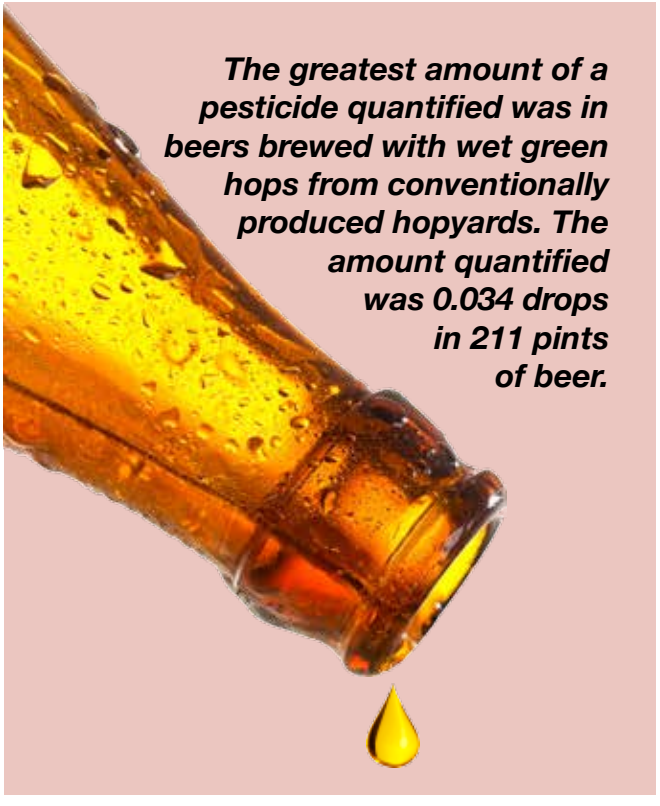
Fate of Pesticide Residues in Beer

Summary of a Joint University Study

Demand for hoppy beers continues to grow and craft brewers are proving to be innovative in the ways they are introducing high volumes of hops into their brews. Hops are increasingly being added later in the brewing process in both dried whole-cone and pelletized form and many craft breweries are pioneering the addition of green, undried, high-moisture hops to the brewing process. Concurrently consumers are demanding wholistic inputs into the brews they consume, leading to concerns that hops may be contributing a pesticide load in beer. Proactively researchers at Washington State University and University of California Davis sought to determine what the late addition of hops and "wet-hopping" (use of green hops) contribute to pesticide residue levels in beer.

In 2013, WSU set up controlled plots of conventional hops and treated them with a range of commonly used pesticides, including treatments for insects, mites, diseases, and weeds. Heavier than average (but realistic and legal) amounts were applied. Both conventional, organically certified, and no pesticide pest control regimens were utilized in separate hop yards. WSU proceeded to brew beers from these hops, using fresh (green/wet) hops, dried whole hops, and pelletized hops in a variety of brewing schemes that included heavy hopping and hopping late in the brewing process. The beers brewed by WSU from the treated hops were subsequently analyzed by UC scientists at the IR-4/Trace Analytical Laboratory using state-of-the-art technology to screen for some 30 commonly used pesticides. The detection threshold or "limit of quantitation" was 0.5 parts per billion (ppb).



The greatest amount of a pesticide quantified was in beers brewed with wet green hops from conventionally produced hopyards. The amount quantified was 0.034 drops in 211 pints of beer.

FULL ARTICLE: D.B. Walsh, S.D. O'Neal, A.E. George, D.P. Groenendale, R.E. Henderson, G.M. Groenendale, and M.J. Hengel. 2016. Evaluation of Pesticide Residues from Conventional, Organic, and Nontreated Hops on Conventionally Hopped, Late-Hopped, and Wet-Hopped Beers. Journal of the American Society of Brewing Chemists. 74(1):53-56, 2016. http://dx.doi.org/10.1094/ASBCJ-2016-1115-02

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Only two pesticides (bifenazate and boscalid) were quantified in beers above 0.5 ppb. Use of fresh hops grown under the conventional pesticide treatment program resulted in the greatest contribution of boscalid and bifenazate in beer. The highest residue found in any of the beers brewed was 22.48 parts per billion for bifenazate. To put this in perspective, a common international unit of measurement for beer is the hectoliter. A hectoliter is 100 liters or 100,000,000 microliters (µl). In our study the amount of bifenazate in a hectoliter of beer was 1.7 µl. Bifenazate's density is 1.31 g/cm^3. The chemist's rule of thumb for the volume of a drop of water is 50 µl. The amount of bifenazate quantified in a hectoliter of beer was 0.034 drops.

The US Environmental Protection Agency (EPA) sets Acceptable Daily Intake (ADI) quantities for pesticides in food products. The ADI for bifenazate is 10.0 µg/kg of body weight. Since 200 lb = 90.9 kg, this means that a 200-lb. man could safely ingest 909 micrograms (µg) (or 11 drops by our calculation) of bifenazate per day. Given the results of our analysis, to reach 909 µg, a 200-lb man would have to drink 40.43 liters of beer in a day, which is 10.7 gallons or 85.6 pint glasses. A 125-lb individual would have to consume 53.5 pints to reach his or her ADI.

Residue Impact on Beer and Us

- **Let's say we go out and enjoy a few pints...say, six**
- **What's our bifenazate dose?**
  - **6 pints = 6 x 16 oz x 29.57 mL/oz = 2,839mL**
  - **2,839 mL x 22.48 ng/mL = 63,814 ng**
  - **63,814 ng = 63.8 µg of bifenazate in 6 pints**
- **ADI = "Acceptable Daily Intake" (EPA)**
- **ADI for 200 lb. man**
  - **200 lb = 90.9 kg**
  - **10 µg/kg x 90.9 kg = 909 µg/day**
- **Dose from beer compared to ADI**
  - **63.8 µg in the beer**
  - **909 µg/day acceptable**
  - **6 beers/day = ~7% of the ADI**

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