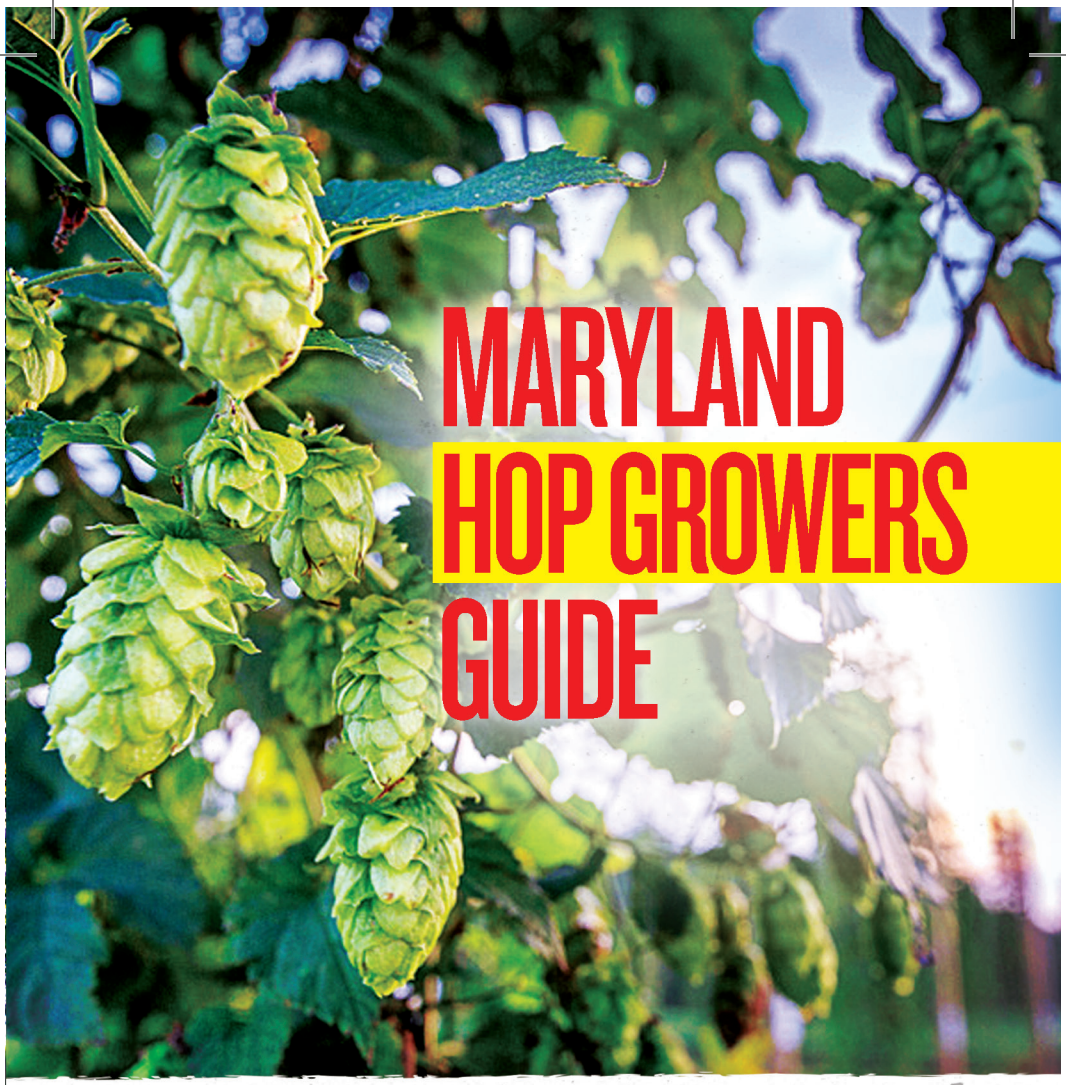


MARYLAND HOP GROWERS GUIDE

A Progress Report on the 2017-2018 Growing Season and Summary of Best Practices for Growing Hops in Maryland

FLYING DOG | UNIVERSITY OF MARYLAND 1856 | COLLEGE OF AGRICULTURE & NATURAL RESOURCES

Flying Dog Brewery and the University of Maryland's College of Agriculture and Natural Resources: Revolutionizing the Future of Beer-Centric Agriculture

IN THE FIRST YEAR OF OUR PARTNERSHIP WITH THE UNIVERSITY OF MARYLAND, WE SPOKE A LOT ABOUT THE FUTURE OF BEER AGRICULTURE IN THE STATE.

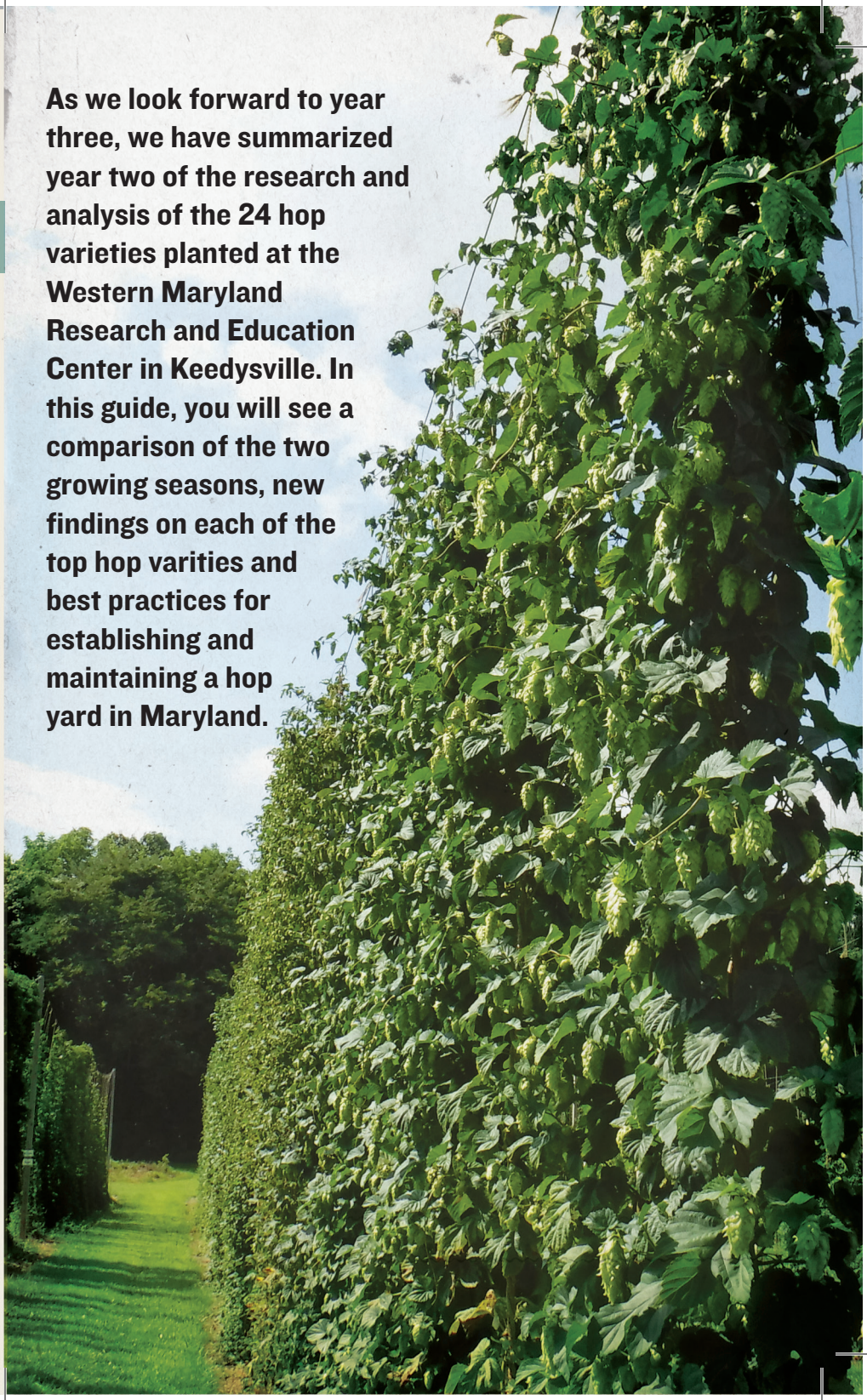
NOW THAT WE ARE IN YEAR TWO, THE FUTURE IS NOW.

Based on findings from the past two years, UMD's College of Agriculture and Natural Resources is establishing a new hop yard of the top varieties next year. Year two saw the yields in 23 of the 24 varieties skyrocket, confirming our belief that hops grown in Maryland need rigourous maintenance to thrive. More important, our second year of this project gave us the confidence to invest even more in Maryland hops.

Amallia, Glacier, Southern Cross, Sorachi Ace and Vojvodina have been standouts and will be planted in the new hop yard in early May 2019. Southern Brewer may also join the mix as long as UMD is able to obtain the plants. It's imperative that the hops we focus on are both agriculturally and commercially viable, so if one of the varieties is not readily available for purchase, it will not be pursued.

(When this guide went to print, we were still in the hunt for Southern Brewer.)

In addition, UMD is implementing an innovative trellising system in this new yard to better fit Maryland's unique climate. Developed by a Maryland-based greenhouse company, galvanized metal poles will be used to withstand the extreme humidity better than pressure-treated wood poles. While the initial investment in metal poles is significantly higher, the season-to-season maintenance will be much less. And because metal is stronger, we will use half the number of posts in the yard – taking them to their engineering limit.



As we look forward to year three, we have summarized year two of the research and analysis of the 24 hop varieties planted at the Western Maryland Research and Education Center in Keedysville. In this guide, you will see a comparison of the two growing seasons, new findings on each of the top hop varities and best practices for establishing and maintaining a hop yard in Maryland.

FROM FLYING DOG CHIEF OPERATING OFFICER MATT BROPHY AND BREWMASTER BEN CLARK:

MATT BROPHY
CHIEF OPERATING OFFICER

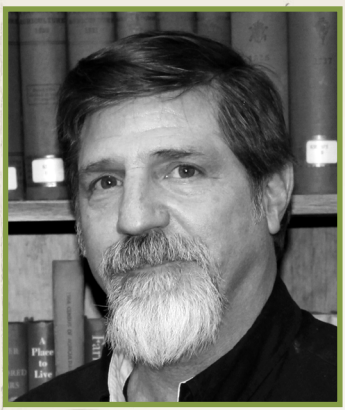
BEN CLARK
BREWMASTER

Our primary goal from year one to year two didn't change: We want Maryland hops to be the same quality as the hops we get from the Pacific Northwest, the largest producer of hops in the United States. While we may see differences in the aroma and flavor of hops grown locally, it's important for them to be as commercially-viable for both growers and brewers here as they are with their Yakima Valley counterparts. A hop could have the most face-melting profile, but if the yield isn't enough to recoup the investment it takes to grow it, it's not going to do anyone any favors.

That's why it's so important that we detail our progress and findings in this guide. The UMD team is establishing and adapting best practices that already resulted in huge increases in yields from year one to year two.

And while it's great to already have multiple data sets for comparison, year three is really where we'll learn the most. It typically takes hop bines three years to reach full maturity, so from next year on, we will be working with fully-mature hops, which will give us the best indication of how viable they truly are in this climate.

FROM UNIVERSITY OF MARYLAND EXTENSION AGENT BRYAN BUTLER:



BRYAN BUTLER
EXTENSION AGENT

Anyone with a base understanding of research knows that true conclusions can only be reached when you have multiple sets of data you can compare. That is what makes Flying Dog's multi-year commitment to this project so exciting.

As with any agricultural project, it all comes down to weather. This past growing season saw 73 inches of rain — where we normally see about 40 inches annually — and it rained through the harvest, which was challenging. But with yields doubling, and sometimes quadrupling, across the board, we now know how well the plants respond to intensive management of disease, pest, fertilization and irrigation, even when the weather conditions are not ideal.

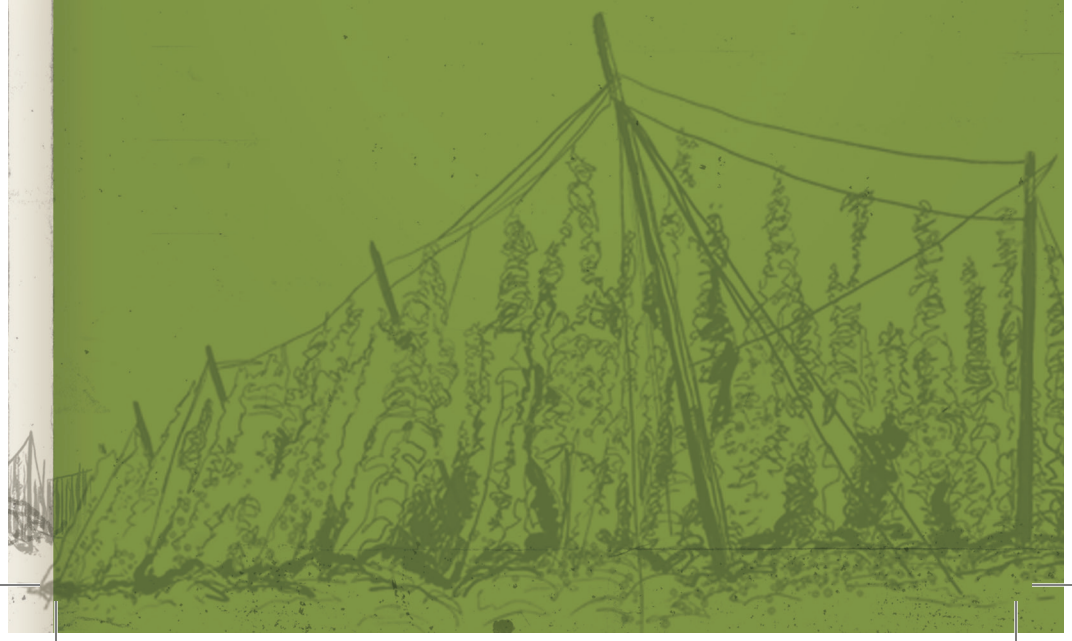
I'm now confident that if we got the right weather patterns, we could see the kinds of yields we see on the West Coast once these hops reach full maturity.

Like Matt and Ben, I look forward to year three and seeing these plants reach full maturity.

The goal of this joint research is to determine what hop varieties are best suited for production in Maryland and what challenges Maryland growers may encounter along the entire production chain – from growing to harvesting to processing. Compared to the Pacific Northwest, Maryland is hotter, more humid, at a lower latitude and has a variety of insects and soil types.

This guide is intended to be less a recipe for production and more a menu for growers to select what works in their own operations with ideas to combat common challenges that limit production in the region. To give potential growers the most accurate look at what it takes, this guide concludes with a glimpse into a year in the life of growing hops.

PROGRESS REPORT



HOP VARIETIES STUDIED

Because this project is a replicated variety trial, the same hops were studied in year two.

Planted in 2016, these 12 varieties were initially chosen from discussions with academic and industry experts on what hops local brewers are interested in or are already using:

AlphAroma	**Chinook**	**Mt. Ranier**	**Southern Cross**
Cascade	**Crystal**	**Nugget**	**Tahoma**
Centennial	**Mt. Hood**	**Sorachi Ace**	**Ultra**

As those discussions extended to farmers who were already growing hops in Maryland, it became clear that there were more varieties that had potential success in this region. The remaining 12 varities were chosen based on both agricultural and market potential:

Amallia	**Glacier**	**Newport**	**Vojvodina**
Canadian Red Vine	**Multihead**	**Southern Brewer**	**Willamette**
Galena	**Neo 1**	**Teamaker VF**	**Zeus**

Each variety was planted in a block of six plants and replicated three times on a ½-acre plot. Plants were spaced widely with 3½ feet between plants and 10 feet between varieties to maximize airflow, a priority in Maryland's humid climate. Data was collected on fertility and irrigation; disease, insect and pest management; harvest timing; levels of acid and oils in the hops; and any other unique aspects of the hop's profile.

The lowest-performing varieties, Neo 1 (with no yield) and Multihead (low plant survival) were removed at the end of this year and will be replaced with two prospective local, heirloom varities.

2018 PLANTING AND GROWING SEASON

Observations of weather conditions in the hop yard began right after Christmas. We saw extreme cold from late December through mid-January with no snow cover and little moisture, which may have contributed to the loss of several Multihead plants.

February through April were average for both temperature and moisture. We saw heavy rain in mid-May that brought downy mildew in the field, and a limited opportunity to apply a fungicide. Phostrol was applied, but it did not have adequate conditions or time to dry.

At the end of May, there was a heavy infestation of leafhoppers, which blow in every year from the south. It depends on the weather patterns, but once they arrive, the population increases very quickly. They reduce the plant's ability to photosynthesize and need to be combatted quickly with an insecticide.

That infestation was followed by another round of heavy rain at the beginning of June with a subsequent round of downy mildew.

In July, the area only got 23 inches of rain — half of the average rainfall for this area — that also included an extremely hot temperature spike in the middle of the month. That caused a Two-Spotted Spider Mite outbreak, which required a heavy application of miticide to control.

From late June through mid-August, there was also an abundance of Japanese Beetles, fought off by an insecticide.

What's interesting about the all of the herbicides, fungicides, pesticides, insecticides and miticides we have access to for this product is that there are very few labeled specifically for hops, making finding the right mix of products challenging, but not impossible.

HOW DID THIS COMPARE TO 2017?

The 2018 season was a more typical reflection of Maryland weather. Heat and humidity were in full force, which set the stage for the a similar amount of insect and disease development as we saw in 2017. What we've now learned is that intensive care is paramount from the third or fourth week of June to early August, which is a small window for a perennial plant, in order for these plants to thrive.

HORTICULTURAL PRACTICES

Soil Preparation
The soil was prepared the previous fall, limed with Phosphorus and Potassium added for levels optimum for corn in Maryland.

Floor Management
Planted rows are maintained as 42-foot-wide bare ground with 12½-foot alleys in between rows. Alleys were planted with tall fescue, which suppresses weeds while allowing equipment use despite Maryland's frequent heavy rains.

Fertility
Nitrogen was applied as six banded applications of sulfur-coated urea for a target of 240 pounds per acre per growing season.

Stringing
Wires were run parallel to the posts to maximize airflow. One and two-year-old plants were strung with two bines per string. Three-year-old plants were strung with two bines on two strings in a "V" arrangement.

Crowning
In 2017, plants reached the top wire long before the optimal date of June 21, indicating that final crowning was too early. In 2018, the final crowning was delayed until May 16 and yields improved dramatically, even in the younger plantings.

HARVEST

This project is not only about growing an excellent hop in sufficient quantities.

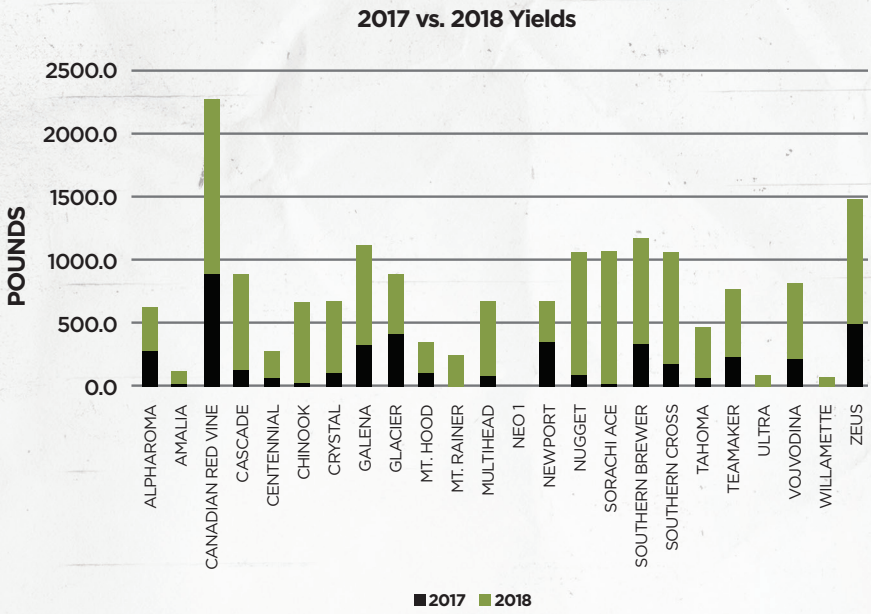
ALSO, THE HOPS MUST BE USEFUL TO CRAFT BREWERS IN MARYLAND, SO IT IS ALSO ABOUT DEMONSTRATING SCALABLE TECHNOLOGIES TO PROVIDE A HIGH-QUALITY PRODUCT IN A USEABLE FORM TO BREWERS.

This meant harvest and post-harvest handling had to be an integral component to this experiment.

One of the most critical components was the timing of the harvest, which needed to be performed consistently and within a narrow window of time to ensure maximum quality and comparison of varieties. To facilitate this, Flying Dog's investment in the partnership included joint funding of a mobile harvester. The harvester ensured that each variety was harvested in a timely and consistent fashion, and ensured the data collected on each variety regarding yield was (and will continue to be) consistent.

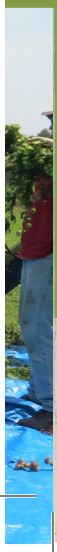
The cones were harvested at 20% moisture and in 2018, all 24 varities were harvested within a 12-day period.

Harvest of the 24 varieties stretched from August 12 through August 24, with each hop harvested at 23 to 29% dry matter.



The entire harvest was very quick – 12 days for 24 varities. Most days, we had to wait for the plants and ground to dry, so harvest wouldn't start until early afternoon. Then, it was essential to get them into the dryer quickly because the moisture content was so high. This year, we used a dehumidifier inside of the dryer to get the moisture out of the hops as fast as possible (reducing moisture content from 20% down to 8% in less than 24 hours).

HOW DID THIS COMPARE TO 2017?

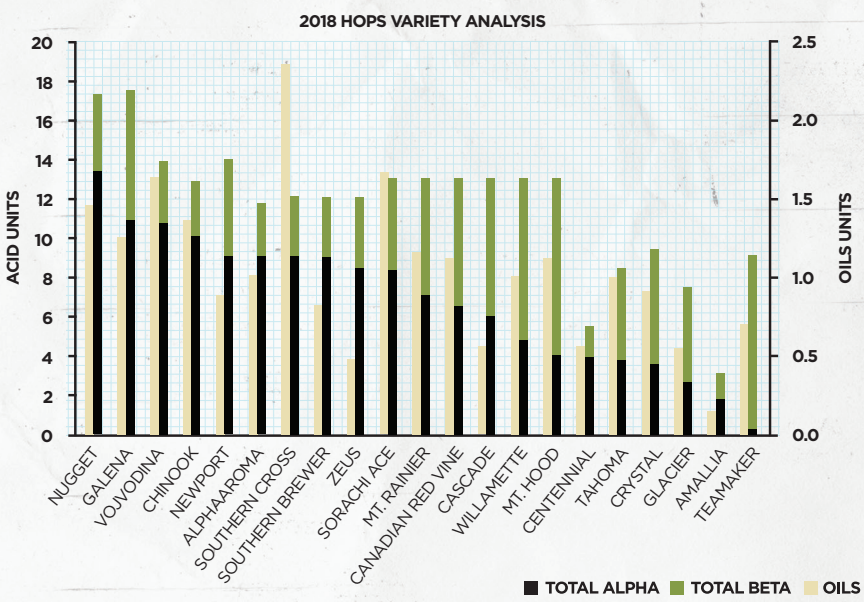


PROCESSING

Like last year, the hops were processed on site at the research facility after harvest. The hop cones were placed in the oast immediately following harvest and dried within 24 hours to 8% moisture. They were refrigerated in sealed bags until they could be ground up in the hammer mill and then run directly into the pelletizer. Special attention was paid to not let the pellets heat above 110 degrees during pelletization. Once pelletized, they were placed in vacuum-sealed bags and frozen.

HOW DID THIS COMPARE TO 2017?

Most of the same processing techniques were used this year to maintain best practices for processing hops and to minimize the number of variables in this project. Because the hops needed to be harvested in a shorter timeframe this year, they were vacuum-packed and stored in a freezer once they were dried. This kept them stable in between processing runs and while we finished the harvest. Processing the hops cold also made efficiency much better, an unexpected discovery out of necessity.

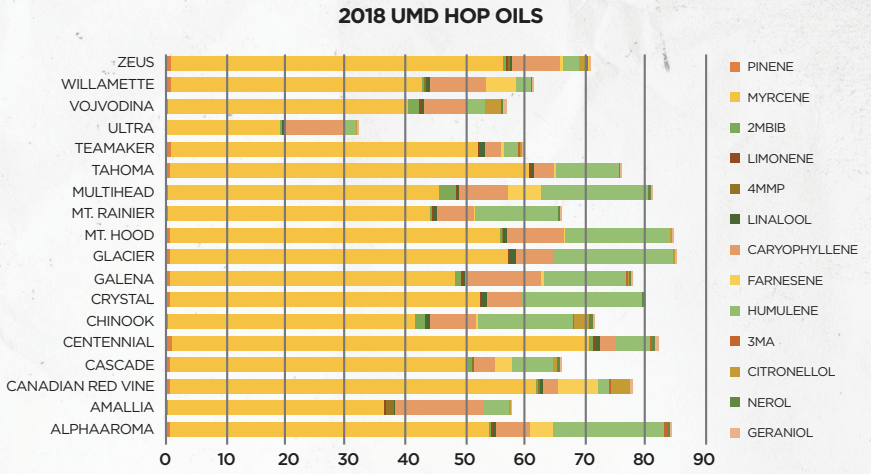


** Please note that the yields on Neo 1 and Ultra were insufficient for outside lab analysis.*

HOP ANALYSIS

Samples of dried cones and final pellets were sent to a facility at Virginia Tech for a complete analysis of oils and acids. A pre- and post-pelletization comparison showed how pelletizing impacts each hop's composition.

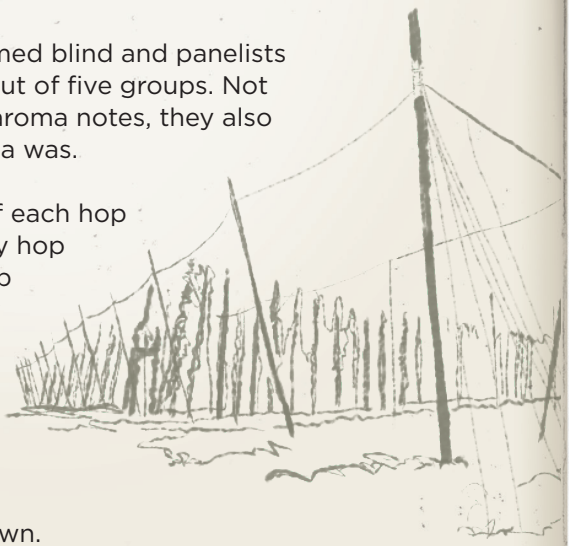
What's interesting is that a typical brewer's evaluation of hops in Yakima Valley does not include any of this data. We solely evaluate hops from a sensory standpoint. But since this is a research-based project, we want to make sure our sensory analysis of UMD's varieties matches up with the actual composition of these hops. And for the most part, our evaluations are aligning with the aromas and flavors that are typically associated with each hop oil. In the long term, this will help us identify patterns of oil compositions based on the ideal profiles for each variety.



Within a week of processing, Flying Dog received all of the hops from 2018's harvest except for the samples that were sent to Virginia Tech. To mimic how the brewery would use them in the brewing process — without brewing an individual beer with each — Flying Dog replicated its dry-hopping process by adding the hops to a light lager set to the same temperature as a dry hop. Brewmaster Ben Clark's sensory team also did an aroma evaluation of the pelletized hops.

Each evaluation was performed blind and panelists selected the top two hops out of five groups. Not only did the team evaluate aroma notes, they also noted how intense the aroma was.

Flying Dog's final analysis of each hop combines the aroma and dry hop evaluations, with the dry hop evaluation weighted heavier because that is the best indication of how the hops would perform in a beer. What was most interesting to Clark was that his team's evaluation of the hops aligned with the oil breakdown.



The top rated hops from the 2018 harvest were:

Vojvodina: Floral and melon aromas followed last year's evaluation with an addition of a huge tropical and citrus pop.

Southern Cross: Last year, this hop was essentially fruit punch, but this year brought more distinct citrus.

Southern Brewer: This variety is typically used for bittering, not flavor or aroma, but the hops grown at UMD align with the most popular hops coming out of the Pacific Northwest right now. Citrus, melon and resin dominate.

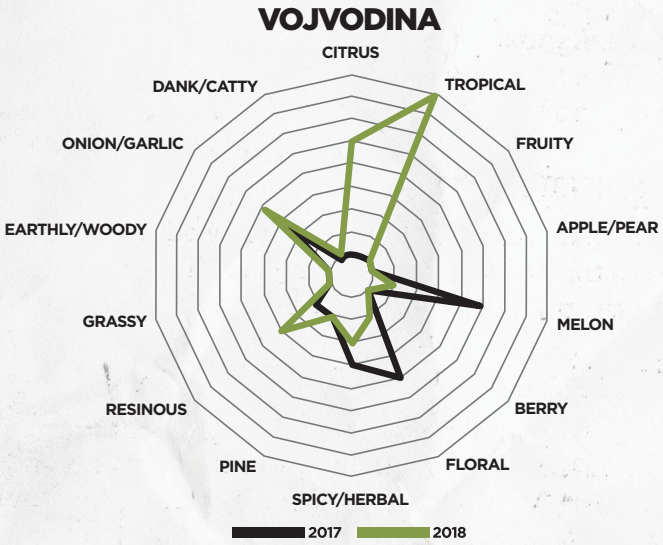
Glacier: Huge fruit and pine with subtle herbal and floral notes this year, compared to a much more prominent resinous notes last year.

Sorachi Ace: The profile of lemon, citrus and spice mimics what you would expect from that variety.

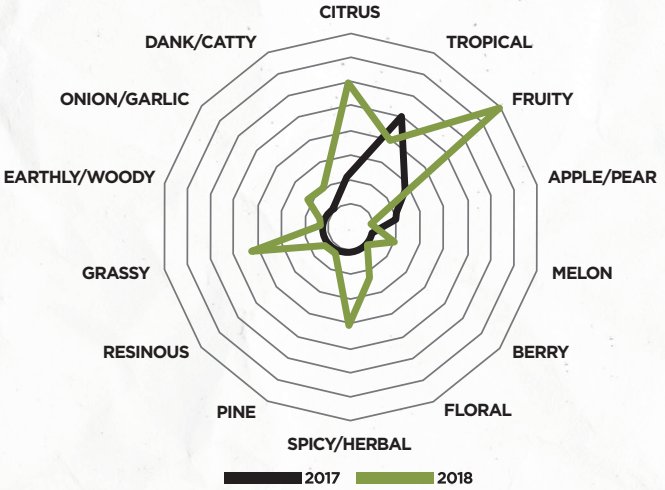
Amallia: There was no yield last year, but this year's harvest brought a unique combination of tropical fruit and earthiness.

Canadian Red Vine: While this hop had the best yield in 2017 and 2018, the profile is a less-desirable combination of onion, garlic and herb.

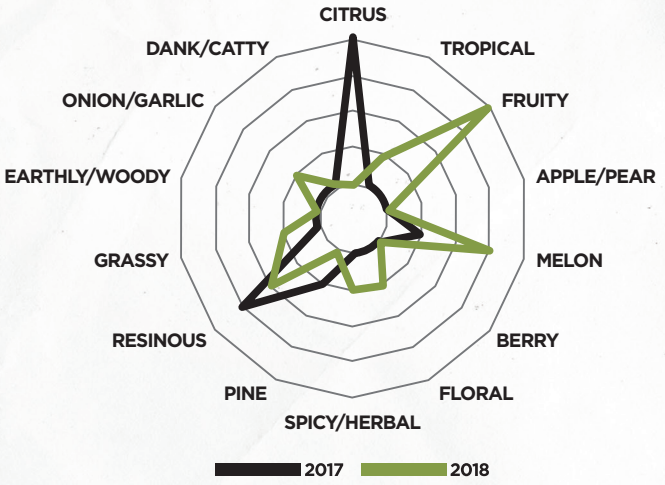
When evaluations were completed, Clark mapped the top performing hop profiles on spider sensory maps to compare profiles from last year's harvest.



SOUTHERN CROSS

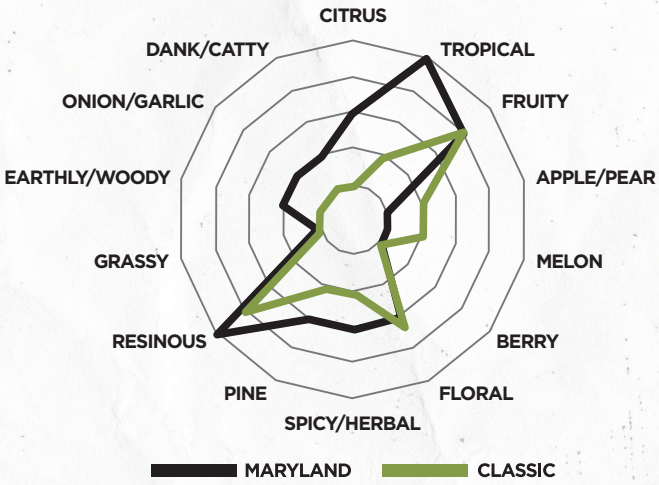


SOUTHERN BREWER

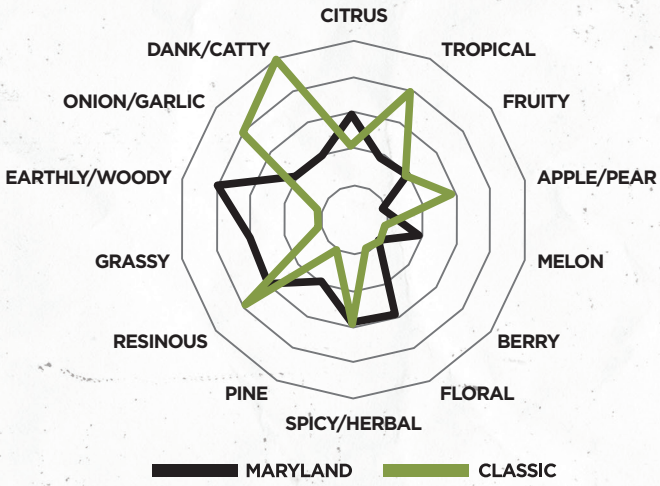


Because the goal of this research is to see if hops grown in Maryland can be the same quality as hops from more traditional growing regions, Clark also mapped the characteristics of Chinook and Zeus, two more common hops, to compare evaluations of the Maryland harvest with each hop's classic profile.

CHINOOK



ZEUS



HOW DID THIS COMPARE TO 2017?

The top hops from the 2017 harvest were Vojvodina, Glacier, Mt. Hood, Newport, Southern Brewer and Southern Cross. Vojvodina, Glacier, Southern Brewer and Southern Cross remained on 2018's list, but Mt. Hood and Newport were replaced by Amallia, Canadian Red Vine and Sorachi Ace.

2018:

Vojvodina: Tropical, citrus

Southern Cross: Citrus, fruit

Southern Brewer: Citrus, melon, resin

Glacier: Pine, fruit, spice

Sorachi Ace: Citrus, lemon, spice

Amallia: Fruit, earth, berry

Canadian Red Vine: Onion, garlic, herb

2017:

Vojvodina: Green, melon

Southern Cross: Fruit punch

Southern Brewer: Tangerine, resin

Glacier: Pine, resin

Mt. Hood: Fruit and herb

Newport: Pineapple, green apple

THAT MEANS THAT THE BIGGEST QUESTION FOR NEXT YEAR IS IF THE AROMAS AND FLAVORS WILL BE THE SAME WHEN THE HOPS ARE FULLY MATURE.

The profile differences from 2017 to 2018 show how drastically some hop varities can change as they are reaching full maturation. This is exemplified by a past experiment of Flying Dog, a series of Single Hop Imperial IPAs. For three years in a row, we released a version with El Dorado, then a new and experimental variety, that was brewed as the plants matured in Yakima Valley. Once the plants reached maturity, the profile of the hop in the beer was no longer desirable as a standalone hop.

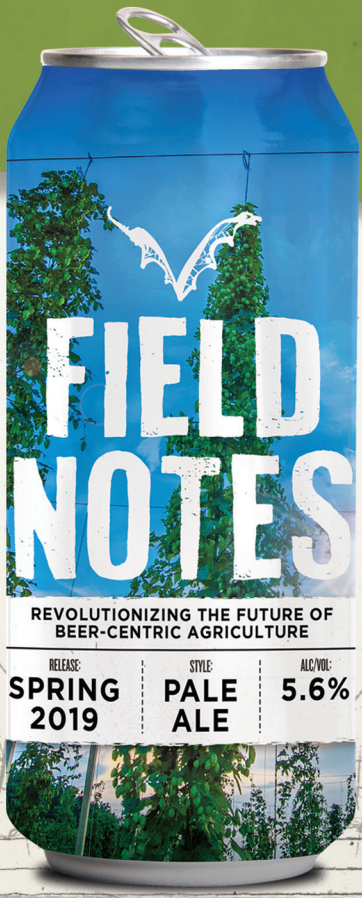
NOTES

FINISHED PRODUCT

Part of Flying Dog's commitment to this project is the release of at least one version of Field Notes Pale Ale, brewed exclusively with hops grown by UMD. The sensory evaluations performed by Ben Clark are a great way to predict how the hops will perform, but they are still predictions. There is no better way to truly evaluate a hop than to brew with it.

What's also essential is the consumer feedback we receive on each Field Notes release. It completes the trifecta of excitement about Maryland hops between growers, brewers and craft beer fans.

Every release of Field Notes Pale Ale has a simple malt base and clean yeast strain to allow for the fullest expression of each hop. A version was released post-harvest in the fall of 2018 and another version was released in the spring of 2019 with hops saved from the 2018 harvest.



Fall 2018

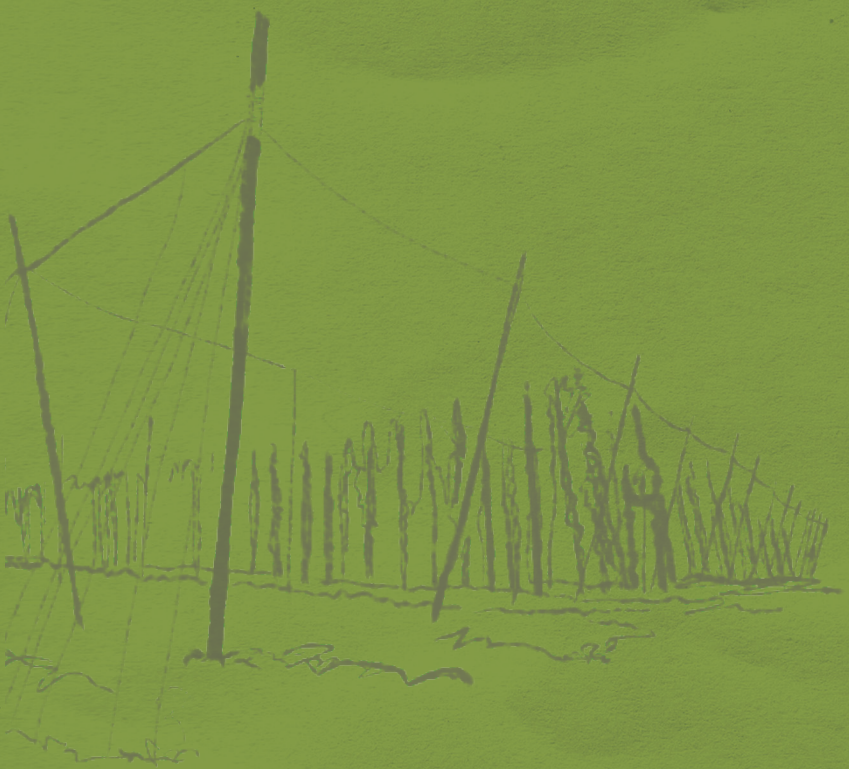
5.6% ABV
Galena used for bittering
Chinook, Crystal, Glacier, Nugget and Vojvodina used for flavor and aroma

Spring 2019

5.6% ABV
Galena used for bittering
Vojvodina, Southern Brewer, Southern Cross used for flavor and aroma

This spring release will be similar to our the original version of Field Notes that we brewed in the fall of 2017 because our top three hops – Vojvodina, Southern Brewer and Southern Cross – remained our favorites. What's most exciting is that because the yields were so much better this past year, we did not need to use any other varieties to as supplements to get the volume to where it needed to be for a production-size brew.

BEST PRACTICES



ESTABLISHMENT OF A MARYLAND HOP YARD

Soil and Site Preparation: It is critical in our climate that you select the best site possible. This will help to reduce the negative effects – extreme heat, high humidity and erratic rainfall – of Maryland weather. The site should have well-drained soil, full sun, good air circulation and accessibility and clear of frost pockets. Soil should be tested at least one year in advance of planting to ensure time to develop a nutrient management plan and allow time to make the proper adjustments. Pay particular attention to pH, Phosphorus and Potassium. Be aware of the previous crops, potential herbicide carryover and the existing weed population. For example, perennials need to be controlled prior to planting to help reduce weed challenges. Sod establishment in the fall prior to the year of planting will help facilitate future hop yard growth, prevent soil erosion and suppress weeds. Tall fescue should be planted between rows in spring or fall of previous year. Availability of water is needed for irrigation.

Variety selection: This is the primary goal of the partnership between Flying Dog and UMD. We are screening 24 varieties in an effort to identify varieties that might be better suited to be grown in Maryland while still possessing the characteristics desired for brewers to make high quality beer.

Planting: April through early May

Fertility: All nutrients and soil pH, except for Nitrogen, should be addressed based on soil test results prior to planting. Nitrogen should be applied the first week after planting, three weeks later and then three weeks later at a total of 75 pounds of Nitrogen per acre.

Weed control: Apply Glyphosate pre-plant to rows to burn down all-weeds prior to planting. Use burndown product as needed to control weeds in the row throughout the first season. Avoid burning hops with drift from burndown products.

Irrigation: Regular and consistent watering is essential. Plants can grow 10 inches a day and need water but should not have wet feet. This means that you want to maintain adequate moisture in the soil profile but do not want puddling of water on the surface or for the soil in the hop yard to have a "muddy" texture. Irrigation should be run as often as four days a week during hot and dry periods.

Trellis: Trellises need to be well anchored and able to support a cable 18-feet high to allow the hops to reach their full potential. Posts should be 4 feet in the ground with plants spaced 3½ feet by 12 feet. It is important that your row spacing is suited to your equipment and that, when the plants are fully mature, operations in the hop yard can continue without damaging the plants.

Training/Pruning: Use one string per plant and encourage all the growth of the plant to climb the string. This will help the plant establish a strong root system and may help to produce a light crop the first season.

Pest Control: Weekly Integrated Pest Management (IPM) scouting is a must for successful hops production in Maryland. Rapid deployment of control measures can make all the difference between success and failure of a new planting. This consists of walking the rows observing overall condition of your plants, looking at vigor, color of foliage, discoloration or browning of leaves and presence of insects or mites. It is important to be examining both the upper and lower surfaces of the leaves with a magnifying glass or hand lens to see mites or early infestations of Leafhoppers. Major pest issues in order of impact on our current planting include: Downy Mildew, Leafhoppers, Mites, Alternaria Cone Disorder, Fusarium Cone Tip Blight and Japanese Beetles.

MANAGEMENT OF AN ESTABLISHED MARYLAND HOP YARD

Optimal Fertility: First week of April, fourth week of April, third week of May, second week of June with a total of 180 lbs. Nitrogen per acre.

Weed control: February Glyphosate plus Chateau, spring burndown

Irrigation: Regular and consistent watering is essential and follows the same guidelines as establishing a new hop yard.

Spring Pruning: This can be done mechanically or with a desiccant. Either way, the critical objective is to completely remove all green tissue above the soil to encourage the plant to push up new strong bines from the crown.

Training/Pruning: Two strings per plant, selecting two or three healthy strong undamaged bines per string.

Pest Control: Weekly Integrated Pest Management (IPM) scouting is a must for successful hops production in Maryland. The same pest control measures taken to establish a hop yard are crucial to maintain a successful crop year-to-year.

SAMPLE HOP YARD SCHEDULE

The schedule below is based on the IPM scouting and control measures taken in the hop yard at Keedysville in 2018:

2/20/18 – SOLICAM DF + SCYTHE

4/10/18 – DRENCHED WITH RIDOMIL GOLD SL (8OZ/A RATE - .8OZ/10GAL, 5 GAL TREATS 50 PLANTS)

5/2/18 – CLEANED DEBRIS FROM ROWS, APPLIED 50 LB N/ACRE

5/3/18 – APPLIED SYCTHE (10% SOLUTION AT 150 GPA)

5/7/08 – CROWNED PLANTS WITH MOWER

5/9/18 – APPLIED 30 LBS N/ACRE, INSTALLED STRINGS

5/10/18 – APPLIED RANMAN (2.75 OZ/A)

5/16/18 – APPLIED 30 LBS N/ACRE

5/17/18 – APPLIED PHOSTROL (2.5PT/A)

5/21/18 – APPLIED TANOS (8OZ/A) + CHAMP FORMULA 2 FLOWABLE (1.33PT/A)

5/25/18 – APPLIED RANMAN (2.75OZ/A) + 30 LBS. N/ACRE

5/30/18 – APPLIED BRIGADE (6.4OZ/A) + PHOSTROL (2.5PT/A)

6/4/18 – APPLIED TANOS (8OZ/A) + CHAMP FORMULA 2 FLOWABLE (1.33PT/A)

6/12/18 – APPLIED 30 LBS N/ACRE

6/12/18 – APPLIED AIM EC (2OZ/A) + CHATEAU (6OZ/A) FOR SUCKER CONTROL

6/12/18 – APPLIED AZAGUARD (16OZ/A) + REVUS (8OZ/A) + PHOSTROL (2.5PT/A)

6/15/18 – APPLIED PHOSTROL (2.5PT/A) + M-PEDE (2% SOLUTION)

6/20/18 – APPLIED PHOSTROL (2.5PT/A) + RANMAN (2.75OZ/A) + AZAGUARD (16OZ/A)

6/25/18 – APPLIED PHOSTROL (2.5PT/A) + TANOS (8OZ/A) + CHAMP FORMULA 2 FLOABLE (1.33PT/A) + AZAGUARD (16OZ/A)

6/26/18 – APPLIED 30 LBS N/ACRE

6/29/18 – APPLIED MALATHION 5 (1PT/A) + PHOSTROL (2.5PT/A)

7/3/18 – APPLIED PHOSTROL (2.5PT/A) + AZAGUARD (16OZ/A)

7/9/18 – APPLIED PHOSTROL (2.5PT/A) + AZAGUARD (16OZ/A)

7/16/18 – APPLIED PHOSTROL (2.5PT/A) + ZEAL

7/18/18 – APPLIED PHOSTROL (2.5PT/A) + ACRAMITE

7/20/18 – APPLIED RANMAN (2.75OZ/A) + AZAGUARD (16OZ/A)

7/27/18 – APPLIED PHOSTROL (2.5PT/A) + AZAGUARD (16OZ/A)

7/31/18 – APPLIED OXIDATE 2.0 (32OZ/100GAL)

8/6/18 – APPLIED PHOSTROL (2.5PT/A) + AZAGUARD (16OZ/A)

8/8/18 – APPLIED M-PEDE (2% SOLUTION)

8/17/18 – APPLIED PHOSTROL (2.5PT/A) + AZAGUARD (16OZ/A)

SAMPLE HOP YARD SCHEDULE

And the schedule below is from 2017:

2/15/17 – CHATEAU (6OZ/A) + GRAMOXONE (1PT/A) ON 2016 PLANTING ONLY

3/24/17 – CHAMP (1.3PT/A)

3/29/17 – ROUNDUP POWERMAX (1QT/A) ON NEW HOPS YARD TO KILL FESCUE STRIPS FOR TILLAGE

3/31/17 – 2017 HOPS ARRIVED, TRANSPLANTED TO LARGER POTS

4/03/17 – DRENCHED WITH RIDOMIL GOLD SL (8OZ/A RATE - .8OZ/10GAL, 5 GAL TREATS 50 PLANTS) AND FERTILIZED WITH UREA AT A RATE OF 50LB N/A (EACH REP 50SQ.FT. 1.84OZ/REP)

4/10/17 – SCYTHE @ 100GPA @5% SOLUTION TO BURN DOWN EARLY GROWTH

4/20/17 – PLANTED 2017 HOPS TRIAL

4/21/17 – STRUNG ALL HOPS AND FERTILIZED WITH UREA AT A RATE OF 50LB N/A (2016 AND 2017 PLANTINGS)

5/02/17 – PHOSTROL (2.5PT/A)

5/09/17 – APPLIED DAKOTA HERBICIDE TO 2017 PLANTING

5/10/17 – APPLIED SCYTHE HERBICIDE SPOT SPRAY TO 2016 PLANTING

5/12/17 – FERTILIZED WITH UREA AT A RATE OF 50LB N/A (2016 AND 2017 PLANTINGS)

5/15/17 – APPLIED M PEDE (2% SOLUTION) AND RANMAN @ 2.5OZ/A) (2016 AND 2017 PLANTINGS)

5/22/17 – APPLIED PHOSTROL (2.5PT/A) (2016 AND 2017 PLANTINGS)

5/25/17 – APPLIED SCYTHE HERBICIDE SPOT SPRAY TO 2017 PLANTING

5/26/17 – APPLIED M PEDE (2% SOLUTION) (2016 AND 2017 PLANTINGS)

6/01/17 – REMOVED LOWER FOLIAGE (2016 PLANTING)

6/03/17 – APPLIED M PEDE (2% SOLUTION) + PRISTINE (28OZ/A) (2016 AND 2017 PLANTINGS)

6/08/17 – APPLIED BRIGADE WSB (16OZ/A) + RANMAN (2.5OZ/A) (2016 AND 2017 PLANTINGS)

6/14/17 – APPLIED SCYTHE HERBICIDE SPOT SPRAY (2016 AND 2017 PLANTINGS)

6/16/17 – APPLIED M PEDE (2% SOLUTION) + PRISTINE (28OZ/A) + ACRAMITE 50WS (1.33LB/A)

6/22/17 – APPLIED M PEDE (2% SOLUTION) + PHOSTROL (2.5PT/A) (2016 AND 2017 PLANTINGS)

6/29/17 – APPLIED BRIGADE WSB (16OZ/A) + RANMAN (2.5OZ/A) (2016 AND 2017 PLANTINGS)

7/07/17 – APPLIED MALATHION 5 (1PT/A) + PHOSTROL (2.5PT/A) (2016 AND 2017 PLANTINGS)

7/14/17 – APPLIED M PEDE (2% SOLUTION) (2016 AND 2017 PLANTINGS)

7/20/17 – APPLIED M PEDE (2% SOLUTION) + PHOSTROL (2.5PT/A) (2016 AND 2017 PLANTINGS)

7/27/17 – APPLIED M PEDE (2% SOLUTION) + PHOSTROL (2.5PT/A) (2016 AND 2017 PLANTINGS)

COST BREAKDOWN

One of the goals of this research is that the findings support the business of beer agriculture in Maryland. With that in mind, UMD decided to be transparent with the costs associated with establishing and maintaining the ½-acre hop yard.

Initial Investment

ITEM	COST
HOPS RHIZOMES (PLANTS)	$1,300
POLES	$4,500
HARDWARE FOR POLES	$1,200
LABOR	$6,400
HARVESTER	$28,000
OAST (FOR DRYING)	$2,000
PELLETIZER	$5,000
IRRIGATION	$1,500
LIQUID NITROGEN COOLING SYSTEM	$500
HAMMER MILL	$2,000
COOLER/STORAGE	$1,000
SEED, FERTILIZER, LIME, CHEMICALS	$3,500
TOTAL COST	$56,900

NOTES

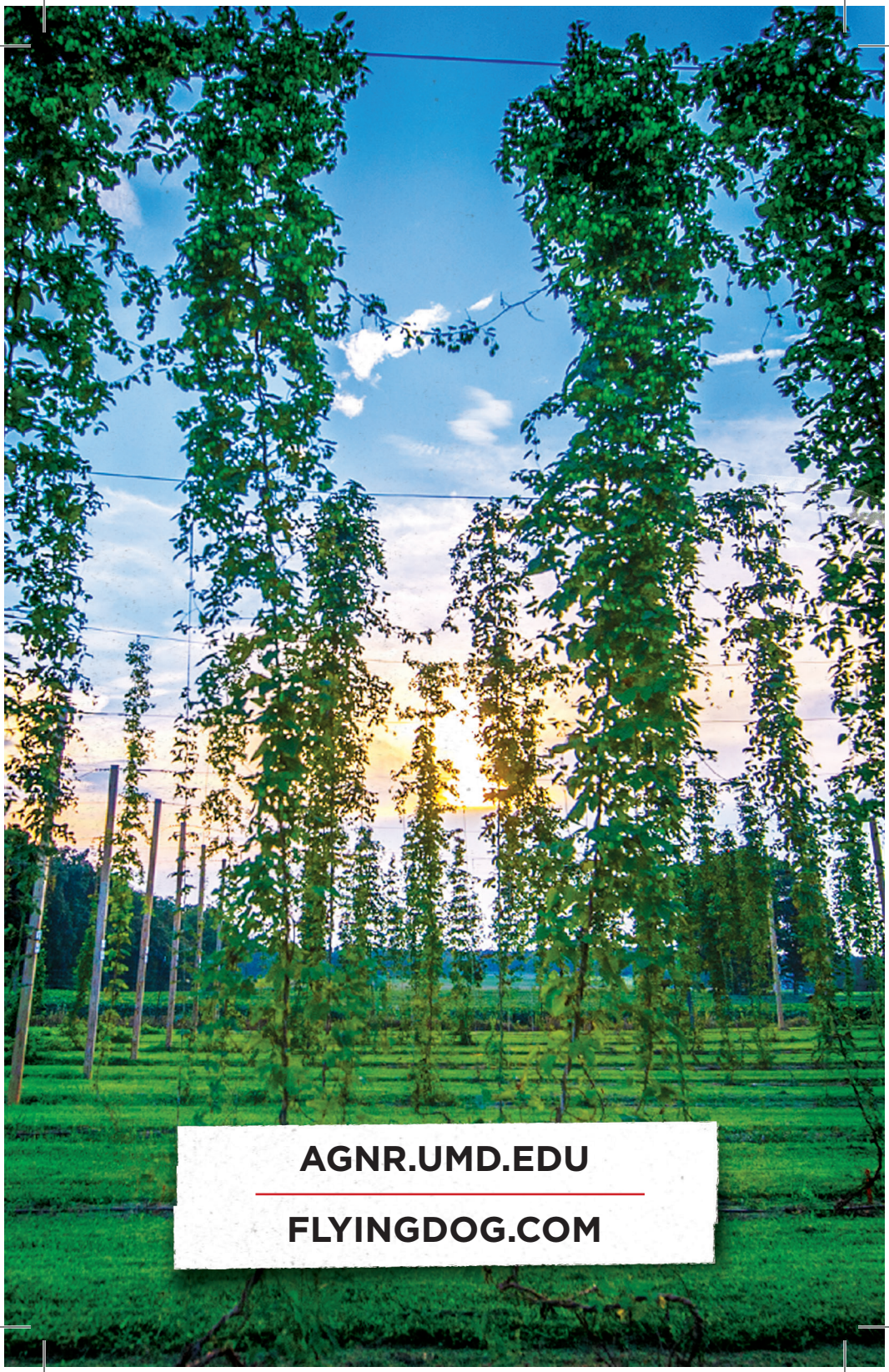
2017 Seasonal Costs

ITEM	COST
HERBICIDES	$130
FUNGICIDES	$550
INSECTICIDES	$300
COCONUT COIR	$175
FERTILIZER	$120
LABOR	$2,400
TOTAL	$3,675

2018 Seasonal Costs

ITEM	COST
HERBICIDES	$127.81
FUNGICIDES	$167.61
INSECTICIDES/MITICIDES	$435.38
COCONUT COIR	$350.00
FERTILIZER	$110.00
LABOR	$3,400.00
TOTAL	$4,590.80

NOTES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