Winter Malt Barley Production and Market Development in the Mid-Atlantic USA

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Abstract

According to the Virginia Craft Brewers Guild, the number of craft breweries is expected to increase by 50% over the next five years. In order to supply this industry with quality raw materials, and to produce as much of this raw material in Virginia as possible, an investment is needed in malt-type barley (Hordeum *vulgare* L.) production research and

extension. Cultivar evaluations and studies of cultivarby-management interactions have been conducted to develop extension recommendations considering both barley yield and end-use quality. Cultivar development through traditional breeding and marker assisted selection is ongoing. Extension programs are focused on understanding the needs of the brewing industry and supplying quality raw materials to that industry.

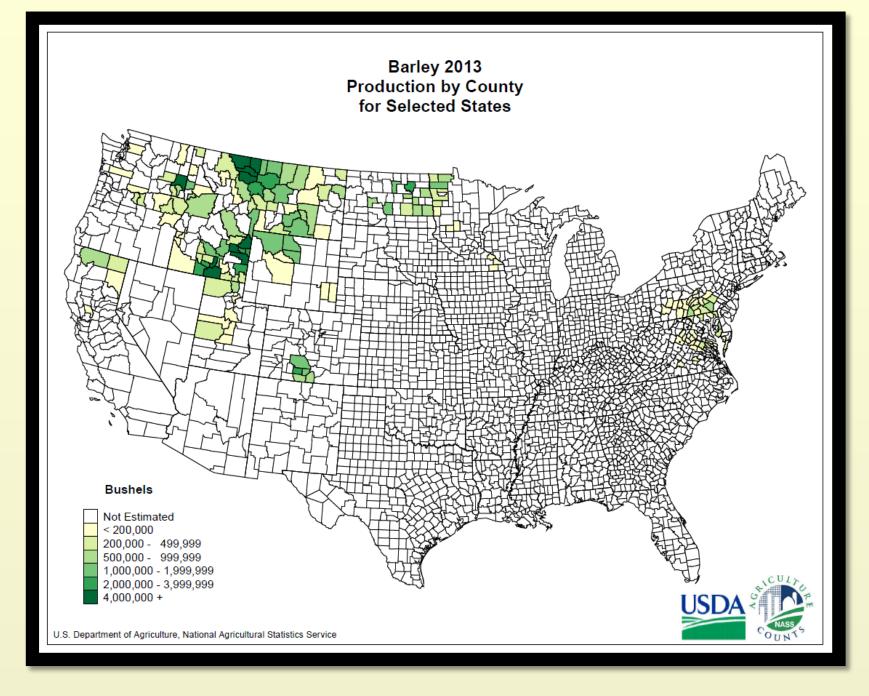
Current Situation

- 1. Current and future demand for locally grown malttype barley exists in Virginia and the mid-Atlantic region
- 2. Virginia currently produces 2.7 million Mg of feed barley annually but plantings are declining due to poor market opportunities
- 3. The number of craft breweries in Virginia is expected to increase by 50% by 2015. Most of these are small operations that add significant value to local agricultural products.
- 4. Due to Virginia's proximity to multiple population centers, value-added commodity production is a viable endeavor for many growers, including barley producers.
- 5. Farm business and tourism opportunities exist with farm-based craft breweries.

Approach

- 1. Evaluation of existing malt-type barley cultivars in the mid-Atlantic with emphasis on agronomic and enduse quality characteristics.
- 2. Breeding and development of new, locally adapted malt-type barley cultivars.
- 3. Research and development of best agronomic practices for malt-type barley for the mid-Atlantic.
- 4. Demonstration and extension of production
- techniques and recommended cultivars.
- 5. End-user outreach and market development.







Madison, WI

Activities

 Participation in the Uniform Winter Malt Barley trials led by USDA-ARS

2013-14 Barley grain yield and agronomic characteristics, UWMBT, conducted at Blacksburg and Warsaw, VA

	Yield	Yield	Moisture	Test Weight	Heading Date	Height	Lodging	Leaf Rust	Powdery	Net Blotch	Yellow	Winter Survival
Line	Rank	(kg ha ⁻¹)	(%)	(kg m ⁻³)	(Julian)	(Inches)	(0-9)	(0-9)	Mildew (0-9)	(0-9)	Dwarf (0-9)	(%)
Location	rtanit	BB. WR	BB, WR	BB. WR	BB. WR	BB, WR	BB, WR	BB. WR	WR	WR	WR	BB
VA10B-43	1	5962	13.9	594.8	114.5	35.3	5.3	1.8	1.3	0.3	0.0	91.7
Violetta	2	5743	13.7	613.3	115.0	32.7	3.8	0.8	1.0	2.0	0.0	86.7
VA09B-34	3	5589	13.5	614.3	111.8	34.2	3.8	1.8	4.3	2.3	0.0	91.7
KWS Scala	4	5382	13.4	559.6	116.2	29.8	4.0	2.7	1.3	0.0	0.3	91.7
KWS Ariane	5	5238	13.4	574.4	118.5	32.0	3.3	5.8	0.0	0.3	2.0	99.0
VA09B-29	7	5182	12.8	558.1	113.7	31.3	6.3	3.5	2.3	5.7	0.0	90.0
KWS Liga	9	5106	14.2	580.9	121.8	33.3	3.2	3.7	4.0	1.0	2.0	93.3
Thoroughbred	10	4796	13.3	554.1	116.0	33.3	6.5	7.5	7.7	0.0	0.0	91.7
AC 06/054/1	11	4735	16.2	553.0	124.2	35.5	4.7	1.2	2.0	1.0	1.3	95.0
KWS Joy	12	4718	14.7	533.7	122.2	31.8	4.3	4.5	2.7	0.0	3.0	95.0
California	13	4452	17.0	531.7	127.5	30.8	3.0	1.2	0.0	0.3	2.0	94.7
AC 07/022/2	14	4402	13.2	525.5	118.2	29.7	5.0	0.8	0.0	6.3	1.0	95.0
02Ab671	17	3443	13.4	494.4	118.7	31.0	5.3	7.3	8.0	0.3	0.7	86.7
6Ab08-X03W012-5	18	3260	13.6	485.4	119.5	36.7	6.0	7.7	7.7	0.0	0.0	76.7
AC 05/004/12	19	3028	16.7	585.8	127.5	34.0	3.3	0.5	0.0	1.7	2.7	90.0
02Ab431	20	2768	13.5	480.3	115.5	31.2	7.0	8.0	8.0	0.0	0.0	85.0
2Ab08-X05W061-208	22	2683	15.3	457.1	124.2	28.7	5.0	8.0	7.3	0.0	2.0	88.3
McGregor	6	5226	12.9	525.3	117.5	34.0	5.3	3.8	6.0	0.0	0.0	90.0
Saturn	8	5162	13.4	516.7	122.8	34.7	5.5	3.5	0.0	1.7	1.0	80.0
Archer	15	3987	16.9	529.8	123.5	33.2	2.7	1.2	0.7	0.7	3.3	90.0
Strider	16	3452	13.3	504.5	119.2	31.7	2.3	6.5	0.0	1.3	4.7	86.7
Charles	21	2755	14.5	437.2	114.7	27.3	6.2	8.3	0.0	0.0	0.0	85.0
GRAND MEAN		4412	14.2	536.8	119.2	32.4	4.6	4.1	2.9	1.1	1.2	89.7
CV		11.2	11.9	5.1	1.0	5.7	36.6	25.5	26.7	66.0	99.8	3.2
		11.1	16	20	11	10	16	10	11	10	16	4.0



Malt quality testing performed on all entries in UWMB trials by USDA-ARS Cereal Crops Research Unit.

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It Quality of entries in the 2013 Uniform Winter Malt Barley Trial at Blacksburg, VA: USDA-ARS Cereal Crop Research Unit-															
adison, Wisconson															
	Kernel	on	Barley	Malt			Barley	Wort			Alpha-	Beta-			
	Weight	6/64"	Color	Extract	Wort	Wort	Protein	Protein	S/T	DP	amylase	glucan	FAN	Quality	Overall
Variety or Selection	(mg)	(%)	(Agtron)	(%)	Color	Clarity	(%)	(%)	(%)	(°ASBC)	(20°DU)	(ppm)	(ppm)	Score	Rank
rles-Check	25.4	81.0	38	73.6	4.4	1	14.0	5.61	40.8	151	105.6	174	207	29	3
der-Check	23.3	24.7	39	71.3	5.8	2	14.3	4.53	33.0	74	58.7	354	133	8	22
Gregor-Check	27.4	69.5	28	73.2	4.1	1	13.8	4.57	34.0	83	56.4	392	142	14	18
b431	25.7	63.1	35	75.3	3.3	1	13.6	5.90	43.8	152	131.7	135	264	32	1
b671	24.1	56.2	34	76.1	2.9	1	14.3	5.54	39.8	159	124.5	115	236	31	2
08-X03W012-5	24.2	45.2	42	71.8	2.5	1	13.1	4.69	36.6	174	73.3	278	192	29	3
08-X05W061-208	23.6	36.2	34	74.5	2.9	1	14.1	5.14	38.2	139	121.6	151	198	28	5
letta	36.6	90.3	30	76.6	2.0	1	14.1	4.62	33.2	208	58.0	288	175	28	5
roughbred	25.6	51.4	44	74.8	1.9	1	12.6	3.97	33.1	140	62.7	296	154	26	7
S Joy	30.3	77.8	33	75.9	2.4	1	13.3	4.22	33.5	134	72.5	183	151	24	8
fornia	31.1	62.0	31	74.0	2.6	1	15.1	4.78	32.4	153	57.7	194	174	23	9
06/054/1	34.7	85.3	31	75.6	2.6	1	13.1	3.63	29.4	136	44.7	395	125	21	10
S Scala	34.0	90.6	29	76.6	1.9	1	13.6	3.97	31.4	158	59.3	190	143	21	10
S Liga	33.5	82.7	35	75.3	2.2	1	13.2	3.99	30.8	146	55.5	169	136	21	10
07/022/2	32.5	77.6	36	74.3	2.0	1	14.7	4.13	28.6	147	64.2	276	149	19	13
S Ariane	33.1	83.5	34	75.9	2.2	1	14.0	4.07	31.0	136	54.6	234	147	19	13
9B-34	30.6	91.1	35	73.6	2.4	1	14.1	4.23	31.1	73	52.2	713	162	18	15
ner	32.6	60.3	25	70.1	2.4	1	16.2	4.27	27.7	133	40.3	589	154	16	16
9B-29	25.7	55.8	32	72.1	3.7	2	12.8	3.68	30.1	55	40.8	896	134	15	17
.0B-43	26.9	71.8	25	73.6	2.4	1	13.6	4.17	32.3	55	51.7	669	164	14	18
ırn	29.1	67.7	40	70.0	n.d.	3	14.1	4.18	31.2	138	47.7	484	144	10	20
05/004/12	36.4	83.2	41	73.6	2.1	1	14.7	3.95	27.5	144	37.0	424	131	9	21
RRINGTON MALT CHECK	39.5	96.2	73	81.9	2.2	1	11.6	4.76	42.1	115	97.6	110	216	60	
ima	23.3	24.7	25	70.0	1.9		12.6	3.63	27.5	55	37.0	115	125		
tima	36.6	91.1	44	76.6	5.8		16.2	5.90	43.8	208	131.7	896	264		
ins	29.4	68.5	34	74.0	2.8		13.9	4.45	33.2	131	66.9	346	164		
dard Deviations	4.4	18.2	5	2.0	1.0		0.8	0.62	4.3	39	27.9	210	36		
fficients of Variation	14.8	26.6	15	2.6	35.1		5.8	13.91	12.9	30	41.8	61	22		

Activities (cont.)

• Virginia malt-type barley cultivar evaluation studies conducted annually at Warsaw and Blacksburg, VA • Grain physical and compositional analysis (protein, starch, ash, fat, etc.) conducted on samples from Virginia evaluation studies

Our program is focusing on developing barley having superior malt quality for potential use in the brewing industry. In this regard, the Virginia Tech breeding program has evaluated several winter malting barley lines over the past several years, primarily for use as parents in our breeding program. One of the two parents of our hulled barley variety Thoroughbred is 'Plaisant,' a French malting variety, imparting Thoroughbred with fairly good malt extract but lacking desired enzymes for large scale beer production.

• Research and development of best agronomic practices for malt-type barley for the mid-Atlantic.

2012-13, Over L	r Locations, Painter and Orange Moisture Test Weight Lodging						
				Yield			
Cultivar	%	kg m⁻³	0-9	kg ha⁻¹			
Throughbred	13.5	571.6	1.8	5404			
VA10B-43	13.6	567.8	1.7	5331			
VA09B-29	13.3	554.7	1.2	5205			
Endeavor	13.8	549.5	1.9	4708			
VA09B-35	13.4	577.4	2.9	4574			
VA09B-34	13.3	573.8	2.2	4324			
Novosadski 183	13.4	568.7	2.1	4042			
Novosadski 293	13.8	553.6	1.9	4043			
Charles	13.4	506.0	3.0	3526			
LSD (0.05)	0.3	27.0	ns	478			
	Moisture	Test Weight	Lodging	Yield			
Fungicide	%	lb/bu	0-9	bu/ac			
None	13.4	559.0	2.3	4444			
Tilt	13.5	553.7	1.9	4362			
Prosaro	13.5	564.3	2.0	4689			
Tilt+Prosaro	13.6	568.9	2.1	4748			
LSD (0.05)	ns	ns	ns	301			
ns - no significan	t differences						

Summary of perf	ormance of	malt-type ent	ries, Over loca							
				Date			Leaf	Powdery	Net	Barley Yellow
	Yield	Moisture	Test Weight	Headed	Height	Lodging	Rust	Mildew	Blotch	Dwarf Virus
Cultivar	kg/ha	%	kg m ⁻³	(Julian)	(In)	(0-9)	(0-9)	(0-9)	(0-9)	(0-9)
Thoroughbred	5624	13.2	617.5	120.3	92.7	4.1	1.1	5.8	2.3	0.0
VA10B-43	5502	13.3	619.5	117.6	88.8	4.8	0.2	1.3	0.8	0.0
VA12B-7	5377	13.3	623.1	117.7	91.2	3.4	1.6	1.7	2.2	0.0
Saturn	5340	13.4	578.5	121.8	79.1	4.4	0.4	1.0	1.9	0.3
McGregor	5248	13.3	575.6	121.0	89.7	4.2	0.0	5.3	1.3	0.0
KWS Liga	4854	13.5	610.9	124.0	82.8	3.4	0.1	1.8	0.9	1.2
VA09B-35	4805	13.2	617.0	116.1	88.2	6.4	0.0	1.2	0.9	0.0
VA09B-34	4651	13.3	628.4	115.5	87.0	4.5	0.2	0.8	1.1	0.0
Violetta	4624	13.3	628.6	119.9	79.8	3.8	0.0	0.2	1.2	0.3
Endeavor	4575	13.4	618.6	121.5	88.2	4.5	0.5	1.6	2.2	0.0
Charles	3956	13.4	541.0	119.8	75.2	6.2	1.0	1.4	2.2	0.0
LSD (0.05)	224	0.6	8.1	0.4	1.9	0.9	0.6	0.8	0.5	0.6
CV	10									
				Date			Leaf	Powdery	Net	Barley Yellow
	Yield	Moisture	Test Weight	Headed	Height	Lodging	Rust	Mildew	Blotch	Dwarf Virus
Fungicide	kg/ha	%	kg m⁻³	(Julian)	(In)	(0-9)	(0-9)	(0-9)	(0-9)	(0-9)
None	4825	13.3	606.5	119.7	85.6	4.8	1.6	2.2	2.0	0.2
Tilt	5107	13.3	606.7	119.4	86.2	4.4	0.0	2.0	1.2	0.2
Prosaro	4907	13.4	602.2	119.6	85.9	4.5	0.2	2.2	1.7	0.2
Tilt+Prosaro	5002	13.3	605.8	119.6	85.0	4.4	0.0	1.6	1.1	0.1
LSD (0.05)	267	0.6	9.7	0.2	0.9	0.5	0.1	0.4	0.5	0.2

Our typical variety tests do not employ fungicides, however in this case we wanted to assess the relative performance of these malt type barley cultivars under a management regime that would be recommended to commercial growers

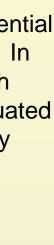
Two experiments were conducted in 2012-13 to measure the effect of cultivar disease resistance and fungicide application in current and promising malttype barley lines and standard cultivar comparisons. Charles and Endeavor are winter malt barley cultivars developed by USDA-ARS in Idaho. Thoroughbred was developed by Virginia Tech and has been widely grown in the mid-Atlantic region. Novosadski 183 and 283 were developed in Yugoslavia (the former Soviet Union) and were originally identified in early screening in the 1990's as being at least partially adapted to Virginia conditions. Lines designated with a VA- are experimental cultivars developed in the Virginia Tech program. Listing and usage of the fungicides in this test does not imply endorsement of these products over others. They were chosen because these products are in common use by producers in the region.

Over locations Thoroughbred, VA10B-43, and VA09B-29 were the highest yielding entries, followed by Endeavor. When Tilt (at GS 48) and Prosaro (GS 58) fungicides were applied, yields were higher than when no fungicide was applied or when Tilt alone was used. This implies that protection from late season diseases such as leaf rust and head scab was advantageous this season.

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Activities (cont.)

•Field days and demonstrations of malt-type winter barley for Virginia

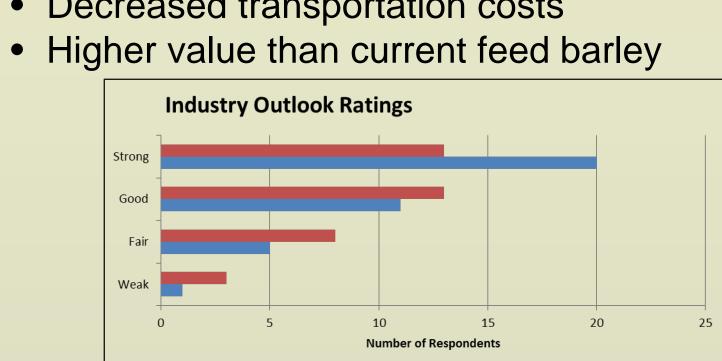


•Uncorking the Possibilities working group and Scholar site for identifying:

- Opportunities
- Stakeholders
- Capabilities
- Information requirements
- Business partners

•Producer and end-user surveys distributed in 2014 • Opportunities:

- Demand-driven and growing market
- "Locally grown" products
- Decreased transportation costs



•Challenges:

- Quality and consistency
- Lack of well-adapted cultivars
- Lack of grain-handling infrastructure and experience



Future Plans

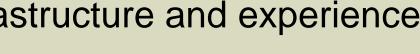
- •Continued malt-type barley cultivar development and evaluation •Field days and demonstrations both for growers and potential end users
- Industry-wide "summit" to further identify needs and barriers to increased local production and use of malt-type barley
- •Expansion of grain quality evaluation and testing capacity at Virginia Tech





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	Uncorking Possibilities: Northern Piedmont and Shenandoah Valley Resources
	Kick-Off Meeting 20 June 2014
	Apple Information
	Brewing Information
	Cideries
	Distilling Information
	Grain Information
	Viticulture Information
	Ermenting Information
	Hops Information
	Nelson County Case Study

• Developing markets means developing relationships





Department of Crop & Soil Environmental Sciences