

Enterprise Budget

Small-Scale Commercial Hops Production in North Carolina

Gary Bullen, Department of Agricultural and Resource Economics, Extension Associate

Robert Austin, Department of Soil Science, Extension Specialist

North Carolina State University

INTRODUCTION:

This budget estimates the typical establishment and annual production costs of growing hops in North Carolina. Initial investment costs and annual expenses are provided for a 0.25-acre research hop yard located in Raleigh, North Carolina. The information in this publication is to serve as a general guide for hops production in North Carolina and is not intended to represent any single farm in particular. Costs and returns vary between farms and over time for any individual farm. The assumptions used in this analysis are intended to best represent small-scale hops productions in North Carolina, if not appropriate for your operation, modify and adjust the information to best fit your situation.

The specific objectives of this budget are to i) provide an accurate estimate of the initial investment costs, annual production costs, and break-even price for two common hop varieties; and ii) provide producers, stakeholders, and other interested parties with a tool to evaluate the profitability, cash flows, and risks associated with a well-managed hop enterprise in North Carolina.

The enterprise budgets presented in this analysis are developed for two different varieties of hops grown under a drip irrigation system. The choice of hops is based on overall yield, health, and potential for small-scale production in North Carolina. The hops presented are Cascade (aroma) and Zeus (bittering).

Hops are a perennial crop that require a significant investment in capital and labor before a crop is produced. These costs must be recovered in the hop yards productive years to become profitable.

The scope of this budget includes costs incurred from initial field preparation to harvest. Costs are divided into initial investment costs and annual expenses. Initial investment costs include the capital costs for trellis construction, planting, site preparation, irrigation setup, and equipment costs as well as the associated labor costs. The initial investment costs also include the annual expenses incurred in year one. Accordingly, the initial investment costs represent the total capital required to produce hops in year-one. Recurring costs beyond the initial establishment year are included in the annual expense report. Annual expenses include regular maintenance costs, cultural practice costs (fertilization, sampling, etc...), and yearly labor costs. Post-harvest operations such as drying, pelletizing, and packaging are outside the scope of this analysis. Currently, growers are limited to processing their hops on-site. As such, it is expected that costs associated with drying and pelletizing will vary greatly depending on existing farm resources and the method and materials used to dry and process the hops.

The assumptions underlying the enterprise budgets are explained in the sections below.

SOURCES OF INFORMATION:

The production costs, annual expenses, yields, and assumptions used in this budget analysis were identified and developed by a group of researchers, agronomists, and project personnel working closely with hops production in North Carolina. The inputs and expenses are considered typical for a small-scale (<1.0 ac) hop farm in North Carolina. The cost and quantity of items in the budget represent those incurred during the setup and management of a research hop yard in Raleigh, North Carolina. Capital

expenses are priced based on the 2010-2011 purchase prices from local farm and building supply stores. Labor costs are calculated based on the current Bureau of Labor rate for manual farm labor and include payroll tax withholdings. Both establishment and annual labor estimates are calculated based on the time recorded to perform each task by project staff.

BUDGET ASSUMPTIONS:

The following assumptions are used in the development of this enterprise budget:

- A hops trellis has a 20-year life.
- The lifespan of a hop plant is 10 years. Changing market demand for new varieties is the primary driver for hops replacement.
- The hourly rate for labor of \$9.75 is based on H2-A labor rate for manual farm labor.
- Wet hops average 75% moisture by weight; dry hops contain 10% moisture.
- Hops are hand harvested.
- Small-scale is considered less than 1 acre or 1000 plants.
- Average observed yields for two of the highest producing varieties in North Carolina are:

Variety	First-year production*	Established Production*
Cascade/Zeus	30-45 lbs dry	40-60 lbs dry
	120-175 lbs wet	150-200 lbs wet

Table 1: Average production observed for the two highest-yielding varieties studied during this project. *Numbers represent 200 plants on 0.25 acre.

Because hops are an experimental crop in North Carolina and realistic yields are under development, production numbers are presented as an average range. The production numbers represent yields recorded at the Raleigh and Mills River hops yards in the 2010 and 2011 growing seasons.

TRELLIS CONSTRUCTION

The construction costs presented are based on producing 200 hops plants on 0.25 acres of land using a short-trellis design. Differences in trellis design and configuration will result in various trade-offs in cost (labor and fixed), management, production, and cultural practices.

Short-Trellis System

The short trellis system used to develop this budget is constructed of thirty 6×6x16’ posts positioned 4ft in the ground. The 30 post are split into 10 rows of 3. Each row is spaced 10’ apart and consists of 3 posts spread 45 feet apart. The end posts are anchored on each side with 48" ground anchors, 12 gauge high-tensile fence wire, and pulled tight with spring-loaded fence tightners. The top wire is 3/8” galvanized aircraft cable (strand wire) connected to the end posts using 8" eyebolts. The bottom wire is 12 gauge high-tensile fence wire crimped to the end posts. The cable is looped and crimped around each eye bolt and protected from abrasion with plastic insulated tubing. The cost of materials to construct the short trellis was \$2097 with labor costs estimated at \$776. The total cost to build the short-trellis was \$2873. This represents 44% of the total initial investment cost (Table 2).

	Quantity	Unit	Cost	Total Cost	Useful Life	Annual Cost
Trellis Materials						
Posts (6"x6"x16')	30	post	\$ 38.50	\$ 1,155.00	20	\$ 57.75
3/8" 7x19 strand wire	1	1330' roll	\$ 380.00	\$ 380.00	20	\$ 19.00
12.5 GA high tensile wire	1	2000' role	\$ 59.95	\$ 59.95	20	\$ 3.00
Ground anchors (4ft)	20	anchor	\$ 10.49	\$ 209.80	20	\$ 10.49
Cable Clamps (3/8")	40	clamp	\$ 0.99	\$ 39.60	20	\$ 1.98
Wire crimps	1	jar	\$ 12.95	\$ 12.95	20	\$ 0.65
Eye bolts (3/8" x 6" Ga)	60	bolt	\$ 1.96	\$ 117.60	20	\$ 5.88
Fence Tightners	30	tightner	\$ 3.99	\$ 119.70	20	\$ 5.99
Washers	1	lb	\$ 1.59	\$ 1.59	20	\$ 0.08
Nuts	1	lb	\$ 1.89	\$ 0.95	20	\$ 0.05
<i>Total Trellis Materials Costs</i>				\$ 2,097.14		\$ 104.86
Trellis Labor						
Bob Cat and Auger Work	6	hour	\$ 9.70	\$ 58.20	20	\$ 2.91
Setting poles	18	hour	\$ 9.70	\$ 174.60	20	\$ 8.73
Ground anchor install	8	hour	\$ 9.70	\$ 77.60	20	\$ 3.88
Anchoring posts	14	hour	\$ 9.70	\$ 135.80	20	\$ 6.79
Top wire install	22	hour	\$ 9.70	\$ 213.40	20	\$ 10.67
Bottom wire install	12	hour	\$ 9.70	\$ 116.40	20	\$ 5.82
<i>Total Trellis Labor Cost</i>				\$ 776.00		\$ 38.80
Total Trellis Cost				\$ 2,873.14		\$ 143.66

Table 2: Costs associated with the construction of a quarter acre short-trellis.

PLANTING

The budget presented assumes 200 rhizomes are planted on 0.25 acre of land. The planting consists of 10 rows spread 10ft apart. Plants are spaced every 3.5 feet within each row. The initial planting cost including rhizomes, mulch, and labor for planting totaled \$781 for the yard, 12% the initial investment costs (Table 3).

	Quantity	Unit	Cost	Total Cost	Useful Life	Annual Cost
Planting Materials						
Rhizomes	200	rhizomes	\$ 2.00	\$ 400.00	15	\$ 26.67
Mulch	5	cubic yard	\$ 18.00	\$ 90.00	1	\$ 90.00
<i>Total Planting Material Costs</i>				\$ 490.00		\$ 116.67
Planting Labor Costs						
Planting	24	hour	\$ 9.70	\$ 232.80	20	\$ 11.64
Mulching	6	hour	\$ 9.70	\$ 58.20	20	\$ 2.91
<i>Total Planting Labor Costs</i>				\$ 291.00		\$ 14.55
Total Planting Cost				\$ 781.00		\$ 131.22

Table 3: Costs associated with planting 200 rhizomes on a quarter acre hop yard.

SITE PREPARATION

The costs associated with site preparation are largely dependent on the initial site conditions and available machinery. Included in this analysis are costs associated with the machinery, labor, and materials required to cultivate, incorporate, and adjust soil conditions before planting. The amount of lime and supplemental nutrients (e.g. P and K) is site dependent and determined by soil samples collected before planting. At the research hop yard the land was cultivated using a 40HP tractor with disk setup. Soil amendments are incorporated during disking. Costs for the tractor and tillage equipment were estimated using the custom rate for each site preparation operation. The size of the hop yard in this study could not justify charging full ownership cost for any machinery for the project. It was assumed that any equipment would not be bought but rented and was estimated based on custom rental basis. Including labor, site preparation was \$247 for the hop yard, 4% of the total initial invest costs (Table 4).

	Quantity	Unit	Cost	Total Cost	Useful Life	Annual Cost
Land Preparation						
Disc	1	acre	\$ 15.00	\$ 15.00	20	\$ 0.75
Drill Post Holes	1	day	\$ 175.00	\$ 175.00	20	\$ 8.75
Fertilizer	1	50 lb bag	\$ 23.00	\$ 23.00	20	\$ 1.15
Lime	4	40 lb bag	\$ 5.49	\$ 5.49	20	\$ 0.27
<i>Total Land Preparation Costs</i>				\$ 218.49		\$ 10.92
Land Preparation Labor						
Disking Field	2	hour	\$ 9.70	\$ 19.40	20	\$ 0.97
Liming Field	1	hour	\$ 9.70	\$ 9.70	20	\$ 0.49
<i>Land Preparation Labor Costs</i>				\$ 29.10		\$ 1.46
Total Land Preparation Cost				\$ 247.59		\$ 12.38

Table 4: Costs associated with preparing the land for a quarter-acre hop yard.

IRRIGATION SYSTEM

Water is applied at the hop yard using a drip irrigation system. The irrigation design presented in this budget is considered representative of those used by small-scale hops growers in the state. Differences in installation costs will present primarily due to the various source, availability, and delivery of on-site water. The source of the water for the short-trellis system is a 2500 gallon cistern. The cistern is filled on site and on an as-need basis from an adjacent farm pond. The water is distributed to the hop yard using a 1 HP pump. The irrigation system is designed with a 1" mainline that 'T's off into individual rows. Water is supplied down the rows using 3/4" polyethylene drip tubing fastened to the 12 gauge high tensile bottom wire with UV resistant zip ties. Water is supplied at each plant using pressure compensating drip emitters. The cost of materials for the irrigation setup totaled \$1,983 for the quarter acre yard, approximately \$1300 (~70%) went toward the on-site water storage cistern. The labor to set the irrigation system was estimated at \$310, with a total irrigation setup cost of \$2293. This represents 35% of the total initial investment cost (Table 5).

	Quantity	Unit	Cost	Total Cost	Useful Life	Annual Cost
Irrigation Materials						
Mainline (10' 3/4" PVC)	10	section	\$ 2.10	\$ 21.00	20	\$ 1.05
Laterials (1/2" poly)	1	1000' roll	\$ 120.00	\$ 120.00	10	\$ 12.00
PVC Fittings (risers)	40	fitting	\$ 0.49	\$ 19.60	10	\$ 1.96
Poly Tube Fittings	10	fitting	\$ 0.54	\$ 5.40	10	\$ 0.54
Irrigation Pump (1 HP)	1	pump	\$ 280.00	\$ 280.00	5	\$ 56.00
Pump Fittings	4	fittings	\$ 8.00	\$ 32.00	10	\$ 3.20
Pressure regulator	1	fitting	\$ 12.50	\$ 12.50	5	\$ 2.50
Mesh Filter	1	filter	\$ 18.00	\$ 18.00	1	\$ 18.00
Cistern (2500 gallon)	1	cistern	\$ 1,324.95	\$ 1,324.95	20	\$ 66.25
Drip emitters (500 total)	2	bag	\$ 62.50	\$ 125.00	5	\$ 25.00
Zip ties (1000 ties)	1	bag	\$ 24.50	\$ 24.50	5	\$ 4.90
<i>Total Irrigation Material Costs</i>				\$ 1,982.95		\$ 191.40
Irrigation Labor						
Dig mainline trench	3	hour	\$ 9.70	\$ 29.10	20	\$ 1.46
Install mainline and	15	hour	\$ 9.70	\$ 145.50	20	\$ 7.28
Zip tie laterials	4	hour	\$ 9.70	\$ 38.80	20	\$ 1.94
Install Drip emitters	7	hour	\$ 9.70	\$ 67.90	20	\$ 3.40
Cistern and Pump setup	3	hour	\$ 9.70	\$ 29.10	20	\$ 1.46
<i>Irrigation Labor Cost</i>				\$ 310.40		\$ 15.52
Total Irrigation Cost				\$ 2,293.35		\$ 206.92

Table 5: Costs related to the installation of a drip-irrigation system on a quarter-acre hop yard.

LABOR

The field work can be done by owner or employees or combination of the two. If the labor is all done by owner this budget still includes a labor charge to reflect the cost of hiring someone, and/or the value of the owner's time. In this study, a general labor rate of \$9.70 is assumed. This is the H2-A labor rate for

general farm labor. Field labor includes tasks such as stringing, training, and pruning as well as the majority of harvest related activities. Although not included in this analysis, experienced labor at a higher rate should be anticipated for machinery and equipment operation. The total cost of labor to setup and install the short trellis, including irrigation and planting, totaled just over \$1,400 (145 hours).

Short-Trellis Labor

Of the \$1,400 in total labor costs, \$780 is associated with the construction of the quarter acre short-trellis. Eighty hours of general field labor were required to auger post holes, set posts, install ground anchors, and secure the top and bottom wires (Table 2). Due to the relatively smaller post size, posts were installed manually without the need of tractor assistance. Just over 30 hours of labor were required to setup the irrigation system (Table 5). The planting and mulching of the 200 hop plants required an additional 30 hours (Table 3). In total, 140 hours of general field labor were required to setup the short-trellis hop yard.

TOTAL INITIAL INVESTMENT COSTS

The total costs for land preparation and establishment is \$6,504.83. The total establishment cost is amortized over estimated useful life of the items, these costs are divided equally over the harvest years. The total establishment cost of \$6,504 is estimated to have an annualized cost of \$494. The annualized cost is included in the annual cost of production fixed cost category (Table 7).

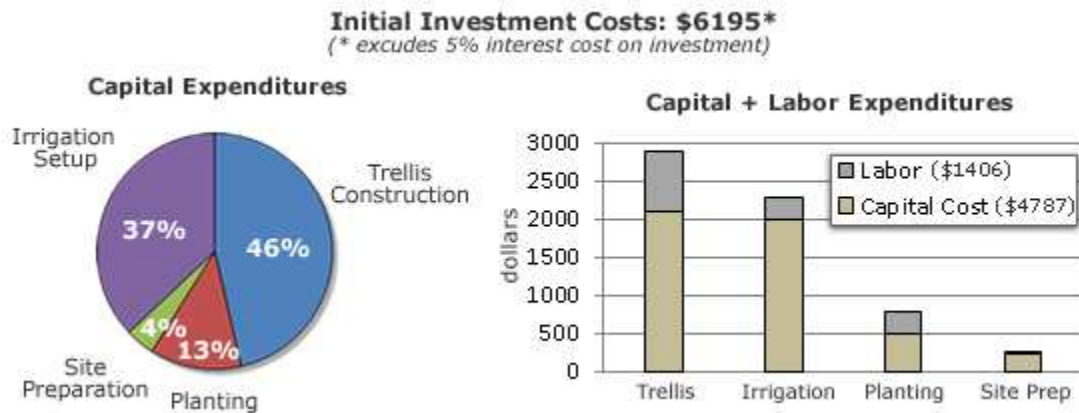


Figure 1: Percent and proportion of initial investment costs related to capital expenditures (left) and capital expenditures plus labor (right).

ANNUAL PRODUCTION EXPENSES

The annual budget is divided into two categories; operating and fixed. The first category is operating, or variable costs, and are those costs which change based on the amount of use. Variable costs include chemicals, hired labor, repairs, and fuel. Annual expenses include the costs associated with cultural practices such as fertilization, sampling, and chemicals, in addition to the yearly maintenance and labor costs. Maintenance costs include expenses associated with trellis upkeep and irrigation repair. These expenses represent an average yearly cost over the life of the system. Maintenance costs will vary between years and on trellis design and irrigation setup. Labor cost including production and harvest labor is estimated to be \$2137 which represents 64% of the total cost of production. Annual cultural costs are estimated to be \$342 for the 0.25 acre site (Table 6).

	Quantity	Unit	Cost	Useful Life	Annual Cost	Total
Operating Costs						
Cultural						
Baler Twine (sisal)	1	2500' roll	37.95	1	\$37.95	\$ 37.95
Fertilizer	2	50lb bag	\$23.00	1	\$23.00	\$ 46.00
Herbicide	1		\$28.00	1	\$28.00	\$ 28.00
Pesticide	1		\$37.00	1	\$37.00	\$ 37.00
Fungicide	1		\$42.00	1	\$42.00	\$ 42.00
Tissue Analysis	5	samples	\$7.00	1	\$7.00	\$ 35.00
Mulch	5	cubic yard	\$18.00	1	\$18.00	\$ 90.00
Fuel	7	gallon	\$3.75	1	\$3.75	\$ 26.25
Lime	1	40lb bag	\$5.49	3	\$1.83	\$ 5.49
Lab Testing (<i>alpha/beta acids</i>)	2	samples	\$35.00	1	\$35.00	\$70.00
<i>Total Cultural Costs</i>						\$ 342.20
Production Labor						
Pre-emergent	1	hour	\$9.70	1	\$9.70	\$ 9.70
Stringing	12	hour	\$9.70	1	\$116.40	\$ 116.40
Training/Initial Pruning	18	hour	\$9.70	1	\$174.60	\$ 174.60
Stripping Leaves	30	hour	\$9.70	1	\$291.00	\$ 291.00
Fertilizing	1	hour	\$9.70	1	\$9.70	\$ 9.70
Mulching	6	hour	\$9.70	1	\$58.20	\$ 58.20
Mowing	16	hour	\$9.70	1	\$155.20	\$ 155.20
Weeding	24	hour	\$9.70	1	\$232.80	\$ 232.80
Spraying	12	hour	\$9.70	1	\$116.40	\$ 116.40
Pruning	36	hour	\$9.70	1	\$349.20	\$ 349.20
Soil Testing	2	hour	\$9.70	1	\$19.40	\$ 19.40
<i>Total Production Labor Costs</i>						\$ 1,503.50
Trellis and Irrigation Maintanc						
Flush lines	1	hour	\$9.75	1	\$9.75	\$ 9.75
Repairs	2	hour	\$9.75	1	\$19.50	\$ 19.50
Replace emitters	2	hour	\$9.75	1	\$19.50	\$ 19.50
Misc. trellis repairs	1	hour	\$9.75	1	\$9.75	\$ 9.75
<i>Total Maintance Costs</i>						\$ 48.75
Harvest Labor						
Picking	60	hour	\$9.75	1	\$585.00	\$ 585.00
<i>Total Harvesting Costs</i>						\$ 585.00
Total Variable Cost						\$ 2,479.45

Table 6: Annual Operating costs associated with a quarter-acre hop yard in North Carolina.

Fixed costs are the costs that incurred whether you produce any hops that year. Fixed costs include amortized establishment cost, taxes, insurance, and land. Land charge is estimated at a rental rate of \$75 per 0.25 acre. An overhead cost is estimated at 8% for the total variable costs to produce hops. Total fixed costs are estimated to be \$868 for the site (Table 7).

Fixed Costs					
Amortized Establishment Cost					\$ 494.17
Taxes & Insurance					\$ 100.00
Land Charge					\$ 75.00
Overhead	\$2,479.45		8%		\$ 198.97
Total Fixed Costs					\$ 868.14

Table 7: Annualized fixed costs associated with a quarter-acre hop yard in North Carolina.

The total cost of production is estimated to be \$3,347 (Table 8)

Total Variable Cost	\$ 2,479.45
Total Fixed Costs	\$ 868.14
Total Costs	\$ 3,347.59

Table 8: Total cost of producing 200 hops on a quarter acre of land in North Carolina.

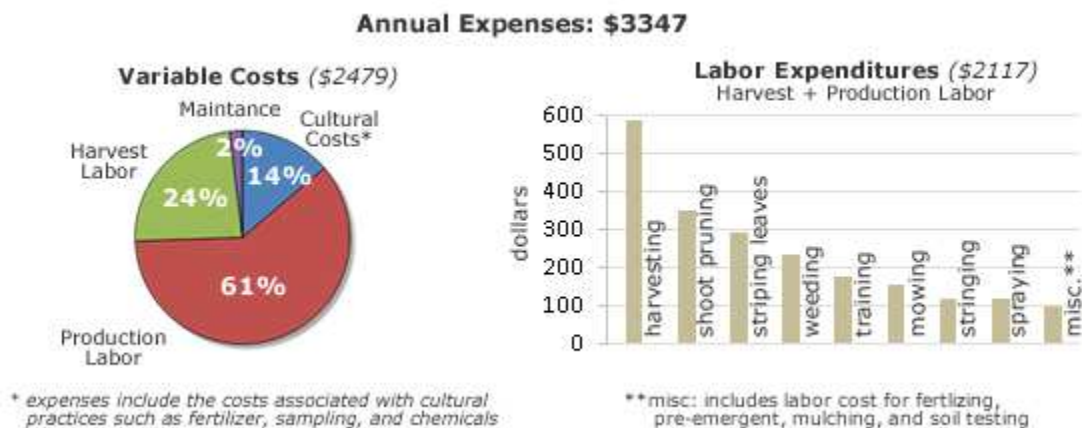


Figure 2: Percent of operating costs by category (left) and annual labor expense split by seasonal task (right).

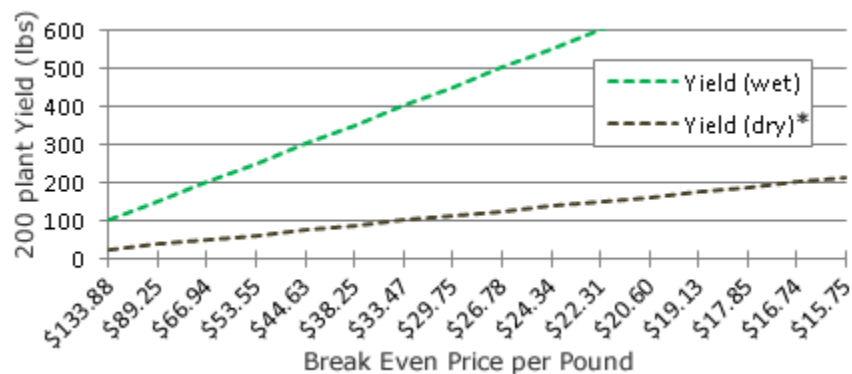


Figure 3: Breakeven-price versus yield for both wet and dry hops. This graphs assumes production of 200 plants on a quarter acre hop yard in North Carolina.

*Budget does not include the cost to dry and process dry hops.