MSU CEREAL RYE VARIETY TRIALS – 2020 RESULTS

With the support of the Michigan Craft Beverage Council, trials to compare cereal rye varieties were established in the fall of 2019 at three locations in Michigan. Data are being collected to evaluate suitability for use in the distilling industry. Yield, agronomic and quality data were collected at two locations (Hickory Corners and Chatham) and only yield data at one location (Gratiot). Plots included 15 varieties with four replications in a randomized complete block design. Two locations (Hickory Corners and Chatham) included four additional replicates with enhanced management including a plant growth regulator and fungicide application.

Hickory Corners, MI

Variety	Yield (bu/A)	Density (lb/bu)	Heading Date	Height (cm)	Lodging (0-5)[$]	Spring Vigor[#] (0-10)
Normal Management						
AC Hazlet	77.1	53.7	5/26	161.3	3.38	10
Aroostook	54.3	53.1	5/22	178.8	2.75	10
Danko	77.0	54.4	5/25	148.8	1.13	10
Elbon	51.2	55.1	5/22	176.7	2.33	10
FL401	37.0	53.7	5/22	182.5	1.38	9
Guardian	65.6	53.3	5/26	171.3	3.50	10
KWS Bono*	100.1	53.9	5/26	135.0	2.00	10
KWS Brasetto*	99.0	53.6	5/26	135.0	1.38	10
KWS Serafino*	99.7	53.9	5/26	145.0	2.00	10
Maton	48.2	54.8	5/21	176.3	2.63	9.75
Merced	38.8	53.5	5/21	152.5	3.88	8.75
ND Dylan	67.8	52.8	5/27	175.0	3.00	9.75
VNS	71.8	54.0	5/26	161.3	2.00	9.5
Wheeler	34.5	52.1	5/27	202.5	0.13	10
Wrens Abruzzi	41.2	55.0	5/22	173.8	2.75	10
Normal Mean	**64.4**	**53.8**	**5/24**	**164.8**	**2.28**	**9.76**
Enhanced Management						
AC Hazlet	70.8	54.3	5/26	166.3	3.00	10
Aroostook	54.5	54.3	5/22	177.5	2.63	10
Danko	78.4	55.1	5/26	146.3	0.75	10
Elbon	50.8	55.2	5/22	174.0	2.40	10
FL401	35.4	54.3	5/21	176.3	2.50	9
Guardian	71.3	54.6	5/25	167.5	2.75	10
KWS Bono*	103.8	54.5	5/26	130.0	1.25	10
KWS Brasetto*	108.4	54.4	5/26	138.8	0.38	10
KWS Serafino*	112.4	54.5	5/26	130.0	0.63	10
Maton	47.0	55.6	5/21	175.0	3.00	9.75
Merced	44.6	54.9	5/21	150.0	3.50	8.75
ND Dylan	60.8	53.6	5/26	171.3	2.88	9.75
VNS	69.3	54.7	5/26	160.0	1.50	9.5
Wheeler	37.3	52.8	5/26	197.5	0.13	10
Wrens Abruzzi	56.4	55.5	5/23	171.3	2.75	10
Enhanced Mean	66.5	54.6	5/24	162.3	2.01	9.79

* Hybrid variety; All others open pollinated

[$] 0 = no lodging, 5 = all plants flat on ground

HICKORY CORNERS TRIAL DETAILS

Planting date: 10/15/19

Fertility: 10/8/19 – 32 lbs N/A, 52 lbs P/A, 12 lbs S/A:

4/3/20 - 70 lbs N/A, 10 lbs S/A

Plant Growth Regulator (Enhanced Management Only): 4/27/20 14.4 oz/A Palisade EC

Fungicide (Enhanced Management Only): 5/27/20 13.7 oz/A Miravis Ace

Harvest: 7/23/2020

Growing season conditions: April and May were cool and moist but June was warm and dry.

Research site details:

W.K. Kellogg Biological Station (KBS): Project managed by Brook Wilke, Dean Baas, Josh Dykstra, Christian Kapp

Previous crop: Soybeans

Soil type: Kalamazoo Sandy Loam

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MSU CEREAL RYE VARIETY TRIALS – 2020 RESULTS

Chatham, MI

Variety	Yield (bu/A)	Density (lb/bu)	Heading Date	Height (cm)	Lodging (0-5)[$]	Spring Vi-gor[#] (0-10)
Normal Management						
AC Hazlet	35.84	55.13	6/13	121.9	2.25	9.75
Aroostook	30.71	54.03	6/12	130.8	3.25	8.00
Danko	28.16	54.75	6/16	108.6	1.25	4.25
Elbon	15.80	53.80	6/13	123.8	3.00	3.00
FL401	NA	NA	NA	NA	NA	1.50
Guardian	31.43	54.05	6/14	126.4	3.25	7.75
KWS Bono*	40.57	54.65	6/16	92.1	1.50	7.25
KWS Brasetto*	39.18	54.15	6/17	101.0	1.25	5.50
KWS Serafino*	36.46	54.80	6/17	101.6	1.25	5.00
Maton	25.66	54.03	6/13	127.6	3.50	5.25
Merced	NA	NA	NA	NA	NA	1.50
ND Dylan	40.19	54.58	6/14	129.5	3.00	9.25
VNS	31.20	54.33	6/15	120.0	3.25	6.25
Wheeler	21.64	51.33	6/17	142.2	1.50	6.00
Wrens Abruzzi	31.98	55.33	6/12	128.3	3.75	5.75
Normal Mean	31.45	54.23	**6/14**	**119.5**	**2.46**	**5.73**
Enhanced Management						
AC Hazlet	53.39	56.13	6/17	100.3	1.50	9.50
Aroostook	38.53	54.75	6/15	115.6	2.75	7.50
Danko	30.93	55.08	6/18	102.2	1.25	4.25
Elbon	25.59	52.33	6/15	119.4	3.75	2.75
FL401	NA	NA	NA	NA	NA	1.75
Guardian	43.41	56.93	6/17	105.4	1.50	9.25
KWS Bono*	28.89	54.40	6/19	83.8	1.75	5.25
KWS Brasetto*	40.17	54.60	6/20	92.1	2.00	5.25
KWS Serafino*	53.44	55.85	6/16	80.6	1.25	8.25
Maton	23.12	55.00	6/15	125.1	4.00	3.00
Merced	NA	NA	NA	NA	NA	1.50
ND Dylan	49.06	55.00	6/17	109.2	2.00	9.75
VNS	38.46	55.15	6/18	102.2	2.25	6.75
Wheeler	23.53	52.58	6/20	123.2	1.00	6.25
Wrens Abruzzi	34.78	56.43	6/16	113.0	3.00	6.75
Enhanced Mean	37.18	54.94	**6/17**	**105.6**	**2.15**	**5.85**

* Hybrid variety; All others open pollinated

[$] 0 = no lodging, 5 = all plants flat on ground

CHATHAM TRIAL DETAILS

Planting date: 9/26/19

Fertility: 5/12/20 - 70 lbs N/A, 10 lbs S/A

Plant Growth Regulator (Enhanced Management Only): 6/3/20 14 oz/A Palisade EC

Fungicide (Enhanced Management Only): 7/16/20 8.2 oz/A Prosaro

Harvest: 8/25/2020

Growing season conditions: 2020 was warmer and wetter than average in the Upper Peninsula

Research site details:

Upper Peninsula Research and Extension Center (UPREC): Project managed by James DeDecker, Christian Kapp, Andrew Bahrman

Previous crop: Corn

Soil type: Eben very cobbly sandy loam

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MSU CEREAL RYE VARIETY TRIALS – 2020 RESULTS

Gratiot County, MI

Variety	Yield (bu/A)	Density (lb/bu)
AC Hazlet	77.8	54.5
Aroostook	63.9	53.4
Danko	80.2	53.6
Elbon	48.5	51.4
FL401	36.4	41.1
Guardian	79.6	54.1
KWS Bono*	108.0	55.9
KWS Brasetto*	103.5	55.2
KWS EXP-B*	107.4	54.7
KWS ProPower*	100.5	54.9
Maton	50.6	49.5
Merced	35.4	44.6
ND Dylan	72.8	53.9
Wheeler	42.8	50.1
Wrens Abruzzi	58.1	54.7
Mean	**71.0**	**52.1**

* Hybrid variety; All others open pollinated

Yield data from Hickory Corners and Gratiot show up to a three-fold difference in average yield between the hybrid varieties and varieties typically used for cover crops or forage (e.g. Wheeler, FL401, Merced). Other open pollinated varieties that have been developed for grain production (e.g. Danko, AC Hazlet) yielded more than the lowest yielding varieties, but less than the hybrids. Furthermore, enhanced management in Hickory Corners influenced the hybrid variety characteristics but not the open pollinated varieties. Statistical analyses are being completed to quantify these potential differential effects of enhanced management on grain yield and other characteristics.

Data from the Chatham location show a slightly different trend. Grain yields were lower overall compared to the other sites, and the hybrid varieties yielded similar to the higher producing open pollinated varieties. Two varieties (FL401 and Merced) did not survive the winter at Chatham. Enhanced management at Chatham also had a larger overall impact on yield and plant characteristics compared to the Hickory Corners site.

Grain quality, spirit yield, and sensory analyses are also being completed on the varieties grown in Hickory Corners, Gratiot and Chatham. These laboratory analyses will take some additional time, but we will continue to update this publication with information as it becomes available.

GRATIOT COUNTY TRIAL DETAILS

Planting date: 10/20/19

Fertility: 10/19/19 – 20 lbs N/A, 80 lbs P/A, 80 lbs K/A:

3/17/20 - 90 lbs N/A, 15 lbs S/A

Fungicide: 5/22/20 8.0 oz/A Delaro, 6/8/20 8.0 oz/a Prosaro + NIS

Harvest: 7/22/2020

Research site details:

Crumbaugh Legacy Farms near Breckenridge, MI. Rye was planted adjacent to the MSU Wheat Performance Trials

Previous crop: Soybeans

Soil type: Parkhill loam, 0 to 1 percent slopes

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MSU CEREAL RYE VARIETY TRIALS – 2020 QUALITY

Protein

Variety	HC Protein (%)	CH Protein (%)	GR Protein (%)	Average Protein (%)
FL401	12.5		15.7	14.1
Merced	10.9		16.1	13.5
Wheeler	12.6	13.8	14.1	13.5
Maton	11.3	13.3	13.6	12.7
Elbon	11.5	12.5	13.2	12.4
Aroostook	10.4	12.4	12.0	11.6
Wrens Abruzzi	10.5	12.2	12.0	11.6
Guardian	9.2	11.3	10.5	10.3
Danko	8.8	11.1	10.7	10.2
VNS	9.1	11.2		10.2
AC Hazlet	8.9	11.3	9.9	10.0
ND Dylan	8.9	10.9	10.1	10.0
KWS ProPower*			9.7	9.7
KWS Bono	8.2	10.0	9.3	9.2
KWS Brasetto*	8.0	10.3	9.2	9.2
KWS-EXP-B*			8.9	8.9
KWS Serafino*	7.7	9.5		8.6

Spirit Yield

Variety	HC Spirit Yield LAA/tonne	CH Spirit Yield LAA/tonne	GR Spirit Yield LAA/tonne	Average Spirit Yield LAA/tonne
KWS Bono	387	375	374	378.7
KWS Serafino*	381	370		375.5
AC Hazlet	384	367	370	373.7
VNS	380	366		373.0
KWS-EXP-B*			372	372.0
Danko	380	365	366	370.3
KWS ProPower*			369	369.0
Guardian	380	361	364	368.3
KWS Brasetto*	379	360	366	368.3
ND Dylan	376	365	361	367.3
Aroostook	365	357	351	357.7
Wrens Abruzzi	371	350	351	357.3
Elbon	358	351	346	351.7
Wheeler	358	352	343	351.0
Maton	360	350	342	350.7
Merced	362		330	346.0
FL401	352		327	339.5

* Hybrid variety; All others open pollinated

Sites: HC = Hickory Corners, CH = Chatham, GR = Gratiot County

GRAIN QUALITY

Cereal rye intended for distilling has two primary quality metrics of interest; spirit yield and flavor. These metrics were analyzed through a partnership with the Hartwick Center for Craft Beverage.

The Predicted Spirit Yield represents the maximum theoretical alcohol production potential of the grain on a per weight basis. The units are Litres of Absolute Alcohol (at 200° Proof) per metric tonne.

Hartwick College | Center for Craft Food & Beverage

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MSU CEREAL RYE VARIETY TRIALS – 2020 QUALITY

GRAIN QUALITY

The desirable 'spicy' aroma characteristic of rye new make spirit is due to certain phenolic compounds. In particular, 4-vinyl guaiacol (4-VG) is produced by yeast by the metabolism of ferulic acid (FA), which is abundant in rye grain.

Flavor (4-VG)

	HC	CH	GR	Average
Variety	4-VG (mg/L)	4-VG (mg/L)	4-VG (mg/L)	4-VG (mg/L)
FL401	5.9		9.0	7.5
Wheeler	5.5	7.7	6.1	6.4
Merced	5.7		6.9	6.3
Maton	4.3	6.8	6.2	5.8
AC Hazlet	4.5	7.1	5.4	5.7
Elbon	5.3	5.8	5.9	5.7
Wrens Abruzzi	5.1	6.2	5.5	5.6
Aroostook	5.0	6.2	5.4	5.5
Guardian	5.2	6.0	5.1	5.4
VNS	4.4	6.1		5.3
ND Dylan	4.9	5.8	5.0	5.2
KWS Serafino*	4.2	5.7		5.0
Danko	3.9	6.4	4.4	4.9
KWS Brasetto*	4.0	5.5	4.5	4.7
KWS ProPower*			4.7	4.7
KWS Bono	3.6	5.1	3.8	4.2
KWS-EXP-B*			4.1	4.1

* Hybrid variety; All others open pollinated

Sites: HC = Hickory Corners, CH = Chatham, GR = Gratiot County

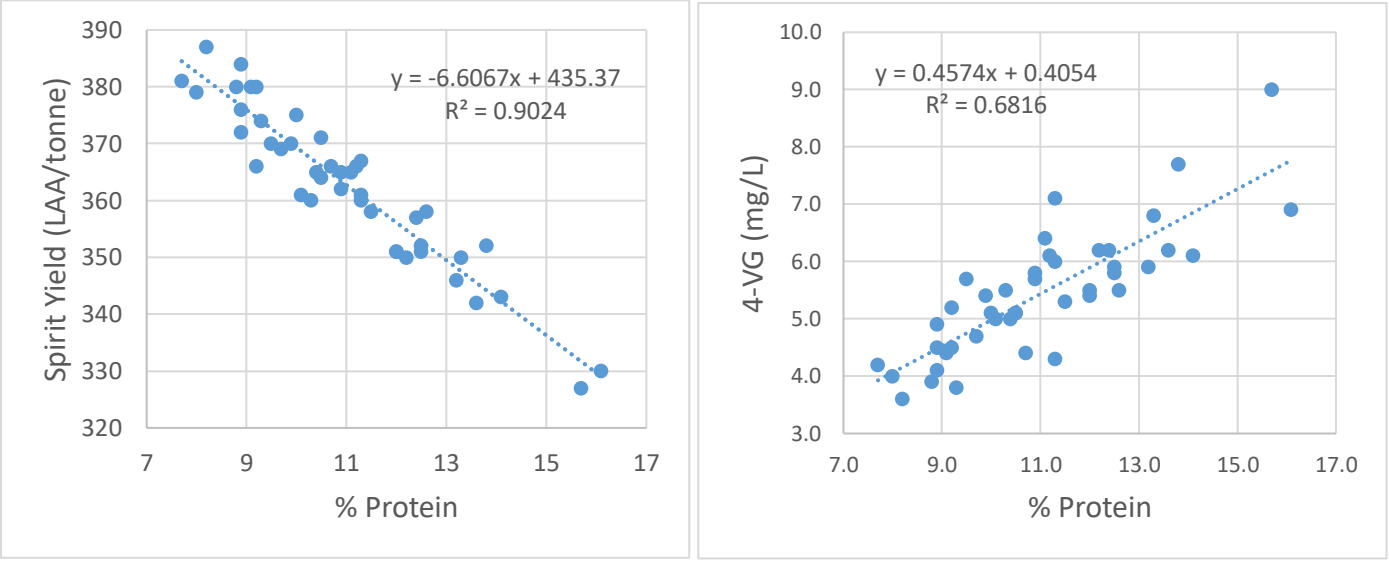

Figure 1. Using each site and variety as an individual data point, a negative relationship was evident between spirit yield and protein, but a positive relationship between 4-VG and protein. These relationships indicate that protein analysis can be useful in predicting spirit yield and flavor compounds.