



# 2011 Cost Estimates of Producing Fresh Market Field-Grown Head Lettuce in Western Washington

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## Preface

The study results presented in this WSU publication serve as a general guide for producing fresh market field-grown head lettuce in western Washington in 2011. This publication can be used by new and existing lettuce producers to help evaluate production decisions, determine potential returns and prepare budgets. Specific assumptions were adopted for this study, but these assumptions may not fit every situation since production costs and returns vary among farm operations, depending on the following factors:

- Capital, labor, and natural resources
- Crop yields
- Type and size of machinery available
- Input prices
- Cultural practices
- Commodity prices
- Operation size
- Management skills

Cost estimation also varies with the intended use of the enterprise budget. To avoid drawing unwarranted conclusions for any particular farm, readers must closely examine the assumptions made and adjust the costs and/or returns as appropriate for their situation.

## Lettuce Production in Washington

Lettuce (head, leaf, and romaine, combined) ranks first in the United States in total value of production of fresh market vegetables (U.S. Census Bureau 2012), and national consumption exceeds 23 lbs per person each year on average between 1980 and 2010 (USDA ERS 2012). Lettuce production peaked in Washington in 1990 with 1,700 acres, but by 1999 production dropped to 800 acres (NASS n.d.). Lettuce production has not been tracked in Washington since 1999, when large-scale production was sharply reduced. Washington farmers mostly lost market contracts to farmers in California who can supply lettuce year-round (U.S. Census Bureau 2012), and California is now the largest supplier of lettuce in the U.S. Washington lettuce

growers also suffered some significant disease problems, which could not be combatted by normal crop rotations due to urbanization and loss of available farmland. Today in Washington, lettuce is a popular direct market crop statewide, when in season.

Historically, crisphead (also known as iceberg) was the most popular lettuce type grown in Washington, but today romaine (also known as cos), leaf (green and red), and butterhead (also known as bibb or Boston) types are more popular. Lettuce production is limited by high temperatures, and if temperatures exceed 86°F day/60°F night, the crop will develop tipburn, bolting (forms a flower stalk), and loose heads (Wein 1997). Lettuce types and cultivars differ in bolt resistance. Romaine is more resistant than crisphead, while butterhead and leaf types are the most resistant (Sanders 2001). Lettuce is productive in cool temperatures (optimum range is 60–65°F) and low light conditions, making the crop well suited to western Washington.

Lettuce seed is very small, with approximately 25,500–41,500 seeds per ounce. Lettuce can be direct seeded or transplanted. For transplants, lettuce is seeded in 98 to 200-cell plastic trays. About 1 lb of seeds and 250 ft<sup>2</sup> of bench space are needed to grow transplants for 1 acre of lettuce. Transplants are typically ready to set in the field in about 4 weeks.

For romaine and crisphead cultivars, in-row spacing is 10–12 inches, and for leaf and butterhead types in-row spacing is 8–10 inches (Sanders 2001). Spacing between rows is 22–36 inches, and should be selected to fit the cultivation equipment. Average number of plants per acre is about 26,000. Most growers plant 2–4 crops of lettuce per year in staggered plantings, with the first field planting at the beginning of March, or as soon as the soil can be worked. The last planting is about 80 days before the fall freeze date (Inglis and Vestey 2000). Lettuce is generally ready for harvest 30–50 days after transplanting or 50–75 days after direct seeding. The final harvest is the end of September or just prior to heavy rains or freezing temperatures.

Fertilizer and adequate soil moisture are essential for high quality lettuce production. Typical fertilizers applied are

nitrogen, phosphate, potash, and calcium. The rates of fertilizer application vary depending on the timing of planting and soil test results. Lime is applied if soil pH is below 6.0; the target pH is 6.7 (Wein, 1997). Irrigation requirement is approximately 1 inch per week, with frequent, light applications in the first 2–3 weeks until the crop is established.

Lettuce is marketed by the head and yields are 15,000 to 36,000 heads per acre, depending on plant spacing, and average yield is 26,000 heads per acre. Lettuce heads are trimmed and packed into cartons or market crates in the field. Harvested lettuce should be cooled immediately to 34°F. If lettuce is sold the same day it is harvested, cooling is not as critical but wilting will occur immediately, reducing shelf life and appearance. If storage is needed, vacuum cooling is a very effective method for rapidly cooling lettuce (USDA ARS 2004). Crisphead and romaine lettuce can be stored under these conditions for 2–3 weeks while butterhead and leaf lettuce can be stored for 1–2 weeks.

For more information about cultural practices and lettuce diseases and pests, see the lettuce crop profile for Washington (Inglis and Vestey 2000).

## Study Objectives

The primary objectives of this study are to: (1) provide an estimate of the costs of physical capital, materials, and labor required to produce head lettuce in the open field; (2) provide growers with a tool for analyzing the profitability of lettuce production; and (3) develop an Excel workbook that allows the user to estimate production costs and examine different production scenarios by changing input assumptions, yield, and price.

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.

## Sources of Information

The data used in this study were gathered from a group of experienced lettuce growers in western 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 if no unforeseen production failures occur. Given that many factors affect production costs and returns, users of the enterprise budget can use the Excel Workbook provided to estimate their own costs and returns.

## Budget Assumptions

1. This budget is based on a 1.5-acre block of field-grown head lettuce within a 20-acre mixed vegetables farm. It is assumed that 0.5 acre of this block is not used for the direct production of lettuce, but is dedicated to utility areas, etc. Therefore, the total productive area for this block is 1 acre. Table 1 shows the assumed field specifications for head lettuce.
2. The growing season is from April to October and the harvest season is from June to October. Lettuce

heads are sold through direct marketing (e.g., farmers markets, direct to retail, Community Supported Agriculture [CSA] subscriptions, etc.).

3. Expected production is 26,000 heads of lettuce and 75% of yield is marketable. Price received by the grower is \$1.75 per head of lettuce.
4. The farm uses reel and microsprinklers for irrigation. Installation cost (including materials and labor) is \$24,330 or \$1,216.50 per acre.
5. The value of bare agricultural land is \$9,330 per acre with property tax of \$108 per acre.
6. Management is valued at \$400 per acre.
7. Interest on investment is 5%.

## Summary of Results

Table 2 shows the estimated annual costs and returns for a 1-acre of field-grown lettuce in western Washington. Production costs are classified into *variable costs* and *fixed costs*. Variable costs include inputs like fertilizer, seed or transplants, and pesticides; machinery fuel, repairs, and maintenance; harvest and packing; other labor, materials, and overhead; and, interest on operating capital. Fixed costs, on the other hand, are incurred whether or not lettuce heads are produced. Fixed costs include depreciation, interest, taxes, and insurance. 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.

Based on the above assumptions, the total production costs for 1 acre of lettuce are estimated at about \$16,452. The calculated net returns over total costs in Table 2 is positive, which means that in addition to covering all cash and opportunity costs, the grower will receive a return on management and on the financial risk assumed in lettuce production. Table 3 shows the sensitivity of net returns to different price and yield scenarios.

Fixed costs in Table 2 are based on underlying cost data shown in Tables 4 to 6. Table 4 presents the capital requirements and irrigation system for a 20-acre mixed vegetables farm. Interest costs and depreciation costs attributed to producing 1 acre of lettuce in the open field are listed in Tables 5 and 6, 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.

Producers reviewing these budgets may state that their own costs are lower than those presented. It should be noted that WSU enterprise budgets are economic budgets (not financial/cash budgets), and to fully understand them, one must understand the concept of *opportunity cost*. Opportunity cost is revenue foregone by not investing in the next best, similar risk alternative. For example, if a producer invests \$50,000 of equity capital in equipment, the pro-

ducer 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 \$50,000 equipment investment must earn a return that is higher than the producer would earn from the next best alternative. If the next best alternative happens to be paying off an outstanding loan that carries an annual interest of 6 percent, economic profits are not realized until a net return greater than \$3,000 is realized by the equipment investment. Thus, the lettuce enterprise budget reflects an interest cost on owned or borrowed capital.

The same is true for operator labor and owned land. In calculating labor and management costs, operator labor and management are valued at the 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 budget represents the net rental return that the producer would receive if the land was rented out rather than being used by the producer.

Depreciation costs in Table 6 include the *annual replacement cost of machinery and equipment*, which is the amount a producer would pay to replace machinery and equipment annually, on average. The use of replacement prices may overstate costs currently being experienced by growers. However, the replacement cost provides an indication of the earnings needed to replace depreciable assets. Recent increases in prices paid for machinery and equipment mean that the depreciation claimed on older purchases substantially understates the amount of capital required to replace that asset. When looking at the long-term viability of the enterprise, it is important to consider the ability of the enterprise to replace its depreciable assets on a replacement cost basis.

## Excel Workbook

An Excel™ spreadsheet version of the lettuce budget (Table 2), as well as associated data underlying the cost calculations (Tables 4–6), are available at the WSU SES Extension website: [http://extecon.wsu.edu/pages/Enterprise\\_Budgets](http://extecon.wsu.edu/pages/Enterprise_Budgets). Growers can modify select values in the Excel workbook and thus use it to evaluate their own production costs and returns.

**Table 1. Head Lettuce Field Specifications**

<b>Block size (productive)</b>	1 acre
<b>In-Row Spacing</b>	10 inches
<b>Between-Row Spacing</b>	3 feet
<b>Row width</b>	2 feet
<b>Row length</b>	100 feet
<b>Density</b>	26,000 heads
<b>Number of Rows</b>	218 rows

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**Table 2. Costs and Returns of Producing Field-Grown Head Lettuce (\$/acre)**

<b>Total Returns</b>	<b>Unit</b>	<b>Price/unit</b>	<b>Quantity</b>	<b>Total</b>	<b>Note</b>	<b>Your Return</b>
Lettuce	head	\$1.75	19,500	\$34,125.00	Assumed yield is 26,000 heads and 75% is marketable.	_____
<b>Variable Costs</b>	<b>Unit</b>	<b>Cost/unit</b>	<b>Quantity</b>	<b>Total</b>	<b>Note</b>	<b>Your Cost</b>
<b>Field preparation and planting</b>						
Chisel plow	hour	\$15.00	2	\$30.00		_____
Lime application, custom	acre	\$50.00	1	\$50.00	Once every 5 years	_____
Moldboard plow	hour	\$15.00	2	\$30.00		_____
Disk	hour	\$15.00	2	\$30.00		_____
<b>Fertilize</b>						
Gypsum	acre	\$150.00	1	\$150.00	Includes labor	_____
Fertilizer	acre	\$100.00	1	\$100.00		_____
Labor	hour	\$15.00	2	\$30.00		_____
Rotary till	hour	\$15.00	4	\$60.00		_____
<b>Transplanting</b>						
Planting labor	hour	\$12.00	45	\$540.00	Hand transplanting	_____
Lettuce transplants	each	\$0.01	26,000	\$260.00		_____
Cultivate weeds	acre	\$585.00	1	\$585.00	45 hours/ac (hand labor); 3 hours/ac (tractor)	_____
<b>Irrigation</b>						
Labor	hour	\$12.00	1	\$12.00	1 hour/ac to move lines	_____
Electricity	acre	\$10.00	1	\$10.00	Labor cost	_____
<b>Harvest</b>	hour	\$12.00	300	\$3,600.00	Harvest by hand	_____
<b>Packing</b>						
Packing labor	hour	\$12.00	300	\$3,600.00	Packing by hand	_____
Cartons	24 ct carton	\$2.80	813	\$2,275.00		_____
Delivery to market	hour	\$12.00	68	\$812.50	Assumed labor is 5 minutes per box	_____
<b>Maintenance and Repairs</b>						
Machinery Repair	acre	\$100.00	1	\$100.00		_____
Fueling and Lubrication	acre	\$200.00	1	\$200.00		_____
Irrigation System Maintenance and Repair	acre	\$100.00	1	\$100.00		_____
<b>Other Variable Costs</b>						
Organic certification	acre	\$250.00	1	\$250.00	\$250 per farm is minimum certification fee.	_____
Overhead (5% of variable costs)	acre			\$641.23		_____
Interest on Variable Costs (5%)*	acre			\$392.75		_____
<b>Total Variable Costs</b>				<b>\$13,858.48</b>		_____
<b>Fixed Costs</b>						
<b>Depreciation</b>						
Irrigation System	acre			\$43.88		_____
Machinery and Equipment Annual Replacement Cost	acre			\$400.00		_____
<b>Interest</b>						
Land	acre			\$466.50		_____
Irrigation System	acre			\$33.45		_____
Machinery and Equipment	acre			\$224.02		_____
<b>Other Fixed Costs</b>						
Land and Property Tax	acre			\$108.00		_____
Insurance Cost (on entire farm)	acre			\$100.00		_____
Field Sanitation Equipment	acre			\$525.00	Rental = \$75/month for 7 months	_____
Management Cost	acre			\$400.00		_____
<b>Total Fixed Costs</b>				<b>\$2,300.85</b>		_____
<b>Total Cost</b>				<b>\$16,159.33</b>		_____
<b>Estimated Net Returns</b>				<b>\$17,965.67</b>		_____

Notes:

\* Interest expense on 7 months during a year.

Machinery Labor rate is \$15/hour; Other Labor rate is \$12/hour.

**Table 3. Estimated Net Returns at Various Prices and Marketable Yields of Field-Grown Head Lettuce**

Marketable Yield (heads per acre)	Price (\$ per head)					
	\$1.00	\$1.25	\$1.50	\$1.75	\$2.00	\$2.25
10,000	-\$4,534	-\$2,034	\$466	\$2,966	\$5,466	\$7,966
15,000	-\$389	\$3,361	\$7,111	\$10,861	\$14,611	\$18,361
20,000	\$3,755	\$8,755	\$13,755	\$18,755	\$23,755	\$28,755
25,000	\$7,900	\$14,150	\$20,400	\$26,650	\$32,900	\$39,150
30,000	\$12,044	\$19,544	\$27,044	\$34,544	\$42,044	\$49,544
35,000	\$16,189	\$24,939	\$33,689	\$42,439	\$51,189	\$59,939

**Table 4. Physical Capital Requirements and Irrigation System for a 20-Acre Farm**

	Purchase Price*	Number of Units	Total Cost	Notes
<b>Machinery, Equipment, Building</b>				
50-Horsepower Tractor	\$30,000	1	\$30,000	
Disk (7 ft)	\$4,000	1	\$4,000	
Rotary tiller (6 ft)	\$3,000	1	\$3,000	
Deep chisel (5 ft)	\$1,000	1	\$1,000	
Harrow (8 ft)	\$1,500	1	\$1,500	
Mold Board Plow	\$1,500	1	\$1,500	
Weed cultivator	\$500	1	\$500	
Fertilizer spreader	\$100	1	\$100	
Mechanical transplanter	\$3,000	1	\$3,000	
Seed transplanter	\$325	1	\$325	
Brush mower	\$2,500	1	\$2,500	
Sprayer**	\$3,200	1	\$3,200	
Tools (hand hoe, harvest knives, etc.)	\$1,000	1	\$1,000	
Pickup	\$30,000	2	\$60,000	
ATV 4WD	\$5,500	1	\$5,500	
Trailer (4-wheel pull)	\$800	1	\$800	
Shop (20'x40')	\$20,000	1	\$20,000	
Machine shed (20' x 60')	\$15,000	1	\$15,000	
Walk-in cooler (9' x13')	\$10,000	1	\$10,000	
<b>Total Cost of Machinery, Equipment and Building</b>			<b>\$162,925</b>	
<b>Irrigation System—Reel and Microsprinklers</b>				
Reel	\$3,000	1	\$3,000	
Microsprinklers	\$300	1	\$300	3 lines at \$100/line
Mainline material (poly tubing)	\$21,000	1	\$21,000	700 ft from source at \$30/hundred ft
Installation (labor)	\$34	1	\$30	2 hours of labor at \$15/hour
<b>Total Cost of Irrigation System</b>			<b>\$24,330</b>	

\* Purchase price is approximate and corresponds to new machinery, equipment, building or irrigation system.

\*\* For insecticide and fungicide.



**Table 5. Interest Costs for a 1-Acre Head Lettuce Block**

	Total Purchase Price	Salvage Value	Number of Acres	Total Interest Cost	Interest Cost Per Acre
Land	\$13,995	\$13,995	1.5	\$700	\$466.50
Irrigation System	\$1,217	\$122	1	\$33	\$33.45
Machinery, Equipment and Building	\$162,925	\$16,293	20	\$4,480	\$224.02
Interest Rate	5.0%				
Salvage Value*	10.0%				

Notes:

Interest Cost is calculated as: (Total Purchase Price + Salvage Value)/2 x 5%.

\*Salvage Value refers to the estimated value of an asset at the end of its useful life. It is calculated as: Total Purchase Price x 10%. Salvage Value does not apply to land because land is not a depreciable asset.

**Table 6. Annual Depreciation Costs for a 1-Acre Head Lettuce Block**

	Total Purchase Price	Number of Acres	Total Value Per Acre	Years of Use	Depreciation Cost Per Acre
Irrigation System					
Reel	\$150	1	\$150.00	15	\$9.00
Microsprinklers	15	1	\$15.00	4	\$3.38
Mainline material	1,050	1	\$1,050.00	30	\$31.50
Machinery, Equipment and Building*					\$400.00

Notes:

The depreciation cost (except for Machinery, Equipment and Building) is calculated as *straight line depreciation*: Total Purchase Price – Salvage Value/Years of Use.

\*An estimate of average annual replacement costs, rather than depreciation costs, is used for machinery and equipment. Replacement prices may overstate costs growers experience. However, they indicate the earnings needed to replace depreciable assets. When looking at long-term enterprise viability, it is important to consider the ability to replace depreciable assets.



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