



Establishing a Hop Yard for Small Farms and Homebrewers

KELLY E. GREER^{*1}, BRIAN J. PEARSON², AND RICHARD V. TYSON¹

¹University of Florida/IFAS Orange County Extension, 6021 S. Conway Rd.,
Orlando, FL 32812

²University of Florida/IFAS Mid-Florida Research and Education Center,
2725 Binion Rd., Apopka, FL 32703

ADDITIONAL INDEX WORDS. demonstration gardens, local food systems, alternative crops, wet hops, craft breweries, *Humulus lupulus*

The Exploration Gardens at the University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) Orange County Extension Office are an integral part of extension educational outreach to residential and commercial clientele in Orange County, Florida. The four-acre garden is made up of more than 10 themed garden demonstrations. One overall goal of the Exploration Gardens is to trial new crops and plant varieties for use in small farms and residential landscapes. The objective of this project was to utilize research findings on hops (*Humulus lupulus*) from the UF/IFAS Mid-Florida Research and Education Center (MREC) to create a demonstration hop yard for small farms and homebrewers. The pilot project was initiated in February 2017. Hops, propagated commercially utilizing tissue culture production techniques, were transplanted into 6-inch-diameter containers and cultivated for three months. Hop cultivars selected for cultivation included Centennial and Chinook, two popular cultivars commonly used in a wide array of craft beer styles. After three months, hop plants were transplanted into the ground and trained on strings tied to a traditional, short-trellis hop yard structure. At the end of the season, hops were harvested and used to brew a special beer in conjunction with a local brewery. Results of the pilot project enhanced community interest and participation in county extension events, increased awareness of alternative specialty crops production and establishment of partnerships with local craft brewers.

Extension demonstration gardens in Florida are used extensively as a teaching tool to reach a diverse range of clientele including homeowners, professionals, volunteers, and students and faculty at schools. As a modified form of on-farm tests, demonstration gardens provide valuable experiential learning opportunities, providing information to clientele interested in new plants, crop varieties, or agricultural practices. The University of Florida Extension Program boasts 61 demonstration gardens in 40 out of Florida's 67 counties (Park Brown et al., 2002). They also collaborate with, support, and extend research that comes from the University.

One of the overall goals of the Exploration Gardens at the Orange County Extension Office is to trial new crops and plant varieties for use in small farms and residential landscapes. The demand for locally produced food is rapidly growing in the United States. This demand stems from concerns about sustainability, nutrition, food safety and security along with farmland retention and economic development (Martinez et al., 2010). In Florida the profitability of the citrus industry is being challenged by citrus greening causing them to actively seek new alternative crops.

Sale of craft beer products in Florida totaled \$875.8 million during 2013. The Florida craft brewing industry has grown rapidly over the past few years. The number of planned breweries

and industry optimism suggest that growth will continue. Based on capital per-brewery data from states with mature craft-beer industries (California, Colorado, Oregon, and Washington), Florida could support almost 550 craft breweries, roughly 10 times the current number.

The United States is the largest global producer of hops with 40% of global production (USDA, 2017). The industry is centered in the Pacific Northwest with Washington, Oregon, and Idaho being the largest producers, with Washington producing 75% of the nation's hops in 2017 (USDA, 2017). Production outside of the Pacific Northwest currently accounts for only 1% of commercial acreage, but interest continues to increase as a result of increased demand for craft beer products and interest in locally sourced agricultural commodities (Tremblay and Tremblay, 2011). In 2007, a hop shortage caused prices to rise sharply (20% for commonly grown varieties and an 80% for specialty varieties (Welch, 2007). Economic analysis of small-scale (0.25 acre) hops cultivation within North Carolina indicates a break even price of between \$22 and \$5 per 2.2 lb for dry strobile yield of between 10.5 and 21 oz/plant, respectively (Bullen and Austin, 2014). Cultivation of hops within Florida for both local and national sale has not been evaluated.

At harvest time, hops contain roughly 75% moisture. If stored at that level, they will spoil. Hops are dried in a hop kiln to an ideal moisture content of 9 to 10%, allowing them to be stored and used for brewing throughout the year. After the hops are dry

^{*}Corresponding author. Email: kg@ufl.edu; phone: 407-245-9200.

and cool, they are compressed into 200 pound bales for delivery to hop processing companies. Hops can also be used fresh, but need to be delivered to the brewery within 24–48 h or else they will begin to deteriorate, become soggy and rot (Vandenengle, 2014).

To directly address increased interest and demand for locally cultivated hops, a demonstration hops yard was established within the Exploration Gardens of the Orange County Extension Office. Successful interactions and educational events occurred with homeowners, local farmers, and brewers (Fig. 1 and Fig. 2).

Materials and Methods

Hops (*Humulus lupulus* L.) is an herbaceous, perennial plant, producing annual bines from an overwintering rootstock. Bines differ from vines because they do not use tendrils to climb, but rather stiff hooked hairs along the stems. In the spring and early summer, bines grow rapidly, winding around their support in a clockwise direction. Bine height responds to shortening day lengths. As bines stop growing vertically, they begin to produce side shoots which bear the inflorescence. Hops are dioecious. The strobiles, or cone-like female inflorescences, produce a crystal-line compound (lupulin) that imparts unique bittering, flavoring, and aromatic qualities to finished beer products (Almaguer et al., 2014; Burgess, 1964). The rootstock is an underground structure consisting of both rhizomes and true roots that may reach a depth of 15 feet or more. During the first year, little growth and few flowers are produced because the plant is establishing its root system. A larger harvest of hops should be expected the second year (Miller et al., 2017).

The Exploration Gardens at the Orange County Extension Office received hop plants propagated by tissue culture from Agri-Starts (Apopka, FL) on 27 Sept. 2016. Using hop plants propagated by tissue culture ensures the stock is of consistent quality and free of pathogens. The cultivars selected for demonstration were Centennial and Chinook. ‘Centennial’ was bred



Fig. 1. Young hop plants (*Humulus lupulus*) on trellis at the Orange County Extension Office, Orlando FL.



Fig. 2. Mature hops plants (*Humulus lupulus*) close to harvest.

by the United States Department of Agriculture (USDA) in 1974 and released in 1990 by Washington State University. It is one of the most popular varieties used in craft brewing with lemon and floral aromas. ‘Chinook’, another USDA cultivar released in 1985, is another favorite of the craft brewing community with grapefruit, spice, and pine aromas.

Hop plants were transplanted on 28 Nov. 2016, into 6-inch diameter containers with Sun Gro Horticulture Metromix 380, an equal parts peat, bark, vermiculite potting medium and cultivated for three months. During that time, they were fertilized once a month using Scott’s Miracle-Gro 24–8–16 (N–3.5% ammoniacal nitrogen, 20.5% urea nitrogen, P–8% available phosphate, and K–16% soluble potash) soluble fertilizer.

The Exploration Garden hop yard was constructed using two metal poles 40 ft apart erected on 3 ft × 3 ft concrete footers so they would withstand hurricane-force winds. We constructed the hop yard using a short-trellis height of 13 ft to allow for easier teaching and demonstration purposes with Garden visitors. Nylon rope was used between the poles to support the vertical growing lines for the bines.

The planting bed was prepared by tilling to a depth of 8–10 inches and then amending with a top dressing of locally made compost. The tilling and compost amendment created a raised bed of approximately 10 inches to allow for adequate drainage. Hops were transplanted from the 6-inch diameter containers on 28 Feb. 2017. Planting consisted of 12 hop plants of each cultivar planted 1 ft apart in two rows of 6 hop plants mounded with a 3 ft space between varieties. Hops were hand watered until established and then only as needed based upon visual determination.

When hop bines were approximately 2–3 ft long, three to four of the strongest bines were selected and trained to wrap clockwise around the sisal lines. All remaining bines were cut back to the crown to encourage upward growth of the selected and trained bines. Hops were continuously monitored for disease and pest incidence. LESCO slow release fertilizer with a N–P–K analysis of 8–2–12 (N–0.80% ammoniacal nitrogen, 7.2% urea nitrogen, P–2% available phosphate, K–12% soluble potash) was applied

in early July. In mid-August the hop cones were mature and harvested. Scaffolding was erected to aid in harvesting.

Results and Discussion

One of the objectives of the Exploration Gardens is to demonstrate new or trending small farm and residential gardening ideas, trials and techniques, and then sharing the results with our clientele through programming, events, and social media. This project validates the value that extension demonstration gardens, collaborations, events, and social media can have in meeting our objectives when used purposefully.

Microbreweries are on the rise and hops are an agricultural commodity necessary for brewing. This, coupled with challenges to the citrus industry, allowed us to make an impact in the community with our project.

To learn how to harvest hops, we participated in a hop harvest field day at the Mid-Florida Research and Education Center. The hands-on training helped to gain an understanding of when hops are ripe and how they come off the bine. Different varieties ripen at different times. If you slightly squeeze the cone, it should feel light, dry, and papery when it is ready to be harvested. The cones should also have a pungent smell similar to cut grass, onions, or beer. If your hands are slightly sticky due to the yellow powdery lupulin, the hops are ready for harvest. Hops that feel wet or heavy and don't pop back when compressed are not ready. The time window to harvest is short so it is important to carefully observe the crop at this stage. We harvested 3 lb of hops from 'Chinook' plants and 2.8 lb from 'Centennial' plants. A local brewer was contacted and agreed to create a brew from the fresh hops and then serve it as part of an educational event at the brewery. (Fig. 3 and Fig. 4).

When the brew was ready, an Eventbrite contest was created to find a name for the wet hopped French style farmhouse ale. Thus "GatorAle" was born. We advertised the event through social media, email, and word of mouth. At the brewery, a display was created with hop plants grown on trellises in containers and a large banner showed the main ingredients. We received a check for \$177, but more important, we helped to create an opportunity for producers, growers, brewers, and the community to come together to network and generate support and awareness for the University of Florida's the research on new crops.



Fig. 3. Harvesting hops plants (*Humulus lupulus*).



Fig. 4. Harvested hops (*Humulus lupulus*) ready for delivery to the brewer.

On 10–11 Sept. 2017, Hurricane Irma struck the Orlando area, impacting the Exploration Gardens hop yard. The hop yard was under water for 48 h. When the water receded the plants appeared to be healthy with healthy foliage on immature bines. The bines were cut back in December and the plants went dormant. In Feb. 2018, we observed new growth starting to appear from the crown but as the second or third node started to grow the growing points began to die off. Within two weeks the crowns were soft and no longer displaying new growth. We dug the rhizomes and the crowns and some of the rhizomes appeared to have rotted. The healthy rhizomes were covered in nodules and galls. We sent soil samples and rhizome samples to the Nematode Assay laboratory at the University of Florida. The results showed a high root knot nematode presence along with stunt and spiral nematodes. We have since removed all of the 'Chinook' and 'Centennial' rhizomes from the hop yard. Researchers at the Gulf Coast Research and Education Center have been observing different hops cultivars to see if there is any level of resistance to the nematodes. Johan Desaegeer, a nematologist for the University of Florida says there is quite a bit of difference among the cultivars with regard to nematode resistance. Going forward we are replacing the hop varieties with 'Cascade' and 'Nugget'. These two varieties have shown to have more nematode resistance according to Desaegeer (personal communication).

We have learned that hi-tensile wire cable secured with a turnbuckle system is a better choice than nylon rope to prevent sagging as the bines become heavy when they mature.

Conclusion

Extension demonstration gardens should continue to collaborate with, support, and extend new and ongoing research.

Extension demonstration gardens are important hands-on tools to use in programming. The combination of seeing and doing is the preferred method of learning by most people. (Richardson, 1994). This study supports the use of extension gardens as a teaching method and warrants the time required to design and create new and innovative demonstrations for any extension program.

Additional research examining the economic value of hops cultivated in the southeastern United States coupled with research focused on the potential improvement of strobile yield are needed

to accurately determine viability of commercial hop production within this region.

For homeowners, hops appear to be a viable backyard crop that could be used with short trellis systems producing enough hops to support home brewers.

Literature Cited

- Almaguer, C., Schönberger, C., Gastl, M., Arendt, E.K., and Becker, T. 2014. *Humulus lupulus*—A story that begs to be told. A review. J. Inst. Brewing 120:289-314.
- Burgess, A. H. 1964. Hops: Botany, cultivation and utilization. Interscience Publishers Inc., New York, NY.
- Brewers Association. 2017. State Craft Beer Sales & Production Statistics, 2017. Accessed 27 Oct. 2018 <<https://www.brewersassociation.org/statistics/by-state/>>
- Park Brown, S., K. Taylor, E. Eubanks, and C. Stephens. 2002 (Revised 2012). Demonstration gardens in the University of Florida Cooperative Extension Service. Extension Publication EP108. University of Florida, Gainesville.
- Martinez, S., M. Hand, M. Da Ora, S. Pollack, K. Ralston, T. Smith, S. Vogal, S. Clark, L. Lohr, S. Low, and C. Newman. N.D. Local food systems: Concepts, impacts and issues. U.S. Department of Agriculture, Econ. Res. Serv., Washington, D.C. <http://www.ers.usda.gov/media/122868/err97_1_.pdf>.
- Hiller, S. M., Gingrich, G. A., Haunold, A., Miller, S. 2017. Growing hops—in the home garden. Accessed 9 May 2018. <<http://www.northeasthopalliance.org>>
- Tremblay, C.H. and Tremblay, V.J. 2011. Recent economic developments in the import and craft segment of the US brewing industry. Oxford Univ. Press, Oxford, United Kingdom.
- U.S. Department of Agriculture. 2017. June Hop Acreage Report. Accessed 9 May 2018. <http://www.usahops.org/userfiles/image/1465839746_2016%20June%20Hop%20Acreage%20USDA%20NASS.pdf>
- Vandenengel, H. 2014. The fresh flavors of wet hop ales. All About Beer Magazine. 35(5). Accessed 8 May 2018. <<http://allaboutbeer.com/article/wet-hop-beer/engle>>
- Welch, D. 2007. Hops shortage likely to boost price of beer. Accessed 8 May 2018. <<http://www.npr.org/templates/story/story.php?storyId=16245024>>