

Growing Hops in the Southeast



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Why is there so much interest in growing hops in the Southeast?

- Proliferation of craft breweries.
- Home brewing increasing.
- Need for organic hops.
- Fresh hops for seasonal brews.
- Locally grown movement.



Will hops grow here?

- Sure they will!
- We have plenty of people doing it now!
- There once was an industry in this region.
- Home brewers grow their own.



The hop plant (*Humulus lupulus*)



- Long-lived perennial plants (10-25 years).
- Commercial plants are all female.
- Bines grow each year to be about 25 feet long.
- Dies back to the crown each fall.
- Establish by planting rhizomes, cuttings, or micro-propagated plants.

Crown puts out lots of shoots; bines

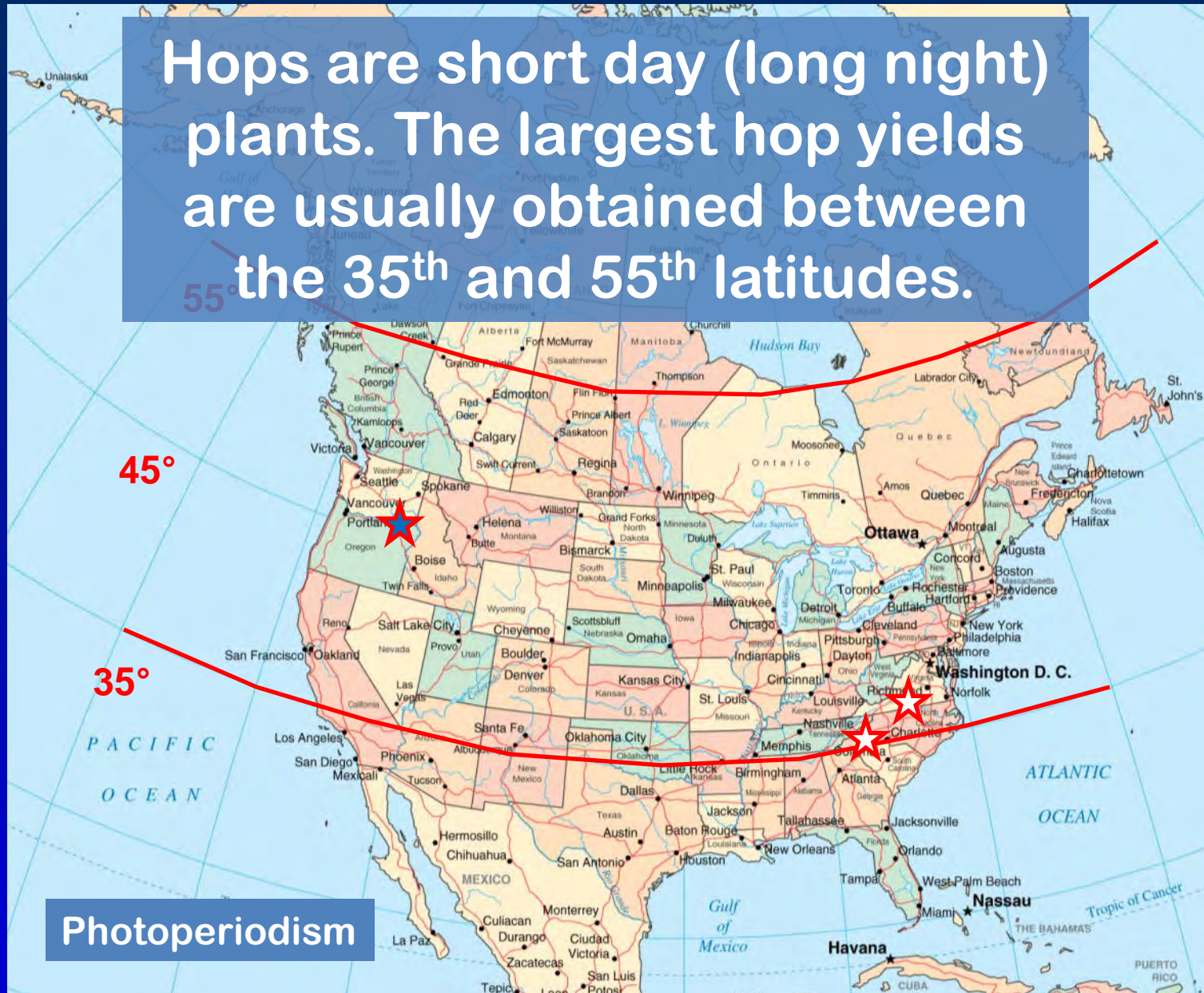


**Burrs
and
cones**



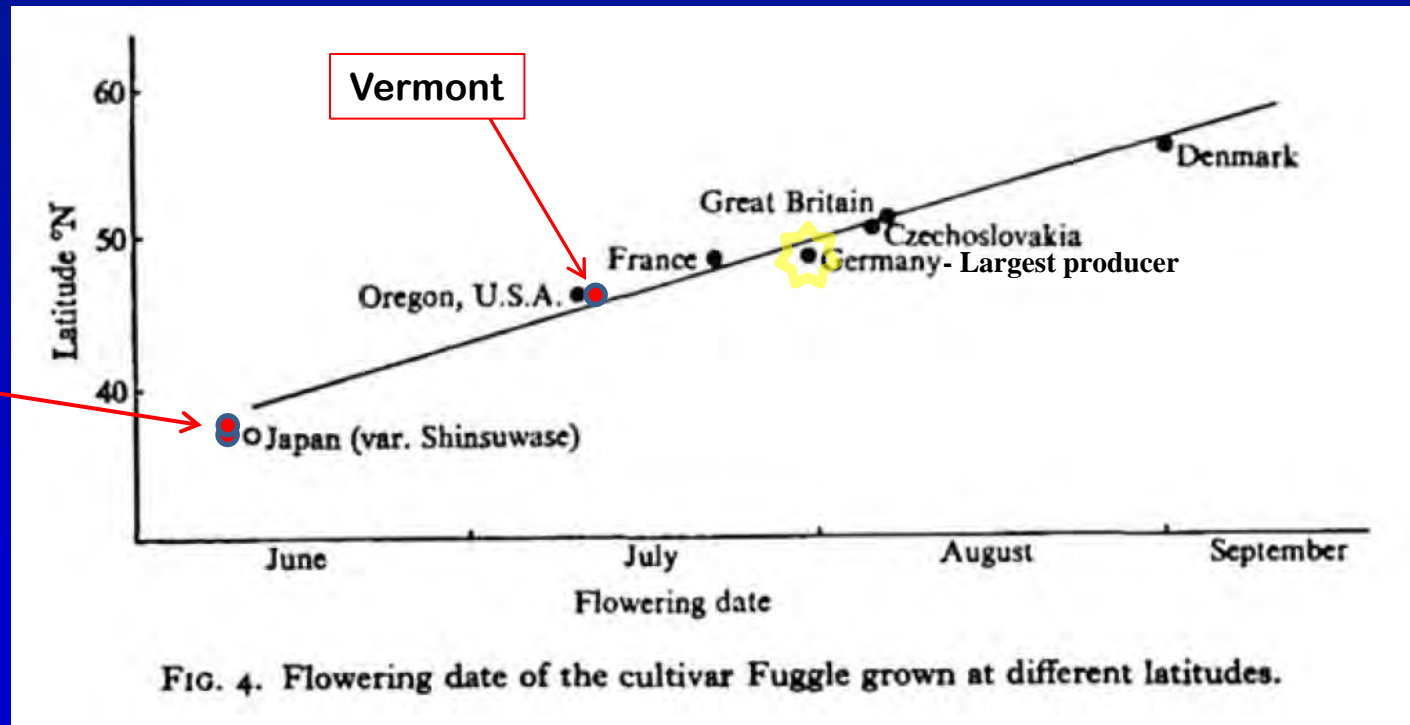
**The mature cone has
lupulin (oil) glands
containing alpha and beta
acids, and essential oils.**

Hops are short day (long night) plants. The largest hop yields are usually obtained between the 35th and 55th latitudes.



Need ≥ 15 hour daylength for highest yields

- Berlin, Germany 16 hrs 50 min
- Yakima Valley, WA 15 hrs 51 min
- Charlottesville, VA 14 hrs 49 min
- Asheville, NC 14 hrs 33 min

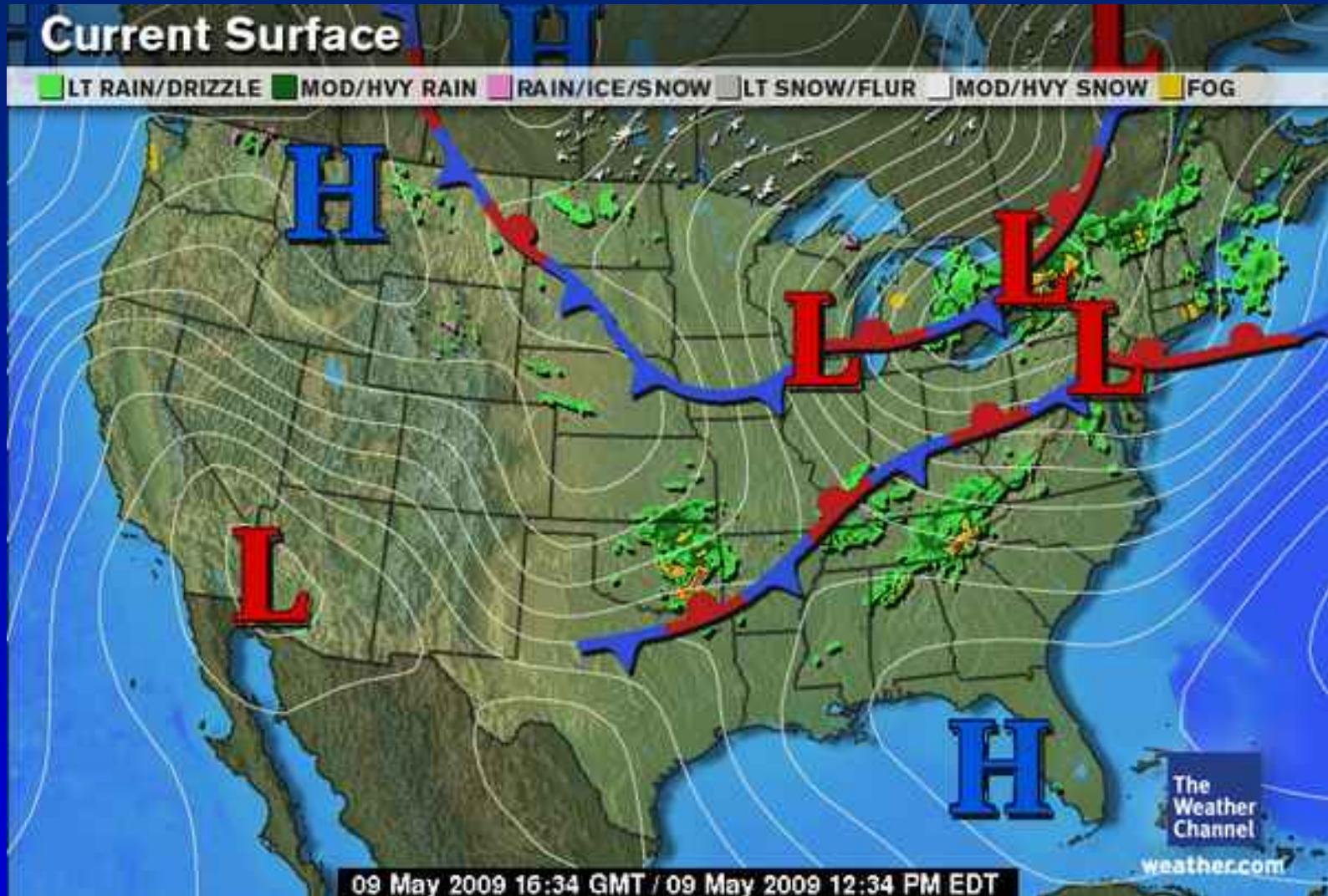


Day Length Issues



- Hops grow vigorously during long summer days and set flowers as days shorten in late June.
- Flower initiation is also node number, cultivar, and temperature dependent.
- Where day length is too short, flowering occurs when node number is met, but before the plants have put on a lot of growth.
- Without intervention, this significantly reduces our yields.

Humidity and high rainfall presents challenges for East Coast producers



About six years ago
farmers started
seriously planting
hops in VA and NC



NC State started a hops research and extension program in 2010

- Soil Science and Horticulture
- Conducted variety trials
- Developed production guidelines
- Looked at economics



Photos from S. King and R. Austin program

Basics of Hops Production



Step 1. Site selection

- Fertile, well-drained soil.
- Good air circulation.
- Good drainage.



- The NC Dept of Agriculture & Consumer Services has a code for hops.



Photo from S. King and R. Austin program

Nutrient Management for Hops in NC

- Hops are big feeders – require fairly large amounts of N/P/K
- Early spring and early summer – split applications of N/P/K.
- pH 6.0 to 6.5

Nitrogen: 125 to 150 lbs/acre

Phosphorus: if soil index is 0: 150 lbs/acre

Potassium: if soil index is 0: 150 lbs/acre

Sulfur: if soil index is 0: \approx 20 lbs/acre

Boron recommend 1 lb/acre

Soil pH between 6.0 and 6.5.

Step 3. Disk and apply any recommended amendments



Photos from S. King and R. Austin program

Step 4. Construct Trellis



Hobby or small-scale trellising

Photos from Battleground Brewers, Red Hill Brewery, and S. King and R. Austin program

Short Trellis Construction

Easy to construct & manage, 12 feet tall; limits yields.



Construction of a traditional tall trellis (16 to 20 feet)



Top wire can be raised and lowered



**No ladders or
cherry pickers
needed.**

Photos from J. Davis program

Step 5. Install irrigation



Photos from J. Davis, S.. King and R. Austin programs

Step 6. Plan for weed control



Step 7. Plant hops in spring



March and April

Photos from J. Davis, S. King, and R. Austin programs

Quality of hop rhizomes

- Try to get certified disease free.
- Buy disease resistant varieties.
- Be cautious of buying from other growers; see the plants in growth.
- Check out your sources carefully.
- There are many viruses, viroids, and mildews that can be brought into your yard on rhizomes.



What does it cost to establish a hop yard?

Estimated costs per Acre

• Trellis establishment	\$5-6,000
• Drip Irrigation system	\$1,200
– (not including source)	
• Rhizomes or plants	\$2-4,000
• Land Prep (fert.,seed,coir)	\$1,000
• Labor	\$3-4,000
Total	\$12-16,000/A

Step 7a. In some est. yards: root pruning and crowning

- Rhizomes will spread out in all directions.
- Cut around the crowns in early spring.
- Shave the top of the crowns in early spring to help control Downy Mildew.



Step 7b. In est. yards: Cutting back to ground

- Remove early shoots to manage disease and control flowering.
- Early shoots may be infected with powdery and downy mildew spores.
- We cut back until mid-April to May 1.



Step 8. Put up strings and train



Coir versus sisal twine

Step 9. Strip bottom of plants



Step 10. Manage for diseases and insects



Monitor your yard daily!

- Plant disease resistant varieties.
- Learn what the insects and diseases look like.
- Take lots of pictures.
- Practice prevention: clean rootstock, spring pruning, farmscaping, etc.
- Take notes so you can do better next year.



Photos from J. Davis program

Downy Mildew



Step 11. Harvest



Hand harvesting

- It takes about one hour to harvest a pound of wet hops.
- A small brewery wants between 25-30 lbs of hops within 24 hours of harvest to do a wet hop brew.
- That means some very long hours or extra help.



How others harvest



Top left: from Blue Mountain Brewery, top right: Willamette Valley Hops; lower left: MOFGA; lower right, Chillindamos Brewing

Step 12. Sell wet hops immediately after harvest



Photo (top left) from silvermoonbrewing.com, (bottom left) from brewpublic.com, (top right) menuinprogress.com, and (bottom right) from beerbasics.com

Step 13. Dry



Drying at Blue Ridge Hops



- Get hops into the dryer ASAP.
- Low temperature and high air flow.

Step 13b. Pelletize?

- Many breweries only use dried, pelletized hops.
- Pelletizers are expensive but can be shared equipment.



Step 14. Package



Note: Hop varieties have different storage stabilities, they don't all keep the same!

Step 15. Sell the hops

- Craft breweries
- Home brewers
- Herbal product companies
- Make your own beers
- Make your own products
- Hop rhizomes and cuttings
- Pick your own
- Sell wet or dried

PICK YOUR OWN HOPS



\$12 per Vine! *\$12 per Vine!*

Use as Fresh Wet Hops
or Dry and Package to Use in a Later Brew



Check Website or Facebook for Specific Dates
in Late August/Early September

www.oceanstatehops.com Exeter, RI



Step 16. Fall Clean-up



Photos from Rita Pelczar



**We have
conducted variety
trials in Raleigh
and Mills River**



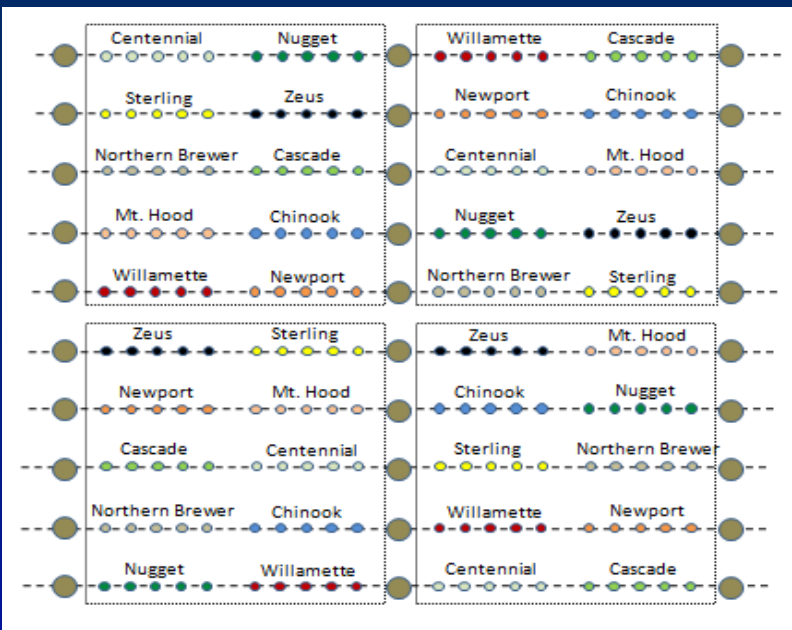
**Cascade, Centennial,
Chinook, Columbus
(Zeus), Galena, Magnum
Mt. Hood, Newport,
Northern Brewer,
Nugget, Sterling, and
Willamette.**



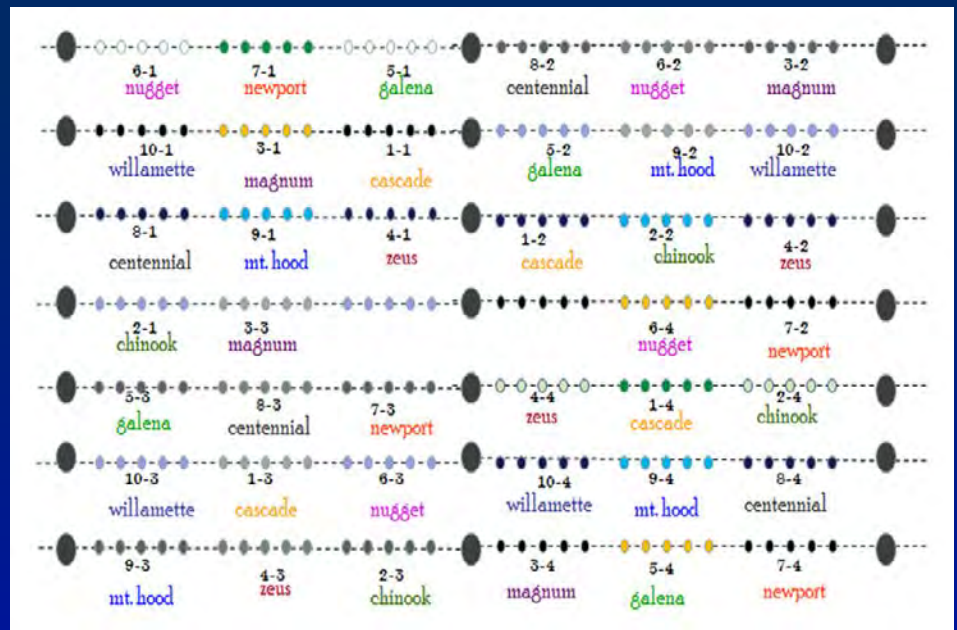
What have we learned from our research?

- Piedmont: Raleigh in July of first year of growth (also called Lake Wheeler in some of the slides)
- Mountains: Mills River in July of first year of growth





Raleigh



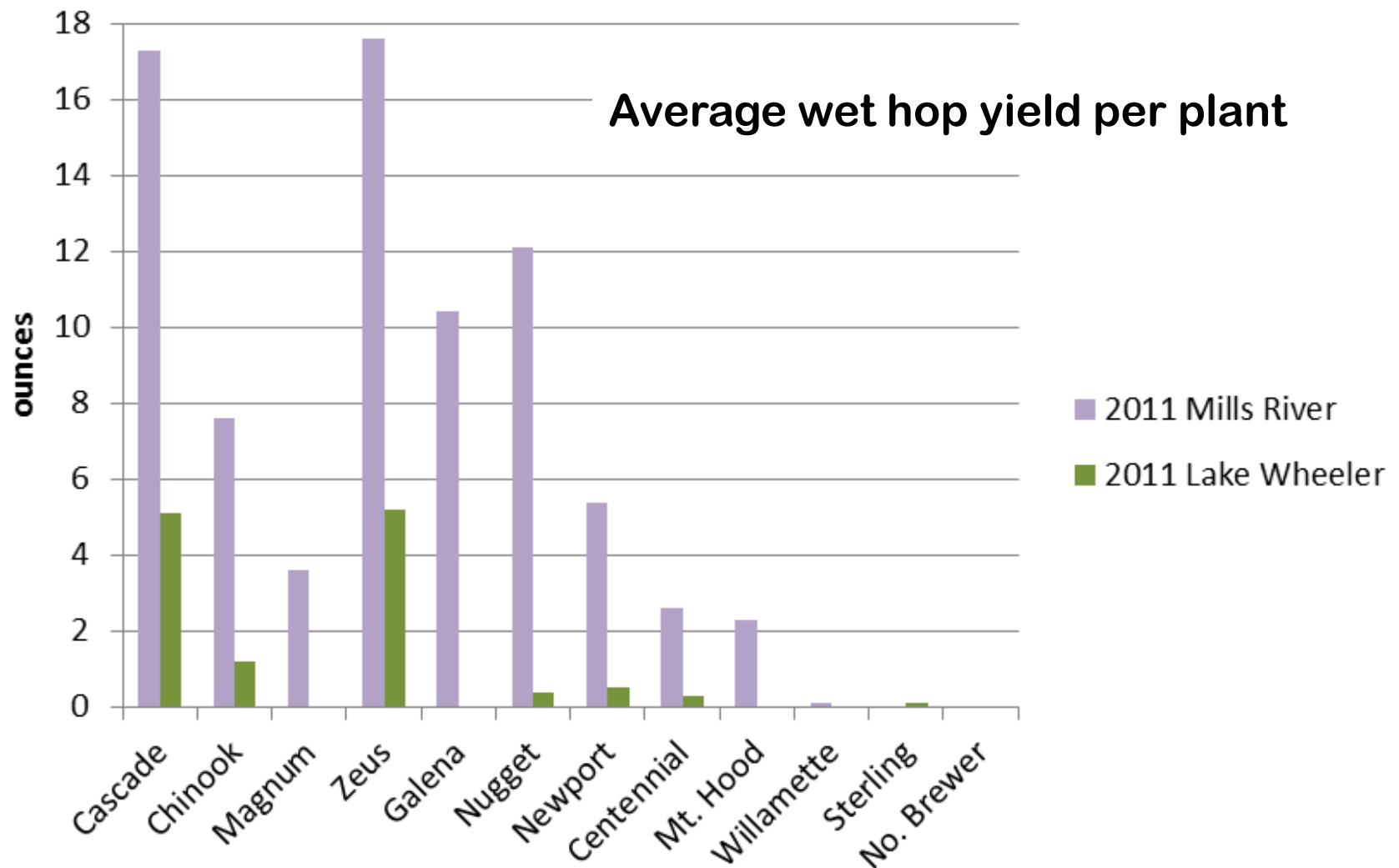
Mills River

- Both sites contained Centennial, Nugget, Zeus, Cascade, Newport, Mt. Hood, Willamette, and Chinook.
- The Raleigh yard also had Sterling and Northern Brewer.
- The Mills River yard had Galena and Magnum.

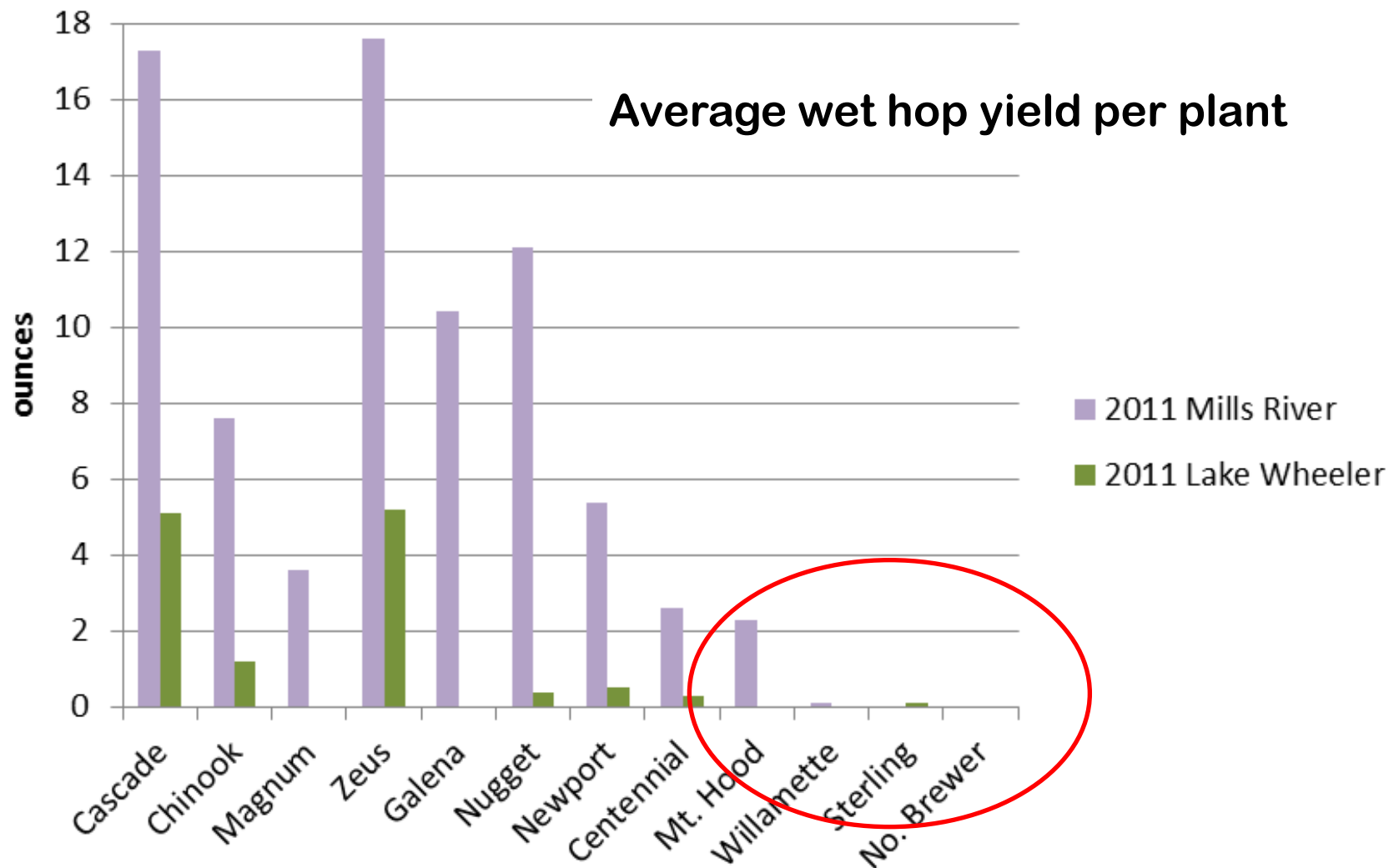
We measured and recorded everything we could think of

- Plant height
- Plant vigor
- Susceptibility to insects and diseases
- Cone yield
- Plant tissue nutrients
- Dried cone analyses
- Soil analyses





2011: higher yields of all varieties in Mills River (year one) than Raleigh (Lake Wheeler) (year two).



2011: higher yields of all varieties in Mills River (year one) than Raleigh (Lake Wheeler) (year two).

Downy Mildew in Mills River



Year 1

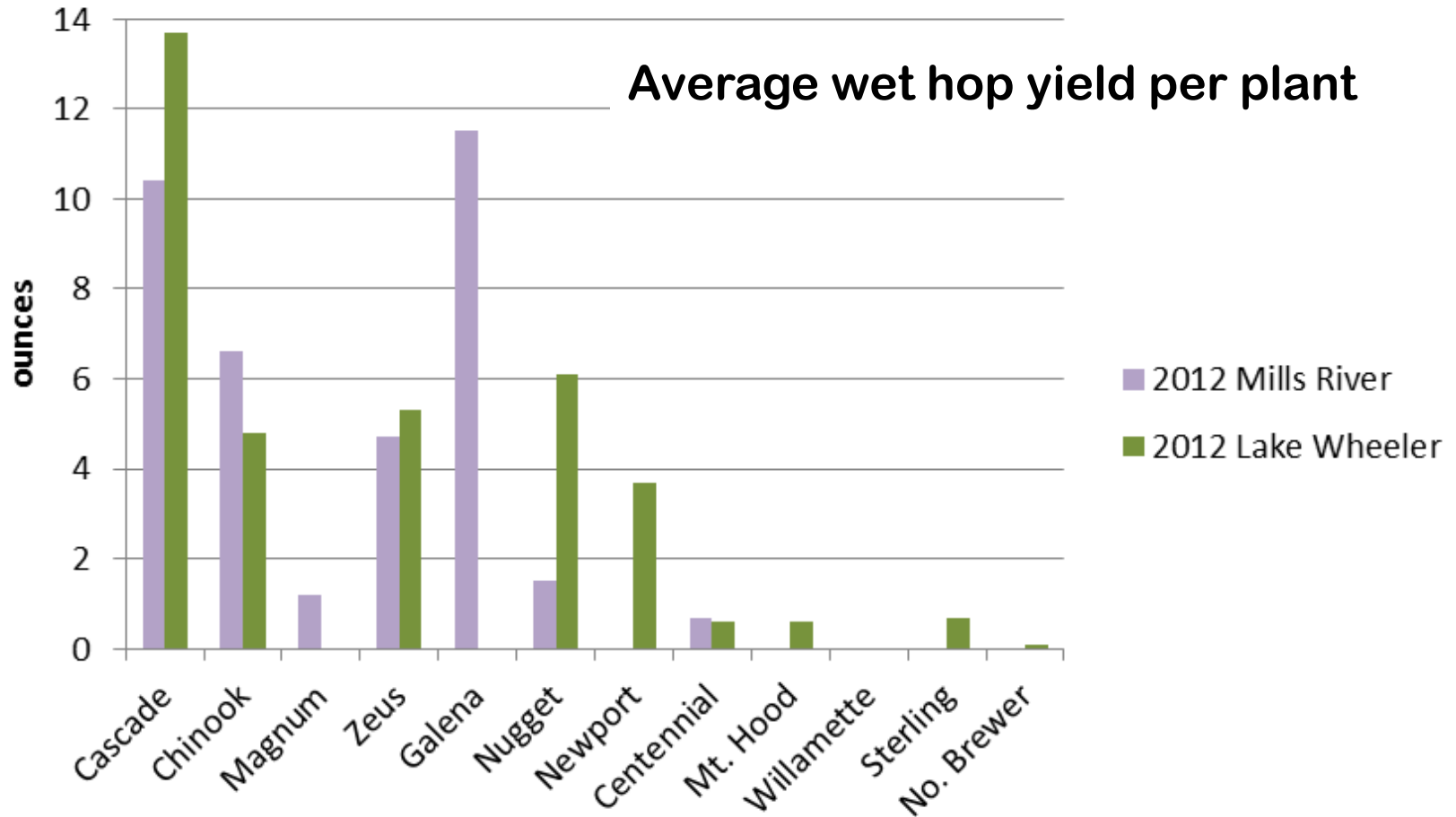


Year 2



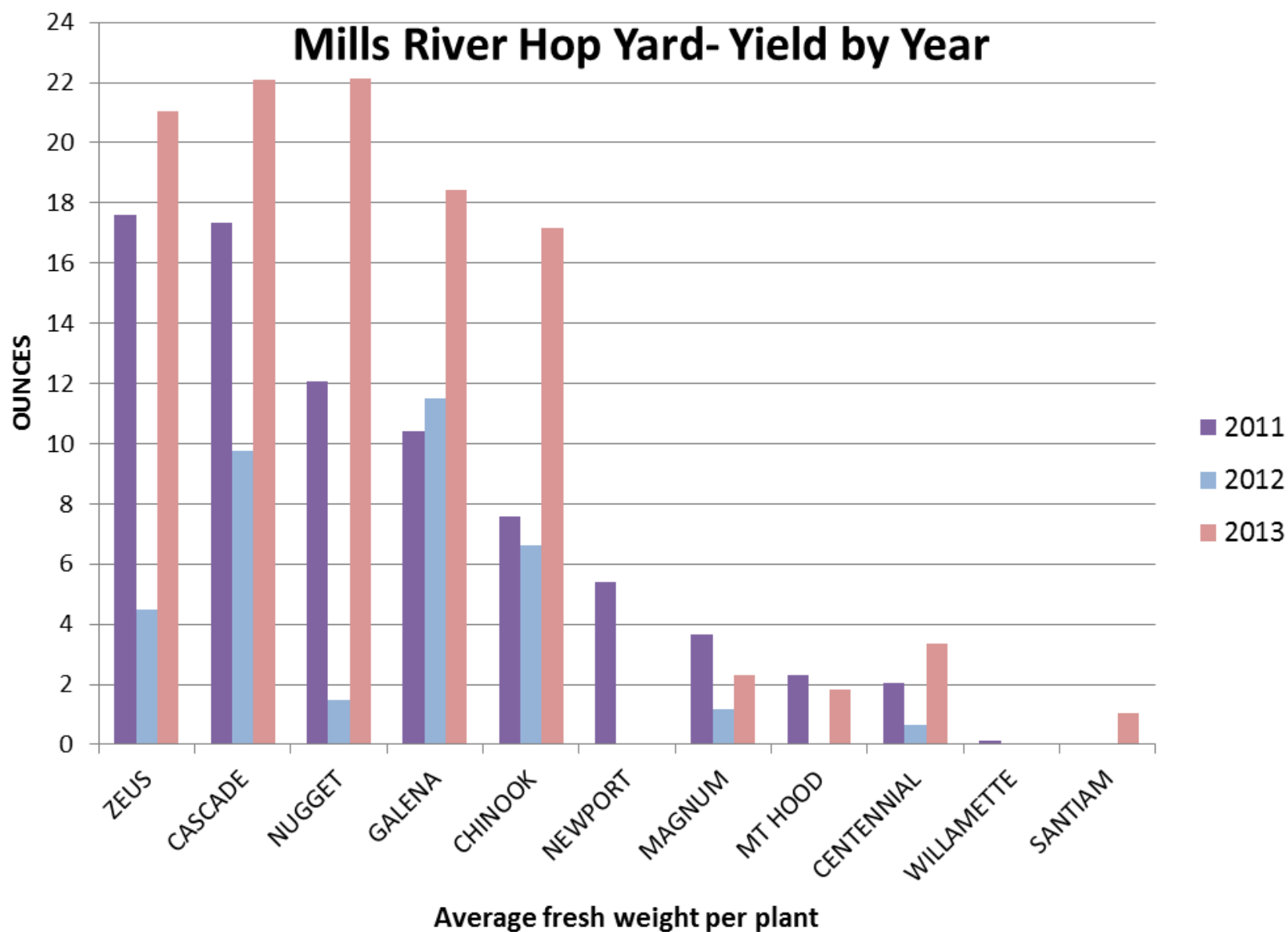
Year 3

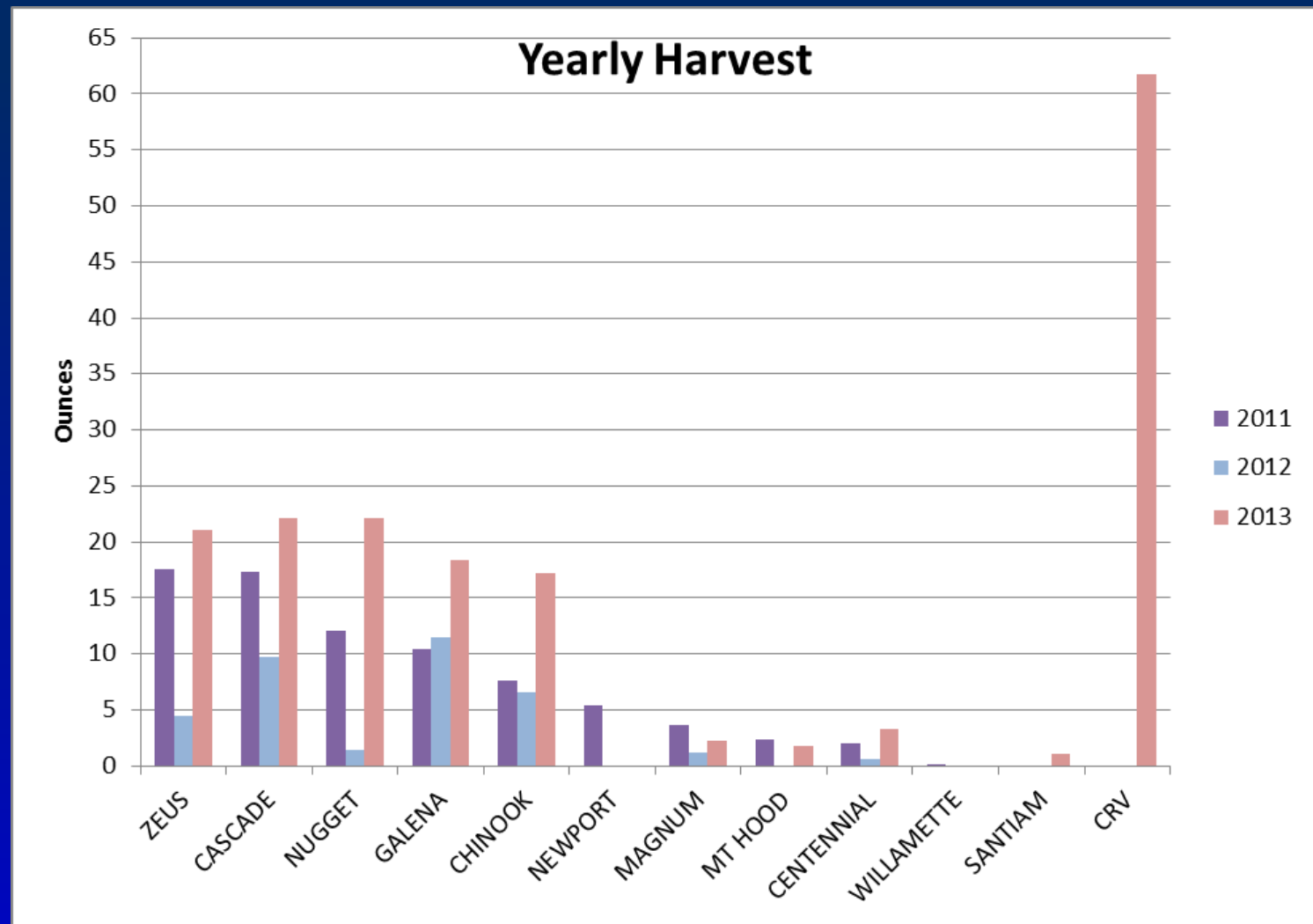




- 2012: four varieties in Raleigh out-yielded those in Mills River.
- Cascade was the most reliable producer.

Mills River Hop Yard- Yield by Year





- Harvest yields including CRV (Canadian Red Vine)
- CRV was planted as a crown (not rhizome) in 2013 and yielded 3.86 pounds per plant.

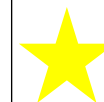
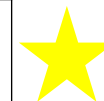
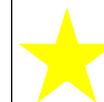


**Canadian Red Vine-
a great first year**

Cones were dried and analyzed.



Variety	White Labs 2011	Alpha Analytics 2013	Average Range %
Cascade Alpha Acid	4	5.2	4.5-7
Cascade Beta Acid	2.6	4.5	4.5-7
Nugget Alpha Acid	8.9	12.1	11-14.5
Nugget Beta Acid	2.8	4.7	4.5-5.5
Chinook Alpha Acid	6.7	8.1	10-14
Chinook Beta Acid	1.7	2.5	3-4
Centennial Alpha Acid	6	5.9	9.5-11.5
Centennial Beta Acid	2	2.6	3.5-4.5
Galena Alpha Acid	9.6	6.8	10-14
Galena Beta Acid	5.3	5.5	7-9
Magnum Alpha Acid	6.9	8	13-15
Magnum Beta Acid	2.6	3.5	4.5-5.5
Zeus Alpha Acid	5.5	6.1	13-17
Zeus Beta Acid	3.8	4.1	4.5-5.5
Mt. Hood Alpha Acid	3.9		3-7
Mt. Hood Beta Acid	4.1		5-7
CRV Alpha Acid		6	2-5.5
CRV Beta Acid		7	5-6



Do the hops make good beer?

- Reports from breweries, home brewers, taste tests, festivals, and hop yards are that Southeastern grown hops can be used, wet and dried, to make good beer.
- We need to work on producing a more consistent product.



- Variety selection appears to be the single most important factor in hop yard success or failure!
- Thus far, Cascade and Columbus (Zeus) are top performers with Galena, Chinook, and Nugget also proving to be acceptable.



Wet Hop Yields

- Common yields from NC and VA plants are one to two wet pounds per plant.
- This should increase as we improve production practices.
- Some growers in NC reporting yields of 4 to 6 wet pounds per plant.
- One pound wet dries to about 0.25 lb.



Hop yields-Cascade

assume 1,000 plants/acre and 8% moisture
(these are reported averages)

Location	Plant age	Wet yields (lbs)	Dry yields (lbs)
Oregon	Mature		1,000-2,000
NY (Univ. est.)	Mature		800-1,200
Michigan	Mature	2,000-6,000	160-480
Vermont (Univ.)	3 years		200
NCSU-mtns	3 years	1,250	313
NC mtns-comm.	4 years	2,000	160
NC mtns-comm.	Mature	4,000	320
NC piedmont-comm.	4 years	2,000-3,000	160-240

Economics of Production



NCSU web resources

NC STATE UNIVERSITY



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Welcome



My name is Jeanine Davis and I am an associate professor in the Department of Horticultural Carolina State University. My research and extension programs are dedicated to the development of organic production systems for herbs, vegetables, and a wide variety of specialty crops.

The purpose of this website is to provide access to up-to-date, practical information on the production and marketing of these crops and to keep you informed about the current projects in my program. visit the other websites I maintain that are listed below. Also visit [NC Medicinal Herbs](#) which is with the University of NC-Chapel Hill.

Some of the current projects my staff and I are involved in include working on a regional Chin production study in which we are overseeing the on-farm test sites. One of those test sites is Mountain Horticultural Crops Research Station in Mills River. We are establishing a new organic Mountain Research Station in Waynesville where we also recently planted a truffle orchard. We are involved in a hops project in which we are cooperating on a funded project, led by Tuskegee University, to train extension agents and other agricultural professionals in organic agriculture for the non-timber forest products component of a ARRA (federal stimulus funds) project to put unemployed and underemployed to work. For that project, we are reviewing inventories of forest products buyers and sellers in western NC, providing technical information, and assisting non-timber forest product producers. We are cooperators on a five year, multi-state project to develop a broccoli industry. And we continue to grow a large number of woodland botanicals and ramps under artificial shade and in the v River location.

Links to Our Projects and Other Web Sites

- [Farm Prosperity Project](#) — Helpful decision making tools, production information, surveys, and presentations pertaining to and farmland protection.
- [NC Organic](#) — An organic agriculture internet resource for North Carolina farmers.
- [NC Specialty Crops](#) — A resource for farmers, entrepreneurs and consumers within the specialty crops market.



NORTH CAROLINA HOPS PROJECT NC STATE UNIVERSITY HOPS RESEARCH AND VARIETY TRIAL

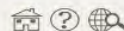
Research Sponsored Through
Golden LEAF
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PROJECT

- INTRODUCTION
- METHODS
- VARIETIES
- OBSERVATIONS
- STATE OF INDUSTRY
- ABOUT US

ADDITIONAL

- CONTRIBUTING FARMS
- RESOURCES
- PHOTO GALLERY - 2010
- PHOTO GALLERY - 2011



PROJECT INTRODUCTION

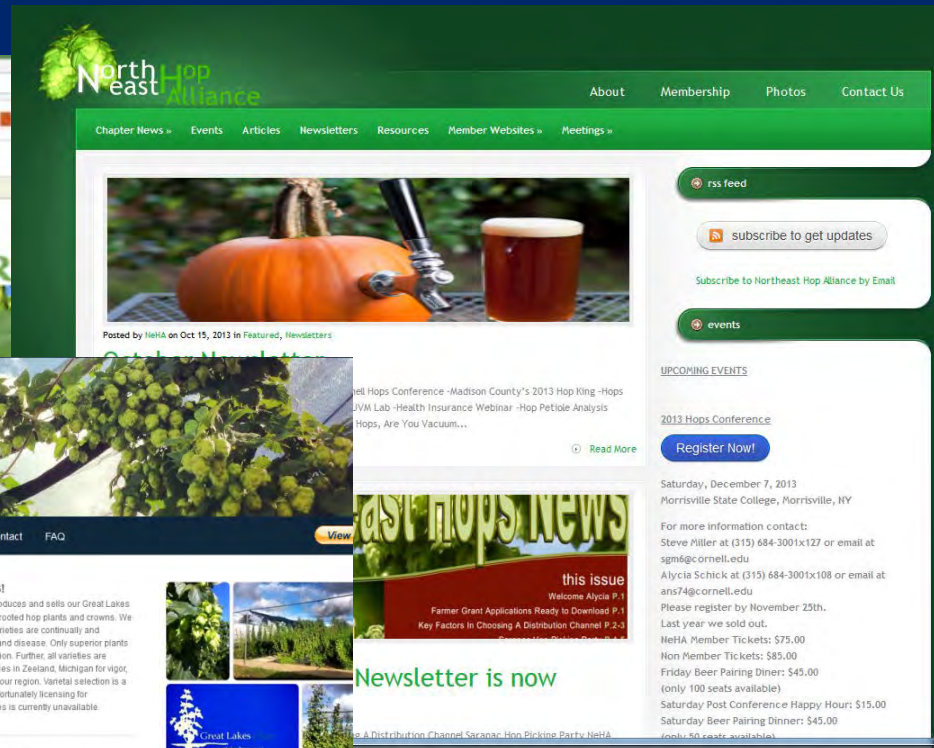
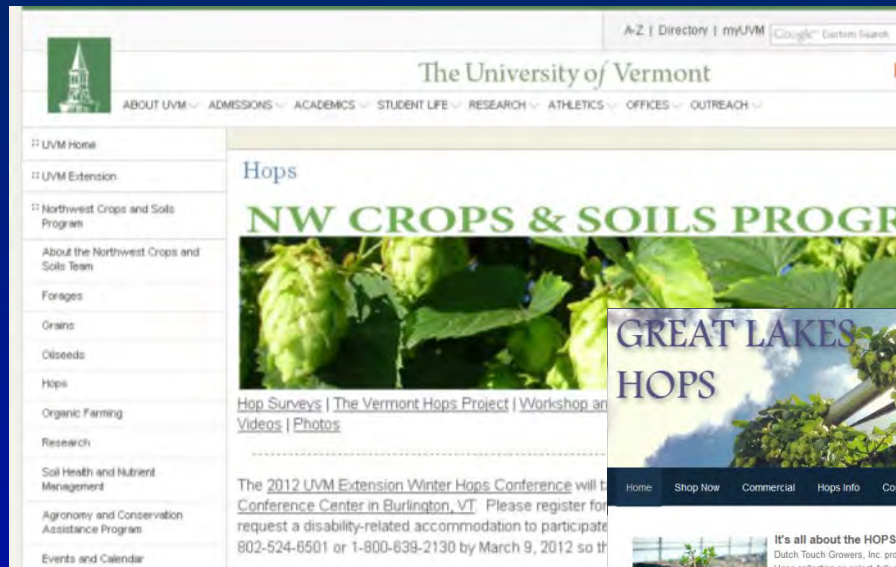
Spurred on by the demands of a burgeoning craft brewing industry and a strong public interest in locally grown ingredients, farmers are experimenting with hops (*Humulus lupulus*) as an alternative income source. Over the past three years, a small community of growers across North Carolina have established hop yards and sold their product to local craft breweries and home brewers. The majority of information and figures regarding hops production in the U.S. is developed for the Pacific Northwest hops industry and is not intended for the unique agronomic, economic, and environmental conditions found in North Carolina. The objective of this project is to help identify the best performing hop cultivars, promising geographic areas for hops production, and the key issues related to nutrition, disease, and pest control. In addition, local market conditions and production costs will also be addressed.



This spring, with support from the Golden Leaf Foundation, an experimental hop yard was established at the Lake Wheeler Road Field Laboratory in Raleigh, North Carolina. The experimental hop yard includes 200 total hops plants on 1/4 of an acre. The hop yard contains 10 different U.S. hops varieties planted randomly throughout the experimental site. The varieties were selected based on their range of alpha acid content (bitterness), yield potential, disease and pest resistance, total U.S. production, and demand by local craft breweries. The site is designed to test which hop varieties are best suited for North Carolina's unique growing conditions and which varieties offer the greatest potential for commercial production. To date, the varieties planted show significant variation in their vigor, height, yield, maturity times, pest and disease resistance, and overall agronomic health. For example, while 7 of the 20 plants of the variety 'Zeus' are at the top of the 12 foot trellis and producing cones, the tallest 'Northern Brewer' is 6 feet, visually stressed, and without cones. Although variation was expected during the establishment year and additional research is needed, it is clear that variety selection will play a significant role in the economic viability of locally grown hops.

In addition to the experimental hop yard in Raleigh, we are actively working in the Mountains with a small community of growers with established hop yards. The hops yards are in various stages of establishment (1-3 years) and managed using a range of cultural practices (i.e. organic, conventional, and mixed). These growers are working with us to help monitor, test, and analyze various agronomic conditions and their significance throughout the growing season. These pioneering growers have provided an opportunity to analyze the agronomic requirements and disease and pest pressures of hop yards managed under different strategies in different stages of establishment and

Other Resources



<http://www.uvm.edu/extension/cropsoil/hops>

<http://nehopalliance.org/>

<http://www.greatlakeshops.com/>



Southern Appalachian Hops Guild

Southern Appalachian Hops Guild

THURSDAY, APRIL 12, 2012

Freeze And Wind Damage To Hops

After almost a month of this crazy warm weather all good things must suffer and suffer my farm did last night. The temperature was 31 degrees at 5 am this morning and continued to drop to 29 degrees until 8:30 when the rise began. The wind and the freeze caused much damage. Almost all of my blueberries and many of my hops vine tips were frozen. Below are some pictures. To see more details about what happened see my blog at www.hopnblueberryfarm.blogspot.com

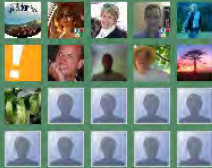


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Contributors

- [Stacy Wilson](#)
- [Chris Reedy](#)
- [Blue Ridge Hops](#)
- [Van Burnette](#)
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Southern Appalachian Hops Guild

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Organization

The Southern Appalachian Hops Guild is a growers association made up of small scale hop farmers and brewers whose mission is to further the cultivation and share good growing practices of hops in the Eastern US.

About

Photos

Likes

111

Highlights

Post Photo / Video

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Southern Appalachian Hops Guild

April 13

Our hops at the Research Station a few days ago. Luckily no frost damage today.



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Van Burnette

Our farm has seen some severe damage in the last few...
Saturday at 7:53pm



Rita Pelczar

This week was pretty tough on our hop yard -- three days...
April 13 at 1:14pm

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Activity

April

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