From Field to Pint
malting barley in the eastern U.S.

by Tracy Hmielowski
With more than 5,000 craft breweries in operation in the U.S., and more opening every month, breweries need to find ways to stand out from the crowd. Some do this by pushing the boundaries of styles, offering triple IPAs with rare hops, or using non-traditional ingredients like cucumbers, hot peppers, and oysters. Others have taken note of the local food movement and source local ingredients, much like farm-to-table restaurants.

Beer, in its simplest form, is made from water, malted barley, hops, and yeast. For a short list of ingredients, it is a challenge for breweries in many parts of the country to find local sources of hops and malted barley. Most hops production in the U.S. occurs in the Pacific Northwest although producers have established successful hops farms in the Midwest and Northeast. Similarly, most of the malting barley production in North America occurs in the Northern Great Plains.

Continued growth in the craft beer industry, combined with the demand for local products, has provided an opportunity for farmers and entrepreneurs in the eastern U.S. to start producing malting barley. However, it is not as simple as a farmer planting a field of barley and selling it to a local brewer. Many malting barley varieties perform poorly east of the Mississippi River, and there are relatively few malting operations in operation in this region.

Malting Barley

In the U.S., the majority of malting barley is grown in the cool, dry climates of Idaho, Montana, Wyoming, and North Dakota. “We have hot and humid and wet summers on the East Coast, which make it difficult to grow malting barley successfully,” explains Aaron MacLeod, Director of the Hartwick College Center for Craft Food and Beverage. The humid, moist, conditions are perfect for Fusarium head blight to grow, and fungicides must be used to keep barley from becoming infected. Fusarium head blight produces deoxynivalenol (DON), a mycotoxin. Farmers can use fungicides to suppress Fusarium head blight, but malting barley cannot have more than one part per million of DON.

Wet conditions also trigger barley to sprout in the field, and barley that has sprouted cannot be turned into malt. “We have a lot of varieties out there that [were developed for] a dry environment, and the minute that they become mature, if they get any [rain], even a heavy dew, they’ll start sprouting in the field,” says Ashley McFarland, Coordinator for the Upper Peninsula Research and Extension Center at Michigan State University. As an alternative to trying to manage western varieties in the East, growers have experimented with varieties from Europe. “If you look at the French malting barley varieties and the German malting varieties, they all have dormancy,” MacLeod says. “They have to because that’s what their climate is like... When we bring those varieties over here, they can work well.”

This interest in growing malting barley across a wider range of climate conditions presents a new line of research for barley breeders. The Eastern Spring Barley Nursery (ESBN) experiment, which is a collaborative effort across multiple universities, was established in 2015 with a grant from the Brewers Association. ASA and CSSA member Richard Horsley, a barley breeder at North Dakota State University, is the lead researcher of the ESBN. Currently, researchers are testing 25 barley varieties across the eastern U.S. At the end of the growing season, researchers measure yield, DON levels, percent protein, and other quality traits that are of interest to both growers and brewers. The researchers hope to identify varieties that grow well in the East, but Horsley says finding varieties with pre-harvest sprout resistance and minimal accumulation of DON are “limiting factors.”

Farmers in the East also need to learn the best management practices for producing malting barley. “You’re taking small-grains growers who are familiar with winter wheat [and] other feed grains and now training them on how to grow a malting barley crop because it requires a different mind-set,”

Penn State researchers Greg Roth and Alyssa Collins examine European malting barley varieties at Penn State’s Southeast Agricultural Research and Extension Center in Lancaster County. Photo by Kristy Borelli.
MacLeod says. Rather than managing for maximum yield, malting barley is managed to meet criteria for malting and brewing. In addition to low DON levels, malthouses need barley that has a high germination rate, and brewers are concerned with protein levels as well as the plumpness and evenness of kernel size.

Although malting barley takes more management, it can sell for approximately three times the amount of feed barley. And while the higher price point will appeal to many farmers, growers are advised to establish contracts with a malthouse before planting. “Barley is one of the few crops sold by variety name,” Horsley points out, so it is important for growers to know which varieties to plant, and what amounts are needed by the malthouse from year to year to avoid having surplus grain. In developing a local supply chain for breweries, the brewers, malthouses, and farmers need to communicate and coordinate their efforts to ensure supplies are available.

### Malting Process

For many craft beer consumers, the malthouse is an unseen intermediate step between the farm and brewery. Malting is controlled germination, which transforms the raw grain into malt. Barley is the most common malted grain, but others, like rye, are also malted. Malted grains are used to make more than beer, too, including whiskey, vinegar, and food products, giving start-up malthouses more customer options than just breweries.

Malting is a multi-step process that prepares the grain for brewing. First, the grain is steeped in water to stimulate germination. This is why the germination rate for malted barley needs to be high. Germination activates enzymes, breaks down some of the protein and carbohydrates stored in the seed, and makes starch reserves accessible for conversion to sugar in the brewing process. Sugars are consumed by yeast during fermentation, converting it to alcohol and CO₂. After several days of germination under controlled conditions, maltsters halt the germination process by kilning the grain. This heating and drying step is when maltsters can also roast the grain, to create specialty malts that brewers use to adjust color and flavor.

In the past decade, there has been an increase in craft malthouse startups. “There is a significant infrastructure investment that has to be made for a malthouse to be up and running—you don’t just become an expert maltster overnight,” McFarland says. The recent establishment of the Craft Maltsters Guild provides a way for maltsters to connect with each other and educational resources. These independently owned operations range from using traditional methods to high-tech systems but share a common goal of producing high quality products in small batches.

### Industry Change

The excitement surrounding the craft beer industry will likely facilitate investment into local barley production and processing. “The craft beer movement in Michigan is huge,” McFarland says, “and we also have an extreme pride for Michigan-grown ingredients... why not try to really stimulate Michigan malting barley going into Michigan craft beer?” Similarly, New York State passed the Farm Brewing Law in 2012, which created a special license for breweries that use local products as a way to encourage growth in industries related to craft beer within the state.
In developing barley varieties for the eastern U.S., plant breeders have an opportunity to address the needs of craft brewers. In 2011 and 2012, the Brewers Association surveyed craft brewers about malting barley and found a mismatch in the characteristics of the malt available to brewers and the characteristics craft brewers want in malt. In general, brewers are looking for malt with more flavor, lower protein (less than 10%), lower diastic power (which affects the body and mouthfeel of a beer), and lower free amino nitrogen (which can affect flavor stability over time) compared with the varieties currently available.

Ultimately, to keep customers returning, brewers need to produce high quality beer. Working backward from the taste preferences of consumers, brewers can plan for what malt they will need and communicate that to malt houses. Maltsters can then develop contracts with farmers to grow the barley varieties they will require. Having a local supply chain with open communication among these groups could cause a shift in the craft brewing industry while also supporting local economies.

T. Hmielowski, Science Editor for CSA News magazine

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