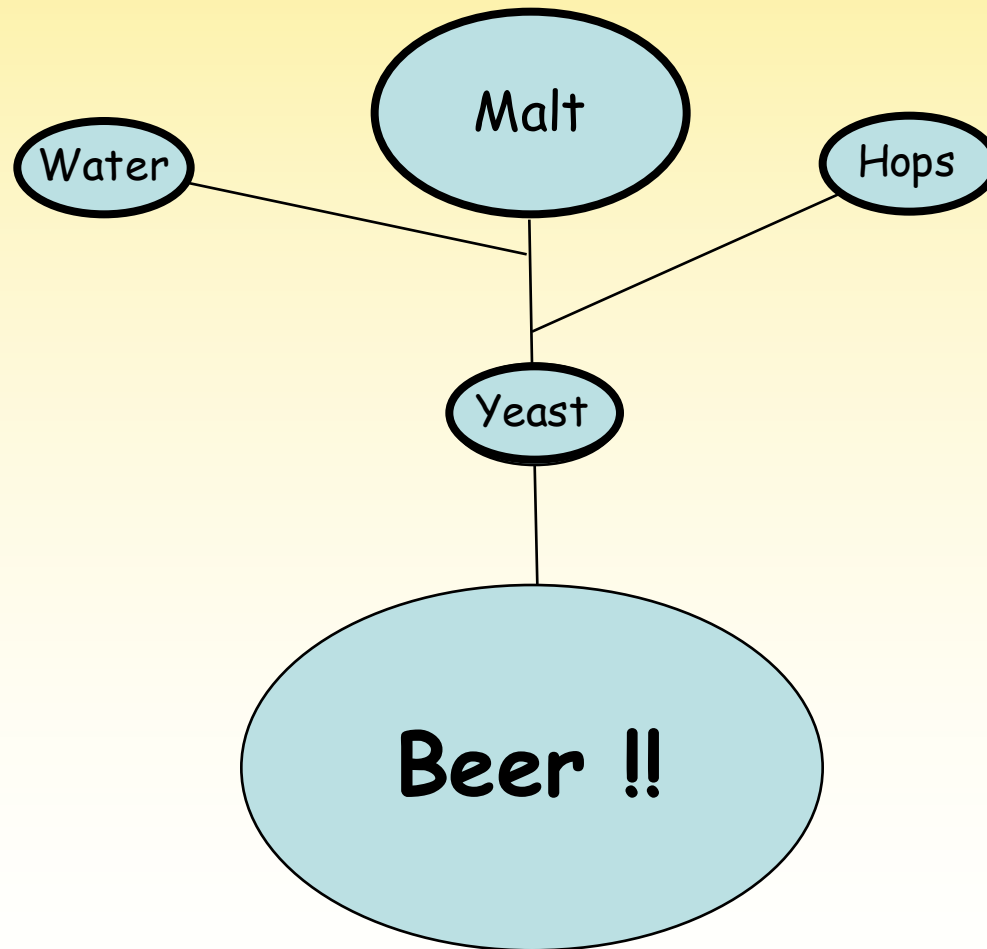


# The Journey: From a breeder's cross to a malting barley variety.

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# Know your roots



# AMBA 2008 Recommended Malting Barley Varieties

## *Six-Row*

Variety	Source	Year*	Variety	Source	Year*
Robust	(MN)	1984	Stander	(MN)	1995
Foster	(ND)	1997	Lacey	(MN)	2000
Legacy	(AB)	2001	Drummond	(ND)	2002
Tradition	(AB)	2004	Stellar-ND	(ND)	2006

## *Two-Row*

Variety	Source	Year*	Variety	Source	Year*
Harrington	(CA)	1989	Conlon	(ND)	2000
Merit	(AB)	2000	AC Metcalfe	(CA)	2005
Craft	(MT)	2007	CDC Copeland	(CA)	2007
Conrad	(AB)	2007	Scarlett	(DE)	2008

\*Year the variety was first added to the AMBA list of recommended malting barley varieties.

# The Journey

## Part 1: Breeder

F1 to F5: The cross and sorting out

## Part 2: Breeder and QA Lab

F5 and beyond: Agronomic evaluation and malt quality evaluation at CCRU

## Part 3: Breeder and AMBA

Formal evaluation of Malting and Brewing quality

# What is Malting Quality?

**Agronomics** (Yield, Heading date, Lodging, Straw strength)

**Disease resistance** (FHB, Ug99)

**Protein**

**Plumpness**

**Color**

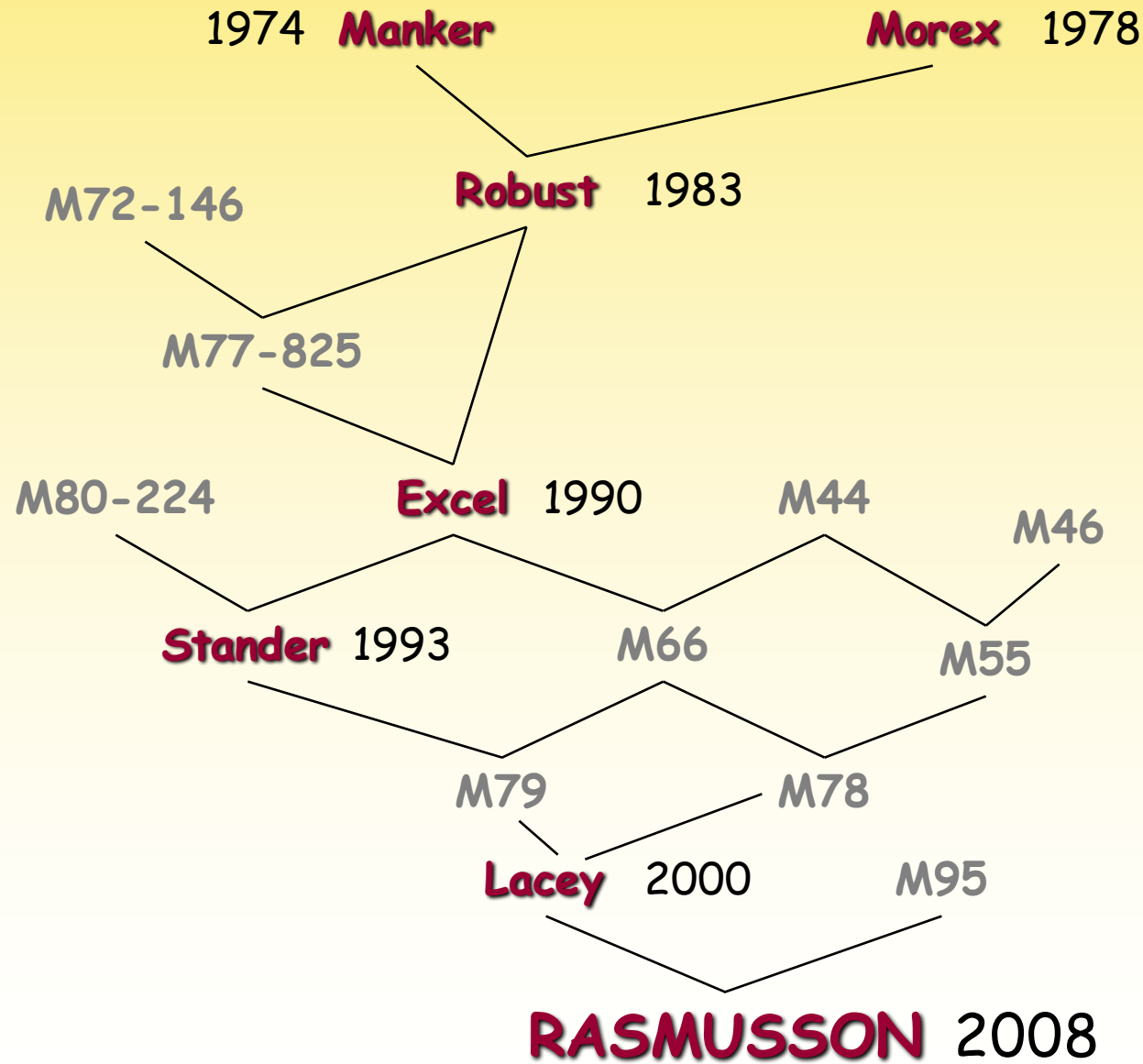
**Wort** (% extract, protein, FAN, color,  $\beta$ -glucan, turbidity, viscosity)

**Enzymes** (diastatic power,  $\alpha$ -amylase)

**Malting and Brewing Performance**

**Taste**

Slide Courtesy  
of K. Smith



1994 **Royal**

1998 **MNBrite**

# Rasmusson (M109)

1997 Fall GH Lacey x M95

1997-98 Winter GH F1

1998 Summer F2

1998 Fall GH F3

1998-99 Winter GH F4

1999 Summer F5

1999-00 Winter F5:6

2000 Summer 1<sup>st</sup> Year Yield Trials

2001 Summer 2<sup>nd</sup> Year Yield Trials, MVN (1<sup>st</sup> Year AMBA Pilot)

2002 Summer 3<sup>rd</sup> Year Yield Trials, MVN

2003 Summer 1<sup>st</sup> Year AMBA Pilot, MVN (2<sup>nd</sup> Year AMBA Pilot)

2004 Summer 2<sup>nd</sup> Year AMBA Pilot (MVN , Seed Increase)

2005 Summer Seed Increase (MVN, 1<sup>st</sup> Year AMBA Plant Scale)

2006 Summer 1<sup>st</sup> Year AMBA Plant Scale (Seed Increase)

2007 Summer 2<sup>nd</sup> Year AMBA Plant Scale (being conducted)

## Head Rows

1 location; 1 replication

Selection for:  
height, heading  
date, lodging, straw  
breakage  
Micro-Malt

Agronomic comparisons of M109 compared to check varieties 2002-2003 in Minnesota On-Farm trials  
(mean of 12 trials)

Variety /line	Yield (Bu/A)	Test Weight	Protein (%)	Plump (%)	Lodging (1 – 9)	DON (ppm)
Robust	<b>88</b>	<b>43.7</b>	<b>13.6</b>	<b>86.1</b>	<b>4.3</b>	<b>0.9</b>
Legacy	94	42.7	13.1	87.1	3.3	1.0
Foster	95	42.2	12.8	90.2	3.4	1.2
Lacey	97	44.9	13.4	86.9	4.2	0.8
Conlon	87	46.4	13.3	91.5	7.2	0.6
Drummond	88	43.2	13.4	85.3	4.1	1.3
M109	<b>101</b>	<b>44.5</b>	<b>13.1</b>	<b>85.1</b>	<b>3.8</b>	<b>1.3</b>



# Mississippi Valley Uniform Barley Nursery

	Malt Extract	Barley Protein	Wort Protein	DP	AA	BG	Quality Score
<b>2001CY</b>							
Morex	78.3	14.5	5.97	166	64.4	155	27
Robust	79.0	14.0	5.77	160	51.5	200	38
M109	80.7	12.8	5.59	149	62.1	120	41
<b>2002CY</b>							
Morex	78.2	14.4	6.05	165	68.8	152	40
Robust	<b>78.7</b>	<b>13.7</b>	<b>5.88</b>	<b>162</b>	<b>53.0</b>	<b>216</b>	<b>45</b>
M109	<b>79.8</b>	<b>12.9</b>	<b>5.81</b>	<b>165</b>	<b>63.6</b>	<b>142</b>	<b>51</b>
<b>2003CY</b>							
Morex	77.8	14.5	5.52	179	59.9	314	30
Robust	77.9	14.0	5.22	163	47.3	470	38
M109	79.7	12.9	5.24	164	60.4	303	54
<b>2004CY</b>							
Morex	77.5	14.0	5.41	170	63.3	314	34
Robust	78.3	13.6	5.36	160	49.8	385	44
M109	79.8	12.9	5.41	166	62.5	321	50
<b>2005CY</b>							
Morex	78.4	13.9	5.62	179	68.7	183	41
Robust	<b>78.2</b>	<b>13.9</b>	<b>5.74</b>	<b>184</b>	<b>53.6</b>	<b>220</b>	<b>43</b>
M109	<b>79.3</b>	<b>13.4</b>	<b>5.81</b>	<b>179</b>	<b>65.4</b>	<b>133</b>	<b>51</b>
M122	78.4	13.4	5.69	169	65.5	261	41

# AMBA Pilot Malting Data

	Extract	Barley Protein	Wort Protein	DP	AA	BG
<b>2001CY</b>						
Robust	<b>79.1</b>	<b>13.4</b>	<b>5.59</b>	<b>147</b>	<b>54.5</b>	<b>257</b>
M109	<b>80.9</b>	<b>11.5</b>	<b>5.03</b>	<b>134</b>	<b>64.8</b>	<b>226</b>
<b>2003CY</b>						
Robust	<b>79.2</b>	<b>14.0</b>	<b>5.94</b>	<b>181</b>	<b>58.7</b>	<b>256</b>
M109	<b>80.0</b>	<b>13.2</b>	<b>5.79</b>	<b>166</b>	<b>74.1</b>	<b>220</b>
<b>2005CY</b>						
Robust	<b>78.6</b>	<b>12.1</b>	<b>5.67</b>	<b>182</b>	<b>61.0</b>	<b>82</b>
M122	<b>79.4</b>	<b>11.2</b>	<b>5.24</b>	<b>157</b>	<b>69.5</b>	<b>113</b>
<b>2006CY</b>						
Robust	<b>79.8</b>	<b>13.1</b>	<b>5.35</b>	<b>173</b>	<b>57.3</b>	<b>234</b>
M122	<b>79.9</b>	<b>12.8</b>	<b>5.17</b>	<b>162</b>	<b>68.9</b>	<b>198</b>

4 Greenhouse harvests

1 Winter harvest

10 Summer harvests ( 143 Station Years)

5 years in the Mississippi Valley Uniform Barley Nursery

9 years Malted and analyzed in the QA lab 70 times

2 years in the AMBA pilot scale program

2 years in the AMBA plant scale program

# Acknowledgements

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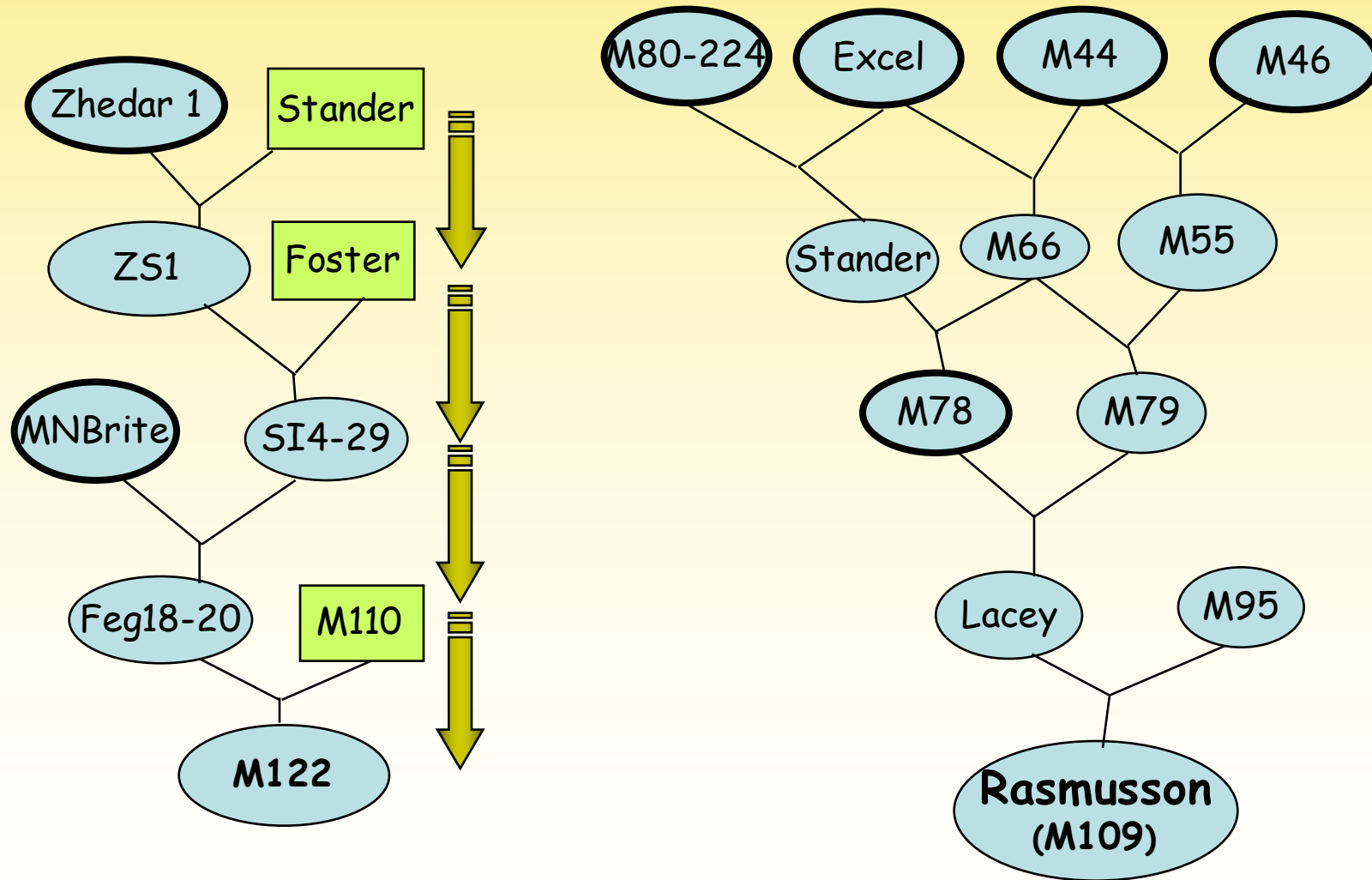
Linda Short      CCRU

Mike Marinac      CCRU

Andrew Standish      CCRU

# Pedigrees of M122 and Rasmusson Barley

Slide Courtesy of K. Smith



## Mississippi Valley Uniform Barley Nursery

	Malt Extract	Barley Protein	Wort Protein	Diastatic Power	Alpha - amylase	Beta - Glucan	Quality Score
<b>2005CY</b>							
Morex	78.4	13.9	5.62	179	68.7	183	41
Robust	78.2	13.9	5.74	184	53.6	220	43
M109	79.3	13.4	5.81	179	65.4	133	51
M122	78.4	13.4	5.69	169	65.5	261	41
<b>2006CY</b>							
Morex	78.7	13.5	5.48	169	62.6	176	42
Robust	79.6	13.2	5.64	158	53.4	229	41
M122	79.7	12.9	5.68	155	67.6	172	43

# M122 Agronomic comparisons to standard check varieties

Variety / Line	Yield	Lodging	Days to Heading	Plant Height	FHB Severity	DON
	(Bu/A)	(%)	(Days)	(inches)	(% of Robust)	(% of Robust)
Sta. Yrs	19	9	18	17	23	
Robust	94	39	57.4	34	100	100
Stander	97	29	57.5	31	135	155
Lacey	99	28	57.4	32	-----	-----
M122	103	41	57.5	34	42	51

## 2001 Mississippi Valley Uniform Barley Nursery – Crookston, MN

Variety or Selection	KWt (mg)	on 6/64" (%)	Barley Color (Agtron)	Malt Extract (%)	Wort Color	Wort clarity	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)	Quality Score
<b>Morex</b>	30.0	70.5	42	<b>78.6</b>	2.0	clr	<b>13.5</b>	<b>5.71</b>	43.3	145	66.7	<b>125</b>	38
<b>Robust</b>	34.5	92.2	40	<b>79.2</b>	1.5	clr	<b>13.6</b>	<b>5.52</b>	41.6	156	49.4	<b>146</b>	53
<b>Stander</b>	35.3	97.0	43	<b>81.2</b>	2.7	clr	<b>12.3</b>	<b>6.32</b>	54.6	123	80.7	<b>128</b>	39
MNBrite	32.7	85.3	39	80.2	*5.4	clr	14.4	*7.93	57.6	166	75.3	36	26
Drummond	33.4	91.8	45	79.7	1.9	clr	12.9	5.54	45.6	151	64.7	123	46
Lacey	34.9	91.2	38	79.5	2.1	Sl. hazy	13.4	5.33	41.0	132	57.5	139	46
M103	34.3	90.2	42	80.4	2.5	clr	11.7	5.97	54.1	90	70.4	153	38
M106	34.0	88.5	36	80.7	2.2	Sl. hazy	12.6	5.50	46.4	129	66.2	100	36
M108	33.0	86.7	39	80.7	2.4	clr	12.2	5.82	50.2	107	66.8	158	38
<b>M109</b>	35.6	93.4	40	<b>81.3</b>	2.0	Sl. hazy	<b>12.1</b>	<b>5.16</b>	45.1	132	62.3	<b>127</b>	54
M110	36.1	94.4	38	80.3	n.d.	hazy	13.0	5.32	43.4	150	57.3	207	47
MOREX M.C.	31.5	72.0	74	80.3	2.2	clr	12.2	6.06	51.9	124	76.7	76	32