**Quality Assessment of Hops (*Humulus lupulus*) Grown in New Jersey**

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**Project Summary:** As the microbrewery industry continues to experience steady growth, there is increased interest and demand for locally sourced ingredients one of which is hops. Hops (*Humulus lupulus*), are primarily grown in the Pacific Northwest (PNW) where producers ensure they consistently meet certain quality standards. Aroma (alpha) and bittering (beta) acid content are among the most important quality control parameters for determining marketability of hops. The reintroduction of hops into New Jersey is of keen interest to NJ and regional brewers, yet there are concerns about the consistency and quality of locally grown hops relative to those grown in the PNW. The purpose of this project was to assess the quality of hops grown throughout NJ in relation to PNW grown hops. Alpha and beta acid content was tested in 12 hop varieties from four NJ farms, using an HPLC. Alpha and beta acid content showed variation of 0-50% from PNW standards, which differed depending on location and genotype. Although hops sampled from NJ did not consistently match the acid content of PNW grown hops, results did show that the acid content of NJ grown hops can reach industry standards. The NJ hops industry is young, and with time, close monitoring, and improved management strategies these quality standards can likely be consistently met in the future.

**Materials and Methods:**

***Plant Material****:* SARE partnership growers contributed dried hop cone samples (approximately 8% moisture) from three locations in New Jersey representing 12 hop varieties, which were analyzed for bittering alpha/beta acid content (Figures 1 and 2).

***Identification, quantification and analysis of hop bittering compounds:***Bittering acids cohumulone, n+adhumulone, colupulone, n+adlupulone were separated and identified by HPLC-UV. Dried hop samples submitted by growers and two 10 gram samples were each randomly subsampled and extracted as biological replicates. Each of the four bittering acids were quantified for each sample according to ASBC method Hops-14, using the International Calibration Extract 3 (ICE-3) to calculate response factors. Acids are reported as percentage of component by weight.

**Figure 1. Alpha acid percentages of the hop samples tested including from the demonstration plot (Snyder Plot) and growers throughout NJ in comparison to the industry standard (YCH Hops), the top sample in each boxed cultivar.**

**Figure 2. Beta acid percentages of the hop samples tested including from the demonstration plot (Snyder Plot) and growers throughout NJ in comparison to the industry standard (YCH Hops), the top sample in each boxed cultivar.**

**Results:** Data collected from hopyards throughout New Jersey provides insight into the bittering and flavor profiles of hops grown in Mid-Atlantic hardiness zones. Both alpha and beta acid content appear to be variable within all varieties tested. Alpha acid content of grower and demonstration plot hops all fell outside of the industry standard range with the exception of one growers Mangum hop sample (Figure 1). On a whole beta acid content across all grower samples fell closer to the industry standard ranges. This was specifically observed in the varieties Magnum, Nugget, and Cascade (Figure 2). In the future, we hope to improve the quality and decrease variation of acid profiles of NJ grown hops, through the use of improved horticultural practices coupled with standardized harvesting and drying protocols for hop cones.

**Conclusions:** Given the infancy of this crop in the Northeastern US, these results provide substantiating evidence for the potential to grow certain varieties of hops as a value-added crop in NJ in the future. However, multi-year data is needed for the locations surveyed in this study to determine whether biochemical profiles remain consistent year to year. In the future special focus will be put on finding post harvest protocols/methods to help growers attain industry bittering acid quality standards. The success of New Jersey and Mid-Atlantic hop growers in securing multi-year contracts with breweries will be contingent upon the ability of growers to provide consistent hop yields, and acid quality. Additional work will also need to be done to assess the volatile composition of these hop samples. This information will help growers market varieties as having northeast regional terroir.

**References:** ASBC Methods of Analysis, online. Method Hops-14. α-Acids and β-acids in hops and hop extracts (International Method). Approved 1990, rev. 2008. American Society for Brewing Chemists, St. Paul, MN, U.S.A. doi: 10.1094/ASBCMOA-Hops-14

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