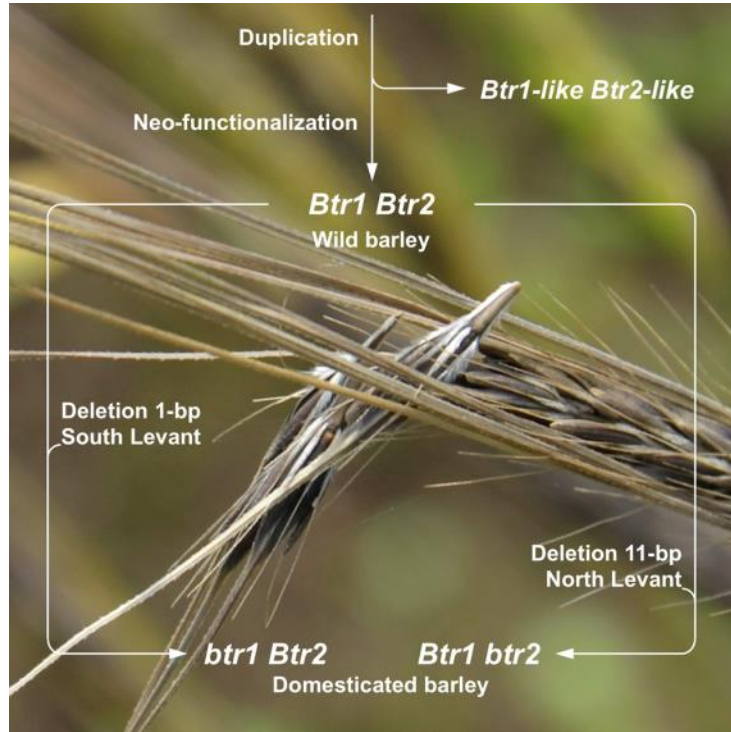


In the beginning there was *Hordeum spontaneum*

Now there are beverages, foods, feeds, and more *Hordeum vulgare**



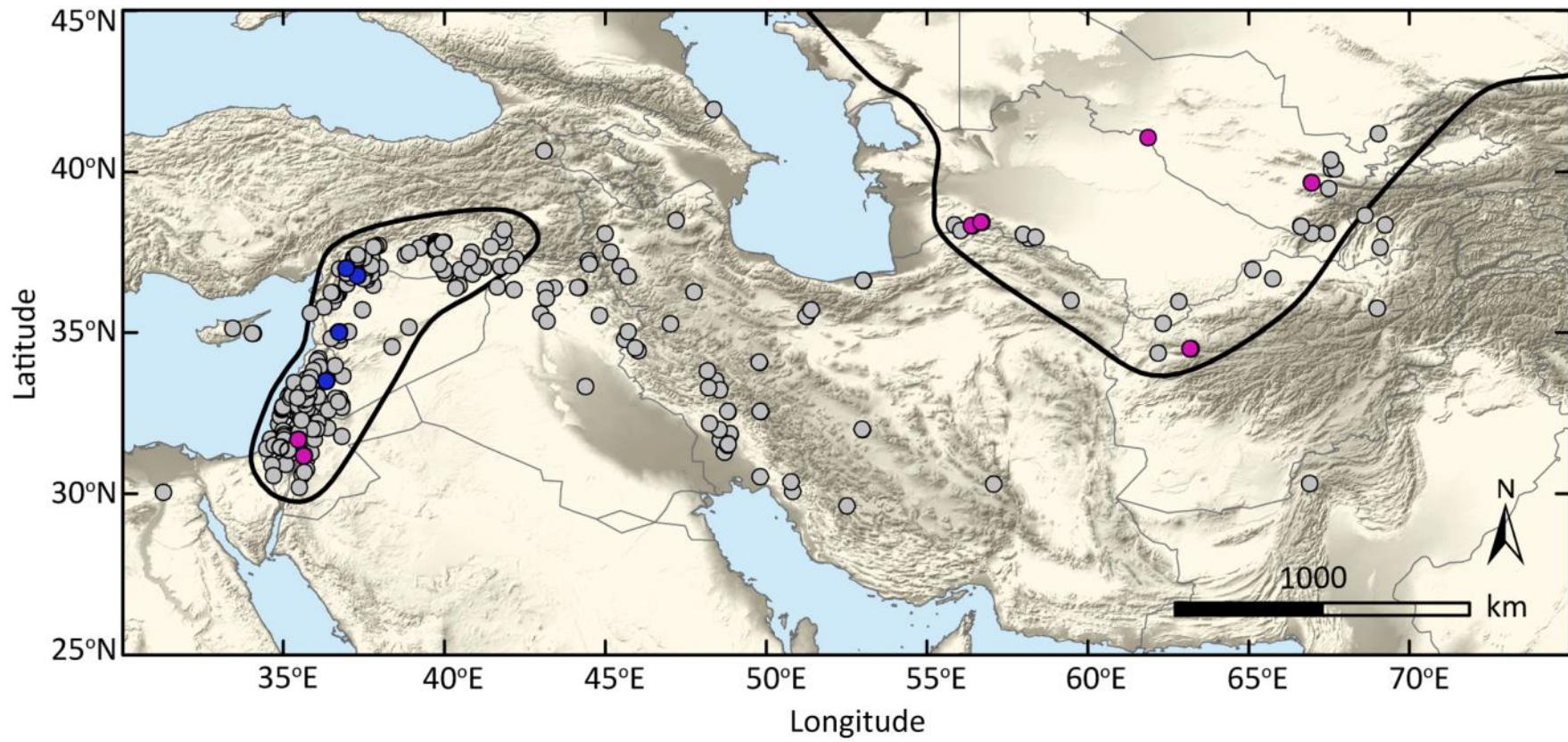
$2n = 2x = 14$

5.3 Gbp

~ 30,000 genes

Self-pollinated (hermaphroditic)

* Technically speaking *spontaneum* and *vulgare* are both subspecies of *H. vulgare*



What domestication hath wrought....



Spontaneum

Shattering (brittle rachis)

2-row

Adhering hulls

Winter annual

Vulgare

Shattering resistant (non-brittle rachis)

2-row, 6-row

Adhering, non-adhering (naked)

Winter, facultative, and spring annual

Apparent
diversity

Apparent
diversity

Domestication and evolutionary bottlenecks

Spontaneum and exotic/landrace accessions

Current varieties

Allelic
diversity

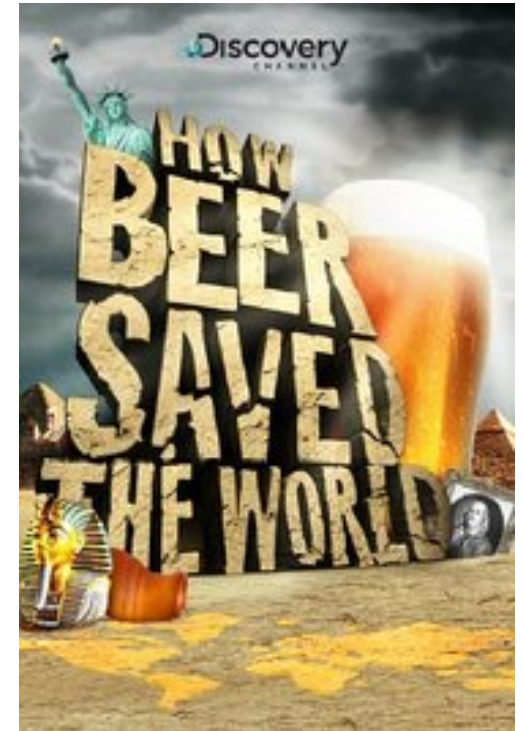


Allelic
diversity

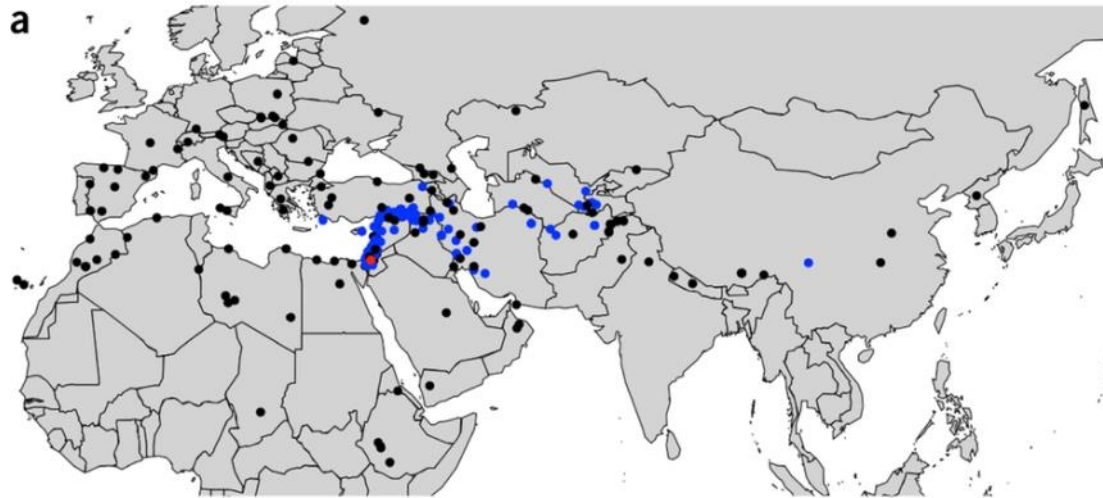
The imperative for conservation and characterization of genetic resources

Domestication – why?

Food and pleasure



From domestication to migration



1 mile per year (?)

Migration and specialization

Europe

Beer

- *Hulls, spring growth habit, 2-row*

Feed (food and some beer)

- *Hulls, spring/winter/facultative, 6-row*



“The decree known as the Reinheitsgebot, issued in Ingolstadt in 1516, had three aims: to protect drinkers from high prices; to ban the use of wheat in beer so more bread could be made; and to stop unscrupulous brewers from adding dubious toxic and even hallucinogenic ingredients as preservatives or flavourings.”

Migration and specialization

Central/East Asia – food

- *Naked, spring, 6-row*

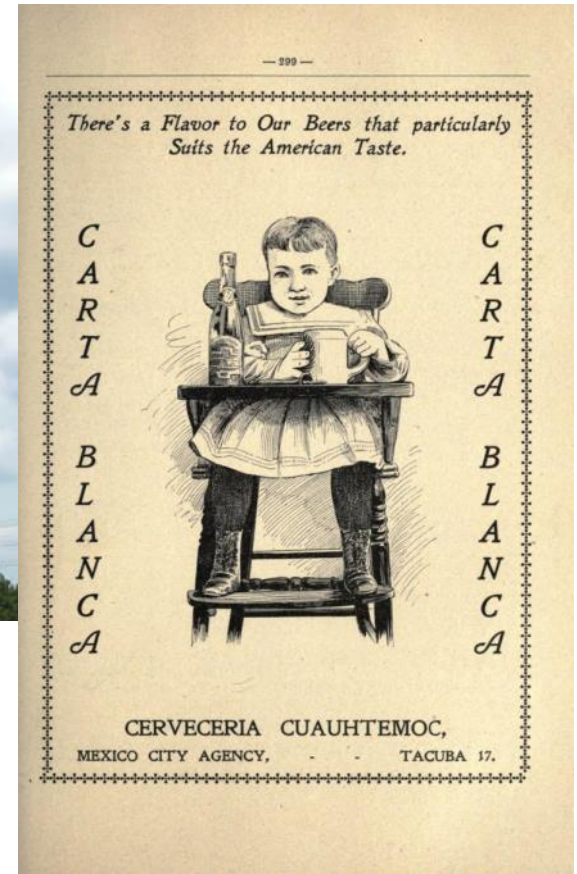
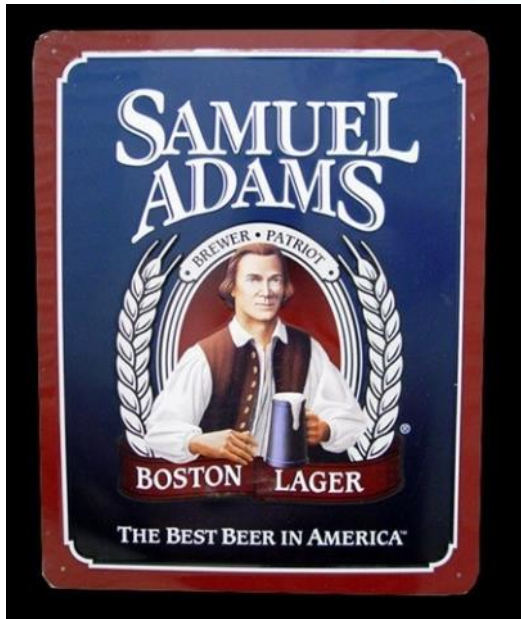


Migration and specialization

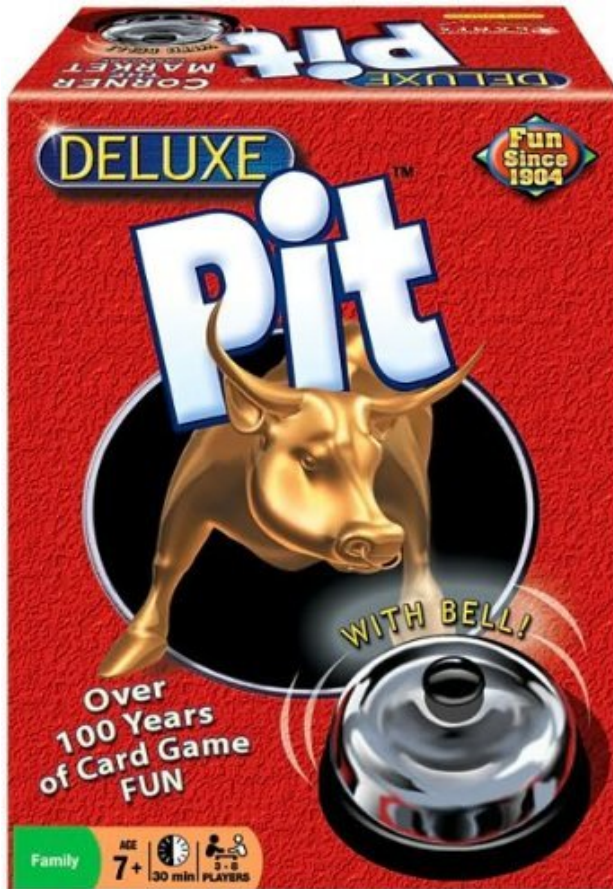
Americas (17th century -)

North and Meso

- *Hulls, spring growth habit, 2-row malt – Europe*
- *Hulls, spring growth habit, 6-row malt – Europe/Asia*
- *Hulls, spring/winter/facultative 6-row feed – Iberian peninsula/North Africa*



The 2017 barley report



----- Forwarded message -----

From: **Morning Agriculture** <morningagriculture@politico.com>

Date: Mon, Sep 18, 2017 at 8:02 AM

Subject: POLITICO's Morning Agriculture: Montana barley growers look to Mexico — NYT highlights Big Food's role in obesity crisis abroad — Pork warns of 'financial apocalypse' if NAFTA 2.0 bombs

To: EatWellatSchool@gmail.com

By John Lauinger | 09/18/2017 10:00 AM EDT

With help from Sabrina Rodriguez, Christine Haughney, Megan Cassella, Catherine Boudreau and Helena Bottemiller Evich

MONTANA BARLEY GROWERS LOOK TO MEXICO: The craft beer sector in Mexico is expanding rapidly, and Montana barley growers want in on the action. Pro Ag's Catherine Boudreau traveled to Montana in June and witnessed how the U.S. Grains Council used funding from two controversial export-promotion initiatives - the Market Access Program and Foreign Market Development - in a bid to entice Mexican craft brewers into making deals.

Montana farmer Mark Lacher noted how [earlier this year](#) industry heavyweights AB-InBev and MillerCoors - which purchase nearly two-thirds of the barley grown in north-central Montana - announced they were reducing the number and size of production contracts with area farmers by anywhere from 20 percent to 60 percent due to oversupply. "The doors are open," Lacher said, referring to potential for new export arrangements.

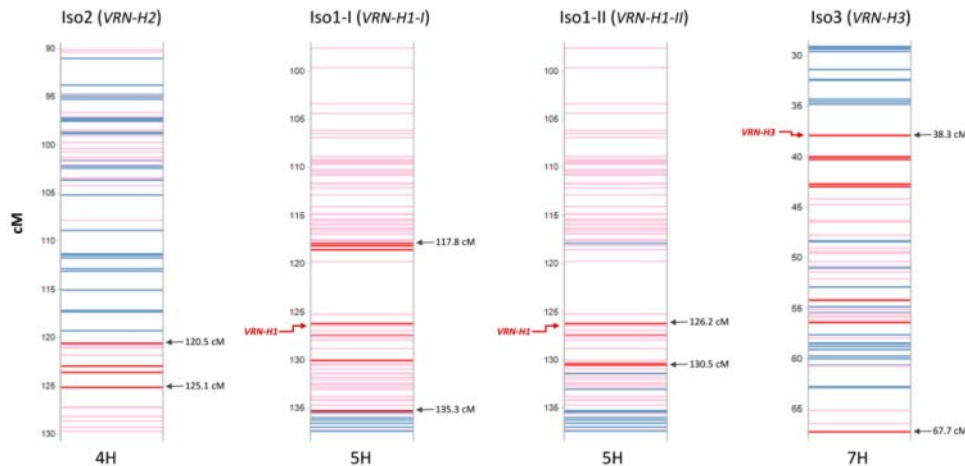
$$\frac{\sum_{i=t_x-12}^{t_x-2} \text{BarleyNass}_i}{10} \times \text{Corn}_{CBOT_{t_x}} = \text{BarleyCombo}$$



Breeding barley at a Land Grant University: The OSU Barley Project

Facultative 2-row malting; Facultative 2 (6) row multi-use naked

Locus/alleles	Phenotype	Mechanism
<i>Vrn1, Vrn2, Vrn3</i>	Growth habit	Loss of function deletions
<i>Ppd1, Ppd2</i>	Flowering time	Loss of function deletions



The OSU Barley Project



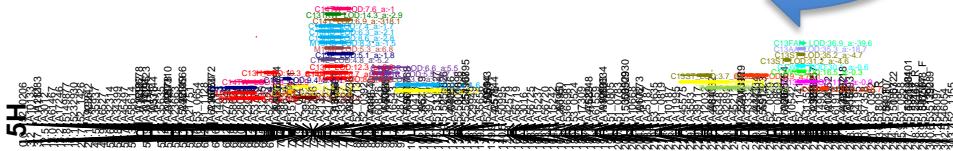
Crossing



Doubled haploids



Genetics and Breeding



Publication, Variety/Germplasm release

Herb, D.W., Benson, A., Carey, D., Cistue, L., Filichkin, T, Fisk, S.P., Helgerson, L., Jennings, R., Li, Y., Meints, B.M., Monsour, R., Moscou, M., Nguyen, A., Onio, A., Romagosa, I., Thiel, R., Thomas, W.B., Tynan, S.P., Vega, V., Vinkemeier, K., Hayes, P.M. 2017. Malt modification and its effects on the contributions of barley genotype to beer flavor. *J. Amer. Soc. Brew. Chem. In press.*

Barley contributions to beer flavor

Deschutes + 6 and the Oregon Promise



BC17-14.P1 Herb, galley 1

Estimated 9–10 pp. (including figures and tables)

*e-Xtra**

Effects of Barley (*Hordeum vulgare* L.) Variety and Growing Environment on Beer Flavor

Dustin Herb,¹ Tanya Filichkin, Scott Fisk, Laura Helgerson, and Patrick Hayes, *Crop & Soil Science Dept., Oregon State University, Corvallis, OR U.S.A.*; **Brigid Meints**, *Dept. of Crop & Soil Science, Washington State University, Mt. Vernon, WA U.S.A.*; **Rebecca Jennings, Robert Monsour, Sean Tynan, and Kristi Vinkemeier**, *Rahr Malting Co., Shakopee, MN U.S.A.*; **Ignacio Romagosa**, *University of Lleida, Lleida, Spain*; **Matthew Moscou**, *The Sainsbury Laboratory, Norwich Research Park, Norwich, NR4 7UH U.K.*; **Daniel Carey and Randy Thiel**, *New Glarus Brewing Co., New Glarus, WI U.S.A.*; **Luis Cistue**, *Estación Experimental Aula Dei, CSIC, Zaragoza, Spain*; **Christopher Martens**, *Cereal Crop Research Unit, USDA-ARS, Madison, WI U.S.A.*; and **William Thomas**, *The James Hutton Institute, Invergowrie, Dundee DD2 5DA, Scotland, U.K.*

ABSTRACT

J. Am. Soc. Brew. Chem. 75(4):000-000, 2017

This research tested the hypothesis that barley genotype can affect beer flavor and assessed the relative contributions of genotype and location to beer sensory descriptors. Golden Promise. Full Pint. 34 of their

is placed on the suitability of barley cultivars for malting, rather than on the potential favorable contributions of the variety per se.

New barley varieties are rigorously tested for malting suitability through programs set by bodies such as the American Malting Barley Association (AMBA) (www.ambainc.org), the Brewing and Malting Barley Research Institute (www.bmbri.ca), Barley

The OSU malt house



Certificates of analysis

Barley World Malts

Buy 'em all at Corvallis Brewing Supply

Company:	OSU Malt Lab															
Date	LAB ID	Description	Moisture %	Friability %	Extract %	Color °SRM	β-glucan mg/L	Soluble %	Protein %	S/T %	FAN mg/L	DP °L	Alpha Amylase	Filtration Time	Clarity	pH
16-Sep	ML-16-854	OSU Malt 2015-3	6.8	92.3	80.8	2.67	76	4.6	9.7	47.4	140	72	44.7	normal	hazy	5.91
	ML-16-855	OSU Malt 2015-5	4.2	86.5	80.5	4.55	97	4.8	9.7	49.5	180	75	53.0	normal	clear	5.81
6-Oct	ML-16-926	Batch 2016-6 Full Pint	3.4	79.3	80.0	4.47	146	4.8	10.1	47.5	193	110	57.3	normal	clear	5.85
27-Oct	ML-16-1015	Batch 2016-7 Buck Hulle	4.0	n/a	87.4	2.08	427	n/a	n/a	n/a	124	61	31	normal	hazy	5.76
30-Nov	ML-16-1149	OSU Batch 2016-8, Copel	3.0	89.0	81.4	4.15	199	4.5	9.6	46.8	170	72	46.5	normal	clear	5.66
2-May	ML-17-505	Copeland Batch 2017-5	4.9	95.8	81.9	1.74	51	4.52	9.3	48.6	205	119	62.2	normal	clear	5.87
	ML-17-506	Copeland Batch 2017-6	5.1	88.1	81.1	1.40	66	4.87	11.4	42.7	202	152	61.4	normal	clear	5.87
22-May	ML-17-574	Copeland Batch 2017-7	5.5	88.4	81.8	1.28	62	4.79	11.6	41.3	194	155	58.5	normal	clear	5.83
	ML-17-575	Copeland Batch 2017-8	5.4	87.5	81.7	1.30	65	4.83	11.7	41.3	198	151	55.8	normal	clear	5.82
2-Jun	ML-17-669	Batch 2017-9, 2015 IF 1	5.2	88.9	83.6	1.60	56	4.78	10.1	47.3	205	161	64.4	normal	clear	5.93
12-Jul	ML-17-832	Batch 2017-11 10.0777	4.8	81.6	82	2.13	58	6.26	12.1	51.7	287	188	89	normal	clear	5.73
	ML-17-833	Buck Batch 2017-10	5.8	n/a	87.8	1.49	388	3.92	9.4	41.7	155	80	36.6	normal	hazy	5.92
31-Aug	ML-17-1010	Buck Batch 2017-12	4.6	n/a	87.8	1.45	208	4.12	9.9	41.6	161	75	37.9	normal	hazy	5.86

Bringing it all back home to Central Oregon

Mecca Grade Estate Malt, Full Pint, and Next Pint



The hull – so divisive!

Is it time for barley to go naked after 10,000 years?

Multi-use naked barley for malt/food/feed: NIFA-OREI

Larry Sidor, Crux Fermentation project + breeders, growers, food processors, maltsters from around the US



Crossing, selection (phenotypic, genetic/genomic), **mutants**, GMOs, and CRISPR

Golden Promise

(gamma irradiation of Maythorpe, ari-e, 1968)



Mechanism

Loss of function deletions

Barley World

www.barleyworld.org

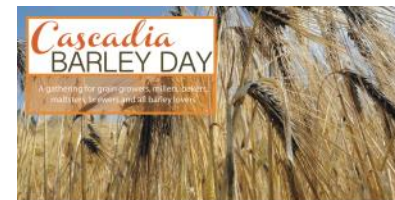
Variety Showcase: October 2, 2017
Portland, OR



Cascadia Grain Conference: January 19/20, 2018
Olympia, WA



Barley Day: May/June ?, 2018
Corvallis, OR



Saturday May 21st 9 am - 5 pm
Oregon State University, Corvallis, Oregon

SCHEDULE OF EVENTS:
9:00 - 10:00 Greenhouse
Panicle Breakfast w/ Amy Holman*, author of The New Bread Basket
10:00 - 12:00 Malt Unit Lab
The malting process and determining malting quality
12:30 - 2:00 Lunch at Myelop Farm
Pulled pork from Bushmaster Meat Company, Barley pasta salad from Ava Gentry's Commons Farmhouse bread from Little T, American Baker, Mixed greens salad from Gathering Together Farm and Malted barley ice cream sandwiches from Loyalty SD SO
2:00 - 4:00 Myelop Farm Tour
Brewing for food, malt and usage quality
Showcasing barley for optimum performance
5:00 Block 15 Taproom
Cost of admission includes one free pint custom brewed beer for the first 100 guests
* Amy Holman, author of The New Bread Basket, is a frequent speaker at the Malting, Malt and Brewing Conference in Corvallis, Oregon.

REGISTER: WWW.BARLEYWORLD.ORG
Early Bird thru May 7th: \$35. After May 7th: \$50. No Day-of Registrations.
For more information contact: laneselman@gmail.com



Breed your own!

- *The Oregon Naked Barley Blend*
- *~ 753 different naked doubled haploids from 20 different crosses*
- *2-row, 6-row; spring, facultative, winter; white, brown, blue, purple*
- *Your opportunity for natural and/or artificial selection*
- *1 envelope plants 100 – 200 square feet*



Thanks!

The Oregon Barley Project crew – past and present



Brought to you by

*Your Oregon and Federal tax dollars, USDA-NIFA grants,
USDA-ARS, American Malting Barley Association, Great
Western Malting, The Flavor7-Pack, Mecca Grade Estate
Malt*