

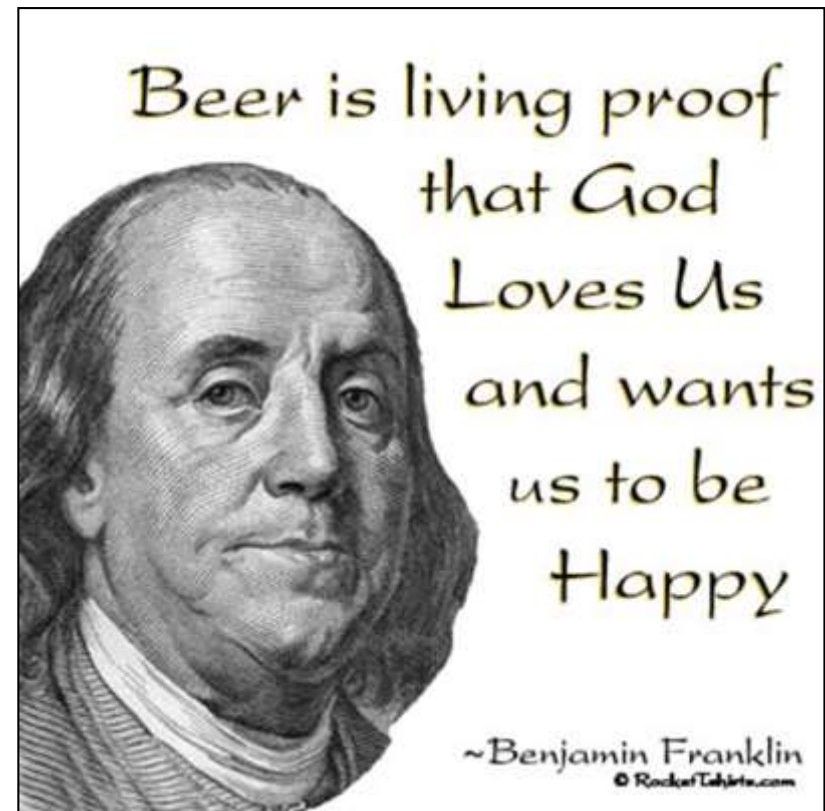
Introduction to Malting Barley in the Great Lakes



Dr. James DeDecker
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Overview

- Barley background
- The craft beer boom
- Barley in Michigan
- Challenges to growth
- 2019 MSU barley survey
- Acknowledgements

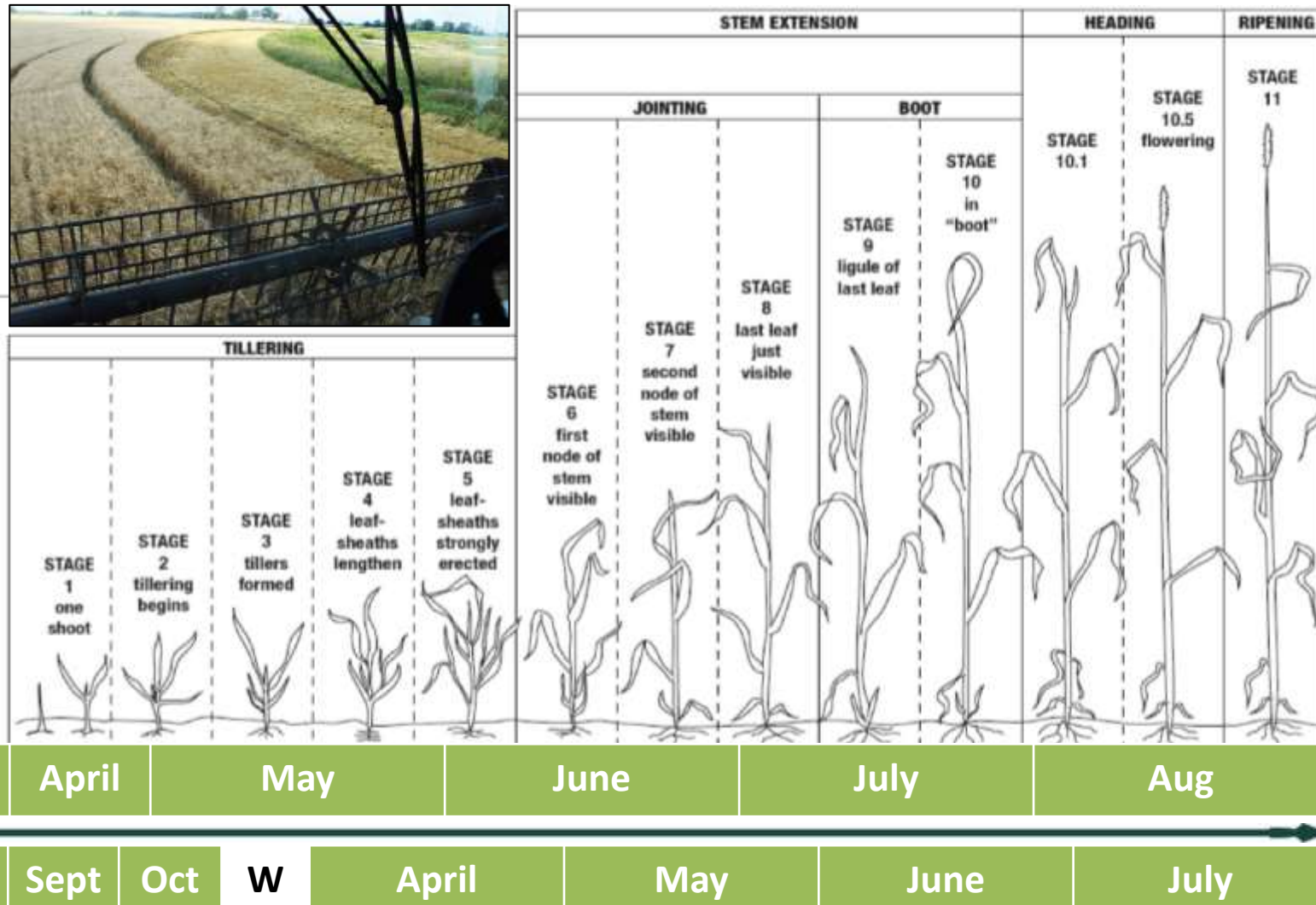


What is Malting Barley?

- An annual cereal grain
 - Livestock feed uses
 - Preferred malting varieties
 - Spring and winter types
 - 2 row vs. 6 row
- The source of fermentable sugars used in making beer
 - Water, barley, yeast, and hops
- Quality is everything
 - High management – High risk



What is Malting Barley?



Supply Chain From Farmer To Malthouse To Brewer & Distiller

(1) Certified Seed is preferred by most farmers because the potential for disease in the field is greatly diminished.



(2) Local farmers seed and grow malting barley seed according to their own cultural practices.



(3) Harvest for both winter and spring malting barley varieties happens between July and August.



(4) A quality malting barley grain meets the minimal requirements established by organizations like the American Malting Barley Association.



(5) Depending on the conditions at the time of harvest, malting barley may need to be dried and stored to establish "dormancy."



(6) Grain is typically delivered to the malthouses in 1 Ton "super totes."



(8) The finished malt is cleaned and bagged for distribution to the brewers and distillers.



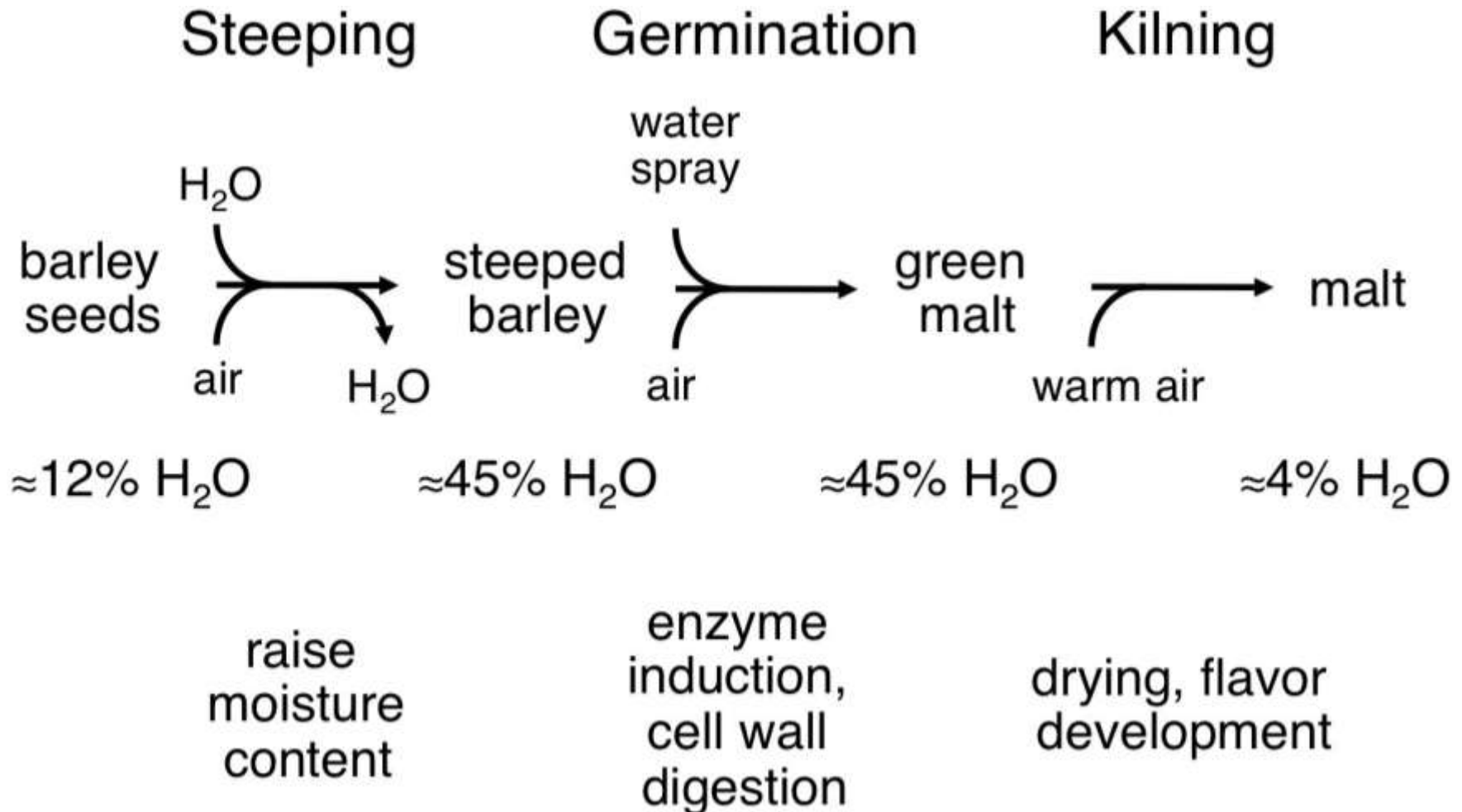
(9) Brewers and Distillers use different fermentation vessels and processes for the creation of beer and spirits.



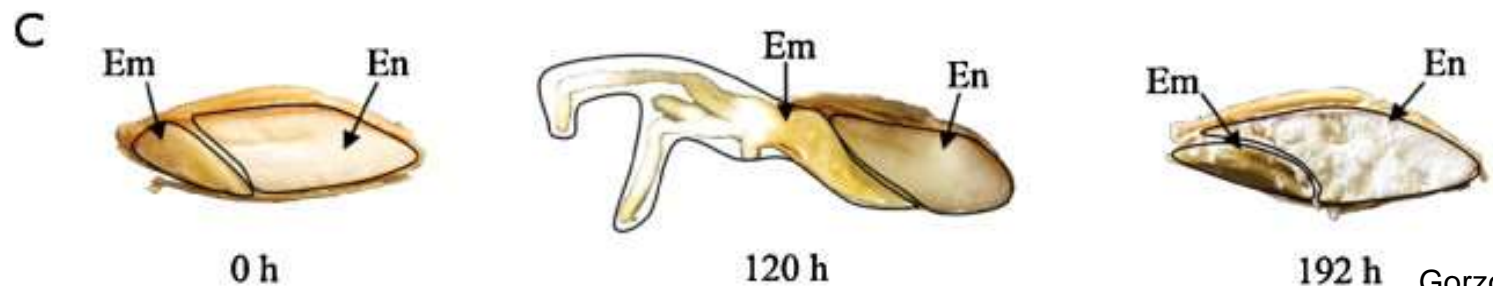
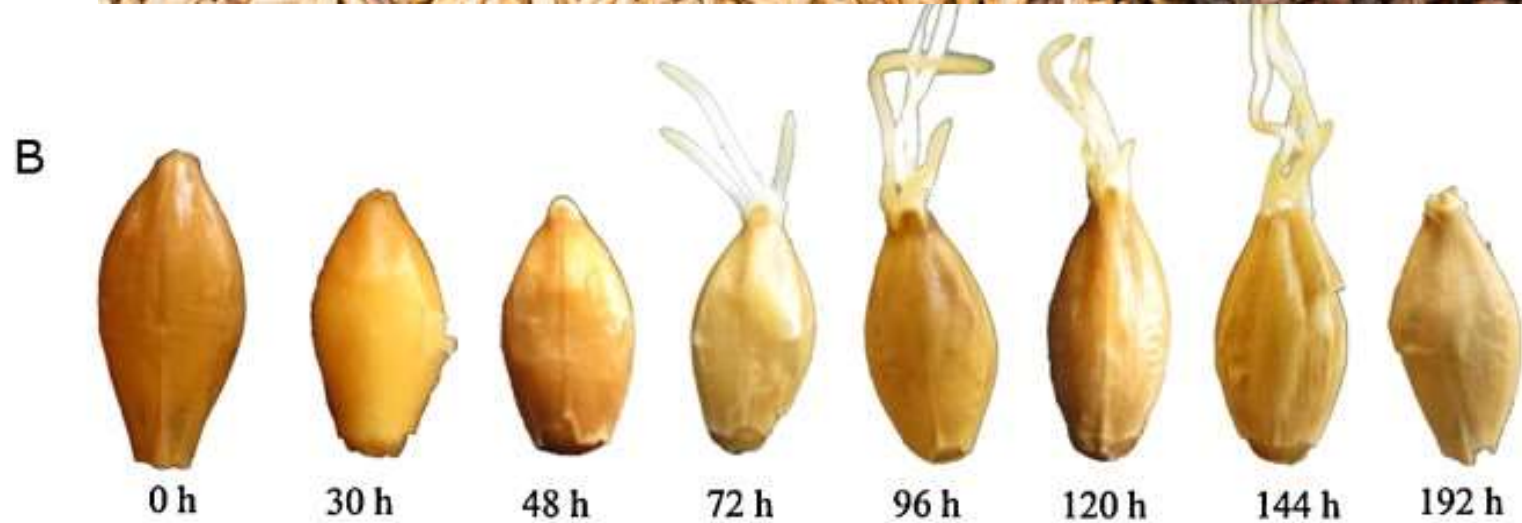
(10) Ales and Spirits are on tap at breweries and distilleries all over New York State.



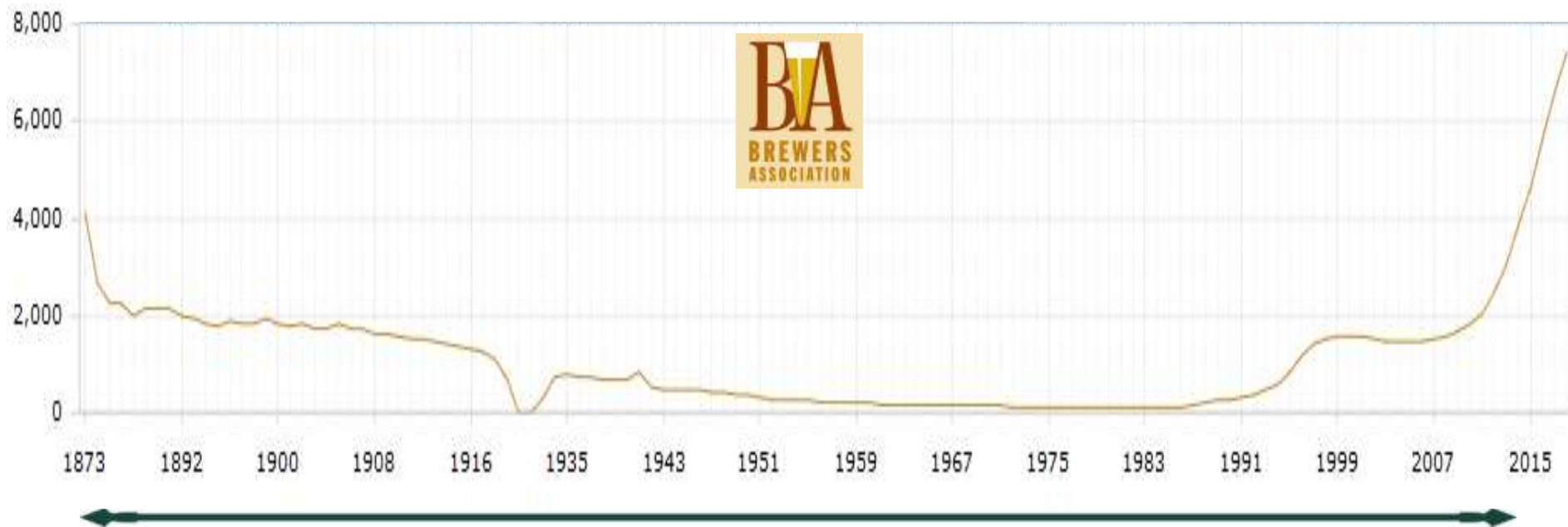
The Malting Process



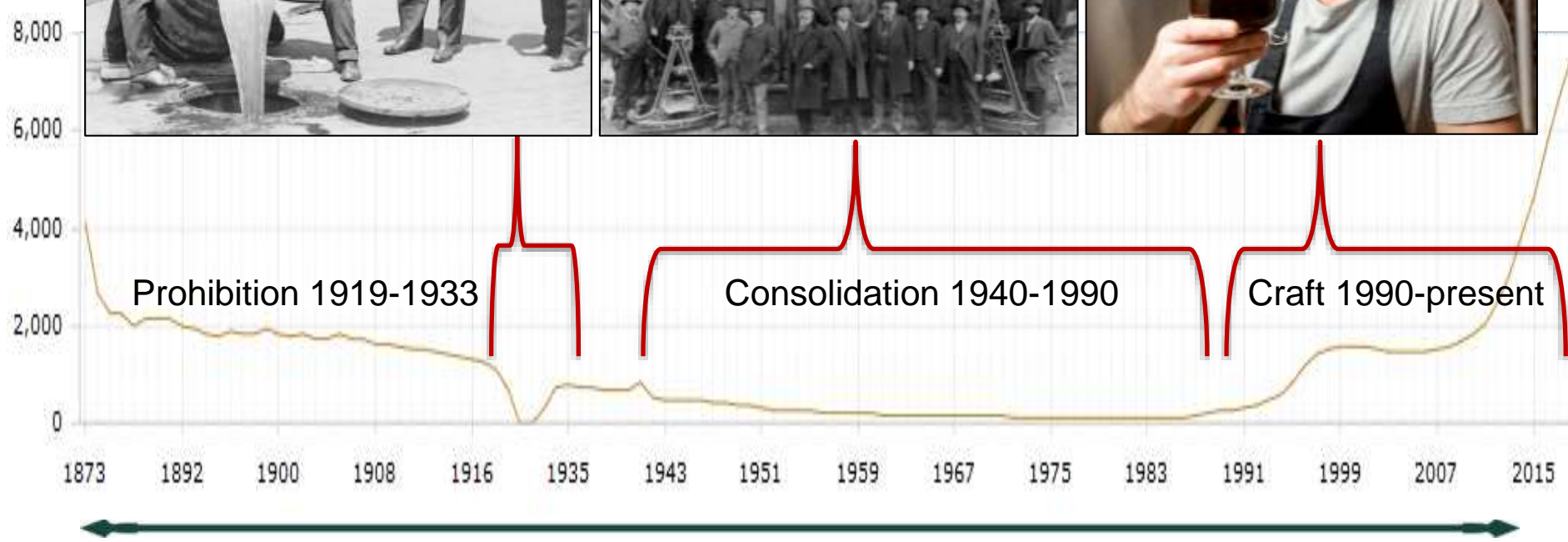
The Malting Process



Historical U.S. Brewery Count



Historical U.S. Brewery Count



Recent U.S. Brewery Count

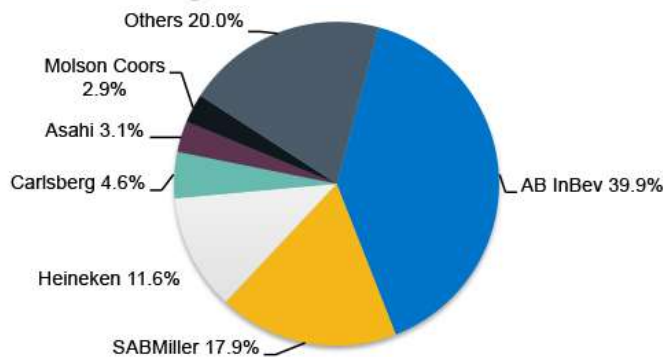
	2014	2015	2016	2017	2018	2017 to 2018 % Change
Craft	3,814	4,628	5,539	6,490	7,346	+13.2
Regional Craft Breweries	135	178	186	202	230	+13.9
Microbreweries	2,076	2,626	3,251	3,933	4,522	+15.0
Brewpubs	1,603	1,824	2,102	2,355	2,594	+10.1
Large/Non-Craft	46	44	67	106	104	
Total U.S. Breweries	3,869	4,672	5,606	6,596	7,450	+12.9



“Craft Brewer” is defined as < 6M bbls annually, and < 25% non-craft ownership



Brewery Connections



Source: Bank of America, Merrill Lynch (Oct 2015)







U.S. BEER SALES VOLUME GROWTH 2018

OVERALL BEER
-0.8%

194,278,588 BBLs

3.9%
CRAFT

25,632,766 BBLs

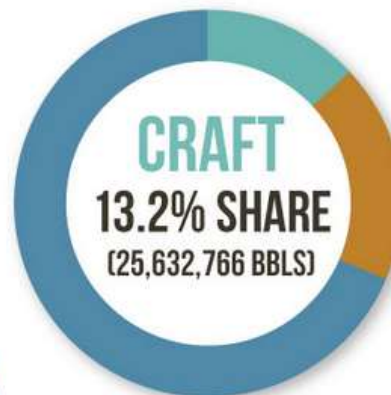
3.6%
IMPORT BEER

35,660,588 BBLs

OVERALL BEER MARKET
\$114.2 BILLION

CRAFT BEER MARKET
\$27.6 BILLION

7% DOLLAR SALES GROWTH

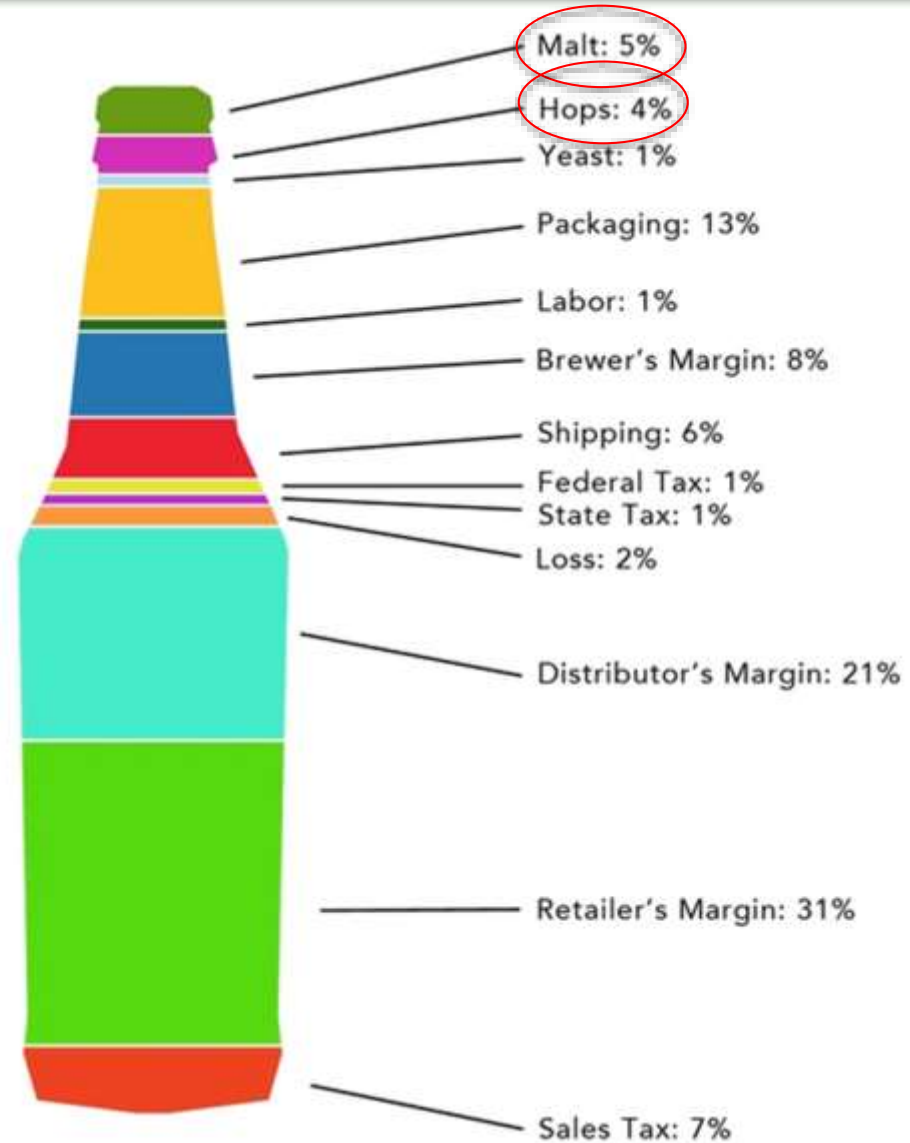


IMPORT
18.4% SHARE
(35,660,588 BBLs)

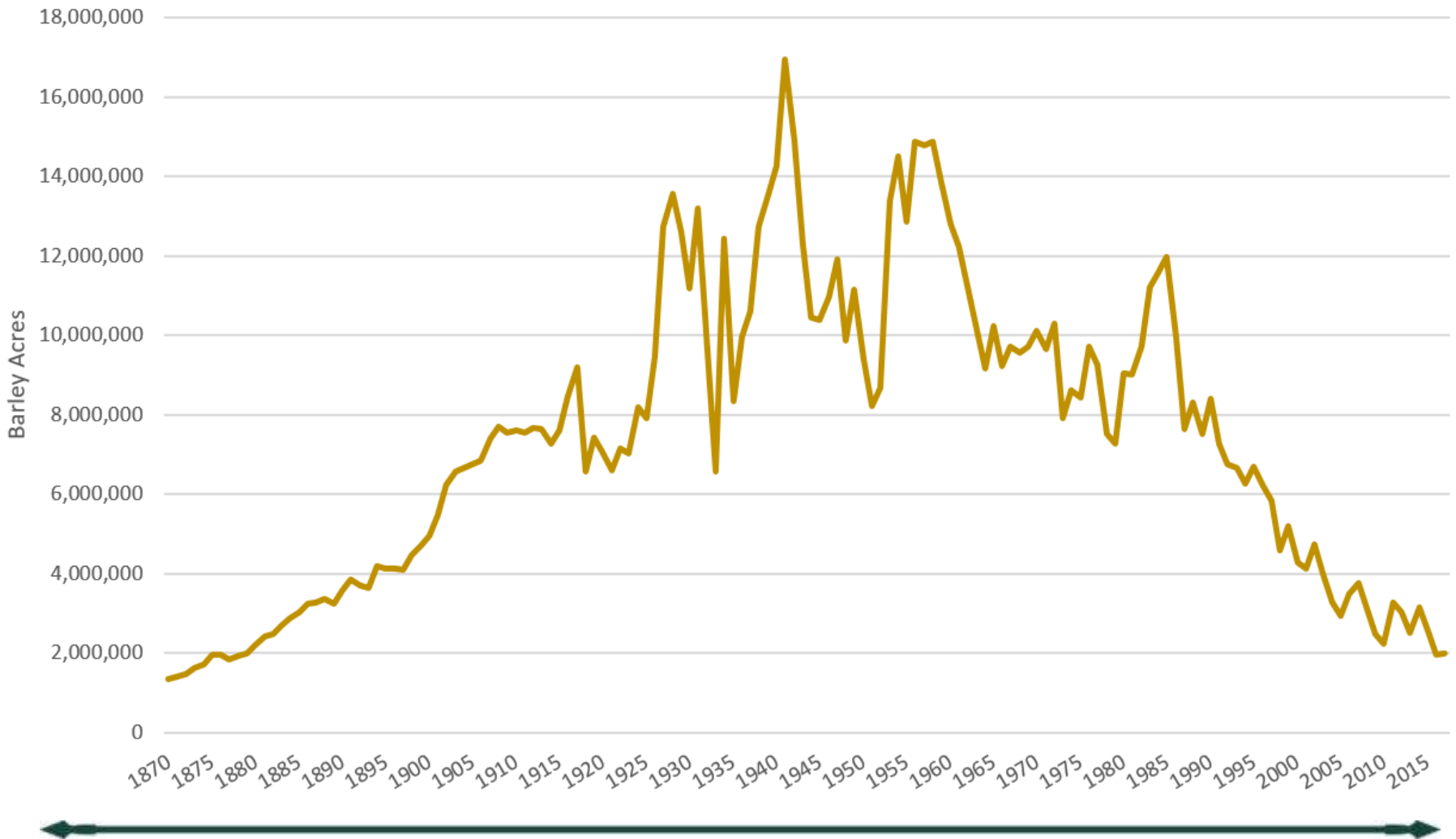
OTHER DOMESTIC
68.5% SHARE
(132,985,234 BBLs)

Craft Beer Value Chain

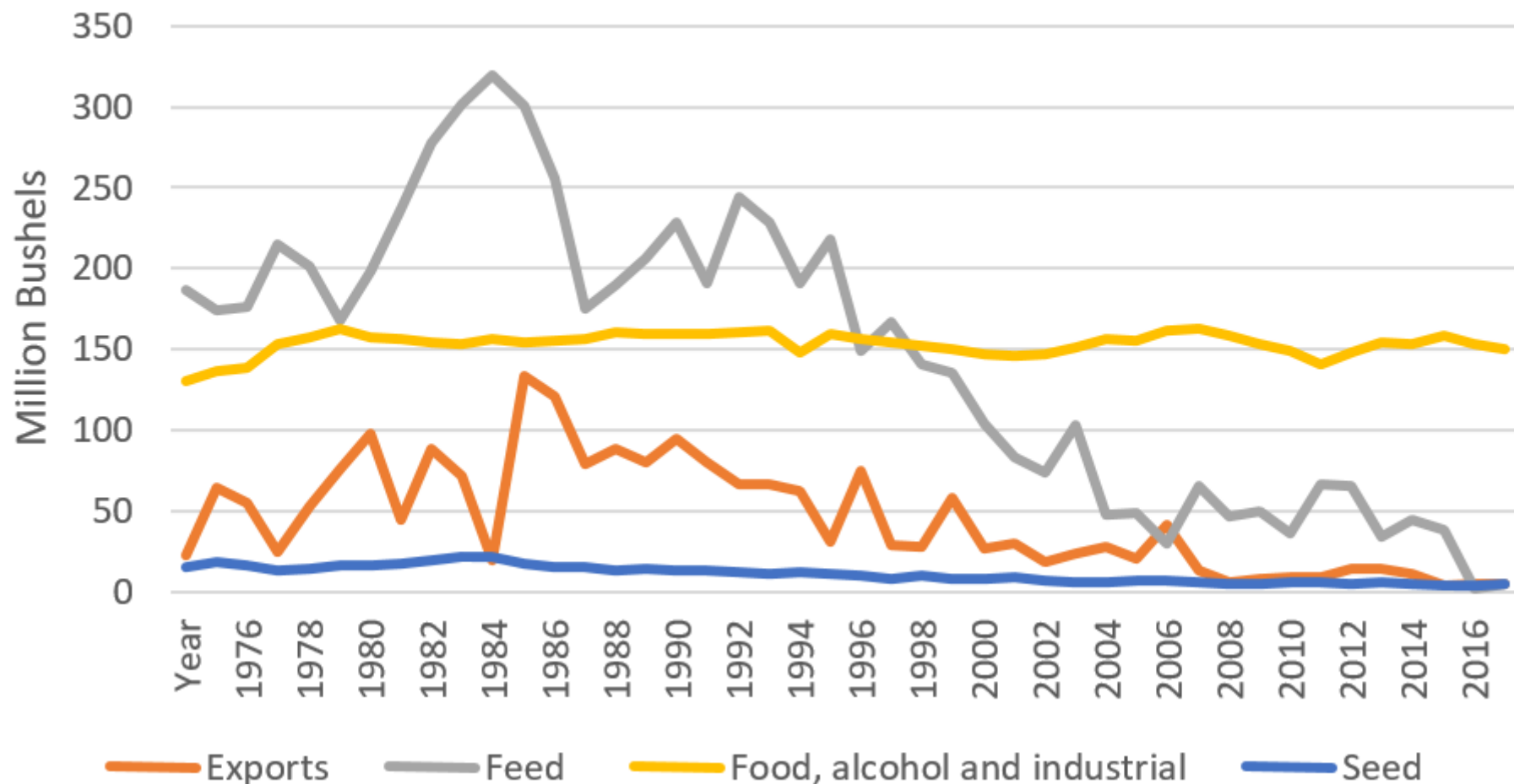
- Average beer ~ 80:1 barley malt to hops by weight
- Barley ~ \$0.17/lb
- Hops ~ \$8.00/lb



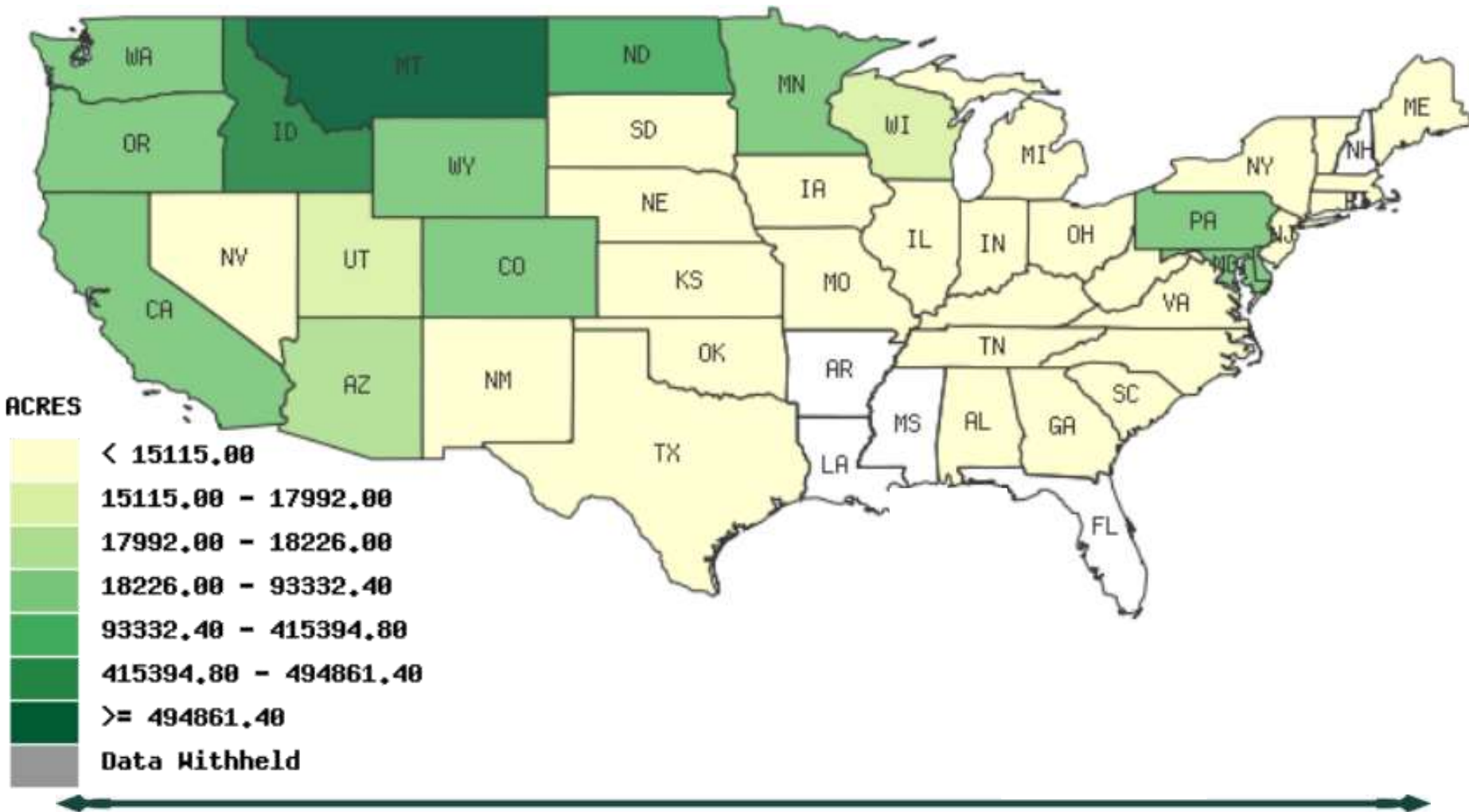
U.S. Barley Acreage Trend



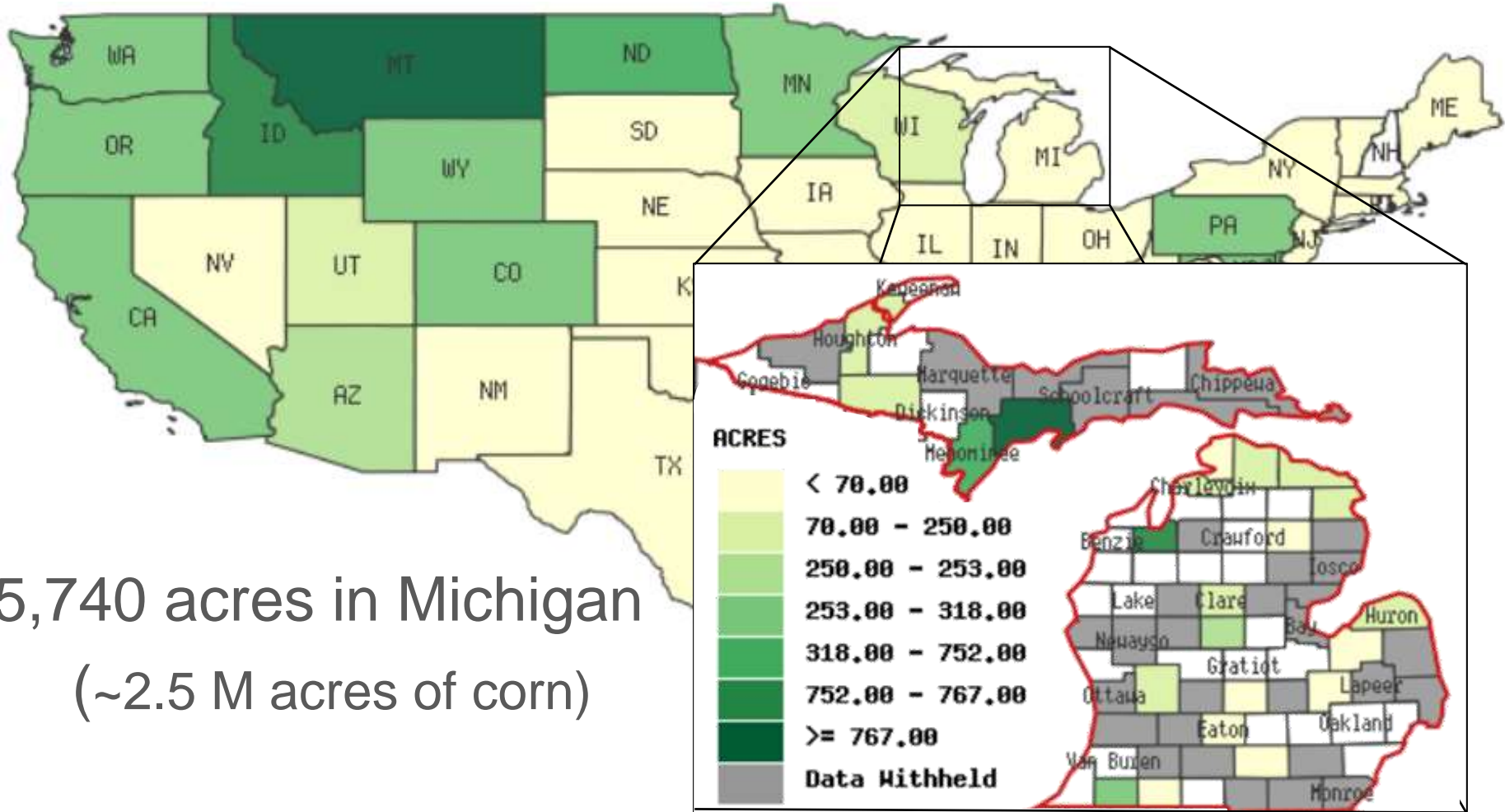
U.S. Barley Utilization Trends



Harvested Barley Acres 2017

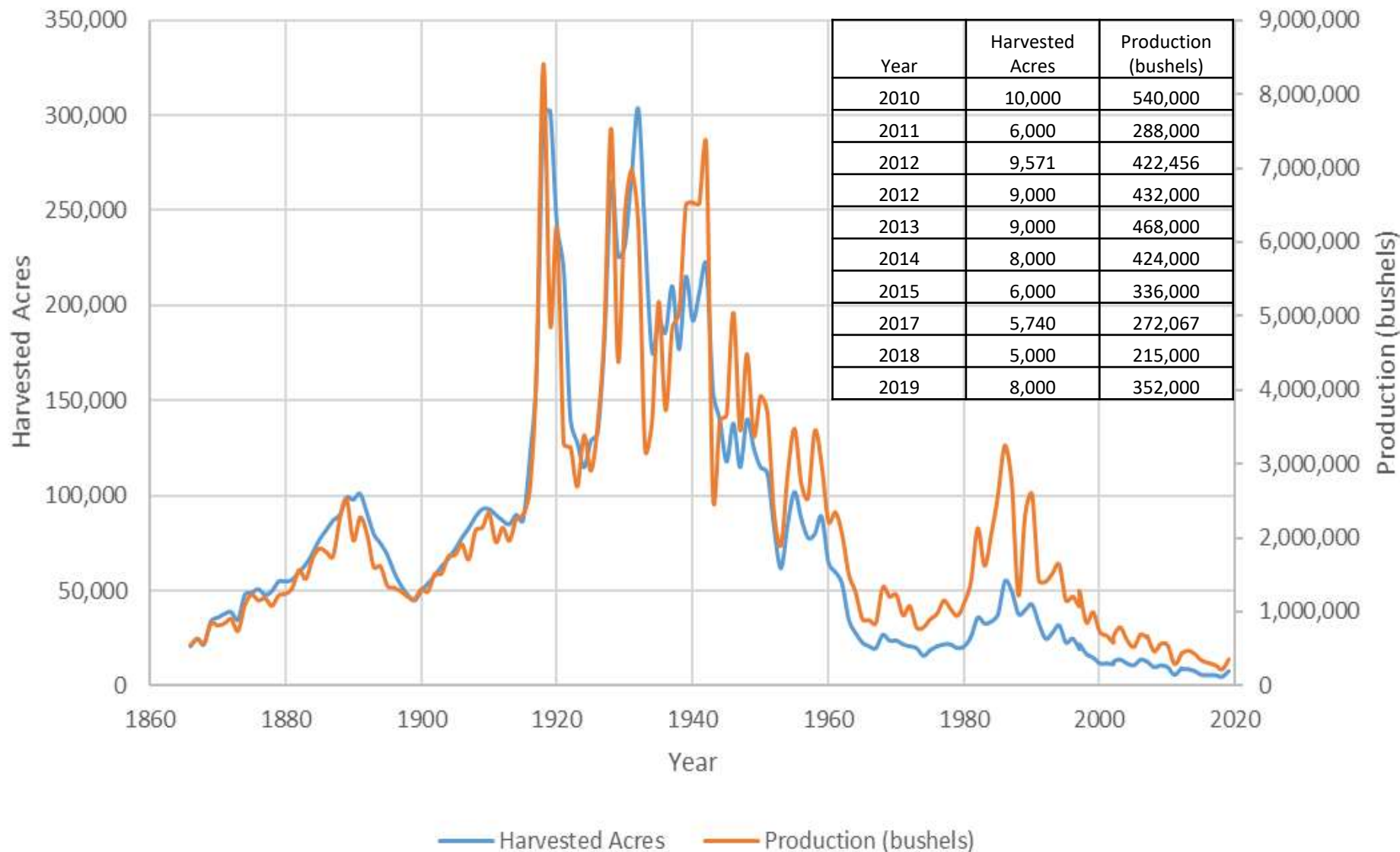


Harvested Barley Acres 2017



5,740 acres in Michigan
 (~2.5 M acres of corn)

Michigan Barley Production 1866-2019





MICHIGAN



4.7 Breweries per Capita*
(RANKS 12TH)
*per 100,000 21+ Adults

\$
ECONOMIC IMPACT

2,566
Million Economic Impact
(RANKS 9TH)

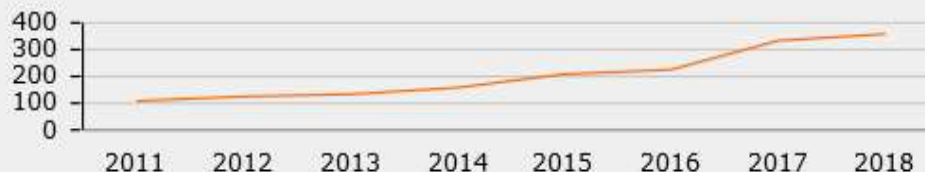
345
Impact per Capita
(RANKS 24TH)

PRODUCTION

899,792
Barrels of Craft Beer Produced
per Year
(RANKS 11TH)

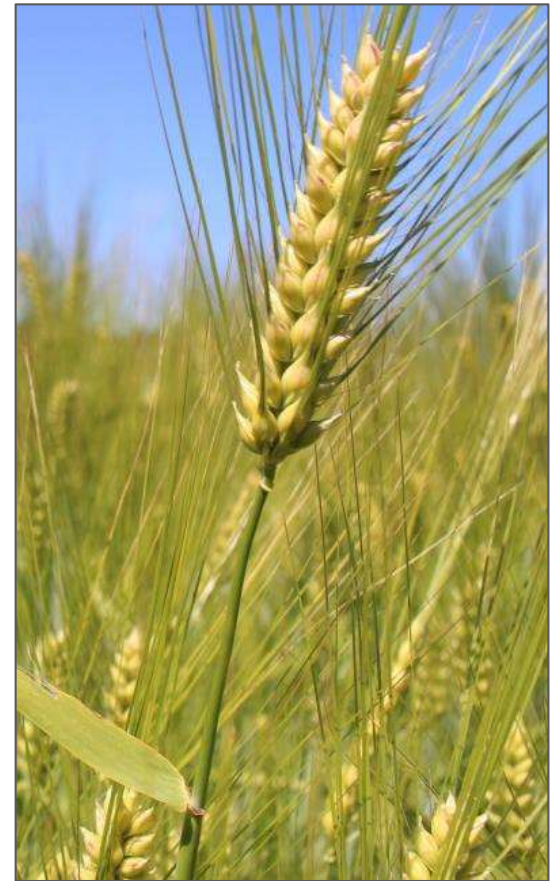
3.7
Gallons per 21+ Adult
(RANKS 14TH)

NUMBER OF CRAFT BREWERIES OPERATING PER YEAR



Challenges to Malting Barley Growth

- Access to varieties and certified seed that are suitable for the Great Lakes region
 - European genetics
 - Spring vs. Winter
 - Two row vs. Six row debate
- Challenging climate
 - Moisture, Temp
 - Pre-harvest sprout
 - FHB and DON
 - Quality risk – Crop insurance



Challenges to Malting Barley Growth

- Access to processing
 - Malthouse development
 - Connecting maltsters and growers
 - Contract negotiation
 - Seed cleaning, storage and packaging
- Avail. of alternative markets
 - Limited feed usage
 - Poor quality can reduce feed value
 - Craft spirits limited processing
 - Nascent alternative food uses



Malthouse opportunities

- Eleven malt houses currently in Michigan
- New malthouses under development
- Feasibility study strongly supports potential in Michigan



Feasibility Study Results

- ✓ Economic feasibility
 - Access to quality barley
- ✓ Market feasibility
 - Plenty of demand
- ✓ Technical feasibility
 - Do-able with training
- ✓ Management feasibility
 - Usually sole proprietors, but partnerships with growers and brewers would help
- Financial Feasibility
 - Narrow profit margins (labor, space, equipment)



MICHIGAN MALTHOUSES

1. U.P. MALT COMPANY
Bill Weisinger
bweising@yahoo.com
(906) 202-2128

2. SUPERIOR MALT
Clem Geiger
cgeiger@hotmail.com
(906) 399-9966

3. VALLEY VIEW FARM
Andrew Boyer
ajboyer@hotmail.com
(231) 675-5785

4. EMPIRE MALTING CO.
Alison Babb
empiremalting@yahoo.com
(352) 226-1644

5. GREAT LAKES MALTING CO.
Jeff Malkiewicz
jeff@greatlakesmalting.com
(231) 714-4551

6. KOOPS' MALT HAUS
Chris Koops
chris@koopsmalt.com
(989) 429-2754

7. FEDORA MALTHOUSE
Julie Baker
fedorabaker1ja@gmail.com
(989) 289-5135

8. VIERZEN ARTISAN MALT
Danielle Vierzen
vierzen27@gmail.com
(616) 302-6835

9. EMERGENT MALT
Kevin Slagh
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(616) 820-9319

10. MITTEN STATE MALT
Larry Judge
larry.judge1@gmail.com
(517) 490-5245

11. MOTORCITY MALT
Tom Laboda
tlaboda@motorcitymalt.com
(248) 425-9402



Malting Barley Budget

Description	Per Acre Subtotal (\$)
Pre-harvest machinery	\$46.25
Seed	\$37.38
Fertilizer	\$87.41
Herbicide & Fungicide	\$21.15
Lime	\$15.00
Labor	\$33.00
Land Rent	\$30.00
Combine & Haul	\$31.84
Total cost per acre	\$302.03
Market value of malting grain (55 bu X \$8)	\$440.00
Net profit per acre	\$137.97



Malting Barley Budget

Description	Per Acre Subtotal (\$)
Pre-harvest machinery	\$46.25
Seed	\$37.38
Fertilizer	\$87.41
Herbicide & Fungicide	\$21.15
Lime	\$15.00
Labor	\$33.00
Land Rent	\$30.00
Combine & Haul	\$31.84
Total cost per acre	\$302.03
Market value of feed grain (55 bu X \$4)	\$220.00
Net profit per acre	-\$82.03



MSU Research and Outreach



- Malting barley research in Michigan since 2013
 - Annual production survey
 - Barley Quality Lab at UPREC
 - Varieties trials
 - Fertility
 - Fungicide
 - Seeding rate
 - Pre-harvest sprout
 - Double cropping
 - Winter hardiness
 - Feed variety trials



MI Malting Barley Production Survey (2019)

- 17 responses from 11 counties
- 554 acres planted for 2019, 490 harvested
- 63% spring, 37% winter
- LCS Odyssey most common spring variety
- LCS Calypso most common winter variety

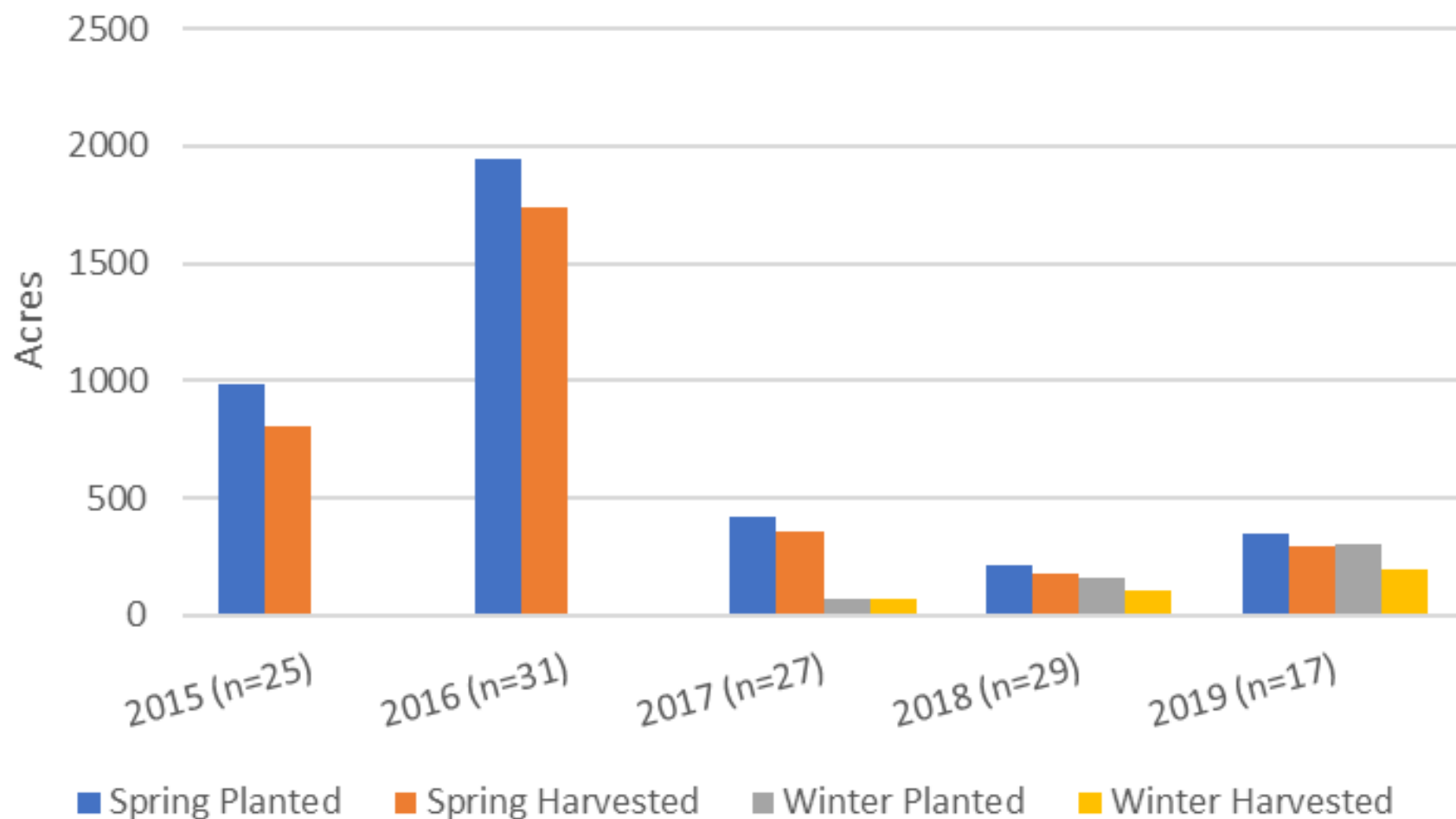


MI Malting Barley Production Survey (2019)

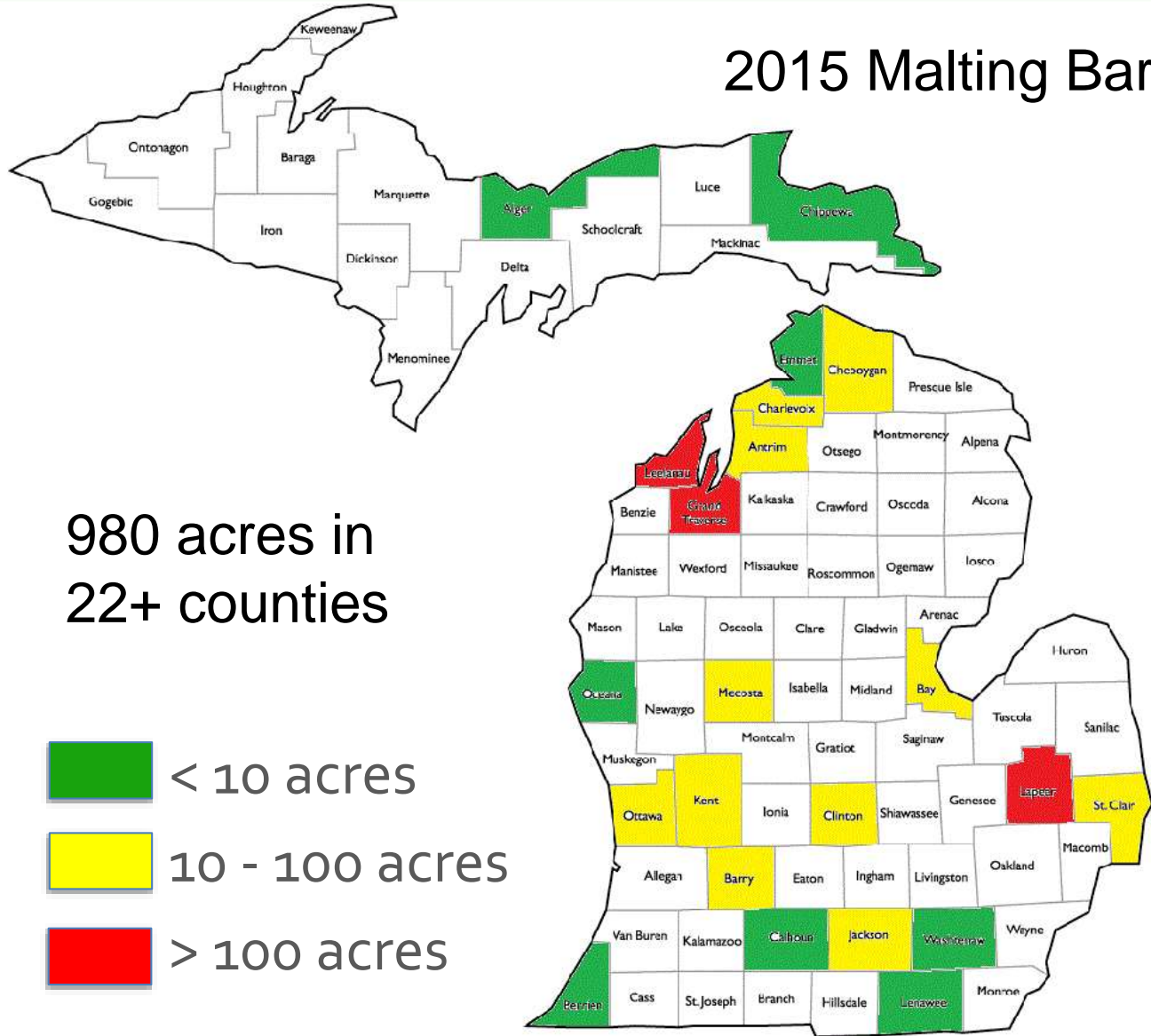
- Average yield 60 bu/a for spring, 61 bu/a for winter (winter injury)
- 50% successfully marketed
- Average price of \$7.71/bu for malting, \$5.75/bu for feed
- Primary quality issues: DON
- Primary challenges: weather (winter injury, wet spring/fall, dry summer), marketing



Michigan Malting Barley Acreage Trend



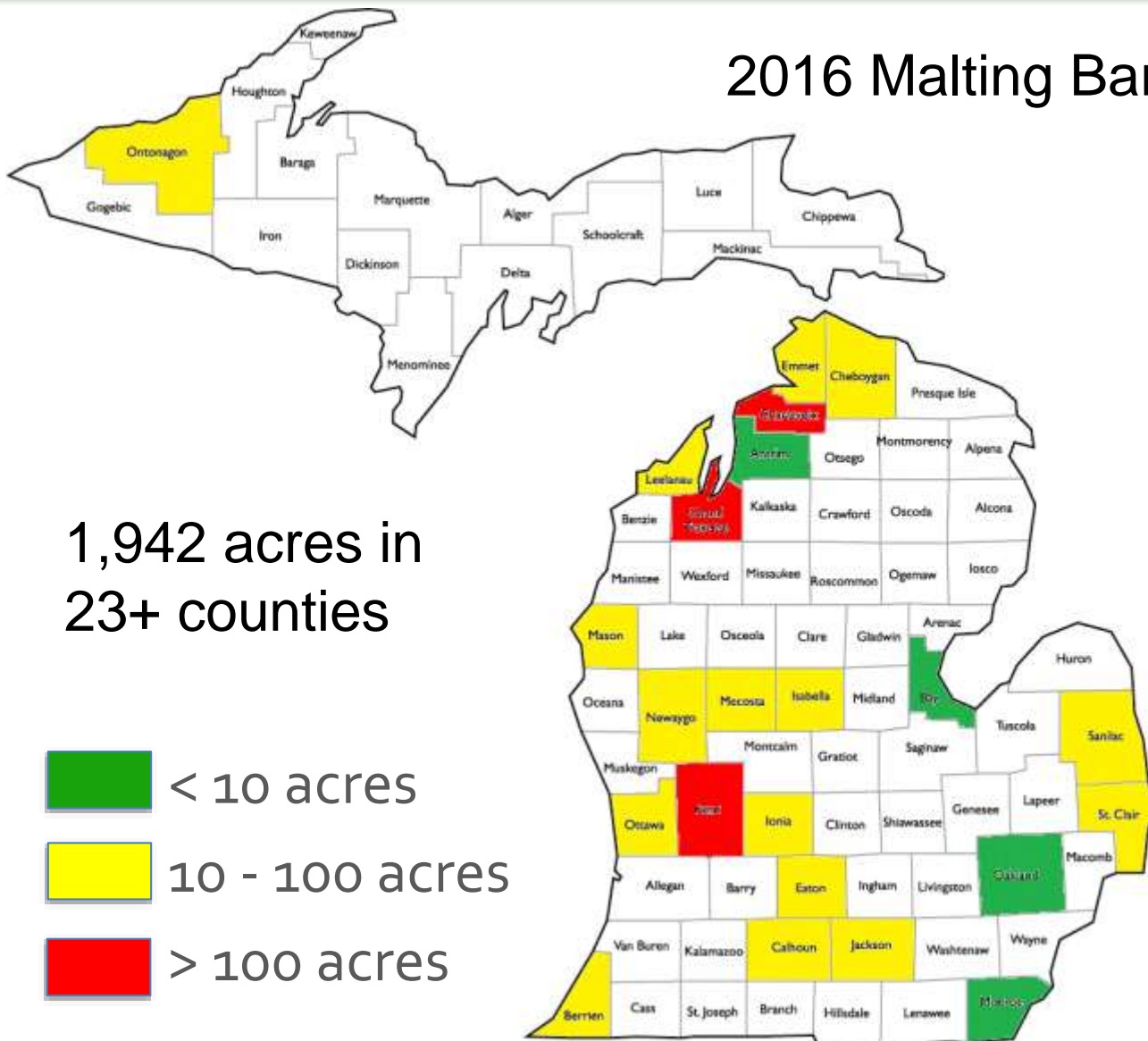
2015 Malting Barley Acres



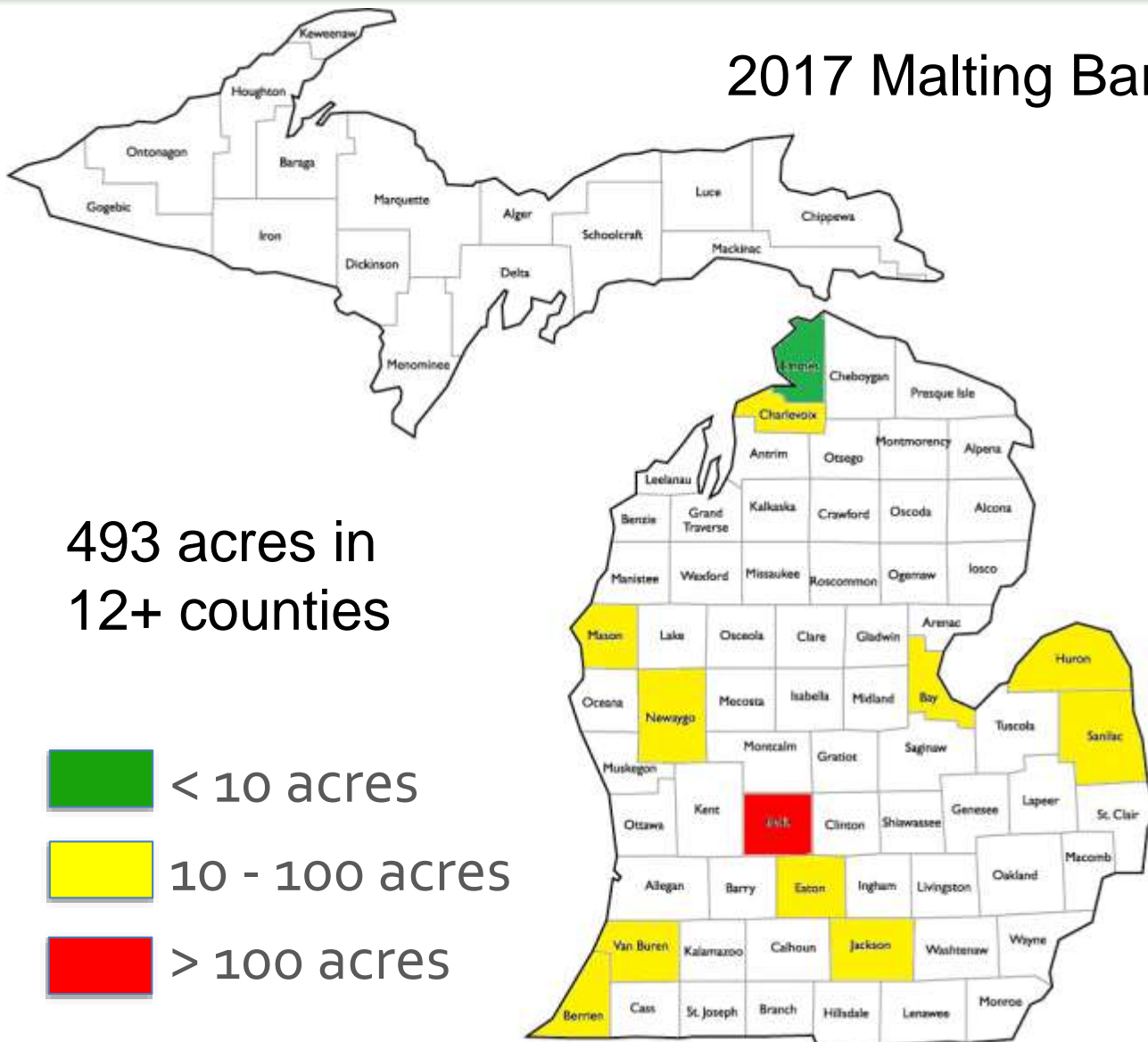
980 acres in
22+ counties

- < 10 acres
- 10 - 100 acres
- > 100 acres

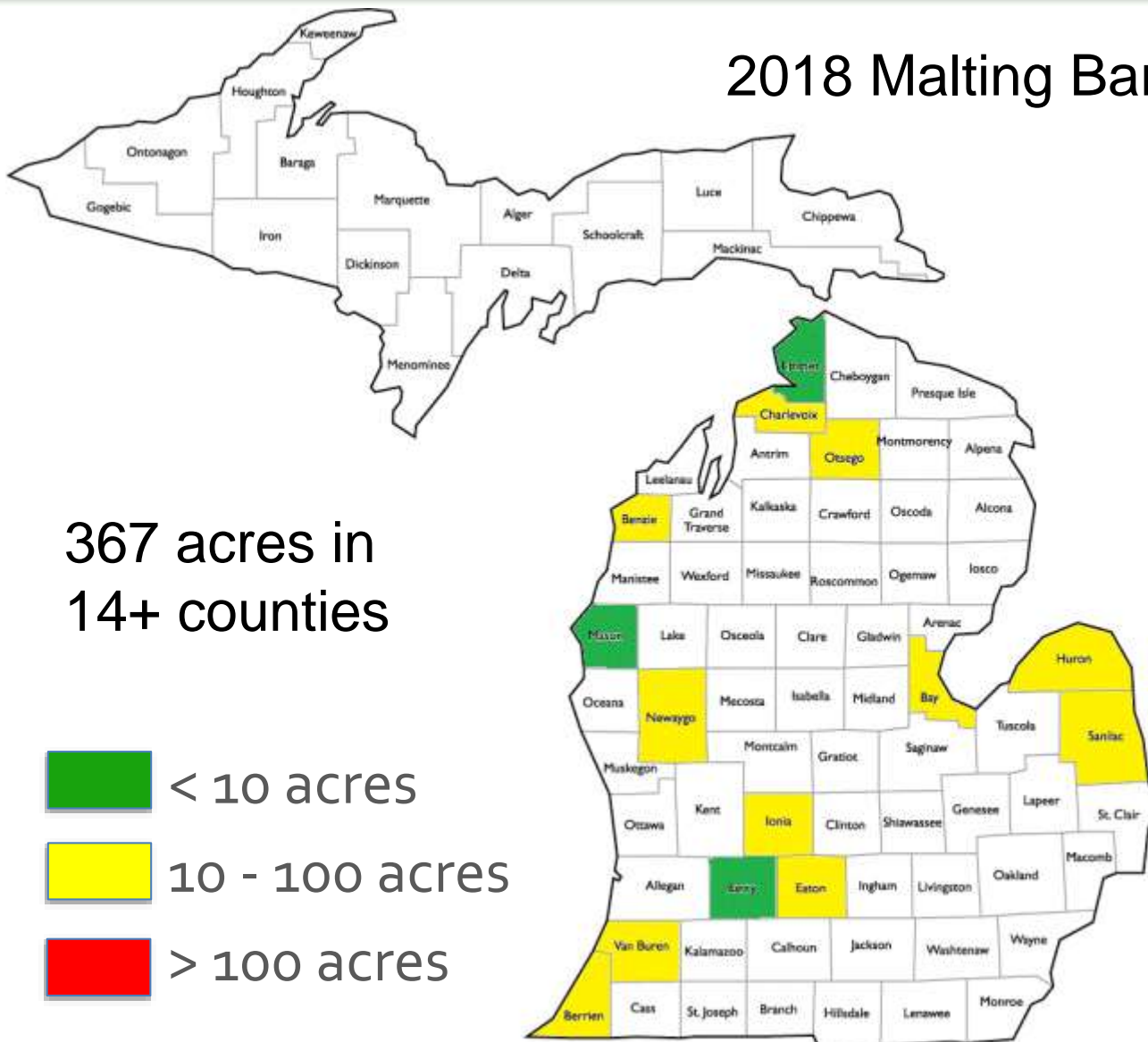
2016 Malting Barley Acres



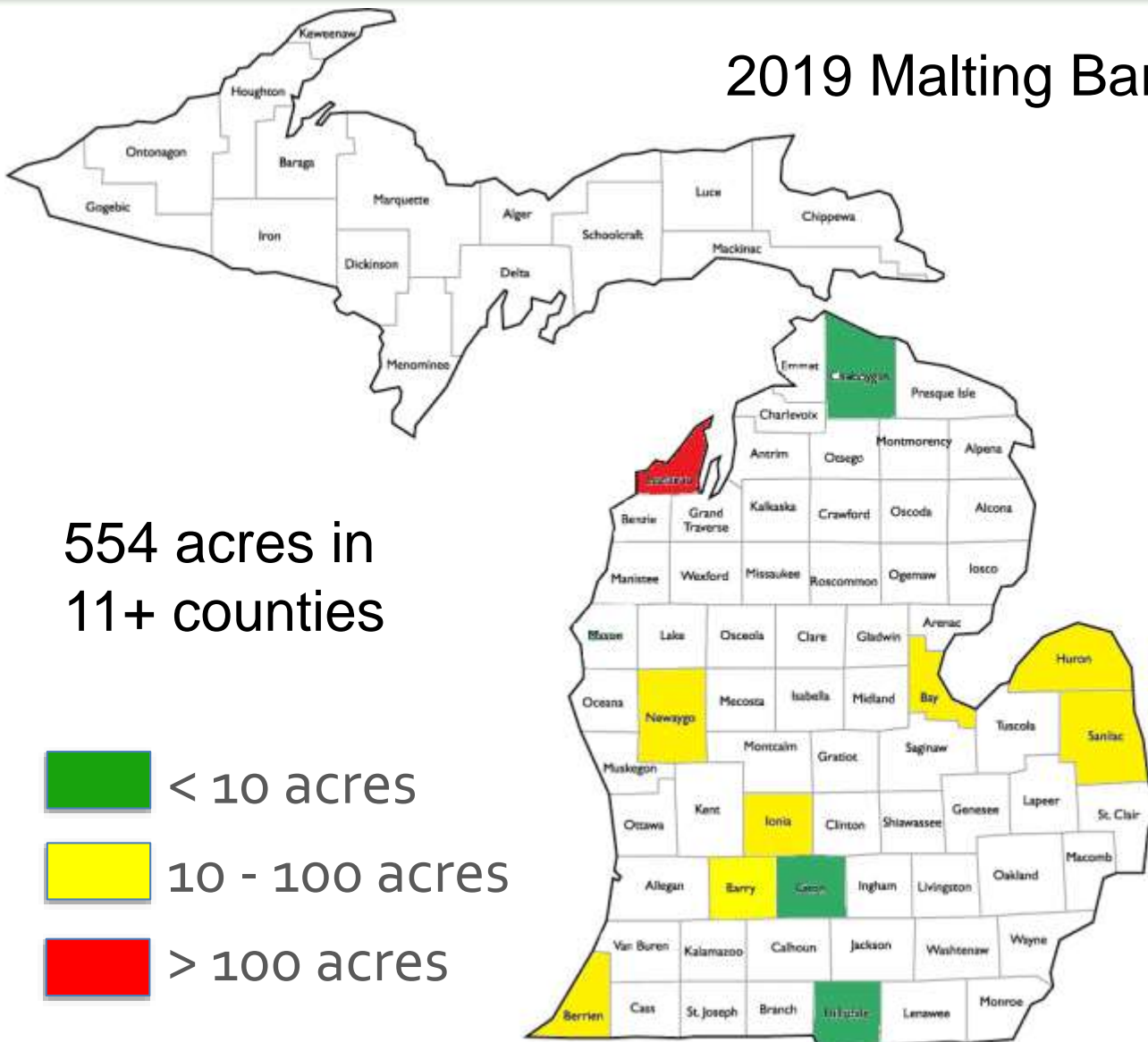
2017 Malting Barley Acres



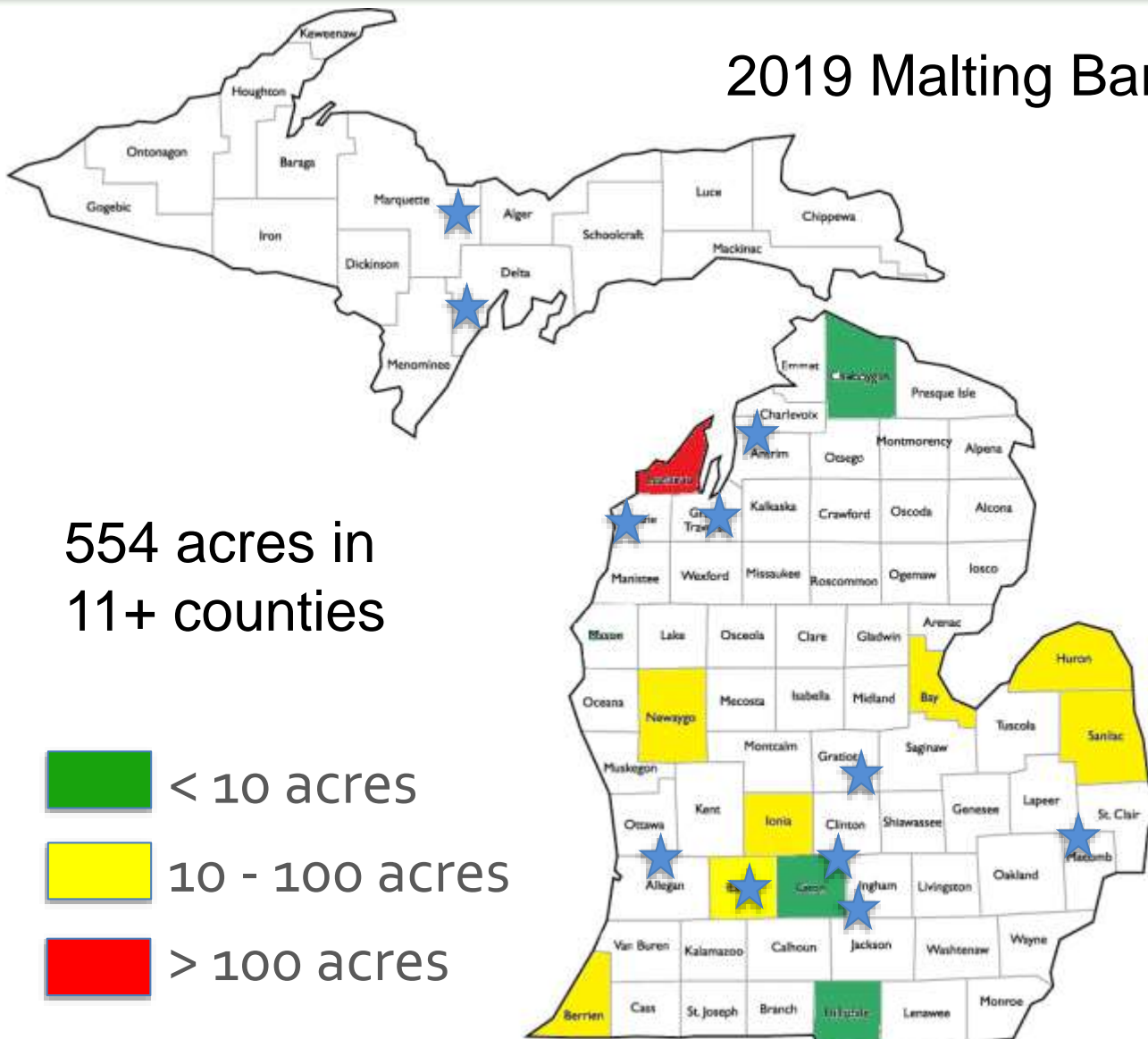
2018 Malting Barley Acres



2019 Malting Barley Acres

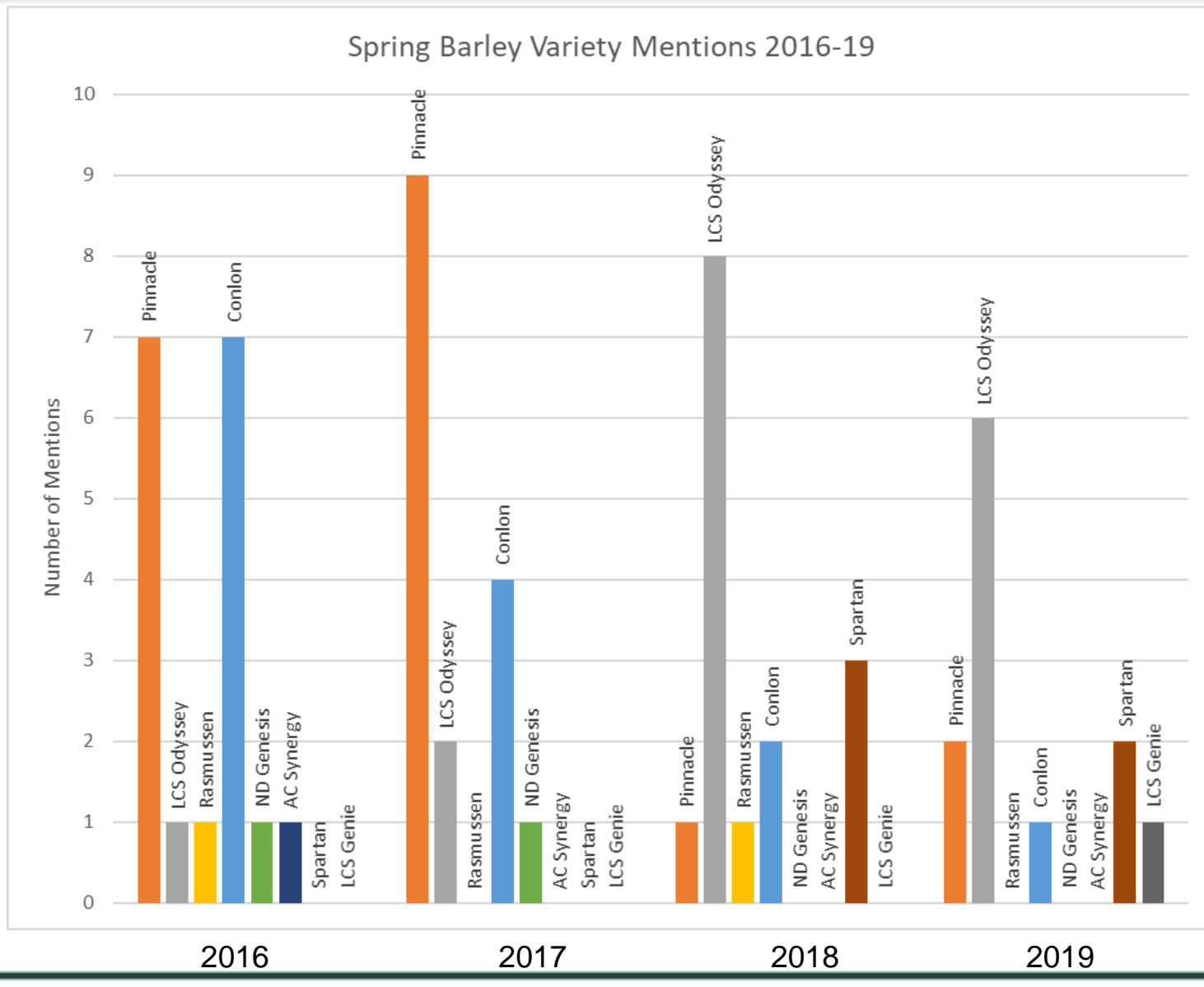


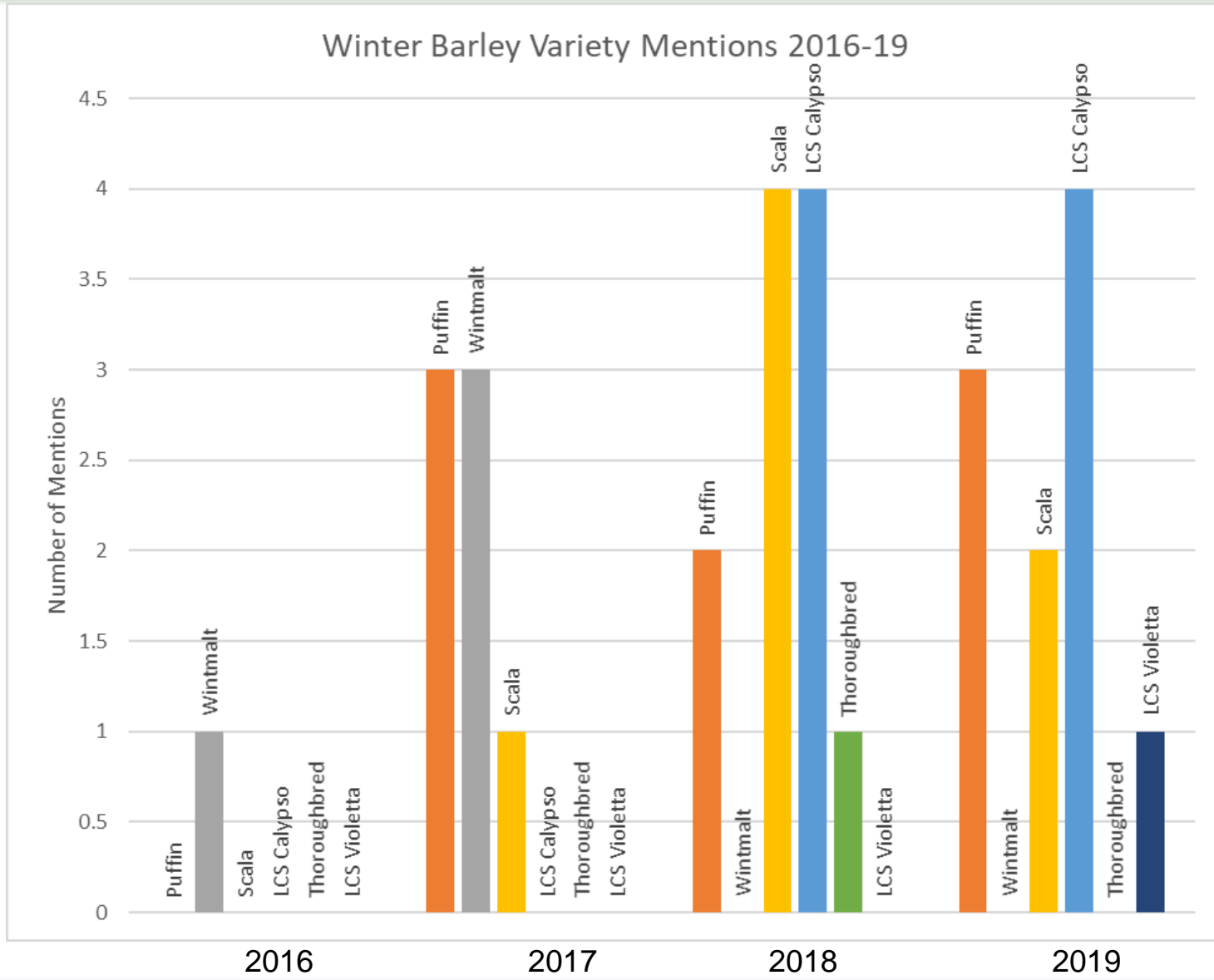
2019 Malting Barley Acres



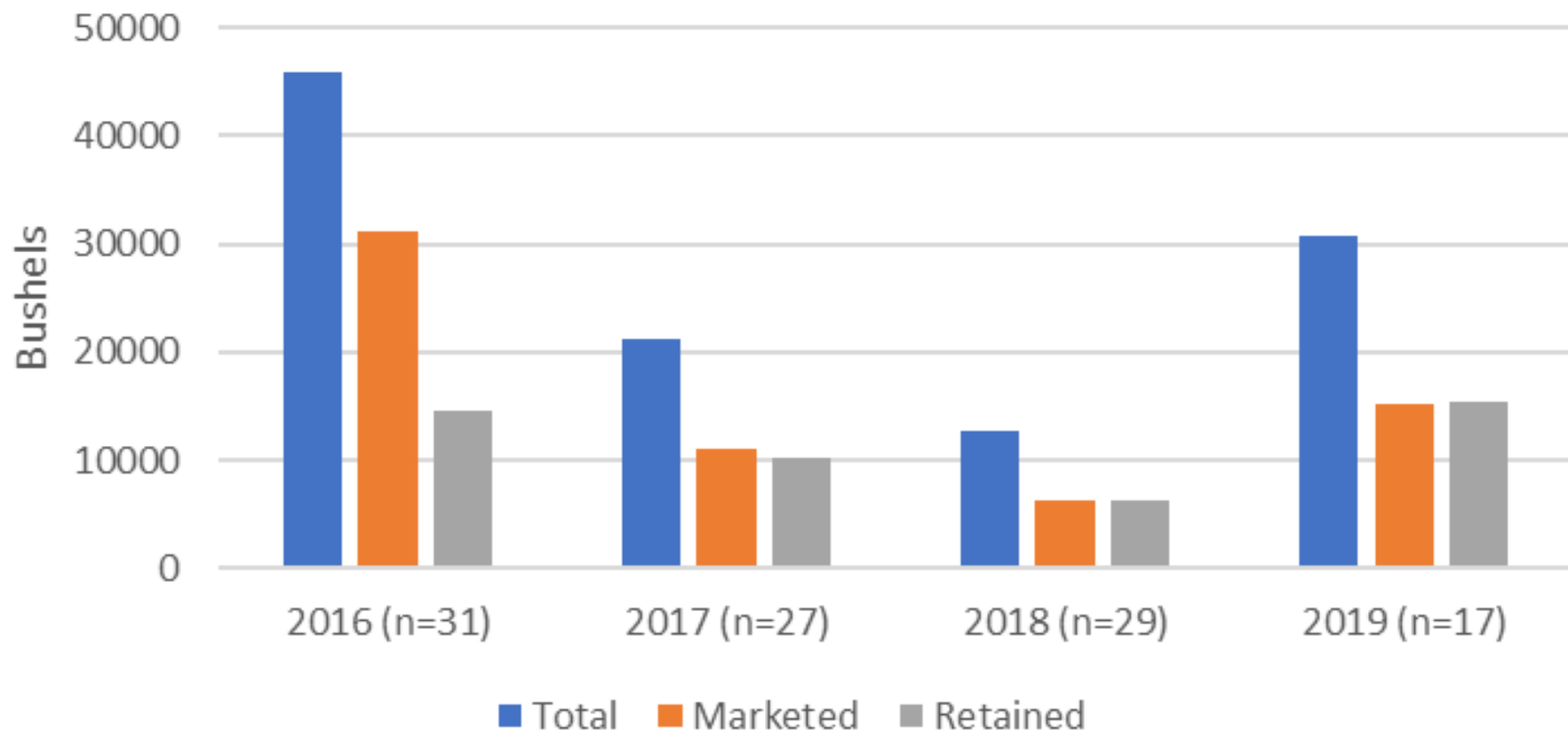
554 acres in 11+ counties

- < 10 acres
- 10 - 100 acres
- > 100 acres

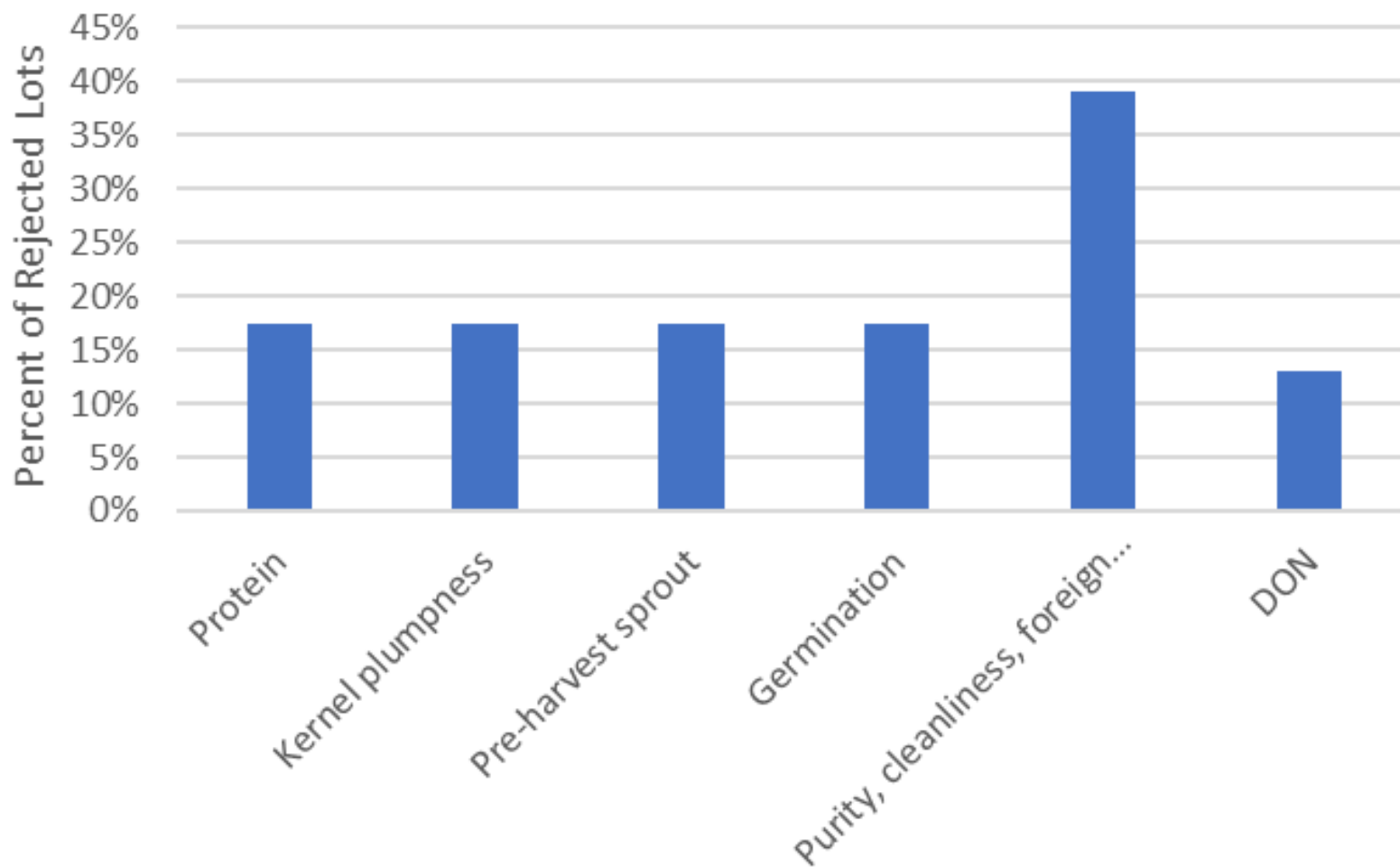




Michigan Malting Barley Production and Marketing Trend



Quality Factors Causing Rejection 2016-2019



Grower comments from 2019

- “Malting barley production in the Upper Peninsula is do-able, but no markets are available.”
- “I am still dedicated to grow barley on a production scale once I acquire the aforementioned necessities. I am very grateful that there is a group of dedicated growers and researchers in Michigan to once again establish malting barley.”
- “Looking for varieties of all brewing grains that exhibit winterkill resistance, Fusarium resistance, and pre-sprout resistance; that grow well in Michigan and produce world-class quality malt.”
- “Until consumers realize their beer is mostly foreign, out of state grain, and hold brewers accountable, malt barley is not a viable crop in MI.”
- “I haven't planted barley yet, but am considering it.”

MSU Malting Barley Team



Dean Baas



Christian Kapp



Martin Nagelkirk



Nicole Shriner



Martin Chilvers



Ryan Hamilton



James DeDecker



Brook Wilke



Dennis Pennington



Christian Tollini

https://www.canr.msu.edu/malting_barley/

Project GREEN



Michigan State University



Inspired Brewing®



American Malting Barley Association, Inc.

AgBioResearch

MICHIGAN STATE UNIVERSITY

Extension



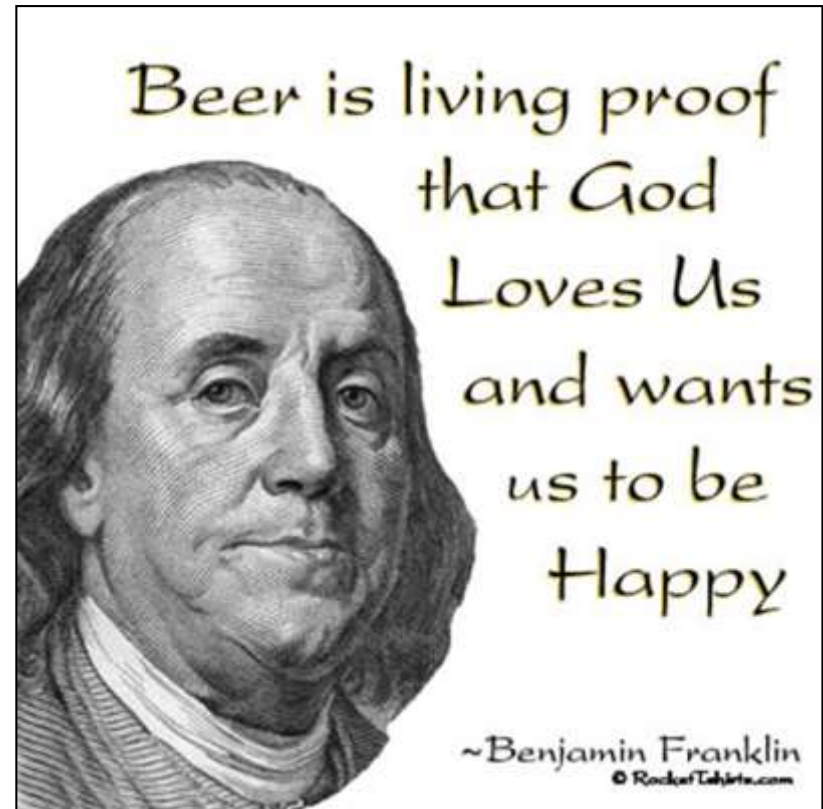
MSU Malting Barley Research Update 2019



Dr. James DeDecker
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Overview

- Eastern Spring Barley Nursery
- 2019 MSU barley survey
- CBC winter barley hardiness project
- Acknowledgements



Variety development priorities for the Eastern U.S.

- Cultivars suitable for the craft industry
- Cultivars able to handle warm nighttime temps
- Cultivars with resistance to:
 - Fusarium head blight and DON accumulation
 - Net and spot blotch
 - Powdery mildew and leaf rust
 - Pre-harvest sprouting

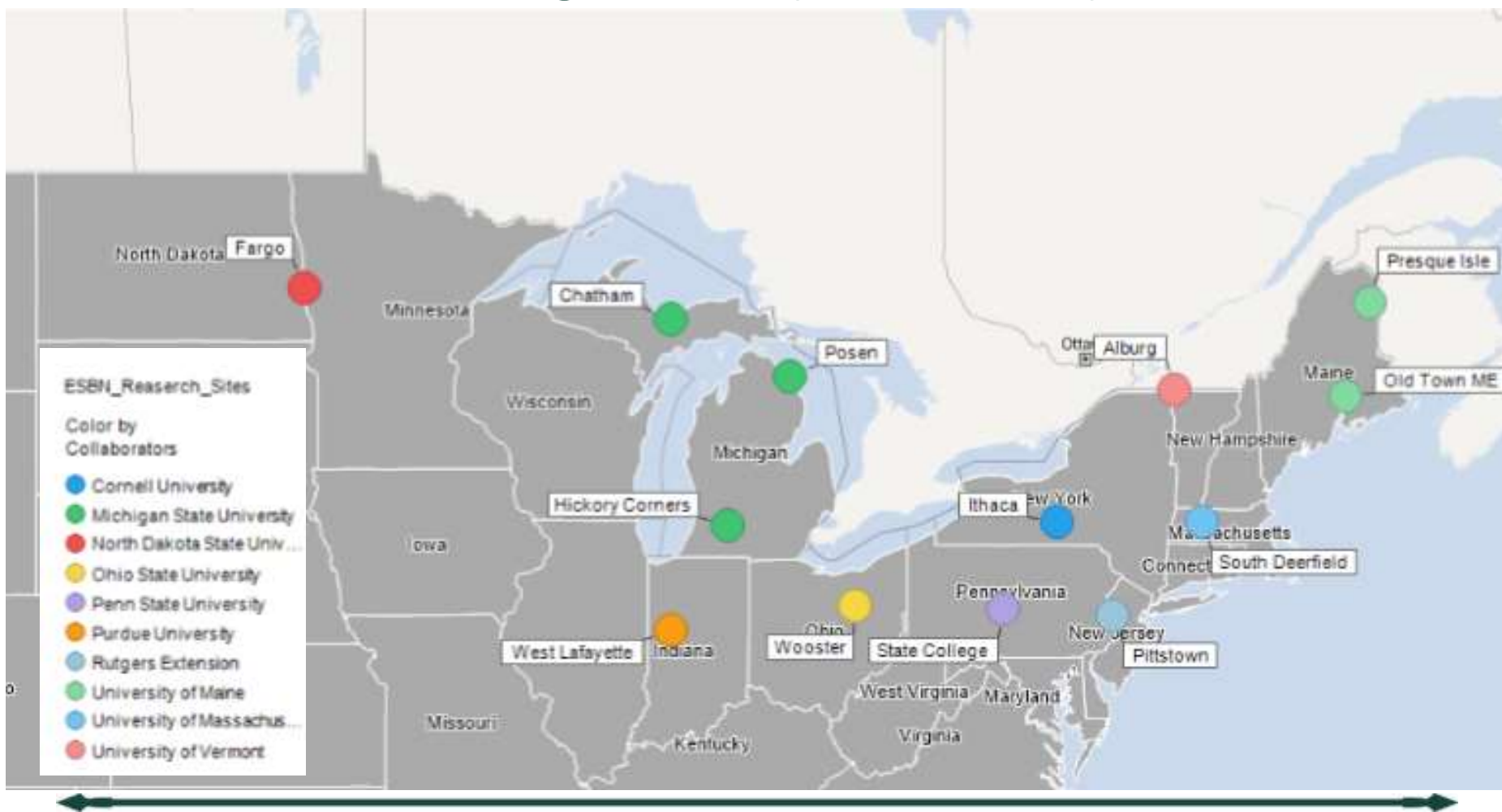


Eastern Spring Barley Nursery

- NDSU established the project & network in 2015
- 10 universities and 13 locations
- Common list of 20-25 barley varieties grown
- Varieties selected based on input from craft industry and research team
- Included two and six-rowed varieties from the US, Canada and Europe (now all two-rowed)



Eastern Spring Barley Nursery





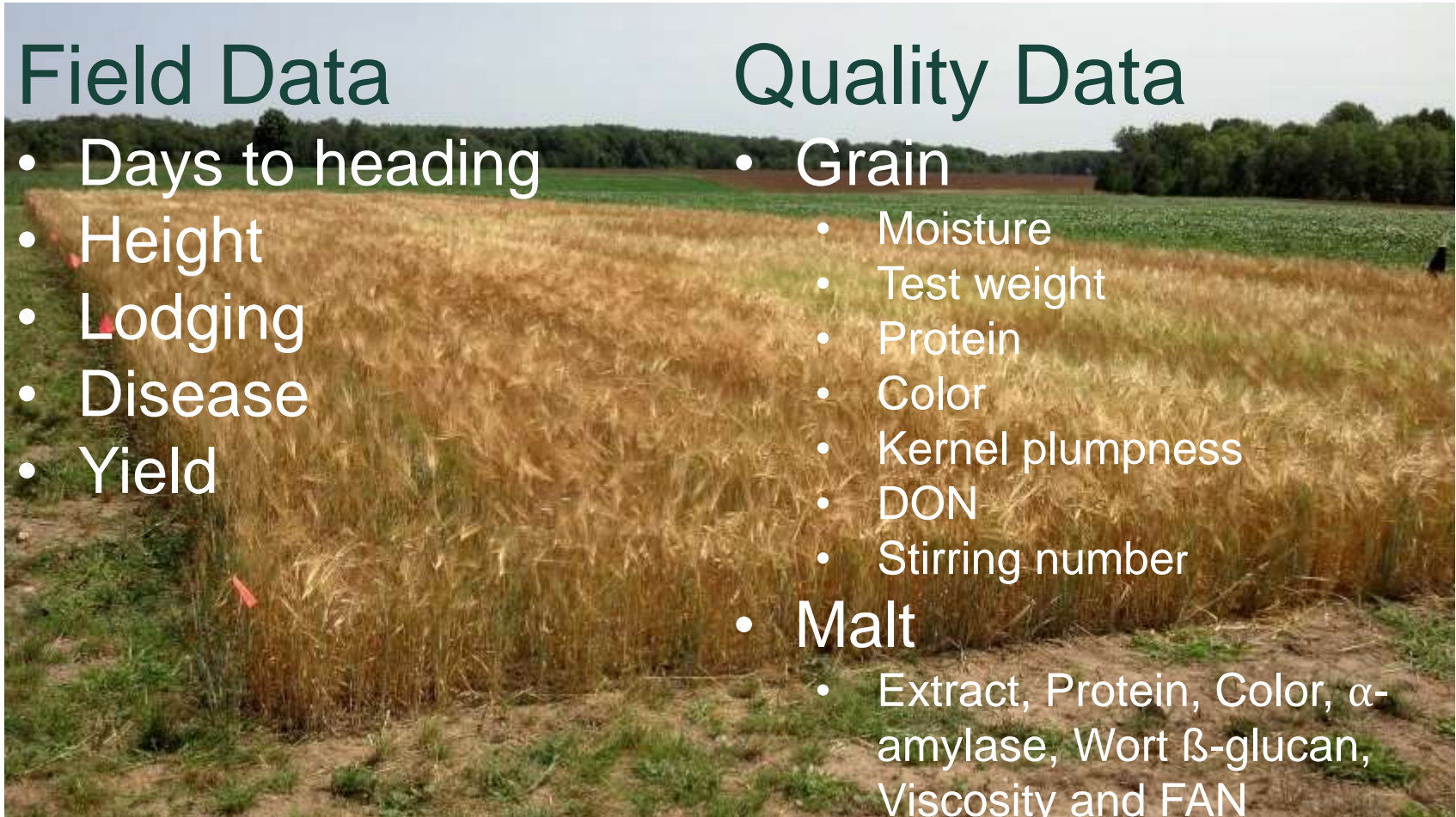
Eastern Spring Barley Nursery

Field Data

- Days to heading
- Height
- Lodging
- Disease
- Yield

Quality Data

- Grain
 - Moisture
 - Test weight
 - Protein
 - Color
 - Kernel plumpness
 - DON
 - Stirring number
- Malt
 - Extract, Protein, Color, α -amylase, Wort β -glucan, Viscosity and FAN



2019 Results: Chatham, MI

Variety	Heading Date	Height	Foliar Disease	Yield	Moisture	Test Weight	GE	DON	Stirring Number	Plump	Protein	Color
2ND32529	32.5	48.9	1.0	55.7	14.0	49.2	98.0	0.0	171.0	94.3	8.9	51.7
ND GENESIS	32.9	59.5	1.4	55.1	14.1	52.4	92.0	0.0	142.0	96.1	9.9	50.8
2ND35693	32.8	54.6	1.1	54.9	13.8	50.0	98.0	0.1	167.0	97.4	9.4	51.0
2ND34954	34.1	48.8	1.7	51.1	14.5	51.2	92.0	0.0	156.0	97.8	9.1	50.9
AAC CONNECT	34.0	50.1	2.0	50.7	14.3	48.4	97.0	0.0	107.0	92.2	10.1	51.3
TRADITION	34.9	57.4	1.0	48.0	14.3	50.2	86.0	0.0	183.0	92.2	9.9	51.7
KWS TINKA	35.5	45.0	2.5	46.6	14.4	49.9	76.0	0.0	161.0	95.4	9.5	50.9
EXPLORER	33.9	43.0	1.9	46.1	14.9	49.3	76.0	0.0	174.0	92.4	9.1	50.1
NEWDALE	36.3	50.2	2.6	44.8	14.6	47.9	60.0	0.0	155.0	74.6	10.3	51.5
ESMA	36.4	46.5	2.0	43.8	14.6	48.9	92.0	0.0	196.0	87.1	9.1	50.7



2019 Results: Posen, MI

Variety	Heading Date	Height	Yield	Moisture	Test Weight	GE	DON	Stirring Number	Plump	Protein	Color
KWS FANTEX	38.0	52.6	121.8	13.0	52.4	84.0	0.0	173.0	94.9	9.8	51.6
ESMA	35.0	49.8	116.0	13.2	52.0	92.0	0.0	161.0	96.4	9.9	50.5
LCS GENIE	38.0	47.7	108.4	12.8	52.3	94.0	0.0	158.0	96.5	10.0	50.6
ICONIC	38.0	59.0	103.3	13.2	51.8	76.0	0.0	173.0	97.6	10.2	50.7
PINNACLE	35.0	60.6	100.1	13.6	51.9	92.0	0.0	155.0	97.2	9.0	50.5
2ND32529	33.0	64.5	97.9	13.2	48.9	98.0	0.0	147.0	98.0	9.3	51.5
AAC CONNECT	35.0	60.3	96.0	13.4	49.6	97.0	0.0	85.0	94.8	10.3	51.6
LCS ODYSSEY	38.0	49.4	95.3	13.2	50.1	50.0	0.0	119.0	96.8	9.1	50.3
ACCORDINE	38.0	55.5	93.3	13.5	52.5	80.0	0.0	141.0	93.2	9.3	50.6
CRESCENDO	42.0	61.4	93.0	13.2	52.0	96.0	0.0	156.0	99.0	10.3	51.2



2019 Results: Hickory Corners, MI

Variety	Heading Date	Height	Yield	Test Weight	GE	DON	Stirring Number	Plump	Protein	Color
2ND32529	9.8	80.7	99.4	44.4	98.0	0.8	18.0	96.1	10.8	48.7
LCS ODYSSEY	10.1	71.2	95.9	44.1	50.0	4.8	112.0	90.1	9.3	49.5
ND GENESIS	7.0	89.1	93.5	46.7	92.0	3.9	18.0	92.3	9.8	49.6
NEWDALE	9.9	78.4	87.5	48.1	60.0	0.9	5.0	91.3	9.6	50.0
2ND34634	5.1	79.8	87.3	45.9	98.0	2.1	7.0	95.7	11.1	49.7
EXPLORER	9.8	67.0	85.9	46.7	76.0	2.2	80.0	93.1	8.5	48.8
ESMA	10.3	70.5	84.8	47.3	92.0	2.2	67.0	91.8	8.7	49.0
2ND34954	10.2	88.2	84.8	48.9	92.0	2.8	31.0	95.5	8.9	49.9
AAC SYNERGY	10.3	82.2	84.0	45.8	80.0	2.5	3.0	95.2	9.1	49.5
TRADITION	6.5	89.3	82.7	46.5	86.0	3.0	101.0	90.8	10.1	49.5



Eastern Spring Barley Nursery

Top Performing Varieties 2015-2018 at Chatham, MI

Rank	Yield	PHS Resistance	Malt Extract
1	AAC Synergy	Pinnacle	Acorn
2	Explorer	Explorer	Cerveza
3	Cerveza	LCS Genie	KWS Fantex
4	Sirish	2ND337660	KWS Beckie
5	Conlon	2ND33757	LCS Odyssey



Eastern Spring Barley Nursery

Cluster analysis groups varieties based on similarity across multiple different parameters

Cluster	Yield	Test weight	Stirring number	Protein	Extract	Wort B-glucan
1	69.9	47.2	97	10.8	81.7	352
2	74.3	48.9	93	10.9	81.3	260
3	68.3	48.5	123	10.2	82.4	277
4	71.0	48.9	136	10.7	81.7	232
5	77.5	49.1	62	11.6	81.2	525
6	65.5	51.9	134	10.3	81.5	513



Eastern Spring Barley Nursery

Cluster analysis groups varieties based on similarity across multiple different parameters

Cluster	Yield	Test weight	Stirring number	Protein	Extract	Wort B-glucan
1	69.9	47.2	97	10.8	81.7	352
2	74.3	48.9	93	10.9	81.3	260
3	68.3	48.5	123	10.2	82.4	277
4	71.0	48.9	136	10.7	81.7	232
5	77.5	49.1	62	11.6	81.2	525
6	65.5	51.9	134	10.3	81.5	513

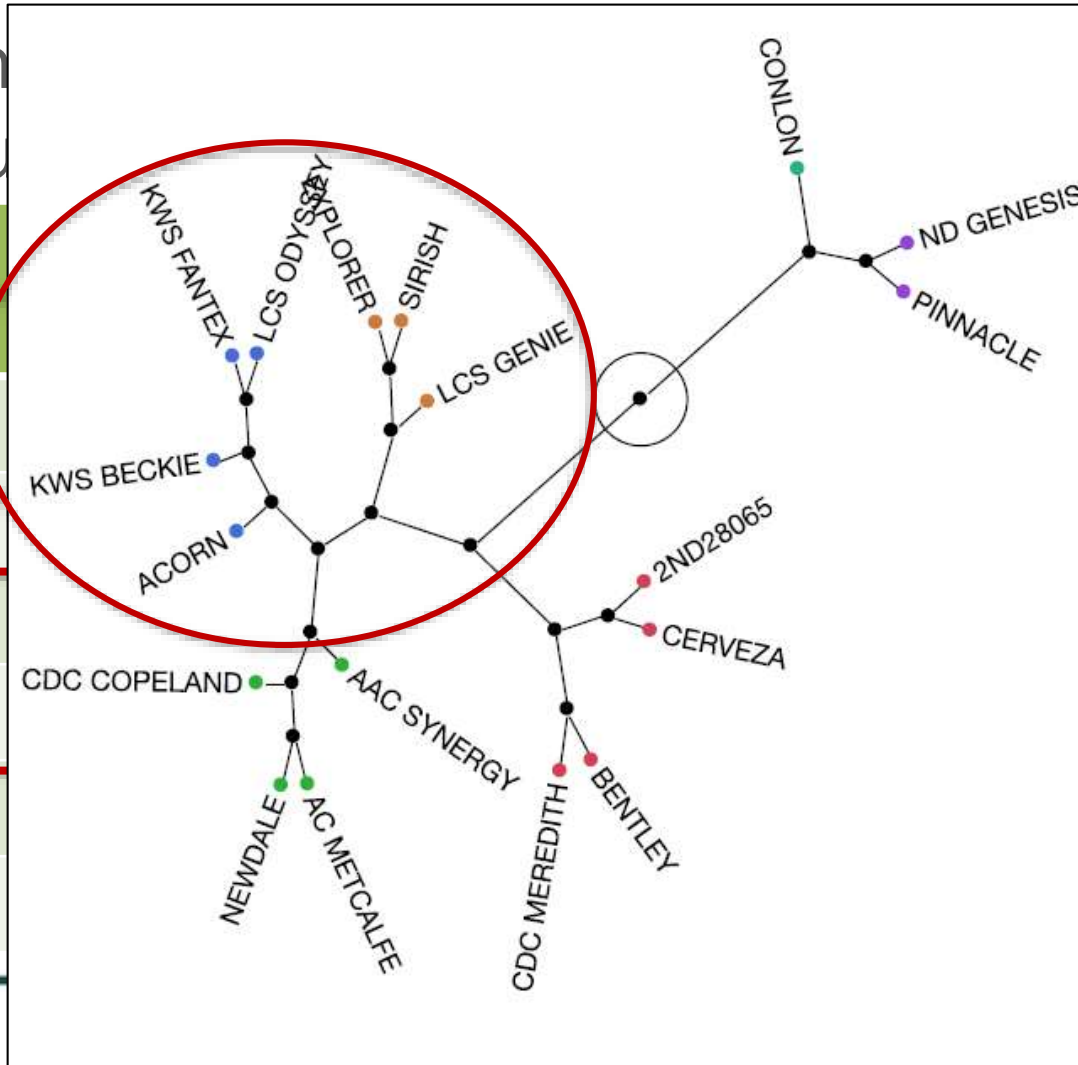


Eastern Spring Barley Nursery

Cluster analysis across multiple traits

similarity

Cluster	Yield
1	69.9
2	74.3
3	68.3
4	71.0
5	77.5
6	65.5



Wort B-glucan
352
260
277
232
525
513

MI Malting Barley Production Survey (2019)

- 17 responses from 11 counties
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- 63% spring, 37% winter
- LCS Odyssey most common spring variety
- LCS Calypso most common winter variety

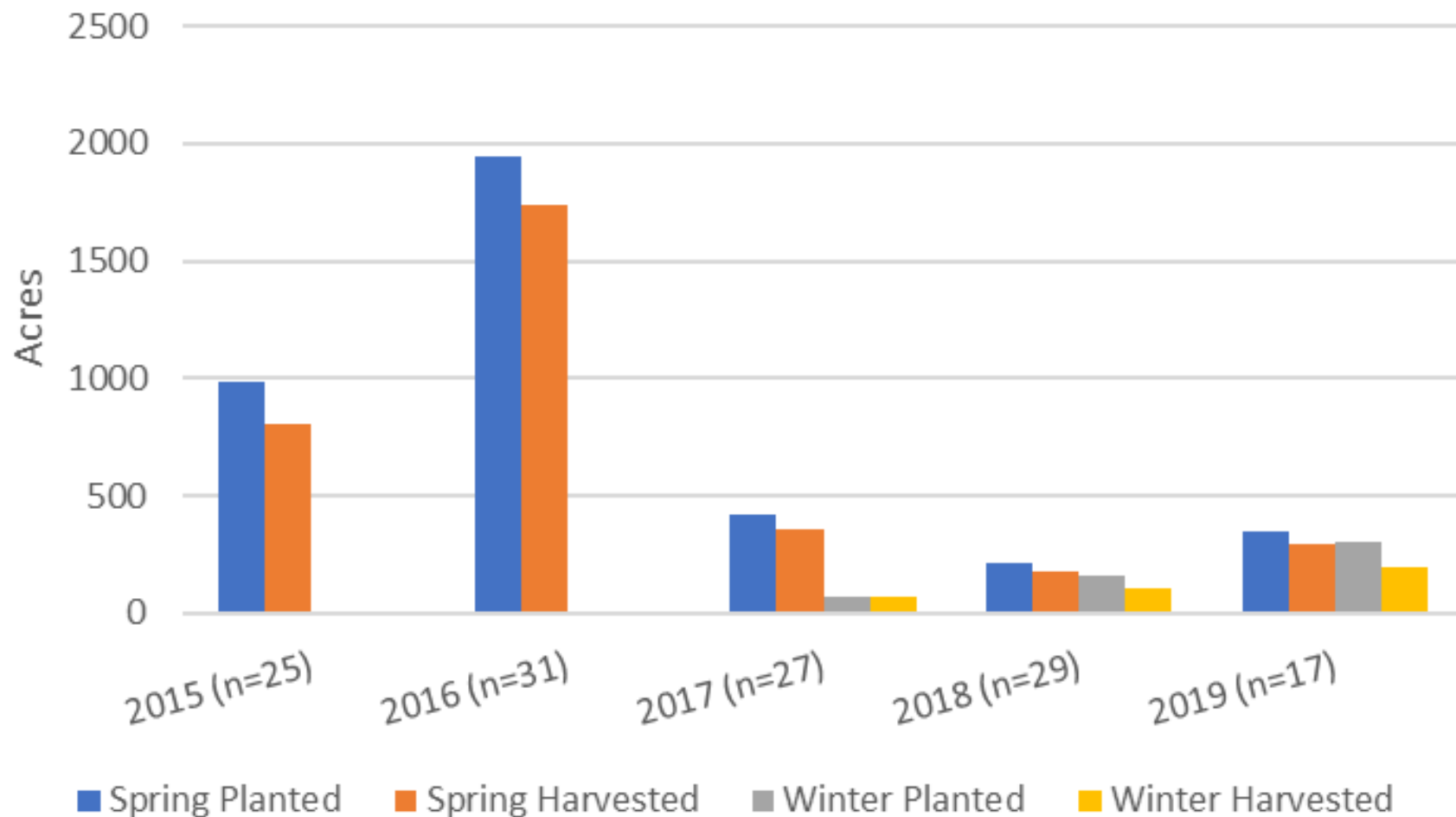


MI Malting Barley Production Survey (2019)

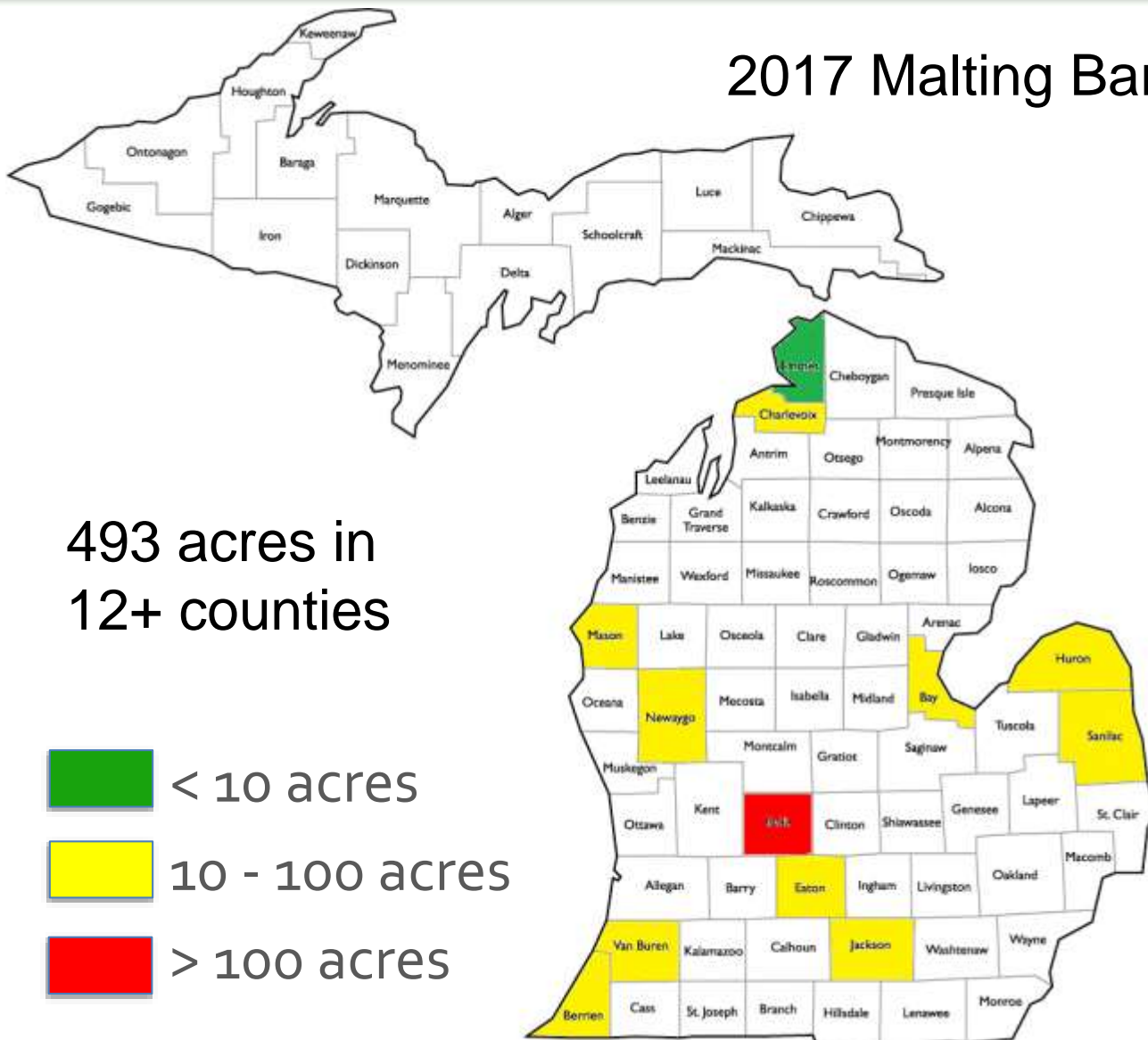
- Average yield 60 bu/a for spring, 61 bu/a for winter (winter injury)
- 50% successfully marketed
- Average price of \$7.71/bu for malting, \$5.75/bu for feed
- Primary quality issues: DON
- Primary challenges: weather (winter injury, wet spring/fall, dry summer), marketing



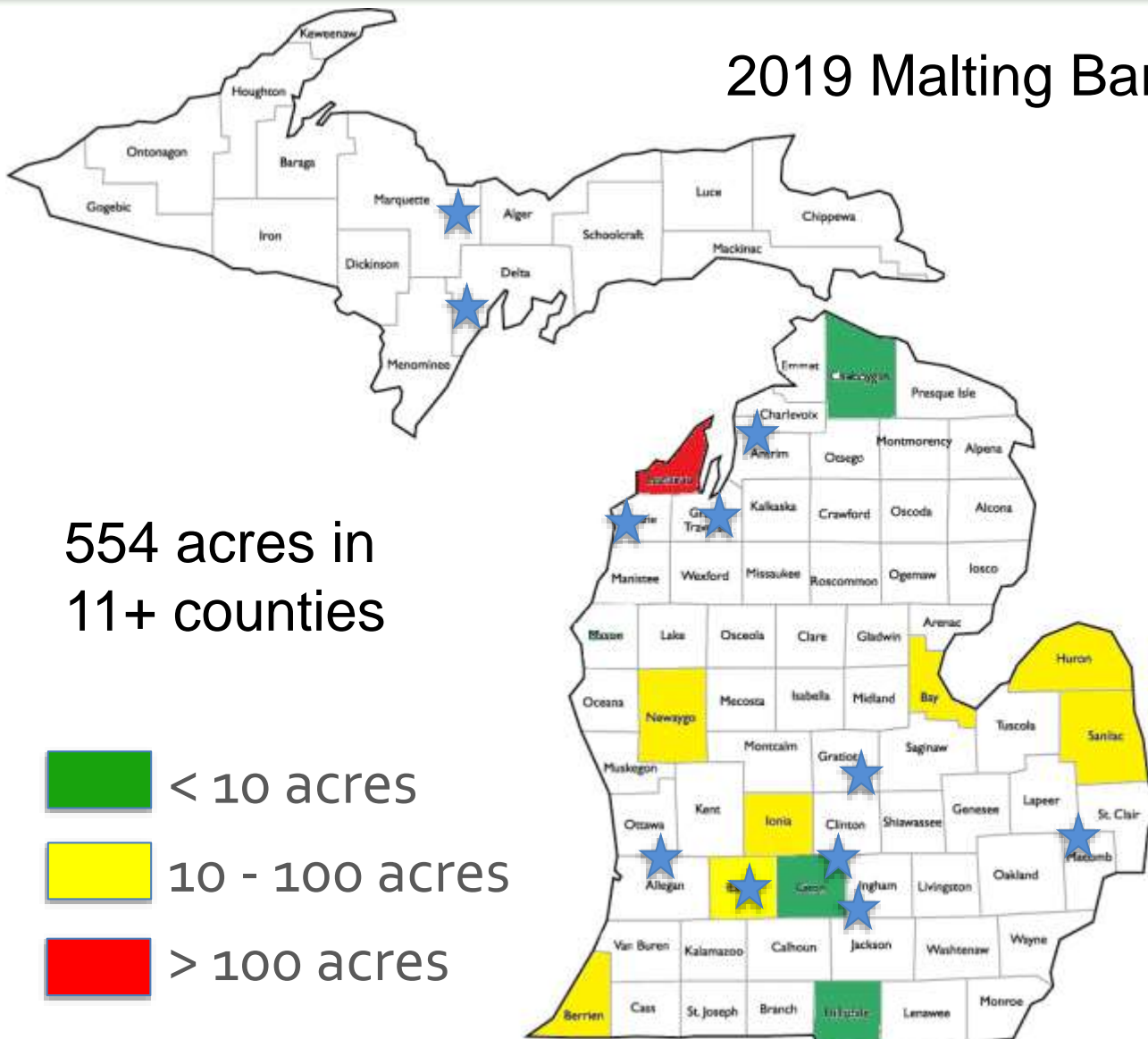
Michigan Malting Barley Acreage Trend

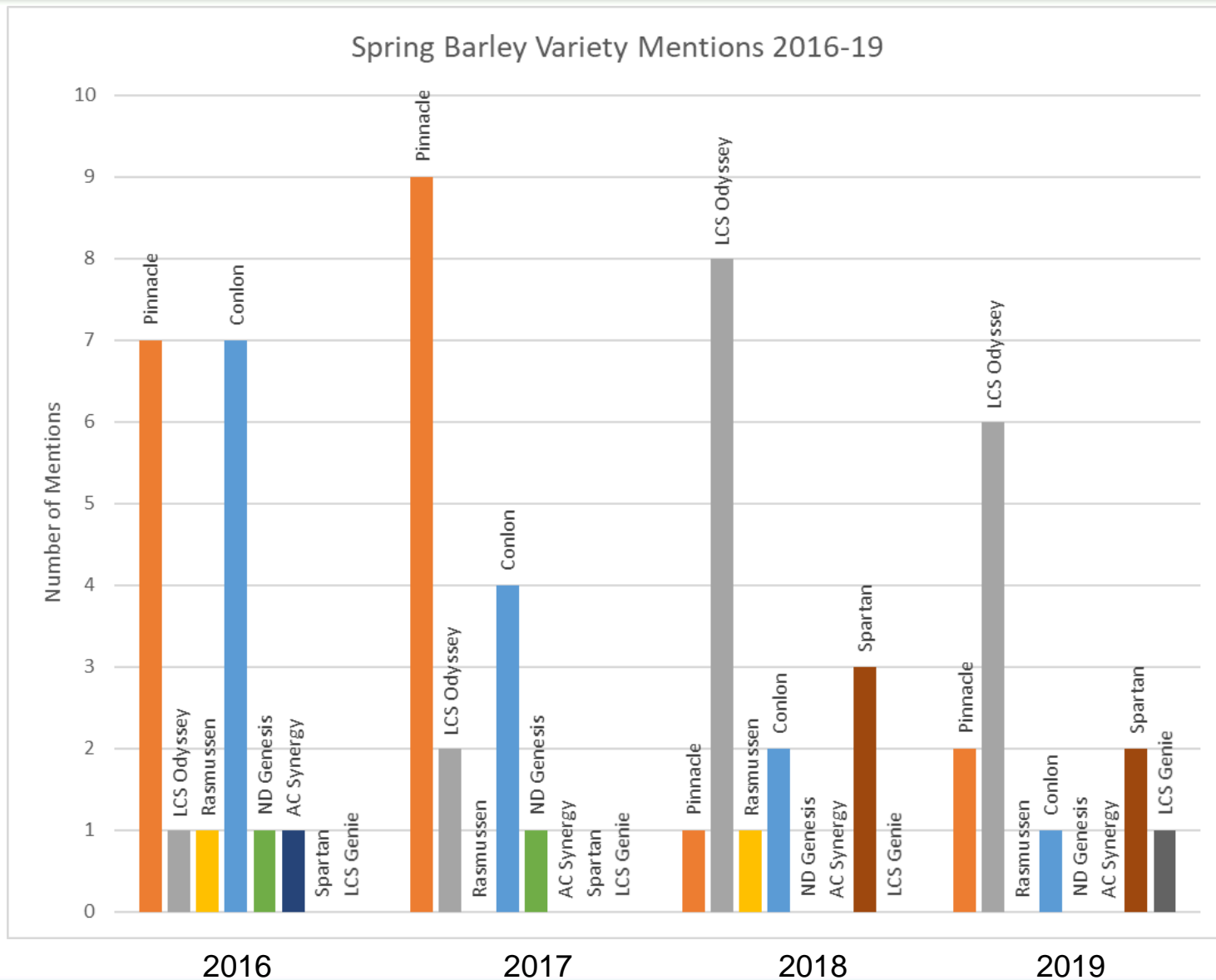


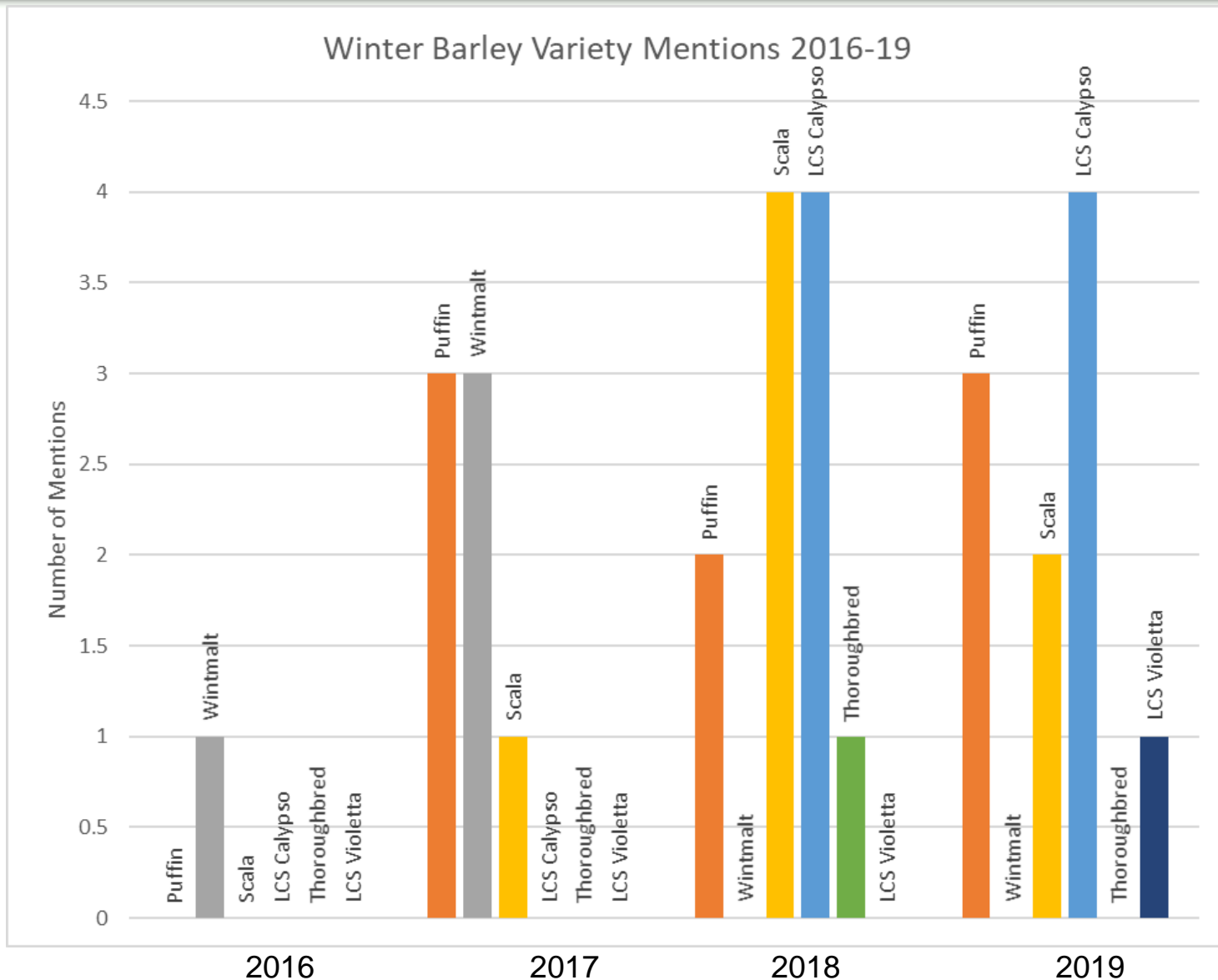
2017 Malting Barley Acres



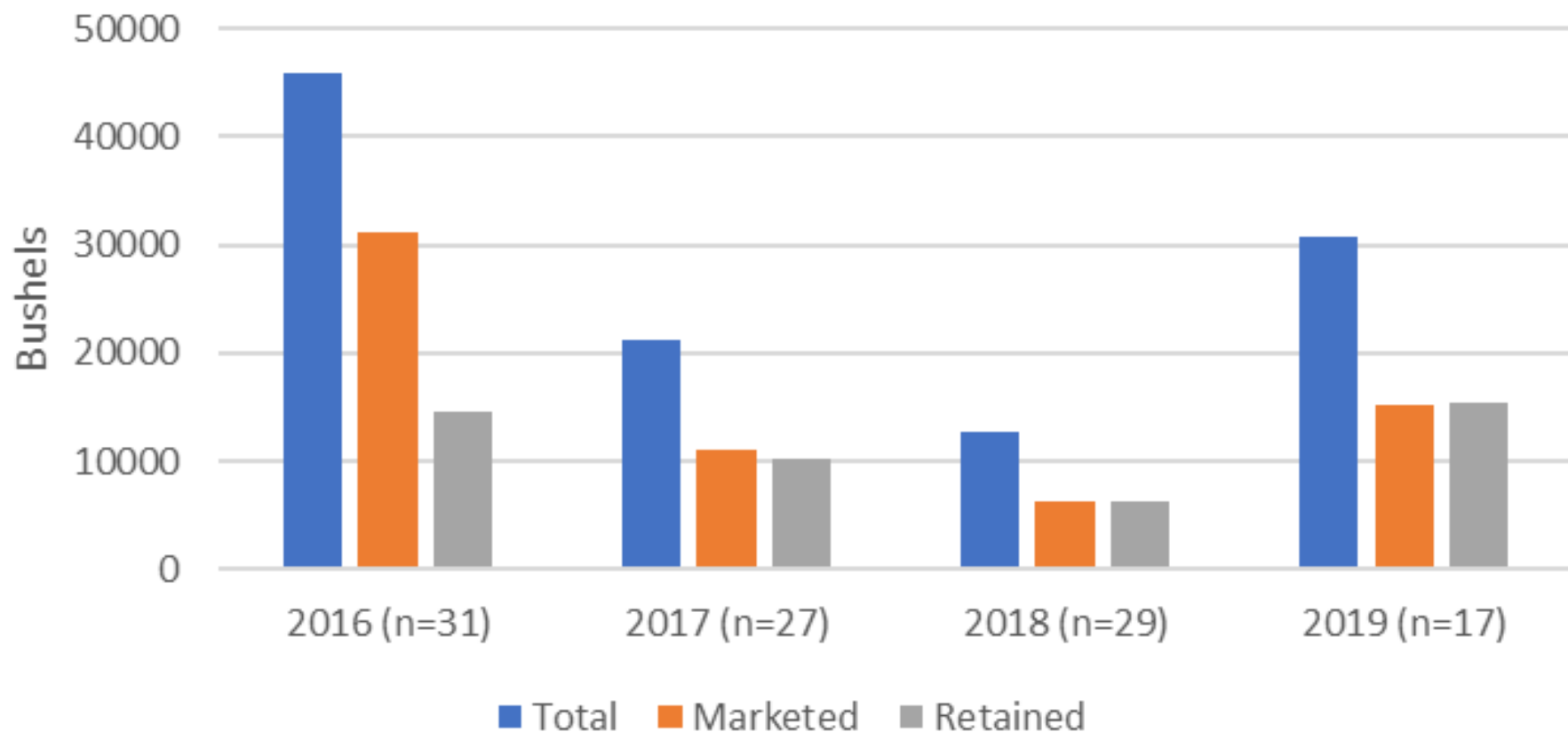
2019 Malting Barley Acres



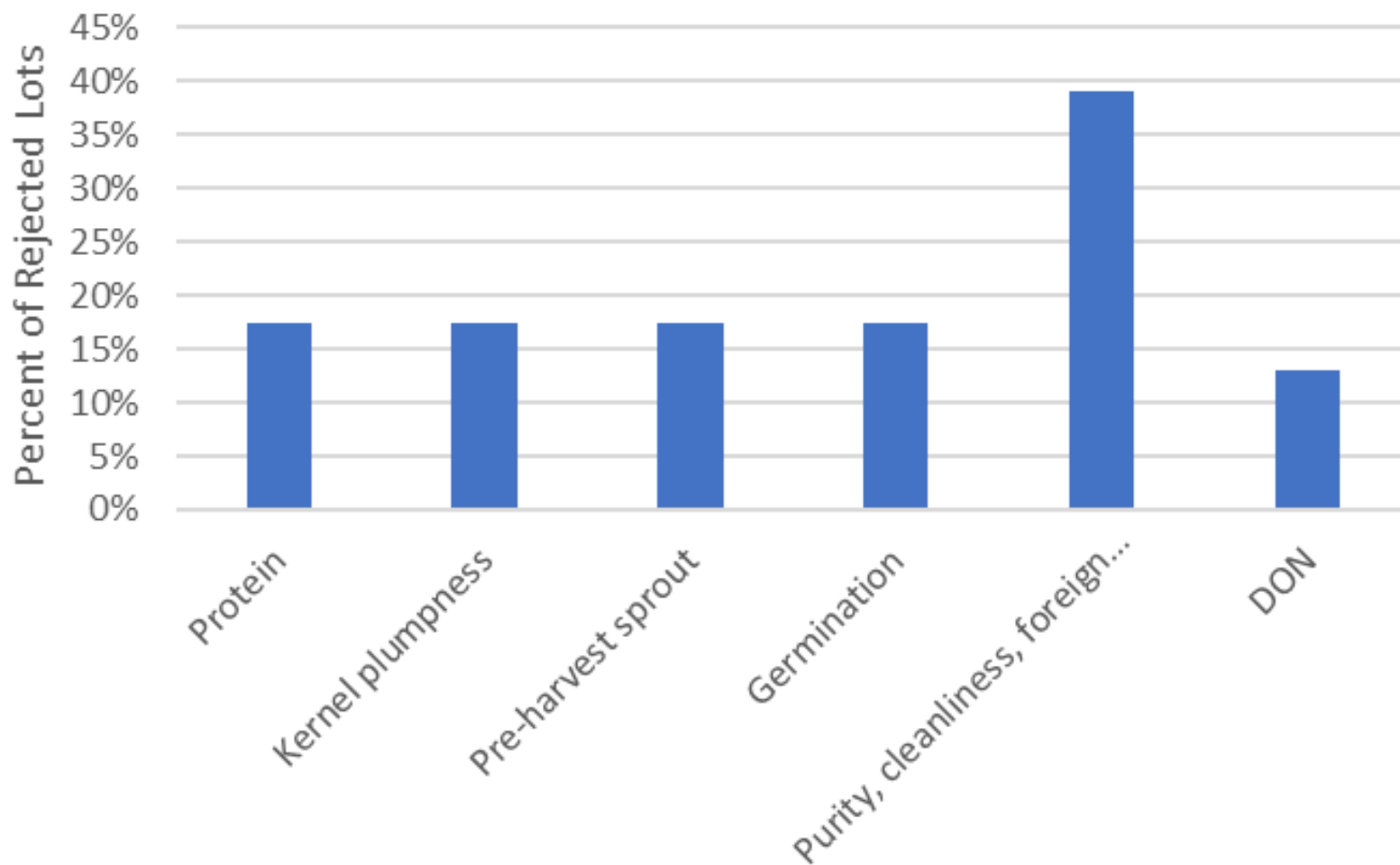




Michigan Malting Barley Production and Marketing Trend



Quality Factors Causing Rejection 2016-2019



Grower comments from 2019

- “Malting barley production in the Upper Peninsula is do-able, but no markets are available.”
- “I am still dedicated to grow barley on a production scale once I acquire the aforementioned necessities. I am very grateful that there is a group of dedicated growers and researchers in Michigan to once again establish malting barley.”
- “Looking for varieties of all brewing grains that exhibit winterkill resistance, Fusarium resistance, and pre-sprout resistance; that grow well in Michigan and produce world-class quality malt.”
- “Until consumers realize their beer is mostly foreign, out of state grain, and hold brewers accountable, malt barley is not a viable crop in MI.”
- “I haven't planted barley yet, but am considering it.”

MSU Malting Barley Team



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Baas



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Kapp



Martin
Nagelkirk



Nicole
Shriner



Martin
Chilvers



Ryan
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https://www.canr.msu.edu/malting_barley/

Project GREEN



Michigan State University



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