California Wheat

Annual Collaborator Meeting

2019

MONDAY, OCTOBER 14, 2019

9:00 AM – 3:00 PM

UC Davis, California

California WHEAT

AGENDA

<u>Morning Session 9:00 A.M. – 12:00 P.M.</u>

Welcome
Small Grains Specialist – Updates and Overview of 2019 Variety Trials
Dr. Mark Lundy – University of California, Davis
Variety Presentation and Evaluations
Breeder Updates
Collaborators Results
- Hard Red Wheat and Hard White Wheat
- Durum Wheat

California Preferred Wheat Variety List
Dr. Dubcovsky, Dr. Lundy, and Teng Vang.
The California Wheat Collaborators Meeting

LUNCH

<u>Afternoon Session 1:00 P.M. – 3:00 P.M.</u>

Open Discussion
From Grain to Finished Product Panel
Wheat Growers - Ed Sills and Ian Anderson
Farm Strategy – Chad Sager
Millers and Bakers – Keith Giusto, Central Milling and Nan Kohler, Grist & Toll
Tortilla Manufacturer – Joe Trummer, Mi Rancho

Moderator: Steven Windh

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Platinum

AgriPro

Bayer

California Wheat Commission

Miller Milling

Gold

Bay State Milling

El Toro Export

Grain Craft

Silver

Barkley Seed

Farmers Grain Elevator

Foss

Mi Rancho

We are proud to serve products made with California Wheat

Lunch catered by Hannibal's Catering using flour from California grown wheat by Early Bird Farm:

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Description of the 2019 California Wheat Collaborator Program

On March 16, 1995 the California Wheat Commission (CWC), in cooperation with the University of California Cooperative Extension, held the first annual California Wheat meeting.

Since then, this meeting has served as a forum between millers and breeders to discuss quality attributes of newly released cultivar and elite breeding lines from private and public breeding programs.

The first millers and end-users to be part of this program were General Mills, Inc., Fisher Mills, Inc., and the California Wheat Commission Laboratory. Breeders who participated for the first time were Arizona Plant Breeders, Farmers Marketing, Resource Seed, Inc., Western Plant Breeders, and University of California, Davis.

In fall of 2018, a total of 6 Hard Red and 3 Hard White entries were grown in Fresno and Davis locations. Only Fresno entries were submitted to the collaborating mills. The Hard Red wheat check sample was SY-Cal Rojo and the Hard White wheat check sample was SY-Blanca Grande 515. The red and white wheat entries were milled (~90 lbs of grain) on a Miag Multomat mill in the Western Wheat Quality Laboratory at the USDA-ARS in Pullman, WA. The flour samples were sent to nine collaborators for bread baking analysis, including artisan baker Keith Giustos at Artisan Baking Center. For tortilla quality, Mi Rancho Tortilla Company analyzed the entries.

Total of five Durum entries were grown in the Imperial Valley and Fresno locations. Only Fresno Valley entries were submitted to the collaborating mills. The Durum wheat check sample was SY Fortissimo. The durum wheat entries were milled at the CWC Laboratory. For all the entries, ~15 lbs of grain were milled (Appendix B, Milling Procedures). The semolina samples were sent to two collaborators. Pasta quality was performed by the CWC lab.

Description of the 2019 California Wheat Collaborator Program

2019 BREEDERS

Five wheat breeding programs participated this year:

1. Arizona Plant Breeders (Hard Red and Durum Wheat).
2. AgriPro Syngenta (Hard Red Wheat)
3. University of California, Davis (Hard Red, Hard White, and Durum Wheat)
4. WestBred (Hard Red Wheat)

2019 COLLABORATORS

Nine collaborators analyzed Hard Red and White Wheat entries:

1. ADM
2. Ardent Mills
3. California Wheat Commission
4. General Mills
5. Grain Craft
6. Limagrain Cereal Seeds
7. AgriPro Syngenta
8. Mi Rancho – Tortilla Manufacturing Company
9. Artisan Baking Center

Two collaborators analyzed Durum Wheat entries:

1. Ardent Mills
2. California Wheat Commission

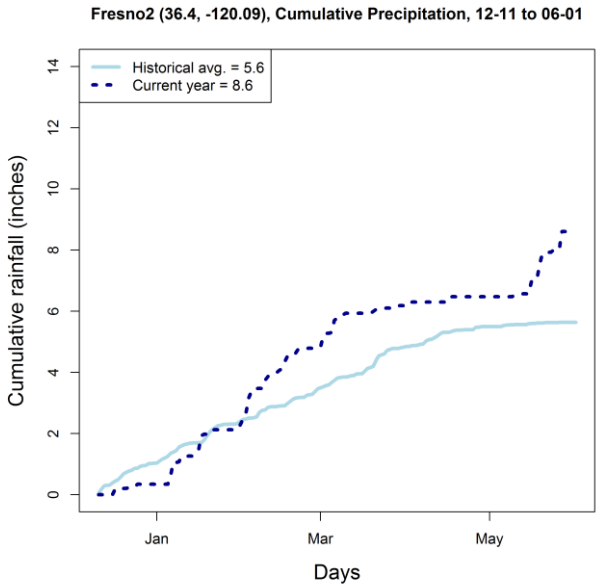
Site information for the 2018-19 Collaborative Trial location (Fresno County CA).

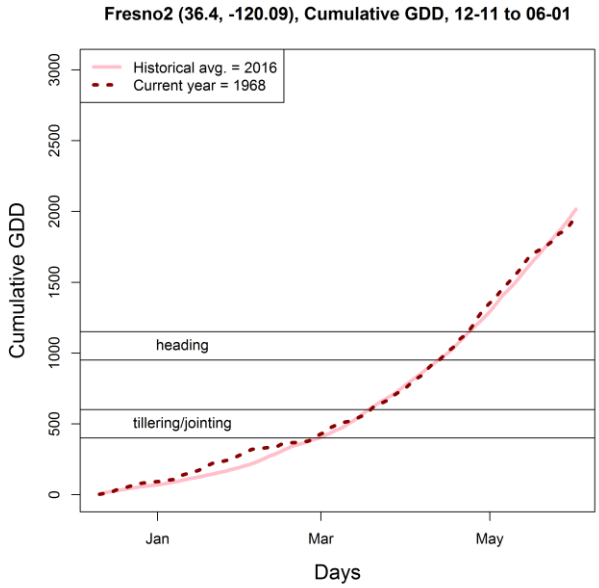
Latitude	Longitude	Soil Type	Previous Crop	Planting Date	Harvest Date
36.3847	-120.0766	Ciervo, wet-Ciervo complex, saline-sodic	cotton	12/11/2018	6/19/2019

Precipitation (planting - 6/1, inches)	Irrigation (seasonal total, inches)	Sub-surface drip irrigation timing and amount (inches)
8.6	21.4	12/21-12/30/18 (4.9"), 1/9-1/15 (2.5"), 3/7-3/19 (4.3"), 4/7-4/14 (3.4"), 4/18-4/22 (2.2"), 4/22-4/26 (2.1"), 4/29-5/2 (2")

Preplant soil nitrate-N concentration	Nitrogen fertilizer (seasonal total, lb/acre)	Nitrogen fertilizer form	Nitrogen timing and amount (lb/acre)
38ppm	152lb	UAN-32	12/21/18 (99lb), 4/7/19 (53lb)

Trial notes: Volunteer barley present. Rogued within plots, but some volunteers in alleys resulted in minor sample contamination.



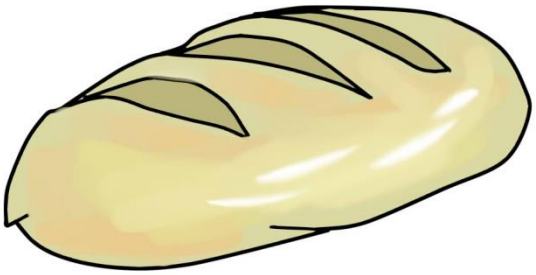


2019 Collaborative Trials Site Location (Fresno County, CA)

HARD RED WHEAT

&

HARD WHITE WHEAT



2019 California Hard Red and White Wheat Collaborator Entries*

Hard Red and Hard White Wheat					
Breeder	**Wheat**	**Check**	**Sample #**	**Entry Name**	**Group**
Arizona Plant Breeders					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1
			HRS-1	APB 410089	1
AgriPro Syngenta					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	2
			HRS-2	AP Octane	2
UC Davis					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	3
			HRS-3	UC 1882	3
	Hard White	x	HWS CONTROL	SY Blanca Grande 515	4
			HWS-1	UC 1839	4
			HWS-2	UC 1909	4
WestBred					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	5
			HRS-4	WB 9490	5
			HRS-5	WB 9699	5

Check Samples Descriptions

SY-Cal Rojo (Hard Red Wheat)

Cal Rojo is hard red spring wheat. It was released by Resource Seeds, Inc (now Syngenta). in 2006. It was selected from the cross CMT1171-4//Pfau /Veery #5/3/Bonus. Its experimental designation was RSI 00WB80404. Cal Rojo is medium-early maturing (3 days earlier than Summit) and has excellent straw strength. Plant height is shorter than Blanca Grande by 12 cm and Summit by 8 cm. Foliage is blue-green at boot stage; the flag-leaf is erect and twisted. The stem has a waxy bloom, but no anthocyanin. The last internode of the stem is hairy, and the peduncle is erect. The stem has four nodes, and the internodes are hollow. The spikes are awned, inclined, mid-dense and tapering in shape, with tan 2 glumes that are long and wide, having shoulders that are narrow and elevated, and an acuminate beak. Seed is hard, red, elliptical, with a rounded cheek and medium brush, a crease that is narrow and shallow, and midsize germ. At the time of release it was resistant to stripe rust, leaf rust, and powdery mildew, moderately resistant to Septoria tritici leaf blotch, and moderately susceptible to BYD. It was evaluated as Entry 1478 in the UC Regional Cereal Testing program from 2005-present for late fall planting in the Central Valley and surrounding areas, the south-central coast, and the southern desert regions of California.

SY-Blanca Grande 515 (Hard White Wheat)

Blanca Grande 515 is a hard white spring wheat. It was released by Resource Seeds, Inc (now Syngenta) in 2010. The stripe rust resistance genes Yr5 and Yr15 were introduced by four backcross generations into the susceptible cultivar Blanca Grande and then combined using marker assisted selection at UC Davis (project supported by Resource Seeds Inc.).

Resource Seeds Inc. selected the best lines among BC4F2 lines homozygous for the two genes. This cultivar is very 6 similar to the original Blanca Grande but is resistant to prevalent races of the stripe rust pathogen present in California. It has medium early maturity, averages about 40 inches in plant height, and has fair straw strength. At the time of release it was resistant to stripe rust and leaf rust, moderately resistant to BYD, and susceptible to Septoria tritici leaf blotch. It subsequently became moderately susceptible to BYD and susceptible to powdery mildew. It was evaluated as Entry 1657 in the UC Regional Cereal Testing program from 2010-present for late fall planting in the Central Valley, surrounding areas, the south-central coast region, and southern desert areas of California.

2019 Collaborative Common Wheat Productivity

Breeder	Wheat	Check	Sample #	Entry Name	Entry No.	Group	Collaborative Trial			UC Regional Variety Trials											
							Fresno Yield (lbs/acre)			Sacramento Valley (2017-19) 14 site-years Yield (lbs/acre)			Northern SJ Valley (2017-19) 7 site-years Yield (lbs/acre)			Southern SJ Valley (2017-19) 7 site-years Yield (lbs/acre)			Imperial Valley (2016-18) 3 site-years Yield (lbs/acre)		
							Mean	SD	Rank	Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank
Arizona Plant Breeders																					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	1	11078	765	4	5571	524	4	6467	515	7	6948	1229	3	6330	362	5
			HRS-1	APB 410089	1903	1	10886	-	6	5554	585	5	6575	750	4	6220	1317	8	-	-	-
Syngenta																					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	2	11078	765	4	5571	524	4	6467	515	7	6948	1229	3	6330	362	5
			HRS-2	AP Octane	1878	2	11774	-	1	6013	543	1	6711	568	3	6717	1250	6	7100	466	1
UC Davis																					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	3	11078	765	4	5571	524	4	6467	515	7	6948	1229	3	6330	362	5
			HRS-3	UC 1882	1882	3	11436	-	3	5458	537	6	6521	568	5	6458	1263	7	6639	466	2
	Hard White	x	HWS CONTROL	SY Blanca Grande 515	1657	4	10500	628	7	5444	529	7	6520	515	6	6865	1229	4	6560	357	3
			HWS-1	UC 1839	1839	4	9950	-	8	5109	546	8	6261	558	8	7028	1236	1	6087	465	7
			HWS-2	UC 1909	1909	4	9337	-	9	4905	580	9	5832	750	9	5917	1291	9	-	-	-
WestBred																					
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	5	11078	765	4	5571	524	4	6467	515	7	6948	1229	3	6330	362	5
			HRS-4	WB 9490	1887	5	11606	-	2	5693	539	3	7082	574	2	6804	1250	5	6538	466	4
			HRS-5	WB 9699	1888	5	11053	-	5	5960	537	2	7118	568	1	6990	1250	2	6246	466	6

site-years indicates the number of test-year combinations the value is dervied from.

2019 Collaborative Common Wheat Protein

Breeder	Wheat	Check	Sample #	Entry Name	Entry No.	Group	UC Regional Variety Trials											
							Sacramento Valley (2017-19) 14 site-years Protein (%)			Northern SJ Valley (2017-19) 7 site-years Protein (%)			Southern SJ Valley (2017-19) 7 site-years Protein (%)			Imperial Valley (2016-18) 3 site-years Protein (%)		
							Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank
Arizona Plant Breeders																		
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	1	10.81	0.51	7	11.54	0.89	6	13.08	0.58	8	12.13	0.28	6
			HRS-1	APB 410089	1903	1	12.67	0.66	1	12.85	1.53	1	14.89	1.23	1	-	-	-
Syngenta																		
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	2	10.81	0.51	7	11.54	0.89	6	13.08	0.58	8	12.13	0.28	6
			HRS-2	AP Octane	1878	2	10.87	0.55	6	10.80	0.96	9	13.41	0.73	7	13.82	0.47	1
UC Davis																		
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	3	10.81	0.51	7	11.54	0.89	6	13.08	0.58	8	12.13	0.28	6
			HRS-3	UC 1882	1882	3	11.71	0.54	3	11.95	0.95	5	14.05	0.8	4	12.06	0.47	7
	Hard White	x	HWS CONTROL	SY Blanca Grande 515	1657	4	11.51	0.52	4	11.97	0.89	4	13.53	0.58	6	13.16	0.28	4
			HWS-1	UC 1839	1839	4	12.02	0.56	2	12.62	0.95	2	13.83	0.62	5	13.21	0.41	3
			HWS-2	UC 1909	1909	4	11.51	0.66	4	12.18	1.53	3	14.83	1.23	2	-	-	
WestBred																		
	Hard Red	x	HRS CONTROL	SY Cal Rojo	1478	5	10.81	0.51	7	11.54	0.89	6	13.08	0.58	8	12.13	0.28	6
			HRS-4	WB 9490	1887	5	10.40	0.55	8	10.83	0.95	8	12.73	0.73	9	12.62	0.47	5
			HRS-5	WB 9699	1888	5	11.01	0.54	5	11.47	0.95	7	14.60	0.73	3	13.59	0.47	2

site-years indicates the number of test-year combinations the value is dervied from.

2019 Common Wheat Yield, Protein and Overall Rank

Region Group	Name	UC Number	Yield (lbs/acre)	Standard Error	Overall Rank	Protein (%)	Overall Rank
Sacramento Valley							
	WB 9490	1887	6372	483	9	9.69	33
	UC 1882	1882	6031	486	23	10.68	12
	AP Octane	1878	6648	486	5	9.41	36
	SY Cal Rojo	1478	6261	486	13	10	30
	WB 9699	1888	6508	486	6	10.27	24
	APB 410089	1903	6178	486	18	11.66	1
	SY Blanca Grande 515	1657	6363	486	10	10.38	20
	UC 1839	1839	5611	489	32	11	6
	UC 1909	1909	5552	483	33	10.5	14
Northern SJ Valley	WB 9490	1887	8193	712	1	12.02	28
	UC 1882	1882	7281	712	18	12.62	18
	AP Octane	1878	7167	707	23	12.21	23
	SY Cal Rojo	1478	7196	707	22	11.21	36
	WB 9699	1888	7657	707	4	12.3	21
	APB 410089	1903	7229	707	20	13.6	6
	SY Blanca Grande 515	1657	7544	707	7	12.6	19
	UC 1839	1839	7071	707	25	13.71	4
	UC 1909	1909	6486	707	33	12.92	15
Southern SJ Valley	WB 9490	1887	8084	457	4	11.71	33
	UC 1882	1882	7320	457	18	12.43	25
	AP Octane	1878	7923	457	8	12.19	28
	SY Cal Rojo	1478	7525	457	14	11.52	35
	WB 9699	1888	7976	457	6	12.91	19
	APB 410089	1903	7115	505	23	13.98	5
	SY Blanca Grande 515	1657	6387	457	34	13.53	9.5
	UC 1839	1839	6864	457	25	13.99	4
	UC 1909	1909	6627	457	31	13.92	6

GROUP 1 - ARIZONA PLANT BREEDERS

Breeder: Wesam Abu Hammad

Description of Breeder Entries

<u>Hard Red Wheat</u>

APB 410089 (HRS-1)

APB410089 is a hard red spring wheat developed by Arizona Plant Breeder's. It is considered one of our top elite lines evaluated in 2019. This elite line was consistently resistant to lodging across environments. Grain protein content and test weight were equal to or better than check varieties across locations. This line will be evaluated again next year and, is considered a candidate for future release.

Group 1: Arizona Plant Breeders

Milling Data*

Hard Red Wheat (Grams)		
Entry Name	**SY Cal Rojo**	**APB 410089**
Sample	**HRS Control**	**HRS-1**
FIRST_BREAK	3187	3650
SECOND_BREAK	3164	3257
GRADER	1703	1554
THIRD_BREAK	1349	1356
FIRST_MIDS	4613	3199
SECOND_MIDS	9396	8599
THIRD_MIDS	3164	3149
FIRST_M_RED	2003	1359
FOURTH_MIDS	2469	1833
FIFTH_MIDS	1252	1396
RED_DOG	1256	2430
RED_SHORT	674	938
BK_SHORT	1341	1329
BRAN	7584	6450
SUCTION	120	181
TOTAL_FLOUR	32420	29533
FEED_STREAM	10855	11147
%FIRST_REL	42.8	43.4
%SECOND_RELEASE	61.1	61.1
BREAK_FLOUR	17.8	20.3
PATENT_FLOUR	51.7	49.3
FLOUR_YLD (%)	74.9	72.6
Comments:	**Samples achieved first and second break release at anticipated rate with good bran cleanup**	

Group 1: Arizona Plant Breeders

Grain & Flour Quality Data

Data represent only the means of the quality data received from the mills.

Entry Name	**SY Cal Rojo**	**APB 410089**
Sample	**HRS Control**	**HRS-1**
Wheat Data		
Moisture (%)	9.2	9.4
Protein % (12% MB)	13.3	14.0
Ash % (12% MB)	1.55	1.57
1000 Kernel Weight (g)	43.9	49.0
Weight (mg)	40.5	44.2
Diameter (mm)	2.9	3.2
Wheat Hardness (NR)	54.7	51.6
Test Weight (lbs/bu)	62.3	64.5
Wheat Falling No. (sec)	321	405
Kernel Size Distribution (%)	85/14/1	97/3/0
Flour Data		
Flour Moisture %	13.7	13.9
Flour Protein (14% MB)	12.38	13.01
Flour Ash (14% MB)	0.48	0.48
Gluten Index	98.3	92.1
Wet Gluten (14% MB)	30.0	33.5
Farinograph		
Absorption (%)	63.3	65.8
Peak/Dev. Time (min)	8.0	7.7
Stability (min)	18.4	12.2
MTI (F.U.)	13.8	27.8
Mixograph		
Absorption (%)	65.1	66.3
Mix Time (min)	4.3	3.1
Mix tolerance (1-8)	3.8	4.0
Alveograph		
P (mm)	123	109
L (mm)	60	60
P/L Ratio	2.05	1.82
W value (10^{-4} Joules)	316	257

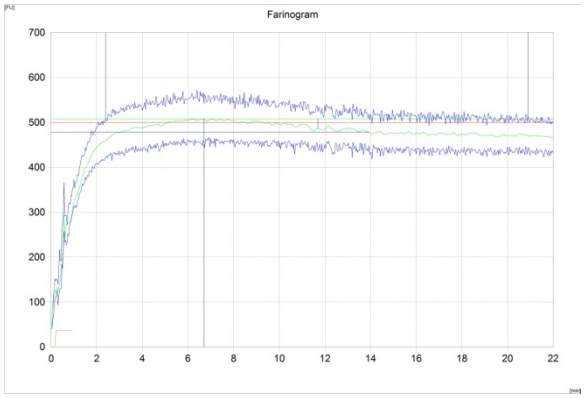
Group 1: Arizona Plant Breeders, Hard Red

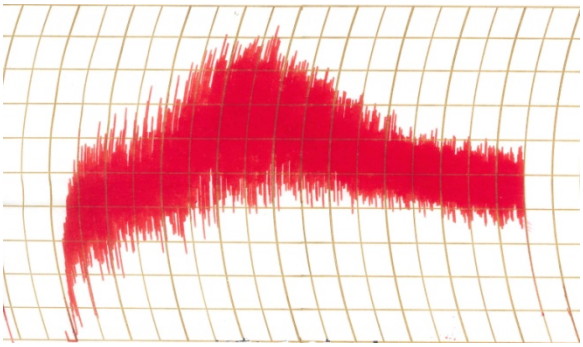
Farinograms **Mixograms**

HRS Control, SY Cal Rojo

Water abs: 63.9%, Development time: 6.7 min, Stability: 18.5 min, MTI: 21 FU

Water abs: 63.3%, Mix time: 3.9 min, MT score: 4

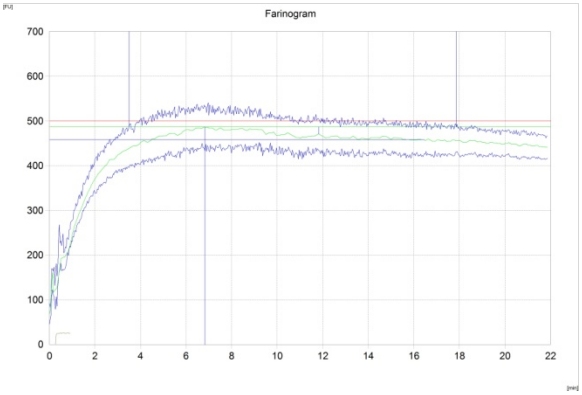


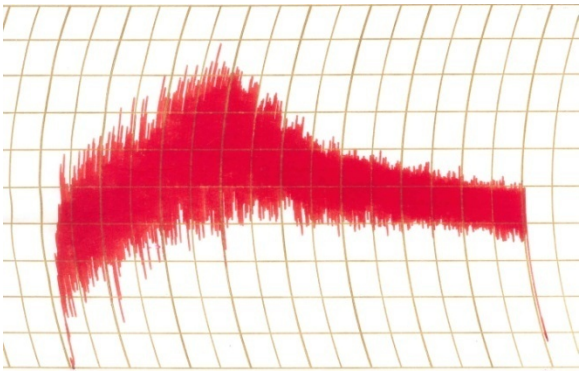


HRS-1, APB 410089

Water abs: 66.2%, Development time: 6.8 min, Stability: 14.4 min, MTI: 16 FU

Water abs: 64.8%, Mix time: 2.9 min, MT score: 3



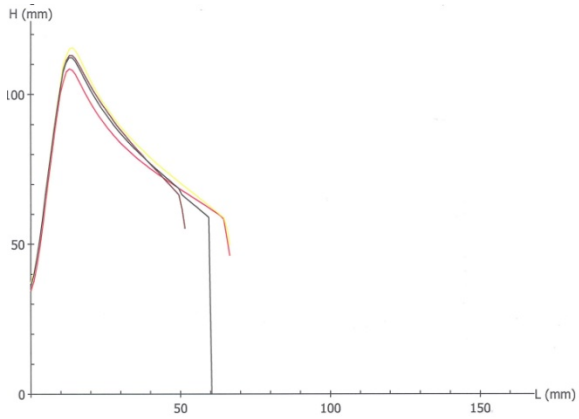


Group 1: Arizona Plant Breeders, Hard Red

Alveograph

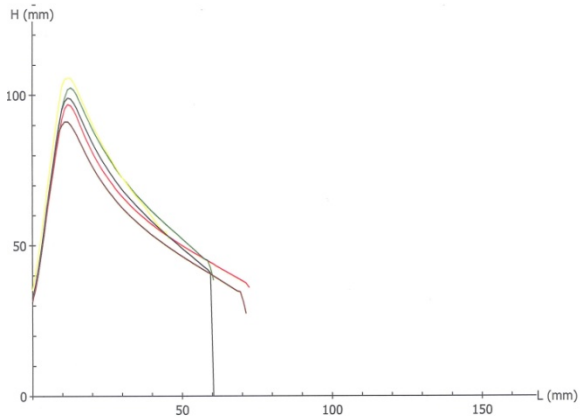
HRS Control, SY Cal Rojo

P (mmH2O): 123, L (mm): 60,
W (10E-4J): 316, P/L: 2.05



HRS-1, APB 410089

P (mmH2O): 109, L (mm): 60,
W (10E-4J): 257, P/L: 1.82

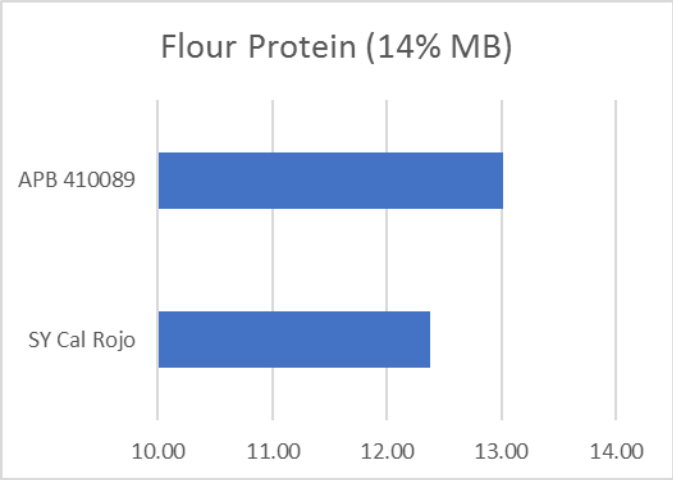


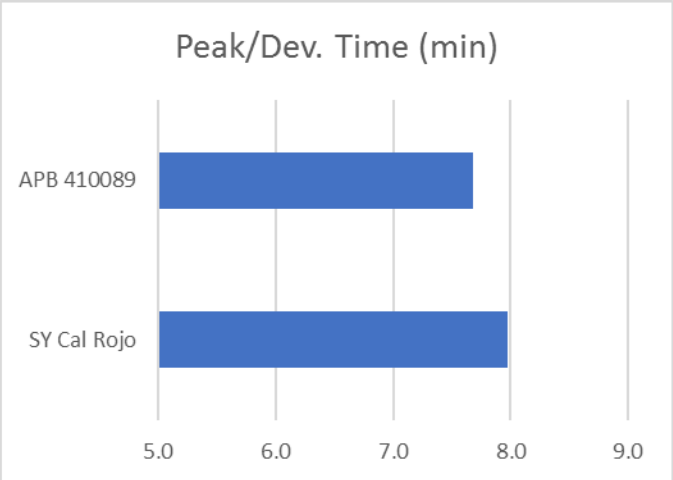
Group 1: Arizona Plant Breeders

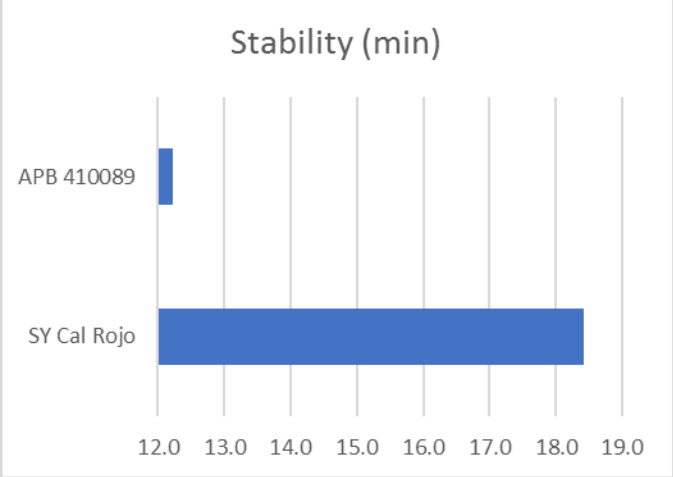
COLLABORATOR RESULTS

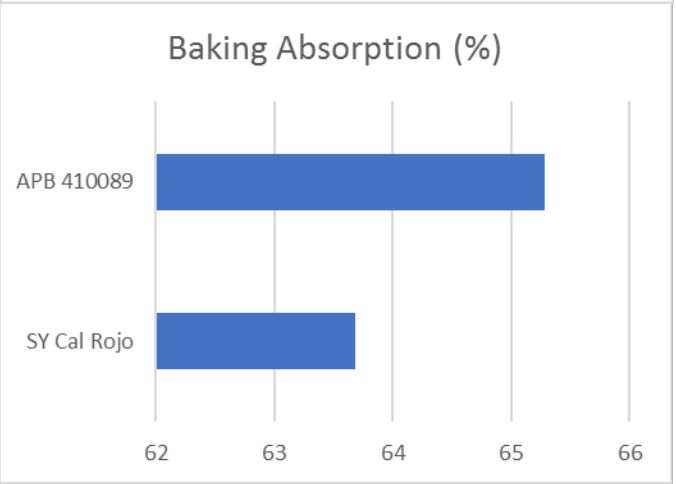
Quality Data – Collaborator Means

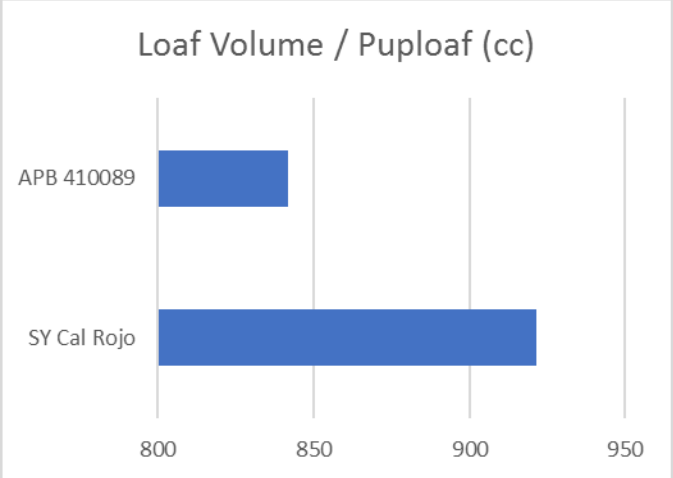
The graphs represent only the means of the quality data received from most of the collaborators.

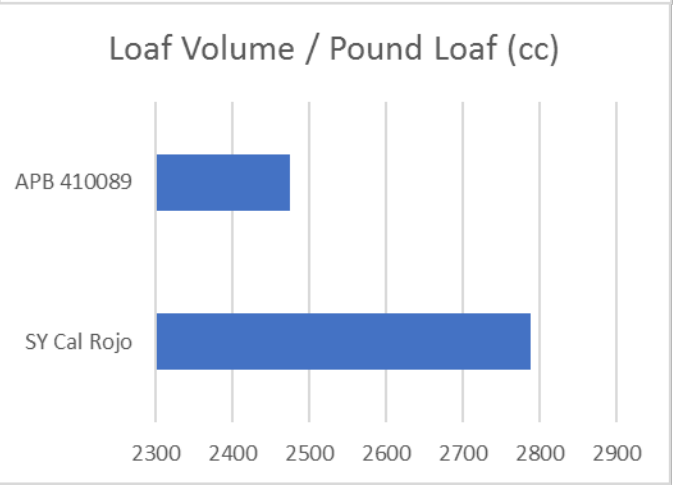










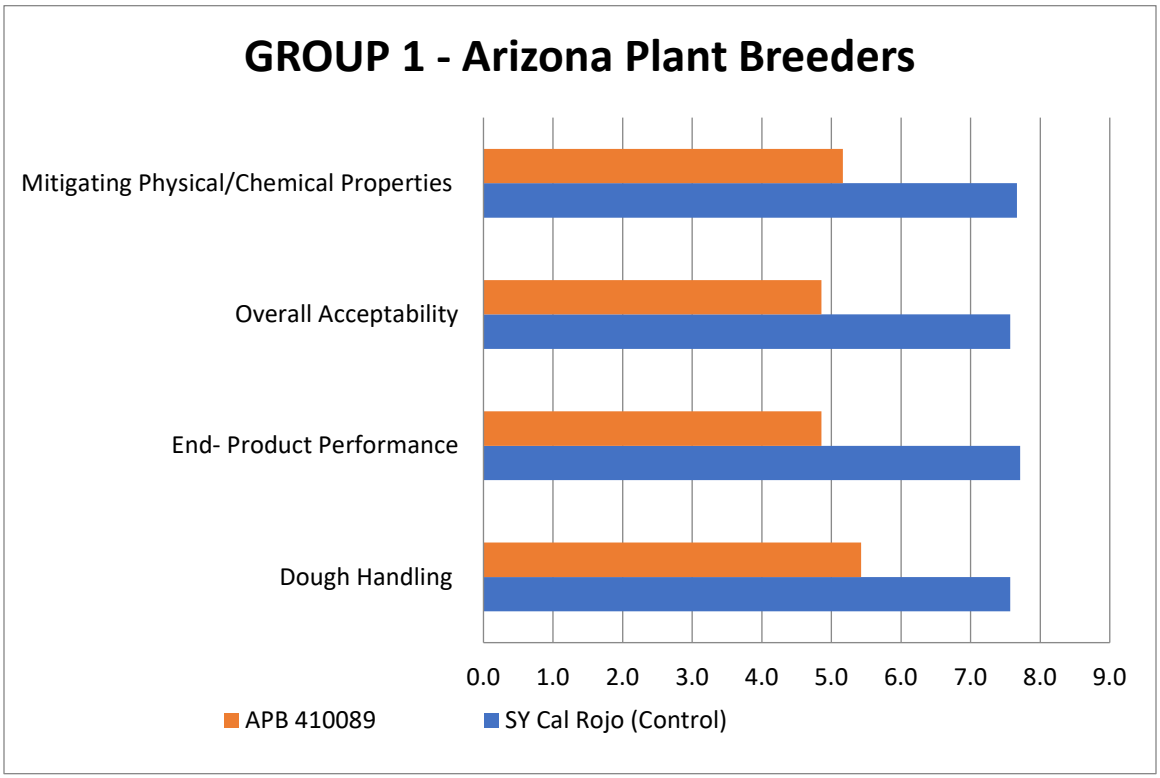


Group 1: Arizona Plant Breeders

End-Product Evaluation

Collaborator Rating Means and Comments

For the end-product evaluation of all varieties, each collaborator submitted their rating and comments for dough handling, end-product performance, and overall acceptability. Each graph represents the collaborator rating means of varieties submitted by each breeder compared to the check sample.



COLLABORATOR COMMENTS

Group 1 - Arizona Plant Breeders		
Entry Name	**SY - Cal Rojo**	**APB 410089**
Sample #	**HRS Control**	**HRS-1**
Dough Handling		
Mill 1	Good out of mixer/Average mix time	Short mix time/ soft dough
Mill 2	slightly dry during make-up	shorter mix time
Mill 3	slightly soft out of mixer, gained strength throughout process, firm/ slightly spongy during molding	slightly soft out of mixer
Mill 4	Nice handleability out of mixer and after proofing. Held gas well and easy to mould	Soft and stick to handle coming out of mixer and fairly sticky to handle after proof times. Not much gas retention
Mill 5	Good absorption and mix strength	Very good absorption, fair mix strength
Mill 6	No Comment	No Comment
Mill 7	No Comment	weak & shorter mixing
End- Product Performance		
Mill 1	Excellent loaf volume/open grain	Low loaf volume/Very open grain
Mill 2	No Comment	No Comment
Mill 3	medium break & shred, good crumb- small rounded & elongated cells, soft & springy crumb	flat top, no break & shred, tight crumb, rounded cells, coarser crumb than control
Mill 4	Nice BRIGHT color, crumb structure and volume	Nice Color, volume, and crumb
Mill 5	Nice interior, good loaf volume	Poor interior, very low loaf volume
Mill 6	No Comment	No Comment
Mill 7	Good crumb grain,exc crumb color	Poor loaf vol, avg grain
Overall Acceptability		
Mill 1	Acceptable baking qualities	Weak dough
Mill 2	No Comment	No Comment
Mill 3	acceptable volume, good crumb	low volume, tighter crumb than control
Mill 4	No Comment	No Comment
Mill 5	No Comment	No Comment
Mill 6	No Comment	No Comment
Mill 7	No Comment	No Comment
Mitigating Physical/Chemical Properties		
Mill 1	Creamy interior	Slightly dull interior
Mill 2	No Comment	No Comment
Mill 3	quick mixing time, softer dough but can still trap gas, crumb not too bright	quick mix time, softer dough than control
Mill 4	Good Absorption, stability and pro.	Good Absorption, stability and pro.
Mill 5	No Comment	No Comment
Mill 6	No Comment	No Comment
Mill 7	No Comment	Good prot, ?FN

GROUP 2 – AGRIPRO SYNGENTA

Breeder: Jim Helmerick

Description of Breeder Entries

<u>Hard Red Wheat</u>

AP Octane (HRS-2)

AP Octane is a hard red spring wheat developed by Syngenta Seeds, Inc. AP Octane was selected for height, maturity, appearance, kernel color, kernel soundness, disease reaction and end use quality that originated with a single cross made in January of 2010. AP Octane is a medium early maturity, medium height variety with average test weight. AP Octane has shown above average tolerance to current races of stripe rust. It has shown average milling and baking characteristics. AP Octane is primarily adapted to the Sacramento and San Joaquin Valleys. It has also been tested under irrigated and high rainfall production areas of Columbia Basin Washington, both fall and spring planted cropping systems with favorable results.

AP Octane has been uniform and stable since 2015. Approximately 0.8% of plants were rogued from the Breeder Seed increase. Over ninety percent of the variant plants were taller (8 to 12 cm). Up to 0.8% variant plants may be encountered in subsequent generations.

Syngenta Seeds, Inc. maintains seed stock and certified classes of Foundation, Registered and Certified. Syngenta Seeds, Inc. will maintain the variety by the head row/progeny method to produce breeder seed as needed. Royalty fees are anticipated. Foundation seed stocks of AP Octane will be available in the fall of 2019. Plant Variety Protection is anticipated in 2019 and AP Octane may only be sold as a class of certified seed. Certified acreage is not to be published by AOSCA and certifying agencies.

Group 2: AgriPro Syngenta

Milling Data*

Hard Red Wheat (Grams)		
Entry Name	**SY Cal Rojo**	**AP Octane**
Sample	**HRS Control**	**HRS-2**
FIRST_BREAK	3187	3031
SECOND_BREAK	3164	2965
GRADER	1703	1578
THIRD_BREAK	1349	1248
FIRST_MIDS	4613	3832
SECOND_MIDS	9396	10250
THIRD_MIDS	3164	3282
FIRST_M_RED	2003	1597
FOURTH_MIDS	2469	2483
FIFTH_MIDS	1252	1256
RED_DOG	1256	1276
RED_SHORT	674	706
BK_SHORT	1341	1367
BRAN	7584	6408
SUCTION	120	146
TOTAL_FLOUR	32420	31668
FEED_STREAM	10855	9757
%FIRST_REL	42.8	42.6
%SECOND_RELEASE	61.1	64.3
BREAK_FLOUR	17.8	17.5
PATENT_FLOUR	51.7	52.3
FLOUR_YLD (%)	74.9	76.4
Comments:	**samples achieved first and second break release at anticipated rate with good bran cleanup**	

Group 2: AgriPro Syngenta

Grain & Flour Quality Data

Data represent only the means of the quality data received from the mills.

Entry Name	**SY Cal Rojo**	**AP Octane**
Sample	**HRS Control**	**HRS-2**
Wheat Data		
Moisture (%)	9.2	9.4
Protein % (12% MB)	13.3	12.9
Ash % (12% MB)	1.55	1.64
1000 Kernel Weight (g)	43.9	46.5
Weight (mg)	40.5	42.6
Diameter (mm)	2.9	3.1
Wheat Hardness (NR)	54.7	63.0
Test Weight (lbs/bu)	62.3	64.4
Wheat Falling No. (sec)	321	309
Kernel Size Distribution (%)	85/14/1	92/8/0
Flour Data		
Flour Moisture %	13.7	13.9
Flour Protein (14% MB)	12.38	11.18
Flour Ash (14% MB)	0.48	0.48
Gluten Index	98.3	99.4
Wet Gluten (14% MB)	30.0	26.2
Farinograph		
Absorption (%)	63.3	59.7
Peak/Dev. Time (min)	8.0	5.5
Stability (min)	18.4	17.4
MTI (F.U.)	13.8	8.3
Mixograph		
Absorption (%)	65.1	62.2
Mix Time (min)	4.3	4.7
Mix tolerance (1-8)	3.8	3.8
Alveograph		
P (mm)	123	113
L (mm)	60	90
P/L Ratio	2.05	1.26
W value (10^{-4} Joules)	316	390

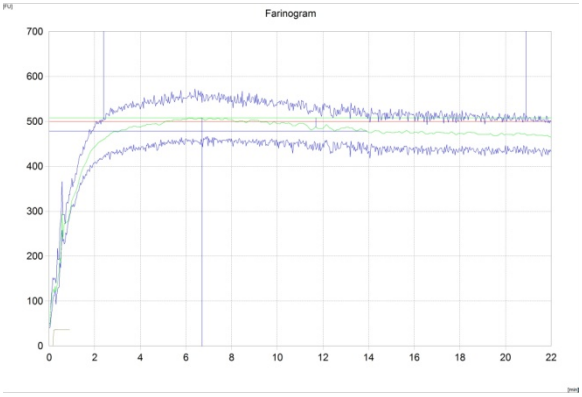
Group 2: AgriPro Syngenta, Hard Red

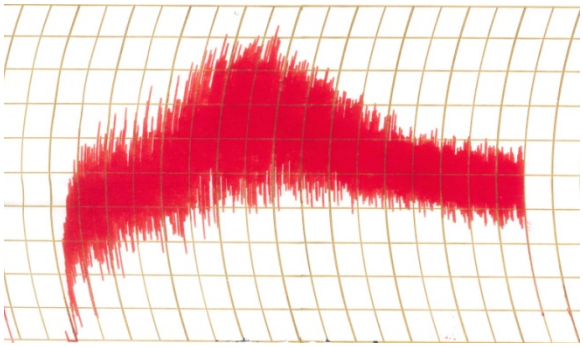
Farinograms **Mixograms**

HRS Control, SY Cal Rojo

Water abs: 63.9%, Development time: 6.7 min, Stability: 18.5 min, MTI: 21 FU

Water abs: 63.3%, Mix time: 3.9 min, MT score: 4

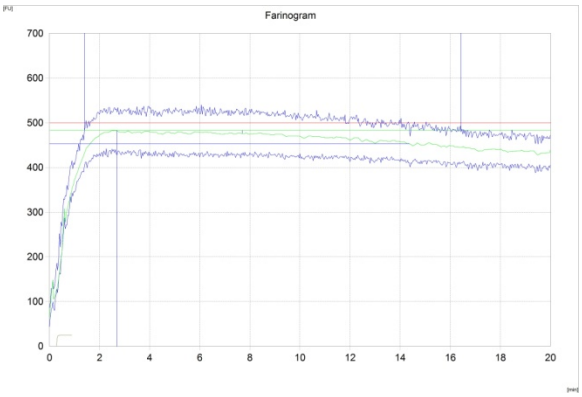


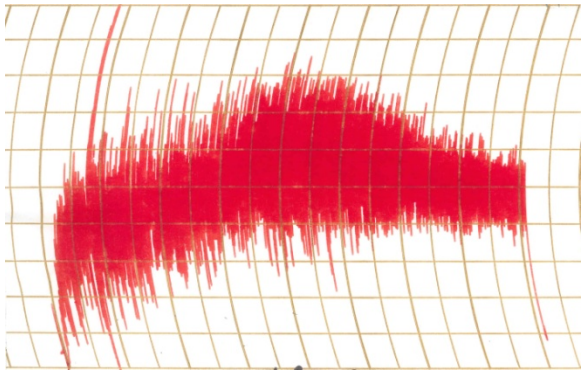


HRS-2, AP Octane

Water abs: 60.6%, Development time: 5.8 min, Stability: 15 min, MTI: 7 FU

Water abs: 59.5%, Mix time: 4.2 min, MT score: 4



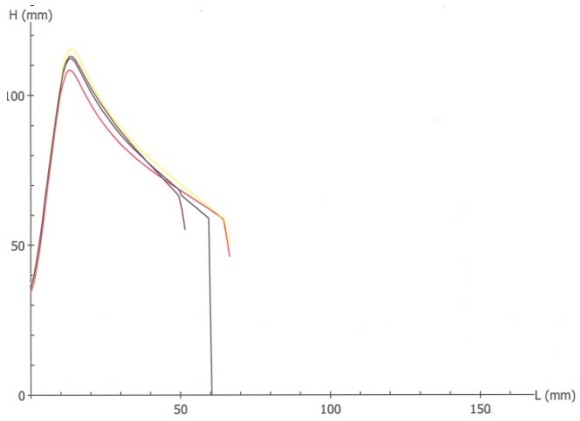


Group 2: AgriPro Syngenta, Hard Red

Alveograph

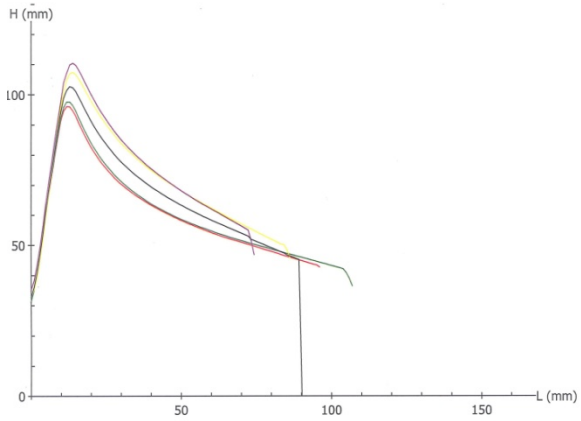
HRS Control, SY Cal Rojo

P (mmH2O): 123, L (mm): 60,
W (10E-4J): 316, P/L: 2.05



HRS-2, AP Octane

P (mmH2O): 113, L (mm): 90,
W (10E-4J): 390, P/L: 1.26

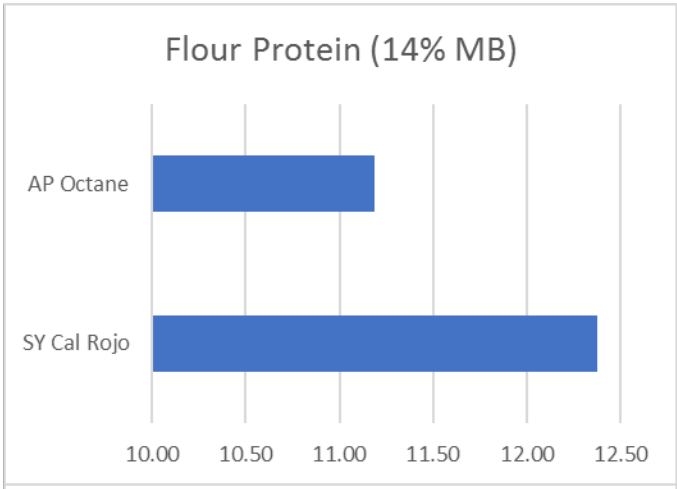


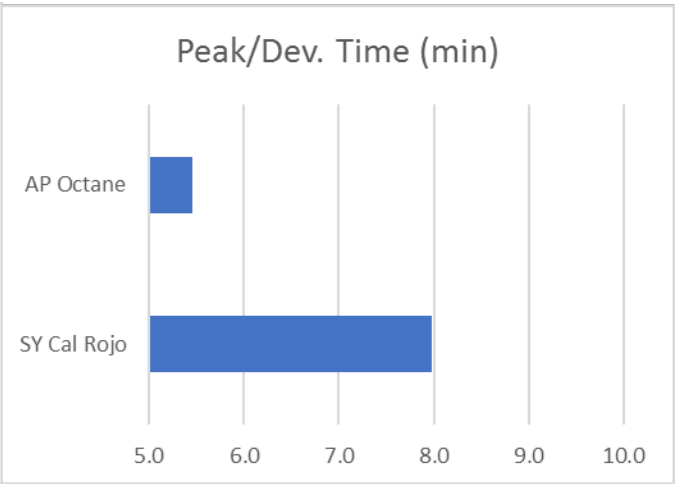
Group 2: AgriPro Syngenta

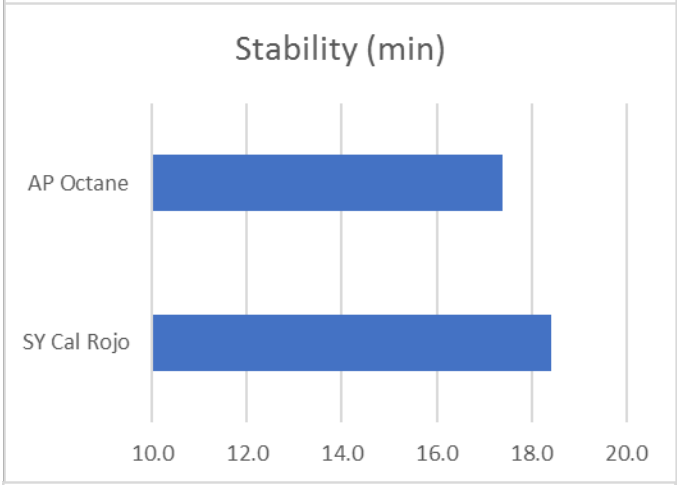
COLLABORATOR RESULTS

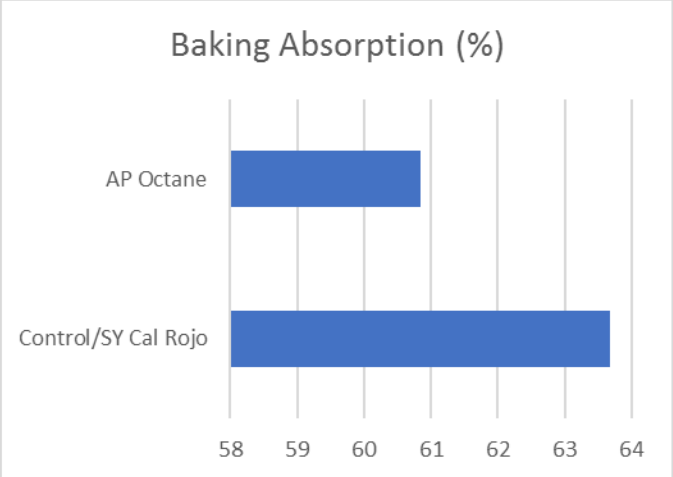
Quality Data – Collaborator Means

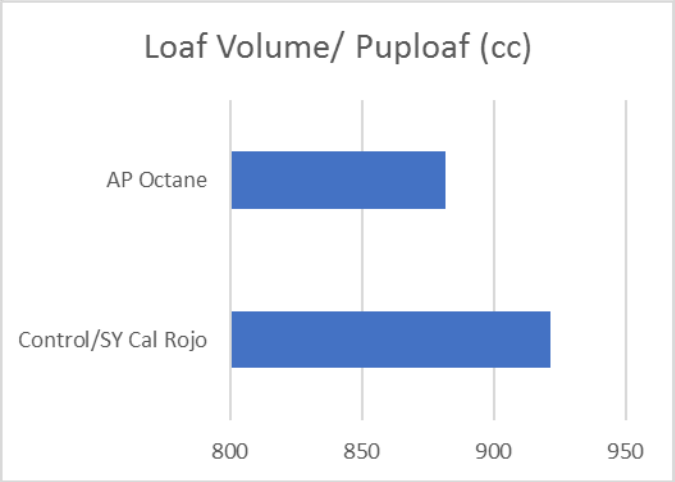
The graphs represent only the <u>means</u> of the quality data received from most of the collaborators.

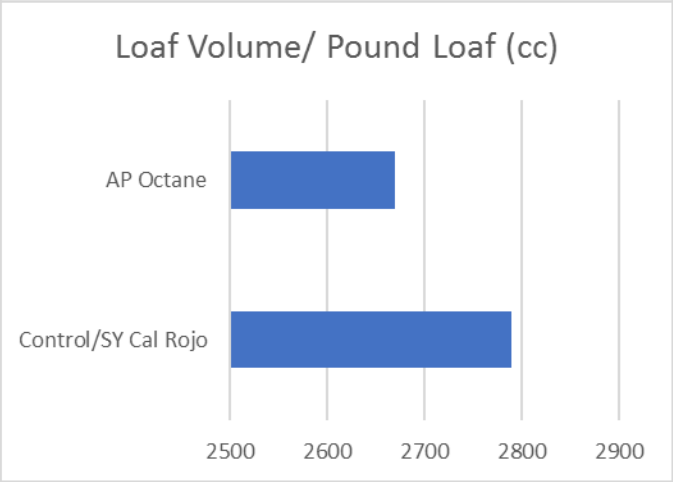








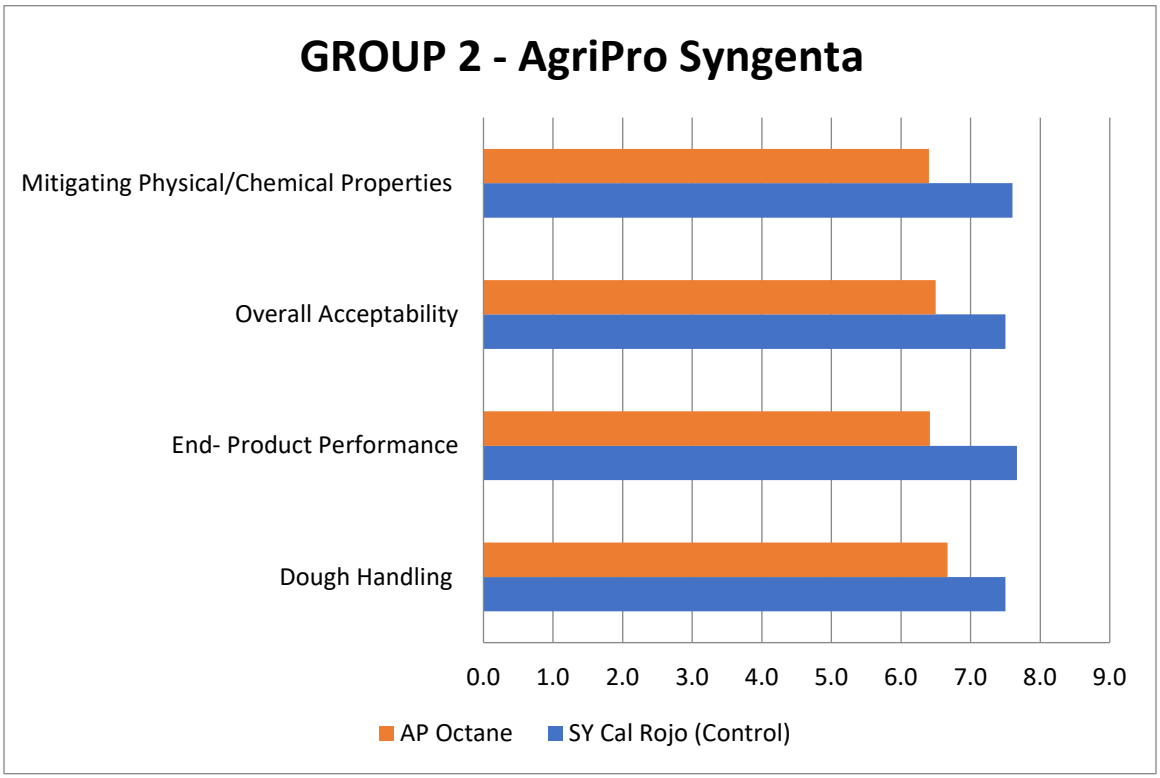




Group 2: AgriPro Syngenta
End-Product Evaluation

Collaborator Rating Means and Comments

For the end-product evaluation of all varieties, each collaborator submitted their rating and comments for dough handling, end-product performance, and overall acceptability. Each graph represents the collaborator rating means of varieties submitted by each breeder compared to the check sample.



COLLABORATOR COMMENTS

Group 2 - AgriPro Syngenta		
Entry Name	**SY - Cal Rojo**	**AP Octane**
Sample #	**HRS Control**	**HRS-2**
Dough Handling		
Mill 1	Good out of mixer/Average mix time	Good mixing strength
Mill 2	slightly dry during make-up	No Comment
Mill 3	slightly soft out of mixer, gained strength throughout process, firm/ slightly spongy during molding	comparable to control in strength, firm/ slightly spongy during molding
Mill 4	Nice handleability out of mixer and after proofing. Held gas well and easy to mould	Strong and extensible.Came out of mixer nice and handled nice after proofing. Moulded well
Mill 5	Good absorption and mix strength	Slightly low absorption, good mix strength
Mill 6	No Comment	No Comment
Mill 7	No Comment	No Comment
End- Product Performance		
Mill 1	Excellent loaf volume/open grain	Good volume / open grain
Mill 2		
Mill 3	medium break & shred, good crumb- small rounded & elongated cells, soft & springy crumb	ok break & shred, slightly tighter than control, rounded cells, slightly coarser
Mill 4	Nice BRIGHT color, crumb structure and volume	Smaller volume than control but nice color and crumb
Mill 5	Nice interior, good loaf volume	Fair interior, slightly low loaf volume
Mill 6		
Mill 7	Very good crumb grain,Exc crumb color	Very good grain & color
Overall Acceptability		
Mill 1	Acceptable baking quality	Accepable baking quality
Mill 2		
Mill 3	acceptable volume, good crumb	acceptable volume, ok crumb
Mill 4	No Comment	No Comment
Mill 5	No Comment	No Comment
Mill 6	No Comment	No Comment
Mill 7	No Comment	No Comment
Mitigating Physical/Chemical Properties		
Mill 1	Creamy interior	Equal to control
Mill 2		
Mill 3	quick mix time, softer dough but can still trap gas, crumb not too bright	longer mix time, dough handling comparable to control, brighter crumb but slightly creamy
Mill 4	Good Absorption, stability and pro.	Low abs and low protein,
Mill 5	No Comment	No Comment
Mill 6	No Comment	No Comment
Mill 7	No Comment	Low prot, ?FN, Very good miller

GROUP 3&4 - UNIVERSITY OF CALIFORNIA, DAVIS

Program Leader: Jorge Dubcovsky
Breeders: Oswaldo Chicaiza and Xiaoqin Zhang

Description of Breeder Entries

Hard Red Wheat

UC 1882 (HRS-3)

UC1882 is a hard red spring wheat that was evaluated in the elite yield trial in 2017 and 2018. The grain yield of UC1882 is similar to Central Red in San Joaquin Valley but 11.8 % less in Sacramento Valley. The grain protein content and the bread making quality of UC1882 is similar to Central Red. UC1882 has introgressed three resistant genes (Yr5, Yr15, Yr36) for stripe rust and the Gpc-B1 gene for grain protein content. UC1882 is resistant to current field strains of Septoria tritici blotch, and BYD. UC1839 is 12 cm shorter and heads two days earlier than Central Red.

Hard White Wheat

UC 1839 (HWS-1)

UC1839 is a hard white spring wheat that was evaluated in the elite yield trial in 2017 and 2018 and in the 2017 regional trial. The yield performance of UC1839 is similar to Patwin-515HP in Sacramento Valley and 5% higher in San Joaquin Valley. The grain protein content of UC1839 is 5% less than Patwin-515HP. UC1839 has the high grain protein gene Gpc-B1. UC1839 has

low levels of polyphenol oxidase enzyme (PPO), which prevents noodle discoloration. The bread making quality of UC1839 is similar to Patwin-515HP. UC1839 has introgressed three resistant genes (Yr5, Yr15, Yr36) for stripe rust. UC1839 is resistant to Septoria tritici blotch, and BYD. UC1839 is five days later in heading time and 19 cm taller in plant height than Patwin-515HP, respectively.

UC 1909 (HWS-2)

UC1909 is a hard white spring wheat that was evaluated in the elite yield trial in 2018. UC1909 has introgressed the stripe rust resistant genes Yr5 and Yr15, The Glu-D1d allele associated with strong gluten strength, the 2NS/2AS translocation from Aegilops ventricosa that has the stripe rust resistant gene Yr17, the leaf rust resistant gene Lr37, and the stem rust resistant gene Sr38; and the Lr19-Yp-Sr25 segment that has the leaf rust resistant gene Lr19, the yellow pigment gene Yp, and the stem rust resistant gene Sr25. The grain yield of UC1909 is 9% and 13% less than Patwin-515HP in Sacramento Valley and San Joaquin Valley, respectively. The grain protein content and bread making quality of UC1909 is similar to Patwin-515HP. UC1909 is four days earlier in heading time and 3cm taller in plant height than Patwin-515HP, respectively. This common wheat line, which will be released under the name 'UC-Amarillo', differs from all current common wheat varieties in California by its distinctive yellow flour rich in carotenoid pigments.

Group 3: UNIVERSITY OF CALIFORNIA, DAVIS HARD RED

Milling Data*

Hard Red Wheat (Grams)		
Entry Name	**SY Cal Rojo**	**UC 1882**
Sample	**HRS Control**	**HRS-3**
FIRST_BREAK	3187	3107
SECOND_BREAK	3164	3139
GRADER	1703	1704
THIRD_BREAK	1349	1307
FIRST_MIDS	4613	3763
SECOND_MIDS	9396	8742
THIRD_MIDS	3164	3171
FIRST_M_RED	2003	1682
FOURTH_MIDS	2469	2358
FIFTH_MIDS	1252	1215
RED_DOG	1256	966
RED_SHORT	674	718
BK_SHORT	1341	1220
BRAN	7584	7116
SUCTION	120	137
TOTAL_FLOUR	32420	30325
FEED_STREAM	10855	10020
%FIRST_REL	42.8	43
%SECOND_RELEASE	61.1	59.1
BREAK_FLOUR	17.8	18.7
PATENT_FLOUR	51.7	50.6
FLOUR_YLD (%)	74.9	75.2
Comments:	**Samples achieved first and second break release at anticipated rate with good bran cleanup**	

Group 3: University California, Davis, Hard Red Grain & Flour Quality Data

Data represent only the means of the quality data received from the mills.

Entry Name	**SY Cal Rojo**	**UC 1882**
Sample	**HRS Control**	**HRS-3**
Wheat Data		
Moisture (%)	9.2	9.3
Protein % (12% MB)	13.3	13.0
Ash % (12% MB)	1.55	1.62
1000 Kernel Weight (g)	43.9	48.1
Weight (mg)	40.5	42.8
Diameter (mm)	2.9	3.1
Wheat Hardness (NR)	54.7	51.9
Test Weight (lbs/bu)	62.3	63.9
Wheat Falling No. (sec)	321	307
Kernel Size Distribution (%)	85/14/1	96/4/0
Flour Data		
Flour Moisture %	13.7	14.0
Flour Protein (14% MB)	12.38	12.00
Flour Ash (14% MB)	0.48	0.49
Gluten Index	98.3	97.7
Wet Gluten (14% MB)	30.0	30.0
Farinograph		
Absorption (%)	63.3	60.9
Peak/Dev. Time (min)	8.0	8.3
Stability (min)	18.4	15.7
MTI (F.U.)	13.8	14.0
Mixograph		
Absorption (%)	65.1	63.6
Mix Time (min)	4.3	3.7
Mix tolerance (1-8)	3.8	3.7
Alveograph		
P (mm)	123	102
L (mm)	60	81
P/L Ratio	2.05	1.26
W value (10^{-4} Joules)	316	299

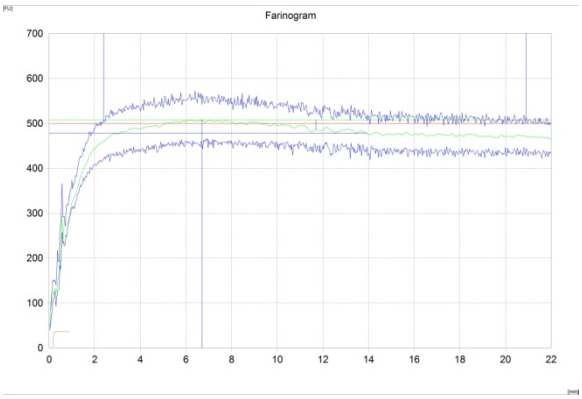
Group 3: UC Davis, Hard Red

Farinograms

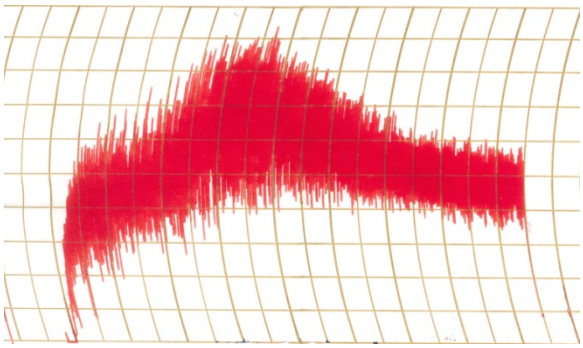
Mixograms

HRS Control, SY Cal Rojo

Water abs: 63.9%, Development time: 6.7 min, Stability: 18.5 min, MTI: 21 FU

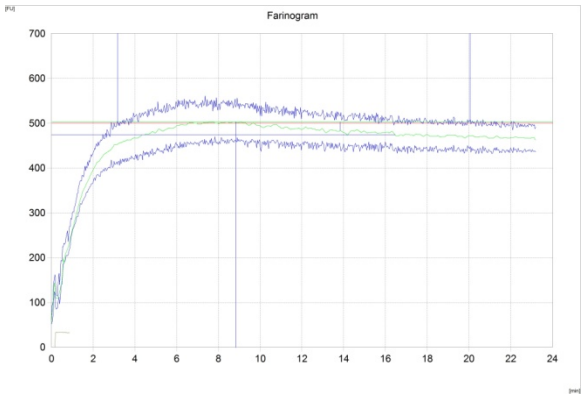


Water abs: 63.3%, Mix time: 3.9 min, MT score: 4

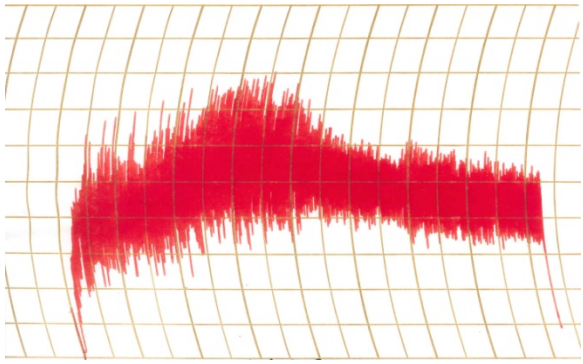


HRS-3, UC 1882

Water abs: 62.9%, Development time: 8.8 min, Stability: 16.9 min, MTI: 19 FU



Water abs: 60.9%, Mix time: 3.4 min, MT score: 3

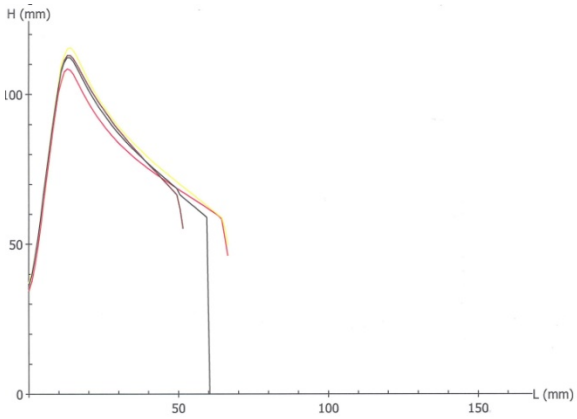


Group 3: UC Davis, Hard Red

Alveograph

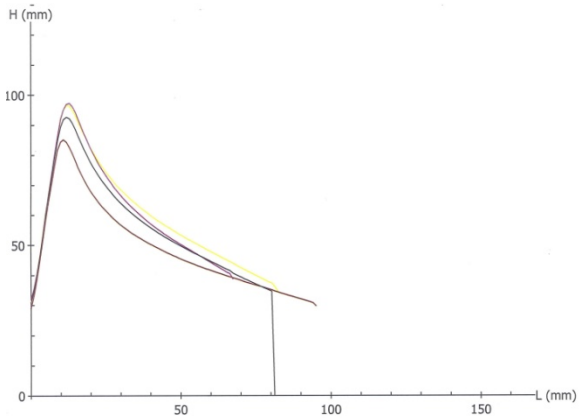
HRS Control, SY Cal Rojo

P (mmH2O): 123, L (mm): 60,
W (10E-4J): 316, P/L: 2.05



HRS-3, UC 1882

P (mmH2O): 102, L (mm): 81,
W (10E-4J): 299, P/L: 1.26

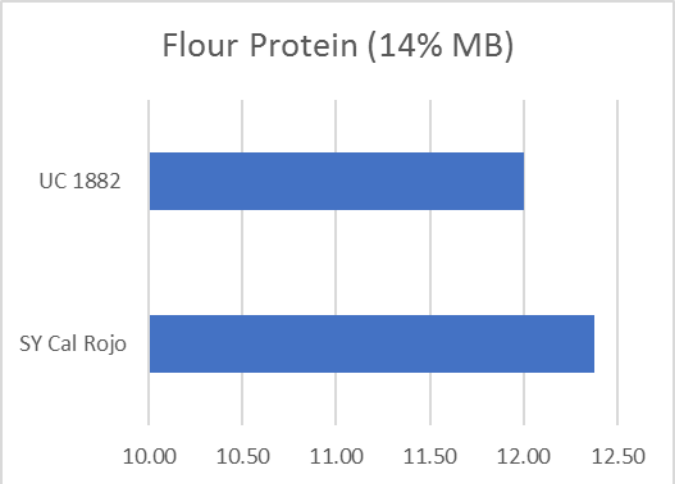


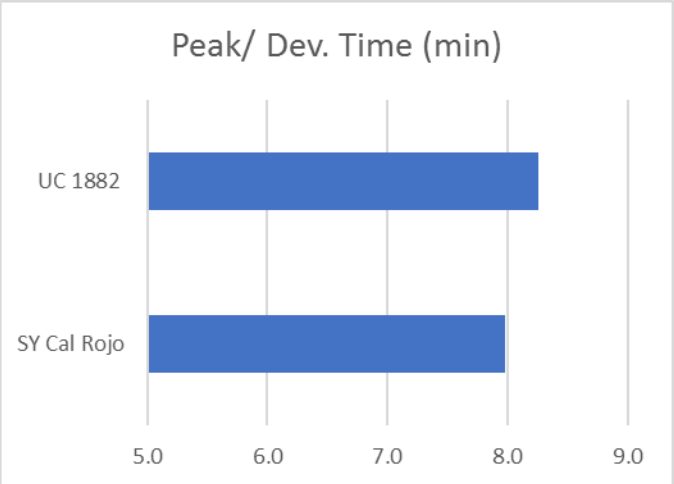
Group 3: University of California, Davis – Hard Red

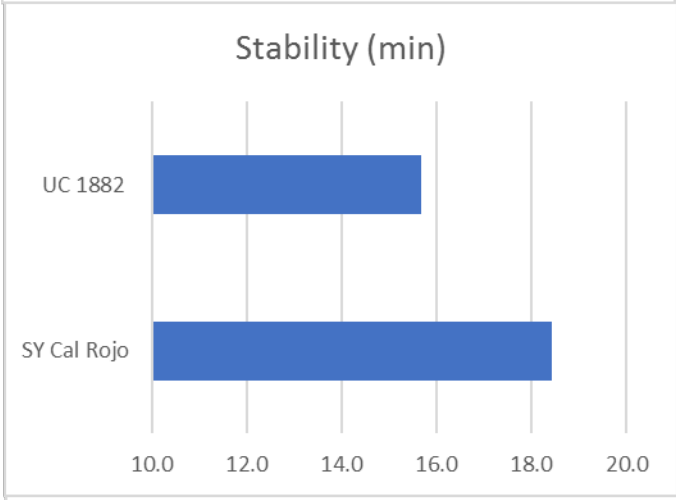
COLLABORATOR RESULTS

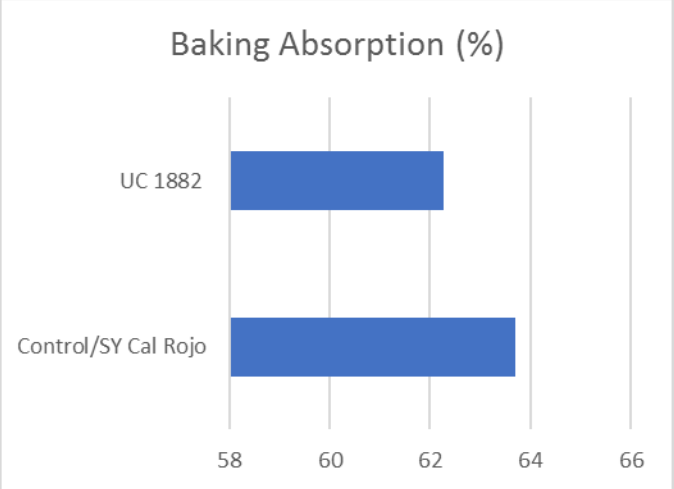
Quality Data – Collaborator Means

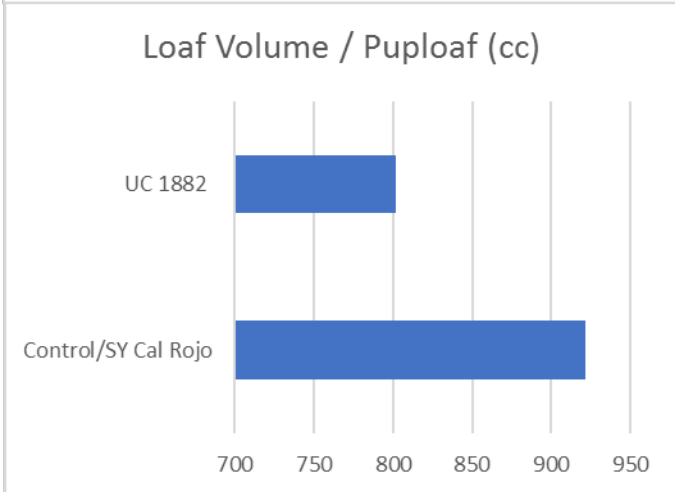
The graphs represent only the <u>means</u> of the quality data received from most of the collaborators.

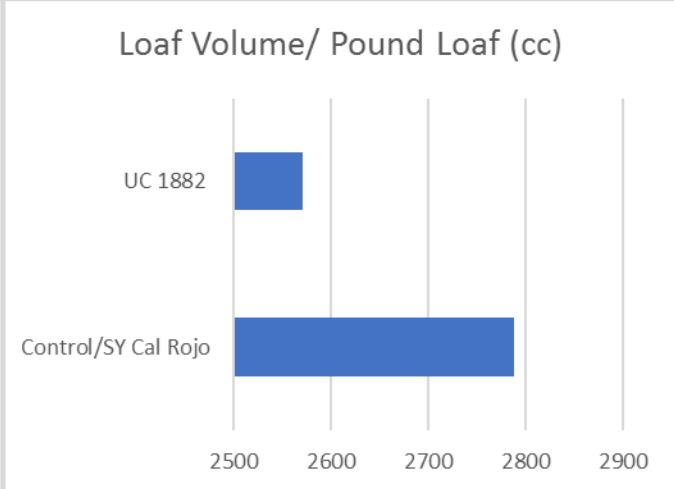










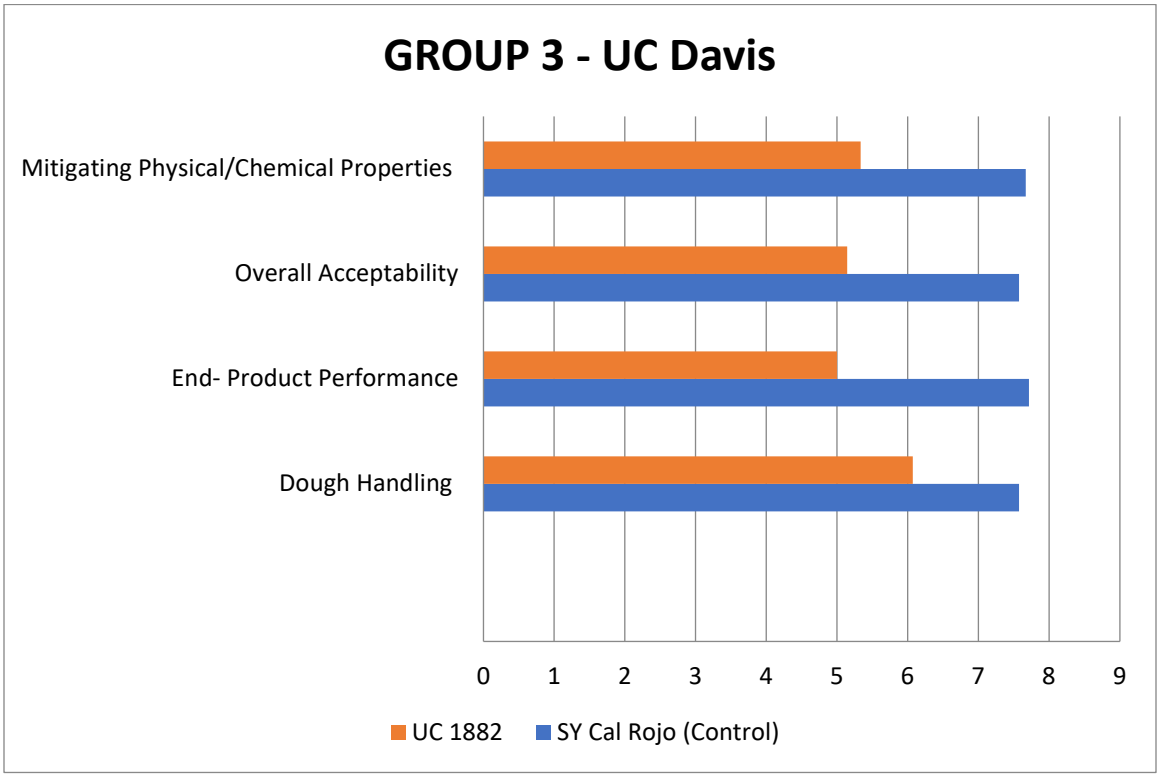


Group 3: University of California, Davis – Hard Red

End-Product Evaluation

Collaborator Rating Means and Comments

For the end-product evaluation of all varieties, each collaborator submitted their rating and comments for dough handling, end-product performance, and overall acceptability. Each graph represents the collaborator rating means of varieties submitted by each breeder compared to the check sample.



COLLABORATOR COMMENTS

Group 3 - University of California, Davis		
Entry Name	**SY - Cal Rojo**	**UC 1882**
Sample #	**HRS Control**	**HRS-3**
Dough Handling		
Mill 1	Good out of mixer/Average mix time	Short mix time/ soft dough
Mill 2	slightly dry during make-up	No Comment
Mill 3	slightly soft out of mixer, gained strength throughout process, firm/ slightly spongy during molding	slightly soft out of mixer, slightly soft/ slightly spongy during molding
Mill 4	Nice handleability out of mixer and after proofing. Held gas well and easy to mould	Handled nicely during entire baking process, strong and elastic with nice gas retention
Mill 5	Good absorption and mix strength	Slightly low absorption, good mix strength
Mill 6	No Comment	No Comment
Mill 7	No Comment	No Comment
End- Product Performance		
Mill 1	Excellent loaf volume/open grain	Low loaf volume/Very open grain
Mill 2	No Comment	No Comment
Mill 3	medium break & shred, good crumb- small rounded & elongated cells, soft & springy crumb	flat top, small break & shred, tight crumb, cell structure not good, coarse crumb
Mill 4	Nice BRIGHT color, crumb structure and volume	Nice Volume and crumb
Mill 5	Nice interior, good loaf volume	Poor interior, low loaf volume
Mill 6	No Comment	No Comment
Mill 7	Very good crumb grain,Exc crumb color	Poor loaf vol
Overall Acceptability		
Mill 1	Acceptable baking quality	Weak dough
Mill 2	No Comment	No Comment
Mill 3	acceptable volume, good crumb	low volume, poor crumb
Mill 4	No Comment	No Comment
Mill 5	No Comment	No Comment
Mill 6	No Comment	No Comment
Mill 7	No Comment	No Comment
Mitigating Physical/Chemical Properties		
Mill 1	Creamy interior	Slightly dull interior
Mill 2	No Comment	No Comment
Mill 3	quick mix time, softer dough but can still trap gas, crumb not too bright	quick mix time, soft dough, dark white crumb, not very bright
Mill 4	Good Absorption, stability and pro.	Low abs and low pro
Mill 5	No Comment	No Comment
Mill 6	No Comment	No Comment
Mill 7	No Comment	SS Flour

Group 4: UNIVERSITY OF CALIFORNIA, DAVIS HARD WHITE

Milling Data*

	Hard White Wheat (Grams)		
Entry Name	**HWS CONTROL**	**HWS-1**	**HWS-2**
Sample	**SY Blanca Grande 515**	**UC 1839**	**UC 1909**
FIRST_BREAK	3069	2708	3034
SECOND_BREAK	3428	3301	3477
GRADER	1800	1819	1668
THIRD_BREAK	1228	1145	1314
FIRST_MIDS	3625	3404	3106
SECOND_MIDS	8115	8853	8185
THIRD_MIDS	3171	3086	2574
FIRST_M_RED	1609	1506	1344
FOURTH_MIDS	2389	2288	1767
FIFTH_MIDS	1313	1001	810
RED_DOG	1570	896	657
RED_SHORT	744	505	457
BK_SHORT	1296	1028	1260
BRAN	7086	5916	6965
SUCTION	141	32	117
TOTAL_FLOUR	29888	29143	27396
FEED_STREAM	10696	8345	9339
%FIRST_REL	42.1	43.8	42.9
%SECOND_RELEASE	61.6	64.9	58.2
BREAK_FLOUR	19	19.1	21.3
PATENT_FLOUR	48.9	52.7	52.1
FLOUR_YLD (%)	73.6	77.7	74.6
Comments:	**All samples achieved first and second break release at anticipated rate with good bran cleanup.**		

Group 4: University of California Davis, Hard White Grain & Flour Quality Data

Data represent only the means of the quality data received from the mills.

Entry Name	**SY Blanca Grande 515**	**UC 1839**	**UC 1909**
Sample	**HWS Control**	**HWS-1**	**HWS-2**
Wheat Data			
Moisture (%)	9.5	9.4	9.5
Protein % (12% MB)	13.8	13.9	14.2
Ash % (12% MB)	1.49	1.57	1.51
1000 Kernel Weight (g)	46.3	40.8	37.2
Weight (mg)	41.0	39.3	34.8
Diameter (mm)	3.0	3.0	2.8
Wheat Hardness (NR)	58.0	60.4	61.8
Test Weight (lbs/bu)	65.4	62.6	64.4
Wheat Falling No. (sec)	283	404	399
Kernel Size Distribution (%)	95/5/0	93/6/1	74/26/0
Flour Data			
Flour Moisture %	13.7	13.6	13.6
Flour Protein (14% MB)	12.54	13.01	13.40
Flour Ash (14% MB)	0.46	0.47	0.48
Gluten Index	97.5	95.7	98.9
Wet Gluten (14% MB)	33.8	35.7	30.7
Farinograph			
Absorption (%)	64.7	61.7	61.0
Peak/Dev. Time (min)	7.8	10.9	23.3
Stability (min)	18.6	20.9	36.5
MTI (F.U.)	16.0	16.8	7.5
Mixograph			
Absorption (%)	65.6	64.8	64.4
Mix Time (min)	3.8	4.3	7.2
Mix tolerance (1-8)	3.7	3.8	5.3
Alveograph			
P (mm)	117	104	119
L (mm)	94	95	67
P/L Ratio	1.24	1.09	1.78
W value (10^{-4} Joules)	398	368	358

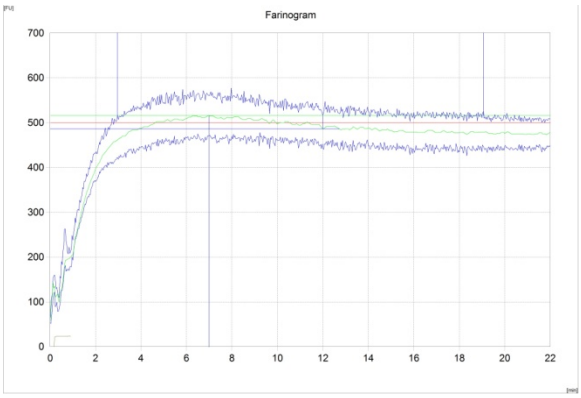
Group 4: UC Davis, Hard White

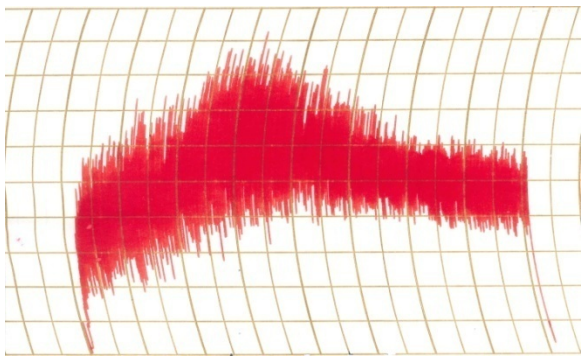
Farinograms Mixograms

HWS Control, SY Blanca Grande 515

Water abs: 65.7%, Development time: 7 min,
Stability: 16.1 min, MTI: 30 FU

Water abs: 63.4%, Mix time: 3.5 min,
MT score: 4

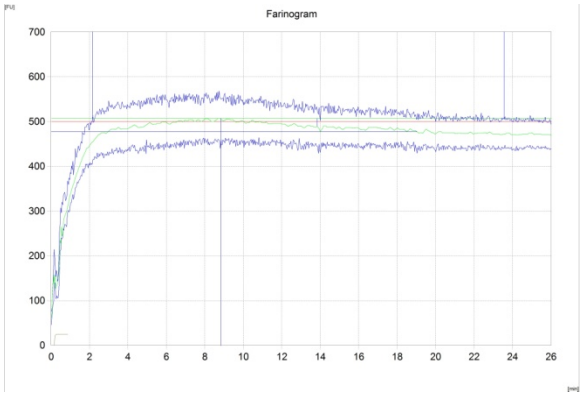


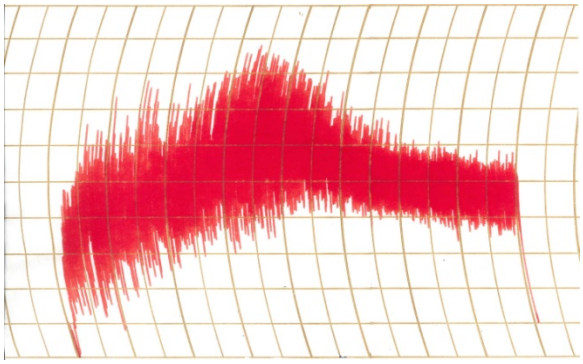


HWS-1, UC 1839

Water abs: 62.2%, Development time: 8.8 min,
Stability: 21.4 min, MTI: 17 FU

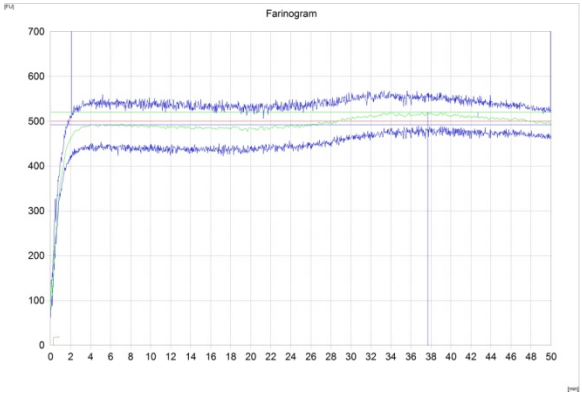
Water abs 61.1%, Mix time: 3.8 min,
MT score: 4



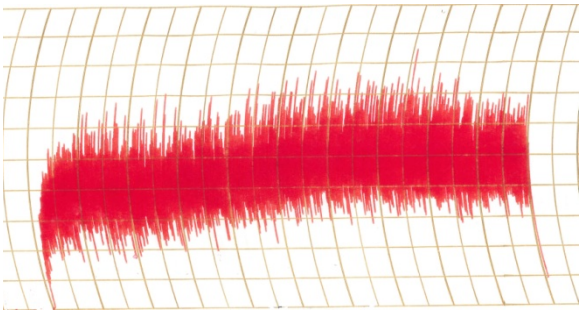


HWS-2, UC 1909

Water abs: 62.1%, Development time: 37.7 min,
Stability: 47.8 min, MTI: 10 FU



Water abs 60.1%, Mix time: 7.6 min,
MT score: 7

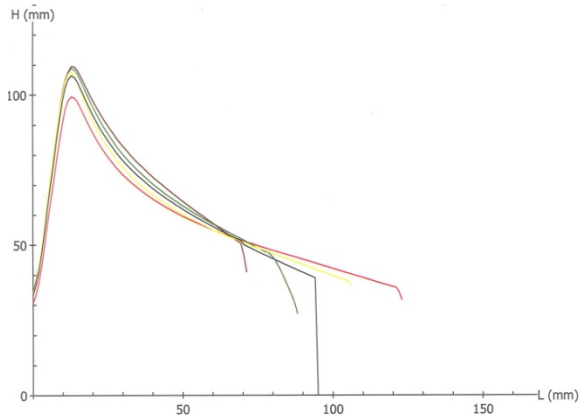


Group 4: UC Davis, Hard White

Alveograph

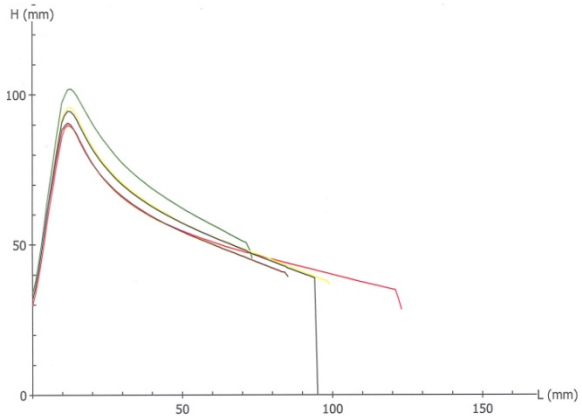
HWS Control, SY Blanca Grande 515

P (mmH2O): 117, L (mm): 94,
W (10E-4J): 398, P/L: 1.24



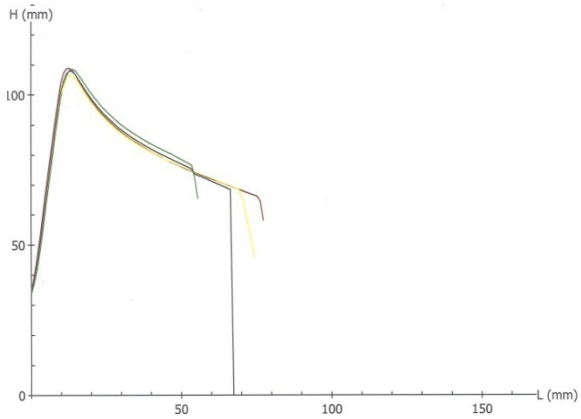
HWS-1, UC 1839

P (mmH2O): 104, L (mm): 95,
W (10E-4J): 368, P/L: 1.09



HWS-2, UC 1909

P (mmH2O): 119, L (mm): 67,
W (10E-4J): 358, P/L: 1.78

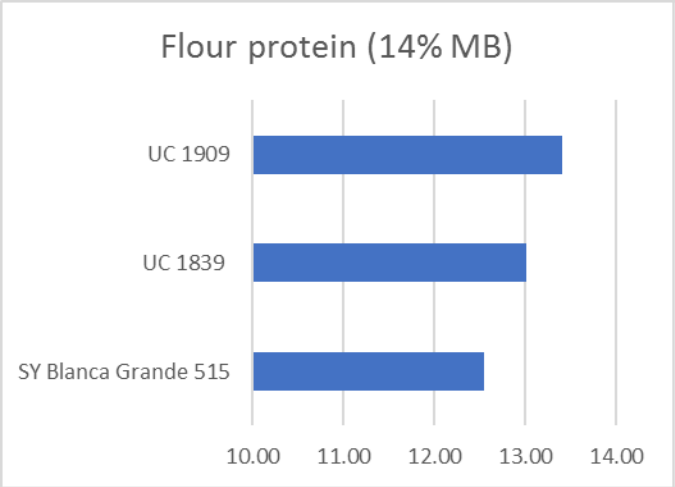


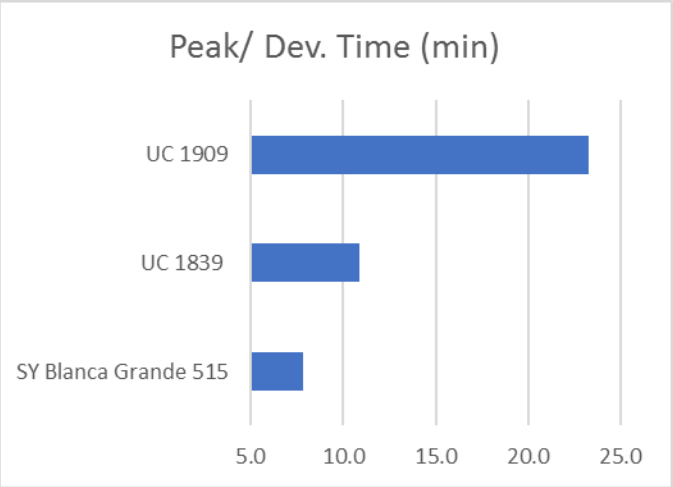
Group 4: University of California, Davis – Hard White

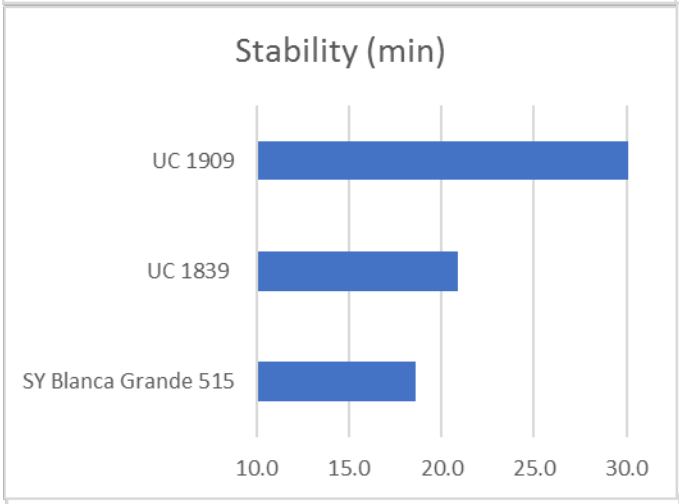
COLLABORATOR RESULTS

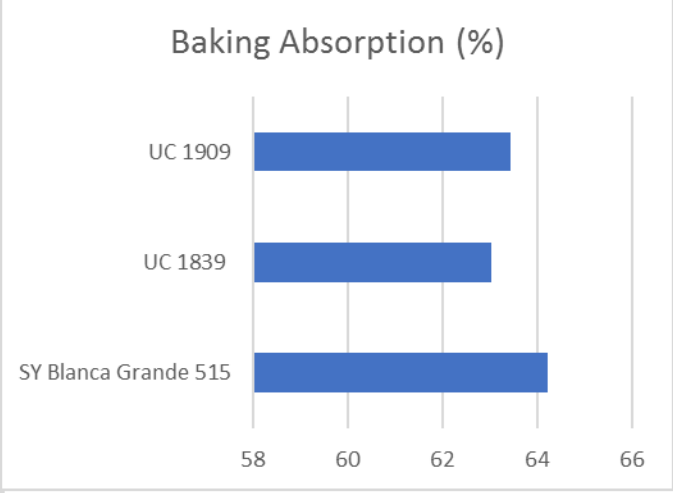
Quality Data – Collaborator Means

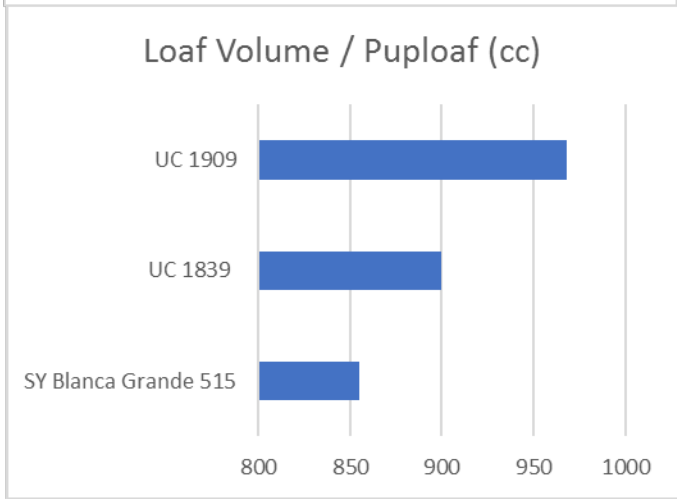
The graphs represent only the <u>means</u> of the quality data received from most of the collaborators.

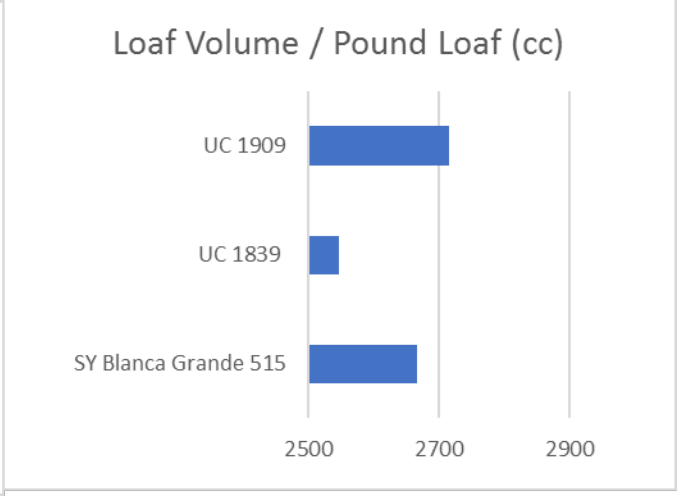










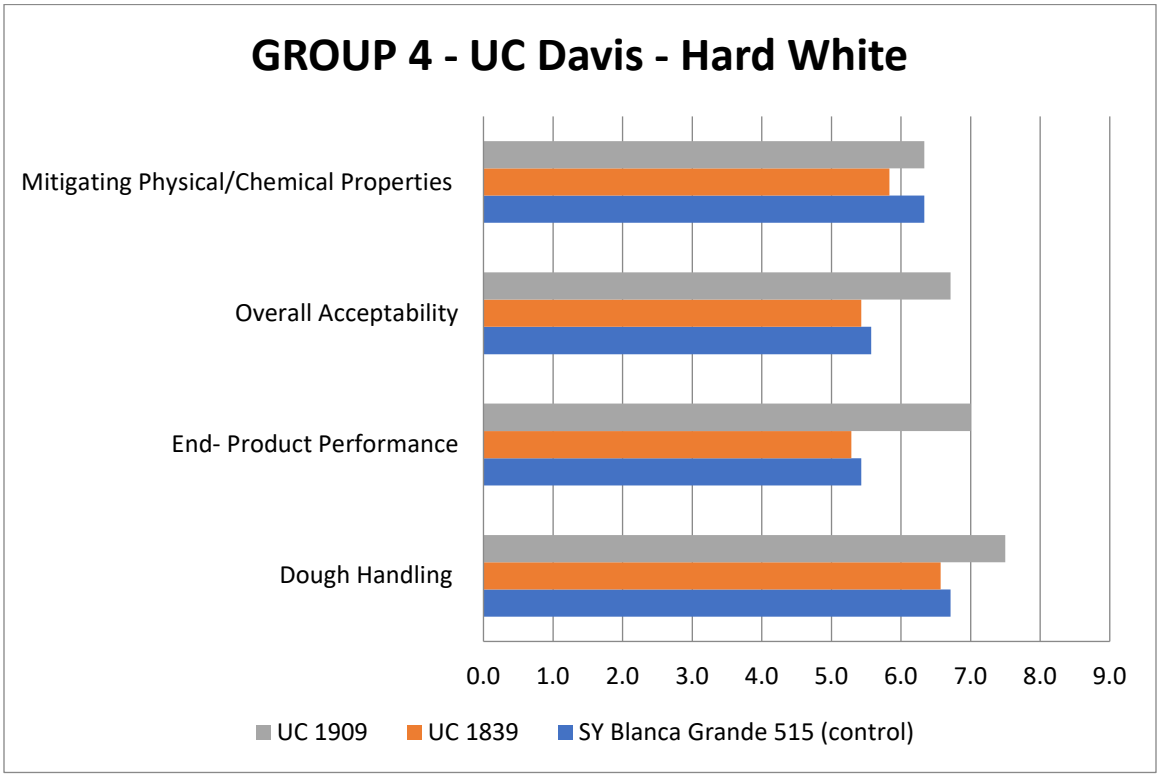


Group 4: University of California, Davis – Hard White

End-Product Evaluation

Collaborator Rating Means and Comments

For the end-product evaluation of all varieties, each collaborator submitted their rating and comments for dough handling, end-product performance, and overall acceptability. Each graph represents the collaborator rating means of varieties submitted by each breeder compared to the check sample.



COLLABORATOR COMMENTS

Group 4 - University of California, Davis, Hard White			
Entry Name	**SY - Blanca Grande 515**	**UC 1839**	**UC 1909**
Sample #	**HWS Control**	**HWS-1**	**HWS-2**
Dough Handling			
Mill 1	Shorter mix/ Slightly soft dough	Shorter mix/soft dough	Tough dough/long mix
Mill 2	breakdown in mixer	slightly dry during make-up	very strong and slightly dry during make-up
Mill 3	soft & slightly sticky out the mixer, gained strength but still soft/ slightly firm/ slightly spongy during molding	slightly soft out the mixer but not sticky, firm/ slightly spongy during molding	strong out the mixer, good extensibility/ spongy dough, strong/ spongy during molding
Mill 4	Extensible, soft and slightly tacky out of mixer but nice handleabiliy throughout process	Slightly stronger than control but extensible and handled nice. Good gas retention during moulding and proofing	Soft and pliable out of mixer however did not hold up in proofing and didn't retain gas well
Mill 5	Good absorption and mix strength	Fair absorption, good mix strength	Sl low abs., excellent mix strength
Mill 6	No Comment	No Comment	No Comment
Mill 7	No Comment	No Comment	Longer mixing & slightly bucky
End- Product Performance			
Mill 1	Open Grain / Lower volume	Very open grain	Open Grain/Good volume
Mill 2	open grain	slightly open grain	yellow color
Mill 3	flat top, small break & shred, too open crumb, rounded cells	flat top, small break & shred, tighter crumb than control, small rounded cells,	rounded top, high, smooth break & shred, slighlty open crumb, rounded & elongated cells
Mill 4	Nice color, volume and crumb	Slightly lower volume than control but still had nice color and crumb texture	Off color, decent volume and crumb but very yellow.
Mill 5	Poor interior. Very low loaf volume	Poor interior. Very low loaf volume	Very nice interior. Good loaf volume
Mill 6	No Comment	No Comment	No Comment
Mill 7	Poor loaf vol, Very good crumb color	Avg baker	Very good grain
Overall Acceptability			
Mill 1	Acceptable baking quality	Equal to control	Slightly better than control
Mill 2	No Comment	No Comment	No Comment
Mill 3	acceptable but low volume, softer dough	acceptable but low volume, slightly softer dough	good, high volume, strong & extensible dough
Mill 4	No Comment	No Comment	No Comment
Mill 5	No Comment	No Comment	No Comment
Mill 6	No Comment	No Comment	No Comment
Mill 7	No Comment	No Comment	No Comment
Mitigating Physical/Chemical Properties			
Mill 1	Average strength	Average baking quality	Very yellow interior
Mill 2	No Comment	No Comment	No Comment
Mill 3	quick mix time, slightly sticky, crumb not too bright & too soft, not springy	good mix time, slightly coarse crumb, slightly creamy compared to control	longer mix time, stronger dough, yellow crumb, soft & springy
Mill 4	Good Absorption, stability and pro.	Good pro slightly longer mix requirments and lower abs.	Flour color, long mix requirements off taste, low abs
Mill 5	No Comment	No Comment	No Comment
Mill 6	No Comment	No Comment	No Comment
Mill 7	poor FN, stronger gluten	Exc flour yld/prot	Very yellow flour, strong gluten, Exc prot

GROUP 5 - WESTBRED

Breeder: Betsa Mantilla

Description of Breeder Entries

<u>Hard Red Wheat</u>

WB 9490 (HRS-4)

WB9490 is a hard red awnless spring wheat variety adapted from the San Joaquin Valley to the Sacramento Valley with excellent grain yield potential and stripe rust resistance. It is an awnless forage wheat similar to WB-Patron for forage yield performance with improved grain yield and end-use quality. It has a short to medium height and medium maturity similar to WB-Patron. Its growth habit and appearance are similar to WB-Patron but a bit more slender and shorter in height. It has been found to have adequate milling and baking quality aspects improved over WB-Patron according to wheat quality lab testing done previously.

WB 9699 (HRS-5)

WB9699 is a hard red spring variety adapted to the Southern San Joaquin and Sacramento Valley with excellent grain yield potential and stripe rust resistance. It has excellent standability and forage green chop yield potential in the Southern SJV as well. It has a short to medium height and medium maturity similar to Summit 515. Its growth habit is upright and about 2 inches taller than Summit 515. It has been found to have adequate milling and baking quality aspects and end use quality according to wheat quality lab testing done previously.

Group 5: WESTBRED

HARD RED

Milling Data*

	Hard Red Wheat (Grams)		
Entry Name	**SY Cal Rojo**	**WB 9490**	**WB 9699**
Sample	**HRS Control**	**HRS-4**	**HRS-5**
FIRST_BREAK	3187	2625	2514
SECOND_BREAK	3164	2576	2468
GRADER	1703	1360	1396
THIRD_BREAK	1349	1241	1342
FIRST_MIDS	4613	3519	3678
SECOND_MIDS	9396	8452	8902
THIRD_MIDS	3164	3056	3670
FIRST_M_RED	2003	1420	1586
FOURTH_MIDS	2469	1602	2972
FIFTH_MIDS	1252	1442	1915
RED_DOG	1256	2760	3196
RED_SHORT	674	909	1074
BK_SHORT	1341	1253	1476
BRAN	7584	5901	6927
SUCTION	120	185	236
TOTAL_FLOUR	32420	27478	30679
FEED_STREAM	10855	10823	12673
%FIRST_REL	42.8	43.9	43.1
%SECOND_RELEASE	61.1	62.9	62.4
BREAK_FLOUR	17.8	16.8	14.6
PATENT_FLOUR	51.7	48.5	44.2
FLOUR_YLD (%)	74.9	71.7	70.8
Comments:	**Samples displayed some 'wooliness' to the flour that resulted in poor sifting in the reduction streams. The overs of the last flour cloth, Red Dog, weights were elevated because of this with a resulting loss of flour yield to a level abnormally low with this mill. Some of this flour may be able to be recovered in a longer flow mill if additional sifting area is brought online to deal with the poor sifting.**		

Group 5: WestBred

Grain & Flour Quality Data

Data represent only the means of the quality data received from the mills.

Entry Name	**SY Cal Rojo**	**WB 9490**	**WB 9699**
Sample	**HRS Control**	**HRS-4**	**HRS-5**
Wheat Data			
Moisture (%)	9.2	9.3	9.3
Protein % (12% MB)	13.3	12.0	12.0
Ash % (12% MB)	1.55	1.56	1.46
1000 Kernel Weight (g)	43.9	49.3	50.0
Weight (mg)	40.5	43.9	44.4
Diameter (mm)	2.9	3.1	3.7
Wheat Hardness (NR)	54.7	68.5	67.3
Test Weight (lbs/bu)	62.3	64.9	65.9
Wheat Falling No. (sec)	321	371	358
Kernel Size Distribution (%)	85/14/1	95/5/0	97/3/0
Flour Data			
Flour Moisture %	13.7	14.0	14.0
Flour Protein (14% MB)	12.38	11.53	11.18
Flour Ash (14% MB)	0.48	0.48	0.48
Gluten Index	98.3	93.2	96.1
Wet Gluten (14% MB)	30.0	29.0	27.9
Farinograph			
Absorption (%)	63.3	63.0	64.2
Peak/Dev. Time (min)	8.0	6.6	7.1
Stability (min)	18.4	10.8	12.9
MTI (F.U.)	13.8	30.8	24.0
Mixograph			
Absorption (%)	65.1	63.5	63.2
Mix Time (min)	4.3	3.4	3.6
Mix tolerance (1-8)	3.8	4.0	3.8
Alveograph			
P (mm)	123	104	123
L (mm)	60	56	74
P/L Ratio	2.05	1.86	1.66
W value (10^{-4} Joules)	316	208	310

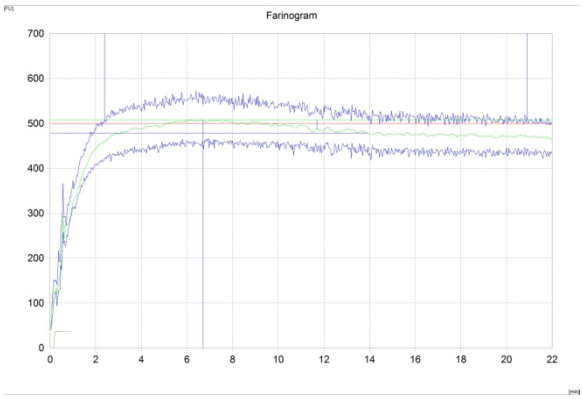
Group 5: WestBred, Hard Red

Farinograms

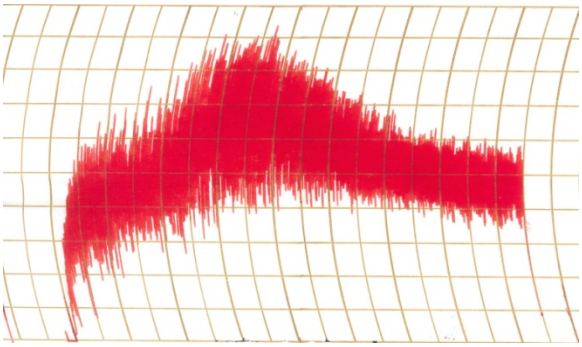
Mixograms

HRS Control, SY Cal Rojo

Water abs: 63.9%, Development time: 6.7 min, Stability: 18.5 min, MTI: 21 FU

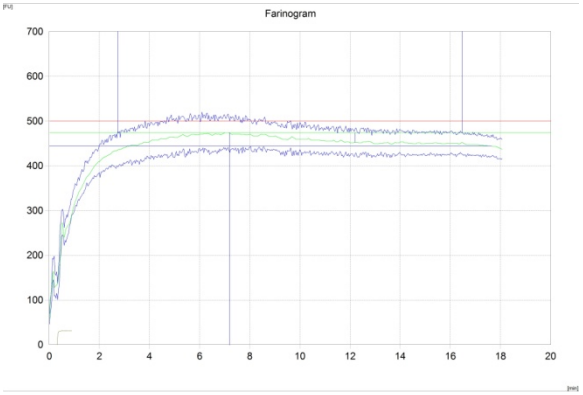


Water abs: 63.3%, Mix time: 3.9 min, MT score: 4

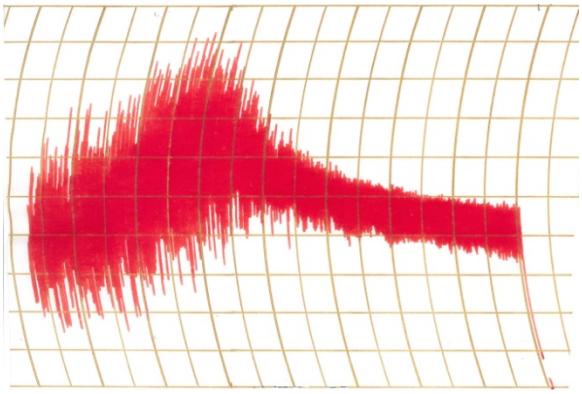


HRS-4, WB 9490

Water abs: 64.4%, Development time: 7.2 min, Stability: 13.7 min, MTI: 22 FU

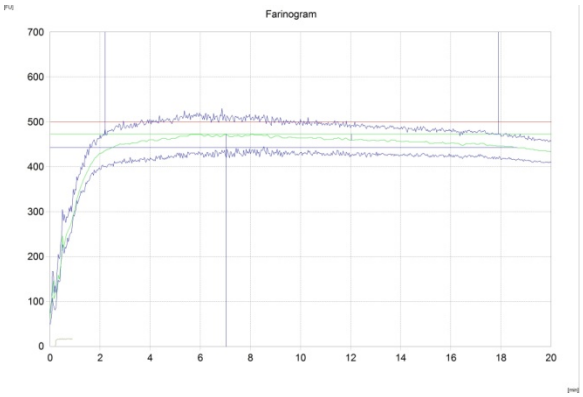


Water abs: 62.4, Mix time: 3.2 min, MT score: 3

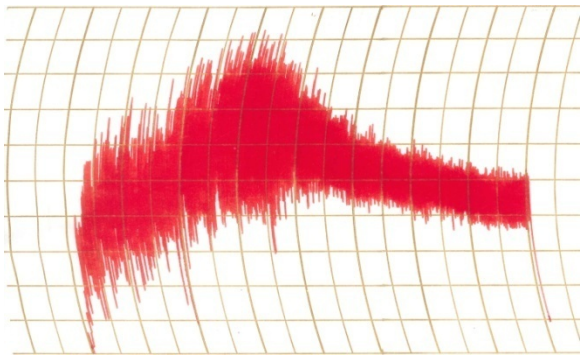


HRS-5, WB 9699

Water abs: 65%, Development time: 7 min, Stability: 15.5 min, MTI: 14 FU



Water abs: 63, Mix time: 3.2 min, MT score: 3

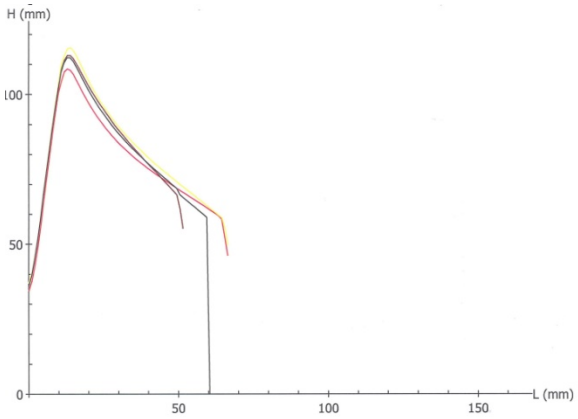


Group 5: WestBred, Hard Red

Alveograph

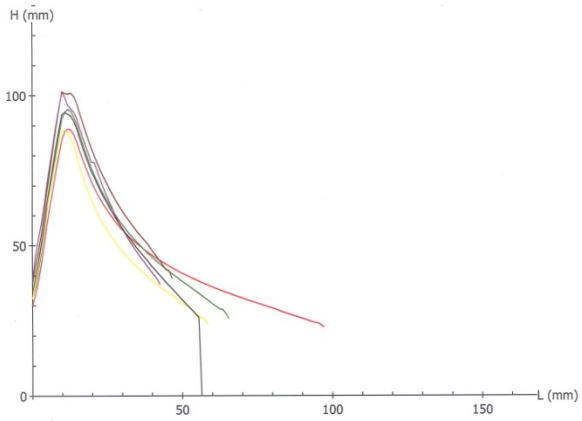
HRS Control, SY Cal Rojo

P (mmH2O): 123, L (mm): 60,
W (10E-4J): 316, P/L: 2.05



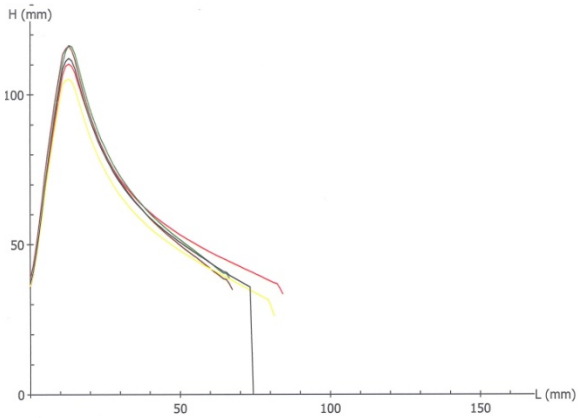
HRS-4, WB 9490

P (mmH2O): 104, L (mm): 56,
W (10E-4J): 208, P/L: 1.86



HRS-5, WB 9699

P (mmH2O): 123, L (mm): 74,
W (10E-4J): 310, P/L: 1.66

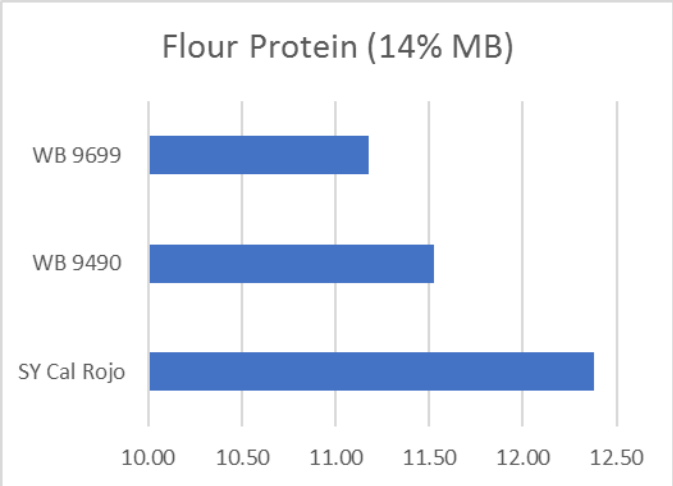


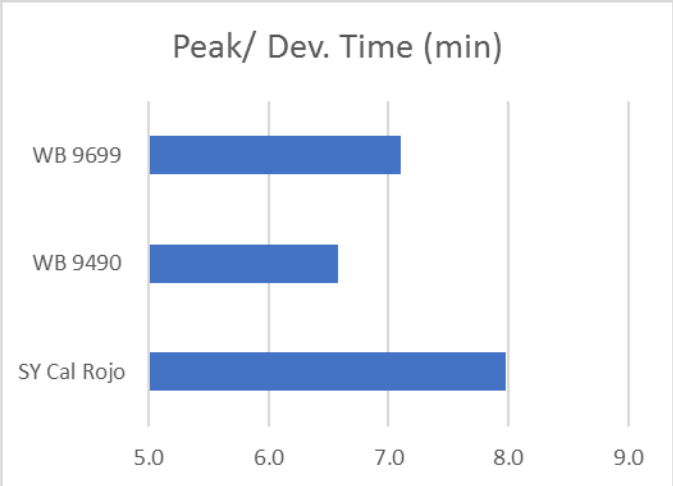
Group 5: WestBred

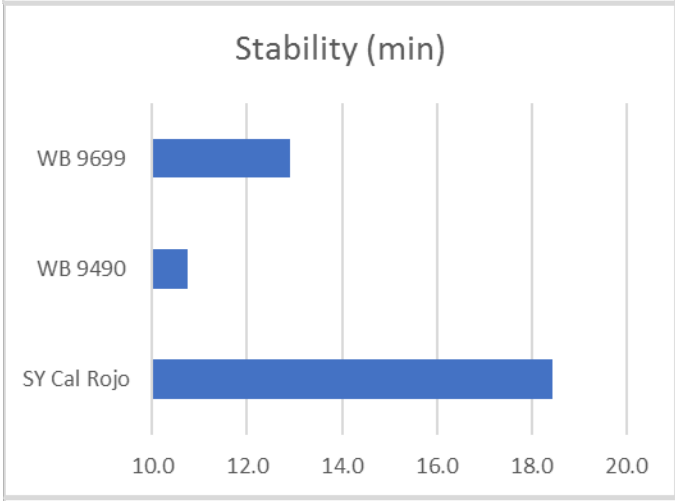
COLLABORATOR RESULTS

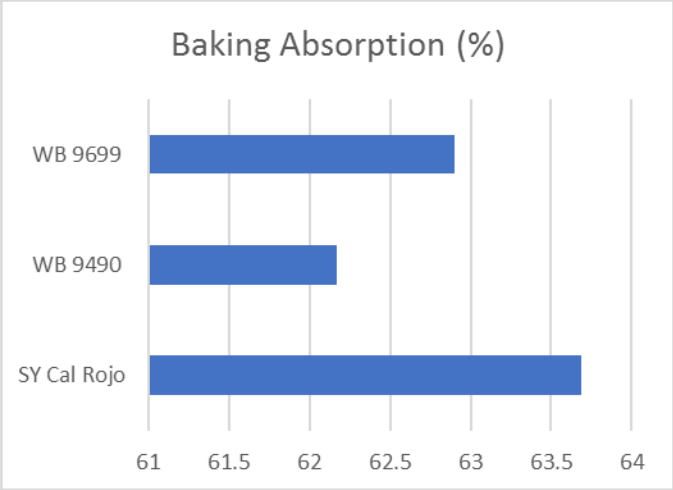
Quality Data – Collaborator Means

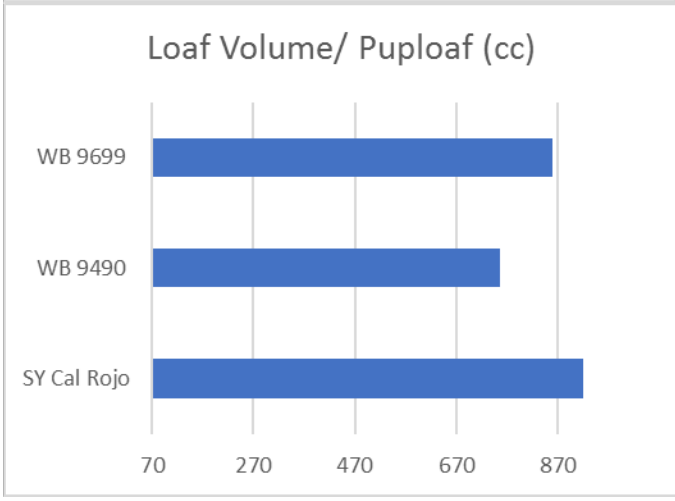
The graphs represent only the means of the quality data received from most of the collaborators.

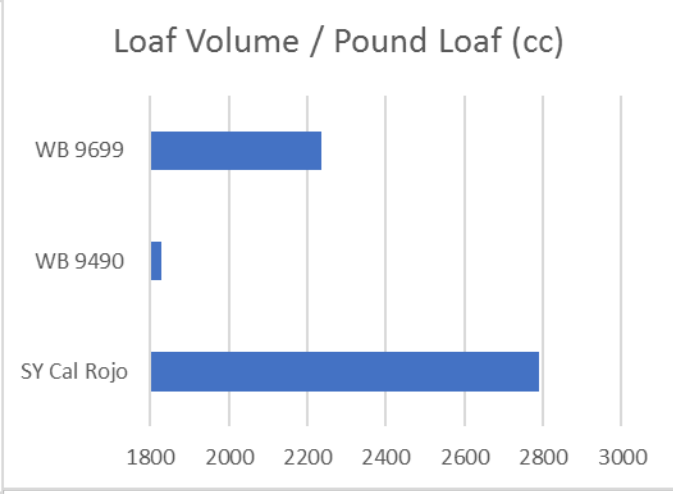








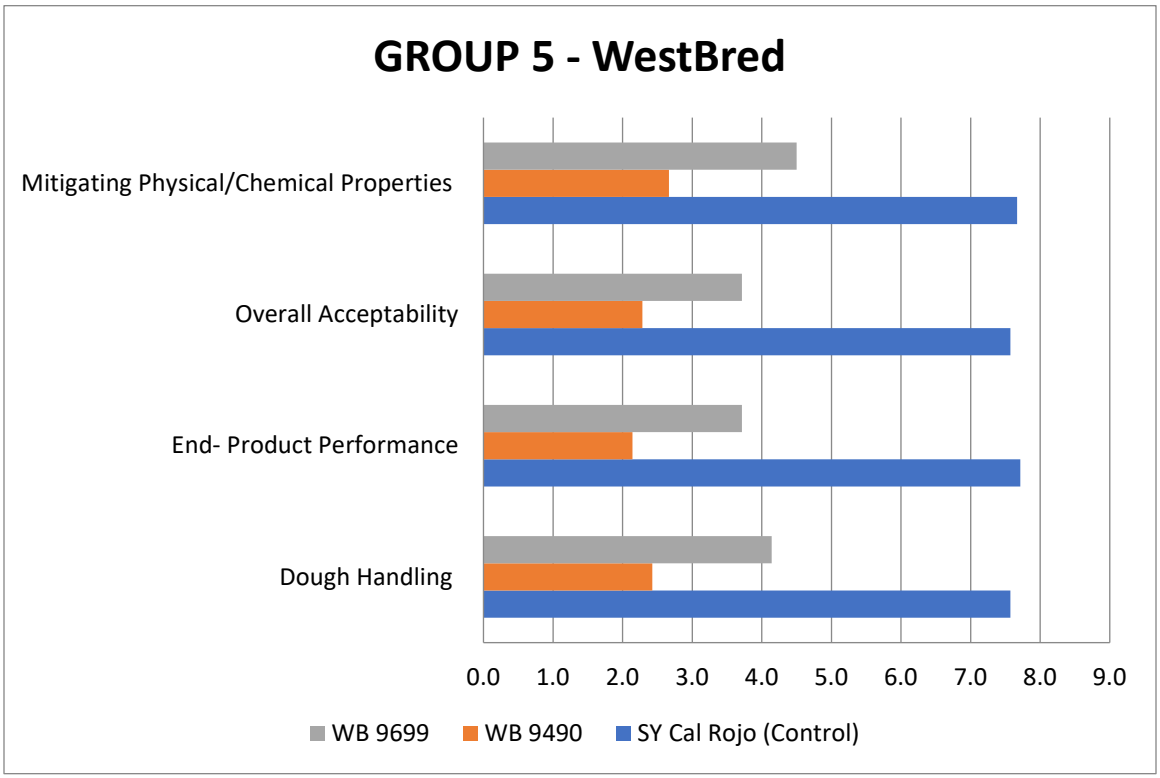




Group 5: WestBred
End-Product Evaluation

Collaborator Rating Means and Comments

For the end-product evaluation of all varieties, each collaborator submitted their rating and comments for dough handling, end-product performance, and overall acceptability. Each graph represents the collaborator rating means of varieties submitted by each breeder compared to the check sample.



COLLABORATOR COMMENTS

Group 5 - WestBred			
Entry Name	**SY - Cal Rojo**	**WB 9490**	**WB 9699**
Sample #	**HRS Control**	**HRS-4**	**HRS-5**
Dough Handling			
Mill 1	Good out of mixer/Average mix time	Soupy sponge and dough	Soupy sponge and dough
Mill 2	slightly dry during make-up	wet and mellow, very short mix time, breakdown in mixer	wet and mellow, very short mix time, breakdown in mixer
Mill 3	slightly soft out of mixer, gained strength throughout process, firm/ slightly spongy during molding	soft out of mixer, very soft/ not spongy (couldn't trap gas), very soft & sticky during molding	slightly comparable to control out the mixer, gained some strength, slightly soft/ slightly spongy during molding
Mill 4	Nice handleability out of mixer and after proofing. Held gas well and easy to mould	Nice out of mixer but then turned sticky with no gas holding and hard to handle	soft out of mixer though extensible. Handleability was not great through process
Mill 5	Good absorption and mix strength	The dough did not pick up	The dough did not pick up
Mill 6	No Comment	No Comment	No Comment
Mill 7	No Comment	Weaker slack dough at mix	No Comment
End- Product Performance			
Mill 1	Excellent loaf volume/open grain	Too soft to mix	Too soft to mix
Mill 2	No Comment	flat top, open grain, yellow color, poor quality	open grain, yellow color, poor quality
Mill 3	medium break & shred, good crumb- small rounded & elongated cells	flat top, no break & shred, very little rise, open, rounded cells	slightly flat top, small break & shred, very small rounded cells, slightly soft crumb
Mill 4	Nice BRIGHT color, crumb structure and volume	No volume, dense and hard to mould	small volume but decent crumb and color
Mill 5	Nice interior, good loaf volume	The dough did not proof	The dough did not proof
Mill 6	No Comment	No Comment	No Comment
Mill 7	Very good crumb grain,Exc crumb color	Poorer crumb grain & color	Slighty above Avg baker
Overall Acceptability			
Mill 1	Acceptable baking quality	Very poor quality	Very poor quality
Mill 2	No Comment	very poor quality	poor quality
Mill 3	acceptable volume, good crumb	poor volume, soft & sticky dough	low but acceptable volume, ok crumb
Mill 4	No Comment	No Comment	No Comment
Mill 5	No Comment	No Comment	No Comment
Mill 6	No Comment	No Comment	No Comment
Mill 7	No Comment	No Comment	No Comment
Mitigating Physical/Chemical Properties			
Mill 1	Creamy interior	No Strength/Unacceptable	No Strength/Unacceptable
Mill 2	No Comment	No Comment	No Comment
Mill 3	quick mix time, softer dough but can still trap gas, crumb not too bright	quick mix time, very soft & sticky, gummy feel to crumb	good mix time, softer dough couldn't trap gas as well as control (smaller initial rise, deflated quickly), slightly creamy crumb
Mill 4	Good Absorption, stability and pro.	Low pro, stability and no gas holding. Volume was not there	Low protein
Mill 5	No Comment	No Comment	No Comment
Mill 6	No Comment	No Comment	No Comment
Mill 7	No Comment	Lower prot, poor milling/mix tolerance	Exc TW, Lower prot, poor miller

Flour Quality Data - All Mills Summary

			Group 1	Group 2	Group 3	Group 5			Group 4	
	Entry Name	**SY Cal Rojo**	**APB 410089**	**AP Octane**	**UC 1882**	**WB 9490**	**WB 9699**	**SY Blanca Grande 515**	**UC 1839**	**UC 1909**
	Sample #	**HRS Control**	**HRS-1**	**HRS-2**	**HRS-3**	**HRS-4**	**HRS-5**	**HWS Control**	**HWS-1**	**HWS-2**
	Flour Analysis									
Mill 1	Flour Moisture %	13.72	14.05	13.84	14.02	14.00	13.93	13.63	13.48	13.52
Mill 3	Flour Moisture %	13.72	13.98	13.85	14.05	14.10	14.08	13.76	13.56	13.62
Mill 4	Flour Moisture %	13.88	14.26	14.06	14.23	14.24	14.24	13.98	13.74	13.82
Mill 5	Flour Moisture %	13.30	13.50	13.60	13.70	13.80	13.70	13.20	13.10	13.30
Mill 6	Flour Moisture %	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
Mill 7	Flour Moisture %	13.70	13.90	13.90	14.10	14.00	14.00	13.70	13.60	13.60
	Average	**13.72**	**13.95**	**13.87**	**14.02**	**14.02**	**13.99**	**13.71**	**13.58**	**13.64**
	STD	**0.24**	**0.25**	**0.16**	**0.18**	**0.14**	**0.18**	**0.29**	**0.30**	**0.24**
Mill 1	Flour Protein (14% MB)	12.39	12.98	11.24	11.90	11.30	11.13	12.41	12.89	13.17
Mill 3	Flour Protein (14% MB)	11.67	12.85	11.11	11.85	11.10	11.07	12.29	12.85	13.12
Mill 4	Flour Protein (14% MB)	12.54	13.26	11.30	12.12	11.42	11.32	12.59	13.29	13.50
Mill 5	Flour Protein (14% MB)	12.36	13.1	11.16	12.02	12.04	11.26	12.46	13.01	13.31
Mill 6	Flour Protein (14% MB)	13.00	13.00	11.00	12.00	12.00	11.00	13.00	13.00	14.00
Mill 7	Flour Protein (14% MB)	12.3	12.9	11.3	12.1	11.3	11.3	12.5	13	13.3
	Average	**12.38**	**13.01**	**11.18**	**12.00**	**11.53**	**11.18**	**12.54**	**13.01**	**13.40**
	STD	**0.43**	**0.15**	**0.12**	**0.11**	**0.40**	**0.13**	**0.25**	**0.15**	**0.32**
Mill 1	Flour Ash (14% MB)	0.47	0.50	0.49	0.50	0.49	0.48	0.44	0.45	0.47
Mill 3	Flour Ash (14% MB)	0.51	0.44	0.48	0.47	0.47	0.51	0.52	0.52	0.51
Mill 4	Flour Ash (14% MB)	0.49	0.50	0.50	0.51	0.49	0.48	0.46	0.48	0.48
Mill 5	Flour Ash (14% MB)	0.48	0.48	0.49	0.51	0.48	0.48	0.46	0.47	0.44
Mill 6	Flour Ash (14% MB)	0.47	0.50	0.44	0.46	0.45	0.46	0.46	0.45	0.48
Mill 7	Flour Ash (14% MB)	0.47	0.48	0.48	0.50	0.48	0.48	0.44	0.46	0.46
	Average	**0.48**	**0.48**	**0.48**	**0.49**	**0.48**	**0.48**	**0.46**	**0.47**	**0.48**
	STD	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.02**	**0.03**	**0.02**	**0.02**
Mill 3	Gluten Index	97.82	89.57	99.46	96.99	90.75	96.69	96.03	93.49	98.63
Mill 4	Gluten Index	98.70	94.70	99.40	98.35	95.61	95.50	98.97	98.00	99.27
	Average	**98.26**	**92.14**	**99.43**	**97.67**	**93.18**	**96.10**	**97.50**	**95.74**	**98.95**
	STD	98.26	92.14	99.43	97.67	93.18	96.10	97.50	95.74	98.95
Mill 3	Wet Gluten (14% MB)	32.00	36.04	27.50	31.52	31.39	30.28	33.91	35.82	32.66
Mill 4	Wet Gluten (14% MB)	28.09	30.91	24.89	28.43	26.54	25.51	33.65	35.63	28.69
	Average	**30.04**	**33.48**	**26.19**	**29.97**	**28.96**	**27.89**	**33.78**	**35.72**	**30.67**
	STD	**2.76**	**3.63**	**1.85**	**2.19**	**3.42**	**3.37**	**0.18**	**0.13**	**2.80**
	Farinograph									
Mill 1	Absorption (%)	63.8	66.0	60.4	61.4	63.1	64.9	65.5	62.2	61.1
Mill 3	Absorption (%)	63.9	66.2	60.6	62.9	64.4	65.0	65.4	62.2	62.1
Mill 4	Absorption (%)	62.9	65.8	59.8	60.4	62.8	64.3	64.7	62.0	62.0
Mill 5	Absorption (%)	62.5	65.1	58.1	58.8	61.7	62.7	63.3	60.4	58.9
	Average	**63.3**	**65.8**	**59.7**	**60.9**	**63.0**	**64.2**	**64.7**	**61.7**	**61.0**
	STD	**0.7**	**0.5**	**1.1**	**1.7**	**1.1**	**1.1**	**1.0**	**0.9**	**1.5**
Mill 1	Peak/Dev. Time (min)	8.1	7.9	4.8	8.5	6.2	6.5	7.0	9.7	8.9
Mill 3	Peak/Dev. Time (min)	6.7	6.8	5.8	8.8	7.2	7.0	7.0	8.8	37.7
Mill 4	Peak/Dev. Time (min)	8.4	8.0	6.0	7.2	6.1	8.1	8.2	12.2	41.2
Mill 5	Peak/Dev. Time (min)	8.7	8.0	5.2	8.5	6.8	6.8	9.0	12.8	5.2
	Average	**8.0**	**7.7**	**5.5**	**8.3**	**6.6**	**7.1**	**7.8**	**10.9**	**23.3**
	STD	**0.9**	**0.6**	**0.6**	**0.7**	**0.5**	**0.7**	**1.0**	**1.9**	**18.8**

			Group 1	Group 2	Group 3	Group 5			Group 4	
	Entry Name	SY Cal Rojo	APB 410089	AP Octane	UC 1882	WB 9490	WB 9699	SY Blanca Grande 515	UC 1839	UC 1909
MILLS	Sample #	HRS Control	HRS-1	HRS-2	HRS-3	HRS-4	HRS-5	HWS Control	HWS-1	HWS-2
Mill 1	Stability (min)	17.2	11.0	16.5	17.0	9.1	11.3	17.1	18.0	17.5
Mill 3	Stability (min)	18.5	14.4	15.0	16.9	13.7	15.7	16.1	21.4	47.8
Mill 4	Stability (min)	19.8	13.0	19.1	18.4	10.7	13.8	23.3	26.0	62.6
Mill 5	Stability (min)	18.2	10.5	18.9	10.4	9.5	10.8	17.8	18.1	18.2
	Average	**18.4**	**12.2**	**17.4**	**15.7**	**10.8**	**12.9**	**18.6**	**20.9**	**36.5**
	STD	**1.1**	**1.8**	**2.0**	**3.6**	**2.1**	**2.3**	**3.2**	**3.8**	**22.4**
Mill 1	MTI (F.U.)	16	32	7	12	39	30	13	21	8
Mill 3	MTI (F.U.)	21	16	7	19	22	14	30	17	10
Mill 4	MTI (F.U.)	8	25	13	10	26	20	7	10	2
Mill 5	MTI (F.U.)	10	38	6	15	36	32	14	19	10
	Average	**14**	**28**	**8**	**14**	**31**	**24**	**16**	**17**	**8**
	STD	**5.9**	**9.5**	**3.2**	**3.9**	**8.1**	**8.5**	**9.8**	**4.8**	**3.8**
	Mixograph									
Mill 3	Absorption (%)	63.3	64.8	59.5	60.9	62.4	63	63.4	61.1	60.1
Mill 6	Absorption (%)	66.0	67.0	63.0	65.0	64.0	63.0	66.0	67.0	67.0
Mill 7	Absorption (%)	66.0	67.0	64.0	65.0	64.0	63.7	67.5	66.3	66.0
	Average	**65.1**	**66.3**	**62.2**	**63.6**	**63.5**	**63.2**	**65.6**	**64.8**	**64.4**
	STD	**1.6**	**1.3**	**2.4**	**2.4**	**0.9**	**0.4**	**2.1**	**3.2**	**3.7**
Mill 3	Mix Time (min)	3.9	2.9	4.2	3.4	3.2	3.2	3.5	3.8	7.6
Mill 6	Mix Time (min)	5.0	3.0	5.0	4.0	4.0	4.0	4.0	5.0	7.0
Mill 7	Mix Time (min)	4.0	3.3	4.9	3.8	3.0	3.5	4.0	4.3	7.0
	Average	**4.3**	**3.1**	**4.7**	**3.7**	**3.4**	**3.6**	**3.8**	**4.3**	**7.2**
	STD	**0.6**	**0.2**	**0.5**	**0.3**	**0.5**	**0.4**	**0.3**	**0.6**	**0.4**
Mill 3	Mix tolerance (1-8)	4	3	4	3	3	3	4	4	7
Mill 6	Mix tolerance (1-8)	4	3	4	3	2	3	4	4	6
Mill 7	Mix tolerance (1-8)	3.5	6	3.5	5	7	5.5	3	3.5	3
	Average	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**5**
	STD	**0.3**	**1.7**	**0.3**	**1.2**	**2.6**	**1.4**	**0.6**	**0.3**	**2.1**
	Alveograph									
Mill 3	P (mm)	123	109	113	102	104	123	117	104	119
Mill 3	L (mm)	60	60	90	81	56	74	94	95	67
Mill 3	P/L Ratio	2.05	1.82	1.26	1.26	1.86	1.66	1.24	1.09	1.78
Mill 3	W value (10^{-4} Joules)	316	257	390	299	208	310	398	368	358

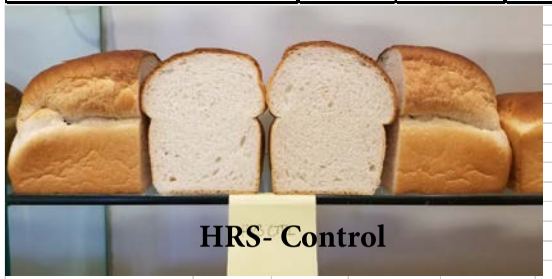
			Group 1	Group 2	Group 3	Group 5			Group 4	
	Entry Name	**SY Cal Rojo**	**APB 410089**	**AP Octane**	**UC 1882**	**WB 9490**	**WB 9699**	**SY Blanca Grande 515**	**UC 1839**	**UC 1909**
	Sample #	**HRS Control**	**HRS-1**	**HRS-2**	**HRS-3**	**HRS-4**	**HRS-5**	**HWS Control**	**HWS-1**	**HWS-2**
	Baking Analysis									
Mill 1	Absorption (%)	58.0	59.0	57.0	58.0	57.0	57.0	58.0	59.0	59.0
Mill 2	Absorption (%)	65.9	68.2	62.6	64.9	66.4	67.0	67.4	64.2	64.1
Mill 3	Absorption (%)	64.5	65.0	61.0	63.0	62.0	64.5	64.0	62.0	65.0
Mill 4	Absorption (%)	62.9	65.8	59.8	60.4	62.8	64.3	64.7	62.0	62.0
Mill 5	Absorption (%)	62.0	64.0	58.0	59.0	59.0	60.0	63.0	60.0	58.0
Mill 6	Absorption (%)	66.0	67.0	63.0	65.0	64.0	63.0	66.0	67.0	69.0
Mill 7	Absorption (%)	66.5	68.0	64.5	65.5	64.0	64.5	66.5	67.0	67.0
	Average	**63.7**	**65.3**	**60.8**	**62.3**	**62.2**	**62.9**	**64.2**	**63.0**	**63.4**
	STD	**3.0**	**3.2**	**2.7**	**3.1**	**3.2**	**3.3**	**3.1**	**3.2**	**4.0**
Mill 1	Mixing Time (min)	11	5	12	6	0	0	7	7	18
Mill 2	Mixing Time (min)	23	9	23	13	2	4	17	19	23
Mill 3	Mixing Time (min)	3	2	4	3	3	3	3	3	5
Mill 4	Mixing Time (min)	8	8	8	8	8	8	8	8	8
Mill 5	Mixing Time (min)	25	16	20	20	5	5	20	20	25
Mill 6	Mixing Time (min)	3	3	4	3	3	3	3	4	8
Mill 7	Mixing Time (min)	3	3	4	3	3	3	3	3	5
	Average	**11**	**7**	**11**	**8**	**3**	**4**	**9**	**9**	**13**
	STD	**9.5**	**4.9**	**8.0**	**6.5**	**2.5**	**2.4**	**7.1**	**7.3**	**8.6**
Mill 3	Loaf volume	890	815	875	810	775	855	850	840	930
Mill 6	Loaf volume	945	855	885	785	690	820	900	925	985
Mill 7	Loaf volume	930	855	885	810	805	905	815	935	990
	Average Puploaf	**922**	**842**	**882**	**802**	**757**	**860**	**855**	**900**	**968**
	STD	**28**	**23**	**6**	**14**	**60**	**43**	**43**	**52**	**33**
Mill 1	Loaf volume	2900	2500	2875	2600	-	-	2650	2675	3000
Mill 2	Loaf volume	2625	2350	2525	2500	1800	2125	2725	2475	2300
Mill 4	Loaf volume	2732	2569	2496	2554	1856	2344	2720	2580	2668
Mill 5	Loaf volume	2897	2485	2780	2633	-	-	2574	2456	2897
	Avg. Pound Loaf	**2789**	**2476**	**2669**	**2572**	**1828**	**2235**	**2667**	**2547**	**2716**
	STD	**134**	**91**	**187**	**58**	**40**	**155**	**71**	**102**	**310**

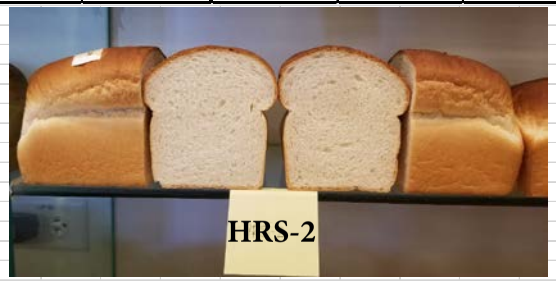
Overland Park					Bake							Farinograph				Analytical			
SampleID	Receipt Date	Sample Date	Sample Description	Lot Number	Bake Absorption (%)	Mix Time	Loaf Volume	Grain	Texture	Crumb Color	Dough Condition	Absorption	Peak	Stability	MTI	Moisture	Ash (14%MB)	Protein (14%MB)	Falling Number
190910014	9/10/2019	9/10/2019	2019 California Collaborator	HRS Control	58	11	2900	Open	Soft	Slightly Crmy	Good	63.8	8.1	17.15	16	13.72	0.468	12.39	409
190910015	9/10/2019	9/10/2019	2019 California Collaborator	HRS 1	59	5	2500	Very Open	Soft	CR SL Dull	Soft	66	7.93	11.03	32	14.05	0.496	12.98	423
190910016	9/10/2019	9/10/2019	2019 California Collaborator	HRS 2	57	12	2875	Open	Soft	Creamy	Good	60.4	4.84	16.47	7	13.84	0.492	11.24	340
190910017	9/10/2019	9/10/2019	2019 California Collaborator	HRS 3	58	6	2600	Very Open	Soft	Slightly Dull	Soft	61.4	8.53	17	12	14.02	0.500	11.90	388
190910018	9/10/2019	9/10/2019	2019 California Collaborator	HRS 4								63.1	6.24	9.14	39	14	0.487	11.30	412
190910019	9/10/2019	9/10/2019	2019 California Collaborator	HRS 5								64.9	6.51	11.27	30	13.93	0.483	11.13	446
190910020	9/10/2019	9/10/2019	2019 California Collaborator	HWS Control	58	7	2650	Very Open	Soft	CR SL Dull	Good	65.5	7.03	17.05	13	13.63	0.438	12.41	349
190910021	9/10/2019	9/10/2019	20192 California Collaborator	HWS 1	59	7	2675	Very Open	Soft	Dull	Good	62.2	9.66	18	21	13.48	0.453	12.89	492
190910022	9/10/2019	9/10/2019	2019 California Collaborator	HWS 2	59	18	3000	Open	Soft	Dull	Tough	61.1	8.89	17.5	8	13.52	0.474	13.17	529

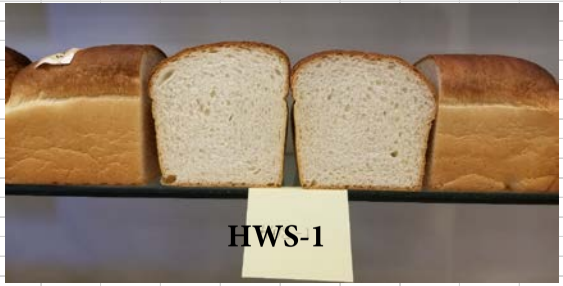
Ardent Mills™

Nourishing what's next.™

	Group 1		Group 2		Group 3		Group 4			Group 5		
Sample #	HRS Control	HRS-1	HRS CONTROL	HRS-2	HRS CONTROL	HRS-3	HWS CONTROL	HWS-1	HWS-2	HRS CONTROL	HRS-4	HRS-5
Baking Analysis												
Absorption (%)	65.90%	68.20%	65.90%	62.60%	65.90%	64.90%	67.40%	64.20%	64.10%	65.90%	66.40%	67%
Mixing Time	23 Min.	9 Min.	23 Min.	23 Min.	23 Min.	13 Min.	17 Min.	19 Min.	23 Min.	23 Min.	2 Min.	4 Min.
Loaf volume	2625 cc	2350 cc	2625 cc	2525 cc	2625 cc	2500 cc	2725 cc	2475 cc	2300 cc	2625 cc	<1800 cc	2125 cc







	Group 1		Group 2		Group 3		Group 4			Group 5		
Sample #	HRS Control	HRS-1	HRS CONTROL	HRS-2	HRS CONTROL	HRS-3	HWS CONTROL	HWS-1	HWS-2	HRS CONTROL	HRS-4	HRS-5
Flour Analysis												
Flour Moisture %	13.72	13.98	13.72	13.85	13.72	14.05	13.76	13.56	13.62	13.72	14.10	14.08
Flour Protein (14% MB)	11.67	12.85	11.67	11.11	11.67	11.85	12.29	12.85	13.12	11.67	11.10	11.07
Flour Ash (14% MB)	0.51	0.44	0.51	0.48	0.51	0.47	0.52	0.52	0.51	0.51	0.47	0.51
Gluten Index	97.82	89.57	97.82	99.46	97.82	96.99	96.03	93.49	98.63	97.82	90.75	96.69
Wet Gluten (14% MB)	32.00	36.04	32.00	27.50	32.00	31.52	33.91	35.82	32.66	32.00	31.39	30.28
Farinograph												
Absorption (%)	63.9	66.2	63.9	60.6	63.9	62.9	65.4	62.2	62.1	63.9	64.4	65
Peak/Dev. Time (min)	6.7	6.8	6.7	5.8	6.7	8.8	7	8.8	37.7	6.7	7.2	7
Stability (min)	18.5	14.4	18.5	15	18.5	16.9	16.1	21.4	47.8	18.5	13.7	15.7
MTI	21	16	21	7	21	19	30	17	10	21	22	14
Mixograph												
Absorption (%)	63.3	64.8	63.3	59.5	63.3	60.9	63.4	61.1	60.1	63.3	62.4	63
Mix Time	3.85	2.94	3.85	4.15	3.85	3.4	3.47	3.79	7.64	3.85	3.16	3.17
Mix tolerance	4	3	4	4	4	3	4	4	7	4	3	3
Alveograph												
P	123	109	123	113	123	102	117	104	119	123	104	123
L	60	60	60	90	60	81	94	95	67	60	56	74
P/L	2.05	1.82	2.05	1.26	2.05	1.26	1.24	1.09	1.78	2.05	1.86	1.66
W	316	257	316	390	316	299	398	368	358	316	208	310
Baking Analysis												
Absorption (%)	64.5	65	64.5	61	64.5	63	64	62	65	64.5	62	64.5
Mixing Time	2.83	2.47	2.83	3.8	2.83	2.6	2.5	3.25	5.17	2.83	2.63	3.2
Loaf volume	890	815	890	875	890	810	850	840	930	890	775	855

Whole Wheat Flour Analysis

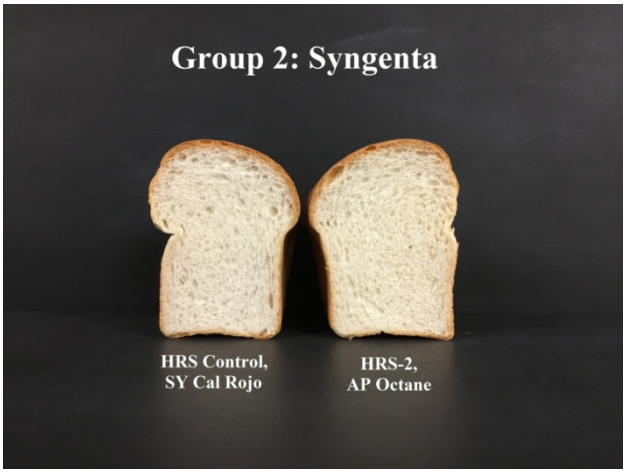
	Group 1						Group 4		
Sample #	HRS Control	HRS-1	HRS-2	HRS-3	HRS-4	HRS-5	HWS CONTROL	HWS-1	HWS-2
Flour Analysis									
Flour Moisture %	9.10	8.90	8.80	8.10	8.70	8.60	8.30	8.70	8.60
Flour Protein (14% MB)	12.50	13.63	12.50	12.54	11.66	11.68	13.28	13.46	13.76
Flour Ash (14% MB)	1.43	1.52	1.63	1.55	1.43	1.40	1.45	1.37	1.53
Gluten Index	84.67	52.33	92.89	62.07	47.60	73.89	69.47	59.58	97.48
Wet Gluten (14% MB)	30.56	39.32	28.53	35.37	32.36	29.64	39.44	44.98	33.64
Farinograph									
Absorption (%)	70.1	75.1	68.9	73.4	72.9	73.4	75.1	72	73.7
Peak/Dev. Time (min)	4	4.2	4.2	3.8	3.8	4.3	4.3	4.2	8.3
Stability (min)	3	3.2	3.2	3.5	2.5	2.7	4.3	3	16.1
MTI	64	53	61	42	78	71	49	56	25
Baking Analysis									
Absorption (%)	70	75.5	70.5	73.5	73	73.5	75.5	72.5	74
Mixing Time	2.92	2.33	3.55	2.20	2.23	3.13	2.18	3.10	4.90
Loaf volume	700	675	670	600	520	640	675	580	735

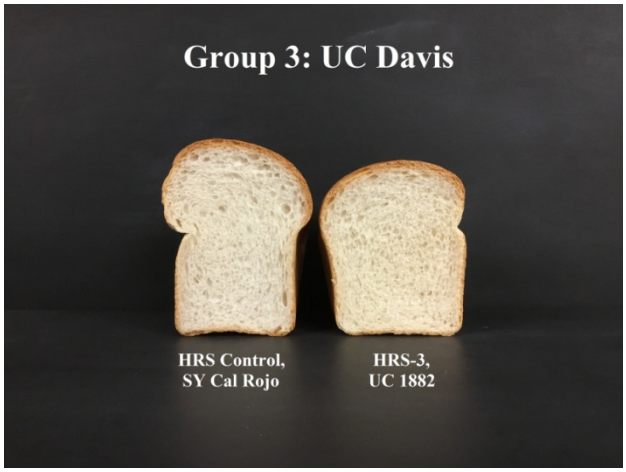
SAMPLES BAKED WITH ASCORBIC ACID AND NO ASCORBIC ACID RESULTS

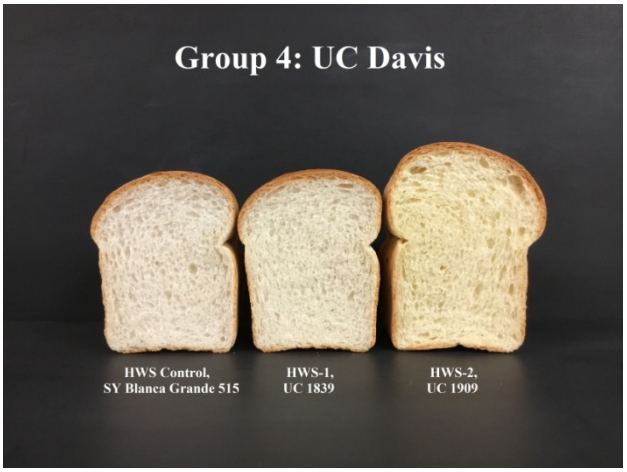
Without Ascorbic acid												
Sample #	HRS Control	HRS-1	HRS CONTROL	HRS-2	HRS CONTROL	HRS-3	HWS CONTROL	HWS-1	HWS-2	HRS CONTROL	HRS-4	HRS-5
Baking Analysis												
Absorption (%)	64.5	65	64.5	61	64.5	63	64	62	65	64.5	62	64.5
Mixing Time	2.83	2.47	2.83	3.8	2.83	2.6	2.5	3.25	5.17	2.83	2.63	3.2
Loaf volume	890	815	890	875	890	810	850	840	930	890	775	855

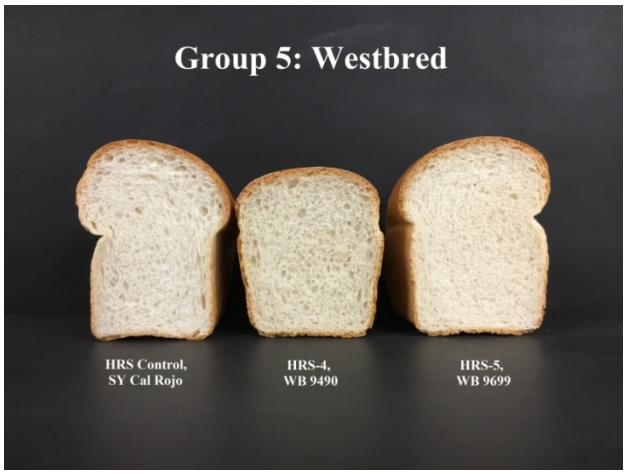
With Ascorbic acid												
Sample #	HRS Control	HRS-1	HRS CONTROL	HRS-2	HRS CONTROL	HRS-3	HWS CONTROL	HWS-1	HWS-2	HRS CONTROL	HRS-4	HRS-5
Baking Analysis												
Absorption (%)	63.5	63	63.5	62	63.5	63	64	63	67	63.5	63	65
Mixing Time	3.02	2.5	3.02	3.92	3.02	2.67	2.92	3.5	6.17	3.02	2.67	3.02
Loaf volume	940	955	940	875	940	940	1020	925	895	940	890	935

Group 1: Arizona Plant Breeders
HRS Control,
SY Cal Rojo
HRS-1,
APB 410089

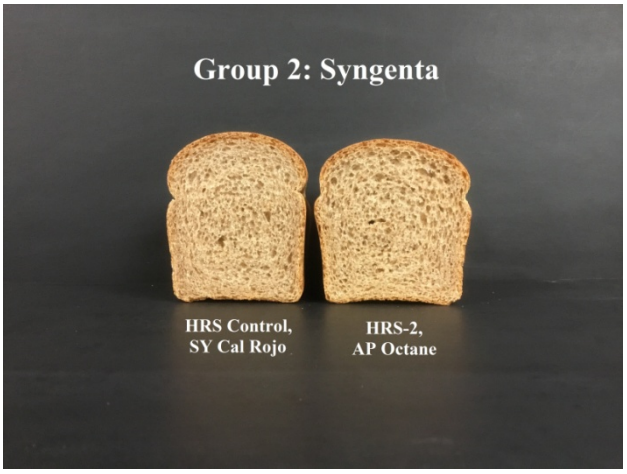

Group 2: Syngenta
HRS Control,
SY Cal Rojo
HRS-2,
AP Octane

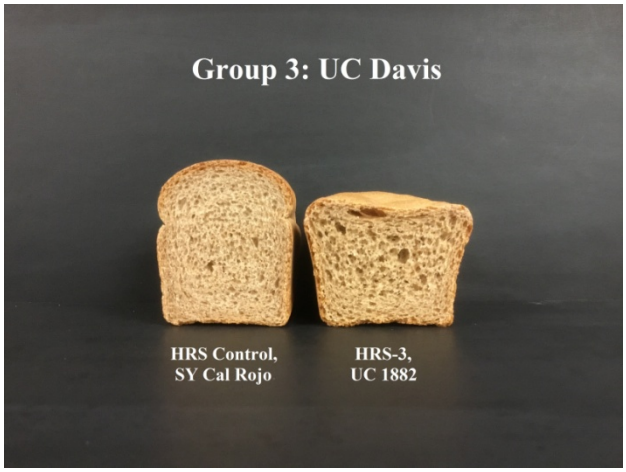

Group 3: UC Davis
HRS Control,
SY Cal Rojo
HRS-3,
UC 1882

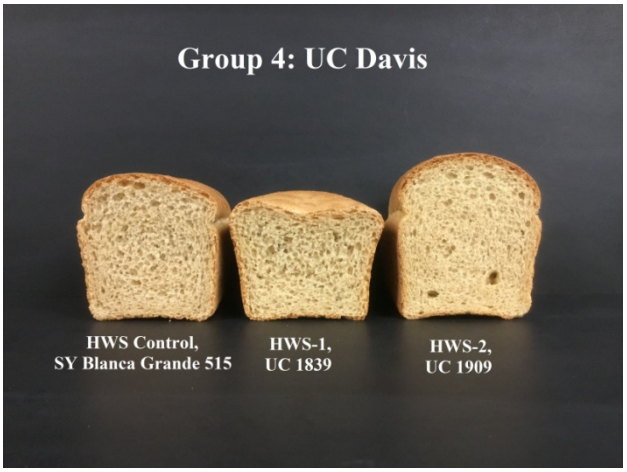

Group 4: UC Davis
HWS Control,
SY Blanca Grande 515
HWS-1,
UC 1839
HWS-2,
UC 1909

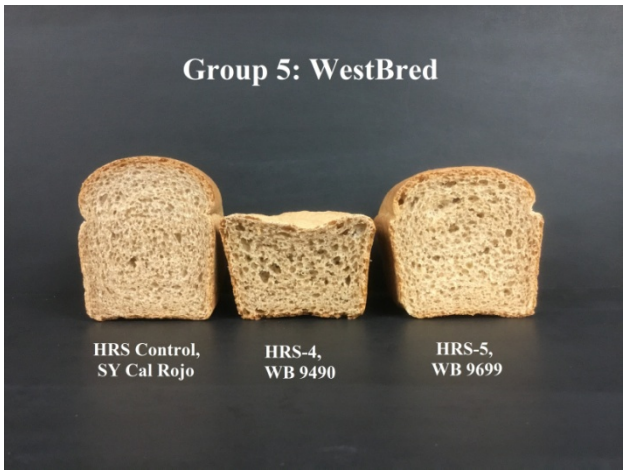

Group 5: Westbred
HRS Control,
SY Cal Rojo
HRS-4,
WB 9490
HRS-5,
WB 9699

Group 1: Arizona Plant Breeders
HRS Control, SY Cal Rojo
HRS-1, APB 410089


Group 2: Syngenta
HRS Control, SY Cal Rojo
HRS-2, AP Octane


Group 3: UC Davis
HRS Control, SY Cal Rojo
HRS-3, UC 1882


Group 4: UC Davis
HWS Control, SY Blanca Grande 515
HWS-1, UC 1839
HWS-2, UC 1909


Group 5: WestBred
HRS Control, SY Cal Rojo
HRS-4, WB 9490
HRS-5, WB 9699

	Group 1		Group 2		Group 3		Group 4			Group 5		
Sample #	HRS Control	HRS-1	HRS CONTROL	HRS-2	HRS CONTROL	HRS-3	HWS CONTROL	HWS-1	HWS-2	HRS CONTROL	HRS-4	HRS-5
Flour Analysis												
Flour Moisture %	13.88	14.26	13.88	14.06	13.88	14.23	13.98	13.74	13.82	13.88	14.24	14.24
Flour Protein (14% MB)	12.54	13.26	12.54	11.30	12.54	12.12	12.59	13.29	13.50	12.54	11.42	11.32
Flour Ash (14% MB)	0.487	0.499	0.487	0.498	0.487	0.512	0.464	0.476	0.484	0.487	0.485	0.481
Gluten Index	98.7	94.7	98.7	99.4	98.7	98.35	98.97	98	99.27	98.7	95.61	95.5
Wet Gluten (14% MB)	28.09	30.91	28.09	24.89	28.09	28.43	33.65	35.63	28.69	28.09	26.54	25.51
Farinograph												
Absorption (%) (as-is)	62.9	65.8	62.9	59.8	62.9	60.4	64.7	62	62	62.9	62.8	64.3
Peak/Dev. Time (min)	8.4	8	8.4	6	8.4	7.2	8.2	12.2	41.2	8.4	6.1	8.1
Stability (min)	19.8	13	19.8	19.1	19.8	18.4	23.3	26	62.6	19.8	10.7	13.8
MTI	8	25	8	13	8	10	7	10	2	8	26	20
Baking Analysis												
Absorption (%)	62.9	65.8	62.9	59.8	62.9	60.4	64.7	62.0	62.0	62.9	62.8	64.3
Mixing Time	8	8	8	8	8	8	8	8	8	8	8	8
Loaf volume	2732.3	2568.6	2732.3	2496	2732.3	2553.5	2719.5	2580.4	2667.9	2732.3	1856.2	2344.1

GRAIN CRAFT

GRAIN CRAFT - 2019 CALIFORNIA WHEAT COMMISSION - COMMON WHEAT

Sample Description	Flour Moisture	Flour Ash	Flour Protein	FNV	Farino Abs	Farino Peak	Farino MTI	Farino Stab	Bake Abs	Mix Time	Dough Score	Dough Comments	Loaf Volume	Crumb Color	Interior Grain	Interior Texture	External	Bake Evaluation Comments
				>350	>59	>5	<35	>12	>59	>14			>2850					
HRS CONTROL	13.3	0.479	12.36	398	62.5	8.7	10	18.2	62.0	25.0	6	Tight	2897	5	7	7	5	Good absorption, Very good mix strength, Nice interior, Good loaf volume
HRS 1	13.5	0.477	13.10	418	65.1	8.0	38	10.5	64.0	16.0	6	Sl. Slack	2485	2	4	4	1	Very good absorption, Fair mix strength, Poor interior, Very low loaf volume
HRS 2	13.6	0.487	11.16	306	58.1	5.2	6	18.9	58.0	20.0	8	Developed	2780	4	5	5	3	Slightly low absorption, Good mix strength, Fair interior, Low loaf volume
HRS 3	13.7	0.505	12.02	363	58.8	8.5	15	10.4	59.0	20.0	8	Developed	2633	3	4	4	1	Slightly low absorption, Good mix strength, Poor interior, Low loaf volume
HRS 4	13.8	0.482	12.04	404	61.7	6.8	36	9.5	61.0 57.0	6 4	2 2	Runny						The sponge felt wet and sticky. The dough did not pickup in the mixer. The dough did not proof.
HRS 5	13.7	0.478	11.26	421	62.7	6.8	32	10.8	62.0 58.0	5 5	3 3	Runny						The sponge felt wet. The dough did not pickup in the mixer and collapsed going into oven.
HWS CONTROL	13.2	0.459	12.46	306	63.3	9.0	14	17.8	63.0	20.0	8	Developed	2574	4	4	4	1	Good absorption, Good mix strength, Poor interior, Very low loaf volume
HWS 1	13.1	0.468	13.01	400	60.4	12.8	19	18.1	60.0	20.0	8	Developed	2456	2	4	4	1	Fair absorption, Good mix strength, Poor interior, Very low loaf volume
HWS 2	13.3	0.442	13.31	412	58.9	5.2	10	18.2	58.0	25.0	2	Bucky	2897	2	7	7	5	Slightly low absorption, excellent mix strength, Very nice interior, Good loaf volume

	Group 1		Group 2		Group 3		Group 4			Group 5		
Sample #	HRS Control	HRS-1	HRS CONTROL	HRS-2	HRS CONTROL	HRS-3	HWS CONTROL	HWS-1	HWS-2	HRS CONTROL	HRS-4	HRS-5
Flour Analysis												
Flour Moisture %	14	14	14	14	14	14	14	14	14	14	14	14
Flour Protein (14% MB)	13	13	13	11	13	12	13	13	14	13	12	11
Flour Ash (14% MB)	0.47	0.5	0.47	0.44	0.47	0.46	0.46	0.45	0.48	0.47	0.45	0.46
Mixograph												
Absorption (%)	66	67	66	63	66	65	66	67	67	66	64	63
Mix Time	5	3	5	5	5	4	4	5	7	5	4	4
Mix tolerance	4	3	4	4	4	3	4	4	6	4	2	3
Baking Analysis												
Absorption (%)	66	67	66	63	66	65	66	67	69	66	64	63
Mixing Time	3.45	3	3.45	4.45	3.45	3.15	3.3	4.3	8	3.45	3.15	3.45
Loaf volume	945	855	945	885	945	785	900	925	985	945	690	820

Group	Year	LabN	Variety	Class	Flrprot	Flrmst	Flrhrd	SKCSFlr	Ash	Mixoabs	Pktime	Pkht	Tol	Mr	Babs	Bake mixtime	Natwhr	Natpkht	Loaf	Grain	Tex	Color	Pred loaf	Pred loaf diff
					14%mb	%			%	%	min			R	%	min	engery		cc					
1	2019	1	HRS CONTROL	HRS	12.3	13.7	119	53	0.472	66.0	4.00	5.10	1359	6.5	66.5	3.0	7.4	64.7	930	8	5	8	940	-10
1	2019	2	HRS-1	HRS	12.9	13.9	133	57	0.475	67.0	3.25	5.45	979	4	68.0	2.5	4.8	67.8	855	5	5	5	979	-124
2	2019	3	HRS CONTROL	HRS	12.3	13.7	119	53	0.472	66.0	4.00	5.10	1359	6.5	66.5	3.0	7.4	64.7	930	8	5	8	940	-10
2	2019	4	HRS-2	HRS	11.3	13.9	118	57	0.484	64.0	4.85	4.85	1356	6.5	64.5	3.6	6.8	58.0	885	8	5	7	875	11
3	2019	5	HRS CONTROL	HRS	12.3	13.7	119	53	0.472	66.0	4.00	5.10	1359	6.5	66.5	3.0	7.4	64.7	930	8	5	8	940	-10
3	2019	6	HRS-3	HRS	12.1	14.1	90	42	0.503	65.0	3.75	5.00	1034	5	65.5	2.9	6.5	66.4	810	5	4	4	927	-117
4	2019	7	HWS CONTROL	HWS	12.5	13.7	100	51	0.440	67.5	4.00	5.15	1426	7	66.5	2.7	6.3	67.1	815	6	4	7	953	-138
4	2019	8	HWS-1	HWS	13.0	13.6	132	56	0.463	66.3	4.25	5.20	1325	6.5	67.0	3.1	6.9	71.8	935	5	5	4	985	-50
4	2019	9	HWS-2	HWS	13.3	13.6	118	52	0.464	66.0	7.00	4.75	1642	7	67.0	5.3	10.9	64.9	990	8	5	1	1005	-15
5	2019	10	HRS CONTROL	HRS	12.3	13.7	119	53	0.472	66.0	4.00	5.10	1359	6.5	66.5	3.0	7.4	64.7	930	8	5	8	940	-10
5	2019	11	HRS-4	HRS	11.3	14.0	138	69	0.484	64.0	3.00	5.00	730	3	64.0	2.7	5.7	64.2	805	4	4	4	875	-70
5	2019	12	HRS-5	HRS	11.3	14.0	130	64	0.475	63.7	3.50	5.00	992	4.5	64.5	2.9	6.4	63.4	905	6	5	5	875	31

Rating 9=Exc 1=Poor

Syn TOL=larger value, stronger gluten; NatWhr= WattHr-amt of energy to mix dough, low value=weak dough

SKCSFLR=Syn NIR predication based on Skcs wheat

FLRHRD=Syn Nir predication based on AACC Norrishard wheat

	Comments: Liked/Disliked								
Sample #	**Mi Rancho Control**	**HRS Control**	**HRS - 1**	**HRS - 2**	**HRS - 3**	**HRS - 5**	**HWS-C**	**HWS-1**	**HWS-2**
Color Hunter Color L*a*b									
L (dark to light 0-100)	80.31	81.24	81.27	83.47	82.56	80.63	81.73	81.7	80.89
a(-green to + red)	1.58	1.25	1.25	1.26	1.17	1.74	1.06	1.22	1.88
b(-blue to + yellow)	20.98	17.5	19.69	19.13	18.93	20.47	19.36	18.93	29.51
Puncture test									
Rupture (N)	4.75	5.05	4.72	3.651	4.029	4.409	4.343	4.503	4.31
Extensibility(mm)	11.062	12.302	12.869	10.781	9.47	11.185	12.445	12.623	13.693
Work(N*mm)	46.575	57.422	57.516	35.212	41.473	52.695	49.97	54.063	55.385

Comments: Liked/Disliked										
Sample #	**Mi Rancho Control**	**HRS Control**	**HRS - 1**	**HRS - 2**	**HRS - 3**	**HRS - 5**	**Mi Rancho Control**	**HWS Control**	**HWS-1**	**HWS-2**
Entry Name										
Product Evaluation										
Dough Handling										
Rating (1-9)	9	8	8	7	7	7	9	8	8	8
End- Product Performance										
Rating (1-9)	9	8	6	7	8	8	9	8	8	2
Overall Acceptability										
Rating (1-9)	9	8	7	2	8	8	9	8	8	2
Mitigating Physical/Chemical Properties										
Rating (1-9)	9	8	7	2	8	8	9	8	8	7
			lost tortillas during	all mold in 1 week	wet dough	tough dough				Yellow tortillas not acceptable

DURUM WHEAT

2019 California Wheat Collaborator Entries

Durum Wheat*

Breeder	Wheat	Check	Sample #	Entry Name	Group#
Arizona Plant Breeders					
	Durum	X	Durum Control	SY Fortissimo	1
			DUR-1	Alberto	1
			DUR-2	Tiburon	1
UC Davis					
	Durum	X	Durum Control	SY Fortissimo	2
			DUR-3	UC 1870	2
			DUR-4	UC 1910	2

Check Sample Description

SY FORTISSIMO

SY Fortissimo is a durum wheat. It was released by Resource Seeds, Inc. in 2006. It was selected from the cross Vic/Leeds// Aldura/881. Its experimental designations were RSI 00WV50064 and RSI 64. It is awned, has medium late maturity, averages about 36 inches in plant height, and has good straw strength. At the time of release it was resistant to stripe rust, Septoria tritici leaf blotch and BYD, and moderately susceptible to powdery mildew. It was evaluated as entry 1429 in the UC Regional Cereal Testing program from 2004-present for late fall planting in the Central Valley and the Imperial Valley of California.

2019 Collaborative Durum Wheat Productivity

Breeder	Wheat	Check	Sample #	Entry Name	Entry No.	Group	Collaborative Trial			UC Regional Variety Trials											
							Fresno Yield (lbs/acre)			Sacramento Valley (2017-19) 5 site-years Yield (lbs/acre)			Northern SJ Valley (2017-19) 5 site years Yield (lbs/acre)			Southern SJ Valley (2017-19) 3 site-years Yield (lbs/acre)			Imperial Valley (2017-19) 3 site-years Yield (lbs/acre)		
							Mean	SD	Rank	Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank
Arizona Plant Breeders																					
	Durum	X	Durum Control	SY Fortissimo	1429	1	11070	918	3	6774	793	5	7926	1117	3	8314	695	2	7137	460	2
			DUR-1	Alberto	1813	1	11033	-	4	6816	793	4	8083	1120	2	7981	699	5	7067	460	3
			DUR-2	Tiburon	1640	1	11785	-	2	7364	793	3	8532	1117	1	8700	699	1	7317	460	1
UC Davis																					
	Durum	X	Durum Control	SY Fortissimo	1429	2	11070	918	3	6774	793	3	7926	1117	3	8314	695	2	7137	460	2
			DUR-3	UC 1870	1870	2	11844	-	1	7905	810	1	8532	1134	1	8296	742	4	6520	487	5
			DUR-4	UC 1910	1910	2	10796	-	5	7522	859	2	7835	1197	4	8310	788	3	6668	560	4

site-year indicates the number of test-year combinations the value is dervied from.

2019 Collaborative Durum Wheat Protein

Breeder	Wheat	Check	Sample #	Entry Name	Entry No.	Group	UC Regional Variety Trials								
							Sacramento Valley (2017-19) 3 site-years Protein (%)			Northern SJ Valley (2017-19) 5 site-years Protein (%)			Southern SJ Valley (2017-19) 3 site-years Protein (%)		
							Mean	SE	Rank	Mean	SE	Rank	Mean	SE	Rank
Arizona Plant Breeders															
	Durum	X	Durum Control	SY Fortissimo	1429	1	12.00	0.33	5	11.92	1.19	3	13.88	0.54	3
			DUR-1	Alberto	1813	1	12.14	0.33	4	11.35	1.19	5	14.19	0.54	2
			DUR-2	Tiburon	1640	1	12.25	0.33	2	12.00	1.19	2	13.84	0.54	4
UC Davis															
	Durum	X	Durum Control	SY Fortissimo	1429	2	12.00	0.33	5	11.92	1.19	3	13.88	0.54	3
			DUR-3	UC 1870	1870	2	12.19	0.40	3	11.49	1.2	4	13.31	0.6	5
			DUR-4	UC 1910	1910	2	12.75	0.70	1	12.16	1.34	1	15.92	0.75	1

site-year indicates the number of test-year combinations the value is dervied from.

2019 Durum Wheat Yield, Protein and Overall Rank

Region Group	Name	UC Number	Yield (lbs/acre)	Standard Error	Overall Rank	Protein (%)	Overall Rank
Sacramento Valley							
	SY Fortissimo	1429	6137	458	7	10.33	27
	Alberto	1813	5501	458	19	11.97	16
	Tiburon	1640	6362	458	4	11.08	23
	UC 1870	1870	6061	458	10	13.04	6
	UC 1910	1910	6006	458	13	12.53	9
Northern SJ Valley							
	SY Fortissimo	1429	9761	542	23	12.24	11
	Alberto	1813	10065	542	15	11.43	23
	Tiburon	1640	10860	542	7	12.85	4
	UC 1870	1870	10754	600	8	11.97	14
	UC 1910	1910	9987	542	16	12.36	8
Southern SJ Valley							
	SY Fortissimo	1429	9437	371	6	13.96	9
	Alberto	1813	8774	371	13	13.05	21
	Tiburon	1640	6714	415	30	14.21	7
	UC 1870	1870	7882	491	22	-	-
	UC 1910	1910	9157	371	7	15.43	2
Imperial Valley							
	SY Fortissimo	1429	8086	493	8	-	-
	Alberto	1813	7418	493	17	-	-
	Tiburon	1640	7622	493	15	-	-
	UC 1870	1870	6678	493	25	-	-

GROUP 1: ARIZONA PLANT BREEDERS

Breeder: Wesam Abu Hammad

Description of Breeder Entries

Durum Wheat

ALBERTO (DUR-1)

Alberto is a durum wheat. It was released by Arizona Plant Breeder's in 2016. It was selected from a male-sterile recurrent selection population (MSFRS Pop). Alberto is a high yielding variety. It is awned, is early to medium in maturity, averages about 32 inches in height, has excellent straw strength and is resistant to lodging. It is resistant to leaf and stripe rust. Alberto has excellent milling characteristics including strong gluten strength and excellent color. It was evaluated as entry 1813 in the UC Regional Testing Program from 20010-present for late fall planting in the Central Valley and the Imperial Valley of California.

TIBURON (DUR-2)

Tiburon is a durum wheat. It was released by Arizona Plant Breeder's in 2013. It was selected from a male-sterile recurrent selection population (MSFRS Pop). Tiburon is a very high yielding variety. It is awned, is medium in maturity, averages about 36 inches in height, and has good straw strength. It is resistant to leaf and stripe rust. Tiburon has very good milling characteristics including strong gluten strength and excellent color. It was evaluated as entry 1640 in the UC Regional Testing Program from 2010-present.

Group 1: Grain & Semolina Quality Data

Data represent only the means of the quality data received from the mills. Durum Wheat samples were milled at the California Wheat Commission Laboratory and the semolina samples were sent out to the mills.

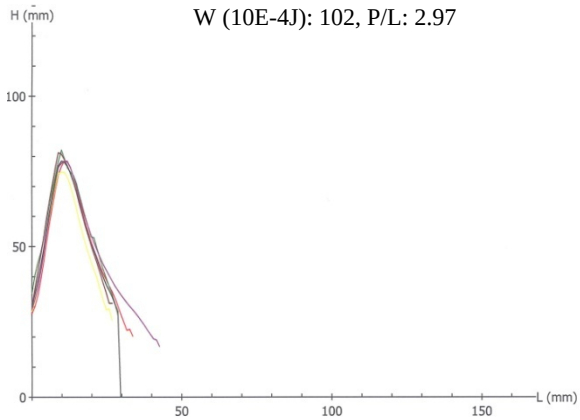
Entry Name	**SY Fortissimo**	**DUR-1**	**DUR-2**
Sample #	**Durum Control**	**Alberto**	**Tiburon**
Wheat Data			
Moisture (%)	8.78	8.85	8.72
Protein % (12% MB)	13.18	13.43	13.44
Ash % (12% MB)	1.48	1.45	1.71
Test Weight (lbs/bu)	64.00	61.66	63.04
1000 Kernel Weight (g)	52.08	46.30	56.50
Wheat Falling No. (sec)	408	424	493
Kernel Size Distribution (%)	92/8/0	92/8/0	97/3/0
Milling Data			
Total Yield (%)	76.37	77.63	75.99
Semolina Yield (%)	62.83	62.76	62.41
Semolina Data			
Semolina Moisture %	13.75	13.68	13.90
Semolina Protein (14% MB)	12.28	12.26	13.08
Semolina Ash (14% MB)	1.02	0.97	1.02
Gluten Index	53.50	85.10	82.01
Wet Gluten (14% MB)	37.80	39.22	37.64
Color L*	83.83	83.11	83.40
Color a*	-2.38	-2.35	-1.97
Color b*	25.42	26.70	25.98
Mixograph			
Absorption (%)	61.60	61.55	63.16
Mix Time (min)	2.9	3.5	3.0
Mix tolerance (1-8)	6.5	8	8
Alveograph			
P (mm)	108.5	128	142.5
L (mm)	38.5	59	52
P/L Ratio	2.85	2.205	2.835
W value (10^{-4} Joules)	155.5	253.5	263.5
Pasta Analysis			
L*/ a*/ b*	53.55/2.90/36.94	52.98/3.68/36.56	53.05/3.20/34.61
Color Score	7.50	7.50	6.00
Cooked Weight (g)	29.23	29.50	29.94
Cooking Loss (%)	6.09	5.55	6.51
Firmness (g cm)	5.47	6.73	6.91

Group 1: Arizona Plant Breeders

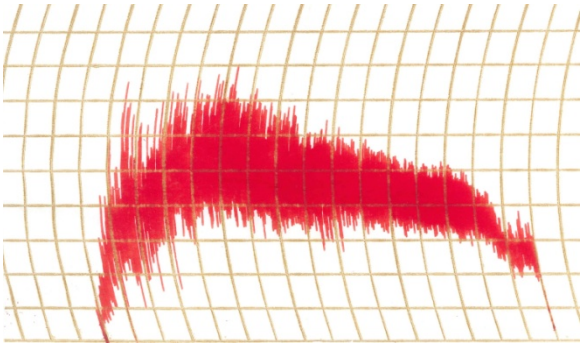
Alveograph **Mixograms**

Dur Control, SY Fortissimo

P (mmH2O): 86, L (mm): 29,
W (10E-4J): 102, P/L: 2.97

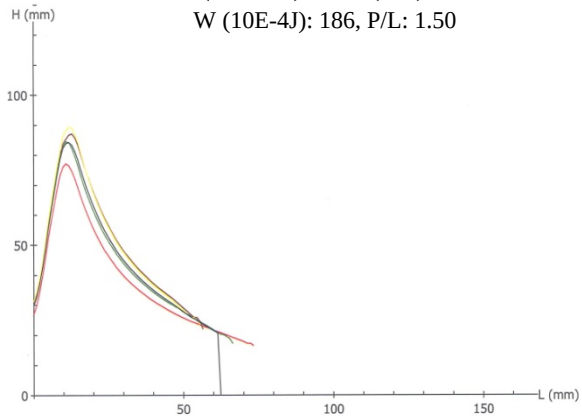


Water abs: 61.60%, Mix time: 2.76 min,
MT score: 6

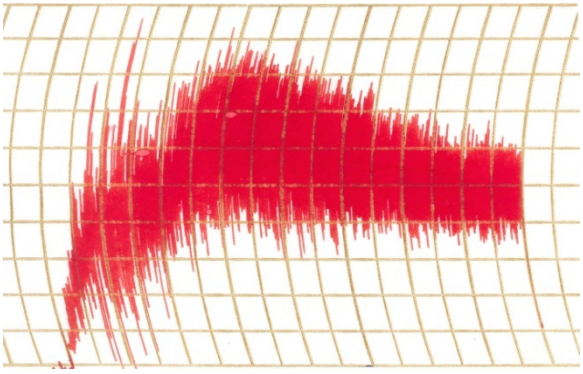


Dur-1, Alberto

P (mmH2O): 93, L (mm): 62,
W (10E-4J): 186, P/L: 1.50

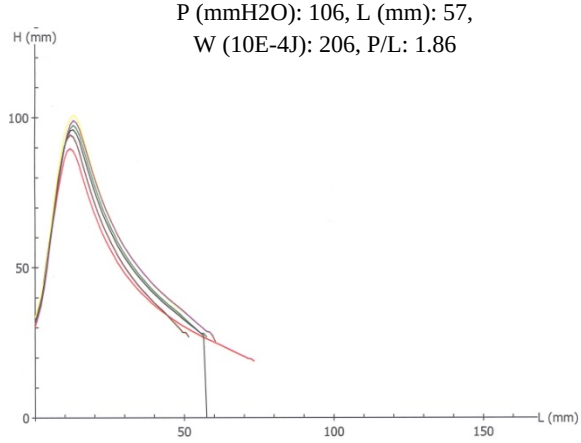


Water abs: 61.55%, Mix time: 3.01 min,
MT score: 8

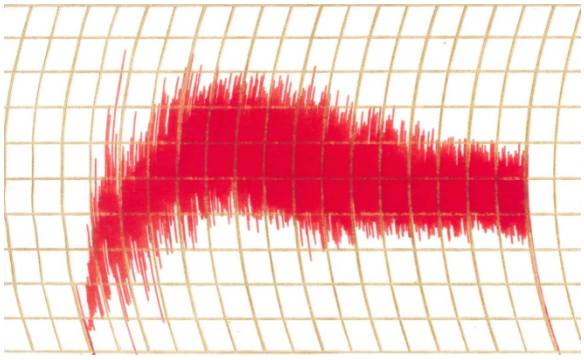


Dur-2, Tiburon

P (mmH2O): 106, L (mm): 57,
W (10E-4J): 206, P/L: 1.86



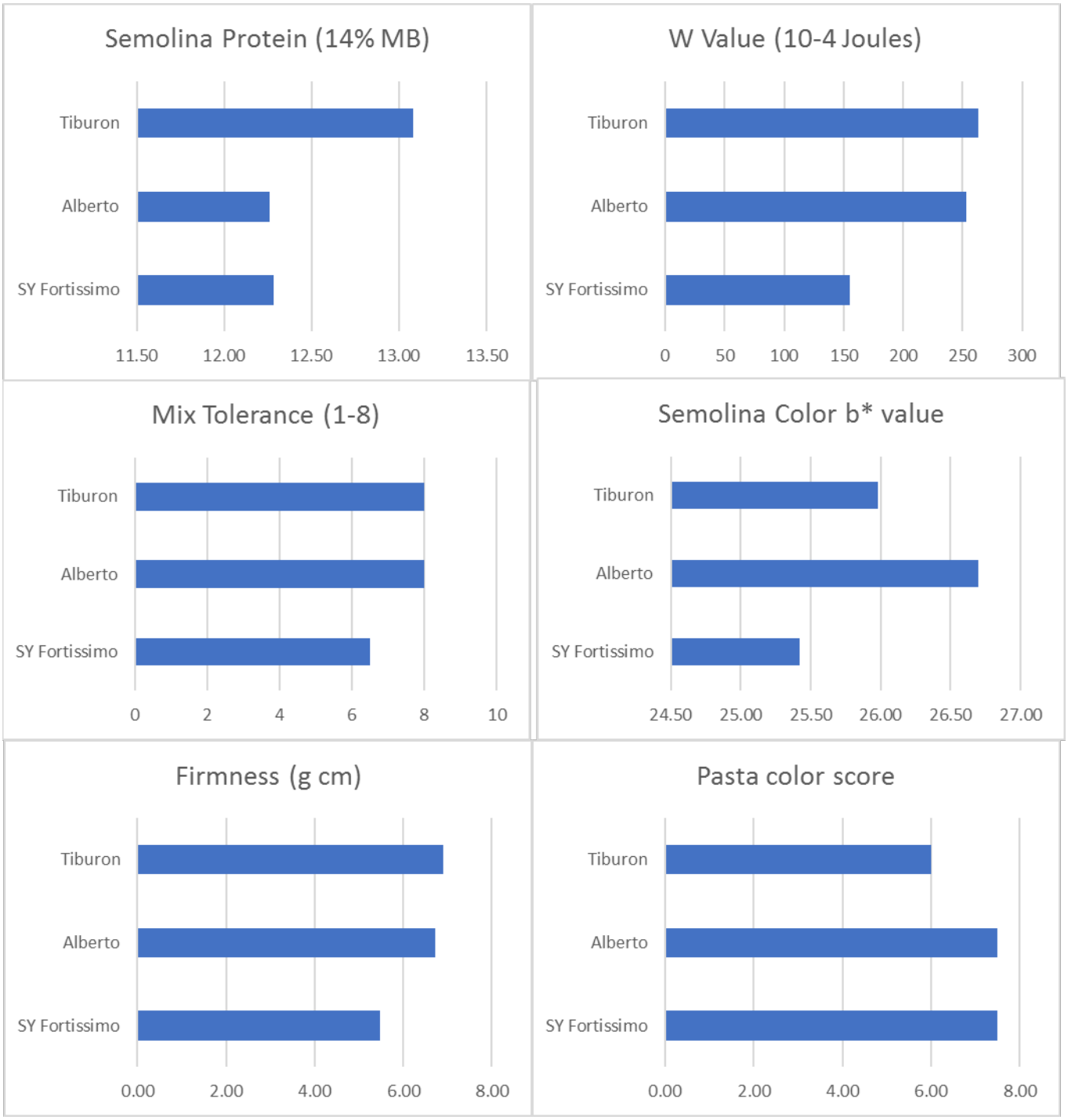
Water abs: 63.16%, Mix time: 2.82 min,
MT score: 8



Group 1: Arizona Plant Breeders

Quality Data – Collaborator Means

The graphs represent only the means of the quality data received from most of the collaborators.



GROUP 2 - UNIVERSITY OF CALIFORNIA, DAVIS

Program Leader: Jorge Dubcovsky
Breeders: Oswaldo Chicaiza and Xiaoqin Zhang

Description of Breeder Entries

Durum Wheat

UC1870 (DUR-3)

UC1870 is a durum wheat evaluated in the 2018 elite yield trial. The grain yield of UC1870 is 2.3% less than Desert Gold in Sacramento Valley and Imperial Valley; and 4.9% higher than Desert Gold in San Joaquin Valley. UC1870 has the low cadmium allele for the *Cdu1* gene. The grain protein content and the pasta quality of UC1870 is similar to Desert Gold. UC1870 is 10 days earlier in heading time and 9 cm shorter in plant height than Desert Gold, respectively.

UC1910 (DUR-4)

UC1910 is a durum wheat derived from the durum variety Desert King. UC19010 is the result of the introgression of the low cadmium allele for the Cdu1 gene, two alleles for yellow pigment and the Gpc-B1 gene for grain protein content. The grain yield of UC1910 is 11.2% and 15.8% less than Desert Gold in San Joaquin Valley and Imperial Valley, respectively. The pasta quality of UC1910 is being evaluated in 2019. UC1910 is two days earlier in heading time and 2cm shorter in plant height than Desert Gold.

Group 2: University of California Davis

Grain & Semolina Quality Data

Data represent only the means of the quality data received from the mills. Durum Wheat samples were milled at the California Wheat Commission Laboratory and the semolina samples were sent out to the mills.

Entry Name	**SY Fortissimo**	**DUR-3**	**DUR-4**
Sample #	**Durum Control**	**UC 1870**	**UC 1910**
Wheat Data			
Moisture (%)	8.78	8.68	8.55
Protein % (12% MB)	13.18	12.94	13.76
Ash % (12% MB)	1.48	1.54	1.83
Test Weight (lbs/bu)	64.00	64.7	64.6
1000 Kernel Weight (g)	52.08	51.5	54.1
Wheat Falling No. (sec)	408	481	605
Kernel Size Distribution (%)	92/8/0	90/10/0	95/5/0
Milling Data			
Total Yield (%)	76.37	77.00	74.03
Semolina Yield (%)	62.83	62.05	61.39
Semolina Data			
Semolina Moisture %	13.75	14.03	14.13
Semolina Protein (14% MB)	12.28	12.10	13.03
Semolina Ash (14% MB)	1.02	0.88	1.02
Gluten Index	53.50	79.20	63.23
Wet Gluten (14% MB)	37.80	38.37	41.87
Color L*	83.83	83.95	84.38
Color a*	-2.38	-2.61	-2.30
Color b*	25.42	27.76	25.30
Mixograph			
Absorption (%)	61.60	61.43	62.98
Mix Time (min)	2.9	3.2	2.7
Mix tolerance (1-8)	6.5	8	7
Alveograph			
P (mm)	108.5	133.5	127
L (mm)	38.5	63.5	52
P/L Ratio	2.85	2.13	2.415
W value (10^{-4} Joules)	155.5	282.5	231
Pasta Analysis			
L*/ a*/ b*	53.55/2.90/36.94	52.82/2.57/36.68	53.39/2.77/37.01
Color Score	7.50	7.50	7.50
Cooked Weight (g)	29.23	30.03	29.44
Cooking Loss (%)	6.09	6.57	6.21
Firmness (g cm)	5.47	6.29	6.74

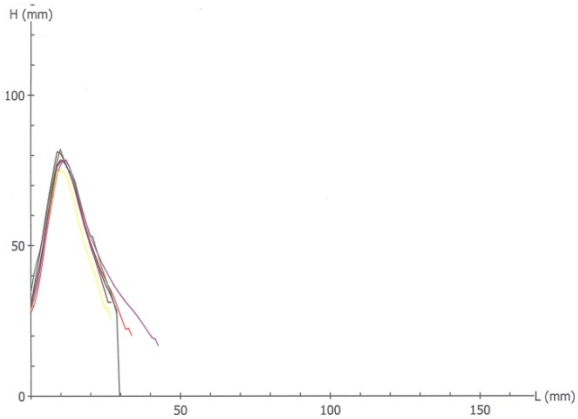
Group 2: UC Davis

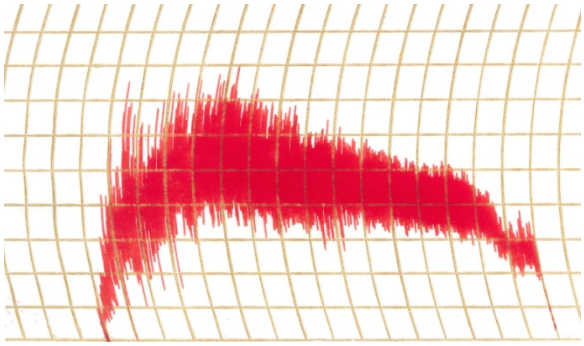
Alveograph | Mixograms

Dur Control, SY Fortissimo

P (mmH2O): 86, L (mm): 29,
W (10E-4J): 102, P/L: 2.97

Water abs: 61.6%, Mix time: 2.76 min,
MT score: 6

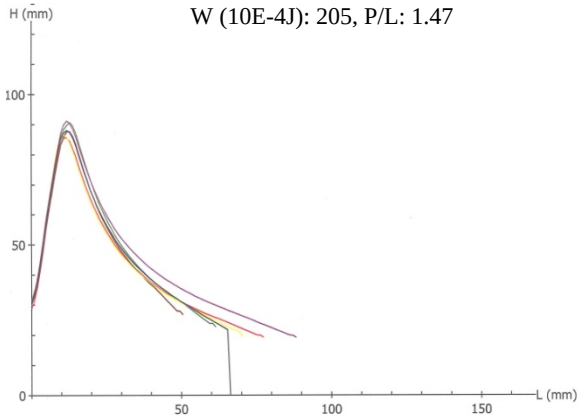


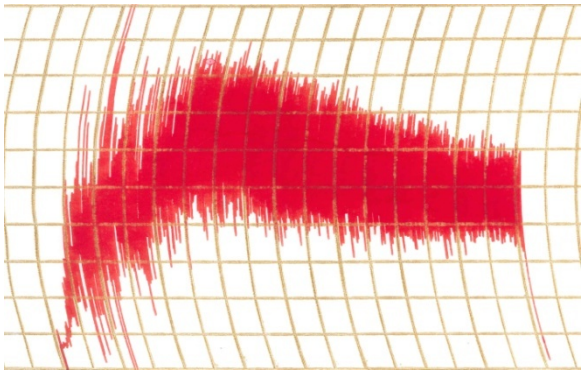


Dur-3, UC 1870

P (mmH2O): 97, L (mm): 66,
W (10E-4J): 205, P/L: 1.47

Water abs: 61.43%, Mix time: 2.89 min,
MT score: 8

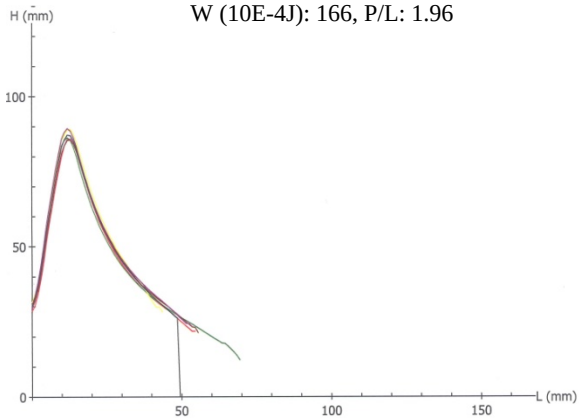


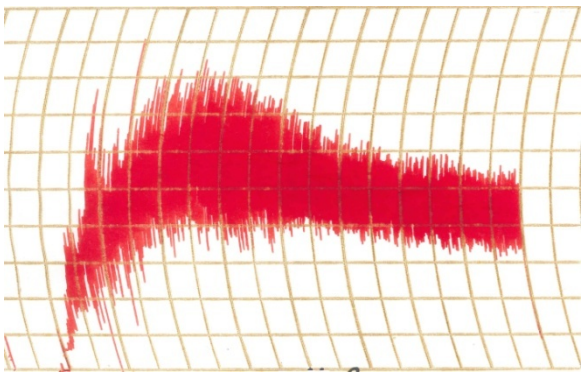


Dur-4, UC 1910

P (mmH2O): 96, L (mm): 49,
W (10E-4J): 166, P/L: 1.96

Water abs: 62.98%, Mix time: 2.50 min,
MT score: 7





Group 2: University of California Davis

Quality Data – Collaborator Means

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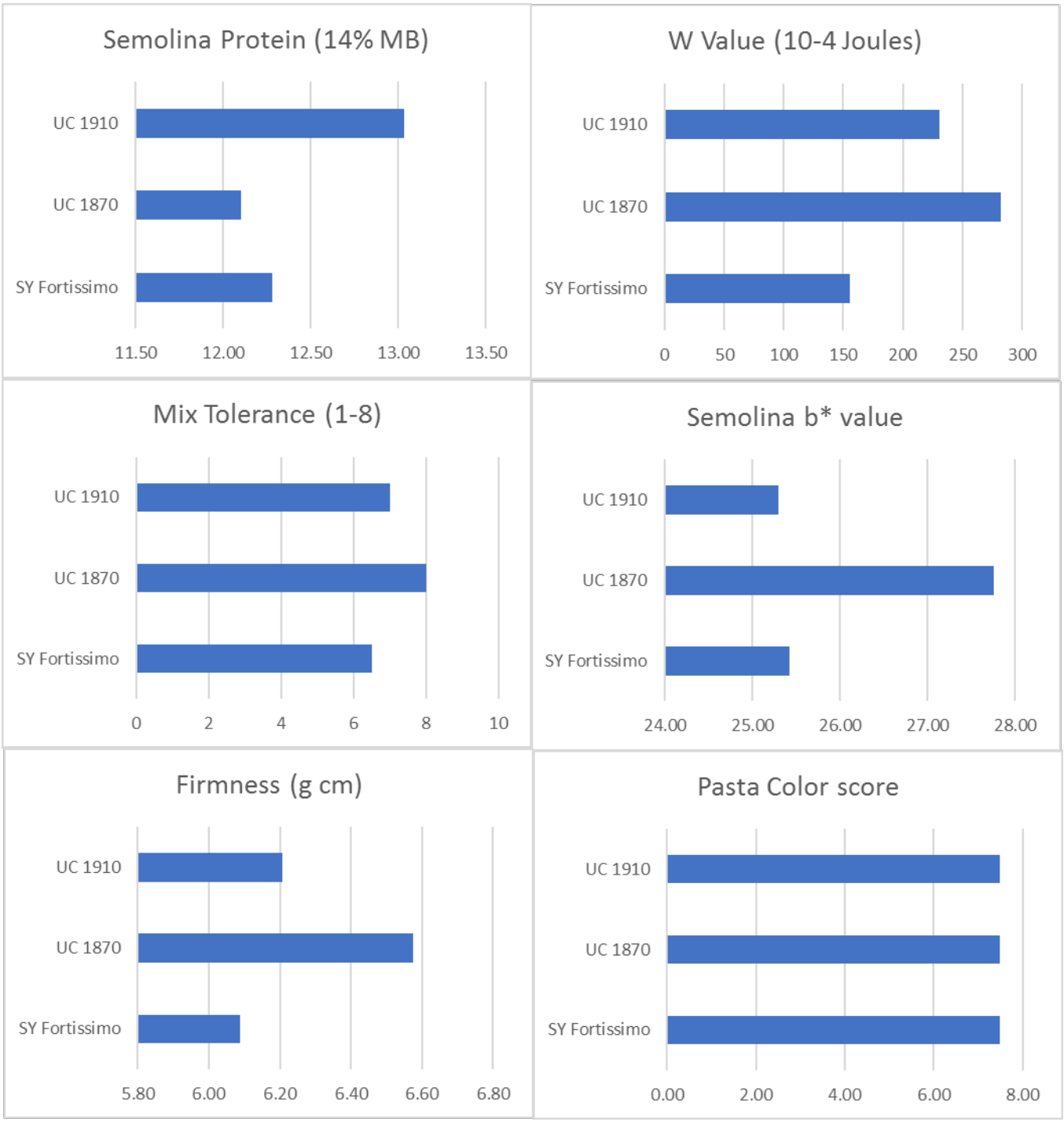


All Mills Summary Data – Durum Quality

Mills		Durum Control	Group 1		Group 2	
			DUR-1	DUR-2	DUR-3	DUR-4
		SY Fortissimo	Alberto	Tiburon	UC 1870	UC 1910
Wheat Analysis						
2	Moisture	8.78	8.85	8.72	8.68	8.55
2	Protein (12% MB)	13.18	13.43	13.44	12.94	13.76
2	Ash (12% MB)	1.48	1.45	1.71	1.54	1.83
2	Test Weight lb/bu	64.0	61.7	63.0	64.7	64.6
2	1000 Kernel Weight (g)	52.1	46.3	56.5	51.5	54.1
2	Falling Number (seconds)	408	424	493	481	605
	Kernel Size Distribution (%)	92/8/0	92/8/0	97/3/0	90/10/0	95/5/0
Milling						
2	Total Lab Mill Yield (%)	76.37	77.63	75.99	77.00	74.03
	Semolina Yield	62.83	62.76	62.41	62.05	61.39
Semolina Analysis						
1	Semolina Moisture %	13.70	13.61	13.78	13.96	14.03
2	Semolina Moisture %	13.80	13.76	14.01	14.10	14.23
	AVERAGE	**13.75**	**13.68**	**13.90**	**14.03**	**14.13**
	STD	**0.07**	**0.11**	**0.16**	**0.10**	**0.14**
1	Semolina Protein (14% MB)	12.57	12.56	13.42	12.31	13.15
2	Semolina Protein (14% MB)	12.00	11.97	12.74	11.89	12.92
	AVERAGE	**12.28**	**12.26**	**13.08**	**12.10**	**13.03**
	STD	**0.40**	**0.42**	**0.48**	**0.30**	**0.16**
1	Semolina Ash (14% MB)	1.02	0.99	1.02	0.89	0.99
2	Semolina Ash (14% MB)	1.02	0.95	1.03	0.87	1.04
	AVERAGE	**1.02**	**0.97**	**1.02**	**0.88**	**1.02**
	STD	**0.00**	**0.03**	**0.01**	**0.01**	**0.04**
1	Gluten Index	64.53	81.73	89.42	71.69	76.99
2	Gluten Index	42.48	88.46	74.61	86.70	49.46
	AVERAGE	**53.50**	**85.10**	**82.01**	**79.20**	**63.23**
	STD	**15.59**	**4.76**	**10.47**	**10.61**	**19.46**
1	Wet Gluten (14% MB)	41.88	46.47	40.02	43.71	46.14
2	Wet Gluten (14% MB)	33.72	31.96	35.25	33.04	37.60
	AVERAGE	**37.80**	**39.22**	**37.64**	**38.37**	**41.87**
	STD	**5.77**	**10.26**	**3.37**	**7.55**	**6.04**
1	Color L*	82.66	81.75	82.36	82.80	83.04
2	Color L*	85.00	84.47	84.43	85.09	85.71
	AVERAGE	**83.83**	**83.11**	**83.40**	**83.95**	**84.38**
	STD	**1.65**	**1.92**	**1.46**	**1.62**	**1.89**
1	Color a*	-1.96	-1.83	-1.57	-2.10	-1.76
2	Color a*	-2.79	-2.87	-2.37	-3.12	-2.84
	AVERAGE	**-2.38**	**-2.35**	**-1.97**	**-2.61**	**-2.30**
	STD	**0.59**	**0.74**	**0.57**	**0.72**	**0.76**

Mills		Durum Control	Group 1		Group 2	
			DUR-1	DUR-2	DUR-3	DUR-4
		SY Fortissimo	Alberto	Tiburon	UC 1870	UC 1910
1	Color b*	24.77	25.83	25.23	26.88	24.57
2	Color b*	26.07	27.57	26.73	28.63	26.02
	AVERAGE	**25.42**	**26.70**	**25.98**	**27.76**	**25.30**
	STD	**0.92**	**1.23**	**1.06**	**1.24**	**1.03**
		Mixograph				
1	Absorption (%)	61.6	61.6	63.2	61.4	63.0
1	Mix Time	3.01	4.03	3.17	3.49	2.86
2	Mix Time	2.76	3.01	2.82	2.89	2.5
	AVERAGE	**2.9**	**3.5**	**3.0**	**3.2**	**2.7**
	STD	**0.2**	**0.7**	**0.2**	**0.4**	**0.3**
1	Mix tolerance	7	8	8	8	7
2	Mix tolerance	6	8	8	8	7
	AVERAGE	**6.5**	**8.0**	**8.0**	**8.0**	**7.0**
	STD	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**
		Alveograph				
1	P	131	163	179	170	158
2	P	86	93	106	97	96
	AVERAGE	**108.5**	**128.0**	**142.5**	**133.5**	**127.0**
	STD	**31.8**	**49.5**	**51.6**	**51.6**	**43.8**
1	L	48	56	47	61	55
2	L	29	62	57	66	49
	AVERAGE	**38.5**	**59.0**	**52.0**	**63.5**	**52.0**
	STD	**13.4**	**4.2**	**7.1**	**3.5**	**4.2**
1	P/L	2.73	2.91	3.81	2.79	2.87
2	P/L	2.97	1.5	1.86	1.47	1.96
	AVERAGE	**2.9**	**2.2**	**2.8**	**2.1**	**2.4**
	STD	**0.2**	**1.0**	**1.4**	**0.9**	**0.6**
1	W	209	321	321	360	296
2	W	102	186	206	205	166
	AVERAGE	**155.5**	**253.5**	**263.5**	**282.5**	**231.0**
	STD	**75.7**	**95.5**	**81.3**	**109.6**	**91.9**

Ardent Mills™

Nourishing what's next.™

		Moisture	Ash (14%)	Protein	Color			Bran Scan				Gluten index	Wet gluten
					L	a	b	Aleurone %	Aleurone spec	Bran spec	Bran %		
2001-19-003835	Durum- Contol	13.7	1.0178	12.5683	82.66	-1.96	24.77	5.63	236.23	46.73	1.75	64.53	41.88
2001-19-003836	Durum 1	13.61	0.9948	12.5567	81.75	-1.83	25.83	5.57	231.22	68.96	2.44	81.73	46.47
2001-19-003837	Durum 2	13.78	1.017	13.4176	82.36	-1.57	25.23	5.2	219.86	46.64	1.8	89.42	40.02
2001-19-003838	Durum 3	13.96	0.8903	12.3126	82.8	-2.1	26.88	5.05	206.64	38.91	1.45	71.69	43.71
2001-19-003839	Durum 4	14.03	0.992	13.1493	83.04	-1.76	24.57	4.32	185.64	30.59	1.2	76.99	46.14

		Mixograph			Alveograph					NIR		
		Peak time (min)	Peak Height (%)	MT Score	P (mm)	L (mm)	P/L ratio	W (10^{-4} Joules)	Speck count	Moisture	Ash (14%)	Protein (14%)
2001-19-003835	Durum- Contol	3.01	74.21	7	131	48	2.73	209	36	14.2	0.92	12.7
2001-19-003836	Durum 1	4.03	79.69	8	163	56	2.91	321	33	14.2	0.94	12.9
2001-19-003837	Durum 2	3.17	79.48	8	179	47	3.81	321	40	14	0.96	13.6
2001-19-003838	Durum 3	3.49	81.16	8	170	61	2.79	360	36	14.4	0.85	12.5
2001-19-003839	Durum 4	2.86	76.66	7	158	55	2.87	296	33	14.5	0.87	13.3

California WHEAT COMMISSION

									KERNEL SIZE DIST. (100G)			MILLING								
CWC SAMPLE#	ENTRY NAME	PROT % 12% MB)	MOIST %	ASH (12%)	TEST WEIGHT lb/bu	TEST WEIGHT kg/hl	1000 KERNEL WEIGHT	FALLING NUMBER	L	M	S	TOTAL EXTRACT	SEMOLINA EXTRACT	ASH (14%)	SPECKS	PROT (14%)	MOIS %	WET GLUT 14% MB	GLUT INDX	
Durum Control	SY Fortissimo	13.18	8.78	1.48	64.00	83.32	52.08	408	92	8	0	76.37	62.83	1.02	29	12.00	13.80	33.72	42.48	
DUR-1	Alberto	13.43	8.85	1.45	61.66	80.29	46.30	424	92	8	0	77.63	62.76	0.95	32	11.97	13.76	31.96	88.46	
DUR-2	Tiburon	13.44	8.72	1.71	63.04	82.08	56.50	493	97	3	0	75.99	62.41	1.03	29	12.74	14.01	35.25	74.61	
DUR-3	UC 1870	12.94	8.68	1.54	64.67	84.18	51.55	481	90	10	0	77.00	62.05	0.87	20	11.89	14.10	33.04	86.70	
DUR-4	UC 1910	13.76	8.55	1.83	64.62	84.12	54.05	605	95	5	0	74.03	61.39	1.04	32	12.92	14.23	37.60	49.46	

		MIXOGRAPH					ALVEOGRAPH				SEMOLINA COLOR			PASTA ANALYSIS						
CWC SAMPLE#	ENTRY NAME	ABS %	PEAK TIME (MIN)	PEAK HEIGHT (MU)	PEAK INTEGRAL	SCORE	P (mm)	L (mm)	W VALUE	P/L RATIO	Color L*	Color a*	Color "b*"	COLOR L*	COLOR a*	COLOR b*	COLOR SCORE	COOKED WHT (g)	COOK LOSS %	FIRM (gcm)
Durum Control	SY Fortissimo	61.60	2.76	51.69	107.46	6.0	86	29	102	2.97	85.00	-2.79	26.07	53.55	2.90	36.94	7.5	29.2	6.1	5.47
DUR-1	Alberto	61.55	3.01	60.40	132.70	8.0	93	62	186	1.50	84.47	-2.87	27.57	52.98	3.68	36.56	7.5	29.5	5.6	6.73
DUR-2	Tiburon	63.16	2.82	57.50	122.01	8.0	106	57	206	1.86	84.43	-2.37	26.73	53.05	3.20	34.61	6	29.9	6.5	6.91
DUR-3	UC 1870	61.43	2.89	56.67	121.13	8.0	97	66	205	1.47	85.09	-3.12	28.63	52.82	2.57	36.68	7.5	30.0	6.6	6.29
DUR-4	UC 1910	62.98	2.50	56.03	99.44	7.0	96	49	166	1.96	85.71	-2.84	26.02	53.39	2.77	37.01	7.5	29.4	6.2	6.74

APPENDIX A – Milling Procedures

Wheat Cleaning and Milling Procedure for Hard Red and White Wheat

By Western Wheat Quality Laboratory

Overview and Discussion

Upon receipt, the wheat is cleaned and stored in 30 gallon plastic cans. If needed, the cleaning process consists of a Clipper cleaner which has an air lifting followed by a #16 round screen and a 1/12" X ½" slotted screen, the middle fraction being accepted for milling. To condition the wheat for milling, the proper temper or moisture level is attained by the addition of tempering solution. A mixer having a 3 bu capacity is used for this operation. Pre-tempering of the grain to 12% moisture was done to accommodate the dry condition of the grain. Samples were held for a minimum of 48 hours at 12% moisture before tempering for milling. The first temper (14% moisture for soft wheat and 16% moisture for hard wheat) is added 18 to 24 hours before milling. The temper solution contains a wetting agent (0.1% of 75% aqueous Aerosol OT) to hasten moisture penetration. Ten minutes prior to milling, the wheat is given a second temper by the addition of 0.5% temper solution based on dry wheat weight.

Approximately 90 pound samples of each variety are tempered for milling on a Miag Multomat flour mill. The mill produces ten flour streams and four feed streams from three break and five reduction rolls (see Flow Sheet for WWQL Miag Multomat). A feed rate of 920-980 g/min is adjusted to give proper load to the mill.

Break rolls are adjusted so that material flow through the mill is balanced while still achieving good bran clean-up characteristics without excessive shattering. The target first break release is for 43% of the grind to pass through a #25 Tyler (707 micron) wire screen in 20 seconds of sifting. The target second break release is for 64% of the grind to pass through the above sifting. The third break roll is adjusted to clean the bran as completely as possible without excessive shattering.

The reduction milling starts by balancing 1st reduction and 2nd reduction rolls to achieve approximately 1:1.5 ratio of production. The adjustment for reduction rolls is done by observation of stock with the objective of making as much flour as possible by the end of the process but not to the point of over-grinding and flaking the stock.

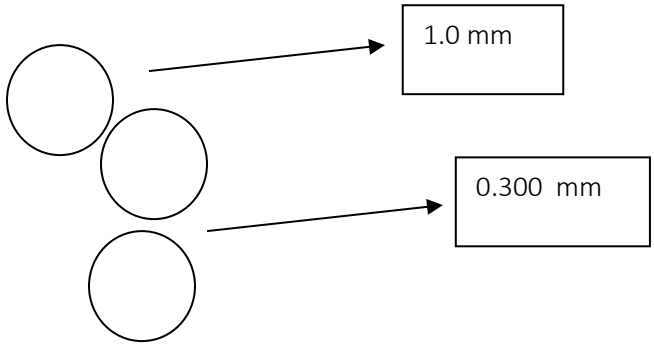
Each of the ten flour streams are weighed A straight grade flour is produced by blending all ten flour streams in a horizontal ribbon blender.

Wheat Cleaning and Milling Procedure for Durum Wheat

By California Wheat Commission Laboratory

1. CHOPIN Mill (Pre-break)

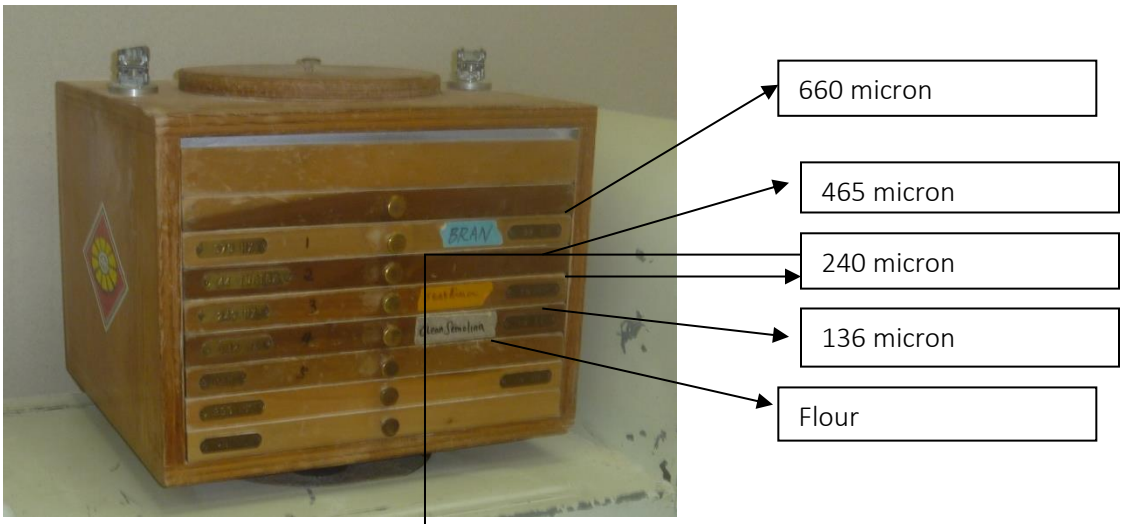
Three rolls



2. WITT Mill

Passes through one set of rolls (corrugated) <0.051 mm

Sifter



3. Purifier

Set of sieves Deck 1 : 423, 472, 472, 526 microns

Set of sieves Deck 2: 363, 363, 363, 452 microns

CWC Durum Tempering Method

Durum has three tempering stages:

1. Temper grain to 12%. Let it sit for minimum of 2 days before the 2nd tempering.

2. Temper grain to 14% the day before milling (overnight).

3. Temper grain to 16% This is for 30 min before milling the grain.

CWC uses Tempering bins that are set to rotate for 15 minutes.

Notes: