



Winter Barley

AN ANNUAL COVER CROP THAT WILL SUPPORT
MALTING AND BREWING INDUSTRIES

Overview

Fall planting of barley (*Hordeum vulgare*) as a winter annual has many features that make it attractive to producers and end-users, particularly craft brewers, distillers and maltsters. Fall planting and earlier harvest in the summer gives growers additional options to integrate winter cover crops and realize important ecosystem services including limiting soil erosion, sequestering carbon as organic matter, providing wildlife habitat, and reducing nutrient leakage to surface and subsurface water reservoirs. Winter barley will typically have higher yields than spring barley in many regions, and earlier harvest may help avoid diseases such as stem rust and Fusarium head blight that can have a devastating effect on barley and small grain production in Minnesota.

Researchers are also investigating whether it may also be possible to double crop or relay crop winter barley with soybeans, enabling winter barley to potentially share some of the large soybean acreage in Minnesota. There is a strong demand for barley in Minnesota from malting companies (i.e. Rahr Malting, Shakopee, the largest malt production site in the world), a vibrant and diverse brewing industry (over 190 breweries), a rapidly growing distilling market, and consumers interested in local food and beverage production.

Spring barley has a long production history in Minnesota with over two million acres in the 1930s. While the current acreage of spring barley is less than 100,000 acres, there is a mature supply chain and a wealth of production knowledge that can be seamlessly transferred to winter barley. Currently, winter barley is not in commercial production in Minnesota. However, we have been conducting research over the past decade to develop barley as a winter annual crop that can produce high quality grain for the malting, brewing and distilling industries. In general, winter barley is less winter hardy than winter wheat or winter rye. Thus, a primary focus of our breeding and genetics research is to increase the winter hardiness of winter barley. This is being facilitated by studying the genetic and physiological basis of low temperature survival.

Research Status and Goals

AGROECOLOGY

Best management practices for producing spring barley in Minnesota are well established and production guidelines are easily available through Extension: extension.umn.edu/agriculture/small-grains. Many of these practices will be applicable to winter barley; however, additional research is being conducted that is specific to winter barley. Initial recommendations for winter barley in Minnesota are also available through Extension: extension.umn.edu/small-grains-crop-and-variety-selection/winter-barley-emerging-crop.

Activities: The timing of planting and seeding rate can be manipulated to optimize the number of plants that survive the winter. A planting date near Oct. 1 is optimal for southern Minnesota to maximize winter survival. Winter survival is also influenced by snow cover, so tillage practices that leave crop residue to trap snow will enhance yields of fall-sown barley. Maltsters prefer low protein barley so less nitrogen fertilizer and more efficient uptake of nutrients in the fall and spring will reduce nitrogen loss to the environment.

Outcomes: A Winter Barley Production Guide and risk mapping tools to help Minnesota producers successfully integrate winter barley into their cropping systems.

BREEDING AND GENETICS

The biggest obstacle to winter barley variety development is improving winter hardiness. Current varieties exhibit inconsistent survival during St. Paul winters, and cold temperatures and little to no snow cover present the biggest challenges.

Activities: To identify sources of winter hardiness, the University program has collaborated in the screening of over 2,000 accessions from around the world for survival in Minnesota winters and identified around 20 that are being used in breeding. We use genomics resources and new breeding methods like genomic selection to develop “facultative” barley, which is capable of surviving winters, but does not require the six-week cold period necessary to transition to flowering. Facultative barley provides flexibility for breeding and producers as it can be planted in the spring or fall. This will be important for seed production as seed increases can be planted in the spring to provide seed for fall planting. We currently have advanced breeding lines with improved winter survival and good malting quality that will soon enter industry testing.

FOOD SCIENCE

Many grain and malt characteristics determine the malting quality of a barley variety. New varieties must meet current industry standards to be utilized.

Activities: The barley breeding program works with the USDA Cereal Crops Research Unit and Rahr Malting to evaluate the malting quality of breeding lines. These laboratories process hundreds of samples each year from yield trials conducted across the state.

Outcomes: Advanced lines that are potential new varieties will be evaluated at a pilot scale by local brewers and in the American Malting Barley Association pilot studies, visit ambainc.org to learn more.

Pilot Studies

The University barley breeding program coordinates a national winter malting barley trial that provides useful information for variety selection. We will expand variety testing to additional Minnesota on-farm trials to provide similar information for our growers. We have initiated a dual cropping system experiment where soybean will follow winter barley in either a double or relay cropping system.

COMMERCIALIZATION PLAN

Barley is a significant U.S. crop with average annual production of 212 million bushels valued at \$894 million as a raw agricultural commodity (2004–13). The impact of barley on the U.S. economy is even more significant if the value-added products resulting from its utilization as an animal feed, in malt beverages, and in food products are considered. About 100,000 acres of barley are planted in Minnesota annually. However, as recently as 1988 more than a million acres were planted. New winter barley varieties that perform well in the field and in the malt house and brewery will easily find their way into the marketplace. The recent explosion in small craft brewers, over 190 in Minnesota alone, will create increased demand for locally produced malting barley. Publicly released varieties will be distributed through Minnesota Crop Improvement Association.

TIMELINE

Agroecology research in the next five years will establish solid guidelines for winter barley production in Minnesota. Ongoing genetics research will provide new selection tools that will be implemented in the breeding program as developed.

- Studies will quantify the potential of this summer and winter annual cropping system and be expanded to compare dual and summer cropping systems for soil moisture, total biomass, and nutrient loss.
- Data will provide information to quantify the value of environmental impacts.
- Breeding work to improve grain yields and develop new varieties.
- Winter barley variety candidates will begin to enter industry testing in 2022.
- Malting quality research will accompany breeding activities to assure new varieties fit end-user needs.
- Food science research to analyze food quality characteristics, benefits and applications.