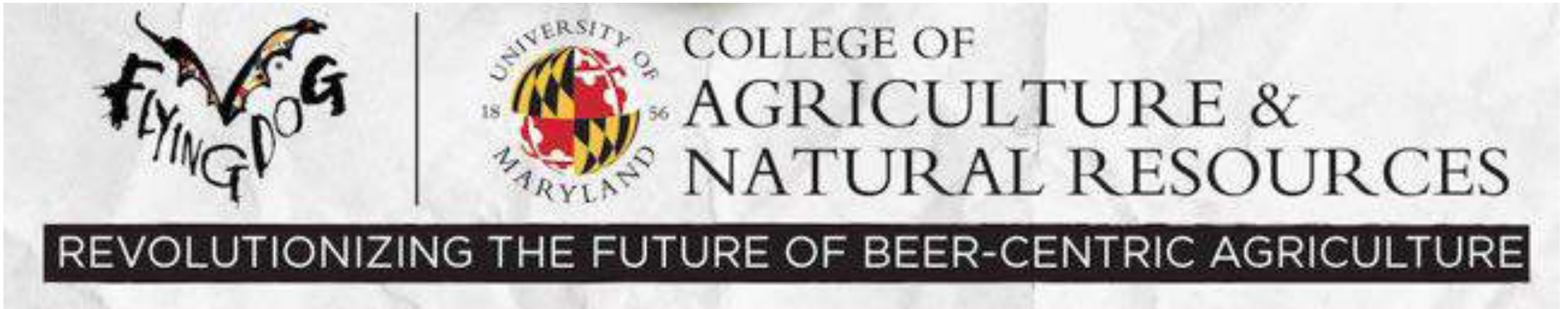


# University of Maryland Hops and Crops Project

Bryan Butler, Extension Agent

University of Maryland Extension



# For the last 70 years many Hops have been breed to thrive in the high desert with irrigation

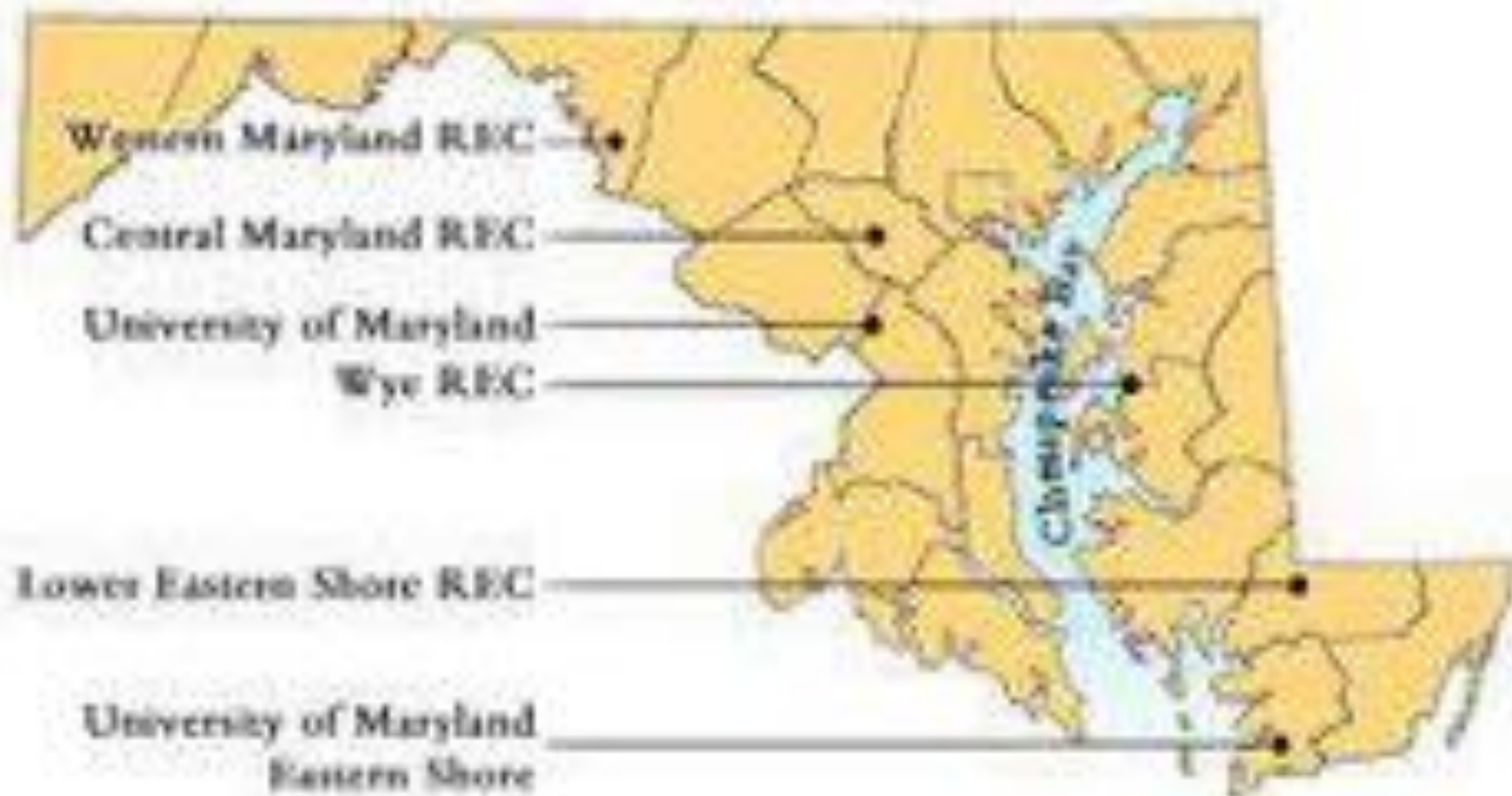
- Ideally hops are grown commercially between 35° and 55° north or south of the equator
- 39.5 at WMREC - Creating Management Challenges
- High Insect and Disease Pressure
- There is a lot we need to learn about this crop



# Hop Vendors Swallow A Bitter Pill As They Confront An Oversaturated Market & Customers Who Can't Pay

Forbes JAN 26, 2018 @ 08:02 AM

- To keep up, existing U.S. growers, concentrated around Yakima, Idaho and Oregon, started planting. And planting. And planting more. Between 2012 and 2017, domestic hop acreage grew 95.8% to a record-breaking 53,200 acres.
- According to the Hop Growers of America association (USA Hops), it costs approximately \$10,000 to cultivate a new field and \$10,000 per year to maintain it. An acre can produce between 800 and 3,000 pounds annually, with specialty varieties selling between around \$8-\$14 per pound.



# Maryland Craft Beverage Industry

**BUY**  
*Local*  
**FIRST**

- Quickly growing
  - 70 breweries
  - New malt houses
- ‘Buy Local’ movement demand for local ingredients
  - Currently not meeting the demand

All of the ingredients used were grown at UMD’s Western Maryland Research and Education Center, which is the site of these hop trials. Syngery and Scala malt is alongside Zeus, Glacier, Southern Brewer, Southern Cross and Vojvodina hops.



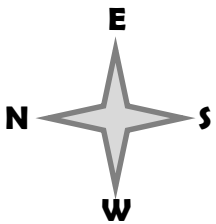
- 12 Varieties of Hops planted May 12th 2016 Keedysville, Maryland.
- 12 more Varieties Planted April 19th 2017. Varieties selected were recommended by the industry.
- Spaced 3.5' x 14' on ½ Acre. Laminated posts with a cable at 18'. Posts are 4' in the ground.
- Soil was prepared the previous fall, limed, and phosphorus and potassium added to optimum levels.
- Planting received the equivalent of 180 pounds of Nitrogen from three applications in 2016, in 2017 four applications for a total of 200lbs. N.
- Tall fescue planted between rows in spring 2016.
- Weekly IPM scouting with control measures taken as needed.
- Irrigation, Irrigation, Irrigation

## **2016**

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

## **2017**

- **Canadian Red Vine**
- **Galena**
- **Glacier**
- **Amallia**
- **Neo 1**
- **New Port**
- **Multi Head**
- **Southern Brewer**
- **Teamaker VF**
- **Willamette**
- **Vojvodina**
- **Zeus**

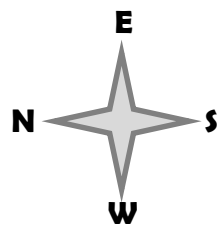


University of Maryland (WMREC)  
2016 Hops Yard—Variety Trials

|     |                |
|-----|----------------|
| AAA | Alpharoma      |
| CAS | Cascade        |
| CEN | Centennial     |
| CHI | Chinook        |
| CRY | Crystal        |
| MHO | Mt. Hood       |
| MRA | Mt. Ranier     |
| NUG | Nugget         |
| SOR | Sorachi Ace    |
| SCR | Southern Cross |
| TAH | Tahoma         |
| ULT | Ultra          |

|     |     |     |     |               |
|-----|-----|-----|-----|---------------|
| MRA | NUG | CAS | SOR | ROW 3 BLOCK 3 |
| TAH | SCR | MHO | ULT | ROW 2 BLOCK 3 |
| CHI | AAA | CEN | CRY | ROW 1 BLOCK 3 |
| SOR | NUG | CHI | MRA | ROW 3 BLOCK 2 |
| CEN | MHO | TAH | AAA | ROW 2 BLOCK 2 |
| CRY | SCR | ULT | CAS | ROW 1 BLOCK 2 |
| MHO | CHI | SOR | CEN | ROW 3 BLOCK 1 |
| CRY | TAH | AAA | SCR | ROW 2 BLOCK 1 |
| NUG | ULT | CAS | MRA | ROW 1 BLOCK 1 |

6 plants per variety  
per block  
3 blocks  
3.5' between plants  
10' between  
varieties



University of Maryland (WMREC)  
2017 Hops Yard—Variety Trials

6 plants per variety  
per block  
3 blocks  
3.5' between plants  
10' between varieties

|     |                   |
|-----|-------------------|
| AMA | Amallia           |
| CAN | Canadian Red Vine |
| GAL | Galena            |
| GLC | Glacier           |
| MHD | MultiHead         |
| NEO | Neo 1             |
| NPT | Newport           |
| SBR | Southern Brewer   |
| TEA | Teamaker VF       |
| VOJ | Vojvodina         |
| WLM | Willamette        |
| ZUS | Zeus              |

|     |     |     |     |               |
|-----|-----|-----|-----|---------------|
| AMA | ZUS | NPT | CAN | ROW 3 BLOCK 3 |
| VOJ | SBR | TEA | GAL | ROW 2 BLOCK 3 |
| WLM | NEO | MHD | GLC | ROW 1 BLOCK 3 |
| CAN | ZUS | WLM | AMA | ROW 3 BLOCK 2 |
| MHD | TEA | VOJ | NEO | ROW 2 BLOCK 2 |
| GLC | SBR | GAL | NPT | ROW 1 BLOCK 2 |
| TEA | WLM | CAN | MHD | ROW 3 BLOCK 1 |
| GLC | VOJ | NEO | SBR | ROW 2 BLOCK 1 |
| ZUS | GAL | NPT | AMA | ROW 1 BLOCK 1 |



Crowning  
April 18th



# Crowning Date

- 2016 April 1
- 2017 April 10
- 2018 May 12

Getting it wrong by 7 days can  
effect yield by more than 50%





Too Late



On Time



Too Early



### Training

First two years, one string with 2 or 3 bines.

Third year two strings per plant 2 or 3 bines per string.





5/13 Ridomil Gold (drench) *Target Pest-* Downy Mildew

5/20 Ranman *Target Pest-* Downy Mildew

6/8 Ranman+Phostrol+Bifenthrin 8oz. +50 lbs. N *Target Pest-* Downy Mildew and Leafhoppers

6/24 Ranman+Bifenthrin 8oz. *Target Pest-* Downy Mildew, Leafhoppers

6/31 Phostrol+Bifenthrin 8oz. *Target Pest-* Downy Mildew, Japanese Beetles

7/7 Phostrol+Bifenthrin 8oz. *Target Pest-* Downy Mildew, Japanese Beetles, Tent Caterpillars

7/15 Pristine+Bifenthrin 16oz.+50 lbs. N *Target Pest-* Downy Mildew, Powdery Mildew, Two spotted Spider Mites

7/25 Rally+Admire Pro *Target Pest-* Powdery Mildew, Two spotted Spider Mites,

7/29 Flint+M Pede+Malathion *Target Pest-* Downy Mildew Powdery Mildew, Two spotted Spider Mites

8/16 M Pede *Target Pest-* Two spotted Spider Mites, Armyworms

## WMREC Hops Timeline 2017

- 2/15/17 – Chateau (6oz/A) + Scythe herbicide 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)
- 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
- Fertilized with urea at a rate of 50lb N/A (2016 & 2017 planting)
- 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 & 2017 plantings)
- 5/15/17 – Applied M Pede (2% solution) and Ranman @ 2.5oz/A (2016 & 2017 plantings)
- 5/22/17 – Applied Phostrol (2.5pts/A) (2016 & 2017 plantings)
- 5/25/17 – Applied Scythe herbicide spot spray to 2017 planting
- 5/26/17 – Applied M Pede (2% solution) (2016 & 2017 plantings)
- 6/01/17 – removed lower foliage (2016 planting)
- 6/03/17 – Applied M Pede (2% solution)) + Pristine (28oz/A) (2016 & 2017 plantings)
- 6/08/17 – Applied Brigade WSB (16oz/A) + Ranman (2.5oz/A) (2016 & 2017 plantings)
- 6/14/17 – Applied Scythe herbicide spot spray (2016 & 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 & 2017 plantings)
- 6/29/17 – Applied Brigade WSB (16oz/A) + Ranman (2.5oz/A) (2016 & 2017 plantings)
- 7/07/17 – Applied Malathion 5 (1pt/A) + Phostrol (2.5pt/A) (2016 & 2017 plantings)
- 7/14/17 - Applied M Pede (2% solution) (2016 & 2017 plantings)
- 7/20/17 - Applied M Pede (2% solution) + Phostrol (2.5pt/A) (2016 & 2017 plantings)
- 7/27/17 - Applied M Pede (2% solution) + Phostrol (2.5pt/A) (2016 & 2017 plantings)







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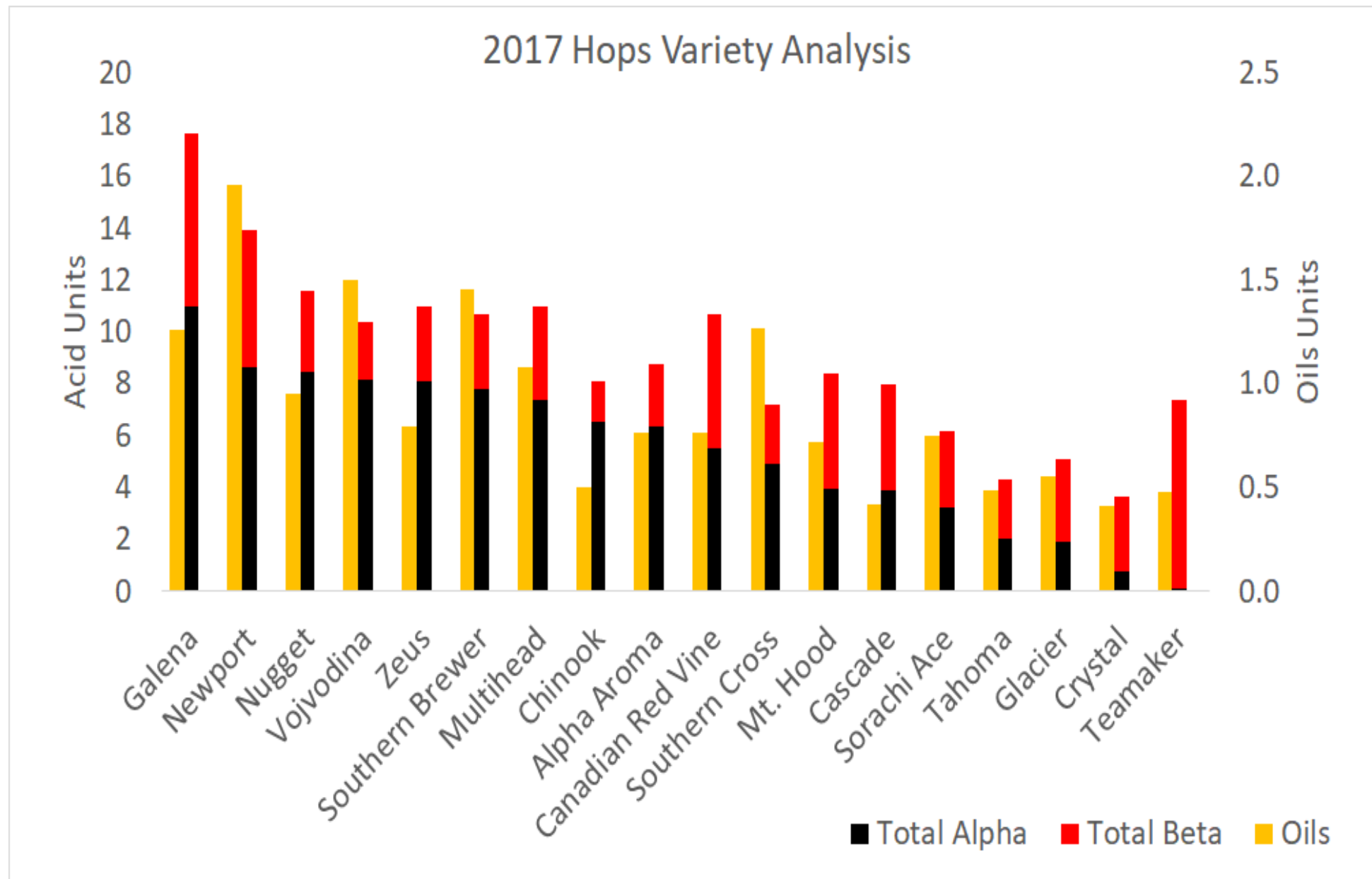












| Variety           | Total Weight pellets (g) | Total Weight (lbs) | # of Bines Harvested | Predicted wt (lbs) / 900 Bines | Weakness/Strength   |
|-------------------|--------------------------|--------------------|----------------------|--------------------------------|---|
| Glacier           | 3500                     | 7.7                | 18                   | 386                            | Strong pine-like resin, mild fruity notes                         |
| Southern Brewer   | 2850                     | 6.3                | 18                   | 315                            | tangerine, citrus, resin  |
| Vojvodina         | 2000                     | 4.4                | 18                   | 220                            | Floral first, then some melon fruit notes, some 'green hop' notes |
| Southern Cross    | 1655                     | 3.6                | 18                   | 182                            | Fruit Punch, sweet tropical fruits                                |
| Mt. Hood          | 1090                     | 6.6                | 18                   | 120                            | Fruity, herbal, mild aroma  |
| Newport           | 3000                     | 1.3                | 18                   | 333                            | Bright fruit notes, Pineapple, green apple, 'fresh' hops          |
| Cascade           | 1235                     | 2.7                | 18                   | 136                            | Nice citrus character, some fruity notes                          |
| Crystal           | 980                      | 2.2                | 17                   | 114                            | mild fruit, freezer burnt strawberries                            |
| Nugget            | 815                      | 1.8                | 17                   | 95                             | Green, herbal, some citrus  |
| Alpharoma         | 2385                     | 5.3                | 18                   | 263                            | Mild tea, fruity notes  |
| Galena            | 2800                     | 6.2                | 18                   | 309                            | Grassy, green, resin, dill, OG                                    |
| Multihead         | 680                      | 1.5                | 13                   | 104                            | Diesel/OG   |
| Zeus              | 4235                     | 9.3                | 18                   | 467                            | Herbal, grassy, dill  |
| Canadian Red Vine | 7375                     | 16.3               | 18                   | 813                            | Old grass, sweet, freezer burnt berries, 'stale' hop              |
| Tahoma            | 675                      | 1.5                | 16                   | 84                             | Old fridge/Pear, Freezer burnt fruit                              |
| Teamaker VF       | 2060                     | 4.5                | 18                   | 227                            | Smells like tea leaves  |
| Centennial        | 550                      | 1.2                | 15                   | 73                             | Low yield   |
| Sorachi Ace       | 255                      | 0.6                | 14                   | 36                             | Low yield   |
| Mt. Ranier        | 150                      | 0.3                | 16                   | 19                             | Low yield   |
| Ultra             | 150                      | 0.3                | 18                   | 17                             | Low yield   |
| Chinook           | 390                      | 0.9                | 16                   | 48                             | Low yield   |
| Williamette       | 150                      | 0.3                | 18                   | 17                             | Low yield   |
| Amallia           | 270                      | 0.6                | 15                   | 36                             | Low yield   |
| Neo 1             | 0                        | 0                  | 14                   | 0                              | Low yield   |

Initial investment cost to establish this project .

| Item                              | Cost     |
|-----------------------------------|----------|
| Hops rhizomes (plants)            | \$1,300  |
| Poles                             | \$4,500  |
| Hardware for poles                | \$1,200  |
| Labor (\$20/hr * 320 hrs)         | \$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                        | \$51,500 |

2017 Seasonal Costs for the 1/2 acre

| Item         | Cost    |
|--------------|---------|
| Herbicides   | \$130   |
| Fungicides   | \$550   |
| Insecticides | \$300   |
| Coconut coir | \$175   |
| Fertilizer   | \$120   |
| Labor        | \$2,400 |
| Total Cost*  | \$3,675 |

In 2017 there was additional cost of laboratory analysis of oil and acid hops panel contracted through VA Tech for research purposes

| Item                                     | Cost    |
|--|---------|
| Pre-pellitization panels (24 varieties)  | \$3,256 |
| Post-pellitization panels (24 varieties) | \$3,256 |
| Total Cost                               | \$6,512 |



# COLLEGE OF AGRICULTURE & NATURAL RESOURCES

REVOLUTIONIZING THE FUTURE OF BEER-CENTRIC AGRICULTURE