

Assessment of Hops for Tennessee

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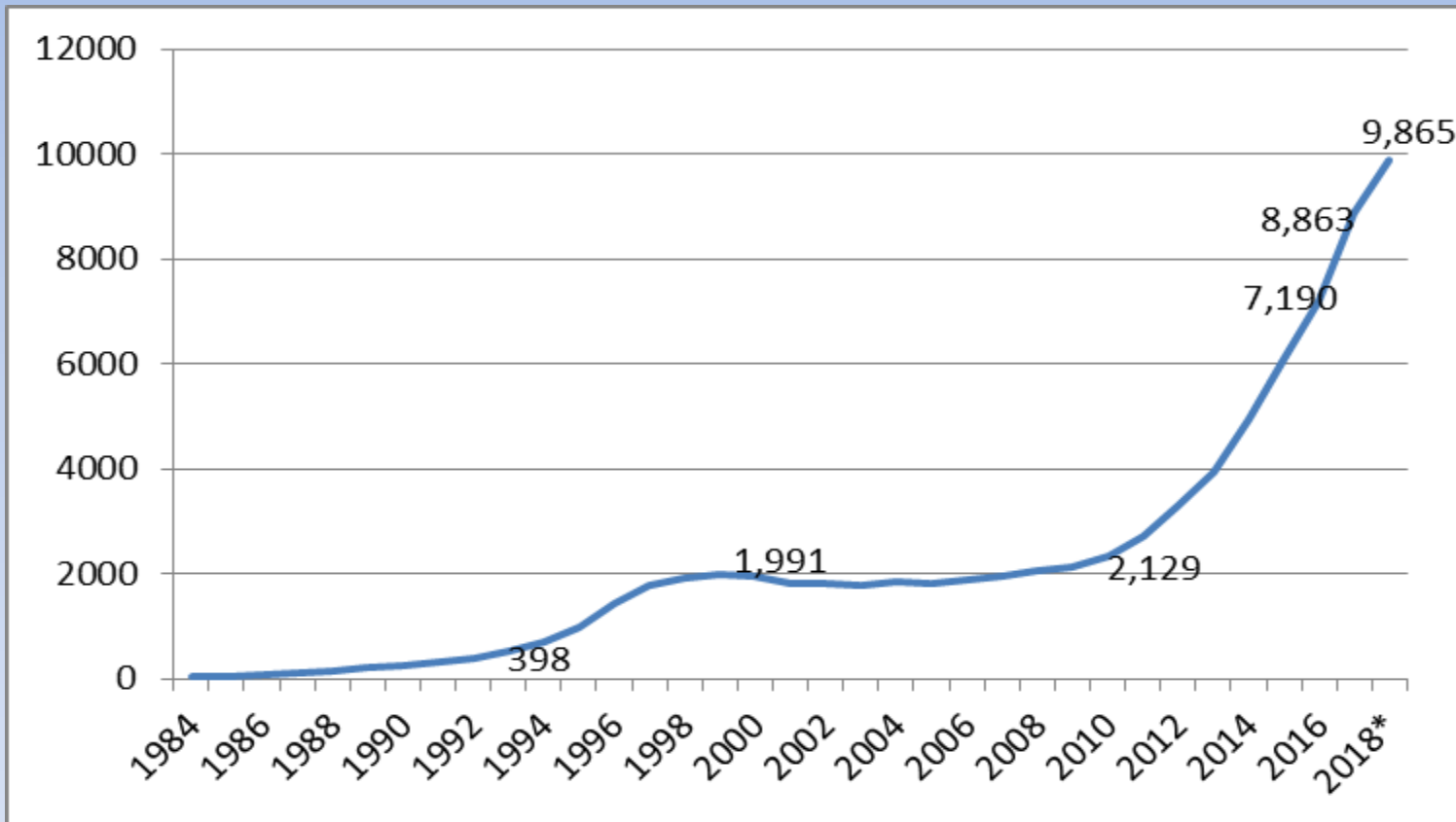
Outline

- Growth in Craft Beer-Hops
- Nature of plant, processing
- Hops in the Southeast

Hops

- Hops is a flower of *Humulus lupulus*
- used in beer production as a preservative and flavor additive
- Grown as a bine (vine) on a trellis system (16-18 feet), hops are generally dried and usually pelletized before use
- wet hops may be a source of demand held by brewers in the southeast (hops must be used or dried within in 24-36 hours due to oxidation of key ingredients)

Growth in Number of US Breweries

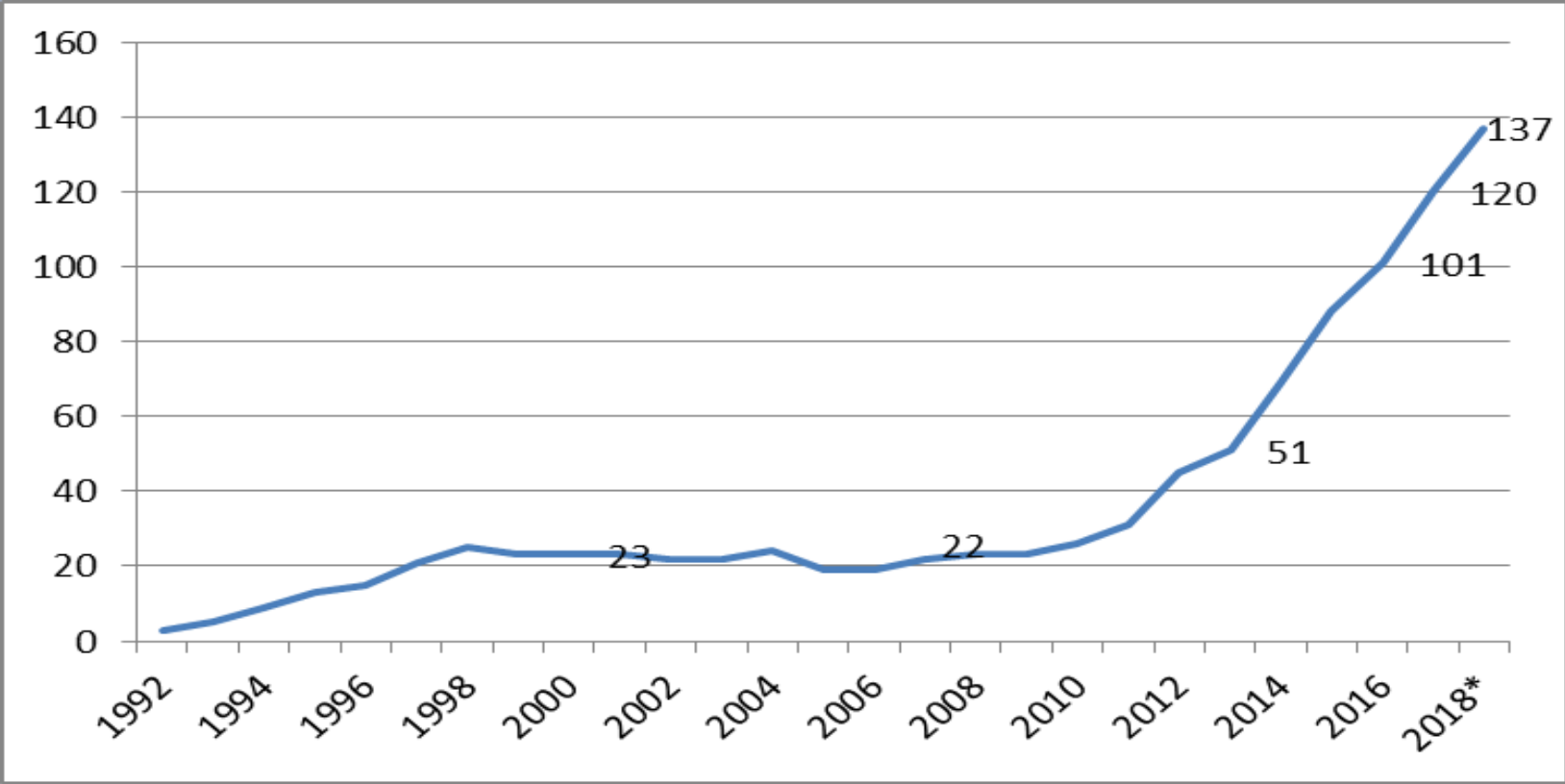


Source: Alcohol and Tobacco Tax and Trade Bureau, US. Dept. of the Treasury

*3rd Quarter

But Experts talking about slowdown

Growth in Number of TN Breweries



Source: Alcohol and Tobacco Tax and Trade Bureau, US. Dept. of the Treasury

*3rd Quarter

Hops Demand

(USA Hop Growers of America)

- Increased demand tied to tremendous growth in the US craft beer industry
 - 2016: 25.8 million barrels
 - 2011: 11.5 million barrels
 - 2003: 5.5 million barrels
- Hopping rate for craft beer
 - 1.24-1.65 pounds per barrel (31 gallons)
 - Has been increasing
- \$26.0 billion 2017

Growing Industry

- US Production:
 - 2007: \$180 m, 30,911 acres, 3 states
 - 2017: \$617.8 m, 52,963 acres, 29 states
 - 1,959 pounds average yield per acre
 - Concentrated in arid parts of PNW
- >98% used to brew beer
- 26 other states 2,504 acres, 750 pounds/acre
- Cascade, Centennial, Chinook varieties
- But:
 - Estimated loss to pest and diseases is 15%
 - Talk of looming “over acreage”

Hops Yard



Hops Flower (Cone)



Hops Flower



Alpha Acids

- Alpha acids: found in the resin glands of the flowers of the hop plant and are the source of hop bitterness.
- Alpha acids: humulone, adhumulone, cohumulone, posthumulone, & prehumulone
- As a % of dried weight level vary by variety
- Cascade 4.5-8%
- Centennial 9-11.5%
- Chinook 12-14%

Other Components

- Essential oils:
 - Often add aroma, other attributes
- Flavonoids
- Beta acids

Three Major Categories

- Bittering hops have higher concentrations of alpha acids
- Aroma hops:
 - Lower concentration of alpha acids (~5%) and are the primary contributors of hop aroma and (nonbitter) flavor.
 - Often added later in the boiling process
 - May be used in dry hopping (added after cooling-while beer ferments).
- “Dual-use” hops: bittering & aromatic

Harvest, Drying, Pelletizing

(Gorst Valley Hops)

- Cut bines down
- Remove flowers (cones) from stems and bine
- Sort cones from leaves and stems
- Oxidation of lupulin start immediately
- Dry immediately unless wet hopping (24-36 hour window)
- Subject to food safety regulations

Drying



- Oasting or drying to appropriate moisture content (8-10%)
- Air flow driven by centrifugal fans is key
- Watch, adjust for humidity level
- Excess moisture can lead to:
 - Mold and mildew
 - Loss of lupilin
 - General spoilage





Pelletizing

- Brewers typically prefer to use pellets
- Hammer Mill
- Usually baled after drying
- Pelletizing:
 - Breaking bales into powder
 - Heat generated activates resins, bind the powder into pellets

Milling – NOW IT IS FOOD

- Size Reduction to ¼" minus
- Utilizing hammer mill



Challenges for Southeast Industry

- High establishment cost
- Small size
- Low yields
- Humid environment
 - mildews and others diseases
 - pests
- Harvest (need labor quickly)
- Lack of industry infrastructure (custom machine harvest, drying, pelletizing)
- Marketing

Challenges & Possible Solutions: Yields

- VA producers 25% of large producers in PNW (i.e., around 500 pounds / acre) (Dick & Bresowar)
- Lack of vegetation prior to flowering a likely cause
- Yields generally highest between 35(?) and 55 latitude
- Possible solutions?
 - Light extension-interruption
 - Trimming

Light Extension-Interruption

- Lack of summer sun an issue
- Several places (VA, FL, SA) looking at night time light interruption & daylight extension as ways to increase growth and yields
 - Preliminary results from FL appear promising
 - Apparently promising in South Africa but information is proprietary

Pruning as a Way to Increase Yields?

(source: hopnology)

- Optimal pruning (trimming) based on flowering date
- Flowering driven by growing degree days
- Some difference by variety and latitude
- Trimming limits node “stretching” thereby generating more and longer sidearms
- More sidearms mean more hops
- 1.9 (trimmed) vs. 0.88 (not) pounds per plant

Summary, Future Work

- May be an opportunity but many challenges
- NC, VA 30 acres each (2016)
- UTIA Hops Workshops
 - Tuesday, February 19, Macon County Fairgrounds
 - Monday, March 11, UT Research & Education Center at Greeneville
 - Thursday, March 28, UT-Martin Champions Club
- Brewery survey
 - Demand for local hops
 - Demand for local malting barley
 - Demand for other local additives (fruit)



Sources Hops

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Questions, Comments,
Thank You!

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