

2020 ESTIMATED COSTS OF ESTABLISHING AND PRODUCING CONVENTIONAL AND ORGANIC HOPS IN THE PACIFIC NORTHWEST



Preface

The results presented in this WSU publication serve as a general guide for evaluating the feasibility of establishing and producing conventional and organic hops in the Pacific Northwest as of 2020, with a capital and machinery endowment suited to a 660-acre hop 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 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 guide and then adjust the costs, returns, or both as appropriate for their own hop operation.

Hop Production in the Pacific Northwest

The US commercial hop production is concentrated in the Pacific Northwest region (Idaho, Oregon, and Washington). As of 2020, the United States harvested 60,718 acres of hops. Only 3% of harvested acreage is from outside the Pacific Northwest region and includes 25 states: Arizona, California, Colorado,

Connecticut, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Vermont, Virginia, and Wisconsin (HGA 2021, 2022). Within the Pacific Northwest, hops acreage is concentrated in Washington State, which accounts for 72% of the three-state total based on a five-year average between 2016 and 2020. For the remainder, 14% came from Idaho and 14% from Oregon (USDA NASS 2022).

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 a percentage of the total weight of the hops. The two main classifications of hops are (1) aroma varieties and (2) bittering varieties (i.e., alpha varieties). From 2015 until 2020, planted acreage of alpha hops increased by about 7% per year on average, while the planted acreage of aroma hops increased by about 8% per year on average during the same period (HGA 2021). The proportion of alpha and aroma varieties in total planted acreage has varied over the years—in 2012 the respective shares were 50-50 but in 2020 the production area for aroma varieties were nearly four times more than that of alpha varieties. The greater relative share is mainly driven by increased demand for aroma varieties by craft brewers.

Study Objectives

This study provides information on (1) the variable and fixed costs required to establish and produce conventional and organic 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 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 were obtained from the Hop Growers of America board members representing Idaho, Michigan, Nebraska, 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. Some of the cost centers are the same for producing conventional and organic hops, and we note in the subsequent section Budget Assumptions the similarities and differences.

Due to the method used to generate the enterprise budgets, 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 growers can use the Excel workbook (available at the WSU School of Economic Sciences' [Crop Enterprise Budgets website](#)) to evaluate their own production costs and returns.

Budget Assumptions

Following are the general assumptions made in developing the enterprise budget for *both organic and conventional hops* grown in the Pacific Northwest:

1. The representative farm has 660 acres devoted to (conventional or organic) 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 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 varieties are grown on a standard trellis.
5. Management is valued at \$250 per acre. This value is representative of what the producer committee felt was a fair return for an operator's management skills.
6. The prevailing interest rate is 6.5% for a short-term loan and 5% for a long-term loan.
7. The hop plants have a five-year life span.

Specific assumptions for *conventional hop production* are as follows:

1. The hop field is planted with 80% aroma varieties and 20% alpha varieties.

2. Hop varieties are projected to have an average mature-year production of 1,800 lb/acre for aroma varieties and 2,800 lb/acre for alpha varieties. First year production is projected to be 80% of mature-year production.
3. The gross returns for aroma and alpha varieties are \$6.50 per pound and \$3.25 per pound, respectively.

Specific assumptions for *organic hop production* include:

1. Only organic aroma varieties are produced. The average yield during mature-year production is 1,440 lb/acre for aroma varieties. First-year production is projected to be 80% of mature-year production.
2. The gross return of organic aroma varieties is \$11.46 per pound.
3. In addition to the drip irrigation system, an overhead sprinkler system is required which costs about \$1,000 per acre.

Table 1. Hop production specifications (conventional or organic).

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

Summary of Study 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 five years, which includes one year of immature hops and four 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, which are the same for conventional and organic hop production.

Table 2. Estimated costs for preparing and establishing a standard trellis hop field (conventional or organic).

	\$/acre	Comments and Notes
Land Preparation		October to 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	\$29.00	5% of land prep cost
Total Land Preparation	\$609.00	
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 at \$20/hour
Interest	\$356.50	5% of above establishment costs
Total Establishment Cost	\$7,486.50	
Total Land Preparation and Establishment Cost	\$8,095.50	

Conventional Hops

Table 3 shows the annual costs and returns estimated for five years of hop planting. The study assumed that the hops could achieve maturity in the second year. Also, recall that in the conventional production system the ratio of planted varieties in the hop field is 80% aroma and 20% alpha and that each variety sells at a different price (with aroma fetching a higher price). Based on these assumptions, the total production costs for

conventional hops during mature production are estimated at \$13,589 per acre. The break-even return required for aroma hops as of 2020 is \$8.17/lb assuming a yield of 1,440 lb/acre and holding the price and yield of alpha hops and all other variables the same. On the other hand, the break-even return for alpha hops is \$7.55/lb assuming a yield of 560 lb/acre and holding all other variables, including aroma yield and price, constant.

Table 3. Estimated annual costs and returns of producing conventional hops in standard trellis under drip irrigation.

	Year 1	Mature Production ^a	Comments and Notes
Estimated Production Level (lb/acre)			
Aroma	1,152	1,440	1,800 lb per acre × 80%
Alpha	448	560	2,800 lb per acre × 20%
Estimated Price (\$/lb)			
Aroma	\$6.50	\$6.50	
Alpha	\$3.25	\$3.25	
TOTAL RETURNS (\$/acre)	\$8,944.00	\$11,180.00	

	Year 1	Mature Production^a	Comments and Notes
Variable Costs (\$/acre):			
Fertilizer and Leaf Feed	\$750.00	\$700.00	Includes N, P, K, S, Zn, and other plant nutrients
Chemicals	\$650.00	\$900.00	Includes all herbicides, pesticides, and fungicides (for powdery mildew control)
Consulting	\$25.00	\$25.00	Includes agricultural field consulting
Custom Hire	\$80.00	\$80.00	Includes custom spraying, harvesting, tractor work, etc.
Licenses, Fees, and Dues	\$100.00	\$150.00	Includes assessments, dues, licenses, inspection fees, royalties
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	\$120.00	\$120.00	
Seasonal Labor	\$4,000.00	\$4,000.00	Includes health insurance, employer taxes, etc.
Supplies	\$300.00	\$380.00	Includes twine, clips, and packaging supplies
Interest on Operating Capital	\$174.06	\$183.88	5% of above variable costs $\times 6 \div 12$ (6 months)
Total Variable Costs	\$7,136.56	\$7,538.88	
Fixed Costs (\$/acre):			
Depreciation Cost of Fixed Capital	\$988.27	\$988.27	Includes machine, equipment, shop, office, and irrigation infrastructure
Interest Cost of Fixed Capital	\$670.08	\$670.08	Includes machine, equipment, shop, office, and irrigation infrastructure
Insurance Cost	\$230.00	\$230.00	Includes property insurance, crop insurance, and liability insurance
Land and Property Taxes	\$77.00	\$77.00	\$70 per acre $\times 1.1$ acres
Land Cost	\$675.00	\$675.00	\$15,000 per acre $\times 4.5\%$
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		\$2,689.43	
Total Fixed Costs	\$3,360.35	\$6,049.79	
TOTAL COSTS (\$/acre)	\$10,496.92	\$13,588.66	
NET RETURNS (\$/acre)	-\$1,552.92	-\$2,408.66	

^aRepresents the remaining years that the hop plants are in full production (i.e., Year 2 to Year 5).

^bRepresents the cost incurred during the establishment years that must be recaptured during the mature production years in order for an enterprise to be profitable. It is calculated as accumulated costs during the establishment year and first year of production, minus the revenues during the first year. The net costs are then amortized at 4.5% for four years.

A further analysis of the break-even returns for aroma hops is presented in Table 4. This analysis shows that the first break-even return is \$3.97/lb. This is the minimum return for the owner-operator to cover the operation's variable costs. Returns lower than this figure suggest that it is more profitable not to operate (shutdown price) to produce hops. The second break-even return is about \$4.51/lb, which is needed to cover the total cash costs and to be economically viable in the short run. The third break-even return is \$5.20/lb, which is needed to cover the cash costs plus depreciation of machinery and buildings. This third break-even return is needed for the operation to be financially viable in the long run. The fourth break-even return is \$8.17/lb. If this return is realized, the owner-operator would recover all out-of-pocket expenses plus realize a competitive return on equity capital invested in land, hop planting,

machinery, equipment, and buildings. Failure to obtain this break-even return level means that the owner-operator will not receive a return on capital contributions equal to what could be earned in alternative uses.

Table 5 shows the sensitivity of the enterprise's net returns to different combinations of price and yields of aroma hops. For this analysis, the range of aroma prices considered is from \$6.50/lb to \$7.75/lb, and the yields range from 840 lb/acre to 2,240 lb/acre during mature production. Yields that are about 1,840 lb/acre and greater will generate a positive return across the assumed prices. The description of break-even returns and sensitivity analysis is focused on aroma hops because of its greater relative share in the hop farm (i.e., 80%), making it the main driver of the enterprise's profitability.

Table 4. Break-even return^a (\$/lb) of conventional aroma hops for different levels of enterprise costs during mature production of conventional aroma and alpha varieties.

	Cost (\$/acre)	Break-even Return (\$/lb) ^a
1. Total Variable Costs	7,538.88	3.97 ^b
2. Total Cash Costs ^c = Total Variable Costs + Land & Property Taxes + Insurance Cost + Administration + Utilities + Overhead	8,315.88	4.51 ^d
3. Total Cash Costs + Depreciation Costs	9,304.15	5.20 ^e
4. Total Cost = Total Cash Costs + Depreciation Costs + Interest Costs ^f + Management Cost	13,588.66	8.17 ^g

Notes: Aroma yield (lb/acre) = 1,440. The price of aroma hops is \$6.50/lb.

^aBreak-even return is calculated as: *cost minus the alpha hops gross return, then divide the difference by aroma yield during mature production.*

^bIf the return is below this level, hops are uneconomical to produce.

^cIf there are other cash costs on an individual's farm, these costs must be identified and included in the cash cost break-even return calculation.

^dThe second break-even return allows the producer to stay in business in the short run.

^eThe third break-even return allows the producer to stay in business in the long run.

^fInterest costs include some actual cash interest payments.

^gThe fourth 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 *plus* opportunity costs.

Table 5. Estimated net returns^a per acre of a hop enterprise at various prices and yields of aroma hops during mature production.

Yield (lb/acre) ^b	Price (\$/lb) ^c					
	\$6.50	\$6.75	\$7.00	\$7.25	\$7.50	\$7.75
840	-\$6,309	-\$6,099	-\$5,889	-\$5,679	-\$5,469	-\$5,259
1,040	-\$5,009	-\$4,749	-\$4,489	-\$4,229	-\$3,969	-\$3,709
1,240	-\$3,709	-\$3,399	-\$3,089	-\$2,779	-\$2,469	-\$2,159
1,440	-\$2,409	-\$2,049	-\$1,689	-\$1,329	-\$969	-\$609
1,640	-\$1,109	-\$699	-\$289	\$121	\$531	\$941
1,840	\$191	\$651	\$1,111	\$1,571	\$2,031	\$2,491
2,040	\$1,491	\$2,001	\$2,511	\$3,021	\$3,531	\$4,041
2,240	\$2,791	\$3,351	\$3,911	\$4,471	\$5,031	\$5,591

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

^aNet return is what the grower receives after all production expenses have been accounted.

^bRepresents the average yield over 4 years of full production.

^cPrice represents gross return.

Organic Hops

Table 6 shows the annual costs and returns estimated for five years of organic aroma hop planting. The total production costs are estimated at \$14,753 per acre during mature production.

Given these costs, and holding all other variables constant, the break-even return required for organic aroma hops is \$10.25/lb, assuming a yield of 1,440 lb/acre.

Table 6. Estimated annual costs and returns of producing organic hops in standard trellis under drip irrigation.

	Year 1 (\$/acre)	Mature Production ^a	Comments and Notes
Estimated Production Level (lb/acre)			
Aroma	1,152	1,440	
Estimated Price (\$/lb)			
Aroma	\$11.46	\$11.46	
TOTAL RETURNS	\$13,201.92	\$16,502.40	
Variable Costs:			
Fertilizer and Leaf Feed	\$2,030.00	\$2,030.00	Includes N, P, K, S, Zn, and other plant nutrients
Chemicals	\$1,320.00	\$1,320.00	Includes all herbicides, pesticides, and fungicides (for powdery mildew control)
Consulting	\$0.00	\$0.00	Includes agricultural field consulting
Custom Hire	\$140.00	\$140.00	Includes custom spraying, harvesting, tractor work, etc.
Licenses, Fees, and Dues	\$220.00	\$220.00	Includes assessments, dues, licenses, inspection fees, royalties
Parts and Repairs	\$460.00	\$460.00	Includes equipment, trellis, irrigation, facilities
Fuel and Oil	\$180.00	\$180.00	Includes gasoline, diesel, lubricants, propane
Drying Fuel	\$84.00	\$80.00	
Irrigation Water	\$90.00	\$90.00	
Seasonal Labor	\$4,110.00	\$4,110.00	Includes health insurance, employer taxes, etc.
Supplies	\$380.00	\$380.00	Includes twine, clips, and packaging supplies
Interest on Operating Capital	\$225.35	\$225.25	5% of above variable costs × 6 ÷ 12 (6 months)
Total Variable Costs	\$9,239.35	\$9,235.25	
Fixed Costs:			
Depreciation Cost of Fixed Capital	\$1,021.61	\$1,021.61	Includes machine, equipment, shop, office, and irrigation infrastructure
Interest Cost of Fixed Capital	\$692.58	\$692.58	Includes machine, equipment, shop, office, and irrigation infrastructure
Insurance Cost	\$368.00	\$368.00	Includes property insurance, crop insurance, and liability insurance
Land and Property Taxes	\$77.00	\$77.00	\$70 per acre × 1.1 acres
Land Cost	\$675.00	\$675.00	\$15,000 per acre × 4.5%
Management	\$250.00	\$250.00	Includes benefits, social security, etc. for management personnel
Administration	\$170.00	\$170.00	Includes benefits, social security, etc. for administration personnel
Utilities	\$130.00	\$130.00	Cost of electricity and telephones
Overhead	\$30.00	\$30.00	Includes office supplies and professional services (attorney, accounting, etc.)

	Year 1 (\$/acre)	Mature Production ^a	Comments and Notes
Amortized Establishment Cost ^b		\$2,103.71	
Total Fixed Costs	\$3,414.19	\$5,517.90	
TOTAL COSTS	\$12,653.54	\$14,753.15	
NET RETURNS	\$548.38	\$1,749.25	

^aRepresents the remaining years that the hop plants are in full production (i.e., Year 2 to Year 5).

^bRepresents the cost incurred during the establishment years that must be recaptured during the mature production years in order for an enterprise to be profitable. It is calculated as accumulated costs during the establishment year and first year of production, minus the revenues during the first year. The net costs are then amortized at 4.5% for four years.

The break-even returns for organic aroma hops are shown for different levels of enterprise cost recovery in Table 7. The minimum return is \$6.41/lb to cover the operation's variable costs. The hop enterprise cannot profitably operate if this return is not realized. The second break-even return required to cover the total cash costs is \$6.95/lb. At this level, the enterprise will be financially viable in the short run. The third break-even return, \$7.66/lb, is needed to cover the cash costs plus depreciation costs of fixed capital, which will allow the hop enterprise to stay in business in the long run. The fourth break-even return is \$10.25/lb. When this return is realized, the grower can recover all out-of-pocket expenses and earn a competitive return on equity capital invested.

Table 8 shows the sensitivity of net returns to different levels of organic aroma prices and crop yields. The organic aroma hop enterprise is profitable in the majority of the assumed yield and price combinations. The net returns only become negative when the yield is 1,220 lb/acre, or when the yield is 1,440 lb/acre and the price received is about \$10/lb.

The main differences between the conventional and organic systems arise from the more expensive input costs in the latter. The top five variables that are more expensive in organic production than conventional production are fertilizers, custom hire, insurance, chemicals, and license fees (in that order). The combined costs of organic fertilizers and organic chemicals comprise 36% of the total variable costs and are two times higher than the aggregated costs of the same inputs in conventional hops.

Given the study's assumptions, results suggest that the production of conventional or organic aroma hops in the Pacific Northwest is economically profitable, provided that the price

received is more than the break-even price of \$8.17/lb for conventional aroma hops, or more than \$10.25/lb for organic aroma hops, given a yield of 1,440 lb/acre in either production system. Besides the break-even price, the size of the operation is also an important factor to consider in farmer decision-making because of the expensive investment outlay to establish and maintain a hop enterprise.

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 all hop operations in the Pacific Northwest. An interactive Excel workbook, described below, is provided to enable individual growers to estimate their returns based on the costs of their production.

Excel Workbook

The enterprise budgets (Table 3 and Table 6) as well as associated data underlying the per-acre cost calculations (detailed cost of fixed capital, calculation of salvage value and depreciation costs, and amortization calculator) are also made available in a spreadsheet format (Excel). The following Excel workbooks, the *2020 Cost Estimates of Establishing and Producing Conventional Hops in the Pacific Northwest* and the *2020 Cost Estimates of Establishing and Producing Organic Hops in the Pacific Northwest*, are available at the WSU School of Economic Sciences' [Crop Enterprise Budgets website](#). Owner-operators can modify select values and thus use these Excel workbooks to evaluate their own production costs and returns.

Table 7. Break-even return (\$/lb) of organic aroma hops for different levels of enterprise costs during mature production.

	Cost (\$/acre)	Break-even Return (\$/lb) ^a
1. Total Variable Costs	9,235.25	6.41 ^b
2. Total Cash Costs ^c		
= Total Variable Costs + Land & Property Taxes + Insurance Cost + Administration + Utilities + Overhead	10,010.25	6.95 ^d
3. Total Cash Costs + Depreciation Costs	11,031.86	7.66 ^e
4. Total Cost		
= Total Cash Costs + Depreciation Costs + Interest Costs ^f + Management Cost	14,753.15	10.25 ^g

Notes: Organic aroma yield (lb/acre) = 1,440. The price of organic aroma hops is \$11.46/lb.

^aBreak-even return is calculated as: cost divided by yield during mature production.

^bIf the return is below this level, hops are uneconomical to produce.

^cIf there are other cash costs on an individual's farm, these costs must be identified and included in the cash cost break-even return calculation.

^dThe second break-even return allows the producer to stay in business in the short run.

^eThe third break-even return allows the producer to stay in business in the long run.

^fInterest costs include some actual cash interest payments.

^gThe fourth 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 *plus* opportunity costs.

Table 8. Estimated net returns^a per acre of an organic hop enterprise at various prices and yields of organic aroma hops during mature production.

Yield (lb/acre) ^b	Price (\$/lb) ^c					
	\$9.96	\$10.26	\$10.56	\$10.86	\$11.16	\$11.46
1,220	-\$2,602	-\$2,236	-\$1,870	-\$1,504	-\$1,138	-\$772
1,440	-\$411	\$21	\$453	\$885	\$1,317	\$1,749
1,660	\$1,780	\$2,278	\$2,776	\$3,274	\$3,772	\$4,270
1,880	\$3,972	\$4,536	\$5,100	\$5,664	\$6,228	\$6,792
2,100	\$6,163	\$6,793	\$7,423	\$8,053	\$8,683	\$9,313

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

^aNet return is what the grower receives after all production expenses have been accounted.

^bRepresents the average yield over four years of mature production.

^cPrice represents gross return.

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