

## **“Upper Peninsula malting barley variety trial”**

**MSU Extension Project GREEN Report**

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### **Project justification:**

Growth in the microbrewery sector and specialty beers is driving interest in smaller scale, local malting by artisan brewers. Barley acreage is experiencing a decline nationally and larger scale malting companies are willing to accept barley grain supplies from the upper Great Lakes region to meet demands in their regional malting facilities.

Cash crop opportunities are limited on most Upper Peninsula farms. Corn grain, soybeans and sugar beets are not well-suited for the region due to shortness of the growing season and cool climate. However, small grains including feed-grade barley are proven crops in the region. By improving the quality of barely grain to allow entry into the malting barley markets, crop value could be improved significantly and a new cash crop opportunity for Upper Peninsula farmers developed.

Best management practices in nitrogen fertility and use of fungicides to improve barley grain quality for malting are underway at the MSU Research and Extension Center in the Upper Peninsula. It is currently unknown which barley varieties are best adapted for malting barley production in upper Michigan. Field studies to identify commercially available malting barley varieties with best potential for producing malting grade barley grain in the northern Michigan environment are an important part of developing this new opportunity.



Figure 1: Planting barley variety plots (left) at the MSU Upper Peninsula Research and Extension Center on May 14, 2013 in Chatham, MI. Plots emerged (right), photo May 28, 2013.



Figure 2: Plots on July 2, 2013 (left) and August 2, 2013 (right)



Figure 4: Plot harvest (9/13/13) and seed cleaning/processing (9/18/13)

**Objective:**

Compare performance of commercial malting barley varieties under Upper Peninsula environment, including yield, moisture at harvest, test weight, protein content, DON (vomitoxin) contamination and additional standards established by the malting barley industry.

**Results:**

Four replications of small plots (3' X 16') in a randomized complete block design including nineteen malting barley varieties were planted at the MSU Upper Peninsula Research and Extension Center in Chatham. The plots were fertilized according to soil test recommendation, weeds controlled with herbicide, cereal leaf beetles were controlled with Sevin insecticide, and was sprayed with Prosaro fungicide according to label instructions at early heading to control fusarium and other fungal diseases.

Variety	Type	Bu/a (14.5% mst)	Tst Wt (14.5% mst)	DON	Protein	Moisture	Color	Plump >6/64	Germ Energy 72 hrs	Germ Capacity 96 hrs	RVA (sec)
Oddysey	2-row	57.21	49.8	0.0	13.9	17.1	48.7	97.7	92	89	54
NSA 1820	2-row	52.35	50.1	0.0	14.8	16.1	48.7	98.3	74	89	8
Pinnacle	2-row	52.08	48.7	0.2	13.0	16.3	48.3	97.4	87	91	107
Conrad	2-row	49.66	49.1	0.1	13.7	16.9	48.9	91.8	71	85	7
Genie	2-row	49.62	50.2	0.2	13.8	16.4	48.7	93.8	73	82	6
Merit 57	2-row	48.48	47.6	0.2	13.9	16.5	48.4	98.2	80	92	154
Overture	2-row	48.18	49.8	0.0	12.7	17.1	48.2	96.3	93	89	96
Voyager	2-row	43.1	48.4	0.6	13.1	17.2	49.4	98.2	79	94	165
Merit	2-row	40.93	47.8	0.1	12.9	16.7	49.2	98.7	85	88	155
Conlon	2-row	40.28	49.7	0.1	14.2	16.3	47.9	98.0	58	83	6
Innovation	6-row	55.47	47.1	0.0	15.3	15.9	48.3	96.0	99	100	72
Lacey	6-row	53.98	49.5	0.0	14.3	17.4	47.8	94.7	97	97	39
Rasmusson	6-row	53.65	48.5	0.0	14.5	16.1	47.8	97.2	97	98	79
Celebration	6-row	52.86	47	0.0	14.4	16.7	47.2	96.6	86	95	7
Tradition	6-row	51.89	47.4	0.0	13.9	15.9	47.7	91.8	92	94	93
Stellar-ND	6-row	51.77	46.6	0.0	14.3	16.6	48.0	96.7	98	96	105
Quest	6-row	50.61	47.8	0.0	14.7	16.7	48.3	92.7	96	99	75
Robust	6-row	50.45	47.7	0.0	14.3	15.8	47.8	96.0	97	96	30
Legacy	6-row	48.07	46.9	0.0	14.3	16.2	48.2	95.3	89	96	133
MEAN		50.03	48.4								
CV (%)		16.5	1.5								
LSD <sub>0.05</sub>		ns	ns								

Figure 5: Yield and test weight corrected to 14.5% moisture. Quality analysis from North Dakota State University on single, composite sample consisting of equal amount of grain from each replication for each entry

Notes from Paul Schwartz, NDSU:

- DON quantitation limit is around 0.2 ppm
- Protein < 13.5% is desired for 6-row and < 12.5% for 2-row
- Moisture should be <13% for storage. Germination deteriorates at higher moistures and mold risk is greater
- Germination should be >95%

	= badly sprouted
	=probably sprouted

- RVA: Rapid Visco-Analyser which is used to test sprout damage in grain -

**Discussion:**

1. Average yield of 50.3 bushels per acre is somewhat less than the average yield of 55.9 bushels per acre from MSU spring barley variety trials at the same location in 2008 – 2011. If the 2011 barley trial results are eliminated, the average yield for 2008-2010 was 47.7 bushels per acre.
2. The grain samples harvested had higher moisture content than desirable. This may have impacted germination rates and almost certainly resulted in increased sprouting. There was significant variation of date of maturity among the 19 varieties. This led to a harvest date earlier than desirable for most varieties. Planting was delayed due to wet weather. Earlier planting will likely result in dryer grain at harvest. In addition, harvest of single varieties (in comparison with harvest of a large number of varieties with different maturities in a single block of plots) will eliminate the need to compromise harvest date in an attempt to find the ‘best-fit’ harvest timing.

3. Statistical analysis was conducted for yield and test weight only.
4. DON contamination was acceptable in 15 of the 19 varieties. All varieties with higher than desirable DON levels were 2-row types.
5. Grain protein levels were generally higher than desirable, with exception of four 2-row types.
6. Test weight was generally good and seed plumpness was good for all varieties. Standard barley test weight is 48 lbs per bushel at 14.5% moisture.

**Conclusions:**

1. Yield and test weight of all varieties was close to normal, local averages. There were no statistical differences at the 0.05 level of significance. Voyager, Merit and Conlon were the low yielders in the trial and Oddysey, Innovation and Lacey were the high yielders.
2. DON levels for composite samples were generally acceptable, or very nearly so, with the exception of Voyager.
3. Protein levels for composite samples were generally too high. Nitrogen fertilizer adjustment could contribute to a solution for this problem.
4. Seed plumpness for composite samples was good.
5. Seed moisture, germination and sprouting were generally unacceptable. Grain was harvested at too high moisture content. Late planting and very cool mid-summer and harvest conditions probably contributed to this. Earlier planting, more timely harvest and post-harvest aeration could help correct these problems.
6. The results of the 2-year Project GREEN-funded “Malting Grade Barley Production in Northern Michigan – Improving Quality Through Improved Fertility management and Disease Control Practices” will help identify ways to improve grain protein content and control fungal contamination. The project was conducted at the same site.
7. Additional MSU work with malting barley is needed. A more comprehensive malting barley research proposal has been submitted by the Michigan Brewer’s Guild to MDARD for the 2014 Strategic Growth Initiative Grant Program. The proposal has strong partners, including the Michigan Brewer’s Guild, MSU AgBioResearch, and MSU Extension. It includes expanded variety testing in the Upper Peninsula, northwest and northeast lower Michigan, the ‘thumb’ area of Michigan and the Gratiot/Isabella county area. It also includes a component to develop malting and brewing testing facilities for local malting barley destined for Michigan craft brewers, and an educational component to share project results with farmers, maltsters and craft brewers.

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