



TOPIC: AGRIBUSINESS

THE CHANGING FACE OF BARLEY PRODUCTION

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Barley is a grass — and more specifically a cereal grain in the Poaceae family. This is the same botanical family as wheat, maize (corn), rice, oats, rye, and sorghum. Barley has been grown by humans since at least 7,000–9,000 BCE. The oldest archaeological sites containing evidence of barley growth are found in what is now Iraq. It is now grown worldwide.

Barley is grown as animal feed and as a malting grain for beer, spirits and an impressive array of foods. A small amount of barley, mostly hull-less barley, is grown for human consumption. One of the biggest differences between feed barley and malting barley is the protein content. It is desirable for feed barley to be high in protein whereas for the most part malting barley needs to contain less than 12%. There is a niche market for specific varieties of higher protein barley which when malted for longer time periods can create very high levels of diastatic enzymes. These natural amylases and dextrinases are able to digest additional starch added to a mash to improve the overall extract or spirit yield. Farmers growing malting barley that do not meet the specs required by maltsters are able to unload it — at a lower price — as feed barley. The issue is that the yield of barley when growing for malting quality could be lower resulting in a double hit if that crops then fails to attract the expected premium.

Barley is widely adapted, much more so than other cereals. In the United States, it can be grown in USDA zone 3 — which extends from northern Montana to northern Minnesota, and in the northern tip of Maine — through zone 9, which includes southern Florida, southern Texas, and much of California. In recent years, the global barley harvest has been hovering around 150 million metric tons per year, with the 2020/2021 growing season hitting a high of 160 million metric tons. In contrast, the global corn harvest usually tops one billion metric tons per year. Worldwide, the largest producer of wheat is Russia, followed by France, Germany, Australia, and Spain. (These are figures from 2018.)

In North America, most barley is grown in western and central Canada, although a considerable amount is also grown in the northern central US. Yields depend on the site and the growing conditions, but — in North America — may be as low 40 bushels per acre. On the other hand, in 2020 in Idaho, barley farmers set a record at 100 bushels per acre. [i] (Bushels per acre is a volume per area measurement. In other parts of the world, harvest statistics are given as metric tons per hectare — a weight per area measure. As such, comparing harvest yields with other parts of the world is difficult.)

Barley is a cool-season crop that matures quickly relative to other cereals. It is best grown where daytime highs are in the 70s°F (20°C) in the weeks leading up to harvest. It can be planted in the late fall as winter barley. In this case, it will sprout and then overwinter and mature in the early spring. Barley can sprout at temperatures as low as 34°F (1°C) . Farmers in warmer climates generally plant barley as a winter crop. Barley can also be planted as spring barley if there is enough time to grow before summer high temperatures reach 85°F (29°C). Farmers in cooler growing zones plant their barley in the spring. Spring barley usually matures in around 90 days — more quickly than wheat or corn — and a major focus of barley geneticists is to develop even shorter-term barley cultivars. The overwhelming majority of malting barley grown in North America is spring barley. The same is true in Europe.

Barley does not require a large amount of nitrogen fertilizer to grow. In fact, too much nitrogen will likely make malting barley varieties exceed their desired nitrogen content. In commercial production, the existing weight of nitrogen in an acre of soil plus the added nitrogen should equal 190–210 pounds per acre. Malting barley farmers additionally do not add nitrogen after the seed head of the barley is formed. Barley's demand for phosphorus and potassium — the "P" and "K" in fertilizer NPK ratings — is low. Dr. Nigel Davies, Senior Adviser Technical and Sustainability at First Key Consulting comments "Fertiliser choice is also a major focus for reducing carbon emissions. Nitrogen based fertilisers are a major component of the carbon embedded in malting barley. Manufacturers of nitrogen fertilisers have made significant strides to reduce their process emissions and create lower emissions or abated fertilisers that reduced the impact in the final fertiliser by around 40%. They are now going further to use non fossil-based fuels in production. When fertilisers are applied, they can become nitrous oxide in the atmosphere if the soil is poor in health and cannot quickly assimilate the applied fertiliser. However, there is some great innovation in this area which has already delivered carbon negative malting barley by introducing nitrogen-fixing crops when the ground is normally bare between harvest and replanting. This has the potential to create a market for carbon credits to be sold within the supply chain to give an incentive to grow good quality malting barley and de-risk the supply into brewing, distilling and food." [ii]

Barley is widely adapted, but the largest plantings in North America exist at or near the northern end of where agriculture is possible. North of these locations, the growing season is too short for the commercial production of crops. This distribution is due to economics. Farmers in more temperate regions can grow corn, wheat, or soy, which yields more per acre and fetches a better price per bushel. Modern hybrid corn has pushed the yields from around 70 bushels acre in the 1970s to over 220 today. And the price per bushel for barley — if it were sold on the open market — would be lower. However, the vast majority of malting barley is not sold that way — it is grown by farmers under contract to maltsters. The maltster agrees to pay a competitive price and the farmer agrees to deliver the harvest at the agreed upon price, even if the open market price per barley went higher.

Changes

Barley production has been changing for decades and will almost certainly continue to change in the future. Changes include where barley is being planted, how much is being planted, what cultivars are being planted to drive yield and improve disease resistance, and what they are used for.

Moving North

Economics has pushed barley fields to the north of regions where farmers can successfully grow corn or soy. In recent years, this push has intensified as GMO corn varieties with shorter growing seasons (and more drought resistance) have been introduced. In the 1980s, if you drove north on Hwy 29 through North Dakota (where most of their irrigated farmland lies), you would have seen almost wall to wall barley fields. Now, the southern part of the state is largely planted to corn — with barley mostly grown near the northern border.

The incursion of GMO corn into former barley growing regions is not being countered by GMO varieties of barley. There are no GMO barley varieties approved for growth in the US and no seed company has announced plans to develop any. The American Malting Barley Association (AMBA) estimates it would take 10 years for such a variety to be developed, tested, and propagated. [iii] And, nearly everyone in the beer industry feels that consumers would not welcome beer made from GMO barley.

Dr. Nigel Davies comments on the acceptability of GMO “there is still an unease about use of GMO in the minds of many consumers and hence in the brands that use them. The yield improvement in cereal is undeniable but there are alternate methods to generate such improvement that do not involve manipulation. Genomics is the term for market selected breeding that can definitively identify positive traits based on a plant's genetic makeup. It is a higher-tech version of market-assisted breeding and removes the chance associated with simply looking at varieties in a breeding programme and assessing their quality by eye (phenotype). The skill comes in developing a library of genetic markers that can be scanned for in a newly crossed variety. These markers are called “snips” (single nucleotide polymorphisms) and look for unique variations in genetic sequences that can prove a particular gene that has a specific malting or brewing characteristic are actually present in the new variety. This could increase the success rate of breeding programs and fast-track development from around 10 years to 5 provided sufficient new genetic markers are developed”

Currently, the bulk of barley in North America is grown in western and central Canada, near the border with the US. The US states Montana, Idaho, and North Dakota produce almost 80% of the barley grown in this country. The remainder is grown in other northern states or in Colorado (at relatively high altitudes). In the early 1900s, however, New York, California, and what is now the “corn belt” — centered in Iowa and Illinois — were the major barley-growing regions.

Another factor that will impact the geographic distribution of barley production zones is climate change. As the earth warms, more northern sites will become suitable for barley production. Of course, sites south of those will be able to support the growth of corn or soy. The net change in available land for barley production will depend to great deal if the newly warm regions have large amounts of arable land. In North America, this would mean arable land would need to be available in the middle latitudes of Canada.

The Decline of Feed Barley

In North America, the regions of barley production have changed in recent years, but so has what is being planted. The amount of feed barley grown in North America has been declining steadily for decades. [iv] In the 1970s around half of all barley grown in the US was feed barley. [v] These days, it is less than 25%. (In other parts of the world, feed barley is still going strong.) This decline corresponds to a drop in overall acres planted to barley in North America in past decades. The export market for US barley has also decreased. The demand for malting barley has remained stable.

Changes in Cultivars

New barley varieties are being introduced every year and what cultivars get planted in the US changes from year to year. The American Malting Barley Association publishes a yearly list recommended varieties for farmers to plant. [vi] In 2022, it contained 34 two-row malting varieties and 7 six-row. In the mid-1980s, 70% of all barley grown in the US was six-row. By the mid-teens, this was roughly halved as the number of two-row cultivars (and acres planted with them) increased. The AMBA's list also notes if the variety is a spring or winter variety. In 2022, only 9 of the 41 recommended varieties were winter barley varieties.

The AMBA also produces maps of what cultivars are grown in which states. These show that not only do barley varieties change over time, but different varieties are grown in different locations. For example, here are the top three varieties grown in the top 3 barley producing states. In Idaho in 2021, the top varieties were ABI Voyager, CDC Copeland, and Moravian 69. In Montana, the top three were AC Metcalf, Bill Coors 100, and Expedition. In North Dakota, they were AAC Synergy, ND Genesis, and Tradition (the only six-row variety among those mentioned).

The Future

Predicting the future is always dicey. Even if you understand all of the salient variables at work today, novel events may intrude. For example, for years agricultural experts have been stating that the prime farmland for various crops will be shifting towards the poles. However, nobody foresaw that Russia and the Ukraine — two of the top producers and exporters of barley — would be at war in 2022. Other challenges facing those who use malted barley are potential threats to current areas for growing malting barley due to climate change, water availability or diminishing soil health and possible declines in malting capacity if old plants go offline and new facilities are not built. The continued popularity of beer, however, should ensure that malting barley production (or malt production) does not drop to the point that beer production is seriously impacted.

By Dr. Chris Colby

[i] Idaho sets record for average barley yield. Sean Ellis. Idaho Farm Bureau Federation. Feb 4, 2021. <https://www.idahofb.org/newsroom/posts/idaho-sets-record-for-average-barley-yield/>

[ii] Malt and Malt Products in “Brewing: New technologies”(2006) ed Bamforth, C. W., Woodhead Publishing, UK

[iii] GM Statements. American Malting Barley Association, Inc. <https://ambainc.org/about/gm-statements/>

[iv] Malting Barley in North America. Scott Heisel.

https://www.canr.msu.edu/uploads/234/78941/Malting_Barley_Production_in_North_America_-_Scott_Heisel.pdf

[v] US Barley Industry. Heid, Jr. and Leith. USDA publication, 1978. <https://naldc.nal.usda.gov/download/CAT85840110/PDF>

[vi] American Malting Barley Association, Inc. <https://ambainc.org>

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