Costs and Returns for Irrigated Organic Russet Burbank Potato Production in Southern Idaho

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Organic farming has experienced unprecedented growth since the U.S. Department of Agriculture (USDA) introduced national organic standards in 1992, rising from 403,400 to 2,655,382 acres nationally from 1992 to 2008, with an average growth rate of 13 percent per year (USDA-ERS). Fresh produce is the top-selling category in retail sales, and potatoes rank seventh within that category (Oberholtzer et al., 2005; *The Packer*, 2002).

The relatively steady growth in demand for organic food has increased grower interest in organic production. This publication presents two enterprise budgets for organic potato production in southwest and southcentral Idaho.

Shorter, drier seasons and cold winters tend to reduce pest and disease problems, making organic production easier. Thus, Idaho with its high desert climate has great potential for leadership in organic potato production. In 2008, Idaho ranked fifth in the country, behind California, Colorado, Washington, and Oregon, for total organic potato acreage (USDA-NASS).

Price premiums for organic products, reflecting increased consumer demand, have contributed to the growth in organic production. However, price premiums often are volatile, mainly due to supply and demand fluctuation in this relatively small market. For example, in 2008, organic potatoes were produced on nearly 1,200 acres in Idaho, but that fell to just over 500 acres in 2009 due to weakening demand for organic products in the economic recession and to lack of profitability (Figure 1).

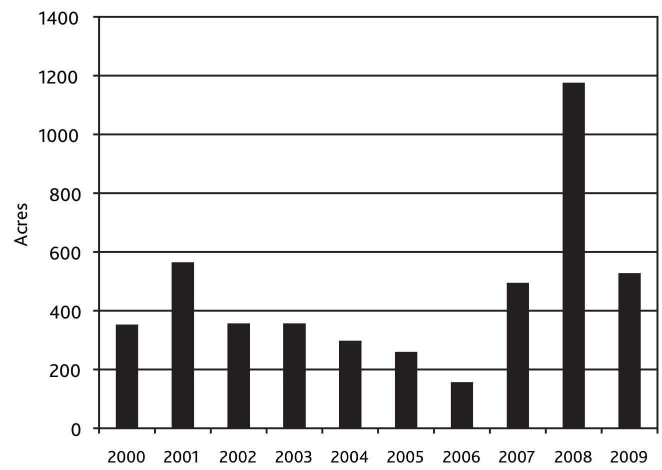
Price premiums help compensate for decreased net revenue due to pest issues, lower yields, and certification costs associated with organic production. Certification costs include an annual fee for inspection and certification. Also, for farmers who are converting land from conventional to organic production, another certification "cost" is the price premiums they forgo during the required 3-year transition period in which they must follow organic practices yet cannot market the crop as organic.

Producing certified organic potatoes requires learning organic production practices and a systems-based approach as well as access to organically certified land. Organic production can be quite profitable when organic price premiums are high. Growers need to be able to secure solid contracts for their organic products, because when organic supply is greater than demand, growers may need to sell organic produce in the conventional marketplace, without any premiums. Eastern Idaho potato growers who recently were certified organic reported that they were able to sell only about 40 percent of their production as organic, with the rest (oversized and off-grade) selling as organic animal feed or going into conventional markets (Esplin, 2009). Ideally, a higher percentage of the crop would be marketed as organic; for example, if demand were sufficient for the larger potatoes that make up the food-service carton market or if enough organic potatoes were available to make production of frozen or dehydrated product feasible.

ASSUMPTIONS

This study compares economic costs and returns for producing organic potatoes on farms of two sizes. The smaller is a 300- to 450-acre organic farm that leases a solid-set irrigation system for potato production. Potatoes are raised on 30 to 50 acres in any one year, depending on profitability. The larger farm is approximately 800 to 1,000 acres, with organic potatoes raised on approximately 100 acres. Both systems

Figure 1. Organic Potato Acreage in Idaho, 2000–2009



rotate potato production, with a minimum of 4 years between plantings.

Grower interviews provided detailed data on production practices for organic potatoes in southwest and southcentral Idaho. Costs of production were based on 2009 values (Patterson and Painter, 2009). For a fairer comparison, we assume the larger farm also rents a solid-set irrigation system, although a larger grower may be more likely to use a center pivot for irrigation. Both fixed and variable costs are significantly different for land with a center-pivot irrigation system, as opposed to cement ditches and gated pipe, which necessitates rental of solid sets as well as a pump mainline system for potato production.

Typically, the smaller farm sells all its produce as organic, but the larger farm does not—clearly a problem for the latter grower (Esplin, 2009). For example, let us assume a yield of 375 cwt per acre and a price of $7.84 per cwt for both growers, with all production sold as organic (columns 1 and 2 in Table 1). This price includes a 12-percent organic premium over an average conventional fresh market price of $7.00 per cwt, based on the 3-year average fresh market price for 2007–2009 (USDA-AMS). With equivalent revenue for both farms, the large farm has per-acre net returns to risk that are about 12 percent higher than the small farm at $1,148 per acre, compared to $1,026 per acre for the small farm (Table 1). In the second example (column 3 in Table 1), only 40 percent of the large farm's production is sold as organic and 60 percent as conventional, causing net returns to fall to $961 per acre, about 6 percent lower than net returns for the small farm. Of course, lack of organic premiums could occur just as easily on the small farm; these examples simply illustrate the importance of receiving an organic premium on a high percentage of your production.

While both yield and price values undoubtedly would vary from farm to farm (and from year to year), in this study we focus mainly on cost differences between these two systems. Variable machinery costs such as fuel, labor, and repairs are higher on the smaller farm, which we assume uses older, less efficient machinery. Accordingly, fixed machinery costs are about 32 percent lower on the smaller farm, at $73 per acre compared to $108 per acre on the larger farm (Table 1). Fixed costs are highly variable among farms, depending on farm size and on base assumptions for the machinery complement. If the smaller farm purchased newer equipment, fixed costs would be higher but variable costs would fall. These all are important considerations to the grower contemplating organic production.

Table 1. Comparison of Production Costs and Net Returns ($/acre) for Organic Russet Burbank Potato Production, by Farm Size* and Percent Organic Premium Received**

	(1) Small farm, 100% organic premiums	(2) Large farm, 100% organic premiums	(3) Large farm, 40% organic premiums
Revenue (yield x price)	**2,940**	**2,940**	**2,753****
Yield (cwt/acre)	375	375	375
Price ($/cwt)	7.84	7.84	7.34
Variable machinery costs			
Fuel, at $2.65/gal	61	52	52
Lubricants	8	7	7
Machine labor, at $15.80/hr	102	46	46
Repairs	90	44	44
Total variable machinery costs	**261**	**149**	**149**
Variable production costs			
Seed	383	383	383
Fertilizer	147	139	139
Pesticides	96	96	96
Custom & consultants	58	28	28
Irrigation	363	363	363
Other	284	276	276
Total variable production costs	**1,591**	**1,434**	**1,434**
NET RETURNS OVER VARIABLE COSTS	**1,349**	**1,506**	**1,318**
Fixed production costs			
Fixed machinery costs (depreciation, interest, housing, insurance)	73	108	108
Land rent	250	250	250
Total fixed production costs	**323**	**358**	**358**
TOTAL PRODUCTION COSTS	**1,914**	**1,792**	**1,792**
NET RETURNS TO RISK	**1,026**	**1,148**	**961**

* The small farm assumes a 30- to 50-acre potato field; the larger farm assumes a 100- to 120-acre potato field. Both are irrigated using solid-set handlines.

** An organic premium is received on just 40% of the larger farm's production in this example, thus reducing the average price received by approximately 6.4%. The organic price of $7.84/cwt is about 12% higher than the conventional price assumption of $7.00/cwt.

Rotations

Crop rotation is integral to success in organic production. Growers need to take into account how well this crop fits within the entire production cycle. To accumulate sufficient nutrients for a successful potato crop, an alfalfa or hay stand of 2 to 5 years typically precedes organic potato production. Potato production usually is followed by a grain crop (e.g., wheat, barley, or oats). The shortest rotation is 2 years of alfalfa followed by potatoes and a grain crop. Crop choice varies considerably based on organic premiums. A typical rotation is a 7-year cycle: 3 years in alfalfa; 1 year in potatoes, beans, or corn; 1 year in a grain crop, often with a cover crop planted in the grain stubble after harvest; 1 year in a row crop; and the seventh year in another grain crop that also serves to establish alfalfa, which is planted with the grain. Another common rotation is an alfalfa–grass hay mix for 4 or 5 years instead of the 3 years of alfalfa, stretching the rotation out to 8 or 9 years.

Fertility

In addition to the nutrients supplied by the previous years of alfalfa or grass hay production, organic potato production relies on compost to supply sufficient nutrients, especially phosphorus and potassium. The smaller organic farmer applies 3 to 5 tons of compost to each acre every year. The larger organic grower interviewed for this study actually beds compost directly under the potato row using a potato planter, burying it 4 inches below the seed and using about 1.5 tons of compost per acre. However, for this analysis we assume both farmers use a more typical fertility regime, with a custom application of 4 tons of compost per acre (see Table 2, page 7, and Table 6, page 11). The large dairy industry in this region is an excellent source of local compost which typically costs about $20 per ton, including delivery and field application.

In addition to compost, both farms use a liquid fish fertilizer from a large local fish farm. This product costs $1.85 per gallon plus delivery. Its nutrient composition is 2-2-0, or 2 percent (by weight) of both nitrogen and phosphorus. In addition, some growers add 3 gallons per acre of humic acid, at $2.25 per gallon. Liquid fish fertilizer typically is applied multiple times through the irrigation system, totaling about 30 gallons per acre per year.

Cover crops are used to supply nutrients in organic systems in many areas of the country. However, this region's short growing seasons can limit the potential contribution of a cover crop. Growers state that they would like to add a fall-planted cover crop to the potato rotation, but these stands tend to be inconsistent in a short-season climate and do not always supply sufficient nutrients to justify planting expense. If a grain crop is harvested fairly early, a cover crop such as Austrian winter peas may be planted.

Pest control

Few pesticides have organic approval. Spinosad (Entrust 80W Naturalyte) is the only pesticide used by both the smaller and larger organic potato growers. It is used to control Colorado potato beetle (*Leptinotarsa decemlineata*). The foliar spray is applied at 1.5 to 3 ounces per acre and costs $32 per ounce (see Table 3, page 8, and Table 7, page 12). The small-farm growers using the lower rate repeat the application in about 10 days and believe this two-stage application system provides better protection. Application costs tend to be considerably higher for small fields, averaging $19 per acre for the small farm compared to $7.50 per acre for the larger farm. Aerial applicators may have minimum charges, which will greatly increase per-acre costs for small growers. One grower tried to avoid using spinosad by instead spraying field borders with pyrethrums.

For detailed pest management strategies for organic potato production, see "Pest Management Strategic Plan for Organic Potato Production in the West," available at
http://www.ipmcenters.org/pmsp/pdf/CA-CO-ID-OR-WAOrganicPotatoPMSP.pdf

Weed control

Mechanical cultivation is the main weed control method for organic potato production. The smaller organic farm uses an 18-foot harrow for the first cultivation, a Lilleston rolling cultivator for the second and third cultivations, and a basin tillage tool, e.g., a

Dammer Diker, for the fourth cultivation (see Table 2, page 7). The larger organic farm (see Table 6, page 11) uses a 6-row cultivator and a harrow with 16-inch straight tines for the first cultivation, then cultivates two more times without the harrow on the cultivator. The fourth cultivation is with a basin tillage tool such as a Dammer Diker. Cultivation is in spring, usually April and May.

Budgets for both farms include a $50 per-acre charge for handweeding, but this cost will vary from year to year depending on weed pressure. No other tillage operations occur until defoliation in September. Potatoes are defoliated using a flail chopper on the smaller farm or a stubble shredder on the larger farm.

Machinery costs

The smaller organic farm uses older, less expensive equipment than the larger organic farm and replaces it less frequently (see Table 4, page 9, and Table 8, page 13). Older machinery typically is narrower, resulting in slower operations that require more labor. Thus, machine hours are more than twice as high for the smaller farm: 6.4 hours per acre compared to 2.9 hours per acre for the larger farm (Table 3, page 8, and Table 7, page 12). The smaller farm uses 17 percent more fuel: 23 gallons per acre compared to 19.7 gallons per acre for the larger farm. Total variable machinery costs (those costs that vary with production level) were 75 percent higher for the small farm, at $261 per acre compared to $149 per acre for the larger farm (Table 1, page 3). However, due to the larger amount of money invested in machinery, machinery ownership costs (also called fixed costs) are almost 48 percent higher for the larger farm, at $108 per acre compared to $73 per acre for the smaller farm (Table 1).

No costs are included for operations beyond the field, including any type of transloading such as transferring potatoes to semi-trailers for hauling to storage or processing. These costs may vary considerably by organic operation. Potato budgets developed for commercial growers in Idaho allow $0.10 per cwt in 2009 for transloading operations (Patterson, 2009). Commercial potato budgets are not directly comparable to these organic budgets due to widely differing assumptions underlying the calculations.

Newer potato-production machinery is expensive, thus hard to justify unless the farm is sufficiently large. Center pivots are another large investment and may not be cost-effective for small or irregularly shaped fields. Small producers may need to use small, older, more labor-intensive machinery; though it is slower and more prone to breakdowns, it is readily available and not expensive (but repair costs will be higher).

Land rent

Land rent reflects ownership costs for the irrigation system, whether it consists of concrete ditches, gated pipe, or sprinkler irrigation. In this comparison, we assume equal land rent of $250 per acre, and both farms rent solid-set pipe systems for another $250 per acre. If these systems had different irrigation systems, such as a center pivot, comparison between systems would be difficult.

TRANSITIONING TO ORGANIC PRODUCTION

Growers transitioning from conventional to organic production could grow alfalfa for 2 years and produce certifiable organic potatoes in the third year if no chemicals except those approved for organic production were used after May of the first year. Alfalfa production for the first 2 years must use approved organic methods but cannot be sold as organic alfalfa, due to the required 3-year transition period. Since organic standards require that any machinery used in conventional production be thoroughly cleaned before switching to organic production, growers must either have dedicated organic equipment or clean it as required by the standards before using it for organic potatoes.

Crops grown during the transitional period can sometimes be marketed as such for a premium. For example, horse owners may want hay that has not been sprayed but may not care that it's not certified organic. Hay is an economical crop choice for the transitional period. Multiple hay cuttings will help control weeds, and inputs are minimal, particularly after establishment. If the crop is established before the transitional period begins, chemical weed control can be used to help create a good stand of hay that competes well with weeds.

Potato variety selection

Potato variety selection will depend on the target market. Red-, yellow-, and blue-skinned varieties may be suited for specialty fresh markets; russet varieties often are best suited for both fresh and process markets. It is important to know the strengths and weaknesses of each variety and to select varieties with the desired yield, storage, and market quality.

RESULTS

Net returns over total production costs were 12 percent higher for the larger organic farm, at $1,148 per acre for the larger organic farm compared to $1,026 per acre for the smaller organic farm, assuming identical crop yields and prices (columns 1 and 2 in Table 1). In reality, yields and prices would no doubt differ, as organic farmers often produce special varieties and use retail or direct marketing outlets with differing prices.

Growers in eastern Idaho with larger acreage report that they receive organic premiums on only about 40 percent of their production (Esplin, 2009). Surveyed growers for the smaller organic farms used either direct marketing or organic contracts and received organic premiums for all their production. If the larger organic farm receives an organic premium for only 40 percent of its production, net returns are 6 percent lower than the smaller farm's, at $961 per acre for the larger farm compared to $1,026 per acre for the smaller farm (column 3 in Table 1, page 3).

Both variable machinery costs and total variable production costs were higher for the smaller farm, but fixed (or ownership) costs were lower. Variable machinery costs, which include fuel, lubrication, machinery labor, and repairs, are 75 percent higher for the smaller farm, at $261 per acre compared to $149 per acre for the larger farm (Table 1). The smaller farm uses less expensive, older equipment and more labor, basically trading capital for labor costs. The larger farm can justify using newer, more expensive, and more efficient equipment, lowering labor costs but increasing capital costs. Fixed production costs include machinery depreciation, interest, housing, and insurance, as well as land rent. Fixed machinery costs were 48 percent higher for the large farm, at $108 per acre compared to $73 per acre for the small farm (Table 1). Land rent, which includes ownership costs of the irrigation system, was assumed to be identical for both farms at $250 per acre. For the sake of comparison, both farms were assumed to rent solid-set handlines. In reality, the interviewed grower on the larger farm has a center-pivot irrigation system in place. This reduces labor and eliminates handline rental—both of which are variable costs—and increases fixed costs due to the expense of the irrigation system.

In general, producing organic potatoes on a smaller scale is more costly. Variable production costs were 11 percent higher for the small farm at $1,591 per acre compared to $1,434 per acre for the large farm. Machine labor costs are more than twice as expensive on the smaller farm, averaging $102 per acre compared to $46 per acre, assuming labor is paid $15.80 per hour (see Table 1, page 3). Fuel costs were 17 percent higher for the small farm ($61 per acre versus $52) due to the increased time required for smaller equipment. These costs will vary depending on the fuel efficiency for either system. The larger farm typically used wider equipment; e.g., a 6-row system compared to a 4- or 2-row system on the smaller farm (see Tables 4, 5, 8, and 9, pages 9, 10, 13, and 14).

Farmers with small fields pay more per acre for custom aerial application due to minimum job charges. Per-acre aerial application costs were about 2.5 times higher for the smaller farm (Table 3, page 8, and Table 7, page 12).

SUMMARY

Producing organic potatoes requires an organic production system, using a relatively long crop rotation to minimize pest problems while maintaining fertility requirements. This report analyzes organic potato production for different farm sizes: a relatively small producer, with 30 to 50 acres in potatoes, and a larger producer, with about 100 to 120 acres in potatoes.

Under the specific assumptions of this analysis, organic potato production is profitable for both sizes of organic farms, with net returns to risk averaging approximately $1,000 per acre for the scenarios in

Table 1 (page 3). The smaller farm had higher operating costs due to smaller, less efficient machinery and higher charges for custom operations such as aerial pesticide application. The larger farm uses more expensive machinery, which reduces labor expense by about half but increases capital costs relative to the small farm. The smaller farm substitutes labor for capital, as labor-saving newer machinery is not cost-effective at this scale. Fuel expenses are only about 17 percent higher on the smaller farm, even though machine hours for potato production are more than double the hours on the large farm, because the small farm's lower horsepower machinery pulling smaller equipment uses less fuel per hour.

This study makes a simplifying assumption of equivalent yields and prices for the small and large organic farms. Prices will vary considerably by year, by contracts, and by type of marketing, such as farmer markets versus wholesale. These two enterprise budgets use slightly different regimens for fertility and pesticide application. Organic growers will have their own sets of individual practices, given their particular challenges and resources. These two examples provide a useful comparison of a smaller commercial grower, with a farm size of 300 to 450 acres, and a larger grower with 100 to 120 acres in organic potato production and a farm size of approximately 800 to 1,000 acres. Organic potato production averages about 1 in 8 years for both farm sizes with these assumptions.

The Idaho organic grower faces particular challenges and advantages due to a short growing season in some areas of the state. Fall cover crops, which organic growers often use to supply additional nitrogen, tend to be inconsistent in this region, and frequently do not supply sufficient nutrients to justify planting expenses. However, cooler, shorter growing seasons reduce pest problems, for which organic growers have few resources. Idaho has a reputation for quality potatoes, which could be extended to include quality organic potatoes. Profit margins for organic potatoes have the potential to exceed those for conventional potatoes, particularly if current marketing challenges could be addressed.

Table 2. Schedule of Operations for Producing Organic Russet Burbank Potatoes Following Alfalfa (Small Farm)

Month	Operation	Tooling	Materials/service
Seasonal	Fertilize	Custom applied	4 tons/acre compost
Seasonal	Irrigate	Move pipe 6–7 times (rented solid-set handlines)	
Spring	Disc	150HP-WT, 12-ft disc	
Spring	Plow	150HP-WT, 4-bottom plow/packer	
Spring	Mark out	150HP-WT, 12-ft bedder	
Spring	Plant	150HP-WT, planter and shank in 1 gal/acre humic acid	
Spring	Cultivate	150HP-WT, 18-ft harrow	
Spring	Cultivate	150HP-WT, 12-ft Lilleston rolling cultivator	
Spring	Cultivate	150HP-WT, 12-ft Lilleston rolling cultivator	
Spring	Dammer Diker	150HP-WT, 4-row Dammer Diker	
Summer	Fertilize	Applied through irrigation system	10 gal/acre liquid fish and 1 gal/acre humic acid
Summer	Spray pesticide	Custom aerial	1.5 oz/acre spinosad (Entrust)
Summer	Spray pesticide	Custom aerial	1.5 oz/acre spinosad (Entrust)
Summer	Weeding	Occasional handweeding	
Fall	Defoliate	150HP-WT, 12-ft flail chopper	
Fall	Harvest	120HP-WT, 2-row side digger/windrower	
Fall	Harvest	150HP-WT, 2-row harvester	

Table 3. Production Costs ($/acre) for Organic Russet Burbank Potatoes Under Solid-set Irrigation (Small Farm)

Item	Qty/acre	Unit	Price or cost/unit ($)	Subtotal by cost type ($)	Value or cost/acre ($)
GROSS RETURNS					
Potatoes, Russet Burbank	375	cwt	7.84		2,940.00
VARIABLE COSTS					
Seed				**382.5**	
Russet Burbank potato seed	22.5	cwt	15		337.5
Cut and treat with fir bark	22.5	cwt	2		45
Fertilizer				**146.75**	
Compost	4	ton	20		80
Humic acid	3	gal	2.25		6.75
Liquid fish	30	gal	2		60
Pesticides				**96**	
Spinosad (Entrust)	3	oz	32		96
Custom and consultants				**58**	
Aerial application	2	acre	19		38
Consultant/soil testing	1	acre	20		20
Irrigation				**363**	
Solid set rental	1	acre	250		250
Irrigation repair	1	acre	15		15
Irrigation water	1	acre	43		43
Irrigation power	1	acre	55		55
Machinery				**159.11**	
Fuel	23	gal	2.65		61.03
Lubricants	1	acre	8.13		8.13
Machinery repairs	1	acre	89.95		89.95
Labor				**178.68**	
Irrigation labor (solid sets)	2.4	hr	11.25		27
Handweeding	1	acre	50		50
Machinery labor*	6.44	hr	15.8		101.68
Other				**152.45**	
Crop insurance (multiperil)	1	acre	30		30
Overhead	1	acre	70.7		70.7
Fees and assessments	1	acre			51.75
Operating interest					54.97
Total variable costs					**1,591.46**
Variable costs/unit					**4.24**
NET RETURNS ABOVE VARIABLE COSTS					**1,348.54**
FIXED COSTS					
Machinery depreciation	1	acre	30		30
Machinery interest	1	acre	29.15		29.15
Machinery insurance, housing, licenses	1	acre	13.82		13.82
Land rent	1	acre	250		250
Total fixed costs					**322.97**
Fixed costs/unit					**0.86**
TOTAL COSTS/ACRE					**1,914.43**
TOTAL COST/UNIT					**5.11**
RETURNS TO RISK					**1,025.57**

*Labor cost includes a base wage plus 30% for taxes and benefits.

Table 4. Machinery Complement for Organic Russet Burbank Potato Production (Small Farm)

Type of machine	Replace. value ($)	Age at purchase (yr)	Years of life	Use (hr/yr)	Salvage value ($)	Repairs: materials & labor ($/yr)	Fuel (gal/hr)	Taxes, housing, ins., licenses ($)	Labor multiplier	Acres/hr
Tractors, ATVs										
120HP-WT	10,000	15	25	150	2,500	1,000	1.2	1.2	1.1	
150HP-WT	35,000	12	25	350	4,000	2,000	6.5	1.2	1.1	
4WD-ATV	7,320	0	15	100	1,000	750	12	6.8	1.2	
Equipment										
12-ft disc	2,000	15	25	150	100	300	6.5	0.6	1.1	7
4-bottom plow + packer	6,500	15	25	150	750	500	7.5	0.6	1.1	4
12-ft bedder	3,500	15	25	150	500	500	7	0.6	1.1	7
4-row potato planter	8,000	15	25	20	200	3,000	7	3	1.2	5
18-ft harrow	2,000	15	25	150	100	500	6.5	0.6	1.1	10.5
12-ft Lilleston rolling cultivator	2,500	15	25	150	100	500	6.5	0.6	1.1	5
4-row Dammer Diker	5,000	15	25	50	500	1,000	7	0.6	1.1	6
12-ft flail chopper	4,000	15	25	50	400	750	7	0.6	1.1	8
2-row side digger/windrower	3,000	15	25	40	0	1,000	8	1.7	1.3	3
2-row harvester	5,000	15	25	40	0	1,000	7.5	2	1.3	1
Trucks				**Miles/yr**			**Miles/gal**			
Tandem axle truck	20,000	15	15	1,000	5,000		6	10.1	1.2	
Tandem axle truck	20,000	15	15	1,000	5,000		6	10.1	1.2	
Tandem axle truck	20,000	15	15	1,000	5,000		6	10.1	1.2	
¾-ton pickup	15,000	7	7	12,000	750		12	6.8	1.2	
¾-ton pickup	15,000	7	7	12,000	750		12	6.8	1.2	

Table 5. Machinery Costs ($/acre) for Organic Russet Burbank Potato Production (Small Farm)

	Fixed costs ($/acre)				Variable costs($/acre)						
	Deprec.	**Int.**	**Taxes, housing, ins., & licenses**	**Total fixed costs**	**Repairs**	**Labor**	**Fuel & lube.**	**Total variable costs**	**Labor (hr/acre)**	**Fuel use (gal/acre)**	**Total cost ($/acre)**
Machinery costs for the following implements are spread across every acre of the farm, regardless of crops produced											
ATV	0.84	0.62	0.1	1.56	0.3	3.43	0.76	4.49	0.22	0.32	**6.05**
¾-ton pickup #1	2.47	1.04	0.95	4.46	1.13	0	4.75	5.88	0	2.02	**10.34**
¾-ton pickup #2	1.64	0.69	0.63	2.96	0.75	0	1.59	2.34	0	0.68	**5.3**
Tandem axle truck	2	1.88	2.53	6.41	4	1.87	0.86	6.73	0.12	0.37	**13.14**
Tandem axle truck	2	1.88	2.53	6.41	4	1.87	0.86	6.73	0.12	0.37	**13.14**
Tandem axle truck	2	1.88	2.53	6.41	4	1.87	0.86	6.73	0.12	0.37	**13.14**
Machinery costs for the following implements are specific to the operations for each crop											
150HP-WT + 12-ft disc	0.63	0.68	0.11	1.42	1.11	2.46	2.44	6.01	0.16	1.04	**7.43**
150HP-WT + 4B plow, packer	1.22	1.43	0.19	2.84	2.17	4.11	4.07	10.35	0.26	1.73	**13.19**
150HP-WT + 12-ft bedder	0.6	0.71	0.1	1.41	1.25	2.36	2.34	5.95	0.15	0.99	**7.36**
150HP-WT + 4-row planter	3.68	3.76	1.31	8.75	20.33	3.3	3.27	26.9	0.21	1.39	**35.65**
150HP-WT + 18-ft harrow	0.39	0.45	0.06	0.9	0.87	1.64	1.62	4.13	0.11	0.69	**5.03**
120HP-WT + 12-ft Lilliston harrow	0.53	0.76	0.11	1.4	2.02	3.47	2.75	8.24	0.22	1.17	**9.64**
120HP-WT + 12-ft Lilliston harrow	0.53	0.76	0.11	1.4	2.02	3.47	2.75	8.24	0.22	1.17	**9.64**
150HP-WT + 4-row Dammer Diker	1.23	1.43	0.18	2.84	4.42	2.95	2.92	10.29	0.19	1.24	**13.13**
150HP-WT + 12-ft flail chopper	0.78	0.92	0.22	1.92	2.54	2.11	2.08	6.73	0.14	0.88	**8.65**
120HP-WT + 2-row digger/windrower	1.72	2.05	0.39	4.16	10.88	5.9	4.68	21.46	0.38	1.99	**25.62**
150HP-WT + 2-row harvester	7.74	8.21	1.77	17.72	28.16	59.58	15.59	103.33	3.82	6.63	**121.05**
Total	**30**	**29.15**	**13.82**	**72.97**	**89.95**	**100.39**	**54.19**	**244.53**	**6.44**	**23.03**	**317.5**

Table 6. Schedule of Operations for Producing Organic Russet Burbank Potatoes Following Alfalfa (Large Farm)

Month	Operation	Tooling	Materials/service
Seasonal	Irrigate	Move pipe 6–7 times (rented solid-set handlines)	
Seasonal	Fertilize		Apply 3 gal/acre liquid fish with each irrigation
Spring	Chisel/harrow	160HP-WT,18-ft chisel and harrow	
Spring	Fertilize	Custom applied	Apply 4 tons/acre compost
Spring	Chisel/harrow	160HP-WT,18-ft chisel and harrow	
Spring	Mark out	160HP-WT, 7-shank bed splitter and 18-ft harrow	
Spring	Plant potatoes	160HP-WT, 6-row Harriston pick planter	
Spring	Cultivate	160HP-WT, 6-row cultivator plus 16-inch straight tines	
Spring	Cultivate	160HP-WT, 6-row cultivator	
Spring	Cultivate	160HP-WT, 6-row cultivator	
Spring	Dammer Diker	160HP-WT, 6-row Dammer Diker	
Summer	Spray pesticide	Custom aerial	3 oz/acre spinosad (Entrust)
Summer	Weeding	Occasional handweeding	
Fall	Defoliate	160HP-WT, 20-ft flail chopper	
Fall	Harvest	160HP-WT, 3-row potato digger	

Table 7. Production Costs ($/acre) for Organic Russet Burbank Potatoes (Large Farm)

Item	Qty/acre	Unit	Price or cost/unit ($)	Cost subtotal by type ($)	Value or cost/acre ($)
GROSS RETURNS					
Potatoes, Russet Burbank	375	cwt	7.84		2,940.00
VARIABLE COSTS					
Seed				**382.5**	
Russet Burbank potato seed	22.5	cwt	15		337.5
Seed cut & treat	22.5	cwt	2		45
Fertilizer				**138.5**	
Compost	4	ton	20		80
Liquid fish	19.5	gal	3		58.5
Pesticides				**96**	
Spinosad (Entrust)	3	oz	32		96
Custom and consultants				**27.5**	
Aerial application	1	acre	7.5		7.5
Consultant/soil testing	1	acre	20		20
Irrigation				**363**	
Solid set rental	1	acre	250		250
Irrigation water	1	acre	43		43
Irrigation power	1	acre	55		55
Irrigation repair	1	acre	15		15
Machinery				**103.03**	
Fuel	19.7	gal	2.65		52.19
Lubricants	1	acre	6.95		6.95
Machinery repairs	1	acre	43.89		43.89
Labor				**122.94**	
Irrigation labor (solid sets)	2.4	hr	11.25		27
Handweeding	1	acre	50		50
Machinery labor	2.91	hr	15.8		45.91
Other				**177.75**	
Crop insurance	1	acre	36		36
Overhead	1	acre	63.47		63.47
Fees & assessments	1	acre			51.75
Operating interest					49.54
Total variable costs					**1,434.20**
Variable costs/unit					**3.82**
NET RETURNS ABOVE VARIABLE COSTS					**1,505.80**
FIXED COSTS					
Machinery depreciation	1	acre	53.93		53.93
Machinery interest	1	acre	38.38		38.38
Machinery insurance, housing, taxes, & licenses	1	acre	15.31		15.31
Land rent	1	acre	250		250
Total fixed costs					**357.62**
Fixed costs/unit					**0.95**
TOTAL COST/ACRE					**1,791.83**
TOTAL COST/UNIT					**4.78**
RETURNS TO RISK					**1,148.17**

*Labor cost includes a base wage plus 30% for taxes and benefits.

Note that organic potato production is at minimum a 4-year rotation of potatoes, grain, and 2 years of alfalfa. A 6-year rotation of potatoes, beans, grain, and 3 years of alfalfa is also common.

Table 8. Machinery Complement for Organic Russet Burbank Potato Production (Large Farm)

Type of machine	Replace. value ($)	Age at purchase (yr)	Years of life	Use (hr/yr)	Salvage value ($)	Repairs: materials & labor ($/yr)	Fuel (gal/hr)	Taxes, housing, ins., licenses ($)	Labor multiplier	Acres/hr
Tractors, ATVs										
4WD-ATV	7,320	0	15	200	1,500	150	1.2	1.2	1.1	
160HP-WT	65,000	10	25	600	8,500	2,000	7	1.2	1.1	
160HP-WT	65,000	10	25	600	8,500	2,000	7	1.2	1.1	
Equipment										
18-ft spike harrow	22,000	0	25	150	2,000	1,000	6	0.6	1.1	10.47
6-row cultivator	6,600	0	25	150	700	500	10	0.6	1.1	4.85
6-row Dammer Diker	30,500	0	25	150	5,000	1,000	10	0.6	1.1	7.42
6-row bed splitter	6,600	15		150	800	500	9.3	0.6	1.1	9.27
6-row potato planter	25,000	8	25	150	1,000	5,000	12	3	1.2	6.5
3-row potato harvester	86,620	0	25	125	18,300	2,600	12	2	1.2	1.27
20-ft stubble shredder	21,000	0	25	100	4,000	1,000	10	2.5	1.1	13.58
Trucks				**Miles/yr**			**Miles/gal**			
Tandem axle truck	30,000	10	10	2,000	10,000	2,000	6	10.1	1.2	
Tandem axle truck	30,000	10	10	2,000	10,000	2,000	6	10.1	1.2	
Tandem axle truck	30,000	10	10	2,000	10,000	2,000	6	10.1	1.2	
¾-ton pickup	15,000	7	7	6,000	3,500	750	12	6.8	1.2	
¾-ton pickup	30,000	0	7	18,000	15,000	750	12	6.8	1.2	

Table 9. Machinery Costs ($/acre) for Organic Russet Burbank Potato Production (Large Farm)

	Fixed costs ($/acre)				Variable costs($/acre)						
	Deprec.	Int.	Taxes, housing, ins., & licenses	Total fixed costs	Repairs	Labor	Fuel & lube.	Total variable costs	Labor (hr/acre)	Fuel use (gal/acre)	Total cost ($/acre)
Machinery costs for the following implements are spread across every acre of the farm, regardless of crops produced											
ATV	0.58	0.33	0.05	0.96	0.15	4.4	0.08	4.63	0.28	0.03	**5.59**
New ¾-ton pickup	2.14	1.69	1.53	5.36	0.75	0	4.75	5.5	0	2.02	**10.86**
Used ¾-ton pickup	1.64	0.69	0.63	2.96	0.75	0	1.59	2.34	0	0.68	**5.3**
Tandem axle truck	2	1.5	2.02	5.52	2	1.87	0.86	4.73	0.12	0.37	**10.25**
Tandem axle truck	2	1.5	2.02	5.52	2	1.87	0.86	4.73	0.12	0.37	**10.25**
Tandem axle truck	2	1.5	2.02	5.52	2	1.87	0.86	4.73	0.12	0.37	**10.25**
Machinery costs for the following implements are specific to the operations for each crop											
160HP-WT + 18-ft chisel & harrow	0.93	0.67	0.1	1.7	0.72	1.85	1.96	4.53	0.12	0.83	**6.23**
160HP-WT + 18-ft chisel & harrow	0.93	0.67	0.1	1.7	0.72	1.85	1.96	4.53	0.12	0.83	**6.23**
160HP-WT + 6-row potato planter	2.61	1.71	0.51	4.83	5.64	2.64	2.79	11.07	0.17	1.19	**15.9**
160HP-WT + 6-row cultivator & harrow	1.93	1.38	0.19	3.5	1.38	3.54	3.74	8.66	0.23	1.59	**12.16**
160HP-WT + 6-row cultivator	1.84	1.33	0.18	3.35	1.38	3.54	3.74	8.66	0.23	1.59	**12.01**
160HP-WT + 6-row cultivator	1.84	1.33	0.18	3.35	1.38	3.54	3.74	8.66	0.23	1.59	**12.01**
160HP-WT + 6-row Dammer Diker	2.27	1.56	0.17	4	2.75	2.36	2.5	7.61	0.15	1.06	**11.61**
160HP-WT + 20-ft flail shredder	1.2	0.85	0.22	2.27	1.97	1.26	1.33	4.56	0.08	0.57	**6.83**
160HP-WT + 3-row potato harvester	28.82	20.82	5.17	54.81	18.33	13.48	14.25	46.06	0.86	6.06	**100.87**
160HP-WT + 20-ft flail shredder	1.2	0.85	0.22	2.27	1.97	1.26	1.33	4.56	0.08	0.57	**6.83**
Total	**53.93**	**38.38**	**15.31**	**107.62**	**43.89**	**45.33**	**46.34**	**135.56**	**2.91**	**19.69**	**243.18**

RESOURCES

Esplin, K. 2009. Organic Russet marketing challenges. Organic Potato Update, summer 2009. Northwest Coalition for Alternatives to Pesticides, Potato Growers of Idaho, and University of Idaho. http://www.cals.uidaho.edu/aers/publications/OrganicPotatoUpdateSummer2009(web)2.pdf

Miller, J., R. Hirnyck, and L. Downey-Blecker. 2008. Pest Management Strategic Plan for Organic Potato Production in the West. Summary of workshops held on February 16, 2006 in Buhl, Idaho and on January 9, 2008, in Portland, Oregon. http://www.ipmcenters.org/pmsp/pdf/CA-CO-ID-OR-WAOrganicPotatoPMSP.pdf

Oberholtzer, L., C. Dimitri, and C. Greene. 2005. Price Premiums Hold as U.S. Organic Produce Market Expands. USDA-ERS, VGS-308-01.

The Packer. 2002. FreshTrends: Profile of the Fresh Produce Consumer.

Patterson, P. 2009. Southcentral Idaho: Magic Valley Russet Burbank Commercial Potatoes: No Storage. 2009 Costs and Returns Estimate, EBB3-Po1-09. Idaho Falls: University of Idaho Extension Service. http://www.cals.uidaho.edu/aers/crop_EB/EBB3CentralIdaho/EBB3Po109.pdf

Patterson, P. and K. Painter. 2009. Idaho Crop Input Price Summary for 2009. Agricultural Economics Extension Series 09-04. Moscow: University of Idaho. http://www.cals.uidaho.edu/aers/PDF/AEES/2009/AEES09-04.pdf

U. S. Department of Agriculture, National Agricultural Statistics Service. 2007 Census of Agriculture. 2008 Organic Survey, Table 4: Organic Vegetables, Potatoes, and Melons Harvested from Certified and Exempt Organic Farms. http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Organics/organics_1_04.pdf

ONLINE INTERACTIVE SPREADSHEET

The enterprise budgets in this document are available in a spreadsheet version that allows easy comparison of results with different price and cost assumptions at
http://www.cals.uidaho.edu/aers/r_project_reports.htm.

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