

The Feasibility of Small Farms Growing Hops and Specialty Grains Profitably in Howard County



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PART I

Introduction

This project assessed the potential profitability of growing hops and grains for alcohol production on the fewer than 200 farms of 520 acres in Howard County, MD.

Currently, few of Howard's farms are able to make a profit on an annual basis and none of the farms made more than \$10,000 in annual sales in 2012.^{1,2} This is due to high operating costs and thin margins on agricultural products. The County's farmers have a mix of farming experience, ranging from lifelong farmers to those who have acquired farms in the last few years.

This report provides background on the basics of growing hops and grain crops, assesses the market for these agricultural products in the Baltimore/DC region, and makes recommendations for farmers to profitably grow these crops.

To develop this report, the team conducted site visits and interviews with farmers, farm bureau representatives, University of Maryland agricultural faculty and extension school subject matter experts, and the owners and staff of local breweries, distilleries and homebrew shops. The team also reviewed data from the Howard County Farm Bureau and the USDA Census and conducted academic and industry research on hops and specialty grain farming in the Northeast.

Farming Hops

Hops were largely grown on the East Coast, particularly in New York, until the end of prohibition. At that point, mechanization increased and hops farming moved to the Pacific Northwest because of its geography and because it is out of range of downy mildew disease further east. Downy mildew can kill off plants, which devastates hops yield because a plant can take four years to mature. Currently, 96.75% of American grown hops are farmed in the Pacific Northwest. A growing craft beer market on the East Coast has encouraged farmers to take up hops farming again. For example, 2009 beer sales decreased by 2.2% from the previous year, but craft beer sales rose by 10.3%.³

There are two main types of hops: bittering and aroma. Bittering hops balance the sweetness of the sugars created during malting; their taste is more standardized and therefore more of a commodity. As a commodity, brewers tend to contract with farmers for multiple years. Aroma hops are more varied and provide specific flavors that brewers seek. There is more room for differentiation and higher price points; brewers have more flexibility in experimenting with them.⁴

Hops are a perennial vines that can reach 25 feet in length. There are both male and female plants, and the females grow the flowering hops for which the plant is known. The vine's roots can grow into the soil for 15 feet or more and do so slowly. As a result, few hops can be harvested in the first year of cultivation while the roots are still developing. For proper growth, the plant requires at least 120 days a year without frost, 15 hours of sunlight each day, and a climate with a moist spring and a warm summer. These attributes mean that hops can only be grown at latitudes of between 35 and 55 degrees. Generally, soil made up of well draining, sandy loam is ideal, as

¹ http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Maryland/cp24027.pdf

² http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Maryland/

³ <http://www.uvm.edu/extension/cropsoil/wpcontent/uploads/hopsfeasibilitystudy.pdf>

⁴ <http://www.uvm.edu/extension/cropsoil/wpcontent/uploads/hopsfeasibilitystudy.pdf>

is a mildly acidic pH of 6.0 to 6.2. Proper air circulation is important as well. As big feeders, hops require fairly large amounts of nitrogen, phosphorus and potassium.⁵

Hops farming requires specialized equipment for setting up a hopyard, maintaining it, and harvesting the crops. Hops must be trellised on specialized poles that extend three to four feet below the soil's surface, and drip irrigation must be installed because overhead watering can cause and spread disease. Harvesting a crop larger than 1/2 acre requires mechanized harvesting because hops can be hand harvested at a rate of only one pound of dried hops per hour, too slow to be practical or profitable. The profitability of hand harvesting can be increased by harvesting only the top third of the plant, which yields 94% of the hops and/or by stripping the plant and sorting the hops. These methods can yield up to three pounds of hops per hour. In contract, mechanized picking and sorting yields on average of 20 pounds of hops per hour.⁶ Once harvested, hops must be pelletized and packaged for sale, which requires specialized processing equipment. Packaged hops can then be sold to breweries and home brewing shops.

Besides brewing, hops can also be used to scent soaps, as an herbal medication for relaxation and sleep, as an infusion for tea, and as an edible for humans and livestock.

Farming Specialty Grains

For this portion of the project, the team focused on barley, rye and wheat. All three are used to make both beer and liquor, are easy to grow, and require the same equipment as other non-specialty grains.

Barley is the most complex specialty grain. Two types of barley are used in making alcohol: two-row and six-row, names that refer to the count of grains on the head of the barley. Barley used for alcohol is germinated and dried in a process known as malting. Two-row barley is considered the best for making alcohol and yields on average 1-2% more than six-row barley. However, six-row barley is easier to grow in certain locations because of environmental considerations; it generally grows better on the East Coast than two-row barley.⁷

Generally speaking, barley is simple to grow; it does best in loamy soil with a pH of 6.0 or higher. Six-row barley typically does not require any manual watering, while two-row barley is typically grown with an irrigation system. It is harvested after three months with a motorized reaper binder. Threshing is done with a manual or motorized tool, causing the grain to fall away from the stalks. The final processing—malting—requires a large vat and a kiln to dry out the germinated grains and then roast them.⁸

Beyond beer and liquor, barley, wheat and rye can be used for baked goods, cereals, soups and as a livestock feed.

Current Market for Hops and Specialty Grains

Within Maryland and DC there are currently 70 breweries, most of them craft breweries, that could potentially purchase locally grown hops and specialty grains. There are also ten farm breweries that aim to grow and brew in one location, seven distilleries (with three to five more slated to open in the coming year) and five homebrew shops.

Conversations with local breweries and home brewing shops revealed that the most common hops varieties are Nugget and Columbus for bittering, and Cascade, Amarillo and Czech Saaz for aroma. Additionally, Citra,

⁵ <http://madisoncountycce.org/agriculture/hopsprogram/growinghopsathome>

⁶ <http://www.uvm.edu/extension/cropsoil/wpcontent/uploads/hopsfeasibilitystudy.pdf>

⁷ <http://morebeer.com/beerwiningtechniques/bmg/schwarz.html>

⁸ <https://byo.com/mead/item/722growyourgrains>

Centennial and Chinook are the most desirable dual purpose hops (which can be used for both bittering and aroma).

PART II

Insights

The team's research revealed several key insights described below. The information was consolidated from multiple interviews, which are included in Appendixes A and B.

1. Farmers who want to grow hops and specialty grains for brewing and distilling will need to partner directly with local breweries, distilleries and homebrew shops. A contract should be in place before farmers start growing, otherwise there may be no buyers due to the advanced planning that breweries and distilleries undertake when planning annual operations.
2. There is a need for a secondary processing facility for hops and a malt house for grains. Currently, there are no such facilities in Maryland. A hops processing facility recently opened in Loudoun County, Virginia and there is a small malt house in southern Pennsylvania that at least one local distillery is using.
3. The typical yields for hops in Maryland are between 1/4 and 1/10 of yields in the Pacific Northwest.
4. Hops must be tested for acidity before being sold so breweries can properly carry out their recipes and can combine hops from different growers into one beer. Without testing, brewers have no way of knowing the chemical makeup of the hops they're using. Depending on the production run of a particular beer, small farms in Howard County may be unable to produce enough hops to supply everything that one brewer needs and should expect that their hops will be combined with those from other growers.
5. Locally grown hops and grains need to be priced competitively in comparison to those produced elsewhere (mostly in the Pacific Northwest [hops] and Midwest [grains]) to appeal to local breweries and distilleries. While many breweries and distilleries like the idea of using locally sourced ingredients, they are unwilling to pay more for local produce.

To further explore these key findings, the team has organized its analysis of hops and specialty grains farming into a SWOT analysis, which outlines the strengths, weaknesses, opportunities and threats related to a particular business venture or concept.

Hops Farming SWOT (consolidated from multiple interviews)

Strengths

- There is an interest in locally produced, high quality brewing and distilling products (although this interest does not necessarily equate to potential sales).
- Pelletized hops may be able to fetch high prices in homebrew shops.

Weaknesses

- The local climate is not ideal for hops.
- Farming hops requires expensive, specialized equipment that can cost up to \$100,000 to purchase.
- The switching costs are high and it takes on average four years to get a full yield.
- Hops from different sources cannot be easily combined unless special equipment and testing is used.

- Farmers in Maryland lack knowledge of hops as a crop, as well as the proprietary hops varieties used by multigenerational farmers in the Pacific Northwest.
- There is no processing facility in Maryland.

Opportunities

- Howard County Agricultural Grants have been used to support establishing at least one hops growing project (James Zoller). Additional grants could help farmers overcome the high startup cost of growing hops.
- Brewpubs and homebrew shops present the best opportunity for selling hops grown in Howard County, even if those hops are not processed. Homebrew shops cater to brewers who do not keg their beer, brewpubs are often too small to keg, and both can use whole leaf hops (unprocessed).
- Chinook, Cascade, Nugget and Centennial hops are popular in Maryland and are known to grow well locally.
- Partnerships could be established with the University of Maryland Extension School or the Maryland Brewers Association Agricultural Resources Committee.
- Hops can be sold on the Lupulin Exchange, a site where growers can list hops and find sellers.

Threats

- Drought, insects or disease can quickly wipe out an entire crop.
- Most breweries already have contracts in place.
- Larger hops farms in the Northwest produce cheaper hops and have proven the reliability of their supply.

Generally, at least three acres of land are needed to produce enough hops for an average annual run of one type of beer.

This is based on three assumptions:

1. It takes 1 ½ pounds of dry hops per barrel of beer (based on between one ounce and 1/2 pound of dry hops to produce five gallons of beer).⁹ The amount of hops needed per gallon depends upon the desired flavor profile.
2. The average microbrewery produces 500 barrels annually for each type of beer (based on an average from multiple interviews).
3. In the Pacific Northwest, one acre has an average yield of 1,500 pounds of dry hops per year, whereas in Maryland the average is 250 pounds.¹⁰

As an example, to produce that amount of Cascade hops, it will cost approximately \$25,000¹¹ to set up (not including \$64,000 for secondary processing setup) and then \$23,000¹² in annual expenses (including labor). It may be possible to earn \$7,500 in revenue by the third year of production, which is not enough to be a profitable venture.

These calculations are based on three assumptions:

1. In the Pacific Northwest, one acre has an average yield of 1,500 pounds of dry hops per year, whereas in Maryland the average is 250 pounds.¹³
2. \$10 revenue per pound for pelletized hops (average of multiple interviews).
3. Yield: Year 1: 0%, Year 2: 50%, Year 3: 100%

⁹ Kyle, Maryland Homebrew, 3/13/2016

¹⁰ Jesse Kaiss, Jailbreak, 3/08/2016

¹¹ Appendix E

¹² <http://www.uvm.edu/extension/cropsoil/wpcontent/uploads/CostofGrowingHopsintheNortheast.pdf>

¹³ Jesse Kaiss, Jailbreak, 3/08/2016

Specialty Grains Farming SWOT

(consolidated from multiple interviews)

Strengths

- Winter wheat and rye can be grown as cover crops.
- It is possible to mix local grains with other varieties for growing purposes.
- There is demand for quality locally grown products, although this may not necessarily translate into sales.

Weaknesses

- There is no malt house in Maryland.
- Adding alcohol-quality grains into a crop rotation is not simple. Crops for alcohol require a higher level of monitoring than grains for feed.
- There are often difficulties producing a consistent, alcohol-grade grain.
- Grains must be competitively priced to be worth growing.
- If a farmer is not already growing grains, the cost of acquiring the necessary harvesting equipment is high.

Opportunities

- Some distilleries are willing to take unmalted grain and simulate malting using an enzyme.
- Winter wheat is widely used for making pastries in Pennsylvania.

Threats

- Drought, insects or disease can quickly wipe out an entire crop.
- Most distilleries already have contracts in place.
- Larger grain farms in the Northwest produce cheaper grains and have proven the reliability of their supply.

Generally, at least 6 ½ acres of land are needed to produce enough grain for an average, annual run of one type of liquor, with less needed for beer (barley).

This calculation is based on three assumptions:

1. One acre can produce 67 bushels of wheat, barley or rye.^{14,15}
2. One bushel equates to 55 pounds of each grain.¹⁶
3. One ton per month will support the annual production of one type of liquor at a small distillery.¹⁷

Producing that amount of grain will cost approximately \$2,450 annually, based on operation, labor and overhead costs. It may be possible to earn \$2,400 in revenue from selling the resulting straw, which would almost enable breaking even, though this is a best case scenario. It may then be possible to earn \$14,400 in malted grain revenue, though the ability to do the malting is unknown for this region. Because there is no malting facility with which farmers can achieve a final product, it is questionable that farmers can actually earn the malted grain revenue.

These calculations are based on three assumptions:

1. \$375 production cost per acre for wheat, barley or rye.¹⁸
2. \$200 revenue per ton for straw.¹⁹
3. \$0.60 revenue per pound for malted grain (from multiple interviews).

¹⁴ http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=MARYLAND

¹⁵ http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NORTH%20DAKOTA

¹⁶ <https://www.unc.edu/~rowlett/units/scales/bushels.html>

¹⁷ Scott Jendrek, Patapsco Distilling Co, 3/29/2016

¹⁸ http://www.ers.usda.gov/datafiles/Commodity_Costs_and>Returns/Data/CostofProduction_Forecasts/cop_forecast.xls

¹⁹ http://www.hayexchange.com/display_detail_hay.php?id=102410

Part III

Recommendations

Due to the significant challenges of growing hops and alcohol-quality grains in Howard County, the team does not recommend that the County encourage its farmers to grow these crops. The risks are too great and the chances of profitability are too low to ethically advise farmers to make the investments necessary for success. However, there is the potential that these crops could be successfully grown in the future if the County takes the following steps.

First, conduct additional research into the hops and grain varieties that will grow well in Howard County and, more generally, in Maryland. Developing effective growing techniques for these crops via a breeding program will reveal varieties that can withstand the challenges of the local climate. Cornell University undertook a similar research project to determine hops varieties that grow best in New York State and created trial packs for farmers to reduce the risk of growing hops. A partnership with the University of Maryland Extension School's campus in Clarksville, Maryland would be one way to undertake a similar study locally.

Second, any farmer wishing to grow hops, either now or in the future, would be greatly aided by the development of a cooperative focused on reducing the start up costs of building a hop yard. A cooperative could source the poles, cable, ropes and other materials necessary to build and maintain a hop yard, which are not sold in Maryland. As an example, the cost to build a three-acre hop yard is approximately \$25,019. The cooperative could also collectively purchase the harvesting and microprocessing machinery necessary to bring hops to market. For example, a picker/sorter costs between \$4,000 and \$35,000, depending on the size and a pelletizer can cost from \$2,000 to \$18,000.^{20,21,22,23,24} For grains, a reaper/binder can cost between \$1,000 and \$6,000, a thresher can cost between \$200 and \$4,500 and a grain silo can cost up to \$100,000, depending on its size.^{25,26} By consolidating and sharing the costs of the above listed equipment, it would be possible to lower the costs for all farmers.

Finally, Howard County and other public and private partners should explore the possibility of funding and building processing facilities for both hops and malted grains in Maryland. Both types of processing could be combined in one facility to reduce overhead costs and centralize the processing of alcohol-related crops in the state. Without a local facility, it will not be feasible for farmers to grow these crops on a large enough scale to be profitable because the costs of transporting wet hops and raw grains out of state are very high and will not allow farmers to offer the competitive pricing necessary to appeal to local breweries and distilleries.

For farmers already invested in growing hops and specialty grains, the chart below indicates potential partnerships that the team has identified that farmers can investigate right now. These partnerships can help farmers realize profits from the crops they are currently growing and could potentially lead to larger partnerships once a malt house and hops processing facility have been established.

²⁰ <http://madisoncountyce.org/agriculture/hops-program/frequently-asked-questions>

²¹

http://host.madison.com/wsj/business/small-scale-hop-growing-a-big-business/article_a6b4964b-4159-5a06-a8fd-3c8678838196.html

²² <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/hops-feasibility-study.pdf>

²³ <http://www.lawsonmills.com/hop-pellets>

²⁴ <http://www.uvm.edu/extension/cropsoil/wp-content/uploads/hops-feasibility-study.pdf>

²⁵ <http://www.alibaba.com>

²⁶ http://www.backtotheland.com/html/wheat_thrasher.html

Establishment	Location	Opportunity
Barley and Hops Grill & Microbrewery	Frederick	Chinook, Columbus, Cascade, hops
Frisco Tap House and Brewery	Columbia	Setting up system in summer 2016 to enable whole leaf brewing
Maryland Homebrew	Columbia	Smoked malts Whole leaf hops: Warrior, Target, Nugget, Tettnang
Nepenthe Homebrew	Baltimore	Seeking small hops purchases: 30 ounces every 3 weeks
MISCellaneous Distillery	Mount Airy	Specialty grains (buckwheat, others)
Twin Valley Distillers	Rockville	Unmalted grain in 50 lb bags; purple corn
Lost Ark Distilling Co.	Laurel	Malted rye; willing to experiment with small batches of local grains (blue corn, teff)
New Columbia Distillers	DC	Malted barley

Appendix A - Interviews

Establishment	Street Address	City	County	Phone	E-mail	POC
Miscellaneous Distillery	114 S. Main Street, B103	Mount Airy	Frederick		spirits@miscdistillery.com	Dan McNeill, owner
Ellicott Mills Brewing Co	8308 Main Street	Ellicott City	Howard	410.313.8141	brewboys@ellicottmillsbrewing.com	Ray Andreason (brewmaster)
Frey's Brewing Co	8601 Mapleville Road	Mount Airy	Frederick	301-639-7146	freysbrewing@gmail.com	Adam Frey, owner
Monocacy Brewing Company	1781 North Market St	Frederick	Frederick	240.457.4232		Tom Flores
Brewer's Alley	124 North Market St	Frederick	Frederick	301-631-0089		Tom Flores
Barley and Hops Grill & Microbrewery	5473 Urbana Pike	Frederick	Frederick	(301) 668-5555	gary@barleyandhops.net	Gary Brooks
Twin Valley Distillery	711 E Gude Dr.	Rockville	Montgomery	240-421-1115		Edgar
Maryland Homebrew	6770 Oak Hall Lane Suite #108	Columbia	Howard County	(410) 290-3768		Kyle, Kenny
Annapolis Homebrew	836 Ritchie Highway, Suite 19	Severna Park	Anne Arundel	(410) 975-0930	email@annapolishomebrew.com	Brooks McNew
Frisco Taphouse and Brewery	6695 Dobbin Road	Columbia	Howard	410.312.4907	steve@friscotaphouse.com	Ryan is head brewer
Nepenthe Homebrew	3600 Clipper Mill Rd, #130A	Baltimore	Baltimore	(443) 438-4846		Kiran
The Flying Barrel	1781 North Market Street	Frederick	Frederick	301-663-4491	info@flyingbarrel.com	James
Lost Ark Distilling	9385 Washington Boulevard North Suite B	Laurel	Howard	443-279-6178x2	brad@lostarkdistilling.com	Brad Blackwell
Jailbreak	9445 Washington Blvd N, STE F	Laurel	Howard	443.345.9699	kasey@jailbreakbrewing.com	Kasey Turner (owner), Jesse Kaiss (master brewer)
Red Shedman Brewery and Hop Yard	13601 Glissans Mill Rd	Mount Airy	Frederick	301-831-5889	Info@redshedman.com	Victor Allen
New Columbia Distillers	1832 Fenwick St NE	Washington	DC	202-733-1710	cheers@greenhatgin.com	Michael Lowe, co-owner
Patapsco Distilling Co	7609 Main Street	Sykesville	Carroll	410-259-3677	ScottJ@PatapscoDistilling.com	Scott Jendrek

Appendix B - Interview Notes

MISC Distillery

Dan McNeill

1. Makes whiskey
2. Recommends:
 - a. Lost Ark – in Howard County (distillery in process of starting)
 - b. Kevin Haddocks – group ‘Grow and Fortify’
 - i. Very connected with farmers providing brew/distillation crops
 - c. Tom Barse - Milkhouse Brewery
3. Believes too much cost for equipment to grow specialty grain on just a couple of acres
4. What kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Partnering in Carroll County – 10 acres of rye; want to use local grain
 - i. Will also use corn and wheat – Gravel Springs Farm (organic)
 - b. If there were a source in Howard County...differentiated with some special type of grain (maybe buckwheat?), might be interested in partnering with another farm
5. How much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. Dan will be picking up grain directly, so not a lot of shipping cost
6. How much more, if at all, would you be willing to pay, for locally grown hops/grains?
 - a. There is a market for local
 - b. Maybe 5-10% more to charge to say whiskey was from local crops
7. What else should I have asked you today?
 - a. Regional what grains are working right now...really up to farmers/breweries/distilleries to get together
 - b. Farmers have to be willing to take risk on growing what breweries/distilleries will want...best to partner

Ellicott Mills Brewing Co

Ray Andreason (brewmaster)

1. How many barrels of beer do you brew each year?
 - a. 700 barrels
2. What hops do you use and how much?
 - a. Mostly German hops – magnum (bittering), holler tower (aroma), tettnanger (aroma), czech saaz
 - b. Galena (bittering), cascade, chinook, centennial, summit, willamette
 - c. 300 lbs dry hops – T90 pellets, sometimes get stuck having to use T50 (concentrated)
3. What specialty grains do you use and how much?
 - a. Wheat, rye (flaked, not malted), rolled oats used in past for stouts
 - b. Malted wheat

- i. Less than 1000 lbs
- 4. where do your hops come from?
 - a. Mostly germany
- 5. where do your specialty grains come from?
 - a. Mostly germany
- 6. under what circumstances would you use local hops/specialty grains?
 - a. There's a market for local, so just need same quality as current and same price as current
 - b. Thinks local crops would justify price increase...maybe 10%?
 - c. Consistency and availability are key...need to be able to get same hops next year
- 7. how do you use hops (whole, wet/dry, pelletized)?
 - a. pelletized
- 8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Year to year contracts, so flexible for next year
- 9. how much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. Hops \$8-\$16 per lb
 - b. Grain \$0.68-\$0.80 per lb
 - c. Shipping \$500 for a few pallets - \$4.50 per bag to ship
- 10. what else should I have asked you today?
 - a. Bulkhead Brewing – not open yet
 - b. Blackflag Brewing – not open yet
 - c. Manor Hill Brewing – farm brewery

Frey's Brewing Co

Adam Frey - owner, 1500 acres

- 1. very passionate about hops on 1 or 2 acres being a terrible idea in MD
- 2. hop yard for 5 or 6 years; too hot and humid for hops in MD...grows 4 acres of hops
 - a. unless have really large scale, not worth it (50 acres or more)
 - b. hops grow much better out west
 - i. 3 pounds per plant instead of .5 pounds per plant here
 - 1. maybe get \$10 per pound (dry)
 - ii. can also sell rhizomes...need machine to cut them out; 6-10 rhizomes per plant...maybe get \$1 per rhizome
 - c. if have 1 drought year, have no hops or grains to use
 - d. Japanese beetles ate whole harvest one year
 - e. takes 2 weeks to string up the hops, then continuous weeding...expensive manual labor
 - f. 48 hour window to harvest hops - when they're ready, you can't wait on them
 - g. didn't even bother with own hops from 2015
 - h. don't get into farming. stressful, scary, unpredictable
 - i. costly to live in MD

3. can't make a living by farming
 - a. even if inherit a farm...
4. how many barrels of beer do you brew each year?
 - a. 100
5. what hops do you use and how much?
 - a. not comfortable discussing what hops
 - b. what specialty grains do you use and how much?
 - c. wheat, corn, soy beans
 - d. but for beer: red wheat and corn
6. where do your hops come from?
 - a. cascade, chinook grow ok in MD
7. where do your specialty grains come from?
 - a. would love to buy local, but have to go out farther (NY)
8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. don't start growing unless have contract in place to buy your hops/specialty grains
9. how much more, if at all, would you be willing to pay, for locally grown hops/grains?
 - a. none. end customers will not pay \$1 more for a 6 pack
 - b. nobody in practice supports local
10. what is the minimum amount of hops/grains that you would purchase from a single local source?
11. what else should I have asked you today?
 - a. grains - red wheat (winter wheat/hard wheat) is a cash crop
 - i. grown a lot around here
 - ii. replenishes soil, get straw from it, get wheat
 - iii. red wheat makes really good pastries...PA has Tasty Cakes, Entenmann's, etc.
 - iv. highly recommends red wheat over other grains
 1. uses red wheat unmalted in beer (save processing)
 - b. corn lucrative as well for biodiesel

Brewer's Alley/Monocacy Brewing Company

Tom Flores

Hops

1. Real Specialty. Robust crop, but takes a lot of special knowledge and there are pests, not ideal climate.
2. Tom is not convinced or enthusiastic about growing hops in MD
 - a. To have highly productive crops need the right climate, soil and day length
 - b. Too much volatility even when growing in ideal conditions
 - c. Need lots of soil amendments - soil here isn't ideal
 - d. The harvest is very expensive with equipment and labor
 - e. Analogy - you can't just tear out tobacco crops in MD and NC and then try to plant citrus

- f. He's heard of Vanish brewery and the production facility in Loudoun - can't imagine they're making money. Their set up must be expensive
- 3. Hops crowd is putting the cart before the horse
 - a. Local just for the sake of local isn't enough
 - b. People approaching the hops idea are not agriculture people
 - c. If brewers knew hops is good, might be willing to do a one off special brew
- 4. Tom has gotten some heat for not embracing local hops scene
 - a. In ideal conditions hops can be a great crop, but the quality in MD isn't there yet
 - b. It takes just one storm to knock out harvest (this area gets hurricanes in harvest season in August)
- 5. To succeed MD hops needs intensive breeding efforts - breeding is so critical
 - a. Taking varieties developed for other parts of the world and planting in MD is not ideal
 - b. NW USA hops farms yield 1000 to 2000 pounds per acre
 - c. MD hops "leaders" making yielding around 200 to 300 pounds per acre
- 6. Farm brewery
 - a. Very capital expensive. Just buying the right tank for the brewery comes with a long list of considerations and expenses
 - b. Rules for using farm breweries' using their own hops not being enforced
 - i. Howard County govt. does not have the resources to enforce rules
 - ii. Farm breweries only required to use one ingredient grown on farm in brew
 - 1. Not necessarily their hops

Malting Grains

- 1. More future in MD
- 2. Farmers in MD have a greater knowledge re small grains and easier access to combines
- 3. Climate is better for grains
- 4. Some disease issues with barley, but there are more grain options for farmers in area
- 5. Do Maryland farmers have an advantage over growers from other states when selling to Maryland breweries/distilleries, assuming the quality is there?
 - a. The two primary advantages I can see MD small grain growers and malt producers having would be reduced transportation costs as well as the appeal of locality. But it wouldn't take too much for these two advantages to get over-whelmed by the disadvantage of variable quality. The HUGE advantage which Mid-West producers have is a very consistent delivery of high quality malt, despite yearly fluctuations in crop conditions. The massive volume and large number of individual farm operations allows a high degree of blending for consistency, which protects the supply of finished malt from large deviations between what gets produced compared to what is expected. Frankly, we small brewers are pretty spoiled: the many decades of dialogue between the mega-brewers and their suppliers has created an infrastructure that we often take for granted. The system of field & crop management, transportation, malt specifications, etc. assures that we can sort of "ride the coat-tails" of big brewers' malt quality.
 - b. Quality is the key to the whole thing here in MD, just like with hops, but maybe with a lower threshold because of the existing knowledge base with small grains producers.

General thoughts

1. Sustainability is nothing new. Farmers have always stressed sustainability to maintain soil and land
 - a. We need to think long term for this project to be successful
2. Future of farming is not great
 - a. Need something sustainable

Survey

1. how many barrels of beer do you brew each year?
 - a. Between Monocacy and Brewery's Alley - 2600 barrels
2. what hops do you use and how much?
 - a. Approximate industry amounts (Not Monocacy): for 25 barrel batch / 50 kegs
 - i. 1-2 or 20 pounds of hops (hops is the spice)
3. what specialty grains do you use and how much?
 - a. Approximate industry amounts (Not Monocacy): for 25 barrel batch / 50 kegs
 - i. Use 1200 pounds of malt (malt is the backbone)
4. where do your hops come from?
 - a. Northwest USA
5. where do your specialty grains come from?
 - a. Brewer's malt is primarily produced in the Mid-West. This is due to the need to operate granaries and malhouses near the harvest, which is almost exclusively off of the Great Plains of Canada and the US. Then finished malt is shipped out to various destinations from there. There are a few operations in the far West (Vancouver, WA for example) that pull grain from Idaho. The amount of malt being produced by super small malting operations is almost negligible when viewed in terms of sheer mass, but the impact in terms of interest and excitement among small brewers is definitely not negligible
6. under what circumstances would you use local hops/specialty grains?
 - a. Quality is not there yet. Local being local is not enough
7. how do you use hops (whole, wet/dry, pelletized)?
 - a. Vast majority pelletized. Most vacuum sealed, although some specialty hops aren't fully sealed to allow for some oxidation
8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Done years ahead to fight against volatility
 - b. Contract out for five years with varying amounts guaranteed per year
9. how much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. Approximated industry amounts (Not Monocacy):
 - i. 25 cents per pound for barley
 - ii. Up to \$20 for hops
10. what else should I have asked you today?
 - a. Talk to Dr. Angus Murphy
 - b. Need a collaborative effort from government, farmers, brewers, market

Barley and Hops Grill & Microbrewery

Frederick MD

1. how many barrels of beer do you brew each year? 800
2. what hops do you use and how much? We use about 15 varieties of hops, if the question what hops I would like to see produce more locally, it would be Chinook and Columbus for bittering and there is never enough of Cascade for aroma
 - a. bittering hops
 - b. aroma hops
3. what specialty grains do you use and how much? Again there are many specialty grains we use on avg each brew has about 300 lbs. of specialty grain
4. where do your hops come from? We try to source locally since there are new hop farms coming on line locally, but the majority is still coming from the northwest. Now as soon as the hop processor in VA comes on line, I feel we will have more local hops available for us.
5. where do your specialty grains come from? All from the Midwest and Germany
6. under what circumstances would you use local hops/specialty grains? If can be process and malted locally, wet hops and un-malted grains are not in a high demand for us.
7. how do you use hops (whole, wet/dry, pelletized)? Mostly pelletized, harvest time wet hops, very little whole
8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers? Even though we work at a year in advance on hops we still have flexibility to source local
9. how much do your hops/specialty grains cost, and how much do they cost to ship to you? Proprietary information
10. how much more, if at all, would you be willing to pay, for locally grown hops/grains? Competitive market prices
11. what is the minimum amount of hops/grains that you would purchase from a single local source? As much as possible, just cutting down on shipping alone would be a savings and then to be able to market as such is a benefit for us.
12. what else should I have asked you today? Looks like you got all of the strong items

Twin Valley Distillers

Edgar (owner)

1. Makes vodka, whiskey, bourbon, rum
2. Uses local grains as much as possible, all unmalted (no malted grains available from MD)
 - a. Lack of malting facility, and buying malted grains too expensive
 - b. Uses enzymes to simulate malting process (convert starch to sugar)

- i. Quality is same as actual malting...malting just allows for fetching higher price, since there is a segment of the market that values true malted products. Also, if malted, can be considered kosher
 - ii. Cannot make certain types of liquor unless have malted grains
- 3. Local grain cost - pays a little more than market price in order to support local farmers
 - a. Must be in 50lb bags to make his recipes easier
- 4. Sees huge value in opening a secondary processing plant in MD to do malting
 - a. All distilleries would buy from that plant
- 5. Grains are:
 - a. MD yellow corn
 - i. Would like purple corn
 - b. Barley (doesn't know what kind)
 - c. Wheat
 - d. Rye
- 6. Lost Ark potential competitor, but thinks that distillery is not open yet

Maryland Homebrew

Kyle - brewing for 5 or 6 years

Kenny - starting with brewhouse and growing for farm brewery (Brookeville)

Could also contact Chris (manager) - chris@mdhb.com

1. how many barrels of beer do you brew each year?
 - a. Just provide ingredients for people
 - b. One ounce to 0.5lb of hops per batch (5 gallon)
2. what hops do you offer?
 - a. Whole leaf and pellets, large selection...more than 50 types of just pellets
 - b. Sold in 1 ounce pellets; whole leaf by ounce
 - c. German, West Coast, other European styles
 - d. Do also offer hops rhizomes
3. what specialty grains do you offer?
 - a. Mostly malted barley
 - i. Used to be locally grown (maybe from Copper Fox? - distillery in VA)
 - ii. Two row and six row, English and German strains
 - iii. Specialty from malting
 - iv. Highest demand for basic malts
 - v. Barley hit or miss locally
 1. 1 acre will get you 48 bushels - that's not a lot
 2. Need hundreds of acres for a large brewery
 - b. Wheat malt
 - i. Has to be winter wheat to grow well in MD

- c. Malted rye
 - i. Has to be winter rye to grow well in MD
- d. Very rarely do customers ask for unmalted grains (carry small amount)
- e. Could see need for smoked malts (popular)
- f. Malting facility opening Hartford County
- 4. where do your hops come from?
 - a. None local, but have talked with farmers about local
- 5. where do your specialty grains come from?
- 6. under what circumstances would you use local hops/specialty grains?
 - a. Some customers do ask for local hops
 - b. Grains have to be malted
- 7. how do you use hops (whole, wet/dry, pelletized)?
 - a. Pretty limited selection of whole leaf hops
 - i. Amarillo, cascade, centennial, citra, columbus, fuggle, hallertau, kent golding, saaz, samco, willamette, mosaic
 - b. Some new varieties only have in pellets right now - from New Zealand
 - c. Sees market for whole leaf
 - i. Warrior - people like to use for IPAs
 - ii. Target
 - iii. Nugget (grows well in this area)
 - iv. German Noble hops
 - 1. Tettnang
- 8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Contract with hop union
- 9. how much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. 1 ounce pellets \$2-\$4 per ounce (price to customer)
 - b. Leaf hops slightly more expensive
 - c. 11b bags of pellets for \$18-\$36
- 10. how much more, if at all, would you be willing to pay, for locally grown hops/grains?
- 11. what is the minimum amount of hops/grains that you would purchase from a single local source?
- 12. what else should I have asked you today?
 - a. Definitely homebrew market for more hops and grains
 - b. Maybe apples/cider would be profitable
 - i. Similar equipment to make cider as for brewing beer
 - c. Lots of people asking for local honey (for brewing or making meade)
 - i. Takes several years for meade to properly ferment out
 - d. Contact Tom Barse (owner of Milkhouse Brewery and chairman of ag committee) for info
 - e. Ag committee trying to set up local supply chain
 - f. Cascade, nugget, centennial will grow well in MD
 - g. 25-50 ft poles used out West
 - h. 12-15 ft poles used here

- i. No one to process the hops around here
- j. Pelletizer runs a high temp, which destroys acids of hops needed for brewing...so must freeze hops first
- k. Better utilization with pellets...messy to use whole leaf

Annapolis Home Brew

Brooks McNew

1. What advice would you have for local farmers interested in supplying hops and grains?
 - a. I don't really know much about agriculture, but there must be information available somewhere. Generally, compare the climate & soil of the origin varieties and find ones that seem to prefer climate and soil that matches local conditions.
2. What hops and grains do you sell that are local and in what quantity?
 - a. None. Local grown hops are available in very limited quantities and are generally purchased by breweries interested in local products. Local "fresh" hops are of limited usefulness in normal brewing practice because hops require careful drying, processing, and batch testing for general use.
3. What hops and grains do you sell generally and in what quantity?
 - a. None. Brewing requires special grain varieties, careful malting practices, and batch testing. To the best of my knowledge these don't exist locally. In general, grain will be sold as a commodity drop to a malting facility who will process the grain into malt used for brewing.
4. Where do you get your hops and grains from?
 - a. US, German, Belgian, German, and Canadian malting companies.
5. Under what circumstances would you purchase local hops and grains, and in what quantity?
 - a. If the quality is similar to existing commercial varieties, a normal home brew shop could annually sell a few tons of grain and up to a hundred pounds of a local "boutique" variety.
6. How popular are whole leaf hops?
 - a. They make up less than 5% of total hop sales, and that percentage is falling every year.
7. How popular are unmalted grains?
 - a. They make up less than 2% of total grain sales. Unmalted grains still require processing to be useful in brewing - it's rare to use truly "raw" grain. Generally you would find unmalted grain as pregelatinized flakes, torried whole grain, or specialty roasts.
8. What kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Home brew shops generally purchase from hop wholesalers on a week-to-week basis, I only know of a few home brew shops who bother to contract their hops.
9. How much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. Hops can cost from \$8-24 per pound. Base malts .6-.9 per pound. Specialty malts .8-1.5 per pound.
10. How much more, if at all, would you be willing to pay, for locally grown hops/grains?
 - a. Whatever the market will bear. Customers tend to be interested in more expensive varieties such as organic grain, but the actual sales are terrible. Interest does not equate to sales, in other words. I would present the grain at a similar margin and see how it sells, but I would suggest that a high premium may be prohibitive.

11. What is the minimum amount of hops/grains that you would purchase from a single local source?
 - a. 50 pounds of grain; 5 pounds of hops
12. What other information do you think is relevant to supporting local farms (hops/grains or otherwise)?
 - a. Look into hop processing and grain malting. The majority of the cost behind brewing hops and brewing grains are in the processing.

Frisco Taphouse and Brewery

Ryan (head brewer)

1. how many barrels of beer do you brew each year?
 - a. 240 barrels – 3x as many barrels next year
2. what hops do you use and how much?
 - a. Ctz – 1.5lb per batch = 45lb per year
 - b. 100-150lb each
 - i. Centennial
 - ii. Cascade
 - iii. Simcoe/citra/etc. Blend
 - c. Pretty much no whole leaf
 - i. Will get system this summer to enable whole leaf
3. what specialty grains do you use and how much?
 - a. Two-row barley (120 55lb bags)
 - b. Different malts...do not use unmalted
 - c. Some wheat
 - d. Part of brewer's association – try to reach Janna Howley janna@growandfortify.com
 - e. attempting to start local malting facility
 - f. Malting facilities in process: Loudoun County VA, Havre de Grace MD, and Cookesville MD
4. where do your hops come from?
 - a. Brewer supply group in Rhode Island
 - b. Lupulin exchange – buy/sell hops online...good way to move hops excess
5. where do your specialty grains come from?
 - a. Brewer supply group...a lot from England
6. under what circumstances would you use local hops/specialty grains?
 - a. If they were readily available...also would need to know specs on the grains
7. how do you use hops (whole, wet/dry, pelletized)?
 - a. Pelletized...a little whole leaf starting this summer
8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Year-to-year; if could test a sample, would do small batch of beer; then more if good
9. how much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. Expensive malts are \$1.50-\$2.00 per lb...others less than \$1.00

- b. Hops \$4-\$35 per lb
 - c. Shipping pretty cheap
10. how much more, if at all, would you be willing to pay, for locally grown hops/grains?
 - a. None – would have to be competitive; end consumers interested but wouldn't pay much more
 11. what is the minimum amount of hops/grains that you would purchase from a single local source?
 - a. At least 44lb box of hops every 6 months
 - b. At least 2000lb every 3 months
 12. what else should I have asked you today?
 - a. Grows well: cascade, centennial, nugget...quality is very good

Nepenthe Homebrew

Kiran

1. What advice would you have for local farmers interested in supplying hops and grains?
 - a. If want to move product with homebrew shops, reach out to us – would like to work something out
2. What hops and grains do you sell that are local and in what quantity?
 - a. None
 - b. Have looked into local, but amount was too small for the local farms
 - i. 30 ounces to see what customer interest would be
 1. If had gone well, could order 30 ounces every 3 weeks
3. What hops and grains do you sell generally and in what quantity?
 - a. Website has full list...lots of them
 - b. Grains: two-row barley is biggest seller
 - c. Hops: cascade, centennial, Amarillo, chinook, Columbus, citra
4. Where do you get your hops and grains from?
 - a. From large distributor (national company)
5. Under what circumstances would you purchase local hops and grains, and in what quantity?
6. How popular are whole leaf hops?
 - a. A little bit...more varieties for pellet (more shelf stable)
7. How popular are unmalted grains?
 - a. Only small amounts in very specific beers
8. What kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. No contracts; would go with local source
9. How much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. proprietary
10. How much more, if at all, would you be willing to pay, for locally grown hops/grains?
 - a. Depends on how much can be sold for

11. What other information do you think is relevant to supporting local farms (hops/grains or otherwise)?
 - a. People get excited for local and organic, but might not be sustained interest since more expensive
 - b. Thinks some people care more about organic than local

The Flying Barrel

James

1. What hops and grains do you sell that are local and in what quantity?
 - a. None – prices too high, not packaged well enough (need all specs)
 - b. Testing is important
2. Under what circumstances would you purchase local hops and grains, and in what quantity?
 - a. If customers ask
 - b. Customers more focused on what they are putting into beer; maybe too much variability with local
 - c. In general not interested...would prefer pelletized
 - d. Hops go for \$3 per ounce for end customer (likely no room for markup)
3. How popular are whole leaf hops?
 - a. Fairly popular
 - i. Take up more space in fridges (issue)
 - b. even pellets can clog equipment, not just whole leaf
4. How popular are unmalted grains?
 - a. 95% are malted, only slight demand for unmalted (<5lb per week)
5. What other information do you think is relevant to supporting local farms (hops/grains or otherwise)?
 - a. A lot of tradition in brewing, so people seek German, Noble hops, etc.
 - b. People fall back on what they know (less variability), so going local has some risk
 - c. Need to partner up with brewery

Lost Ark

Brad Blackwell

Our distillery is located in Howard County and we made it our mission to buy grains as close to home as possible. For us, the idea of having a "handcrafted" and local product meant that it needed to be as local as possible in every sense. We've been working with Rural Rhythm Farm in Dayton, MD. for all of our corn and wheat. Our biggest challenge has been finding local malted grains since there are no malting facilities in Maryland. We were able to find a malt house in PA that sources a 6-row Barley from Carroll

County. Currently, we are looking for sources for Rye and think we have some lined up coming from southern Maryland.

The great thing about our small batches is that it affords a lot of versatility without too much overhead. We can try a lot of new grain types and it's not terribly expensive. If we were able, I think we would experiment with various types of corn such as a blue corn or other heirloom varieties most popular to Maryland farms. We could also experiment with other grains such as Teff. The ideas are limitless.

We see the market growing vastly in the coming years for distilleries as well as breweries. I think the more accessible the grain becomes in Maryland, the more the local breweries and distilleries will choose to purchase those local products. For many of us, it's a challenge between our business growth and availability from the farms.

Jailbreak

Kasey Turner, founder and COO

1. how many barrels of beer do you brew each year?
 - a. 4500
2. what hops do you use and how much?
 - a. 30-40 varieties – citra (4000 lbs), warrior (2500 lbs), middleaika (1500 lbs), dr. rudy (800 lbs), Amarillo, saaz (all regular)
 - b. Not sure how much – tens of thousands of lbs
 - c. A lot from New Zealand
3. what specialty grains do you use and how much?
 - a. Caramunich 40 and 60, black prinz, special dark roasts, chocolate malts, crystal 60, caramel Vienna, dark munich, two-row
 - b. Two-row: 200K lbs from April through Dec – would be ok to mix grains with locally grown ones
4. where do your hops come from?
 - a. New Zealand
5. where do your specialty grains come from?
 - a. Mostly Canada and US, some Germany, Belgium, France
6. under what circumstances would you use local hops/specialty grains?
 - a. Only if cost is same as now
7. how do you use hops (whole, wet/dry, pelletized)?
 - a. pellets
8. what kinds of contracts are you locked into for purchasing hops/grains, and what flexibility do you have to purchase from new growers?
 - a. Have a lot of contracts...always have flexibility for more hops
 - b. Only contract for grain is two-row
9. how much do your hops/specialty grains cost, and how much do they cost to ship to you?

- a. \$110 per pallet (grain), hops depends
 - b. Hops - \$6-\$25 per lb
 - c. Malts - \$0.35 per lb (two-row), usually \$0.65-\$0.78 per lb for others
10. how much more, if at all, would you be willing to pay, for locally grown hops/grains?
- a. Grains grown here tend to be 2-5x more expensive if grown locally
 - b. Haven't tested market to see about local (lack of pelletization, so can only use fresh hops one year at a time)
 - i. Customers didn't really care about having a local hop
11. what is the minimum amount of hops/grains that you would purchase from a single local source?
- a. no
12. what else should I have asked you today?
- a. Brewpub most likely chance for success (not canning or kegging)
 - b. Processing has to be easy – must be easy to get the products, must be sustainable (can't be one time a year)
 - i. Secondary processing is key

Jailbreak/Farm Malthouse

Conversation with Jesse Kaiss, master brewer at Jailbreak and owner of farm malthouse in Howard County (not yet open)

1. he is growing barley (thoroughbred 6 row) on his farm and has been for a few years
2. has found growing that barley to be difficult
 - a. Challenges because of climate
 - b. Short harvesting window
 - c. Need to monitor health of barley constantly
3. He believes that challenges for barley are going to be similar for distilling-quality grains (wheat, rye, etc.)
4. Yields for barley are not as good as in Pacific NW
5. He would like to process grains grown by other farms in his malthouse but there are currently restrictions about doing value-added processes on farms using materials not grown on the farm, so he can't
 - a. He's in the final stages of getting his malthouse up and running
 - b. He got a grant from the county to build his malthouse
6. Regarding hops: he is considering growing hops
7. He thinks that the best market for the hops would be smaller breweries doing one-off seasonal batches
8. Before growing hops, farmers should have established relationships with breweries
9. He mentioned the processing facility in Lucketts, Loudoun County, VA
 - a. Said it's the biggest hopyard in the NE
 - b. Said he would put me in touch with them (followed up on this on 3/17- no answer yet)
10. I asked about possibility of combining hops from different farms

- a. He said that a hops processing facility has the ability to test the hops for acidity and other qualities and can combine hops with similar profiles into larger batches
- 11. He emphasized repeatedly that he believes there are significant scale challenges for small farms
 - a. Difficult to grow enough hops or grains to make it financially worthwhile
 - i. He said either 1 acre or over 5 acres
 - 1. For 1 acre you could harvest manually
 - 2. For more than that you need costly equipment
 - b. Mentioned poor hops yields - range from 1/10 to ¼ the size of yields in Pacific NW

Red Shedman

Victor Allen (head brewer)

- 1. how many barrels of beer do you brew each year?
 - a. Max capacity 1500 barrels
- 2. what hops do you use and how much?
 - a. Pearl, nugget, cascade, amarillo, citra
 - b. Grows cascade, chinook, columbus (susceptible to downy), crystal, nugget
- 3. Quality of local hops?
 - a. comparable
- 4. Is hops testing necessary/valued?
 - a. No - important for commercial producer though...if selling commercially
- 5. under what circumstances would you use local specialty grains?
 - a. To be able to advertise local MD brew
- 6. What is the cost for hops/grains?
 - a. Gets \$8-\$12 per lb pellets
 - b. \$0.60 lb for malted grain, then costs \$0.03 per lb to get it milled
- 7. what else should I have asked you today?
 - a. In 3rd year of growing hops...just starting to get to the size of being able to mechanize
 - i. \$125 for a telephone pole...expensive to set up
 - ii. Wolf is only company that makes hops pickers

New Columbia Distillers

Michael Lowe, co-owner

- 1. How much alcohol do you make each year?
 - a. Local winter wheat for gin
 - b. Local rye and malted barley for whiskey
 - c. 3000 9 liter cases last year
- 2. Quality of local grains?

- a. Rye won blue ribbon last year at VA state fair
- 3. Where do your specialty grains come from?
 - a. Malted barley from Wisconsin
- 4. How much do your hops/specialty grains cost, and how much do they cost to ship to you?
 - a. Don't know offhand
- 5. How much more, if at all, would you be willing to pay, for locally grown hops/grains?
 - a. For quality malt would be willing to pay a little more...maybe 10%
- 6. What is the minimum amount of grains that you would purchase from a single local source?
 - a. Not interested in shifting wheat/rye to another supplier (long-standing relationship)
 - b. For malted barley, not using that much...as increase production, would need a few tons each year
- 7. What else should I have asked you today?
 - a. Growing market for local
 - b. Potentially market for organic rye and organic wheat
 - i. But can't increase price of end product (consumers won't go for it)
 - c. Need malter for barley
 - d. Uses enzymes for gin instead of malted wheat – gives cleaner, unmalted taste

Patapsco Distilling Co

Scott Jendrek

- 1. What local grains do you use...why do you use them?
 - a. MD corn, wheat, rye, barley, black walnuts
 - b. Use local because this where he shops, and lives...wants to support local
- 2. What malted grains do you use, and from where?
 - a. Simulated - using enzymes; can't tell difference
 - b. Not sure people actually know what malting is, so marketing may not matter
- 3. How much alcohol do you make each year?
 - a. Just under 5000 cases per year (each case is 12 bottles)
- 4. Quality of local grains?
 - a. Thinks local is better - will know farmer
- 5. How much do the grains cost for local compared to from elsewhere?
 - a. \$35-\$40 range per bottle...not sure what customers will pay for local
 - i. Range of some premium vodkas
- 6. What is the minimum amount of grains you would purchase from a single local source?
 - a. 250 lbs per run, 4 runs per week...so 1 ton per month?
- 7. What else should I have asked you today?
 - a. Local barrel facility would be helpful as well; only have local facility
 - b. Kevin Atticks from Grow and Fortify - growandfortify.com
 - i. Insight into regulations
 - c. Really need local malt house

Appendix C - Growing Techniques (Hop Grower's Handbook)

Laura Ten Eyck and Dietrich Gehring, *The Hops Grower's Handbook*, (2015):

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General Hops Facts

- Important to propagate hops fields from rhizomes instead of male plants
 - Hops flowers used in beer only grow on female hop plants
 - Male plants do not contain lupulin, crucial element in hops for making beer
 - Male plants pollinate female plants create seeds that get mixed into hops flowers and add weight product given to brewers without adding anything to brew
 - Some brewers claim seeds add bad flavor
 - Hops fields created by male-female pollination are unlikely to grow into plants of the same variety as the parents.
 - Genetic variety will impact final product
- Acid (alpha and beta acids) found in soft resin of lupulin in hop cones important to bitterness in beer. Alpha acids responsible for bitterness.

Mid Atlantic/NE Hops Concerns

- Japanese beetles can quickly destroy hops field
- Powdery and downy mildew
- Heavy rain storms

Hop Varieties

- Hop varieties with some resistance to powdery mildew and downy mildew:
 - Cascade, fuggle, willamette, chinook, nugget, centennial, liberty and newport
- Hops farmers in Washington engineering hops varieties with greater fungal resistance
 - Patented hops: Apollo

Site Selection

- Site selection is very important - it will take years to remove a hops root system
- Need at least 1 acre to yield enough hops to achieve a profit
- Hops need a lot of water, but do not want to sit in water
 - Land will need quick drainage
 - Wet roots and moisture on the leaves greatly increase susceptibility to insect pests, fungus, and disease
 - Hops need about 30 inches of water during growing season
 - A 1 acre hop yard containing 900 plants could need almost 15,000 gallons of water per week
- Planting on a gentle slope will help with drainage and air circulation
- Hops like a breeze (not heavy winds) to keep leaves dry
- Hop yard should not be located next to livestock wintering area
 - Seeds will blow into hop yard and add to weed problem
- Difficult to take raw ground (pasture or orchard) and turn into hop yard
 - Easier to establish hop yard on field previously planted corn or other type of
- Do not pick land with shade - need to maximize time in sun
- Don't crowd hops plants - space plants 3 feet apart
- The site needs to be easily accessed (not other end of massive farm)
 - Hop yard requires frequent monitoring for pests and disease
 - Hop yard should be conveniently located to the hop processing area
 - Once bines are cut, the cones need to be picked right away

Soil

- Primary Nutrients
 - Need 20-30 pounds of Potassium per acre, 80-150 pounds of nitrogen per acre
 - Nitrogen needs will increase after first year as hops matures (1st year need about 75 pounds, mature hops field could need up to 240 pounds per acre)
 - Excessive nitrogen application can make hops more vulnerable to disease
 - Apply in May and June
 - Cover crops can help increase nitrogen levels
- Secondary Nutrients
 - Hops are particularly negatively impacted by deficiencies in boron and zinc
- Soil Survey
 - Consult USDA soil survey
 - Soil test
 - Take soil samples from various representative sections of hops yard and then mixing together to create homogenous sample for each section to be sent to lab
 - Make sure to identify sections of hops yard and label samples accordingly
 - Laboratory will test pH levels, organic matter levels, and nutrient levels for phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, and aluminum.

- Recommended to perform soil test every three years.
 - Plant tissue testing
 - Once the hops plants are grown, you can have a plant tissue performed to check the nutrient levels the plants are absorbing.
- Addressing results of soil test
 - Hops prefer pH levels between 6.0 and 6.8
 - Altering pH levels in your soil takes at least a year.
 - Consult your local extension agent to interpret soil test results
- Cover Crops
 - Protect field from wind and water erosion during non-growing season
 - Help soil retain moisture and replenish soil organic matter
 - Help control weeds
 - Consider using winter rye, ryegrass, buckwheat, oats, wheat, barley, marigold, wheat, sweet clover, sudan grass, vetch, and red clover.

Disease and Pest Management

- Mildew and disease grow best during moderate heat (64-76 degrees) and wet and humid conditions (common in North East)
 - Spray hops fields with fungicide when the forecast is for rain
- *The Field Guide for Integrated Pest Management in Hops*, Oregon State University, University of Idaho, USDA and Washington State University (2009) is a great resource
- Pruning bines and lower leaves is important for disease control

Common Diseases and Pests

- Downy Mildew
 - Number one enemy of hops farmers
 - Grows in wet and humid conditions
 - Appears as brown and discolored basal spikes
 - Stunt growth of hop bines, reduce number of hop cones produced, and damage the cones that are produced.
 - Prevention
 - Choosing resistant hop varieties (Cascade (moderately resistant); Chinook (moderately resistant); Columbia (moderately resistant) (There are more resistant varieties, but these are three that are in demand in Maryland and North East)
 - Consistently monitor and walk through your hops yard looking for signs of mildew
 - Remove and destroy any afflicted plants
 - Pulling weeds improves air circulation and sun exposure - limiting mildew
 - Avoid sprinkler irrigation
- Powdery Mildew
 - Grows in drier climates
 - Too much nitrogen in soil can lead to powdery mildew
 - Appears as white powder like substance on hops leaves

- Not common in East Coast
- Prevent
 - Choosing resistant hop varieties (Cascade (tolerant
 - Consistently monitor and walk through your hops yard looking for signs of mildew
- Other diseases: Verticillium Wilt, Viruses
- Hop Aphids
 - Translucent looking lice
 - Devour hops leaves and cause black fungus with waste left behind
 - Prevent
 - Insect traps
 - Consistently monitor and walk through your hops yard looking for signs Aphids - Check Weekly
- Japanese Beetles
 - Small red, brown, green and black beetles
 - Devour hops plants
 - Prevent
 - Insect Traps
 - Kill adults and larvae by placing in bowl of soapy water
 - Spray plants with neem oil or insecticides
- Other Pests: Potato Leafhopper, Two-Spotted Spider Mite
- Weed Control
 - Common Weeds
 - Ragweed, Field Bindweed, Pigweed, Quackgrass
 - Prevent
 - Cover crops
 - Heavy mulching around binds in spring to block weeds from growing
 - Consistently monitor and walk through your hops yard and pulling weeds

Designing and Building Hop Yard

- Typical design of a hops yard are rows of poles connected at the top by cables that are anchored at the end of each row of poles. Strings are attached to the cables and then hop plant bines are wrapped around the strings and allowed to grow to the point where they connect to the cables
 - Poles are spaced between 20 and 50 feet apart within each row and separate rows are spaced 14 feet apart.
 - Plants are planted 2-3 feet apart (depending on hop yard density)
- Layout
 - Must decide where each hop variety being grown will be planted
- Poles
 - Approx. 22 feet (18 above ground, 4 below) approx 6-7 inches in diameter for end poles and 3-5 inches for inside poles
 - Strip bark from section being buried to prevent wood rot
 - Two types: anchor and inside poles

- Sourcing:
 - Anchor poles: discarded utility poles
 - Inside poles: contact local logger or lumber yard
 - hop poles made of cedar, black locust, tamarack (larch trees), and oak.
- Approx cost: \$20 per pole plus delivery
- Cables
 - Recommended to use aircraft cables.
 - Cable strength required depends on length of rows and number of plants in each row
 - Additional cable equipment needed: ground anchors, guy strand tensioner, guy hooks, bolts and nuts, thimble eye nuts and plates, two-bolt guy clamps and cable staples
 - Approx cost: 16-40 cents per foot
- Trellis String
 - String traditionally used is coir
 - Coir surface allows hops vines to climb the string
 - Approx: 1 acre of hops will need 3,200 strings which costs \$400
- Installing Irrigation
 - Drip irrigation is recommended over sprinklers
 - Hops plants do not like their leaves to be wet
 - Irrigation costs approx \$1,300 an acre
- Additional equipment needs:
 - Tractor (with forks): approx \$16,000
 - Auger or post hole digger
 - Ladder or man lift
 - Miscellaneous tools: plumb, sledge hammer, power drill, wrench, chainsaw, cable cutters, come-along cable puller

Sourcing Hops

- Grow hops by planting rhizomes, which are part of the hop plant's root system
- Can buy all rhizomes directly from supplier or buy a few and grow plants in a test garden to produce more rhizomes
- Suppliers typically sell rhizomes in March
 - Rhizomes must be planted immediately
- Possible sources for plants and rhizomes:
 - USDA National Clean Plant Network: only sells plant cuttings not rhizomes
 - Private suppliers
- Extremely important to buy from trusted sources to avoid diseases

Planting Hops

- Plant one rhizome buds facing upwards in each hole
 - Leave three feet between each planting
 - Cover each rhizome with a couple inches of soil and tamp down soil gently, but firmly
 - Do not plant the rhizomes in wet ground
- Keep cover crops between hops rows to help control weeds

- Mulching is recommended

First Year Plants and Training to Trellis

- Some farmers choose not to train the first year hop bines to the trellis strings. If doing so, be mindful to remove weeds around these hops bines that are not being trained.
- Do not harvest hop cones from first year plants
- Do not train hop bines to strings until they've grown to a length of six to eight inches
 - Choose the three strongest binds for each plant and train them to a string
 - Prune the remaining bines that grow
- When the hop bines have grown to four to six feet, remove the lower leaves at the base of the bines

Harvest

- Equipment
 - Handpicking for commercial hops farms is not economically feasible
 - It would take about 500 hours to pick 1,000 plants or about 1 acre
 - Need to harvest using equipment
 - Hop harvester Machine that both cuts bine and removes cones
 - Large harvesters up to \$1 million
 - Midsize harvesters \$30,000
 - Smaller harvesters \$12,000
 - Most of these machines are manufactured in California and Europe
 - Or use separate machines to do work of hop harvester
 - Top cutter that removes string from trellis system and machete to remove hops bine from ground
 - Hop-picking machine with metal fingers to remove hop cones from bines
 - Drying Kiln
- When to Pick
 - When to pick is based on moisture level in hops cones
 - Ready to harvest when Moisture level is between 77 and 79 percent
 - Hops moisture may be calculated or done by touch/feel
 - If pinch hops between fingers, hops cone ready to be harvested will feel dry and springy
 - Inside of cone will appear deep yellow and will be sticky
 - Rip a hop cone in half and see if it splits evenly right down the stem of where the cone was connected to the bine
 - If bad weather is approaching, you made to harvest a little early
 - Hops can not be harvested when wet
- Picking hops bines
 - Use hop harvester or top cutter to remove string from trellis system and cut hop bines from ground and deposit bines in truck
 - Cut the bine from the ground before cutting from trellis. Cut bine three feet above ground

- Removing hops cones from bines
 - If not using a hop harvester, transport bines to separate hop-picking machine with pulls the hops cones from the bines
- Drying
 - Hops must be brewed or dried immediately after harvest otherwise they will rot
 - Transport hop cones to drying kiln which is usually a large warehouse
 - Stack hops in layers of about two feet
 - Drying process should lower moisture content from 77-79 percent down to 8-10 percent
 - Once hops are dried they must cooled to room temperature in a separate facility
 - Usual construction of drying kiln is hops cones are laid on burlap cloth on second floor or warehouse and heaters are on floor below heating second floor
 - Smaller scale hops farmers can use the air-drying method instead if not able to build a kiln
 - Spread hops cones on a horizontal screen and allow to dry for a couple days

Hops Packaging and Production

- Hops analysis
 - Farmers need to send hops to a laboratory for analysis
 - Must be dried hops and ideally frozen
 - Analysis performed according to methods created by American Society of Brewing Chemists
 - Samples may be sent to University of Vermont Hop Quality Testing Laboratory
 - Analysis will measure
 - Dry matter content, alpha and beta acids (brewing values), oil content, chemical compounds contained in oils
 - To be sold to brewers hops are preferred by industry to be pelletized
 - Dry hops cones should be bailed to be sent for pelletizing
 - Pelletized hops are vacuum sealed to extend shelf life
 - Pelletizer
 - Specialized pelletizing machines can cost \$40,000 and up
 - Small pelletizers are around \$3,000 and separate hammer mills are around \$2,000

Appendix D - Resources (Hop Grower's Handbook)

Resources for Purchasing Rhizomes, Vegetative Cuttings, and Plants

Rhizomes:

Crosby Hop Farm
8648 Crosby Road NE
Woodburn, OR 97071
Phone: 503-982-5166
Fax: 503-981-2141
<http://crosbyhops.com/product/hop-rhizomes/>

Foothill Hops
5024 Bear Path Road
Munnsville, NY 13409
Phone: 315-495-2451
<http://www.foothillhops.com>

Freshops
36180 Kings Valley Highway
Philomath, OR 97370
Phone: 800-460-6925
Fax: 541-929-2702
<http://freshops.com/>

Hops Direct
686 Green Valley Road
Mabton, WA 98935
Phone: 888-972-3616
Fax: 509-837-6577
E-mail: info@hopsdirect.com
<http://www.hopsdirect.com/rhizomes>

Lone Oak Hop Farm
6021 Deconinck Road NE
Woodburn OR, 97071
Phone: 503-932-3887
E-mail: hopfever@gmail.com
<http://www.loneoakhop.com>

Plants and Vegetative Cuttings

Bundschuh's Greenhouses

1033 Victor Road

Macedon, NY 14502

Phone: 315-986-8872

<http://www.bundschuhsgreenhouses.com>

Cornell Cooperative Extension of Madison County Potted Hop Plant Sale

Cornell Cooperative Extension Madison County Hops Program

100 Eaton Street

Morrisville, NY 13408

Phone: 315-684-3001

Fax: 315-684-9290

<http://madisoncountyccee.org/agriculture/hops-program/potted-hop-plants-for-sale>

National Clean Plant Network, Clean Plant Center Northwest

Hamilton Hall

24106 N. Bunn Road

Prosser, WA 99350-8694

Phone: 509-786-9242

E-mail: healthy.plants@wsu.edu

<http://healthyplants.wsu.edu/hop-program-at-cpcnw/purchasing-hop-material/>

Zerrillo Greenhouses Inc.

6582 East Taft Road

East Syracuse, NY 13057

Phone: 315-656-8466

Laboratories

Soil and Petiole Testing

Agro-One Soils Laboratory

730 Warren Road

Ithaca, NY 14850

Phone: 800-344-2697

Fax: 607-257-6808

E-mail: soil@dairyone.com

<http://dairyone.com/analytical-services/agronomy-services/soil-testing/>

Compost and Pre-Sidedress Nitrate Testing

Cornell Nutrient Analysis Laboratory

804 Bradfield Hall
Ithaca, NY 14853
Phone: 607-255-4540
Fax: 607-255-7656
E-mail: soiltest@cornell.edu
<http://cnal.cals.cornell.edu/>

Hops Analysis

Alpha Analytics
203 Division Street
Yakima, WA 98902
Phone: 800-952-4873
Fax: 509-895-7968
E-mail: info@alphaanalyticstesting.com
<https://www.alphaanalyticstesting.com/>

University of Vermont Cereal Grain Testing Lab
Jeffords Hall, Room 244
63 Carrington Dr.
Burlington, VT 05405
Phone: 802-656-5392
cropsoilvt@gmail.com or erica.cummings@uvm.edu
www.uvm.edu/extension/cropsoil/hops

Equipment

Mechanical Hop Harvesters

Tom Frazer
Dauenhauer Manufacturing Company
PO Box 6764
Ketchum, ID 83340
Phone: 208-928-7411
E-mail: tfrazer@dmfg.com
<http://www.dmfg.com>

University of Vermont Mobile Hop Harvester
Christopher W. Callahan, PE
Agricultural Engineering
University of Vermont Extension
Rutland Office
Howe Center Business Park

1 Scale Avenue, Ste. 55, Rutland VT 05701-4457
Phone:802-773-3349
E-mail: chris.callahan@uvm.edu

John Condzella
Condzella Hops
Broker for Wolf Hop Harvesters, Drying and Baling Equipment
6233 North County Road
Wading River, NY 11792
Phone: 631-461-3841
E-mail: condzellasfarm@gmail.com

US Hop Source
Wolf harvesting, drying, baling equipment
7500 E. Dartmouth Avenue
Denver, CO 80231
Phone: 970-240-9056
E-mail: ushopsource@gmail.com

Drying and Baling Equipment

Hop Dryers

Steenland Manufacturing
54400 State Highway 30
Roxbury, NY 12464
Phone: 607-326-7707
<http://steenlandmanufacturing.com>

Moisture Meter

Moist-Vu DL4000
Reid Instruments
Phone: 509-876-2703
www.reidinstruments.com

Hop Baler

University of Vermont Log Splitter Converted to Hop Baler
http://www.uvm.edu/extension/cropsoil/wp-content/uploads/Baler_instructions_5_4_12.pdf

Sources for Hop Yard Supplies

Fehr Bros Industries, Inc.
895 Kings Highway
Saugerties, NY 12477
Phone: 800-431-3095
Fax: 888-352-1790
E-mail: info@fehr.com
<http://www.fehr.com>

Growers Supply
202 South Division Street
Toppenish, WA 98948
Phone: 509-865-3731
<http://www.growerssupply.net>

Hop Pelletizing Services

Foothill Hops
5024 Bear Path Road
Munnsville, NY 13409
Phone: 315-495-2451
<http://www.foothillhops.com>

Northern Eagle Hop Pelletizing Company
7 Railroad Ave.
Oneonta, NY 13820
Phone: 607-432-0400
E-mail: info@hoppelletizing.com
<http://www.hoppelletizing.com>

Whipple Brothers Farms
2348 Norway Road
Kendall, NY 14476
Phone: 585-350-9707
E-mail: justin.whipple@gmail.com
<http://www.whipplebrothersfarms.com>

Appendix E - Hops Start-up Costs (Hop Grower's Handbook)

Expense (3 acres)	Unit/price	Units/Feet	Add'l Expense		Year 1
Farm Set Up					
Poles	\$20.00	240	\$500.00		\$5,300.00
Cable	\$0.28	7800			\$2,184.00
String	\$0.13	9600			\$1,200.00
Irrigation	\$3,900.00	1			\$3,900.00
Rhizomes (Cascade)	\$5.00	1959			\$9,795.00
Misc trellis rigging/parts ²⁷	\$2,040.00	1			\$2,040.00
Orchard Ladder	\$600.00	1			\$600.00
				Total	\$25,019.00
Processing					
Harvester	\$12,000.00	1			\$12,000.00
Dryer	\$4,800.00	1			\$4,800.00
Moisture Probe	\$4,500.00	1			\$4,500.00
Hops Analysis	\$50.00	1			\$50.00
Compactor ²⁸	\$1,500.00	1			\$1,500.00
Commercial Vacuum Sealer	\$2,000.00	1			\$2,000.00
Pelletizer	\$40,000.00	1			\$40,000.00
				Total	\$64,850.00

Not Included		
Tractor	\$16,000.00	Assume Already Own
Mulch/Soil Mgmt	?	Assume Already Own

²⁷

https://ag.purdue.edu/hla/Extension/Documents/2015_Hops_Workshop_1_per_Page/Getting%20Started%20with%20Hops-Trellis%20Construction.pdf

²⁸ http://www.uvm.edu/extension/cropsoil/wp-content/uploads/PfeifferPinand_Hops_Baler.pdf