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Economic Analysis of Hops Production on an Established Grape Trellis in Arkansas

Lizzy Herrera
Program Associate
Horticulture

Amanda McWhirt
Extension Specialist
Horticulture

Michael Popp
Professor
Agricultural Economics
and Agribusiness

Jennie Popp
Associate Dean
Agricultural Economics
and Agribusiness

Renee Threlfall
Research Scientist
Dept. of Food Science

Aaron Cato
Extension Specialist
Horticulture

Introduction

This factsheet analyzes economic considerations of diversifying a vineyard operation with small-scale hops production in Arkansas. The work was conducted by the University of Arkansas (UA) System Division of Agriculture. The following analysis should be used only as a guide when preparing your own budgets and estimating returns, as results will vary by operation. This analysis is based on integrating a new hopyard into an established grape vineyard, so this budget is best suited for established farm operations. New operations will have additional start-up and establishment costs to consider that are not included in this budget.

Figure 1. Hopyard established on a modified grape trellis at the UA System Fruit Research Station in Clarksville, AR.

Budget Assumptions

This enterprise budget is based on the following assumptions and production practices:

Hops growing site

A study evaluating hops production was conducted at the UA Agricultural Experiment Station's Fruit Research Station in Clarksville, Arkansas from 2018-2021. The hopyard was planted on the end row of a 7-acre vineyard that used a single curtain grape trellis system (Figure 1). The trellis system for that row was modified for hops production since it has been shown that grape trellises can be easily modified to support hops plants (Kneen 2003).

The labor, costs, and yields we present in this factsheet are derived from the results of this experiment of growing hops on 135-linear row feet of a modified grape trellis, and include the assumption that the hopyard will produce over a 20-year period. For this budget, we took our costs and labor data and extrapolated to an operation producing hops on 1,000 linear row feet (about 0.09 acre) with the assumption that the operation is arranged with five 200-linear-feet rows. Our estimates determined that 1,000 row feet is approximately the minimum acreage a grower would want to plant to justify the amount of time and cost needed to manage a small-scale hops operation in Arkansas.

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Plant Establishment Costs

Site preparation

Before planting, it is important to test the soil to determine any nutritional deficiencies and to verify the soil pH and other essential nutrients. One composite soil sample is recommended for 20 acres or less if the site is uniform. Multiple samples may be required for operations larger than 20 acres (USDA NRCS 2002). Soil testing in Arkansas is free and can be obtained through your local Cooperative Extension Office (find your county office at www.uaex.uada.edu).

The soil pH should be amended to 6.0-6.5 for hops production. For most soils in Arkansas this may require the application of lime to raise the soil pH, which should be applied at least six months before planting. For 1,000 linear row feet, we made one 11-pound application of 15-15-15 ($8.80) to amend the soil prior to planting the hops in the fall (Table 1). The cost of pre-plant fertilizers will vary by the source needed for your soil and location (Ha et al. 2017).

Trellising

Hops plants are vigorous perennials, reaching 15 to 20 feet in a single season and producing for 25 years or more. This type of growth requires strong support from a trellis (Kaiser and Ernst 2019). The most common trellis for small-scale production is known as the "I" or "In-line V". A single high-wire grape trellis can easily be modified into either of these types of hops trellises (Figure 2). To increase the trellis height, 4-inch x 4-inch x 12-foot wooden posts ($14.88 ea.) are added to each existing trellis pole every 15 feet. For 1,000 linear feet of grape trellis, we estimated a need of 67 posts (Table 1). The addition of the wooden posts allows the height of the top wire to reach 12 feet, which is considered a low trellis compared to the commercial standard of 18 feet or higher (Richardson 2011). These 4x4 posts were secured with 1/2-inch bolts ($3.66 ea.), with two bolts per post. For additional support, 67 five-foot bracing steel t-posts ($4.29 ea.) were added to each modified trellis pole. We also added 11-gauge wire ($157.50/2,500-ft.) along the top of the trellis, which required some hardware, including a hand winch ($29.41 ea.). The hand winch allows the top wire to be lowered or tightened. We estimated that five hand winches would be needed for five rows of 200-linear row feet of trellising. For more information on trellising and other aspects of hops production in Arkansas, refer to our factsheet FSA6156: "Hops Production in Arkansas" (McWhirt et al. 2021).

Planting

For 1,000 linear row feet, around 400 hops plants ($10.95/ plug plant) will be needed if planted at a 2.5-foot between plant spacing. Plant spacing will vary depending on the cultivar and trellising system, but generally a spacing of 2.5-3.0 feet will be standard (McWhirt et al. 2021). From our preliminary cultivar trials comparing Cascade, Nugget, CTZ, Cashmere, Centennial, and Crystal, we recommend planting Cascade or CTZ (Zeus) in Arkansas. This recommendation is based on our observations of plant vigor and yield of these cultivars.

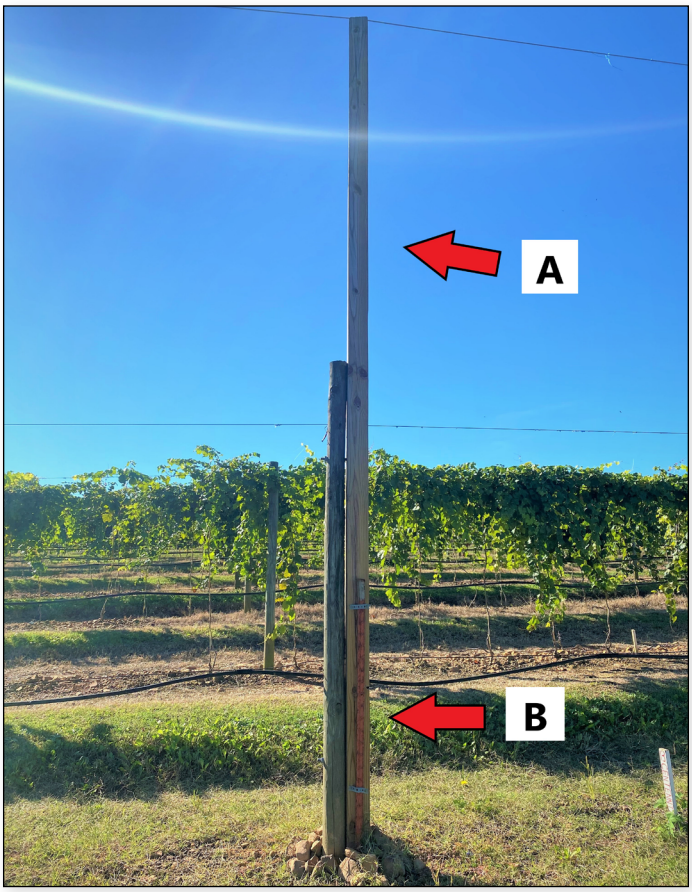

Figure 2. Modifications to a grape trellis to create a 12-foot high hops trellis using A) 4-in. x 4-in. x 12-ft. wooden posts and B) 5-foot bracing t-posts added next to existing posts (UA System, Clarksville, AR).

Harvest Equipment

For small-scale hops operations, cones may be harvested by hand. For hopyards exceeding one acre of production, investment in a mechanical harvester should be considered as a means to reduce labor costs (Ha et al. 2017). Small-scale mechanical harvesters' range widely in price but start at about $10,000.

Hop cones are generally produced in the first summer following a fall planting. Yields will generally increase each year over the first five years, as the crowns establish and increase in size. For harvest, hops bines are cut flush at the ground and then removed from the trellis using 10-foot ladders ($250.49 ea.). For the first year, it's recommended to not cut the bines down for harvest to allow the bines to continue to feed the crown. It may be advisable in the first year to remove the cones by hand for harvest while the bines are still on the trellis if the yield and plant vigor are low. Be aware that harvesting while the plants are still on the trellis will also be more labor intensive (McWhirt et al. 2021). After the first year, bines can be

cut down for harvest. In our experience, once cut, the bines can be placed on 6-foot-long tables ($44.99 ea.) where the cones are removed by hand and placed into 5-quart buckets ($3.48 ea.).

Post-Harvest Equipment

Generally, hops are sold as whole, dried cones or in a pelletized dry form. However, for local markets in Arkansas, there is also the opportunity to sell whole, fresh (wet) hops cones for certain styles of beer. This would be especially beneficial for small-scale operations, as they could and save on processing costs such as pelletizing and drying. However, demand for wet hops is likely to be limited and producers should be prepared to dry and package most of their own hops in preparation for sale.

The walk-in dehydrator ($1,440.75/unit) was built from a converted storage unit near the hopyard to limit quality loss of the cones after harvest. For a detailed guide on how the dryer was constructed, refer to our factsheet FSA-6157 "Constructing a Walk-In Dehydrator for Drying Hops" (Herrera et al. 2021). There are other ways to construct a dryer or dry hops, such as with a food dehydrator ($529.99/unit). The most suitable method will depend on the scale of your operation (Moorhead 2017).

To increase the longevity of stored hops, we recommend that the cones be vacuum-sealed ($2,399/unit). The preserved hops can then be stored in the refrigerator. However, the most ideal method for long-term storage of vacuum-sealed hops is in a freezer ($764/unit), as the low temperatures decrease the rate of deterioration (Ha et al. 2017; Ackley 2018). The method used for drying and packaging hops may vary depending on the size and specific circumstance of your operation, which will impact the final cost.

Irrigation

Hops require consistent watering to support their rapid growth. Drip irrigation is recommended for hops as it helps keep foliage dry and provides direct moisture to the soil, which is well suited for hops shallow root system (McWhirt et al. 2021). Since our hopyard was incorporated into an existing grape row, an elevated drip irrigation system was already installed with no modifications necessary to irrigate the hops. The estimated cost of installing a new drip irrigation system for a hopyard is $1,120.50 per 1,000 linear row feet, which includes the cost of materials and installation (USA Hops 2021a).

Establishment Cost Considerations

The initial investment cost in a hop operation's first year is high ($11,812.28). This includes the cost of site preparation, trellis construction, and purchasing equipment (Table 1). An advantage to converting from an existing grape trellis is the ability to use a pre-existing irrigation and trellis system, which reduces start-up costs. The hops plug plants ($4,380) made up most of the establishment cost, averaging $10.95 per plant. The cost of hops plugs will vary depending on the source and cultivar selected and may range between $10 to $15 per plug plant (Great Lakes Hops 2022). Growers are encouraged to buy high quality plants as they are worth the investment in the long-term.

Operating Costs

After initial plant establishment costs, there will also be recurring operating and production costs that are ongoing for the life of the planting.

Fertility

Annual soil nutrient monitoring (free through the Cooperative Extension Service) and plant tissue nutrient monitoring ($20 ea.) is needed to maintain high hops yields (Table 1). Soil and plant tissue nutrient sampling will help determine your hopyard's annual nutritional needs, with nitrogen monitoring being the most essential. We recommend annually applying approximately 75 pounds per acre each of nitrogen, phosphorus and potassium in a split-application, and to increase the amount applied based on yield (Gingrich et al. 2000). As hops are still a new crop in Arkansas, fertilizer rates are being evaluated. We recommend using a standard rate of 50 pounds of 13-13-13 per year ($36.73). The timing of fertilizer applications should coincide with the plant's rapid early growth in May and June (McWhirt et al. 2021).

Trellising

Three bines should be selected per plant to train to the top wire. In our experience, jute twine begins to break down mid-season and does not work well for training bines. We recommend using about 15,000 feet of synthetic twine ($24.99/20,000-ft roll), secured with 2,000 landscape staples ($129.06) to ensure integrity throughout the season.

Pest and Weed Management

Scout weekly to determine if pests are in your hopyard and to quickly respond to outbreaks. In our experience, fungal diseases, spider mites and caterpillar pests will be regular disease and insect issues on hops in Arkansas. Controlling weeds will also be important to maintain good plant growth and reduce pest issues. We estimate that on average seven fungicide applications, three herbicide applications, two insecticide applications and two miticide applications will be required per year in Arkansas. Your local conditions may require additional or fewer applications depending on the pest pressure in your area.

We estimate the total annual cost of applications of fungicides ($11.06), herbicides ($2.25), insecticides

Table 1. Establishment and operating costs of producing hops over a 20-year period on 1,000 linear row feet on a converted grape trellis in Arkansas.

	Qty	Unit	Price/ Unit ($)	Y1	Y2	Y3	Y4	Y5	Y6	Y20
Plant Establishment Costs										
Site Preparation										
Soil sample analysis	1	test	$0.00	$0.00						
Pre-plant fertilizer	11	lbs.	$0.80	$8.80						
Trellising										
8-ft wooden posts	67	item	$14.88	$996.96						
Bolts	134	each	$3.66	$490.44						
Steel posts	67	each	$4.29	$287.43						
11-gauge wire	2,500	Foot	$0.06	$157.50						
Hand winch	5	item	$29.41	$147.05						
Planting										
Hops plants	400	plug	$10.95	$4,380.00						
Harvest Equipment										
Ladders	2	item	$250.49	$500.98						
Tables	3	item	$44.99	$134.97						
Buckets	30	item	$3.48	$104.40						
Post-Harvest Equipment										
Dryer	1	unit	$1,440.75	$1,440.75						
Vacuum sealer	1	unit	$2,399.00	$2,399.00						
Chest freezer	1	unit	$764.00	$764.00						
			Subtotal	**$11,812.28**						
Operating Costs										
Fertility										
Soil sample analysis	1	test	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tissue sample analysis	1	test	$20.00	$20.00	$20.49	$20.93	$21.38	$21.84	$22.33	$30.38
Trellising										
Fertilizer	45.91	lbs.	$0.80	$36.73	$38.24	$37.84	$37.98	$38.19	$3838	$43.51
Synthetic twine	1	20,000-ft roll	$24.99	$24.99	$25.50	$26.03	$26.55	$27.11	$27.71	$37.01
Landscape staples	2,000	each	$0.06453	$129.06						
Pest Management										
Fungicides	7	app.	$1.58	$11.06	$11.29	$11.40	$11.54	$11.67	$11.82	$14.22
Herbicides	3	app.	$0.75	$2.25	$2.29	$2.33	$2.37	$2.40	$2.44	$3.08
Insecticides	2	app.	$2.83	$5.66	$5.77	$5.86	$5.97	$6.08	$6.19	$7.94
Miticides	2	app.	$4.68	$9.36	$9.54	$9.70	$9.87	$10.05	$10.23	$13.13
Harvest & Post-Harvest										
Paper grocery bags	1,000	each	$0.20362	$203.62	$207.77	$212.07	$216.29	$220.91	$225.79	$301.55
Vacuum seal pouches	1,000	each	$0.23966	$239.66	$244.55	$249.60	$254.58	1$260.01	$265.75	$354.92
Estimated Utility Costs										
Electricity usage	1,148.0	kWh	$0.078	$89.54	$197.63	$281.73	$388.26	$469.83	$477.00	$606.57
Water usage	22,500	Gal	$0.005	$112.50	$115.39	$117.36	$119.09	$120.73	$122.58	$155.87
			Subtotal	**$884.43**	**$878.44**	**$974.85**	**$1,093.87**	**$1,188.81**	**$1,210.22**	**$1,568.19**
GRAND TOTAL				**$12,696.71**	**$878.74**	**$974.85**	**$1,093.87**	**$1,188.81**	**$1,210.22**	**$1,568.19**

($5.66) and miticides ($9.36) to total $28.33 per year. Note that the cost per year only considers the amount needed to for 1,000 linear row feet. The actual cost to apply these products will likely be higher, as tank mixing requires more product.

The pesticide costs in our example are based on the following pesticide groups, but costs will vary depending on the specific circumstances of your operation. Contact your local county Cooperative Extension Service for local recommendations.

- FRAC Groups 4, 21, and 40 fungicides (mefenoxam, cyazofamid and dimethomorph)
- WSSA Groups 1 and 3 herbicides (clethodim and pendimethalin)
- IRAC Group 28 insecticide (chlorantraniliprole)
- IRAC Group UN acaricide (bifenazate).

This estimate only accounts for the amount of the pesticide used in the first year. When purchasing market-ready quantities of pesticides, initial costs are estimated to be $1,256.60 and include fungicides ($680.85), pre-emergent ($119.95) and post-emergent ($69.95) herbicides, insecticides ($249.95) and miticides ($135.90). We model cash flow on the basis of use assuming the vineyard will also need some of these products to control similar pests in the vineyard.

Harvest & Post-Harvest

The hops cones in this study were dried and vacuum-sealed on site at the Fruit Research Station. After harvest, the hops were stored in paper grocery bags ($203.62/1,000 bags) and placed inside of the walk-in dehydrator. It is recommended that the cones be placed into vacuum pouches ($239.66/1,000 pouches) once dried.

Utility Costs

The estimated electric ($0.078/kWh) and water ($0.005/gal) utility costs for 1,000 linear row feet of hops assumes that drip irrigation was used, the chest freezer was used all year and the dryer was only used during the harvest period (about 2 months). A total of 1,148 kilowatt hours (kWh) per season were estimated with the assumption that 15 pounds of wet hops take 20 hours to dry. Drip irrigation water consumption (22,500 gal) was calculated based on the plant's need for one inch of water per week over the growing period (16 weeks). The estimated number of gallons needed for irrigation also considers rainfall, which for Arkansas is estimated to be four to five inches per month. Utility consumption and price will vary based on the equipment used, water source (well, city water, etc.) and annual rainfall for your location.

For year one, the estimated annual operating costs for 1,000 linear row feet totals $884.43, which consists of production ($210.78), pest management ($28.33), harvest and post-harvest ($443.28), and utility costs ($202.04). The annual operating costs increase in years two ($878.44), three ($974.85), four ($1,093.87), and five ($1,188.81) based on yield and other factors. For years 6 to 20, the costs were inflated from $1,210.22 (Year 6) to $1,568.19 (Year 20) based on the estimated inflation rates from the University of Missouri Food & Agricultural Policy Research Institute's U.S. Agricultural Market Outlook (FAPRI-MU 2021)

Labor Expenses

Assumptions: During three years of our research trial, we recorded labor hours spent on various tasks. These estimates are derived from that data. Labor is a major input cost in many specialty crops, and growers are advised to compare these numbers to their own experiences on their farm as some tasks may take more or less time depending on the skills of the labor available.

The hourly labor rate for year one ($11.33/hour) is based on the Arkansas H-2A rate for manual farm labor (Mobile FarmWare 2021). For years two ($11.71/hour), three ($12.11/hour), four ($12.50/hour) and five ($12.90/hour), the wages were inflated based on the wage inflation rate from the U.S. Agricultural Market Outlook (FAPRI-MU 2021). Using the H-2A labor rate in our estimate provides a minimum estimate to what a grower may expect to spend, assuming they pay above minimum wage, which in Arkansas is currently $11.00. This cost does not include other costs associated with hiring H-2A labor (including travel or housing) but is intended only as a baseline to account for the hours spent doing many labor-intensive tasks by hand. Note that fertilizing, weeding and harvesting were done by hand in our trial, and all pesticides except for herbicides were applied using a backpack sprayer. For this budget, we assumed many of these tasks would be done using tractors or other mechanized equipment, as that type of equipment is more commonly used.

The total labor cost for managing 1,000 linear row feet in year 1 was high, starting at $5,591.36 (Table 2), which is to be expected for the establishment year of a crop. We attribute this to the field preparation and trellis construction (160 hrs.), planting (8 hrs.) and harvesting (200 hrs.). As previously mentioned, the labor cost for harvesting would be expected to be high in year 1, as the cones likely will be harvested while the bines were still on the trellis.

In year 2, the estimated labor cost decreased to $3,049.27 (Table 2). The ability to cut the bines from the trellis for harvest reduced the labor time from 200 to 132 hours. The majority of the activities such as stringing (37 hrs.), fertilizing (8 hrs.), weeding (12 hrs.), pruning and training (51 hrs.) and pesticide application (10.5 hrs.) are estimated to take relatively the same amount of time each year. Note that the labor hours for pesticide application is based only on the estimated application time for the hops and not the entire operation. If you plan on producing hops organically or miss an herbicide application, the labor cost may increase.

Harvest labor costs are projected to increase each year as the plants establish and yields increase, resulting in more cones to harvest and process. Overall, we estimate that harvesting would be the highest labor cost each

Table 2. Estimated labor hours and cost of managing a hopyard on a 1,000-row foot converted grape trellis in Arkansas.

Activity	Year 1		Year 2		Year 3		Year 4		Year 5	
	Hrs	*Cost ($11.33/hr)[a]*	*Hrs*	*Cost ($11.71/hr)[b]*	*Hrs*	*Cost ($12.11/hr)[b]*	*Hrs*	*Cost ($12.50/hr)[b]*	*Hrs*	*Cost ($12.90/hr)[b]*
Trellis Construction and Field Preparation	160	$1,812.80	-	-	-	-	-	-	-	-
Planting	8	$90.64	-	-	-	-	-	-	-	-
Stringing	37	$419.21	37	$433.10	37	$447.92	37	$462.37	37	$477.15
Fertilizing	8	$90.64	8	$93.64	8	$96.85	8	$99.97	8	$103.17
Weeding	12	$135.96	12	$140.47	12	$145.27	12	$149.96	12	$154.75
Pruning and Training	51	$577.83	51	$596.98	51	$617.41	51	$637.37	51	$657.69
Pesticide Application	10.5	$118.97	10.5	$122.91	10.5	$127.11	10.5	$131.21	10.5	$135.41
Harvesting	200	$2,266.00	132	$1,545.12	196	$2,372.78	264	$3,299.04	332	$4,281.46
Drying and Packaging	7	$79.31	10	$117.05	12	$145.27	15	$187.45	18	$232.13
GRAND TOTAL	494	$5,591.36	261	$3,049.27	327	$3,952.62	398	$4,967.31	469	$6,041.77

[a] Hourly (Hrs) rate based on the 2019 adverse effect wage rates for H2-A labor *(Mobile FarmWare 2021)*

[b] Hourly rate inflated from previous year based on wage inflation rates from the U.S. Agricultural Market Outlook *(FAPRI-MU 2021)*

year, especially if done by hand. Growers should consider whether a mechanical harvester is a wise investment for their respective farms. Factors to consider are initial cost, expected wage rate inflation, loan term, and quality differences in harvested cones that may impact price received.

Yield

We estimate that a hops plant will produce 20 percent of its mature yield in the first year and steadily increase until the plant reaches maturity (around year 5) (Ha et al. 2017; McWhirt et al. 2021). The yield data we collected from our trial of Cascade and Zeus (CTZ) hops grown on 135-linear row feet and extrapolated for 400 hops plants grown on 1,000 linear row feet provided the following yield estimates. We estimated the dry weights presented in Table 3 based on the assumption that the cones were dried to a moisture content of around 10%, which is the standard.

As expected, yields were low in year 1, with an estimated weight of 40 pounds of dry hops per 1,000 linear row feet and steadily increased in years 2 and 3. Based on the yield data collected in years 1-3, we project that yields would continue to increase in years 4 and 5 as is typical in other growing regions. Year 5 is estimated to be the mature yield of the hopyard at 268 pounds of dry hops per 1,000 linear row feet. Note that yields will vary by location due to environmental conditions and plant productivity. Additionally, canopy management and training additional bines may impact yield.

Net Present Value (NPV) Sensitivity Analysis

The purpose of a NPV sensitivity analysis is to determine the profitability of an investment by looking at the annual expenses and cash flows, as well as discount rates, or the rate of return an investor

Table 3. Wet (fresh) and dry hops cone yield estimates (lbs.) for 400 hops plants grown on 1,000 linear row feet over a 5-year period on a converted grape trellis in Arkansas.

Yield (lbs./1,000 ft.)	Year 1	Year 2	Year 3	Year 4	Year 5
Wet Weight	400	1,040	1,520	2,120	2,680
Dry Weight	40	104	152	212	268

[a] Years 4 and 5 yields are projected based on the data from years 1-3; dry weight based on 10% moisture content.

expects to make. The net present value is the sum of the net cashflow in today's dollars over a period of time. Positive values indicate a profitable investment (Singerman et al. 2019). In this analysis of 1,000 linear row feet of hops in Arkansas, the NPV was calculated over a period of 20 years using a discount rate of 10 percent and estimated inflation rates from the U.S. Agricultural Market Outlook (FAPRI-MU 2021).

Expenses

Table 4 provides a breakdown of the estimated production and labor expenses as well as annual loan payments over a 20-year term to repay first-year establishment costs at an interest rate of 5.5 percent (Table 4). Growing hops, whether starting new or in an established operation, results in first-year cash expenses of $7,717. The total expenses decrease in year two ($5,169) and steadily increase in years three ($6,169), four ($7,303) and five ($8,472). For years 6 through 20, the costs were inflated from $8,693 (Year 6) to $12,630 (Year 20) based on the estimated inflation rates from the U.S. Agricultural Market Outlook (FAPRI-MU 2021). These calculations should be used as a guide when estimating your annual income as hops cone yields and prices will vary depending on the operation, farm-management, agronomic and market factors (Ha et al. 2017).

Revenue

In the first three years of hops production, it is estimated that the net cashflow, at a breakeven price

Table 4. Estimated costs and return of growing hops in Arkansas on 1,000 linear row feet of a converted grape trellis over a 20-year period.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 20
Expenses							
Production	$884	$878	$975	$1,094	$1,189	$1,210	$1,568
Labor (excl. install)	$5,591	$3,049	$3,953	$4,967	$6,042	$6,241	$9,820
Loan on Installation Cost[a]	$1,241	$1,241	$1,241	$1,241	$1,241	$1,241	$1,241
Subtotal	**$7,717**	**$5,169**	**$6,169**	**$7,303**	**$8,472**	**$8,693**	**$12,630**
Revenue							
	Yield (lb./1000 row feet)						
	40	104	152	212	268	268	268
Revenue at Breakeven Price	$1,335	$3,475	$5,206	$7,439	$9,621	$9,835	$13,701
Net Cashflow at Breakeven Price	-$6,382	-$1,610	-$838	$315	$1,380	$1,379	$1,401

[a] Based on a 20-year loan term at an interest rate of 5.5% and an initial outlay of $14,752.55
[b] Calculations based on a discount rate of 10% and a breakeven price of $33.71

of $33.38/pound, is negative. The net cashflow turns positive in years four ($315) and five ($1,380), reaching $1,401 in year 20. This pattern is expected in the first few years as hops don't reach mature yields until years 4 or 5. This is not uncommon for most specialty crops. Hops are a long-term investment, and a well-maintained hopyard could be productive for 20 years or more. For this budget, we assumed mature yields remained constant at a dry weight of 268 pounds for years 5 to 20.

Conclusion

Based on the estimates derived from our hops trials at the Fruit Research Station in Clarksville, AR there is potential for hops to be an economically viable crop in Arkansas. However, we caution growers to explore local market opportunities and determine if hops are a good fit for their enterprise. Table 5 breaks down the price per pound of hops needed to reach breakeven, $15,000, $20,000, and $25,000 net present value at a discount rate of 10 percent. It is estimated that for 1,000 linear row feet, the hops would need to be sold for at least $40/pound to see a profit. However, the breakeven price for a hops operation will be dependent on the scale and unique costs associated with a given operation.

Table 5. Estimated breakeven price and positive net return for target net present values (NPV) for growing hops in Arkansas on 1,000 linear row feet of a converted grape trellis over a 20-year period.

Target NPV	Breakeven Price for Target NPV	$/1,000 linear row feet per year
$0	$33.38	$0
$15,000	$40.18	$750
$20,000	$42.45	$1,000
$25,000	$44.72	$1,250

[a] Calculated at a discount rate of 10%

The national average price for hops in 2020 was $5.97, which is mostly used in larger breweries that can contract at lower prices for bulk purchases (USA Hops 2021b). However, smaller breweries can determine the cost of hops using spot market prices. Spot market prices tend to be higher than contracted prices because the hops can be purchased "on the spot" and delivered immediately (Garbett 2019). For fresh leaf/cone hops, spot market prices can go for as high as $18.90 per pound on the Lupulin Exchange, one of the top websites for free market hops (Lupulin Exchange 2022). There is potential for local market prices to be higher, as the demand for local ingredients by Arkansas breweries continues to grow in the state. One Arkansas hops grower reported selling hops for $25 per pound to local breweries and marketing as a locally grown and made beer (R. Ledford, personal communications, 2019).

Since the baseline market price that Arkansas-grown hops can reliably be sold for is not yet known, we recommend that growers focus on increasing production and labor efficiencies to reduce costs. For example, as previously mentioned, harvesting is going to be the largest input cost for small-scale operations in Arkansas, especially if done by hand. There are other harvesting options available, such as building or purchasing a small-scale mechanical hops harvester. University of Vermont Extension performed a study comparing the efficiency of using a constructed mechanical harvester versus manual harvesting, in which they estimated a 97 percent savings and an improvement in quality by harvesting mechanically. (Callahan 2013).

Our hops trial evaluated training three bines per plant, however there may be potential to increase the number to as much as five or six bines per plant. This may require alternative trellising methods but could be a means to increase yields for each plant, however it may also increase harvest and production costs.

Finally, with any new crop, establishing a strong market will be key. Locally grown hops may be a novelty and demand a high price, however the demand for hops at a price that is economically viable may be limited in the state. Small-scale brewers or home-brewers may be more interested in local products and could be possible avenues to target for marketing.

As previously mentioned, the estimates in this factsheet should act as a guide when determining if hops can be incorporated into your farming operations. The costs and returns will vary greatly on the location, plant productivity, market and size of the operation. However, finding innovative ways to reduce costs, increase yields and new means to market hops will be key to increasing the profitability of hops production in Arkansas.

Other Arkansas Hops Factsheets

This publication is the third in a series of factsheets produced from a project to assess the feasibility of growing hops in Arkansas for local markets. Consult FSA6156 "Hops Production in Arkansas" for information on the basics of growing hops in Arkansas and FSA6157 "Constructing a Walk-In Dehydrator for Drying Hops" for a guide on constructing a drying unit on site.

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LIZZY HERERRA is a program associate - horticulture, University of Arkansas System Division of Agriculture Cooperative Extension. **AMANDA MCWHIRT** is an extension specialist - horticulture, University of Arkansas System Division of Agriculture Cooperative Extension. **MICHAEL POPP** is a professor - agricultural economics, University of Arkansas System Division of Agriculture Cooperative Extension. **JENNIE POPP** is Associate Dean - agricultural economics and agribusiness, University of Arkansas. **RENEE THRELFFALL** is a research scientist - University of Arkansas System Division of Agriculture - Department of Food Science. **AARON CATO** is an extension specialist - horticulture, University of Arkansas System Division of Agriculture Cooperative Extension.

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