can be avoided in the long run, if the grower decides to end the potato enterprise.

The estimated annual costs and returns for Russet Burbank potatoes, grown for the processing market, are shown in Table 1; for Russet Norkotah potatoes grown for the fresh market, these figures are given in Table 2. Based on the assumptions used, the estimated full production cost is $5,577 per acre for Russet Burbank potatoes and $5,590 per acre for Russet Norkotah potatoes. The fixed costs associated with the production of the two potato varieties are the same. The differences are in the variable costs, in particular: (1) there is more seed purchased for producing Russet Norkotah than Russet Burbank and (2) the harvest costs are slightly higher for Russet Burbank due to its slightly higher yield compared to Russet Norkotah.

Annual yield and price received are two key factors affecting the net return to growers. To illustrate their effects on the profitability of producing potatoes, three break-even price levels have been estimated for different levels of cost recovery. Refer to Table 3 and Table 4.

The first break-even price is the amount required to cover total variable costs. If the break-even price is greater than the actual price received, it will not be economical to produce potatoes, even in the short run. The second break-even price is the amount necessary to cover total cash costs, assuming no outstanding loans or land rent. This amount may be viewed as what is needed to remain financially viable in the short run.

The third break-even price is the total cost break-even price. Failure to reach this break-even price level means that the grower will not earn a return on capital and management contributions equal to what could be earned in an alternative investment. Receiving anything above this price means that the grower will make a profit, which is a dollar return over and above all costs (i.e., variable and fixed costs) associated with potato production, including the opportunity cost of investments on land and management.

Realizing a profit means that, in addition to covering all cash and opportunity costs, the grower will receive a return on the opportunity cost of management and on the financial risk assumed in producing potatoes. For Russet Burbank potatoes, this break-even price is about $177 per ton, and for Russet Norkotah potatoes, it is about $183 per ton.

Some potato producers reviewing these budgets may find that their own costs are lower than those presented in the tables. Furthermore, others outside the industry may question the cost estimates and break-even prices, stating "If the break-even price is more than the market price then the producers are operating at a loss. How do they stay in business?" To address these concerns and questions, one must understand that the enterprise budget is an "economic" budget, which means that it takes into account both cash and opportunity costs.

Opportunity cost is taken into account in the enterprise budgets. It is defined as revenue lost by not investing in the next best alternative. It is also typically associated with resources that an individual or business owns, for instance, capital, land, and labor. For example, if a producer invests $50,000 of equity capital in equipment, the producer gives up the alternative of investing this money in the stock market or paying off an outstanding loan. Thus, if the producer is to realize an "economic" profit, the equipment investment must realize a return greater than that associated with the next best alternative. If the next best alternative happens to be paying off an outstanding loan that carries 5% annual interest, economic profits are not realized until a net return greater than $2,500 is realized by the equipment investment.

The same is true for owner-operator's labor, management, and owned land. In calculating labor and management costs, they are valued at their opportunity cost of being hired out to a neighboring farm, or the dollar amount it would cost to hire someone else to do the labor and management being furnished by the producer.

For land owned, the opportunity cost included in the potato budgets represents the rental rate the producer could rent the land for if the land is not used by the producer.

In addition to the break-even prices, Table 5 and Table 6 show the per-acre profits that would be expected from different scenarios of yields and prices received for Russet Burbank and Russet Norkotah potatoes, respectively. These estimates show the sensitivity of profits to potato yield and price, while holding all else constant. Starting with the baseline prices (i.e., $175/ton for Russet Burbank and $180/ton for Russet Norkotah), scales of $160/ton to $210/ton in $5/ton increments are chosen as reference points for growers to determine profit/loss. In addition, for this analysis, the net yields of 30–37.5 ton/acre for Russet Burbank and 29–36.5 ton/acre for Russet Norkotah in 0.5 ton/acre increments are considered.

Given the study's production and cost assumptions, at $175/ton for Russet Burbank, a positive return would be realized if the net yield is 33 ton/acre or above. At $185/ton or higher, any yield combination would result in a positive return for the grower (Table 5). For Russet Norkotah, at $180/ton, positive returns would be received if the net yield is 32 ton/acre or above. At $195/ton or higher, positive returns are possible at any of the net yields in the given range (Table 6).

Excel Workbook

Detailed Excel workbooks for these enterprise budgets are available at the WSU School of Economic Sciences—Crop Enterprise Budgets website. The workbooks allow growers to modify select values to evaluate their own production costs and returns.

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Table 1. Costs and returns per acre of producing potatoes for processing (Russet Burbank).

	Unit	Price/unit	Quantity	Total	Note
TOTAL RETURNS					
Estimated Production	ton	$175.00	31.5	$5,512.50	Price represents payable value. Price is also based on delivery in April out of storage hitting storage incentives for bruise free, size, and specific gravities with no other quality or condition issues. Yield estimate excludes dirt, rot, foreign material, and storage shrinkage.
Variable Costs	**Unit**	**Cost/unit**	**Quantity**	**Total**	**Note**
Soil Preparation & Planting					
Tillage[a]	acre	$100.00	1	$100.00	Includes machinery and labor costs.
Planting	acre	$110.00	1	$110.00	Includes machinery and labor costs.
Seed[b]	cwt	$20.00	25	$500.00	This includes cutting, treatment, labor, and transportation from a 500 mile radius.
Chemicals & Fertilizer					
Fertilizer	acre	$850.00	1	$850.00	Includes material and application.
Fumigation[c]	acre	$380.00	1	$380.00	Includes material and application.
Fungicide & Insecticide[d]	acre	$420.00	1	$420.00	Includes material and application.
Herbicide[e]	acre	$77.00	1	$77.00	Includes material and application.
Irrigation	acre			$245.00	Includes water and power, repairs for center pivot, and irrigation labor.
Harvest	acre			$1,551.75	Includes digging, hauling, cleaning and piling, and storage.
Other Variable Costs				$241.09	Includes crop monitoring and interest on operating capital.
Total Variable Costs	**acre**			**$4,474.84**	
Total Fixed Costs	**acre**			**$1,102.50**	Includes management, administration and overhead, regulatory compliance, land rent, and interest on fixed cost.
TOTAL COSTS	**acre**			**$5,577.34**	
ESTIMATED NET RETURNS	**acre**			**-$64.84**	

Note: Detailed Excel workbooks for these enterprise budgets are available at the WSU School of Economic Sciences—Crop Enterprise Budgets website.

[a] Tillage does not include fumigation.

[b] Untreated seed.

[c] Fumigation refers to one ground application of metam sodium and one ground application of 1,3-dichloropropene on 50% of the acre.

[d] Fungicide includes fungicide seed treatment.

[e] Herbicide includes defoliation.

Table 2. Costs and returns per acre of producing potatoes for the fresh market (Russet Norkotah).

	Unit	Price/unit	Quantity	Total	
TOTAL RETURNS					
Estimated Production	ton	$180.00	30.5	$5,490.00	Price represents payable value. Price is also based on delivery in April out of storage hitting storage incentives for bruise free, size, and specific gravities with no other quality or condition issues. Yield estimate excludes dirt, rot, foreign material, and storage shrinkage.
Variable Costs	**Unit**	**Cost/unit**	**Quantity**	**Total**	**Note**
Soil Preparation & Planting					
Tillage[a]	acre	$100.00	1	$100.00	Includes machinery and labor costs.
Planting	acre	$110.00	1	$110.00	Includes machinery and labor costs.
Seed[b]	bag	$20.00	28	$560.00	Seed cost assumes 28 sacks per acre and includes fees for cutting, FOB from Montana, brokerage, and delivery to field.
Chemicals & Fertilizer					
Fertilizer	acre	$850.00	1	$850.00	Includes material and application.
Fumigation[c]	acre	$380.00	1	$380.00	Includes material and application.
Fungicide & Insecticide[d]	acre	$420.00	1	$420.00	Includes material and application.
Herbicide[e]	acre	$77.00	1	$77.00	Includes material and application.
Irrigation				$245.00	Includes water and power, repairs for center pivot, and irrigation labor.
Harvest				$1,504.00	Includes digging, hauling, cleaning and piling, and storage.
Other Variable Costs				$241.70	Includes crop monitoring and interest on operating capital.
Total Variable Costs	**acre**			**$4,487.70**	
Total Fixed Costs	**acre**			**$1,102.50**	Includes management, administration and overhead, regulatory compliance, land rent, and interest on fixed cost.
TOTAL COSTS	**acre**			**$5,590.20**	
ESTIMATED NET RETURNS	**acre**			**-$100.20**	

Note: Detailed Excel workbooks for these enterprise budgets are available at the WSU School of Economic Sciences—Crop Enterprise Budgets website.

[a] Tillage does not include fumigation.

[b] Untreated seed.

[c] Fumigation refers to one ground application of metam sodium and one ground application of 1,3-dichloropropene on 50% of the acre.

[d] Fungicide includes fungicide seed treatment.

[e] Herbicide includes defoliation.

Table 3. Break-even price per ton of processing potatoes (Russet Burbank) for different levels of enterprise costs.

	Cost ($/acre)	Break-even Price ($/ton)[a]
1. Total Variable Costs	$4,475	$142[b]
2. Total Cash Costs = Total Variable Costs + Regulatory Compliance + Land Rent	$5,350	$170[c]
3. Total Cost = Total Cash Costs + Interest on Fixed Costs + Management Cost	$5,577	$177[d]
Yield (ton/acre)	31.5	
Price ($/ton)	$175.00	

[a] Break-even price is calculated as cost divided by yield of Russet Burbank potatoes.
[b] If the price is below this level, Russet Burbank potatoes are uneconomical to produce.
[c] This amount is needed to remain financially viable in the short run.
[d] The third 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 and opportunity costs.

Table 4. Break-even price per ton of fresh market potatoes (Russet Norkotah) for different levels of enterprise costs.

	Cost ($/acre)	Break-even Price ($/ton)[a]
1. Total Variable Costs	$4,488	$147[b]
2. Total Cash Costs = Total Variable Costs + Regulatory Compliance + Land Rent	$5,538	$182[c]
3. Total Cost = Total Cash Costs + Interest on Fixed Costs + Management Cost	$5,590	$183[d]
Yield (ton/acre)	30.5	
Price ($/ton)	$180.00	

[a] Break-even price is calculated as cost divided by yield of Russet Norkotah potatoes.
[b] If the price is below this level, Russet Norkotah potatoes are uneconomical to produce.
[c] This amount is needed to remain financially viable in the short run.
[c] The third 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 and opportunity costs.

Table 5. Estimated net returns per acre for processing potatoes (Russet Burbank).

Yield (ton/acre)[a]	Price ($/ton)										
	$160	**$165**	**$170**	**$175**	**$180**	**$185**	**$190**	**$195**	**$200**	**$205**	**$210**
30.0	-$702	-$552	-$402	-$252	-$102	$48	$198	$348	$498	$648	$798
31.5	-$537	-$380	-$222	-$65	$93	$250	$408	$565	$723	$880	$1,038
33.0	-$373	-$208	-$43	$122	$287	$452	$617	$782	$947	$1,112	$1,277
34.5	-$208	-$35	$137	$310	$482	$655	$827	$1,000	$1,172	$1,345	$1,517
36.0	-$43	$137	$317	$497	$677	$857	$1,037	$1,217	$1,397	$1,577	$1,757
37.5	$122	$309	$497	$684	$872	$1,059	$1,247	$1,434	$1,622	$1,809	$1,997

Note: Shaded area denotes a positive profit based on the combination of yield and price.
[a] Yield estimate excludes dirt, rot, foreign material, and storage shrinkage.

Table 6. Estimated net returns per acre for fresh market potatoes (Russet Norkotah).

Yield (ton/acre)[a]	Price ($/ton)										
	$160	**$165**	**$170**	**$175**	**$180**	**$185**	**$190**	**$195**	**$200**	**$205**	**$210**
29.0	-$875	-$730	-$585	-$440	-$295	-$150	-$5	$140	$285	$430	$575
30.5	-$710	-$558	-$405	-$253	-$100	$52	$205	$357	$510	$662	$815
32.0	-$545	-$385	-$225	-$65	$95	$255	$415	$575	$735	$895	$1,055
33.5	-$381	-$213	-$46	$122	$289	$457	$624	$792	$959	$1,127	$1,294
35.0	-$216	-$41	$134	$309	$484	$659	$834	$1,009	$1,184	$1,359	$1,534
36.5	-$51	$131	$314	$496	$679	$861	$1,044	$1,226	$1,409	$1,591	$1,774

Note: Shaded area denotes a positive profit based on the combination of yield and price.
[a] Yield estimate excludes dirt, rot, foreign material, and storage shrinkage.

References

Murray, K., P.C. Jepson, and A. Jensen. 2020. Integrated Pest Management for Potatoes in Oregon, Washington, and Idaho. *Oregon State University Extension Service Publication* EM 9275. Oregon State University.

USDA NASS (National Agricultural Statistics Service). 2018. Press Release on Potato Production in the Pacific Northwest.

———. 2019. Quick Stats Lite.

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