

Malting Barley: Contribution of Minnesota and North Dakota to the Soul of Beer

Dr. Paul Schwarz

Professor

Department of Plant Sciences, NDSU

Beer

- 5th most consumed beverage in the world after tea, bottled water, milk, and soft drinks.
- US brewers produce around 180 million barrels/yr.
 - that's 5.6 billion gallons!.
 - US ranks #2 behind China, but is ahead of Brazil, Mexico and Germany.
- "Craft Brew trend": USA brewery numbers have grown from 284 in 1990, to over 8,000 in 2019.
- My objective today, is to show how our region, and specifically malting barley, fits into this world of beer.

The Soul of Beer?

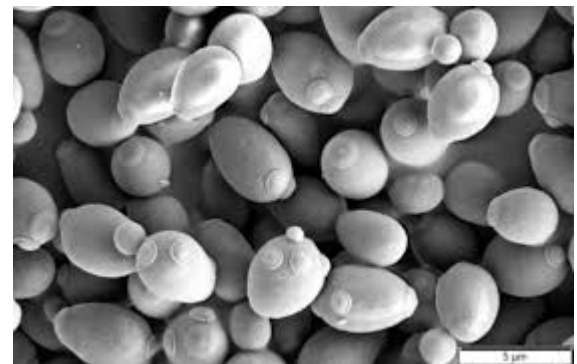
- *Malt is the soul, hops the spice, yeast the spirit, and water the body of beer.*
- Dr. Anton Piendl (Weihenstephan Research Centre for Brewing and Food Quality, TU- Munich)



Dakota Soul from St Paul craft beer pioneer, Summit Brewing, uses ND grown Moravian barley

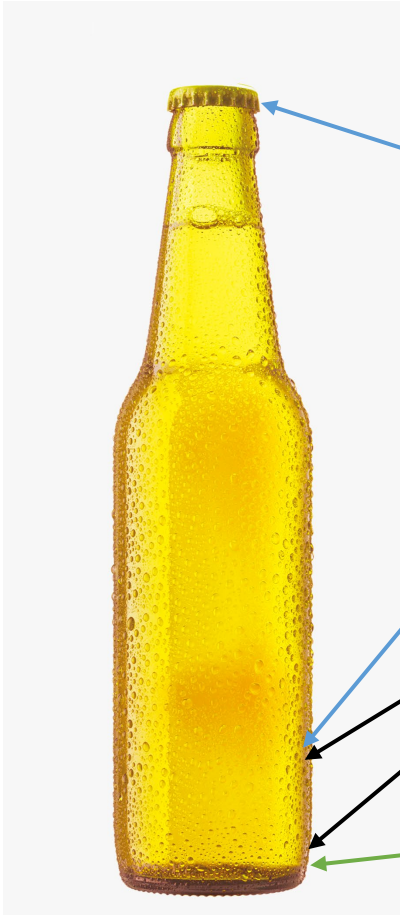
The Soul of Beer?

- Malted barley is an essential ingredient in beer, as its needed to provide fermentable sugars that yeast convert to alcohol and CO₂.
- Without it beer would lack, sweetness, color, and foam.
- Malt provides a "palette" from which the brewer can use other ingredients to adjust the character (aroma, bitterness, fruitiness, etc)



What's in Beer?

(12 oz, all malt Lager)



- Water (11.5 oz)
 - 5 to 6 times this much water is needed to make the beer
- Malted barley 2 oz (57 grams)
 - Some brewers replace part of the malt with other grains (rice, corn)
- Hops 0.009 oz (0.25 grams)

Malt and Malting

- Malting is the controlled germination, or "sprouting" of grains.
- Today the term malt is generally synonymous with barley malt .
 - Other grains are also malted. About 5-10% of all malt used in the US is wheat.
 - The use of "sprouted" grains is also growing in the food industry



<http://www.castlemalting.com/>

Malt and Malting

- Malting is conducted in a "malthouse" or malt plant.
- The person conducting malting is a "maltster".



<https://www.boortmalt.com/en/germination>

A look at Minnesota's and North Dakota's Contributions

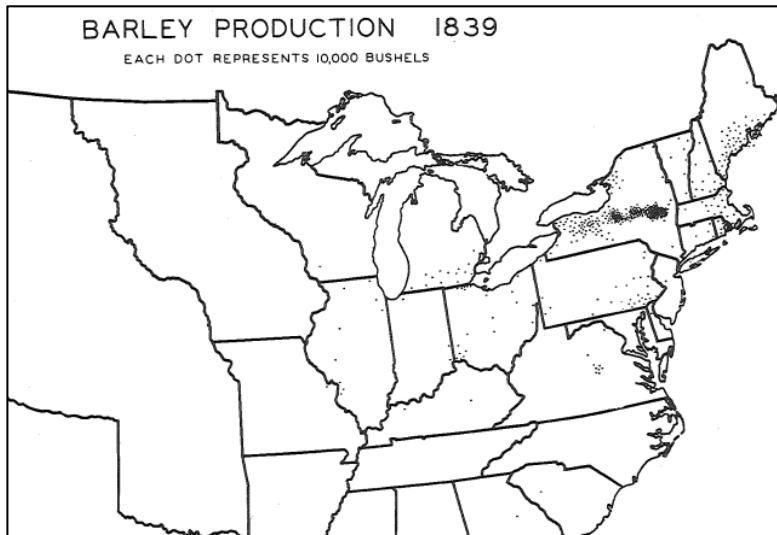
1. *The barley growers*
2. *The maltsters*
3. *The brewers*



1.) Malting Barley in Minnesota and North Dakota

- The history of barley and brewing in the USA dates to the time of colonization:
 - 1st record of a barley crop was in Martha's Vineyard in 1602.
 - 1st brewery was in New Amsterdam (NYC).
- Barley came to Minnesota and Dakota Territory in the mid-to later 19th century, and the region had become a major center of production by the early 20th century.
- MN and ND barley growers, allied agricultural industry personnel, maltsters, and researchers have, and continue to play an important role in US brewing.

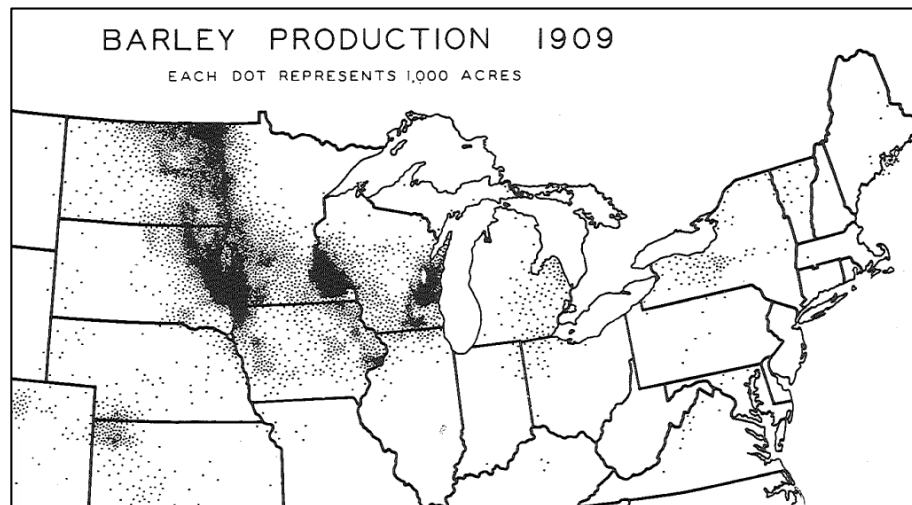
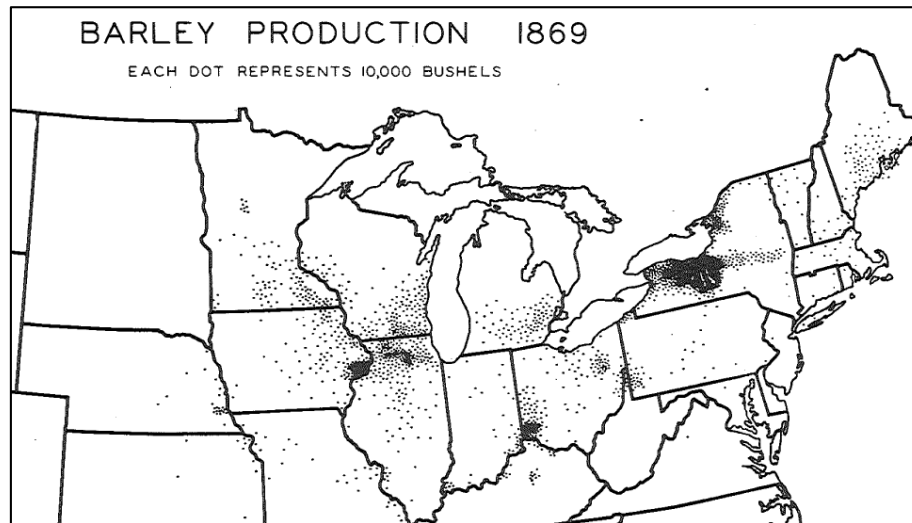
Barley in US History: The Beginnings



- Low production of barley and beer prior to 1830.
- Population preferred spirits over beer.

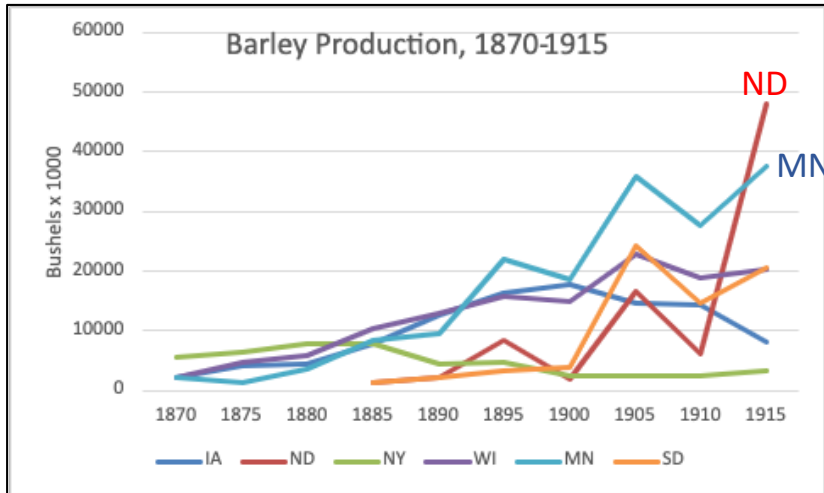
From: American Barley
Production. John Weaver.
1950. Burgess Publishing
Co.

Barley in US History: Westward Movement of Production



From: American
Barley Production.
John Weaver. 1950.
Burgess Publishing
Co.

Westward Movement of US Barley



- Barley production increased from 29 million BU in 1870 to 207 in 1915.
- Much of this growth can be attributed to MN, ND, and SD.
- Production was declining in the eastern states and Iowa.

Westward Movement and Increased Production: Why?

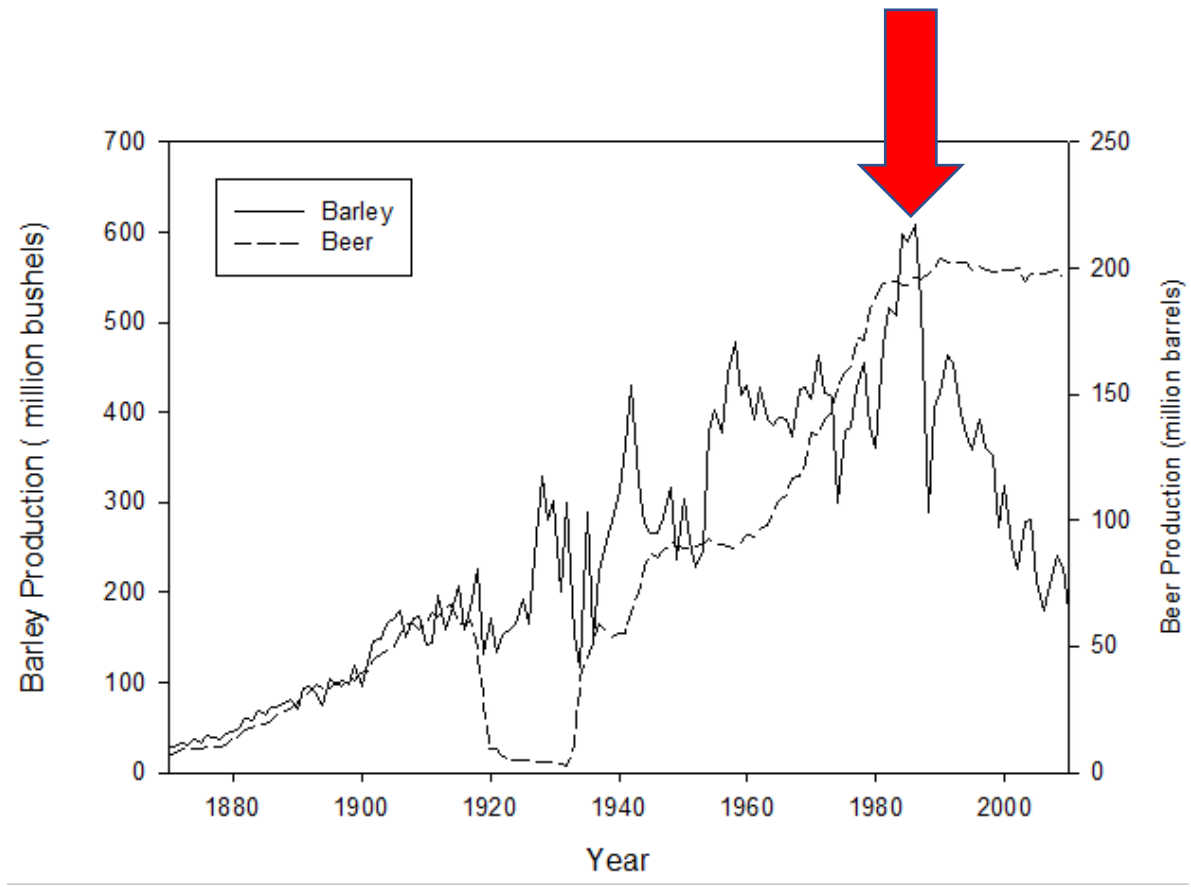
1. Immigration and westward movement of population.
 1. New farmland was well suited to large –scale grain production.
2. Foundation of the modern US brewing industry in mid-late 19th century
 1. Germanic immigration and introduction of a new beer style; "Lager"
 2. Largely in Midwestern cities (Milwaukee, Cincinnati, Chicago, St Louis, Minneapolis-St Paul, etc)
 1. Anheuser-Busch, Hamms, Miller, Pabst, Schlitz, etc.
3. The growing beer industry needed more grain.
4. Barley was increasingly becoming an important feed grain for livestock.

Westward Movement and Increased Production: Why?

Tariff Act of 1890 (McKinley Tariff)

- NY was the center of the US malting industry prior to 1890.
- NY barley production was modest, and large amounts of barley were imported from Ontario.
- The Tariff Act of 1890, intended to protect against foreign competition, placed a 10 to 30 cent/bushel tax on Canadian barley.
- The Tariff Act effectively killed the NY malting industry, and led to its rise in Wisconsin, Minnesota, and Illinois.

US Barley production grew with the brewing industry



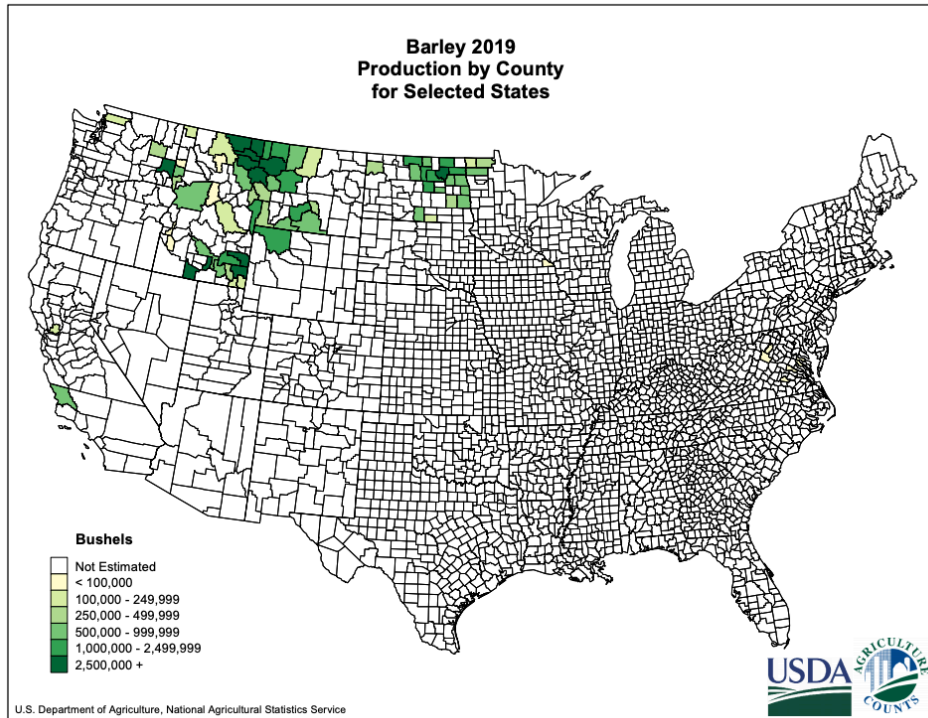
Barley in Minnesota and North Dakota

- Barley production peaked in the 1980s
 - Minnesota: 70 million bushels (1985) vs 3.7 today
 - North Dakota: 184 million bushels (1985) vs 32 today.
- Minnesota provided about 20% of the nation's barley in the early 1900s, but this has decreased to around 3-5%
- North Dakota has consistently provided around 20-30% of the nations' barley since the 1950's

Why has Barley Production Declined?

- Corn, and corn by-products, have largely replaced barley as a feed grain.
- Decline in export markets for feed barley.
- 1996 Farm Bill made other crops (e.g. soybeans, corn) a more attractive choice for growers.
- The fungal disease, Scab (*Fusarium* Head Blight) has made barley more difficult to produce in our region.

Barley Production since 2000



- Total USA barley production has declined:
 - 422 million bushels (1985) to 169 (2019)
 - Much of this decline was in our region.
- As a consequence the center of production has shifted to Idaho and Montana
- Today most barley is grown for malt, and farmers will not grow it without a contract

2.) Malting

Cleaning



Remove thin grain and foreign materials

Steeping



- Raise moisture from 12 to 45%
- Soaking with multiple water changes
- Promotes germination

Malting

Germination



- 3-5 days
- Develops enzymes needed in brewing

Kilning



- Grain dried from 45 to 5% moisture
- Develops color and flavor

Malting in Minnesota and North Dakota

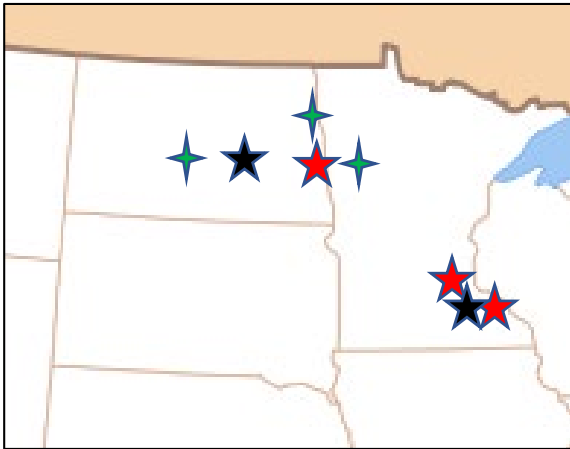
- The region has a long history with the processing of barley to malt.
- Before the mid-20th century, some breweries had their own malthouses, but today production is at independent malt companies .
- Locating malting facilities near barley production makes economic sense as barley is more expensive to ship than malt.
- Keeps value in the region.



Historic method of floor malting:

<http://merryn.dineley.com/2014/07/where-have-all-malting-floors-gone.html>

Regional Malthouses: 1990-present



- Commercial Maltsters
- **Operating**
 - Rahr Malting, Shakopee MN
 - Busch Ag Resources, Moorhead, MN
 - Malteurop, Winona, MN
- Closed
 - Minnesota Malting, Cannon Falls, MN
 - Cargil Malt, Spiritwood, ND
- **Craft**
 - Two Track Malt, Bismarck, ND
 - Vertical Malt, Crookston, MN
 - Maltwerks, Detroit Lakes, MN

Busch Ag Resources. Moorhead, MN

- Built in 1978, when the Red River Valley was the heart of barley production
- Produces malt exclusively for AB-InBev (Anheuser Busch).
- Busch operates another malt plant in Idaho



Fargo Forum

Rahr Malting, Shakopee, MN

- 1937, but the Rahr company history dates to 1847
- Produces about 20% of all US malt.
- Largest maltster in the US, and #10 in world.



Rahr.com

Malteurop, Winona, MN

- French owned, but US operations based in Milwaukee. Plants in Minnesota, Wisconsin and Montana.
- Dates to Winona Malt and Grain Co., founded in the late 1800's.



Cargill Malt. Spiritwood ND

- 1970(s)-2018.
- Originally built by Ladish Malting, Milwaukee.
- Once the largest malt plant in the world.
- **Closure** partially reflects shift of barley acreage to western states.
 - Most newer malt plants in USA have been constructed in ID, MT, or CO.



https://bismarcktribune.com/news/state-and-regional/cargill-to-close-one-of-three-nd-malt-plants/article_3430b411-d59e-5d2c-98f7-4bb5695893c4.html

Current Trends: Craft Malting

- Craft malting is a growing trend, and there are currently >100 craft maltsters in the US.
 - Small % of market
- Small operations that produce malt from local grain.
- Appeals to local food culture, and traceability.
- Often farm/malthouse operations.
 - Tax incentives in some states



Craft Malting in Minnesota and North Dakota



Maltwerks
Detroit Lakes, MN
2017

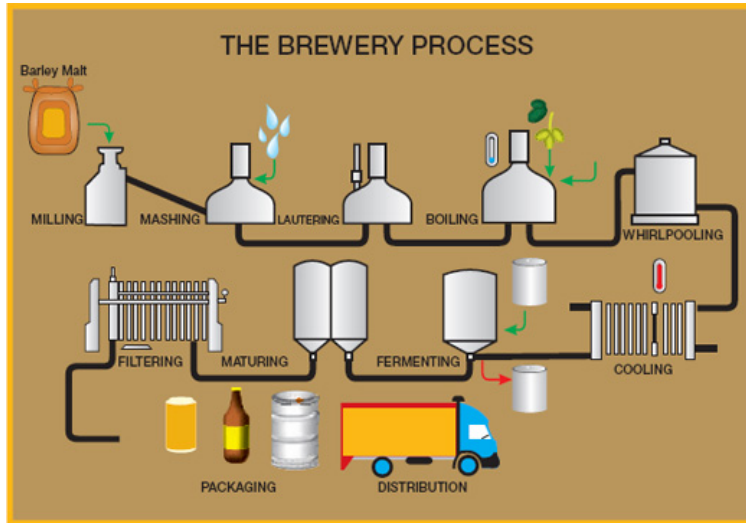


Vertical Malt
Crookston , MN
2017



Two Track
Bismarck, ND
2015

3. Brewing

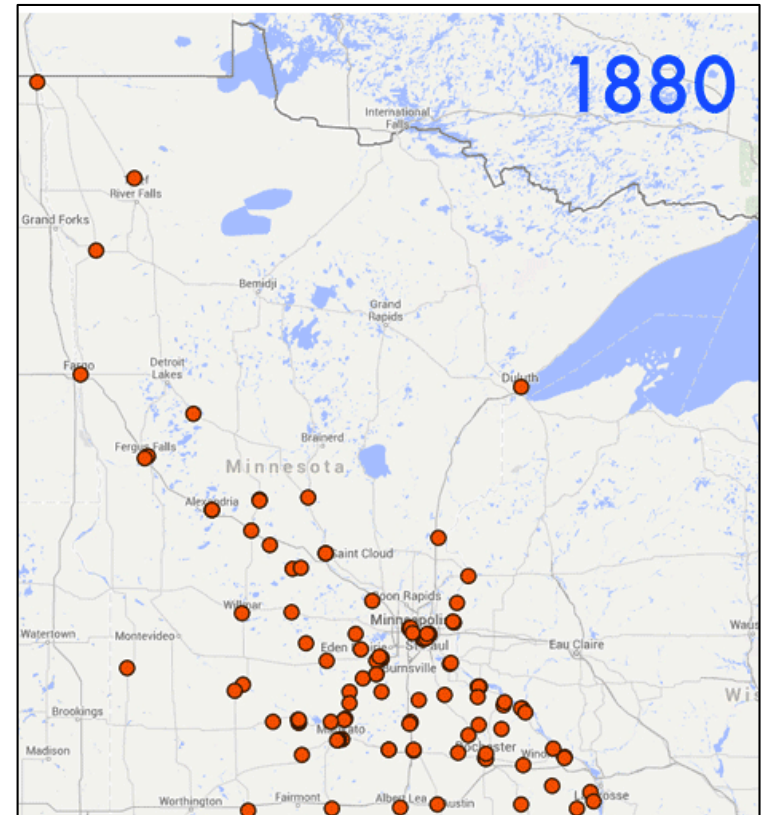


<https://www.eightdegrees.ie/brewing-process-2/>

- Mashing: ground grain is extracted with water.
 - Malt enzymes breakdown starch into sugars.
- Lautering: wort is separated from grain solids.
- Boiling: hops are added.
- Fermentation: Yeast convert sugars to alcohol and CO₂.
- Maturation: removal of undesirable flavors

3.) Brewing in Minnesota and North Dakota

- Brewing in MN has a long history
 - Anthony Yoerg Brewing , St Paul 1848
 - 1870's many small family breweries that served a town or small region
 - 1940's rise of regional breweries (e.g. Hamms)
 - Craft Brewing: 2011-present
 - Summit Brewing 1986
 - James Page Brewing 1986

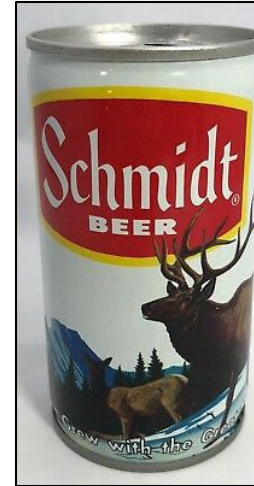


Animated map of MN
breweries 1846-2013:
<https://live.mprnews.org/Event/AmberWaters/history-of-brewing-in-Minnesota>

Historic Minnesota Brewers



Theodore Hamm's
Brewing Co. St Paul 1865.
Closed 1997.
Now brewed by Miller-
Coors



Jacob Schmidt
Brewing Co. St Paul
1900 (1855).
Closed 2002.



Grain Belt
Minneapolis Brewing
Co. 1891.
Closed 1976.
Now brewed by August
Schell



August Schell Brewing
Co. New Ulm 1860.
Second oldest
operating family
brewery in the US

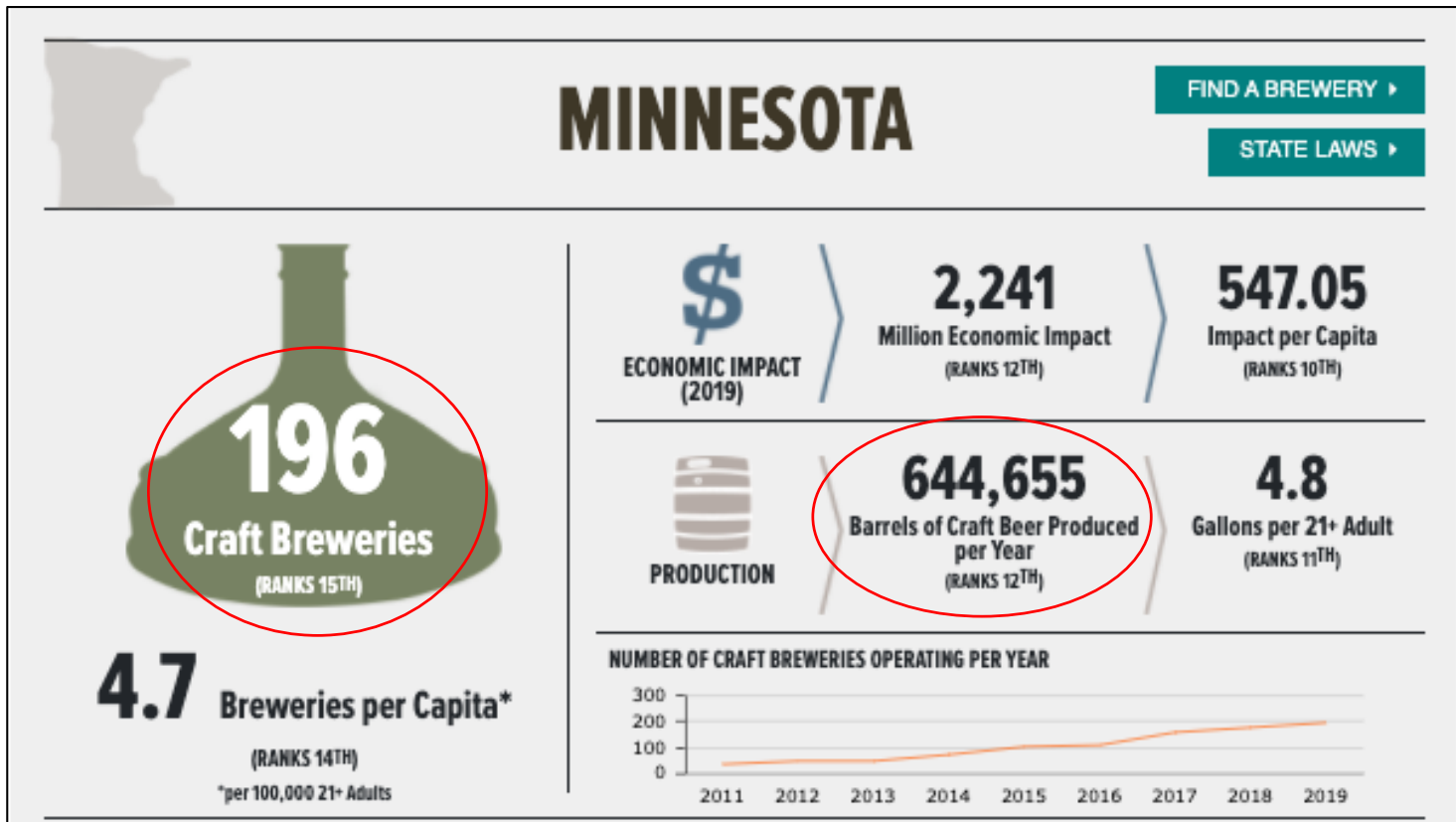
Brewing in North Dakota

- North Dakota beer history is less voluminous
 - Settled later, and lower population
 - Prohibition at statehood, and then national prohibition, 1920-33.
- Dakota Malting and Brewing Company, Bismarck, 1961-1965
 - For more on ND beer history see: North Dakota Beer: A Heady History, Alicia Underlee Nelson
- Current craft beer trend as of 2010 with Fargo Brewing
 - However, there was an earlier attempt at craft brewing in the 1990's in the FM area with: Great Northern Brewing, Old Broadway and Trader and Trapper



Minnesota Craft Brewers

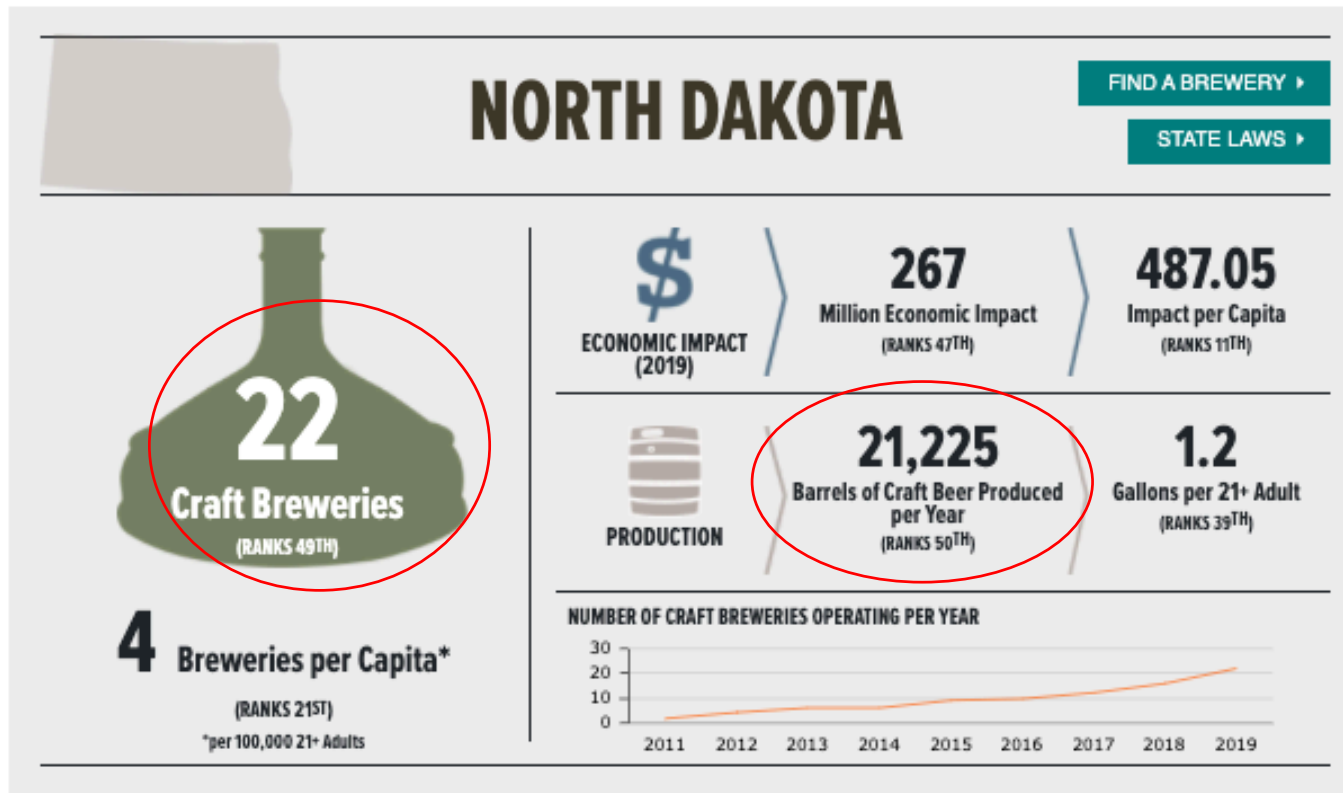
ranks 12th in US production



Source: Brewers Association, Boulder, CO

North Dakota Craft Brewers

ranks 50th in US production



Source: Brewers Association, Boulder, CO

Malt Use in Beer

- Malt is used in brewing as:
 - Grain starch is converted to fermentable sugars by malt enzymes in brewing.
 - Source of beer color (specialty malts are used to provide darker colors)
 - Source of beer's foam
- Amount of malt used depends on beer style (<20 /lbs to >60 lbs/barrel beer)
 - Large multinational brewers tend to replace a portion of the malt with corn or rice, which reduces malt use.
 - Craft brewers tend to produce 100% malt beers, which increases use.

Summary

- Minnesota has a long history of barley, malt and beer production.
 - Although barley production has declined dramatically Minnesota is still a center of malt production, and has a dynamic craft brewing scene.
- North Dakota remains a major producer of malting barley.
 - Craft brewing in the state is becoming established.

Thank –you for your interest

Please contact me with
any questions or
comments

paul.schwarz@ndsu.edu

Paul Schwarz

Department of Plant
Sciences, NDSU

