



## About Us

Mountain View Hops, LLC was established in 2018 with a focus in providing quality propagated hop plants at an affordable price with dependable growth characteristics to existing and beginning hop farms of one acre or less throughout the mid-Atlantic region. Our initial stock was planted in the spring of 2016 and has steadily grown in number of plants and varieties.

We currently cultivate over 20 varieties that are continually evaluated in our own small-scale hop yard nestled in the Blue Ridge mountains of Southwest Virginia. This testing allows us to determine which commonly available cultivars and pest management practices perform best in the mid-Atlantic.

As viability testing continues and cultivars become available, the varieties we offer will change and expand. It is with this gained knowledge that we can more accurately provide existing and developing hop farms with cultivars that can do well in this geographic region. We furthermore test various trellising designs and other farming practices that can make small scale hop farming a more financially viable and less labor-intensive industry to get started in.

(website only) Whether you have 50 plants or 1,500, we look forward to discussing your specific hop yard plant needs and getting you started, or keep you going, in the mid-Atlantic hop farming industry.



## Our Hopyard Design

The hopyard is laid out in a grid-like checkerboard pattern. Each square is 6' x 6'. Each pole is a 4" x 4" x 16' treated post planted 2' in the ground. Plants are placed within the 6' x 6' dirt squares around the poles in a straight line pattern to facilitate ease of tilling the ground. All plants are approximately 6' from the center of their respective poles. Currently, each pole represents one variety with varying numbers of crowns per cultivar around each pole.

The poles have a collar with a rope and pulley system to raise and lower the collars. A strong baling twine is attached to eye hooks in the collar, and when raised, is used as both a climbing media for the hops as well as a guywire to support the poles via a ground stake placed near each crown around the pole. This provides a 14' – 15' grow height for each hop crown. Extensions attached to the collars that will raise the grow height to 18'-19' are currently being tested.

Harvesting and bine maintenance are performed from the ground level by lowering the collars to the desired height using the rope and pulley system. Due, in part, to the distance of the crowns from the pole, bine breakage from raising and lowering the collars is near zero.

Irrigation is currently performed by hand using a portable water tank and pump. However, a hands-free irrigation system designed for this style of yard layout is currently in the planning stages.

Fertilizers and other soil nutrients are weighed out during the winter months for each pole or square based on square footage and manually applied in the spring. This is then followed by tillage of the ground beside each row of crowns using a standard garden tiller.

Grass between rows and around the hopyard is mowed using a self-propelled walk behind bagging mower and zero turn riding mower. All grass is either bagged or blown away from the yard to prevent grass clippings from covering the plants or the ground surrounding them.

Depending on level of vegetation and amount of control needed, foliar applications of fungicides or pesticides are applied using either a backpack style sprayer or an ATV mounted sprayer with a 1 GPM pump.



## 2017 Hop Growth/Harvest Notes

This growing season, approximately  $\frac{3}{4}$  of the hop yard was one and two year old plants with the remaining  $\frac{1}{4}$  being three or four year old plants.

Canadian Redvine	Grew exceptionally well! I wrapped around 10 bines on the string, causing very small cone development. These cones were $\frac{1}{3}$ to $\frac{1}{2}$ the size of the one-year old plants next to it with only 3-4 bines wrapped around their strings. Even though cones were small, the bines reached well above the poles (17'-20'), and the cone quantity was bountiful. If it can be marketed, CRV could be a strong contender.
Centennial	Grew very well and very strong up to a certain point. The plants only got $\frac{2}{3}$ to $\frac{3}{4}$ up the poles (9'-12'), at most. None had much side arm growth, but instead kept the cone bundles close to the bine. Cones were of good size though. I was really pleased with how the plant grew but unimpressed with its final height and total cone production. Being that it is a popular variety, it could be marketed, but it may require more plants to adequately offer a return on investment.
Chinook	Grew moderately well. Reached just above the hop pole (14.5' – 15'). Cones were fairly large in size and plant seemed very healthy. Unfortunately, it wasn't as many cones as I hoped it would produce. It appears to be a popular variety and has strong potential for future development. I will continue monitoring it.
Cascade	Grew moderately well. Reached just above the hop pole (15-16'). This pole had the most plants of the hop yard – 12 plants total. I accidentally hit a few of them with Roundup, which caused their leaves to curl up and the cones to be deformed. On a couple other plants, I had an issue with pesticide/fungicide application that coated their leaves so bad that it most likely caused some photosynthesis issues. Other than those few crowns, the cone production seemed adequate and plant health appeared normal. Marketability should be fine for cultivating this variety.
Galena	Grew very well. I started this variety too early for its liking and had to restart it. Consequently, the bines only got to within a foot or two of the pole top (12'-13'). It throws out rhizomes and lower plant material profusely. It had decent cone development and volume. It seems to be a good variety to market and earnings could be good.
Horizon	It grew ok, but not great. Last year, I had accidentally hit it with Roundup and that could have affected it this year. It grew only $\frac{2}{3}$ to $\frac{3}{4}$ up the pole. It produced hardly any cones. While I would like it to work out, this variety is not currently showing any great promise, but I will continue monitoring it.
Glacier	This variety is similar to Horizon, in its poor showmanship. It grows very strong, fast, and tall (17-20'), but it produced few cones. It was another one that I accidentally hit with Roundup last year, so the effects might still be showing up this year. It is slightly better than Horizon, and I will continue monitoring it, as well.
Willamette	This is another poor growing variety. It got to just above the top of the pole (15'-16'), but it had few cones. Plant growth appeared strong and good, but even though it is a popular variety, if production does not increase, it may not be worth growing. I will continue to monitor it.



Alpha Aroma	It is one of three NZ varieties and has done exceptionally well. I did not have a pole for it this year, but it would have easily reached 14'. This was its first year of growth, because it was planted last fall. It produced a fair amount of cones and it shows great promise for future harvest amounts. Also known as Rakau, it hopefully can be marketed.
Challenger	I started this variety too early as well and had to cut it back and restart it. It reached almost to the top of the pole and produced a lot of very large cones. It grew excellent and if marketed properly, could be a good cultivar. It is also an easy variety to grow cuttings from. I was very pleased with this variety and am hopeful for its future.
Zenith	This variety did not do very well at all. It barely made it over halfway up the pole and produced very few cones. I'm not very impressed with this variety, and if it does not improve, I may consider replacing it.
Columbus	I started this variety too early and had to cut it back and restart it. It reached almost to the top of the pole (13'-14') and produced a lot of very large cones. It, like Challenger, grew excellent and if marketed, could be a very good cultivar. It is another variety that is easy to grow from cuttings. I'm very pleased with it and am hopeful for its future.
Mt. Hood	This variety grew very strongly and reached just over 14'-15'. However, it did not produce many cones. If cone production doesn't increase, it may not be marketable. I will continue monitoring it.
Fuggle	I'm not happy at all with this variety. I restarted this variety as well, and the second growth did just as poorly as the first. It barely made it past halfway up the pole with little cone production. Its foliage was poor as well. These results mimic the previous season's observations, as well. I will let it go one more year, but it is very close to being culled.
Southern Cross	This is another NZ variety that did extremely well. It grew fast, strong, and tall (15'-18'). It produced lots of cones and throws rhizomes and bottom growth like crazy. If this variety can be marketed, it's a very strong keeper.
Pacific Gem	Yet another NZ variety that did awesome. It grew crazy fast, tall, and strong. It had lots of cones. There were tons of rhizomes and bottom growth. It grew at least 17' tall. It is a very strong keeper if it can be marketed. This was another plant that I wrapped around a dozen bines around the string. The results were similar as the CRV in regards to smaller cone size.
Magnum	This was its first year of growth as I planted it last fall. It took a little while for it to start growing, and if it had a pole, it would have gotten near the top of it. It had a couple dozen cones on it that were large and plant looked very healthy. Shows great promise.
? Local	I started this plant midsummer, and it shows great promise. It looked fairly healthy and had a few cones. I look forward to seeing how it grows next year.

Overall, my rankings are as follows:

Excellent	Good	Moderate	Poor
CRV	Chinook	Centennial	Horizon
AlphAroma	Cascade	Mount Hood	Glacier
Challenger	Galena	? Local	Willamette
Columbus		Magnum	Zenith
Southern Cross			Fuggle
Pacific Gem			



## Cone Drying/Packaging Procedures

All cones, within hours of harvest, were spread upon a cloth on a concrete floor to a depth of 1"-2" maximum. The room was temperature controlled to 75 degrees and de-humidified to 50%. Two box fans blew this air continuously day and night over the hop cones until dry. Drying was complete within 48-72 hours post-harvest, depending on variety, density, and moisture content.

The hop cones were then immediately packaged in one ounce vacuum sealed food saver packages and placed in a freezer. Local homebrewers currently have cones for brewing testing and evaluations are pending.

## Pest/Fungicide Controls

Overall, the downy/powdery mildew problems were scarce considering the wet spring and early summer. Controls that were used were a regular, rotational application of various products to include Sulfur, Copper, Captan, Mancozeb, Phosphorous Acid, Neem oil, and Daconil (Chlorothalonil). Daconil was applied only once in combination with DE as a pest/fungicide combination control and led to severe coating of plant leaves on a couple crowns on several varieties. It led to these plants having photosynthesis problems and was not applied again. It is believed that inability in properly suspending the DE in the water led to the DE and Daconil settling to the bottom of the tank and subsequently being sucked up first and severely coating the first plants to be sprayed. Aside from this issue, there were no other issues with fungicide/pesticide applications.

Pest pressure was also relatively small. The two worst pests ended up being leaf hoppers and earwigs. Later in the season, spider mites, Japanese beetles, stink bug larvae, and other various caterpillars and sucking insects made small appearances. Dr. Bronner's soap, Neem oil, Azera, Pyrethrin, and DE were all used in regular, rotational applications as pest pressures dictated.

Leaf hoppers and all other soft bodied insects were easily controlled by oils and insecticidal soaps, but earwigs continued to be a problem throughout the season. They hide in shady areas (under mulch, cracks between collars and posts, under hoisting cords, and deep in field vegetation) during the daylight hours and come out to feed on the hop leaves at night. No controls were effective at controlling them when applied during the day. Application at night was never done for fear of creating a situation that might control earwigs via direct contact from pesticides, but could increase mildew presence from wet leaves during nighttime hours. Further control measures will be tested.

No presence of European corn borer was found during last season or this season.

All pesticides and fungicides were applied in accordance with their labeled instructions ("grapes" were used if "hops" were not listed on the label). The reason for this, is that until very recently, many pesticide/fungicide labels did not list "hops" as a crop. Once burr initiation started, only organic measures were used for pest and fungicide control.

Captan, Mancozeb, and Chlorothalonil (all FRAC group codes M) were found not to be currently registered in VA for use on hops. Subsequently, their use will be discontinued until such time that they are added to the approved fungicides for use on hops. However, their tests indicate a suitable control measure right in line with copper and sulfur. Again, all three of these fungicides were used as best as possible in accordance with their labeling and were not used post burr formation.



## Key Dates – 2017

- 4/1 Started all plants after having continually cut back shoots since mid-March. The spring was colder than normal and wet. This, in combination with poor winterizing techniques the previous fall, prevented some crowns from breaking dormancy like they should, even within the same varieties
- 4/29,4/30 Trimmed all lower leaf growth up to 2'-3' from ground
- 5/10 Fertilized using triple 12 and calculated application rate based on soil tests. Nitrogen was the key element which left P and K being applied slightly higher than soil test recommendations
- 5/16 Retrained Fuggle, Challenger, Columbus, and Galena due to poor growth from starting too early
- 5/20 Applied Cedar chips as a mulch
- 5/21 Applied Zn, Mn, Fe, B, and hi-cal lime per soil test results. Also, Southern Cross, Pacific Gem, and CRV were above or at the tops of their poles (14' +) by this date
- 5/31 Glacier, Mt Hood, and Chinook were at the top or past the tops of their poles (14' +); Columbus passed its previous max height
- 6/3 Planted around 70 plants that were taken from April cuttings. This created 4 plants per pole with Cascade being the exception by having 12
- 6/7 The date that several Cascade plants became caked with DE and Chlorothalonil. Chinook, Centennial, and CRV were also affected but not near as bad
- 6/8 Fuggle and Challenger surpassed their previous max growth
- 6/13 Started watering due to drying ground conditions. This continued throughout the summer and early fall as conditions dictated
- 6/14 CRV - Tons of burrs  
Centennial - small 1" cones  
Chinook – small 1" cones  
Cascade – small ½" – 1" cones  
Galena – surpassed its previous max growth; 1' past previous growth; still growing  
Horizon – small ½" – 1" cones  
Glacier – lots of burrs  
Willamette – medium amount of burrs  
AlphAroma – still growing; almost to top of stake (7')  
Challenger – still growing from retraining; 4'-5' past previous growth  
Zenith – small 1" cones  
Columbus – 4'-5' past previous growth; still growing  
Mt Hood – medium amount of small ½" – 1" cones



- Fuggle – 2’-3’ past previous growth; still growing but slowly  
Southern Cross – tons of burrs  
Pacific Gem – tons of burrs  
Magnum – starting to climb string; 1’-2’ so far
- 6/29 Harvest begins with crowns of Centennial, Cascade, Horizon, Zenith, and Southern Cross
- 6/30 Major growth observations: I have noticed that the last couple of days’ harvests, the cones are very small down around 4’ above ground and typically increase in size as you go up towards the top. However, even the top cones still look to me as if they are a bit smaller than normal. I’m suspecting a combination of multiple factors. First, my soil amendments and fertilizing schedule were late. This could have been in part to my second problem, which was starting the plants a month early instead of waiting until May. Third, I wrapped a minimum of 5-7, and up to 10+, bines around a single string instead of only 3-4, for at least one crown (the oldest) per variety, which may have resulted in smaller cones because the nutrients have to be spread among so much more plant material. Fourth, and I think to a lesser degree, our spring in April and much of May was extremely wet, cloudy, cold, and windy. This stunted their growth some and resulted in some varieties having to be cut off and restarted in early May causing more strain on those few varieties. Lastly, some varieties such as Fuggle may not do well in this climate and soil to begin with. The observations into this area are still ongoing
- 7/11 Applied Cyprus mulch because Cedar chips had all blown away. Also, I cut down and re-strung Centennial for a second crop attempt
- 7/19 Cut down and re-strung crowns from the following varieties for a second crop attempt: Chinook, Horizon, Glacier, Willamette, Zenith, Columbus, Mt Hood, Fuggle, Southern Cross, and Pacific Gem. I made sure to only do 4-5 bines per string this time
- 7/20 Fertilized second crop attempt plants with triple 12 at half the rate of the first growth fertilizing
- 7/23 Cut and re-strung crowns from the following in an attempt for a second crop and fertilized with triple 12 at half the rate of the first growth fertilizing: Galena, Challenger, Mt Hood, and Fuggle
- 8/4 Planted around 40 more plants from the spring and summer cuttings for a total of the following around these poles: 10 Centennial, 12 Chinook, 12 Galena, 12 Challenger, 12 Columbus, and 4 ? (local)
- 9/7 Final harvest. Plants included Pacific Gem, CRV, Galena, Southern Cross, Challenger, Chinook, and ? (local). A lot of this date’s harvest was taken from this year’s plantings from cuttings as well as second cropping attempt
- 9/15 Spread composted manure around hop squares. Was unable to till in due to weather. Will have to sit and break down over winter. Was applied solely for the purpose of increasing organic matter. Did the same the previous September
- 10/30 First freeze (31 degrees) of the fall



- 11/3 Cut down all bines to within 1'-2' of ground and covered with a few inches of soil followed by 1"-2" of mulch from a local saw mill. Noticed that many of the crowns from cuttings taken in April and May of this year had 1" thick stalks/stems full of buds just above the ground
- 1/15/18 So far, we have had a brutally cold winter for this area starting around mid-late December and continuing to present. Very few days have been above freezing and it can be counted on two hands the number of nights that were above teens and single digits. It remains to be seen what effect this bitter cold will have on the yard plants and the potted plants from last season's cuttings. Many "old timers" are saying that cold like this that has hung around this long has not been seen since the 1960s. Furthermore, this winter has seen little precipitation, and it is becoming concerning. I am hopeful that more snowfall or other precipitation will be seen in late January and February



## Testing and Evaluation

Mountain View Hops, LLC is currently testing general hop growing practices and evaluating what varieties grow best and produce relatively well in this region using standard currently acceptable fertilizer and micro-nutrient rates. Tests also include various pesticide/fungicide/herbicide products for proper control of intended targets and evaluating the results. Types of mulches, propagating methods, and other cultural practices from pre-emergence to final packaging and marketing are also being evaluated at MVH.

Our long-term goals include more detailed studies of various fertilizer application rates and disease/pest control measures as they pertain to specific individual varieties. The intent is to take individual varieties that MVH has determined already grew well in this region and further test their reactions to various Nitrogen, Phosphorous, and Potassium application rates, as well as fungicide/pesticide application schedules to determine various disease resistances within each variety while maintaining a control group within each cultivar test plot. These tests will take time, but it is hoped that the results from these annual studies will eventually lead to a more solidified understanding of what hop varieties perform well in the mid-Atlantic region and how best to grow these varieties and hops overall.



## 2016/2017 Experiments and Results

**Experiment 1:** Fall 2016, I covered the hop mounds with grass clippings. I also mounded dirt heavily around the crowns, which created a volcano look with the grass at the top in the center.

**Purpose:** This was done in an attempt to reduce mulch costs as I had a ready and constant supply of grass clippings made throughout the summer. I mounded the dirt as a way to ensure that very cold temperatures wouldn't hurt the crowns.

**Results:** The heavy dirt application and thick grass clippings kept the crowns colder than normal. The grass also compacted down and kept the tops of the crowns moist and wet constantly. This all aided in setting the initial dormancy break back by weeks on some crowns. Luckily, I did not see any disease issues caused by this improper winter protection method.

**Experiment 2:** Wrapping more than the standard number of bines around a single string, up to around a dozen bines from multiple varieties to include CRV, Glacier, Southern Cross, Cascade, and Pacific Gem. The oldest plants were definitely a part of this experiment with some younger ones mixed in.

**Purpose:** To study the effects of having more potential hop producing bines wrapping around each other and to hopefully increase production.

**Results:** Multiple varieties proved that there will always be 1-2 bines that quickly become the "leaders" of the rest of the bines and will reach their maximum height faster and quicker than the others. The remaining bines will get lost in the may lay and subsequent vegetative growth. The vegetative growth will also be extreme and can make it difficult to control diseases and pests. The mass of vegetative growth may also have an impact on nutrient uptake. Finally, cone production numbers are increased, but cones are of a much smaller size. Furthermore, the large number of bines produced cones at wildly different times. Cone size is at least half that of a normal 3-4 bine string and the vastly different cone maturation periods negate any perceived benefits of wrapping large numbers of bines around a single string.



Experiment 3: Using Diatomaceous Earth (DE) tank mixed in water to control hard bodies pests. Chlorothalonil was also added for additional fungicide protection.

**Purpose:** Liquid sevin contains a large portion of DE or similar compound and a small amount of pesticide to control hard bodies insects without direct contact. This is accomplished by the insects crawling through the pesticide laced DE where the DE cuts their exoskeletons and allows the pesticide to enter their bodies and kill them. The goal was to create a similar effect using less costly and more organic methods.

**Results:** The DE could not be kept in suspension properly in the tank and created a situation in which all the DE was dumped on the first row of plants and almost completely coated them. Once dried, it would not come off and significantly hurt the ability of the plant to photosynthesize. This coating was made thicker and more solidified on the leaves of the plants when Chlorothalonil (Bravo, Daconil) was mixed with the DE as well. DE and Pyrethrin was going to be the next test, but after such disastrous results from this first one, all future DE tests mixed in water were abandoned. Perhaps Kaolin clay mixed in water will be the next test.



**Experiment 4:** Growing hop plants from plant cuttings. Various potting soil mixes, types of cuttings (shoots, side arm ends, and segmented side arms and shoots), fertilizing, and potting methods were trialed.

**Purpose:** To determine the feasibility of growing plants in house from healthy stock for the ultimate goal of cost reduction.

**Results:** The experiments and tests are still ongoing, but the following are current findings. Placing the cuttings immediately in water allows for more cuttings to be taken at a single point in time and then later planted in soil. Cutting location does not seem to be an issue, so long as at least one stem node is placed below the water or soil surface. Cuttings appear to develop roots faster when taken after the third or fourth week in April through around Late July to early August. Placing the cuttings in a liquid fertilizer burns the stem and prevents root development. Plain, non-chlorinated water is best. Once potted, roots go down like a tap root and require proper potting methods to accommodate this feature and planting schedules need to be timed correctly so plants can be placed in the ground before roots grow through the bottoms of the pots. No significant difference was found between cuttings dipped in rooting hormone versus not, but further testing still needs to be done. It was found that plants grow and root well in shaded conditions but that new growth became burnt and withered when planted in full sun. This caused the new plants to be set back by having to regrow new leaves capable of handling full sun. Finally, various potting soil mixes are still being evaluated, but looser, seed starting-like soils appear to be the best. Rooting in water prior to planting in pots, versus directly planting cuttings in pots using moist potting soils does not seem to have an effect on the ability of the cuttings to root and grow so long as the soil is kept moist and not saturated. However, cuttings rooted in vials of plain water are much more successful than cuttings grown in jiffy pellets that were kept saturated with water. Also tested whether cuttings rooted better from darkened vials (painted brown to block sunlight) or from clear vials. No difference was found. Clippers were sterilized with rubbing alcohol after taking cuttings between plants and all vials were cleaned with a bleach solution and thoroughly rinsed between uses all in an effort to prevent and/or reduce the spread of disease. Much testing still needs to be conducted to include the effects of greenhouse versus open air potting as well as best light percentage for propagation and fertilizing times and amounts.



Experiment 5: Tested different mulching substances.

**Purpose:** To examine the differences between various mulches in an effort to find a suitable mulch for covering the hop crowns/hills while still maintain water permeability and decreasing the risk of disease and pest pressures.

**Results:** As noted earlier, grass clippings are poor mulches for hops. They compact down and create a hard cap over the hop crown. Furthermore, molds and mildews are easily transferred or created from piles of composting grass clippings. Unless continually kept wet, these caps of grass clippings let the water run off down the sides and not through. Finally, a hard cap of mulch makes it hard for shoots to break through in the spring. Cedar chips were tried next as Cedar is a natural bug repellent. However, the wind easily blew off the chips to expose bare dirt beneath. The cost of cedar chips and the amount needed for constant reapplication was inefficient. Cypress mulch followed due to its ability to suppress disease. The weight and consistency of Cypress mulch varies with brand but showed promise. The wind can blow some of it away and reapplication will be necessary but not near as bad as cedar chips. Finally, a local sawmill's mulch was used for winter protection for the 2017/2018 winter. This mulch is created from multiple varieties of local soft and hardwood trees, is heavier, doesn't blow away in the wind, and appears to show excellent water permeability. This mulch is said to be treated for termites. However, after research, it has been found that certain hardwood trees can harbor the Verticillium wilt pathogen. While the trellis poles have been mulched with this kind of mulch from the beginning of the yard's creation (2016) and will continue to be mulched like this for the immediate future, and no signs of verticillium wilt have currently been found, this type of mulch may end up being replaced with Cypress mulch again as a hop hill/crown cover as a precaution in preventing verticillium wilt. Not using mulch creates a situation where rainfall washes the soil away and exposes the crown. Also, mulch helps retain soil moisture levels and allows for less frequent watering.



Experiment 6: Starting hops earlier than normal.

**Purpose:** Due to less daylight hours than the normal hop growing regions, it was theorized that if frost could be avoided, the hops could benefit from longer exposure to the sun.

**Results:** While a few varieties may have benefitted from being started early (April 1<sup>st</sup>) such as Pacific Gem and CRV, several varieties actually became stunted as a result. These varieties were cut back and retrained on May 16<sup>th</sup>, but never reached the height that they should have. Still, other varieties showed no significant negative or positive signs from being started early. The following season (2018) all but a few varieties will be started around May 1<sup>st</sup> and compared to 2017's growth habits.

Experiment 7: Tried to "double crop" or get multiple harvests by cutting bines down and re-growing new bines immediately after the first harvest. The majority of the hop yard was tested by cutting down each variety as it was harvested and then having new bines retrained for a second harvest. This experiment also ties in with why the plants were started early.

**Purpose:** It has been documented that only one harvest can be performed during each growing season. However, the experiment was to see if multiple harvests could be performed as a way to boost total cone production over the entire year and thus profitability.

**Results:** The commercial growers and literature are correct. Multiple harvests can be performed; however, the negatives outweigh the positives. All labor, disease/pest control measures, and testing practices from harvesting to packaging would have to be doubled. Furthermore, the second crop grows shorter and produces less than the first crop. Both crops cannot be blended together because the first crop would deteriorate terribly before the second crop was ready. All in all, it is advisable to simply start the hops around May 1<sup>st</sup>, train no more than 3-4 bines around a single string (or 6-8 bines split between two strings) and have a single harvest when the majority of the cones are ready for picking. It should also be noted that even though a multiple harvesting schedule is not financially feasible for commercial applications, homebrewers growing a few plants for personal use are not limited by these factors and can perform multiple harvests.



**Experiment 8:** Tested several fungicides and pesticides, both organic and non-organic, to test their abilities in controlling various mildews and pests. Some were found not to be VA approved for use on hops and/or did not have “hops” listed on their labels. “Grapes” was used instead and none were used past burr initiation.

**Purpose:** To test their ability in controlling various pests and mildews/fungi, as well as to monitor any adverse plant reactions to the applications.

**Results:** All fungicides, even if applied using the “grapes” application labeling, showed to be effective against their intended targets. The three fungicides Captan, Mancozeb, and Chlorothalonil (Daconil) used last season and this season were found not to be listed on the VA list of approved fungicides for use on hops. As such, these products will not be used for future control. However, during their use, they were shown to be as effective as other fungicides in their own FRAC group codes of “M” with Mancozeb appearing to be the best overall, while Chlorothalonil and Captan came in second and third, respectively. None were applied after burr formation and no adverse plant reactions were noted. Azera was used as a new organic control for various pests, namely earwigs. The product appeared to work as intended on other pests, but because earwigs could not be directly contacted during the day, its effect on earwigs is still unknown. It is said to control them, but further tests are needed.



## Future (2018) Experiments

Experiment 1: Extending the current poles on several high climbing varieties so as to reach 19' instead of the current 14'.

Purpose: To determine the feasibility and design of attaching extension poles to the existing collars of several varieties that can climb over 16'. Currently, the hops are looped on themselves once they reach a certain height. This is done multiple times on some varieties. Sometimes, the tips are broken while doing this and thus stops any vertical growth of that bine. It is hoped that by extending the poles to 19', the need to loop the tops of the plants will be unnecessary and that accidental breakage of bines will be significantly reduced, thus increasing and maximizing upper plant cone production.

Experiment 2: Using two strings instead of one to train bines in a similar way the large commercial growers use.

Purpose: This past season, the hop bines were trained up only one string. This led with only 3-4 or 10+ (experimental) bines being trained up a single string per crown. It is hoped that by having two strings with 3-4 bines each, the cones will be of normal size and that vegetative growth will not inhibit disease and pest control measures. Furthermore, it is hoped that cone yield weights will be higher.

Experiment 3: A small cold frame-style greenhouse will be erected to aid in propagating hop cuttings.

Purpose: A greenhouse will help retain heat and moisture better and longer than open air propagation. Aside from other various benefits, the hop cuttings can be more accurately tested for the best growing conditions immediately after being taken from the parent plants.



Experiment 4: Continuing to test and evaluate various pesticide/fungicide/herbicide controls with an emphasis on organics.

Purpose: The following pesticides and fungicides will be used to control various fungi, mildews, as well as hard and soft bodies insects and tested for their effectiveness.

Oxidate 2.0 (organic) – fungicide  
Kocide 3000 DF (organic) – fungicide  
Phos Acid (not organic) – fungicide  
Zonix (organic) - fungicide

TriTek oil (organic) – pesticide/fungicide  
Neem oil (organic) - pesticide/fungicide

Surround WG (organic) – barrier repellent  
PyGanic (organic) – pesticide  
Insecticidal soap (organic) – pesticide  
TriTek oil (organic) – pesticide



Can be combined for hard bodies  
insect control



Can be combined for soft bodies  
insect control

An early spring soil drench of Oxidate 2.0 will be applied prior to bine training.

All pesticides/fungicides will be rotated and applied as pest pressures and weather patterns dictate.

Avenger (organic) and other herbicidal alternatives will be used instead of Glyphosate (RoundUp) or 2-4 D (Crossbow) as an herbicide and tested for their effectiveness.





Rank	Variety	lbs wet	lbs dry	oz wet	oz dry	% dry matter	# of plants harvested	# of plants end of season	est # of plants for next season
24	Comet								4
25	Cashmere								4

Totals                    43.21    10.30    691.00    164.9    23.8%                    53            118            184  
 (average)

\*These varieties produced more wet weight than the variety directly above them, but because they were dried more (as the dry matter percentage can attest to), they ended up with less dry weight and were thus ranked lower.

Will also be adding seven more varieties consisting of 28 more plants total for the spring of 2018. This will bring the estimated number of plants next year for the entire hop yard to 184.



### Estimated Hop Production Guidelines

Variety	lbs/acre	1000 plants per acre				1400 plants per acre			
		lbs/ plant normal	avg norm	lbs/ plant 84%	avg 84%	lbs/ plant normal	avg norm	lbs/ plant 84%	avg 84%
Alpha	1100-	1.10-				.79-			
Aroma	2910	2.91	2.01	.18-.47	0.33	2.08	1.44	.13-.33	0.23
CRV	2000 +	2 +	2	.32+	0.32	1.43+	1.43	.23+	0.23
Cascade	1667-	1.67-				1.19-			
	2133	2.13	1.90	.27-.34	0.31	1.52	1.36	.19-.24	0.22
Cashmere	no info	no info	no info	no info	no info	no info	no info	no info	no info
Centennial	1420-	1.42-				1.01-			
	1670	1.67	1.55	.22-.27	0.25	1.19	1.10	.16-.19	0.18
Challenger	1013-	1.01-				.72-			
	1603	1.60	1.31	.16-.26	0.21	1.14	0.93	.11-.18	0.15
Chinook	1640-					1.17-			
	2200	1.64-2.2	1.92	.26-.35	0.31	1.57	1.37	.19-.25	0.22
Columbia	1707-	1.71-				1.22-			
	2200	2.20	1.96	.27-.35	0.31	1.57	1.40	.19-.26	0.23
Columbus	2090-	2.09-				1.42-			
	2615	2.62	2.36	.33-.42	0.38	1.87	1.65	.23-.30	0.27
Fuggle	918-					.65-1			
	1407	.92-1.41	1.7	.15-.23	0.19	1.14-			
Galena	1600-					1.43			
	2000	1.60-2	1.8	.26-.32	0.29	1.29	1.29	.18-.23	0.21
Glacier	2270-	2.27-				1.62-			
	2460	2.46	2.37	.36-.39	0.38	1.76	1.69	.26-.28	0.27
Horizon	1800-					1.29-			
	2000	1.80-2	1.90	.29-.32	0.31	1.43	1.36	.21-.23	0.22
Kirin II	1887-	1.89-				1.35-			
	2500	2.50	2.20	.30-.40	0.35	1.79	1.57	.22-.29	0.26
Magnum	1270-	1.27-				.91-			
	1610	1.61	1.44	.20-.26	0.23	1.15	1.03	.15-.18	0.17
Mt. Hood	1353-	1.35-				.97-			
	1890	1.89	1.62	.22-.30	0.26	1.35	1.16	.15-.22	0.19
Multthead	no info	no info	no info	no info	no info	no info	no info	no info	no info
Newport	2038-	2.04-				1.46-			
	2420	2.42	2.23	.33-.39	0.36	1.73	1.60	.24-.27	0.26
Pacific Gem	2040 +	2.04+	2.04	.32+	0.32	1.46+	1.46	.23+	0.23
Santiam	1340-	1.34-				.96-			
	1840	1.84	1.59	-.21-.29	0.25	1.31	1.14	.15-.21	0.18
Southern Cross	1527 +	1.53+	1.53	.24+	0.24	1.09+	1.09	.17+	0.17



Triple Perle	no info		no info	no info	no info	no info		no info	no info	no info	no info
Willamette	1500-1973		1.5-1.97	1.74	.24-.32	0.28		1.07-1.41	1.24	.17-.23	0.20
Zenith	< 2000		<2	2	< .32	0.32		< 1.43	1.43	< .23	0.23
? Local	no info		no info	no info	no info	no info		no info	no info	no info	no info

1. All "lbs/acre" figures are from three sources (Great Lakes Hops, The Hops List, and the USDA where available) and averaged together.

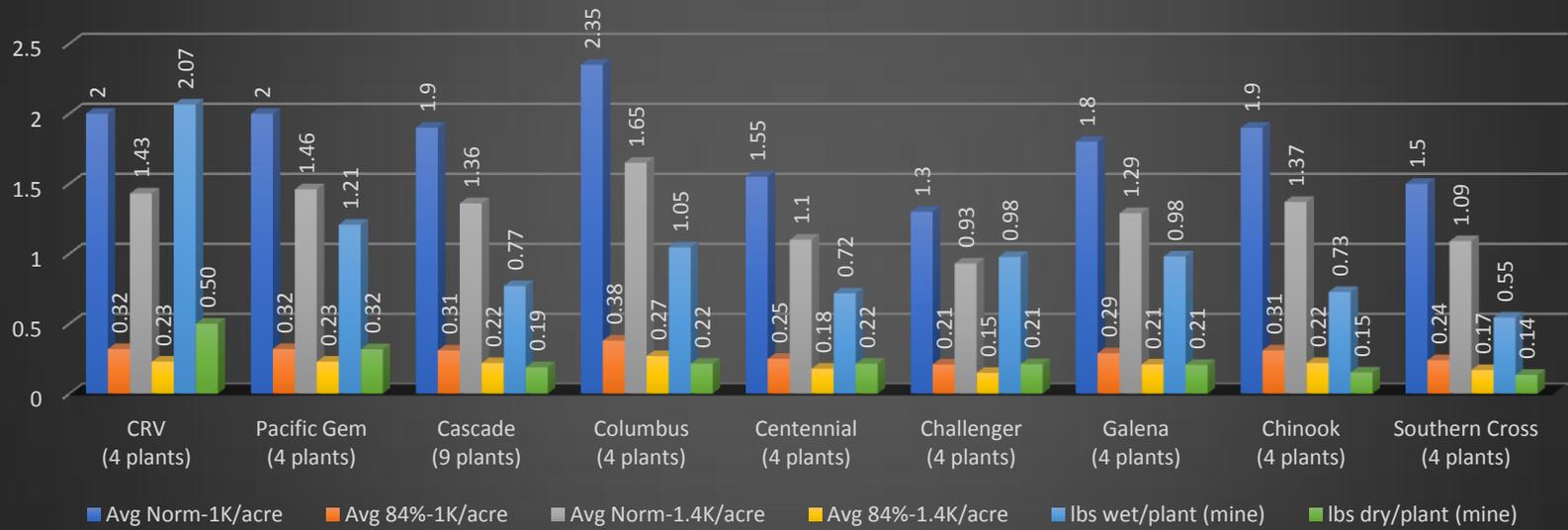
2. The 1400 and 1000 plants/acre figure is based on an email from Great Lakes Hops.

3. The 84% figure is based on a Virginia Tech article entitled "Hops to the harvest." It simply means that these figures are 84% less than, or 16% of the normally harvested lbs/plant average.

4. You will notice that the 1000 plants/acre figures are higher than the 1400 plants/acre figures. This is because the pounds/acre weights are spread among fewer plants. We do not know the plant density for each variety; therefore, two figures were created.

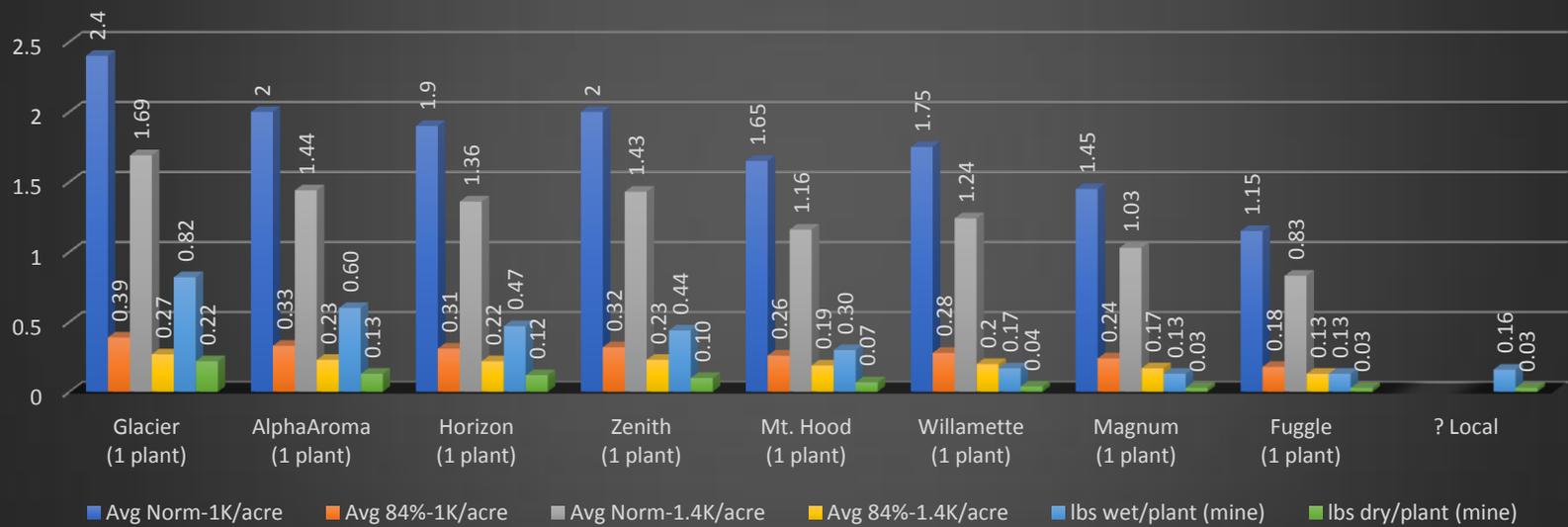
# 2017 Harvest

Presented on a per plant average  
 "( )" = Total plants harvested



# 2017 Harvest

Presented on a per plant average  
 "( )" = Total plants harvested





2017 Year

Variety	Start of Growth <6" shoots	Harvest Date(s)	Days from Growth start to 1 <sup>st</sup> Harvest	Range (-5 days and +10 days)	Est. Season Maturity
AlphAroma	4/1	8/6	128	123-138	GLH-Late (similar to other NZ varieties) USDA-Late to Very Late
CRV	4/1	7/22, 8/6, 9/7	113	108-123	GLH-Late Season USDA-Med. To Med. Early
Cascade	4/1	6/29, 7/15, 7/23, 8/2, 8/10	90	85-100	GLH-mid season (first 3 weeks in Aug) USDA – Med. To Med. Late
Centennial	4/1	6/29, 7/11	90	85-100	GLH-Early to Late July to Early Aug. USDA-Early to Med. Early
Challenger	5/16	7/20, 8/24, 9/7	66	61-76	GLH-mid season USDA-Med. To Med. Late
Chinook	4/1	6/30, 7/19, 8/6, 8/24, 9/7	91	86-101	GLH-Medium Late USDA-Med. To Med. Late
Columbus	5/16	7/15, 8/24	61	56-71	GLH-Mid to Late USDA-Late
Fuggle	5/16	7/17	63	58-73	GLH-Late July to Early Aug. USDA-Early
Galena	5/16	7/20, 8/10, 9/7	66	61-76	GLH-Mid season USDA-Med. To Med. Early
Glacier	4/1	7/16	107	102-117	GLH-Mid season USDA – no info
Horizon	4/1	6/29, 7/19	90	85-100	GLH-Mid to Late USDA- Med. Late
Magnum	4/1	8/10	132	127-142	GLD-Mid season (Mid to late Aug) USDA-Med. To Med. Late
Mt. Hood	4/1	7/16	107	102-117	GLH-Early to mid season (first 3 weeks in Aug) USDA-Medium
Pacific Gem	4/1	7/15, 9/7	106	101-116	GLH-Very Late (too late for northern latitudes) USDA-Late



Variety	Start of Growth <6" shoots	Harvest Date(s)	Days from Growth start to 1 <sup>st</sup> Harvest	Range (-5 days and +10 days)	Est. Season Maturity
Southern Cross	4/1	6/29, 7/19, 9/7	90	85-100	GLH-Mid season (Earlier than other NZ varieties) USDA-late
Willamette	4/1	7/16	107	102-117	GLH-early to mid Aug. to early Sep. USDA-Medium
Zenith	4/1	6/29	90	85-100	GLH-Early to mid season USDA-Med. Early
? Local	No info				

1. The multiple harvest dates were an experiment to see its feasibility, and to maximize the harvest amounts.
2. The varieties started later showed to be ready for harvest much earlier than those started in April. Due to our shorter daylight hours compared to the Northwest, I wonder if the hops felt the need to “catch up” faster.
3. The “range” is purely my thoughts and does not reflect any researched data.
4. The estimated season maturity was taken from Great Lakes Hops and the USDA.



## 2017 Spray Record

Date	Days between	Spray Product
4/16	>4	Copper
4/20	>10	Mancozeb, Phosphorus Acid
4/30	>2	Copper
5/2	>3	Copper
5/5	>5	Captan
5/10	>14	Copper
5/24	>3	Spinosad, Neem oil, DE
5/27	>1	Spinosad, Neem oil, DE
5/28	>3	Copper, Neem oil, Spinosad, DE
5/31	>7	Seven, Neem oil, DE
6/7	>8	Azera, Bravo, Copper, DE
6/15	>19	Copper
7/4	>18	Copper, Neem oil
7/22	>1	Copper, Neem oil
7/23		Copper, Neem oil

Was really dry starting in early June through September. Did not see much mildew problems during this time. Quick turnarounds of spray indicated it rained and washed the spray off. So, I had to reapply.