

**2022 UMHDI Conference**  
LaCrosse, WI, March 5, 2022

**Traditional Hazelnut Breeding**  
**Lois Braun**  
Department of Agronomy and Plant Genetics,  
University of Minnesota

Photo: Rosemount, Oct 5, 2021 by Matthew Ott with Mark Hamann

# Outline

- 1. Controlled Crosses made from 2012 through 2016**
2. Controlled Crosses made in 2020 and 2021



# Breeding for even better...at least bigger... but is bigger better?



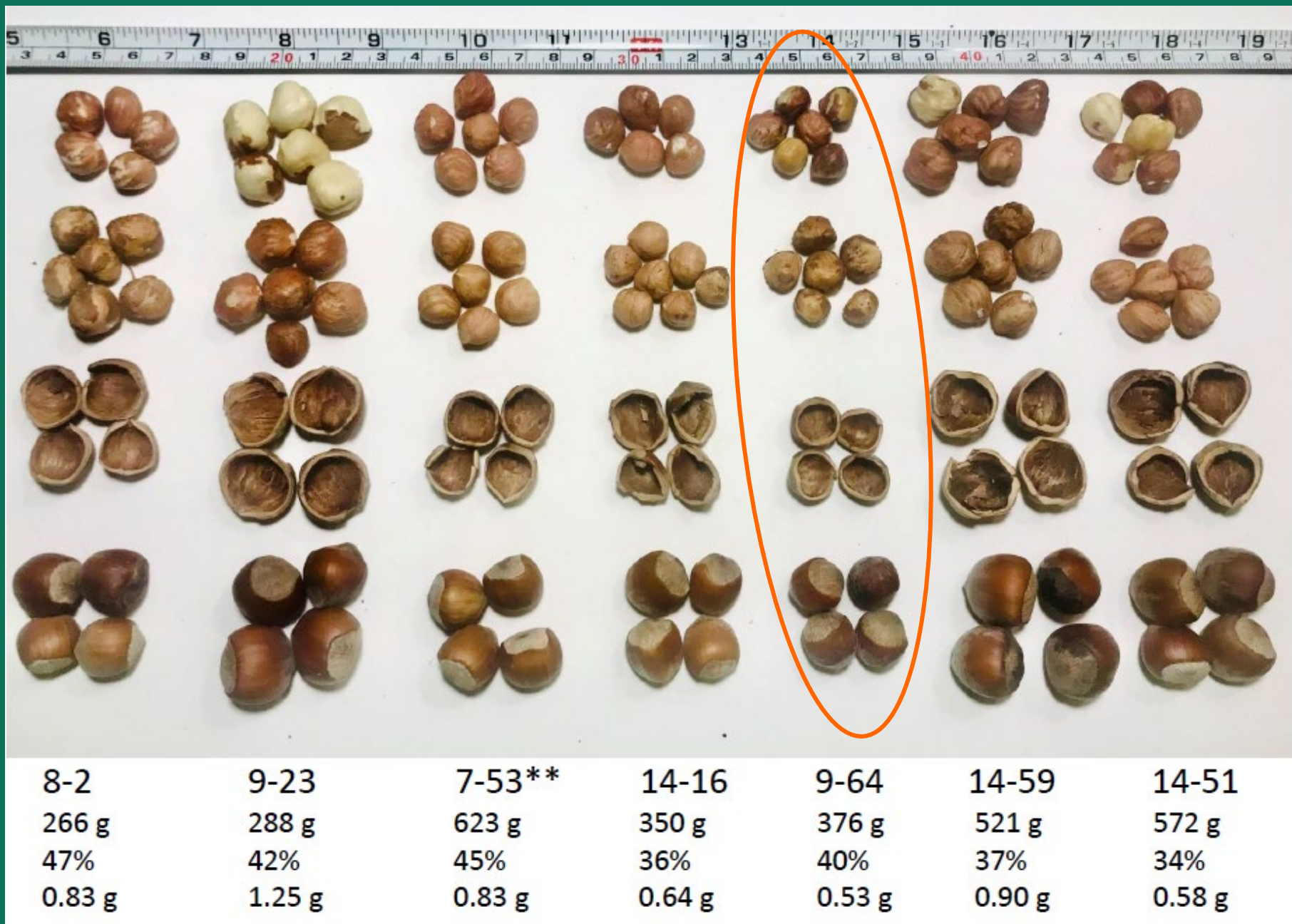
**Eric4-21 x Jefferson (plant 14-19)  
(Midwest by Oregon State)**



**Eric4-21 x Jefferson (plant 14-68)  
(Midwest by Oregon State)**



**7Mile1-9 x Eric4-21  
(Midwest by Midwest)**



Blanched  
Kernels

Un-  
blanched

ID  
Yield  
Kern %  
Kern Wt

2020  
rankings

8-2	9-23	7-53**	14-16	9-64	14-59	14-51
266 g	288 g	623 g	350 g	376 g	521 g	572 g
47%	42%	45%	36%	40%	37%	34%
0.83 g	1.25 g	0.83 g	0.64 g	0.53 g	0.90 g	0.58 g

7th

2nd

14th

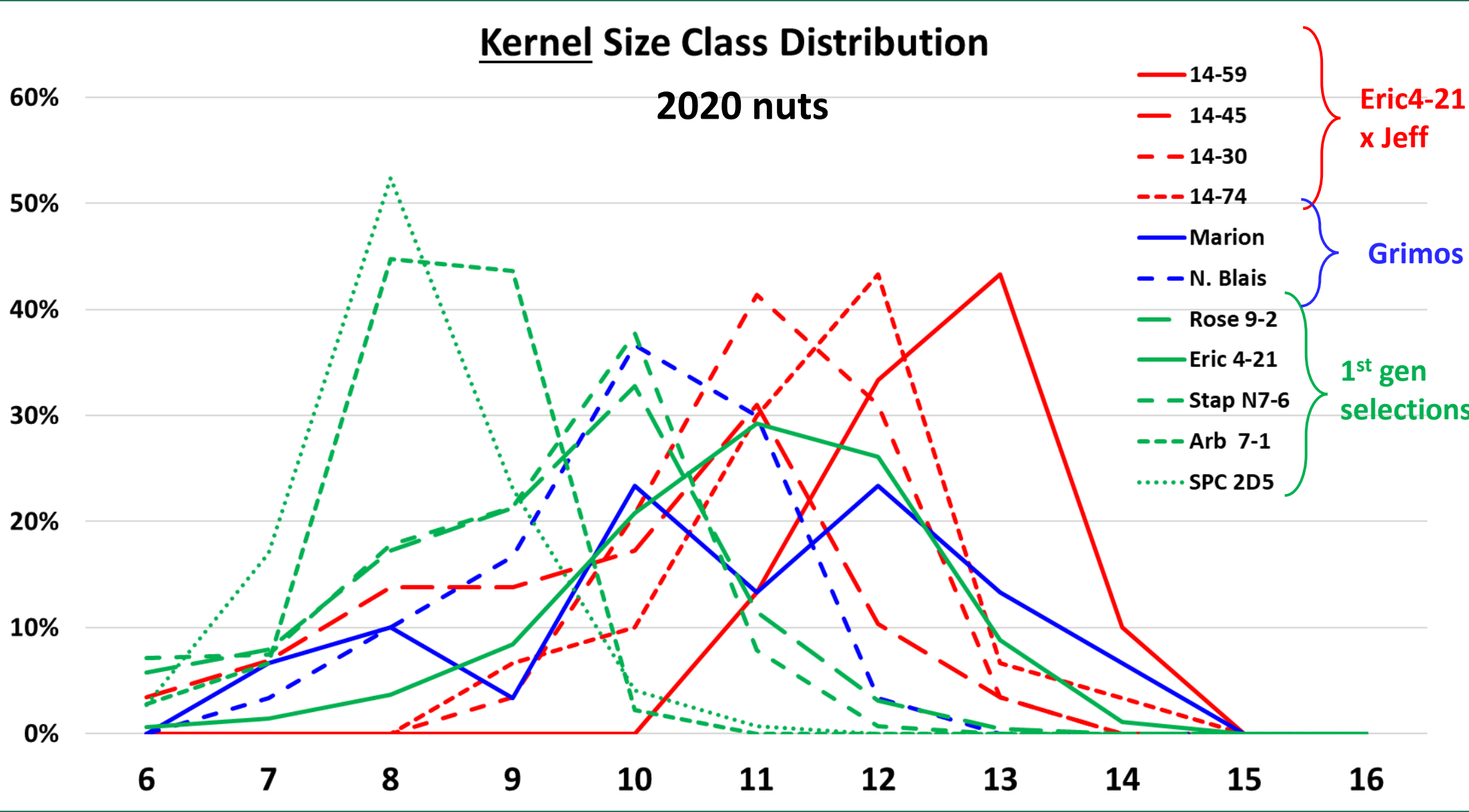
Midwest by  
Midwest

4th

10th

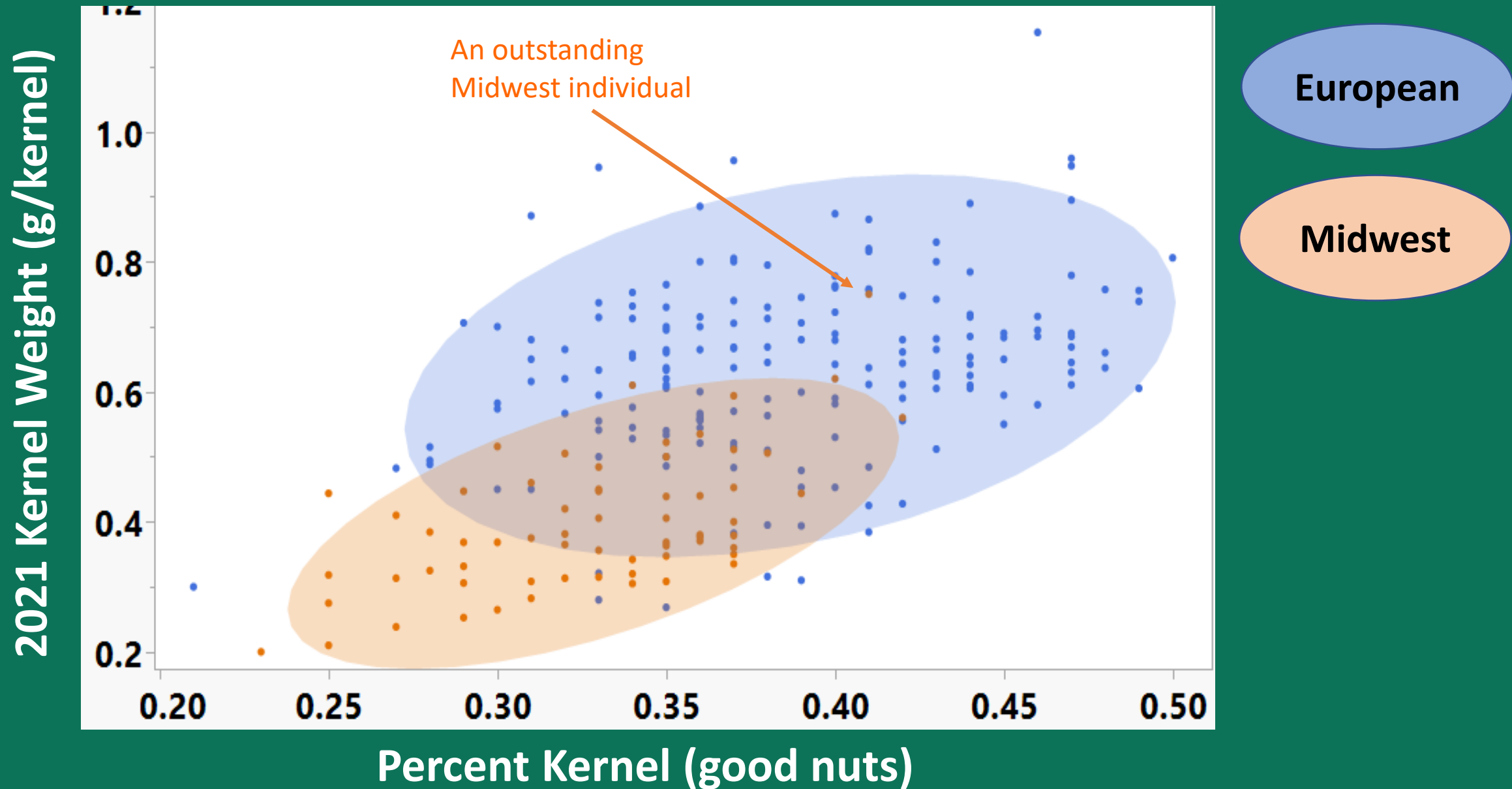
2020 Nuts  
Some of the  
top 20  
2014 and  
2015  
Midwest by  
European  
progeny  
  
(and one  
Midwest by  
Midwest for  
comparison)

Photo: Mark Hamann



in-shell nuts are in the 18 mm + size class

# European Versus Midwest Progeny Kernel Weight vs Percent Kernel





# 7 acres of hazelnuts at Rosemount, Oct 5, 2021

2014 MW by OSU crosses  
planted fall 2015

younger

2015 MW by OSU crosses  
planted fall 2016

2015 Midwest by Midwest,  
planted fall 2016

Aug 2020

Midwest by European

Midwest by Midwest

Midwest by Midwest

Les (6 ft tall)

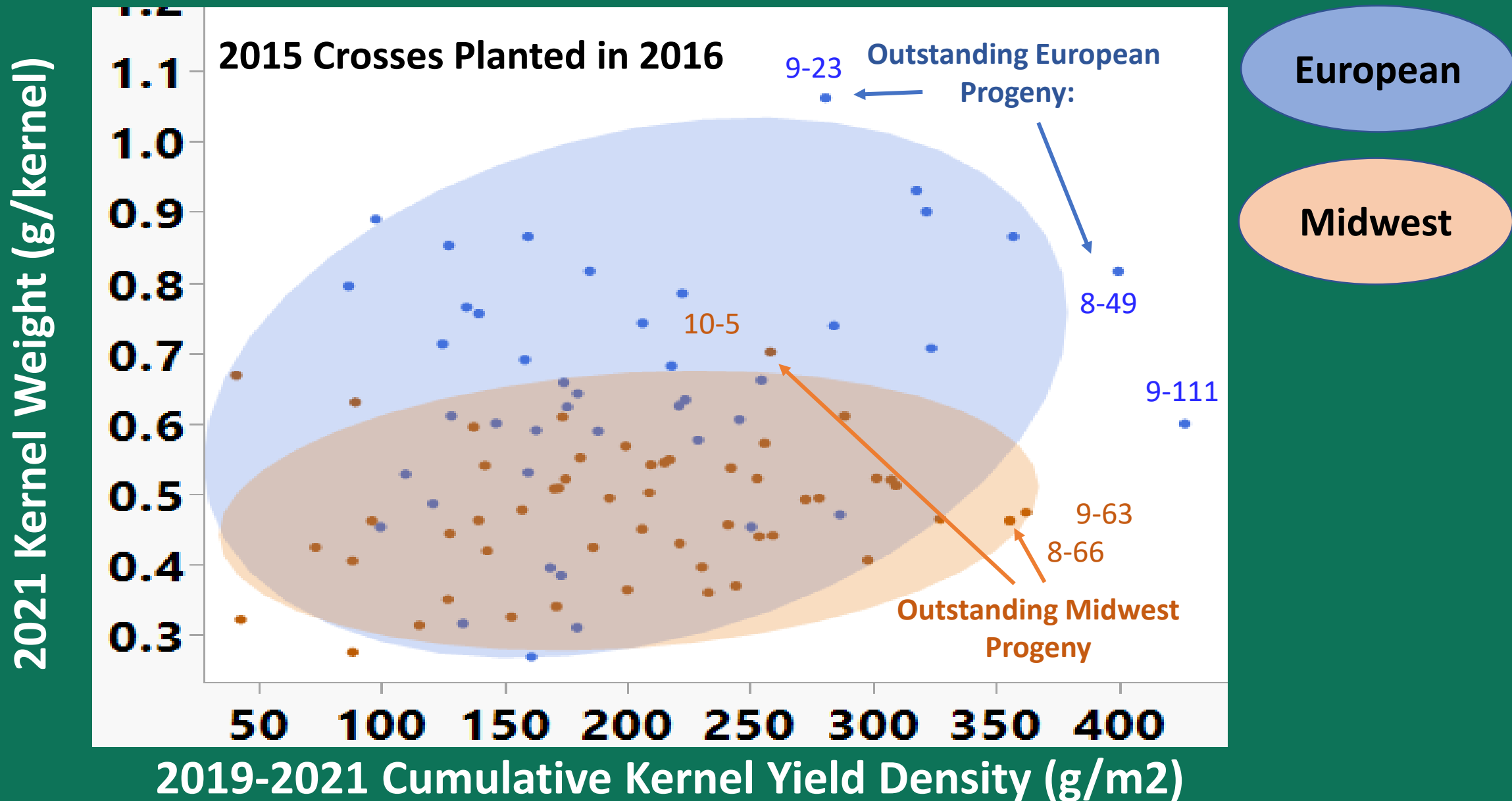
Midwest  
by European





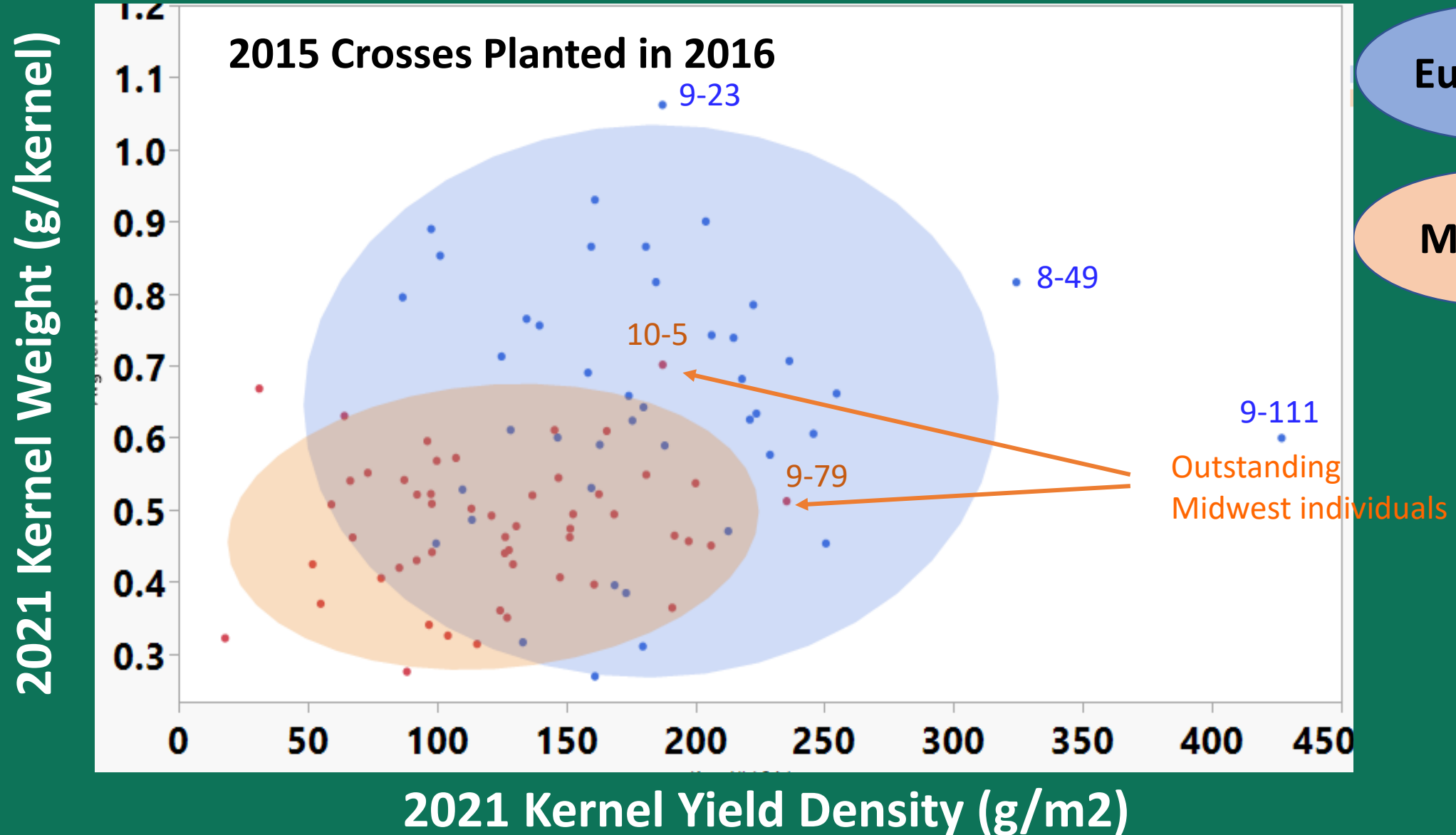
# European Versus Midwest Progeny

## Kernel Weight vs 3 Year Cumulative Kernel Yield Density



# European Versus Midwest Progeny

## 2021 Kernel Weight vs 2012 Kernel Yield Density



# 2021 Top Twenty Backcross Selections considering yield density

Rank Index 2021	Plant ID	Maternal Parent	Paternal Parent	Kernel Weight (g)	Percent Kernel	Kernel Yield (g/plant)		Yield Efficiency (g kernels/sq)
						2020	2021	
1	9-23	7Mile1-9	Jeff	1.06	41%	288	577	140
2	1-48	Eric4-21	McD	1.02	43%	216	448	136
3	18-51	SpC B1-4	York	0.73	46%	326	444	189
4	19-111	Eric4-21	1029.039	0.60	39%		691	213
5	1-26	Eric4-21	Jeff	0.76	42%	84	301	158
6	13-33	LambW	Jeff	0.71	39%	234	674	162
7	7-70	SpC B2-7	McD	0.74	44%	236	524	133
8	15-27	Eric4-21	McD	0.73	41%	254	690	129
9	8-43	Eric4-21	978.064	0.78	44%		426	111
10	7-67	SpC B2-7	McD	0.70	42%	418	719	122
11	1-30	Eric4-21	Jeff	0.91	43%	132	229	89
12	8-38	Lamb58	Jeff	0.74	43%		352	103
13	19-34	Eric4-21	Jeff	0.68	43%		287	109
14	16-72	Gibs5-15	Jeff	0.68	40%		547	107
15	1-17	Eric4-21	Jeff	0.68	38%	95	215	104
16	14-46	Eric4-21	Jeff	0.72	39%	87	291	97
17	19-79	Eric4-21	978.064	0.87	41%		168	80
18	1-18	Eric4-21	Jeff	0.74	39%	83	220	92
19	5-62	SpC B1-4	McD	0.75	46%	324	506	87
20	1-24	Eric4-21	Jeff	0.64	40%	89	227	101
Average				0.76	42%	205	427	123
1st generation selections (8th leaf)				0.50	38%	176		56
Highest values previously				0.74	51%	757		

2014 and 2015 progeny planted from 2015 to 2017 (in 6<sup>th</sup> or 7<sup>th</sup> leaf)

All are Midwest by European from Oregon State

## Next Steps?

1. Collect at least one more year of data on these plants, then propagate the best for replicated yield trials.
2. Put the top selections into micropropagation
  - They might be easier to propagate because they are  $\frac{3}{4}$  European
3. Use the top selections as pollen parents for new crosses

# Outline

1. Controlled Crosses made in 2012 through 2016
2. Controlled Crosses made in 2020 and 2021





# New Crosses in 2020 and 2021

**A) For genomic studies at the University of Wisconsin.**

**B) For Traditional Breeding**

**1) Recombining existing genetics:**

- **Best by Best Midwest (to address specific deficiencies)**

**2) To bring in new genetic diversity:**

- **Midwest by Rutgers**
- **Midwest by Grimos**

**3) Midwest by top selections of Midwest by Oregon State progeny**



**Controlled Crosses  
at Lambertton**

**145 bags placed  
March 11 & 12, 2020**

**158 bags placed  
March 8 & 9, 2021**

**Pollen  
collected  
late  
March to  
early  
April**







**Pollen applied  
early April**

# Figuring out S-alleles from Pollination Success

## Percentages of flowers pollinated that produced nut clusters

		Paternal Parents						
		Arb7-1	Cuddy2-28	Eric4-21	PriceW41	Rose9-2	SpC-2D5	
		<i>S-alleles</i>	<u>6</u>	12	<u>6</u> , 24	<u>6</u>	<u>8</u> , 19	<u>8</u>
Maternal Parents	Arb7-1	<u>6</u>		32%	0%	0%	54%	60%
	Cuddy2-28	<u>12</u>	64%		76%	43%	62%	53%
	Eric4-21	<b>6</b> , <u>24</u>	8%	27%		4%	100%	50%
	PriceW41	<u>6</u>	0%	32%	0%		65%	53%
	Rose9-2	<u>8</u> , 19	30%	47%	48%	35%		5%
	SpC-2D5	<u>8</u>	15%	61%	ok	40%	0%	

Underlined = dominant allele

**Bold S-alleles** = determined by Mehlenbacher

*Italic S-alleles* = determined by our own trial and error

**S-allele incompatibility**

Definitely incompatible

Probably incompatible

# Probable S-alleles of the Selections of our Most Abundant Layers

<b>Arb7-1</b>	<u><i>6</i></u> ,	<b>Group 1</b>
<b>Eric4-21</b>	<u><i>6</i></u> , 24	
<b>PriceW41</b>	<u><i>6</i></u> ,	
<b>Rose9-2</b>	<u><i>8</i></u> , 19	<b>Group 2</b>
<b>SpC-2D5</b>	<u><i>8</i></u> ,	
<b>StapN7-6</b>	<u><i>8</i></u> ,	
<b>Cuddy2-28</b>	<u><i>12</i></u>	<b>probably not 6 or 8</b>
<b>Rose18-10</b>		
<b>SpC-2C7</b>		
<p><b>Bold = determined by Shawn Mehlenbacher</b></p> <p><b>italics = determined by Lois's analysis of our pollination success record, slightly less definitive, but probably close</b></p>		

# Seedlings emerging in late March



They are inoculated with EFB for EFB resistance screening in the greenhouse in April



## Up-potting in May





The nursery  
just before  
field  
transplanting  
in September





**Transporting the plants  
to Becker**





**2,050 seedlings transplanted at Becker.  
Thanks to Mark, Les, Dakota, Gus,  
Annica, Ren and Mark's parents!**



# Planting Complete



Woodchipping in progress in this photo.!

**Upper Midwest  
Hazelnut  
Development Initiative**

UNIVERSITY OF MINNESOTA  
**Driven to Discover<sup>SM</sup>**



Forever Green Initiative



United States Department of Agriculture  
National Institute of Food and Agriculture



MINNESOTA DEPARTMENT  
OF AGRICULTURE