2016 MSU Malting Barley Research

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MSU-UPREC

Why malting barley?

- High interest among craft brewers for terroir and sourcing local products
- Michigan #5 in the nation in total number of breweries, brewpubs and microbreweries
- 1932- 303,000 acres
- 1985 - 55,000 acres
- 2015- 6,000 acres

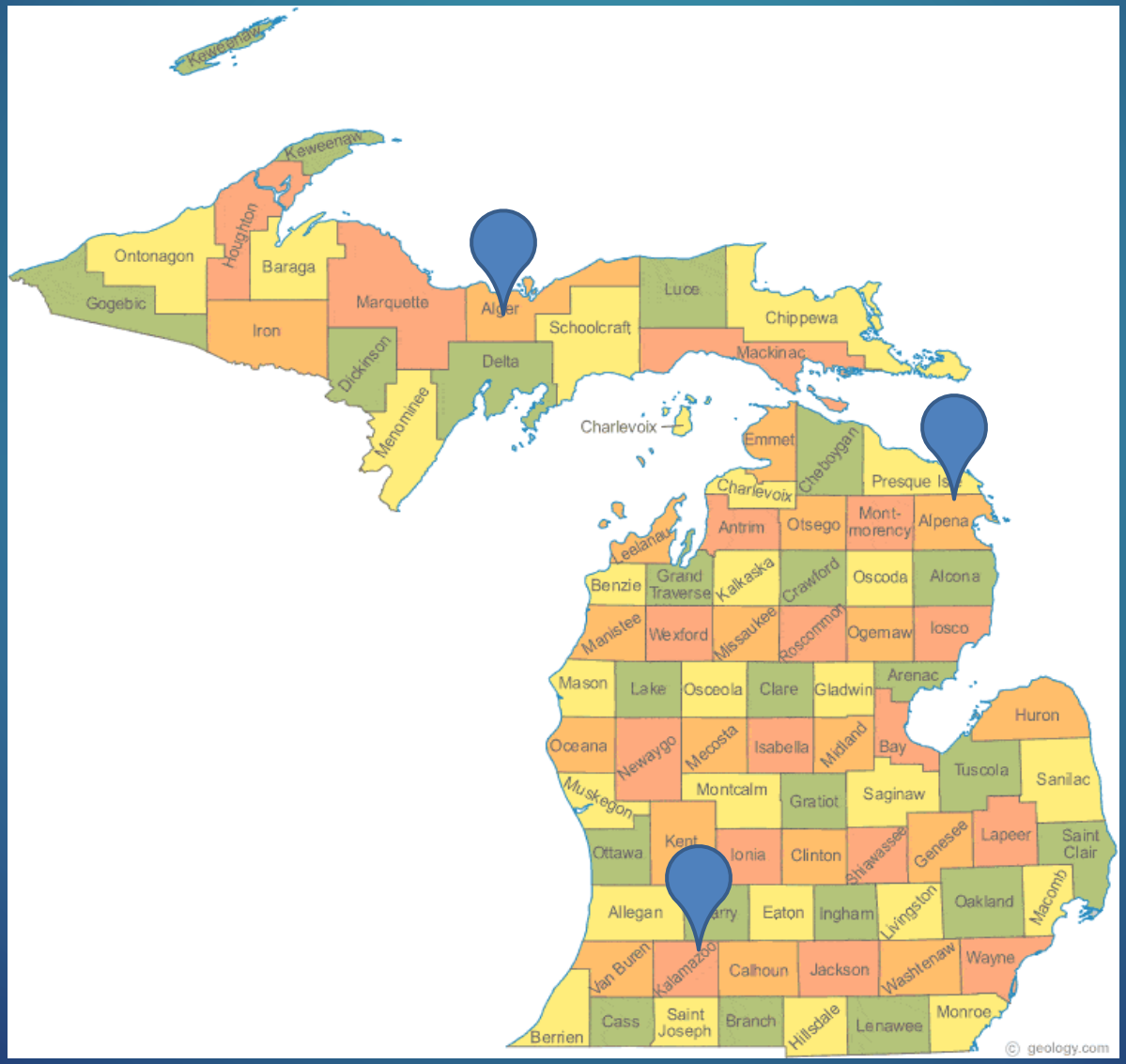
Research conducted in 2016

- ESBN nursery-collaborative effort across 10 states, 3 locations in MI
- N-rate trial
- Seeding rate trial
- Early harvest trial
- Genomic selection for local cereal production (U.K. Heritage trial)

ESBN

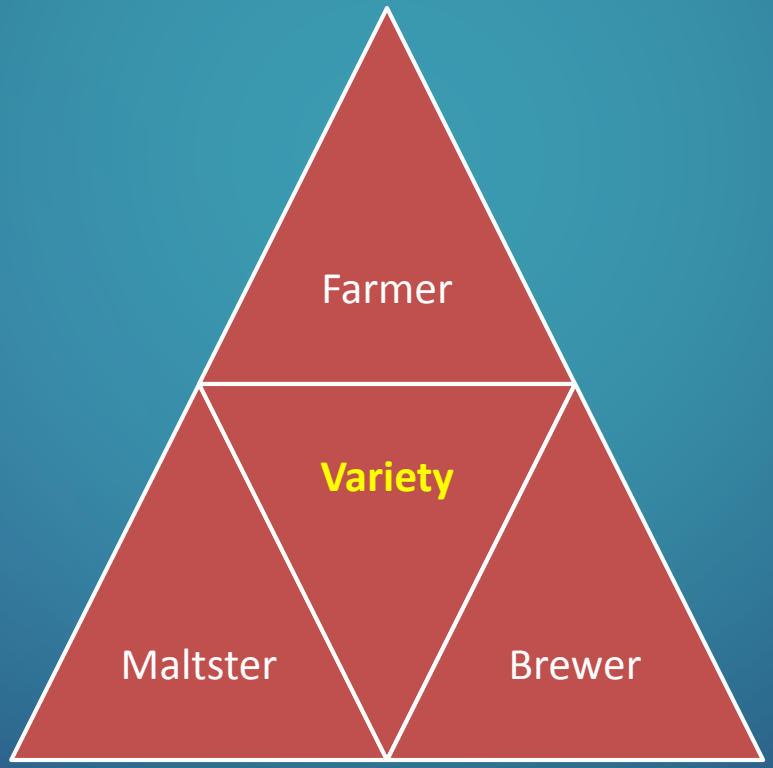
- Eastern Spring Barley Nursery
- 10 states-MI, ND, OH, ME, VT, MA, NJ, PA, IN, NY
- Administered by NDSU
- Purpose-research the adaptability of spring barley cultivars within the Midwest and eastern seaboard with regards to yield and quality
- 3 sites in MI-Chatham, Posen, Hickory Corners

ESBN MI locations



Our challenge

- Identifying promising barley varieties that please the farmer, maltster and brewer



What does everyone want?

- Farmer- YIELD!
- Maltster- quick and high germination (95%), acceptable CP (10-12%), low DON (<1 ppm), high plump (>90%)
- Brewer- high extract, beta-glucan, alpha amylase, S/T, DP, color, etc.
- = Excellent tasting beer

Weather

- Plays a significant role
- Impacts potential yield
- Pre-harvest sprout
- Grain weathering
- High temps (>90 F) may raise crude protein

2016 weather

	Chatham		Posen		Hickory Corners	
	Precip. (in.)	GDD[1]	Precip. (in.)	GDD	Precip. (in.)	GDD
May	3.09	248.2	1.67	328.6	4.16	491.2
June	2.91	608.4	1.30	733.5	1.6	1046.9
July	2.08	1151.1	0.92	1358	4.46	1762.7
Total	**8.08**		**3.89**		**10.22**	
Avg	7.99[2]	1093[3]	8.24	1264	10.7	1738

[1] GDD (Base level 50°) since 1/1/16

[2] 6-year rainfall summary from May 1 – July 31

[3] 6-year GDD average from January 1 – July 31

ESBN agronomics

Agronomic Information	Chatham	Posen	Hickory Corners
Soil Type	Eben Very cobbly sandy loam	Omena Fine sandy loam	Kalamazoo Loam
Previous Crop	Soybeans	Soybeans	Soybeans
Planting Date	5-3-2016	5-10-2016	4-26-2016
Fertility applied	108 lbs/ac of 46-0-0	108 lbs/ac of 46-0-0	125 lbs/ac of 46-0-0
Herbicide applied	13.5 ozs/ac Huskie	13.5 ozs/ac Huskie	13.5 ozs/ac Huskie
Fungicide applied	8.2 ozs/ac Prosaro	8.2 ozs/ac Prosaro	7 ozs/ac Prosaro
Insecticide applied	NA	NA	3.2 ozs/ac Grizzly Z
Harvest date	8-17-2016	8-10-2016	8-1-2016

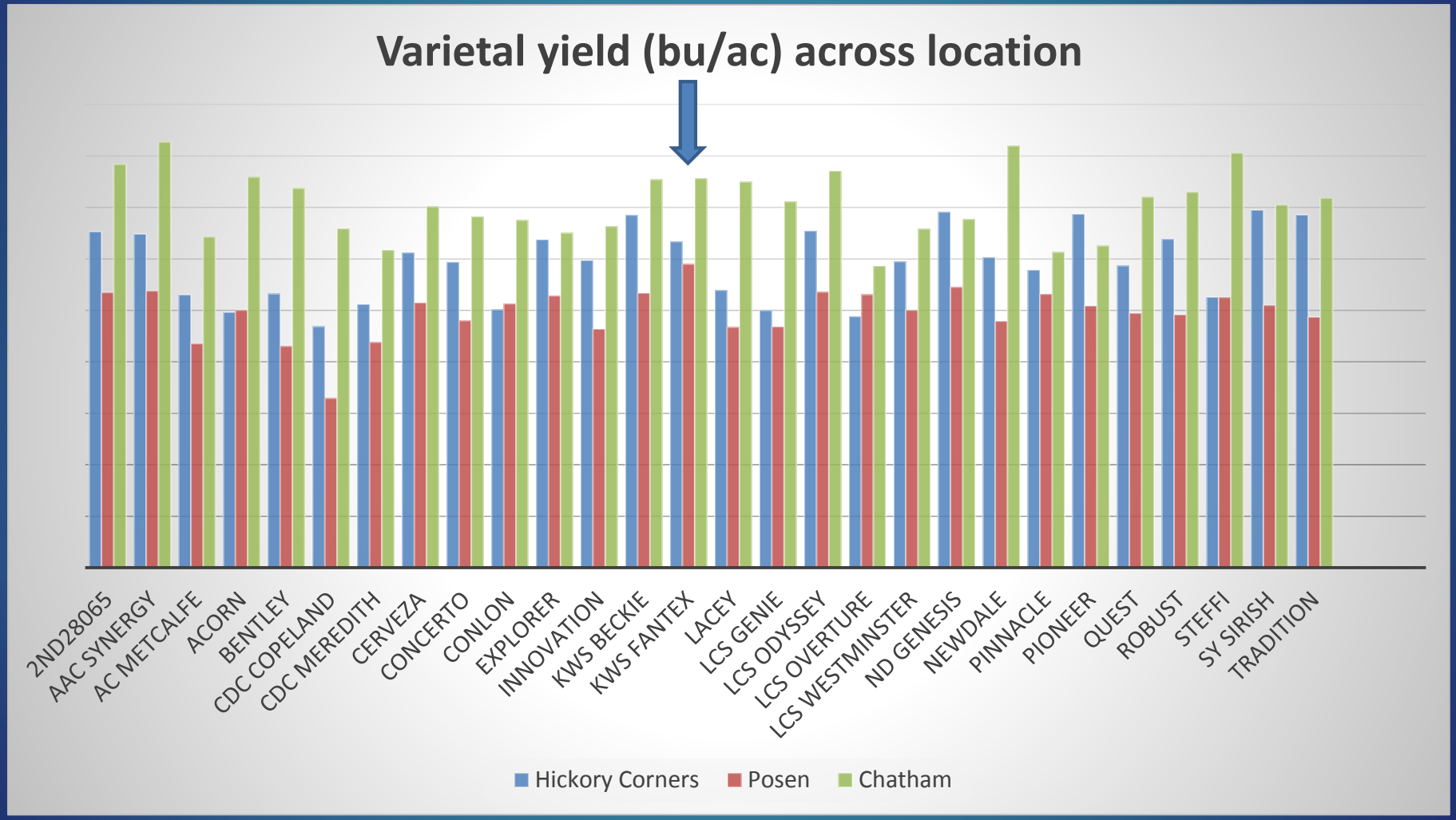
Images

Results/Discussion

Location	Mean Yield (bu/ac)	Protein (%)	Plump (%)	RVA
Chatham	71.5	13.6	93.7	73
Hickory Corners	59.1	14.3	70.3	91
Posen	49.8	12.4	85.6	178

- Posen only site across state to be micro-malted at NDSU
- PHS and high CP severely impacted Chatham, Hickory Corners
- Promising varieties- KWS Fantex, LCS Odyssey
- Certified seed of LCS Odyssey will be grown in 2017

Yield across location



Posen Agronomic Results

Variety	Heading Date	% Moisture	Test weight	Height (in)	Yield (Bu/ac)
2ND28065	7/7/2016	11.7	53.3	22.0	53.5
AAC Synergy	7/10/2016	11.4	53.2	17.7	53.8
AC Metcalfe	7/9/2016	11.5	52.1	22.6	43.5
Acorn	7/11/2016	11.4	53.6	22.0	50.1
Bentley	7/3/2016	11.9	49.8	21.9	43.0
CDC Copeland	7/14/2016	12.0	49.7	16.8	32.9
CDC Meredith	7/4/2016	11.7	49.5	21.4	43.8
Cerveza	7/7/2016	11.7	50.6	21.3	51.5
Conlon	7/1/2016	11.4	52.6	22.4	51.3
Explorer	7/8/2016	11.8	52.7	20.3	52.8
Innovation	6/29/2016	11.0	50.1	22.0	46.4
KWS Beckie	7/8/2016	11.4	52.6	18.8	53.4
KWS Fantex	7/8/2016	11.6	53.1	20.0	59.0
Lacey	7/1/2016	11.4	50.8	23.3	46.7
LCS Concerto	7/11/2016	11.7	53.0	19.5	48.0
LCS Genie	7/11/2016	11.4	53.0	18.4	46.8
LCS Odyssey	7/11/2016	11.8	52.4	21.1	53.6
LCS Overture	7/12/2016	11.3	53.0	21.6	53.1
LCS Westminster	7/7/2016	11.4	53.9	21.7	50.0
ND Genesis	7/5/2016	11.8	54.0	22.3	54.5
Newdale	7/11/2016	11.7	51.9	21.7	47.9
Pinnacle	7/4/2016	11.4	53.3	20.0	53.2
Pionier	7/12/2016	11.7	52.3	20.3	50.9
Quest	6/28/2016	11.2	51.3	22.6	49.4
Robust	6/30/2016	11.5	51.1	22.0	49.2
Steffi	7/8/2016	11.4	52.1	20.8	52.5
SY Sirish	7/10/2016	11.2	51.6	21.3	51.0
Tradition	6/30/2016	10.9	50.8	19.6	48.7
Mean	**7/7/2016**	**11.5**	**52.0**	**20.9**	**49.8**

Posen Quality Results

Variety	Type	DON	Protein	RVA	% Plump
2ND28065	2	0.0	11.9	166	91.1
AAC Synergy	2	0.0	12.2	153	91.2
AC Metcalfe	2	0.0	13.2	202	78.0
Acorn	2	0.0	12.1	176	93.2
Bentley	2	0.0	13.1	197	76.8
CDC Copeland	2	0.0	13.2	188	83.1
CDC Meredith	2	0.0	13.2	175	71.2
Cerveza	2	0.0	12.1	195	69.4
Conlon	2	0.0	12.5	158	92.5
Explorer	2	0.0	12.2	187	93.8
Innovation	6	0.0	13.2	179	80.7
KWS Beckie	2	0.0	12.6	202	90.4
KWS Fantex	2	0.0	11.8	175	85.3
Lacey	6	0.0	12.7	174	76.3
LCS Concerto	2	0.0	12.6	204	94.7
LCS Genie	2	0.0	12.5	183	90.7
LCS Odyssey	2	0.0	11.9	179	94.6
LCS Overture	2	0.0	11.7	153	92.4
LCS Westminster	2	0.0	12.6	174	94.7
ND Genesis	2	0.0	10.9	129	91.3
Newdale	2	0.0	12.8	179	67.2
Pinnacle	2	0.0	10.9	179	89.8
Pionier	2	0.0	12.3	171	91.5
Quest	6	0.0	12.8	197	78.1
Robust	6	0.0	12.6	202	74.3
Steffi	2	0.0	12.5	173	90.0
SY Sirish	2	0.0	12.8	170	95.8
Tradition	6	0.0	13.1	169	79.6
Mean		**0.0**	**12.4**	**178**	**85.6**

My No.1 take-home

- Better to have high quality, lower yielding barley than bin busting low quality feed barley

N-rate study

Why?

Pinpoint most economical, efficient rate with respect to Yield and CP.

CP is defined as the approximate amount of protein in foods that's calculated from the determined nitrogen (N) content by multiplying by a factor derived from the average percentage of nitrogen in the food proteins (Merriam-Webster, 2017).

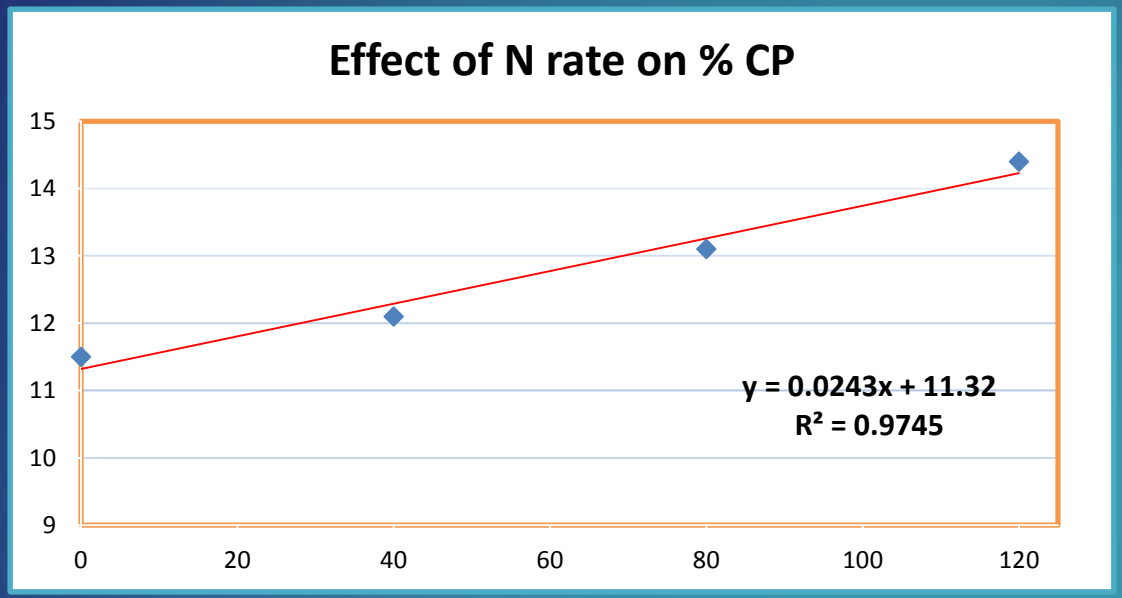
Higher CP, lower available extract, lower amount of sugars-very important for brewers

Methods

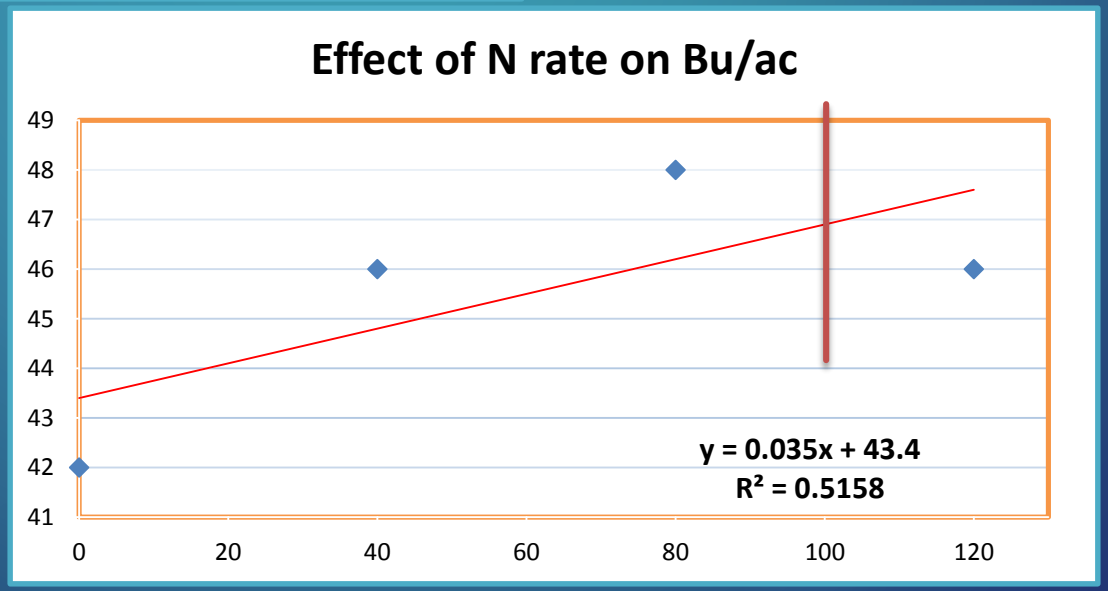
- 4 rates- 0, 40, 80, 120 lbs/acre total N
- Used LCS Odyssey as variety
- Applied at planting in the form of urea (46-0-0)
- Planted on 5-10-16, harvested on 8-10-16
- Samples cleaned, and then ran for CP % using a Foss Infratec Nova

Images

Results



Rate	Bu/ac	% CP
0	42	11.5
40	46	12.1
80	48	13.1
120	46	14.1



Discussion

- Further research needs to be conducted in order to pinpoint rate
- Difficult to make recommendations with only one year of data
- Project GREEEN grant written-hopefully to be continued-3 locations, intensive N monitoring
- Stick with 40-50 lbs N/ac

Seeding rate study

- Purpose- Investigate 6 seeding rates using seeds/acre.
- Previous recommendation-seeding rate's based on weight
- Why not recommended?
- Large variation in seed size, can result in over or under planting.

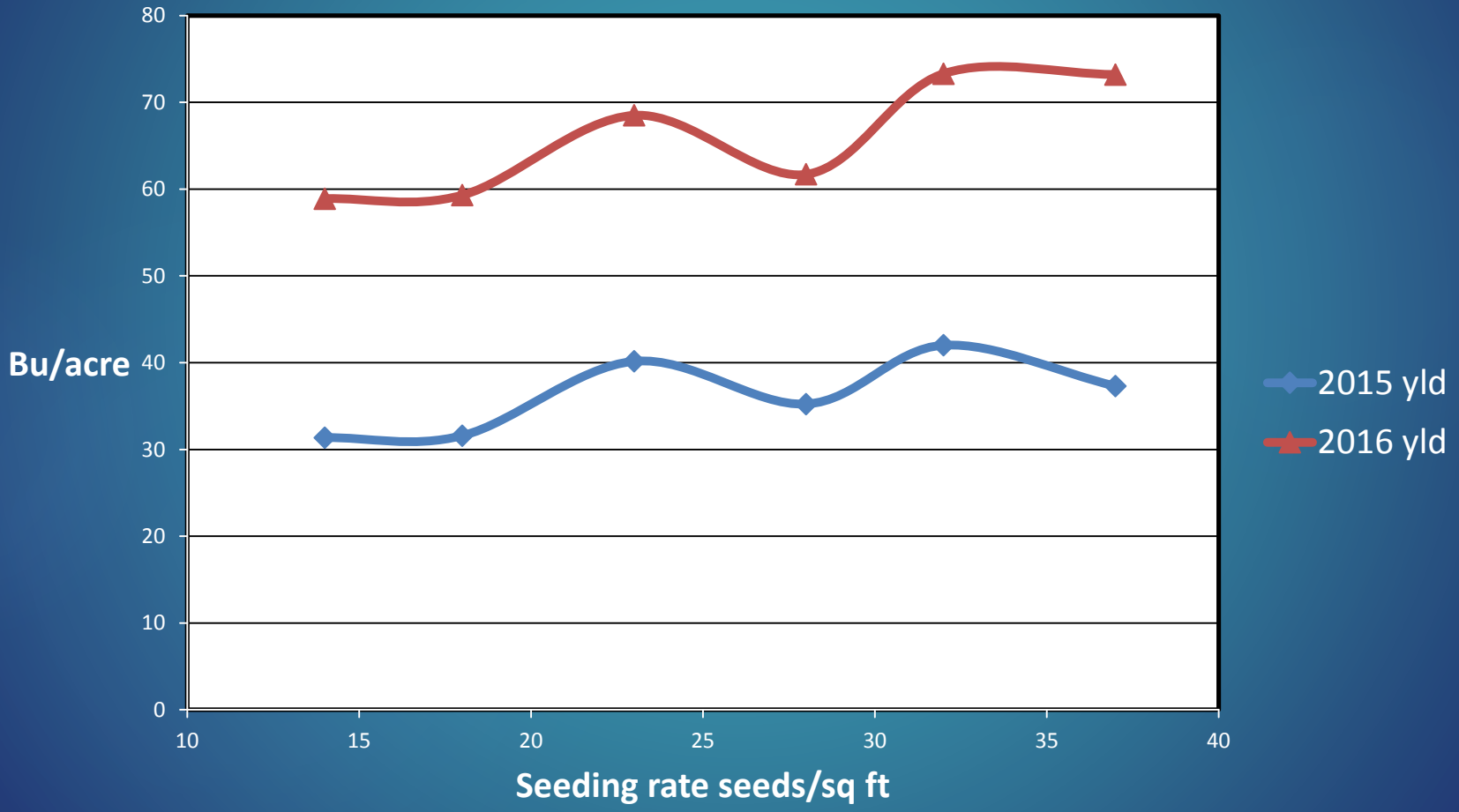
Seed size variation

Variety	Seeds/lb	Planting rate (seeds/acre) When based on 96 lbs/ac
LCS Odyssey	**7,757**	744,648
LCS Overture	8,449	811,085
KWS Fantex	8,675	832,755
KWS Beckie	8,691	834,347
Steffi	9,183	881,543
Bentley	9,509	912,895
Lacey	11,806	113,3412
Tradition	12,285	117,9361
AC Metcalfe	12,318	118,2557
Innovation	12,352	118,5771
Robust	12,591	120,8764
Quest	**13,062**	125,3918

2016 results

Seeds/ac	Seeds/sq ft	Yield (bu/ac)	Test weight	Protein (%)	Plump (%)
609,840	14	58.9	49.1	12.7	90.7
784,080	18	59.3	49.8	12.8	91.2
1,001,880	23	68.5	48.9	12.4	91.3
1,219,680	28	61.7	49.2	12.5	93.9
1,393,920	32	73.3	49.3	12.5	92.9
1,611,720	37	73.2	48.9	12.4	93.9

Compared yield (2015-2016)



Pre-harvest sprout trial

- Purpose- Investigate the feasibility of harvesting at high moistures (15-20%)
- Why-To mitigate the severity of pre-harvest sprout, top quality concern in Michigan
- Researched other tested methods, which included early harvest, swathing

Results

Type	% moisture at harvest	% moisture 1 week after harvest	% moisture 2 weeks after harvest	% moisture 3 weeks after harvest	% moisture 4 weeks after harvest
2	17.8	14.3	14.8	13.9	13.5
6	17.5	13.8	13.8	13.1	13.0

Discussion

- Swathing not recommended due to overlong exposure of grain to heavy dews and rainfall
- Average yield loss of 50% when compared to control
- High moisture harvest may be possible **IF** the correct drying equipment is available

Genomic selection for local cereal production

- Collaboration with John Innes Center, Norwich UK
- Testing UK heritage varieties (31)
- Evaluation of lines for traits-primarily *Fusarium* head blight resistance, also pre-harvest sprout resistance
- Treated as a seed increase

Results

Variety	Yield (bu/ac)	DON	Protein	RVA	% Plump
Ankara Tobak	54.0	< 0.3	12.7	141	93.4
Arabische	57.6	< 0.3	13.0	21	86.9
Bavaria	48.6	< 0.3	14.3	60	95.3
Beavans Archer	45.2	< 0.3	13.2	41	91.5
Bere	37.6	< 0.3	11.6	119	79.6
Burtons Malting	31.2	< 0.3	12.8	11	88.6
Chevallier 1	57.0	< 0.3	12.8	88	86.1
Chevallier Chile	48.7	< 0.3	14.0	123	89.7
Chevallier French	40.4	< 0.3	13.1	75	67.8
Djugay	40.4	< 0.3	15.4	67	71.7
Domen	54.5	< 0.3	14.4	108	88.6
Ducksbill	38.0	< 0.3	13.7	110	92.7
Golden Promise	59.6	< 0.3	13.6	6	87.1
Goldthorpe	52.5	<0.3	13.4	21	88.8
Gotlands	47.1	< 0.3	14.0	62	78.7
Guls	46.7	< 0.3	13.9	53	92.8
Hansen 181	44.9	< 0.3	14.4	38	87.2
Kherson	35.8	< 0.3	16.8	6	85
Kitchin	40.9	< 0.3	15.7	5	94.5
Long Eared Nottingham	53.6	< 0.3	13.7	88	90.8
Mestny	36.2	< 0.3	NA	156	95.1
Moravian Barley	47.1	< 0.3	13.1	55	91.4
Nikaku Chevallier	55.5	< 0.3	14.1	61	93.3
Nurnberg	58.4	< 0.3	14.6	41	94
Nutans Moskva	53.7	< 0.3	14.0	72	92.7
Odessa	54.7	< 0.3	13.2	8	78.8
Old Wiltshire	43.8	< 0.3	13.3	113	86
Prior	38.0	< 0.3	14.1	111	95.6
Scotch Common	22.1	< 0.3	12.5	3	92.7
Spratt	34.4	< 0.3	14.0	15	88.7
Swanneck	46.1	< 0.3	14.1	79	85

Discussion

- Will continue in 2017 with a replicated trial
- Addition of up to 20 more varieties
- Continue to screen for FHB and PHS resistance

Special Thanks

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(the godfather)