Why is there so much interest in growing hops?
- 50+ craft breweries in NC.
- Sierra Nevada and New Belgium moving here.
- Home brewing increasing.
- Need for organic hops.
- Fresh hops for seasonal brews.
- Locally grown movement.

The hop plant (Humulus lupulus)
- Long-lived plants (10-50 years).
- Male and female plants. Want only female plants.
- The photoperiod in NC is only barely long enough for hops – it only produces well between latitudes 35-55 (we’re on the edge!).
- Types: Old world, aroma; bittering; super alpah, dual purpose.

How to establish a hop yard
Will use our research hop yards to demonstrate.
Research hop yard in Raleigh:
Soil sample, disk, lime, and add fertilizer.

These are our soil scientists, Rob Austin and Scott King.
Feb and March 2010

Photos from S. King and R. Austin program

Hobby or small-scale trellising

Feb and March 2010

Photos from S. King and R. Austin program

Short Trellis Construction
Can substitute treated lumber with cedar or locust poles
for certified organic production

Apr 13th, 2010 at Raleigh Research Hop Yard

Photos from S. King and R. Austin program

Short Trellis
Top wire: High tensile fence wire or 3/8” galvanized strand wire

May 17th, 2010 at Raleigh Research Hop Yard

Photos from S. King and R. Austin program

Portable Drip Irrigation System

June 23rd, 2010 at Raleigh Research Hop Yard

Photos from S. King and R. Austin program

Growth on Short Trellis - Raleigh Research Hop Yard

July 27th, 2010
July 19th, 2011

Photos from S. King and R. Austin program
12 ft tall static trellis – allows for ladder stringing and harvesting

- Installed crank handles to two rows – not much benefit on short trellis.
- Added the ‘lasso’ line release system to two rows – much more difficult.

For 1 replication, double strung the hops to the line in a V arrangement.

- They didn’t grow as tall – only half topped out fully, but produced double the average volume per plant!
Drip-irrigation and weed control

Photos from J. Davis program

Planting hops in early spring

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

March and April

Putting up strings

Coir versus sisal twine

Photos from J. Davis program

We can follow many of the recommendations from the Pacific Northwest, but not for soil fertility!

Photo from J. Davis program

Rob, Scott, and Bill Yarborough, our NCDA agronomist took hundreds of soil tests and plant tissue tests to develop recommendations specifically for our soils.

Nutrient Management for Hops in North Carolina

– Hops are big feeders – require fairly large amounts of N/P/K
– Early spring and early summer – split applications of your N/P/K applications seems appropriate for now.

Nitrogen: 125 lbs/acre (crop specific value)
Phosphorus: if soil index is 0: 150 lbs/acre
Potassium: if soil index is 0: 150 lbs/acre
Sulfur: if soil index is 0: ~ 20 lbs/acre
Boron recommend 1 lb/acre
Soil pH between 6.0 and 6.5.
Do your soil testing and follow the recommendations

Training and pruning plants

Spring pruning

- Rhizomes will spread out and take over the yard.
- Large yards till around the crowns during the growing season and use a machine that mows the crowns right below soil surface &/or herbicides.
- Small yards dig around the crown in the spring and discard or replant the cuttings.

Weed control:

- We know it is important.
- We know it is costly.
- We don’t know the economic thresholds.

These are effective methods

But how much is necessary?

Diseases that impact us in NC-this is where we need more research!

- Powdery Mildew
- Downy Mildew
- These two fungi caused the collapse of the eastern hops industry in the early 1900s.
- They are still major diseases throughout the industry.
- Our moist climate puts us at a disadvantage.
**Powdery Mildew**

- Early in the season, remove any infected material and maintain adequate nitrogen.
- Remove lower growth in mid-season to prevent spread up the bines.
- Serenade and Sonata may give some control (biological controls).
- Consider removing infected plants during winter.

**Downy Mildew**

- Remove diseased hills.
- Train bines early to prevent them from coming in contact with soil.
- Begin suckering as soon as vines are strung.
- Strip leaves from bines at a height of 4’ soon after training to reduce the spread of downy mildew up the canopy.
- Avoid overhead irrigation.
- Sonata may work as biological control.

**There are also viruses, wilts, cone blight, and crown rot**

**The major insects we’ve dealt with are aphids, spider mites, Japanese beetles, and the comma butterfly.**

**Timing of harvest is critical**

These were harvested a bit too late.

**How we harvested in Mills River**
How others harvest

Top left: from Blue Mountain Brewery, top right: Willamette Valley Hops; lower left: WDFCS; lower right: Chillinghams Brewing.

Hops are usually dried

Photos from J. Davis program and Rob Austin

Simple Oast for Drying Hops

Each tray holds about 2-3 lbs of wet hops

Total cost: $125

Drying Hops

- Fresh hops are about 75-85% moisture
- Hops should be dried down to about 8-12% If you use heat, be gentle – you don’t want to burn off the oils!
- Experience has shown this feels drier than most people would naturally estimate!
- Need to dry sub-sample of fresh-picked hops down to 0% moisture to determine what % moisture you have
- Then calculate what target weight your hop harvest should be at about 10% moisture – don’t fear the math!

Source: http://sroc.cfans.umn.edu/People/Faculty/JohnFritz/Hops/HopDrying/index.htm

Packaging

Results from 2nd year Raleigh Hop Yard

- 85% of the total yield of the hop yard came from two varieties: Zeus and Cascade.
- Five varieties produce next to nothing! Centennial, Sterling, Mt Hood, Willamette, and Northern Brewer (total ½ lb).
- The short trellis reduces yields compared to the tall trellis; but we need to compare the bottom line.
- Irrigation is critical.
- Labor is high.

Photos from J. Davis program and FoodSaver.com

Results from 2nd year Raleigh Hop Yard

- 85% of the total yield of the hop yard came from two varieties: Zeus and Cascade.
- Five varieties produce next to nothing! Centennial, Sterling, Mt Hood, Willamette, and Northern Brewer (total ½ lb).
- The short trellis reduces yields compared to the tall trellis; but we need to compare the bottom line.
- Irrigation is critical.
- Labor is high.

Photos from J. Davis program and FoodSaver.com
Results from 1st year Mills River Hop Yard

- Zeus, Cascade, and Galena were our top producers. Zeus gave 1.1 wet lbs/plant.
- We're told the quality is good but our alpha acids aren't quite where we want them yet.
- Raising and lowering the top wire works well, but we have to make some modifications.
- Labor is extensive.

Northeast Hops Alliance

Estimated costs per Acre

- Trellis establishment $5-6,000
- Drip irrigation system $1,200
- Rhizomes or plants $2-4,000
- Land Prep (fert, seed, coir) $1,000
- Labor $3-4,000

Total $12-16,000/A

What will it take to make a profit?

- Have to get premium prices!
- Should yield one lb wet hops per plant or more (I would like to see 4 lbs wet)
- 200 plants/quarter acre
- 200 lbs @ $20/lb wet and one lb wet/plant=$4,000 gross return
- Annual costs (??) $2,500
- Net return potential of $1,500
- But some growers only getting $15 per wet pound, which would reduce net return to $500.

So far, no one I've talked to is making a profit yet.

Why do we need a public research and extension program?

- Will hops grow here well enough to be an economically viable crop?
- What varieties should we grow?
- What is the best trellis and management system?
- How should they be fertilized?
- What are the diseases and insects of concern and how do we control them?
- What are the economics of production?
- Will our quality be good enough that brewers will pay a premium for them?