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2015 Estimated Cost of Establishing and Producing Hops in the Pacific Northwest



Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of producing hops in the Pacific Northwest as of 2015, with a capital and machinery endowment suited to a 660-acre hop enterprise. Also discussed are the key factors to consider in expanding a hop operation. 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 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 hops
- Management skills
- Size of the operation
- Type and size of machinery, and irrigation system

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

Hop Production in the Pacific Northwest

The U.S. commercial hop production is concentrated in the Pacific Northwest region (Idaho, Oregon and Washington). As of 2014, the U.S. harvested 38,910 acres of hops where 98% are attributed to the Pacific Northwest states and the remaining 2% to other states that include California, Colorado, Illinois, Indiana, Maine, Michigan, Minnesota, Nebraska, New York, North Carolina, Ohio, Vermont, Virginia, and Wisconsin (HGA 2014). Out of the total volume of hops produced in the U.S., 8% came from Idaho, 13% from Oregon and 79% from Washington State based on a 5-year average between 2010 and 2014 (USDA NASS 2015).

Hops are one of the key ingredients in beer. There are a number of hop varieties and each variety has its own alpha acid (AA) rating, which is represented by the amount of alpha acid as percentage of the total weight of the hops. The two main classifications of hops are: aroma

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varieties and bittering varieties (i.e., alpha varieties). Aroma hops have an oil profile associated with desirable aroma and lower alpha acid rating such as Willamette (4%-5% AA) and Cascade (4.5%-7% AA). Bittering hops have higher alpha acid percentage such as Chelan (12%-14.5% AA), Chinook (12%-14% AA), Millennium (14.5%-16.5% AA), and Apollo (15%-19% AA) (Palmer 1999; USA Hops 2013). From 2010 until 2014, planted acreage of alpha hops decreased by 10% per year on average, while the planted acreage of aroma hops increased by 23% per year on average during the same period (HGA, 2014). The expansion in aroma acreage is mainly driven by increased demand for aroma varieties by craft brewers.

Objectives of study

This study provides information on (1) the variable and fixed costs required to produce hops in the Pacific Northwest, and (2) the ranges of price and yield levels at which hop production would be a profitable enterprise. An Excel workbook is also developed, which allows the user to estimate production costs and examine the impact of different input assumptions, yields, and price scenarios.

Sources of Information

The data were obtained from a committee of hop growers representing Idaho, Oregon and Washington. Their production practices and requirements for labor and capital are the basis for the assumptions used in this study. While there are differences in practices and costs among growers and across the different states, current production methods are considered and a consensus was obtained on the average costs of various inputs in hop production.

Due to the method used to generate the enterprise budget, the values reported 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

Following are the general assumptions made in developing the enterprise budget for hops grown in the Pacific Northwest:

1. The representative farm has 660 acres devoted to hop production, with 600 acres in hops currently being established or currently producing. It takes 1.1 acres of land to establish 1 acre of hops. Thus, on this representative farm approximately 60 acres of land are needed for

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roads, buildings, picking equipment, etc. in support of hops production. The specifications for hop production are shown in Table 1.

2. The value of bare land is \$15,000 per acre with property taxes of \$70 per acre.
3. A drip irrigation system costs \$4,150 per acre (\$2,650/acre material cost plus \$1,500/acre installation cost). The annual water charge is \$95 per acre.
4. The hop plants have a 5-year life.
5. The hop yard is planted with 80% aroma varieties and 20% alpha varieties.
6. The variety of hop to be grown is to be on a standard trellis and projected to have an average mature-year production of 1,800 lb per acre for aroma varieties and 2,800 lb per acre for alpha varieties. First year production is projected to be 80% of mature-year production.
7. Management is valued at \$250 per acre. This value is representative of what the producer committee felt as a fair return to an operator's management skills.
8. The prevailing interest rate is 6.5% for a short term loan, and 5% for a long-term loan.

Summary of Results

Production costs are classified into variable costs and fixed costs. The variable costs reflect costs that are incurred when production takes place in a given year. The variable costs include planting, chemical and fertilizer application, labor (consulting, custom, seasonal), licenses, fees and dues, irrigation, parts and repairs, fuel and oil, supplies, and interest on operating capital. Fixed costs are incurred whether or not the crop is produced. The fixed costs include depreciation and interest costs on fixed capital, insurance cost, land cost, taxes, administration, utilities, overhead, 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 amortized establishment costs assume a total productive life of 5 years, which includes 1 year of baby hops and 4 years of mature hop production. The amortized establishment costs must be recaptured during the mature production years in order for an enterprise to be profitable.

Table 2 shows the estimated costs of land preparation and establishment, while Table 3 shows the annual costs and returns estimated for 5 years of hop planting. The study assumed that the hops could achieve maturity in the second year. Based on the above assumptions, the total production costs for hops during mature production are estimated at \$10,240 per acre. Given

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these costs and holding all else constant, the breakeven price required for aroma hops is \$5.85/lb assuming a yield of 1,440 lb/acre; while the breakeven price for alpha hops is \$1.57/lb assuming a yield of 560 lb/acre. The breakeven price is quite low compared to the assumed price for alpha hops (i.e., \$3.25/lb) mainly because the study takes into account that 80% of the hop farm is planted with aroma hops that fetch a higher price. Table 4 shows the sensitivity of net returns to different price and yield combinations for aroma hops.

Net Present Value and Payback Period

The economic feasibility of investing in a hop enterprise is further assessed by using the net present value (NPV) and discounted payback period. Discounting is a method to estimate the present value of future payments by using a discount rate, which represents the time value of money or the opportunity cost of capital. NPV is the sum of the discounted cash flows from the first year to the last year of the planting's productive life (i.e., 5 years). The discounted payback period gives the number of years it would take to recoup an investment from discounted cash flows.

This study assumes that the grower has a 5-year contract in growing 600 acres of hops (480 acres in aroma hops and 120 acres in alpha hops). Given other production-related assumptions, the NPV of the hop operation is going to be positive only if the grower would renew the contract for at least two additional cycles on the same piece of ground (see Appendix 4 of Excel Workbook). This need arises because of the expensive fixed capital outlay. If there are 3 cycles of a 5-year contract and assuming the same proportion of aroma and alpha varieties are replanted, the irrigation system, machinery and other fixed capital remain in service, and all else are the same, the NPV of the hop operation is estimated at \$1.05 million given a discount rate of 3%. The internal rate of return, or the rate at which the hop enterprise breaks even, is about 3.61%.

The estimated discounted payback period for the investment can vary depending on the costs included in the calculation, and ranges from 3.02 to 16.11 years. If one includes total cash costs, which is the sum of total variable costs, land and property taxes, insurance cost, utilities, administration and overhead, the discounted payback period is 3.02 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 16.11 years (see Appendix 4 of Excel Workbook for details). Table 5 shows the sensitivity of the NPV calculations to different discount rates — 3%, 3.25% and 3.5%, which are in the range of the average annual effective interest rates on non-real estate bank loans made to farmers in the past 5 years (i.e., 3% to 6% for operating expenses, farm machinery and equipment, and other loans between 2010 and 2014; Federal Reserve Bank of Kansas City 2015).

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Expansion of Hop Operation

There are two aspects to an expansion of a hop growing operation. The first is the establishment and maintenance of the hop yard, which is no different in many ways to an expansion of any perennial crop (e.g., orchard), as infrastructure (e.g., trellis and irrigation) needs to be constructed, appropriate machinery purchased, and labor needed for harvesting, pruning and other management activities hired. Because of this, the expansion of the hop yard can be of any size.

The second aspect, which is the major difference with an expansion of a hop operation as compared to expansion of other perennial crop, is access to harvester, kiln and cooling/baling room¹ capacity, which in economic terms is a lumpy investment, meaning that there is kiln size that works best from an economic perspective, which is usually a size matched to about 600 acres of hops. If a hop operation currently runs a kiln, it more than likely is already operating at full capacity; therefore to expand hop growing area would require access to additional kiln capacity. The preference for most hop growers would be to invest in another kiln of their own, which to be economically feasible would require the expansion of the hop growing area to match the capacity of the new kiln, meaning an expansion of around 600 acres. The challenge for an expanding operation is that investing in additional hop area and a hop kiln required a substantial investment of capital, either borrowed or equity.

One possible alternative for hop growers to access additional kiln capacity, particularly for a group of growers who may be planning expansion or are looking for additional kiln capacity and are in close proximity to each other, is to establish some form of cooperative to invest in a hop kiln for the cooperating members. From an economic perspective this may seem reasonable and practical as an expanding producer does not need to invest in both a new yard and kiln at the same time. However, the management of the cooperative kiln will be more complex as harvesting usually occurs nearly simultaneously for all growers, thus determining location, delivery scheduling, separating hops after drying, payment of labor and management would all need to be clearly defined in the agreement between cooperating members.

Discussion

Given the study's assumptions, results suggest that the production of hops in the Pacific Northwest can be economically feasible given a combination of factors, particularly the price of hops, crop yield, size of the operation, and contract. All these need to be considered given the expensive investment outlay to establish and maintain a hop enterprise.

¹ In the context of this report we will refer to the harvester, kiln and cooling/baling room investments simply as an investment in a kiln.

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A hop growing area to match a kiln capacity is 600 acres, and any expansion planned will have to account for access to additional kiln capacity. If a grower wants to own a kiln, the hop operation has to be expanded by 600 acres to justify the substantial capital investment of a kiln. On the other hand, expanding a hop operation for less than 600 acres can be feasible if access to additional kiln capacity can be provided in some form of a cooperative, wherein a producer can share the cost of maintaining a kiln with other cooperating members.

It must be noted that 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 entire population of hop growers. An interactive Excel Workbook is provided to enable individual growers to estimate their returns based on the costs of their production.

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Table 1. Hop Production Specifications

Total production area	660 acres
Growing area	600 acres
In-row spacing	3.5 feet
Between row spacing	14 feet
Life of planting	5 years

Table 2. Estimated Costs for Preparing and Establishing a Standard Trellis Hop Field under Drip Irrigation (\$/acre)

	\$/Acre	Comments and Notes
Land Preparation		October-November of Previous Year
Disc	\$25.00	Custom hire
Subsoil	\$25.00	Custom hire
Plow/Rototill	\$50.00	Custom hire
Cultipack/Sprtooth (2X)	\$50.00	Custom hire
Design	\$30.00	Custom hire
Fumigate	\$400.00	
Interest	\$37.70	6.5% of land prep cost
Total Land Preparation	\$617.70	
Establishment		
Field Poles	\$1,160.00	
Anchor Poles	\$270.00	
Anchor Holes	\$50.00	
Anchor Material	\$250.00	
Wire, cable and staples	\$1,200.00	
Planting stock	\$2,000.00	
Labor	\$2,000.00	
Management	\$200.00	10 hours @ \$20/hour
Interest	\$463.45	6.5% of above establishment costs
Total Establishment Cost	\$7,593.45	
Total Land Preparation and Establishment Costs	\$8,211.15	

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Table 3. Estimated Annual Costs and Returns of Producing Standard Trellis Hops under Drip Irrigation

	Year 1 (\$/acre)	Mature production ^a	Comments and Notes
Variable Costs:			
Fertilizer and leaf feed	\$660.00	\$600.00	Includes N, P, K, S, Zn and other plant nutrients
Chemicals	\$540.00	\$750.00	Includes all herbicides, pesticides, and fungicides (for powdery mildew control)
Consulting	\$15.00	\$15.00	Includes agricultural field consulting
Custom hire	\$80.00	\$80.00	Includes custom spraying, harvesting, tractor work, etc.
Licenses, fees and dues	\$50.00	\$50.00	Includes assessments, dues licenses, inspection fees
Parts and repairs	\$600.00	\$600.00	Includes equipment, trellis, irrigation, facilities
Fuel and oil	\$150.00	\$150.00	Includes gasoline, diesel, lubricants, propane
Drying fuel	\$187.50	\$250.00	
Irrigation water	\$95.00	\$95.00	
Seasonal Labor	\$2,500.00	\$2,500.00	Includes health insurance, employer taxes, etc.
Supplies	\$296.00	\$370.00	Includes twine & clips, and packaging supplies
Interest on operating capital	\$168.14	\$177.45	6.5% of above variable costs x 6/12 (6 months)
Total Variable Costs	\$5,341.64	\$5,637.45	
Fixed Costs:			
Depreciation cost of fixed capital	\$670.65	\$670.65	Includes machine, equipment, shop, office and irrigation infrastructure
Interest cost of fixed capital	\$461.92	\$461.92	Includes machine, equipment, shop, office and irrigation infrastructure
Insurance cost	\$195.00	\$195.00	Includes property insurance, crop insurance and liability insurance
Land & property taxes	\$77.00	\$77.00	\$70 per acre x 1.1 acres
Land cost	\$750.00	\$750.00	\$15,000 per acre x 5%
Management	\$250.00	\$250.00	Includes benefits, social security, etc. for management personnel
Administration	\$240.00	\$240.00	Includes benefits, social security, etc. for administration personnel
Utilities	\$170.00	\$170.00	Cost of electricity and telephones
Overhead	\$60.00	\$60.00	Includes office supplies and professional services (attorney, accounting, etc.)
Amortized establishment cost ^b		\$1,728.47	
Total Fixed Costs	\$2,874.57	\$4,603.03	
TOTAL COSTS	\$8,216.21	\$10,240.48	
Estimated Production Level (Lb/acre)			
Aroma	1,152	1,440	1,800 lb per acre x 80%
Alpha	448	560	2,800 lb per acre x 20%
Estimated Price (\$/lb)			
Aroma	\$6.50	\$6.50	
Alpha	\$3.25	\$3.25	
TOTAL RETURNS	\$8,944.00	\$11,180.00	
Estimated Net Returns	\$727.79	\$939.52	

Notes:

- a. Represents of the remaining years that the hop plants are in full production (i.e., Year 2 to Year 5).
- b. Represents the cost incurred during the establishment years that must be recaptured during the full or mature production years in order for an enterprise to be profitable.

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Table 4. Estimated Net Returns^a Per Acre at Various Prices and Yields of Aroma Hops during Mature Production (\$/acre)

Yield (pounds per acre) ^b	Price (\$ per pound) ^c					
	\$5.50	\$5.75	\$6.00	\$6.25	\$6.50	\$6.75
840	-\$3,800	-\$3,590	-\$3,380	-\$3,170	-\$2,960	-\$2,750
1,040	-\$2,700	-\$2,440	-\$2,180	-\$1,920	-\$1,660	-\$1,400
1,240	-\$1,600	-\$1,290	-\$980	-\$670	-\$360	-\$50
1,440	-\$500	-\$140	\$220	\$580	\$940	\$1,300
1,640	\$600	\$1,010	\$1,420	\$1,830	\$2,240	\$2,650
1,840	\$1,700	\$2,160	\$2,620	\$3,080	\$3,540	\$4,000
2,040	\$2,800	\$3,310	\$3,820	\$4,330	\$4,840	\$5,350
2,240	\$3,900	\$4,460	\$5,020	\$5,580	\$6,140	\$6,700

Note: Shaded area denotes a positive profit based on the combination of yield and price.

- a. Net return is what the grower receives after all production expenses have been accounted.
- b. Represents the average yield over 4 years of full production.
- c. Price represents gross return.

Table 5. Net Present Value and Payback Periods given Different Discount Rates.

Discount rate	Net Present Value	Payback period of Total Cash Cost (no. of years)	Payback period of Total Cost (no. of years)
3.00%	\$1,050,742	3.02	16.11
3.25%	\$607,152	3.02	16.19
3.50%	\$179,671	3.03	16.27

Notes:

Cash cost is the sum of total variable cost, land & property taxes, insurance cost, utilities, administration and overhead; excludes interest on operating capital.

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.