Acondicionado de trigo de Estados Unidos

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Países que cubre U.S. Wheat Associates Suramérica

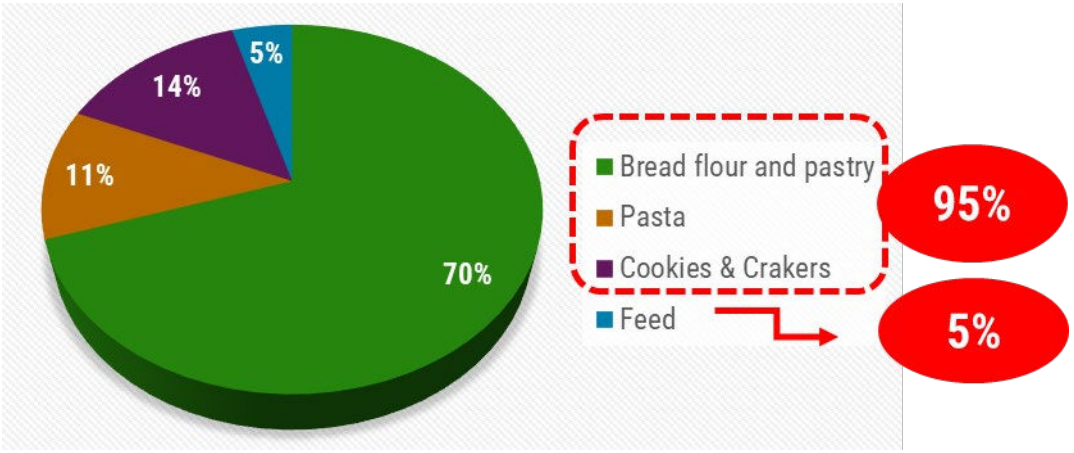
Consumo de trigo y estimados de usos por país.

COLOMBIA

Mercado del trigo en Suramerica

Consumo de Colombia y usos.

El consumo de trigo en Colombia es cerca de 2.02 MTM anuales
(producción de trigo nacional: 11,000 TM anuales)



Colombia es el mercado más diversificado de la región, con 40 molinos que pertenecen a 24 compañías, siendo la mayor concentración de molinos en Cali, Bogotá y la costa (Barranquilla y Cartagena).

El número estimado de panaderías en Colombia es de 25.000. Las pequeñas panaderías tienen una cuota de mercado del 80%.

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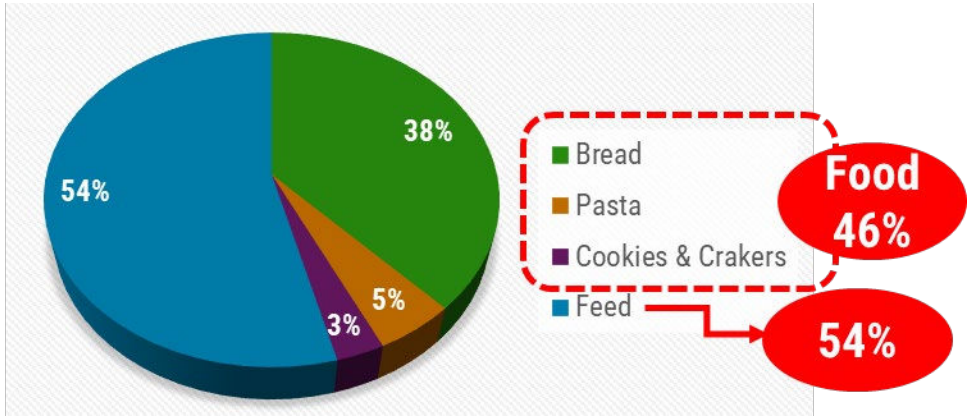
ECUADOR

Mercado del trigo en Suramerica

Consumo de Ecuador y usos.

Importaciones de trigo a ecuador es cerca de 1,4 MTM anuales *(la producción de trigo en Ecuador se ha mantenido estable en los últimos años, entre 6.000 TM – 10.000 TM anuales)*



16 molinos en Ecuador y tres empresas tienen el 70% del mercado de harina: panadera Moderna Alimentos, Grupo Superior e Industrial Molinera.

Aumento significativo en la demanda de trigo para el alimento para camarón ha impulsado el uso de trigo.

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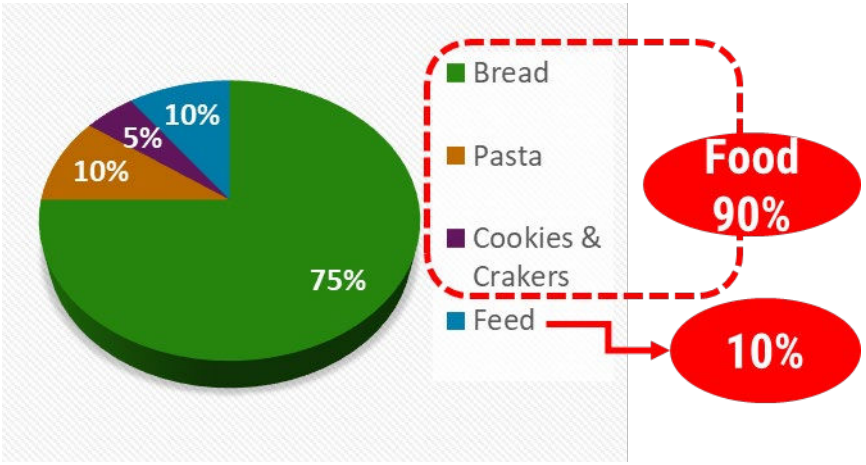
Mercado del trigo en Suramerica

Consumo de Chile y usos.

El consumo de trigo en chile (incluidos alimentos y piensos) ha sido relativamente plano durante varios años en alrededor de 2.1 MTM - 2.4 MTM



El consumo de pan per cápita de 90-93 kg es el más alto de la región de América Latina.
Casi 6.000 panaderías tradicionales de Chile. Panaderia de supermercado esta creciendo.
68 molinos ubicados principalmente en la zona central del país.

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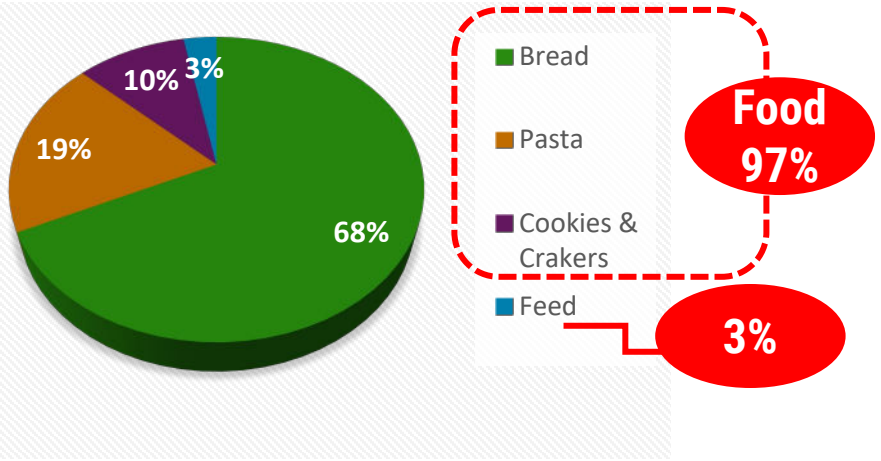
Mercado del trigo en Suramerica

Consumo de Peru y usos.

El consumo de trigo en Perú es de 2.22 MTM anuales (Producción de trigo en Perú alcanza los 230,000 MTM anuales)



Hay 14 empresas de molienda en Perú que operan 23 molinos con una capacidad estimada de 2,7 MMT y una utilización de la capacidad del 82%.

15,000 panaderías en Perú, el consumo anual de pan per cápita de 35.0 kg es similar al promedio regional.

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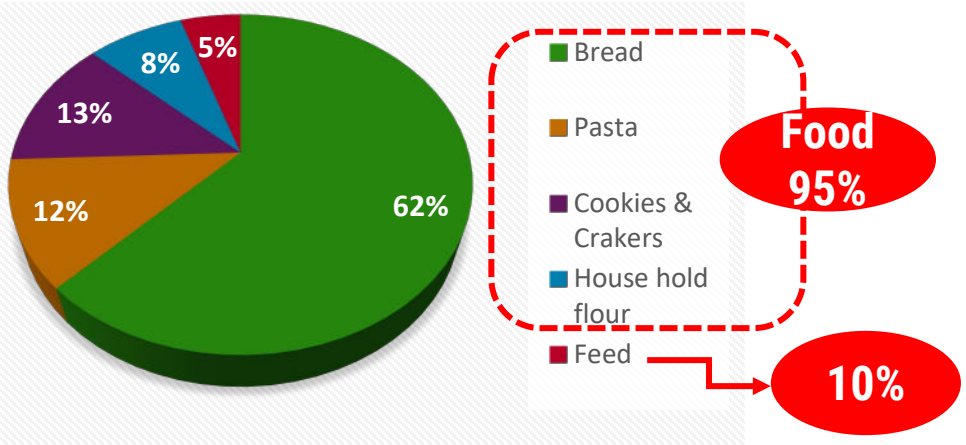
BRAZIL

Mercado del trigo en Suramerica

Consumo de Brasil y usos.

Brazilian wheat consumption reaches 11.5 MMT annually



Brasil representa el 68% de la producción total de galletas en la región de América Latina, con el mayor consumo per cápita en la región (6,5 kg).

La producción total de galletas en Brasil se estima en 1,64 MTM, lo que requiere 1,00 MTM de harina de trigo.

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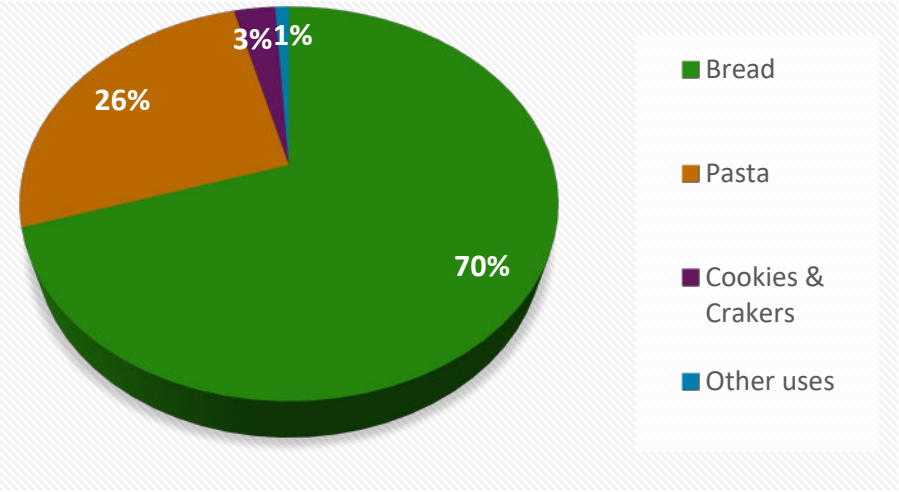
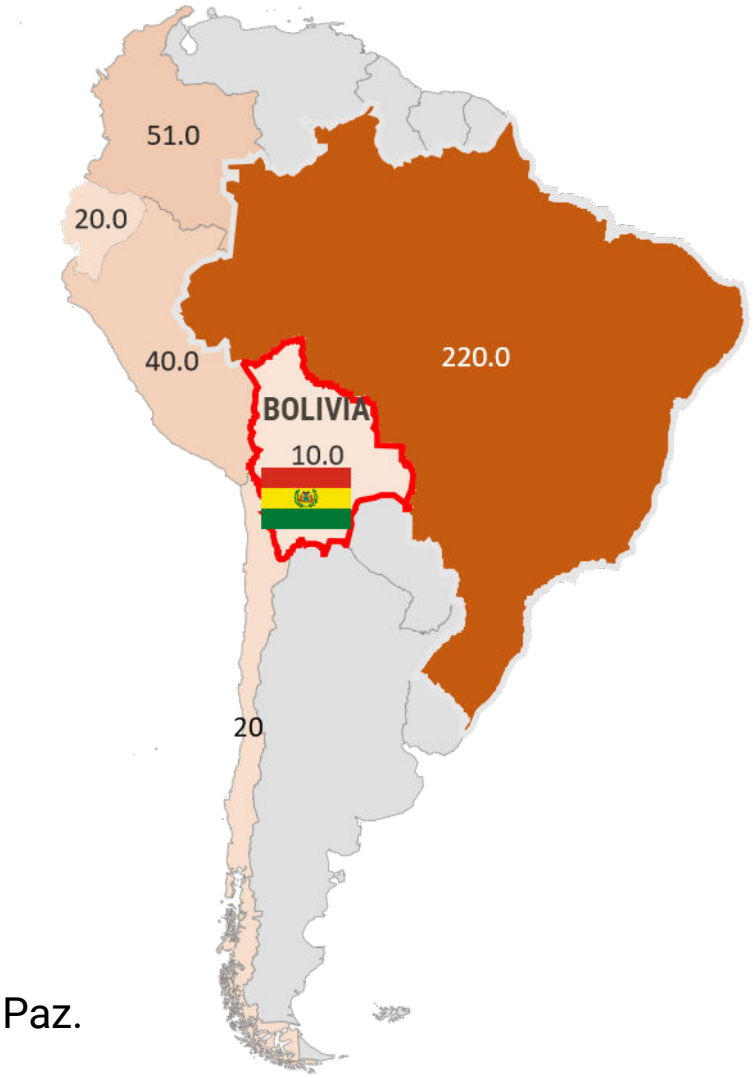
BOLIVIA

Mercado del trigo en Suramerica

Consumo de Bolivia y usos.

Bolivia consume un promedio de 750.000 TM de trigo por año, con un consumo anual per cápita de 65 kg.
El consumo se divide en 8% de trigo importado, 20% de producción nacional y 72% de harina importada.





Bolivia tiene 18 Molinos y están concentrados en Santa Cruz de la Sierra y La Paz.

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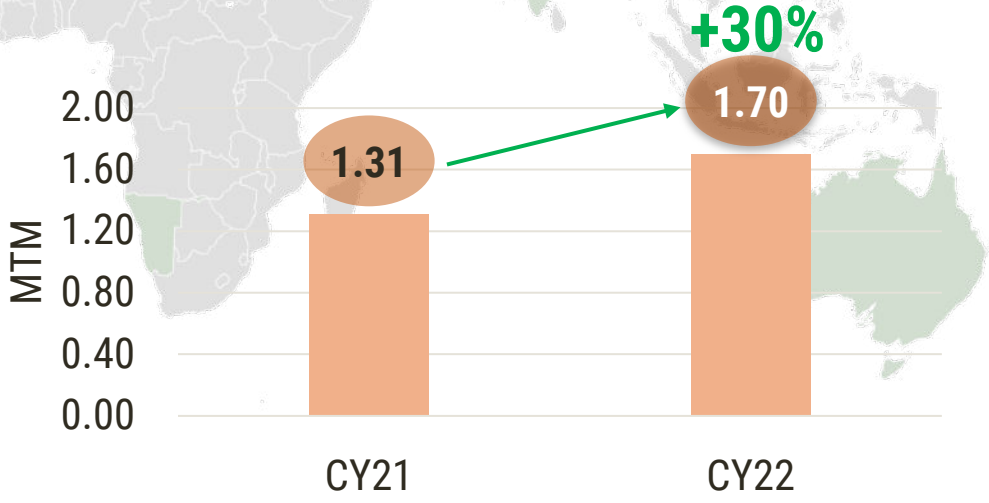
U.S. WHEAT EXPORTS CY22

Trigo exportado a Suramérica - Total de las exportaciones de trigo de EE. UU.

EXPORTACIONES DE TRIGO DE ESTADOS UNIDOS A SURAMERICA 2022:

1.70 MMT

EXPORTACIONES DE TRIGO DE ESTADOS UNIDOS A SURAMERICA CY21 vs CY22 (%)



Source: FGIS, CY 2010 - 2020.

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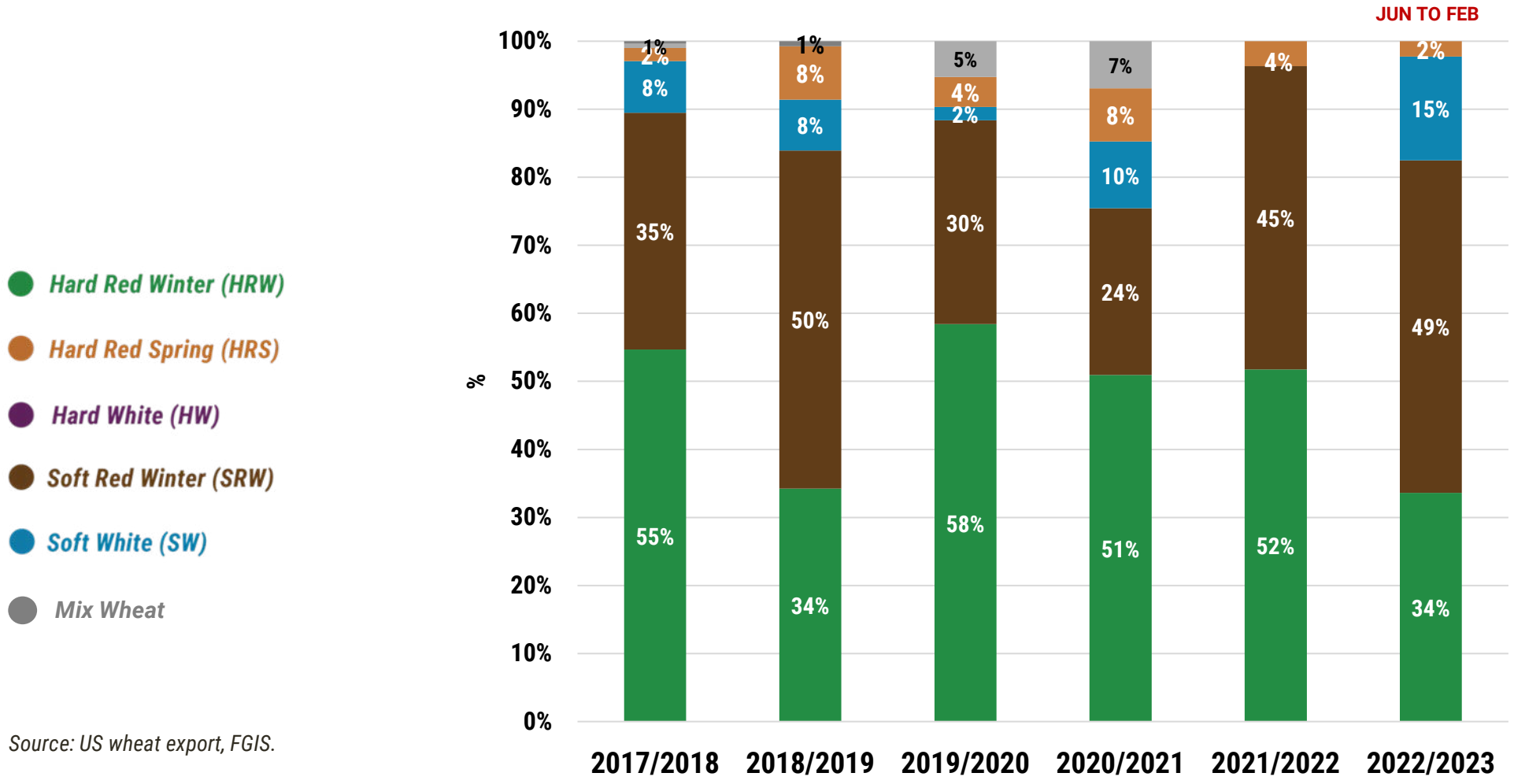
EXPORTACIONES DE TRIGO DE EE.UU. A SURAMERICA (%)



Source: US wheat export, FGIS.

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Milling and Baking Technilogist for Middle Eastern, East and Noth African Region - Casablanca

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Technical Specialist for South American Region - Chile

Marcelo Mitre
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Peter Lloyd
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Ting Liu
Technical Specialist for People´s Republic of China/Hong Kong Region - Beijing

Gerry Mendoza
Baking Consultant for South Asian Region - Manila

Adrian Redondo
Baking Technologist for South Asian Region - Manila

Roy Chung
Bakery Consultant for South Asian Region - Singapore

Shin Hak (David) Oh
Food and Bakery Technologist for North Asian Region - Seoul

Wei-Lin Chou
Asian Products/Nutrition Technologist for North Asian Region - Taipei

Quien lidero el cambio de asistencia técnica de USW

Mark Fowler
USW Vice President of Global Technical Services

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www.uswheat.org/crop-quality

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HARD RED WINTER (HRW)

HARD RED SPRING (HRS)

SOFT RED WINTER (SRW)

SOFT WHITE (SW)

HARD WHITE (HW)

DURUM

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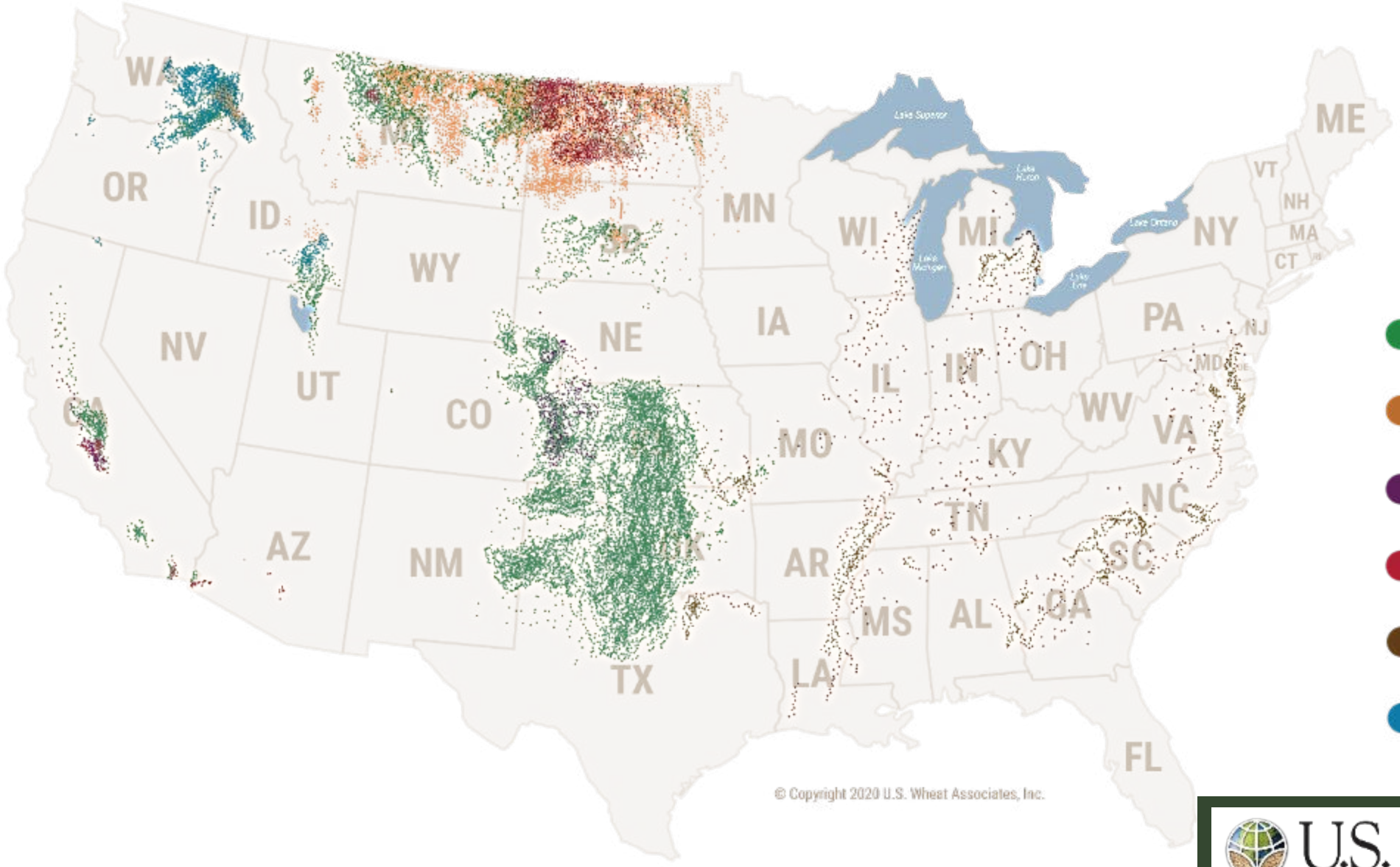

- Hard Red Winter (HRW)
- Hard Red Spring (HRS)
- Hard White (HW)
- Durum
- Soft Red Winter (SRW)
- Soft White (SW)

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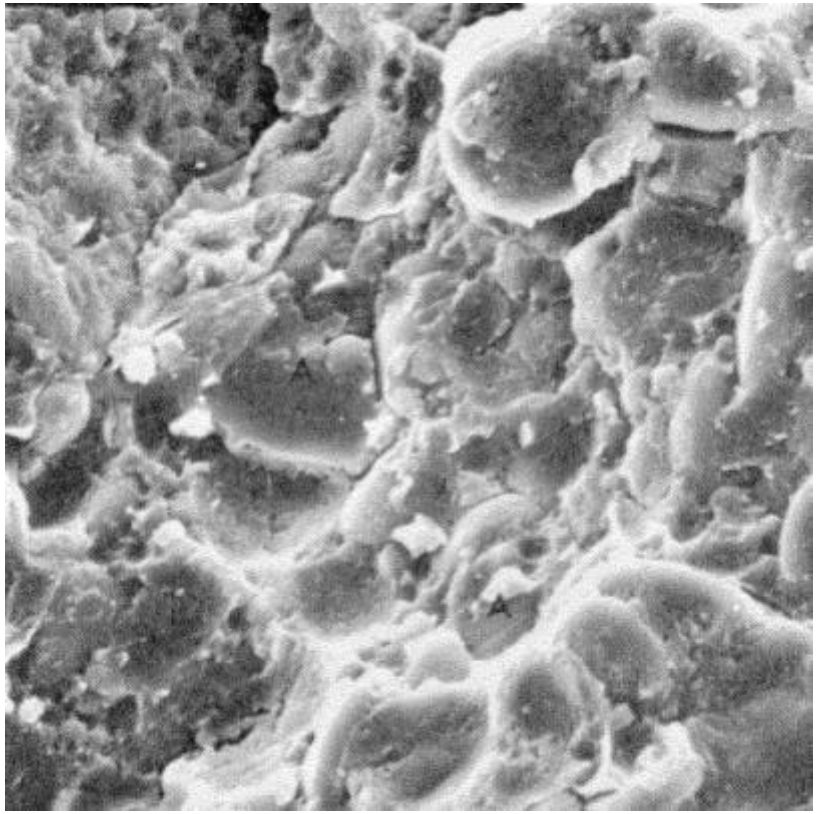
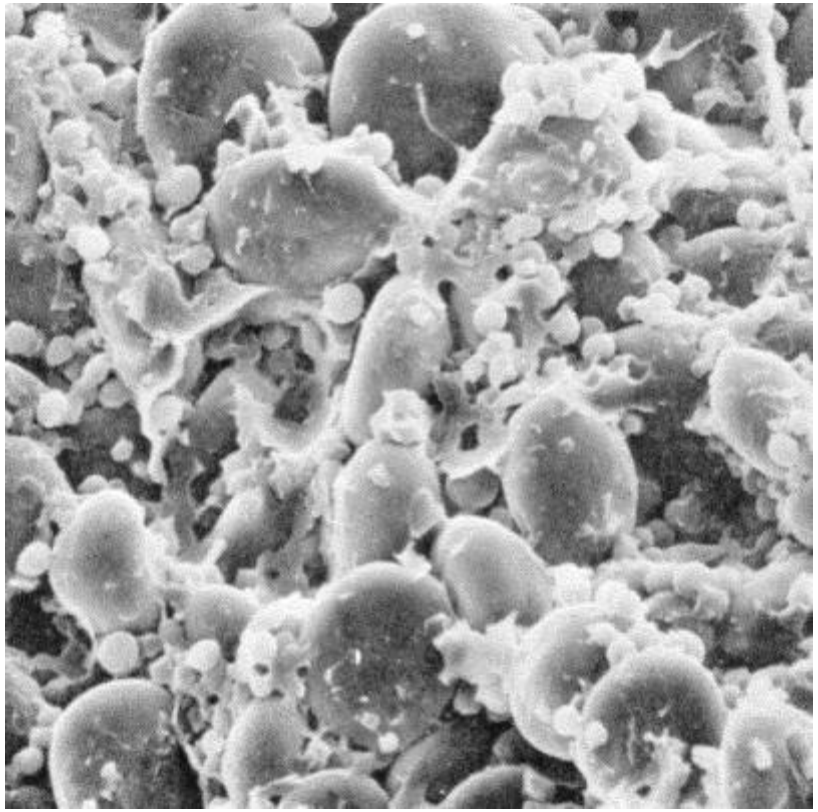
Poco espacio entre las moléculas de almidón



Hard Wheat

Mucho espacio entre las moléculas de almidón



Soft Wheat

CARACTERISTICAS DEL TRIGO

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Proceso de Molienda.

- Almacenaje.
- Limpieza.
- Acondicionamiento.
- Molienda.
- Cernido
- Purificación de sémolas.
- Almacenaje y despacho.

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Para optimizar la extracción en el proceso de molienda se necesita:

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CUIDADOS EN EL ACONDICIONAMIENTO:

- Verificar que el trigo de entrada este limpio.
- Alimentación uniforme y consistente.
- Monitorear la humedad del grano.
- Verificar correcto funcionamiento del Equipo humectador.
- Cumplir los lapsos de reposo establecidos.
- Evitar grandes saltos de humedad (menores o iguales al 3%, según sea el método)
- Verificar que del silo de reposo salga el primer grano que entró. (FIFO)

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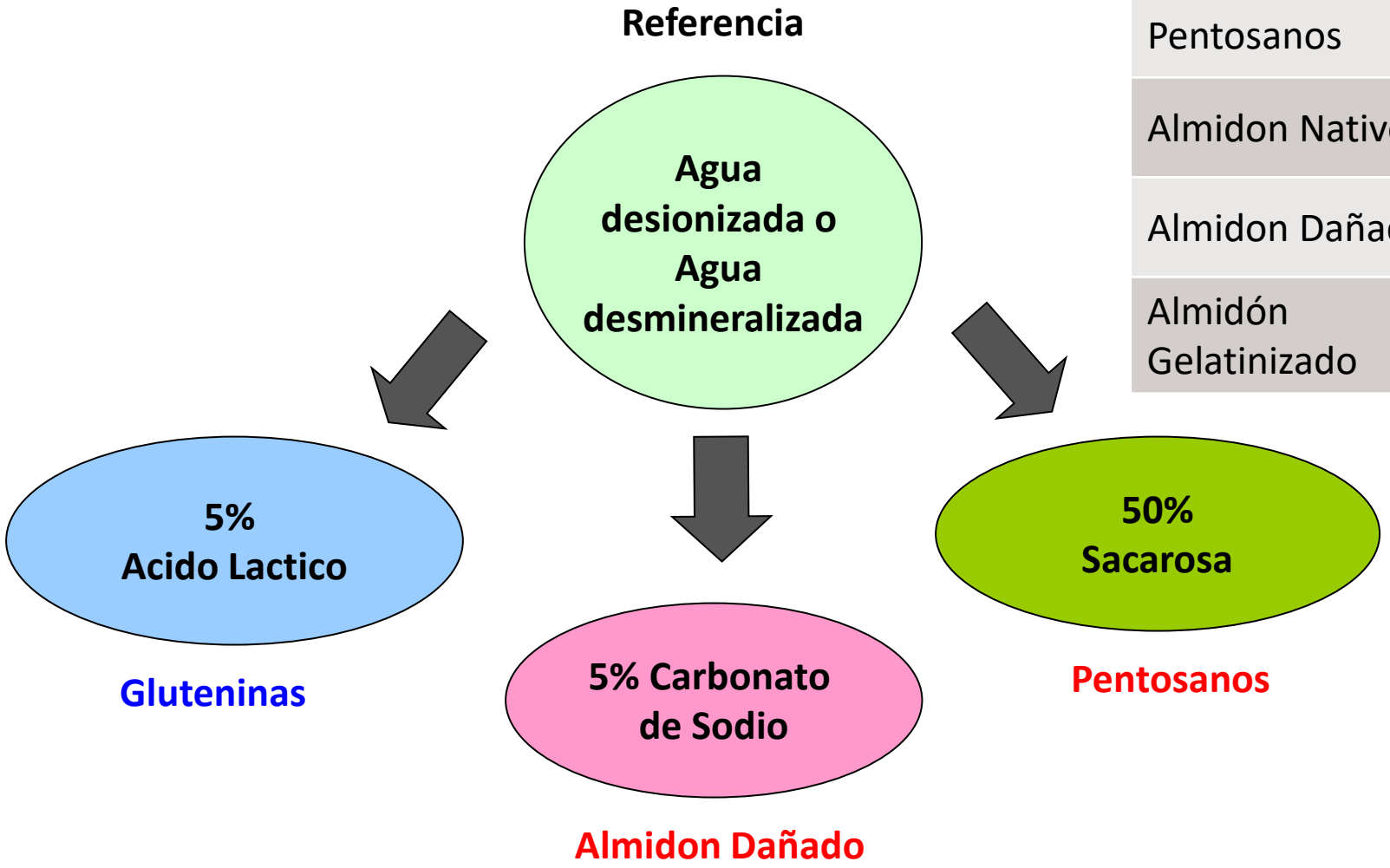
En que consiste el Análisis S.R.C?

Componente	Retención de agua g/g
Proteinas del Gluten	2 - 3
Pentosanos	10 – 15
Almidon Nativo	0.3 – 0.45
Almidon Dañado	1.5 - 10
Almidón Gelatinizado	Mas de 10



(S.R.C) Capacidad de Retención de Solventes

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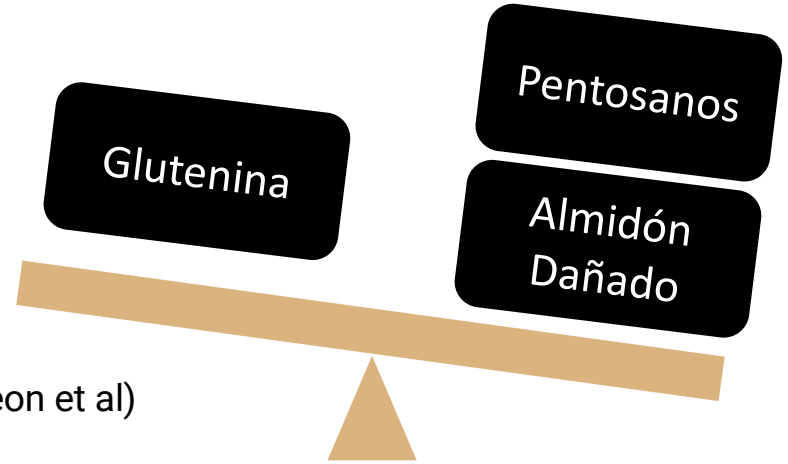
Acido Láctico SRC

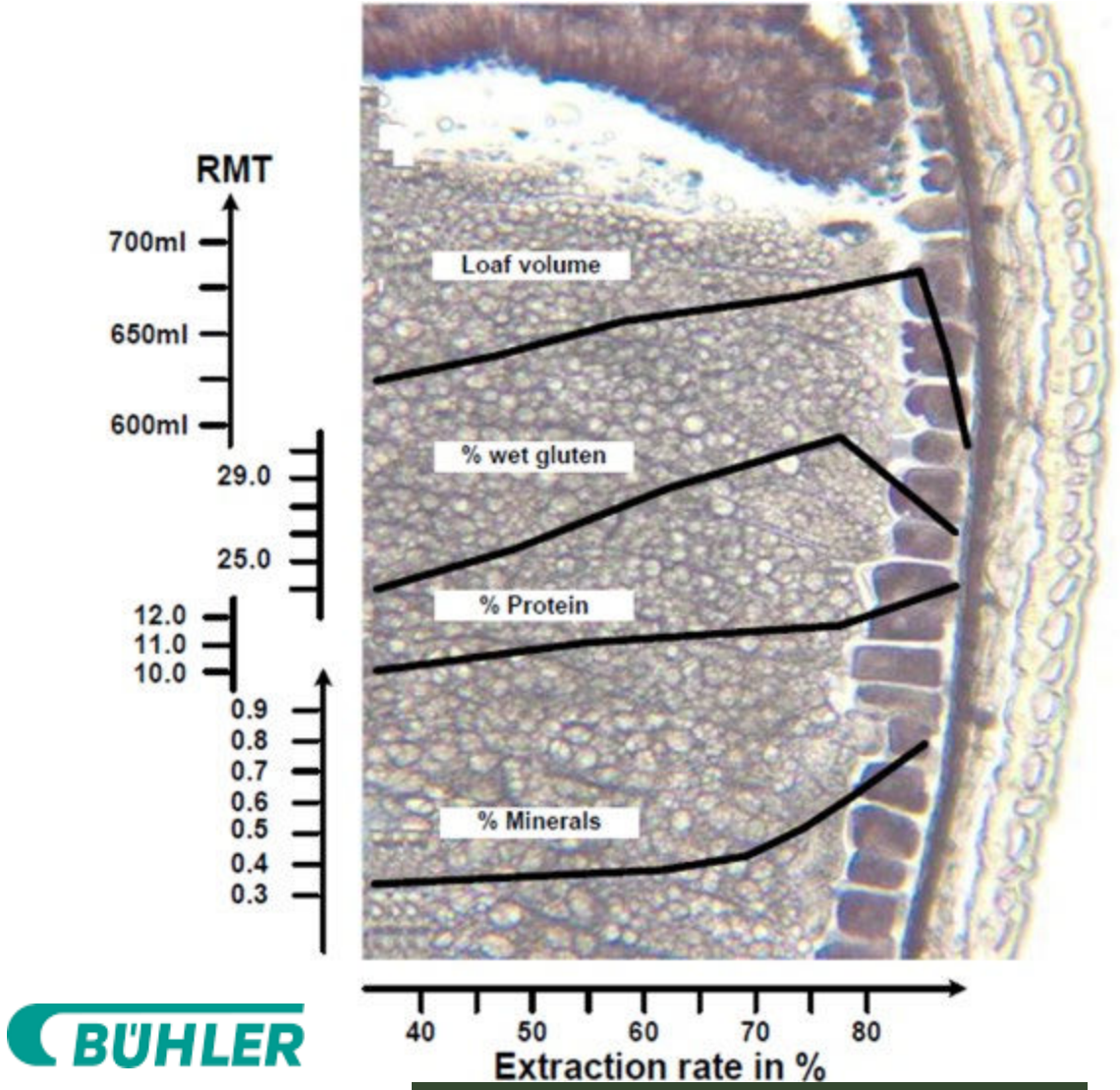
(carbonato de sodio SRC+ sacarosa SRC)

GPI

Gluten Performance Index



(Kweon et al)



BÜHLER

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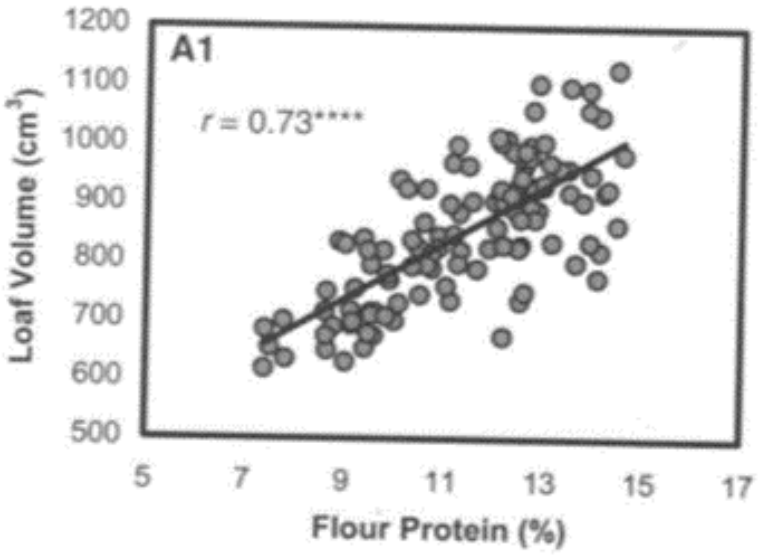
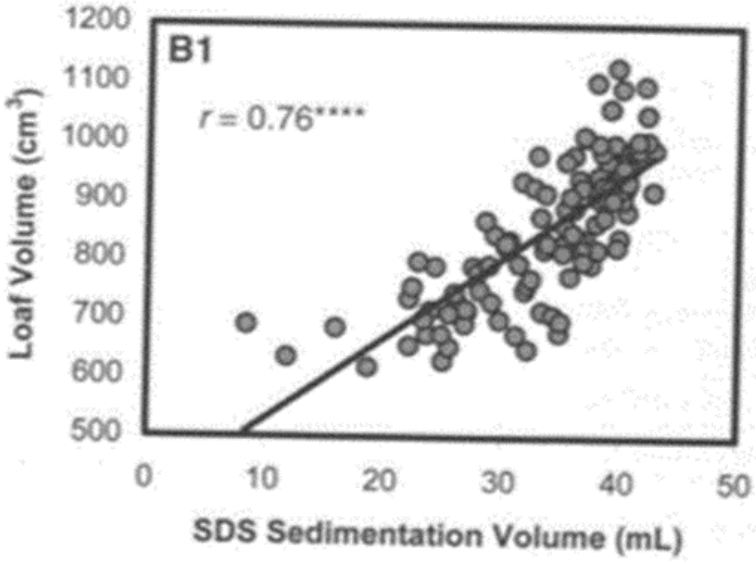
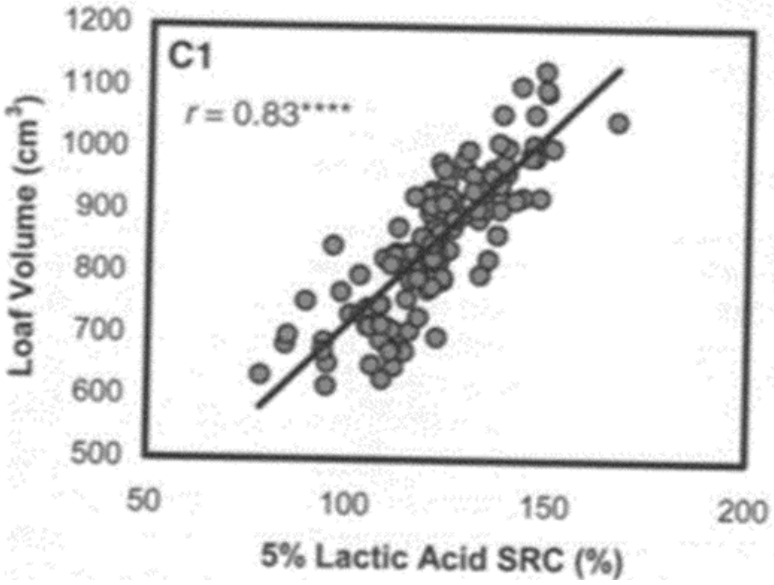
Relación entre volumen de pan y varios análisis

(Xiao et al)







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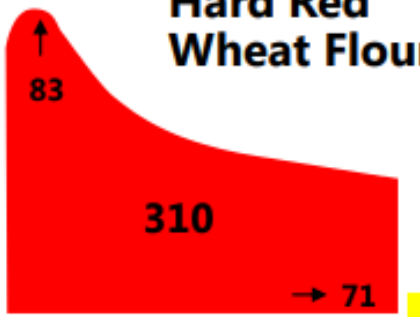
Ejemplos de harinas (Alveografía y SRC)

Hard Red Wheat Flour



1

2

Alveograph			Proximate Analysis		
P	=	83	Moisture	=	13.6
L	=	71	Protein	=	10.0
W	=	248	Ash	=	.52

W@L100 = 310

SRC

Water	Sodium Carbonate	Sucrose	Lactic Acid
59.5	79.0	125	155%

3

Cookie/ Snack Cracker

Alveograph			Proximate Analysis		
P	=	34	Moisture	=	13.0
L	=	87	Protein	=	8.4
W	=	86	Ash	=	.46

W@L100 = 94

SRC

Water	Sodium Carbonate	Sucrose	Lactic Acid
52.0	68.0	88	92%

Sponge-Cracker Soft Red Wheat & Hard Red Blend

Alveograph			Proximate Analysis		
P	=	40	Moisture	=	13.0
L	=	107	Protein	=	8.8
W	=	125	Ash	=	.49

W@L100 = 120

SRC

Water	Sodium Carbonate	Sucrose	Lactic Acid
55.0	72.0	88	95%

President Diane Gannon, LLC, Wheat and Flour Processing Technical Services, Paris, France, 2014

(S.R.C) Capacidad de Retención de Solventes

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Aplicación de SRC en mezclas de harinas (Proporciones en %)

Cultivar	1	2	3	4	5	6	7	8
Blanca Grande						25		
Briggs	20							
Eltan	20							
Jagalene	20							
McNeal	20	75	50					25
Mountral						25		
Nopro				50				
Patterson						25	50	
Reeder			50			25		
Roane	20	25			50			
Stephens				50			50	75
Tam110					50			

(Kweon et al)

(S.R.C) Capacidad de Retención de Solventes

Resultados calculados y medidos del análisis SRC de las mezclas

Flour	Water (%)	Lactic Acid (%)	Na_2CO_3 (%)	Sucrose (%)
		Calculated SRC		
Blend 1	72.0	121.2	100.4	121.8
Blend 2	81.9	137.9	116.4	133.4
Blend 3	84.2	149.1	118.9	136.4
Blend 4	70.5	106.6	100.0	118.6
Blend 5	72.0	119.5	107.9	126.9
Blend 6	69.3	113.5	93.5	110.4
Blend 7	57.1	77.6	80.0	105.1
Blend 8	66.5	100.5	91.8	117.7
		Measured SRC		
Blend 1	70.1	120.7	97.4	121.9
Blend 2	79.6	139.0	111.7	134.7
Blend 3	83.0	149.3	117.2	134.9
Blend 4	69.4	107.2	97.9	117.1
Blend 5	70.1	116.5	102.5	125.7
Blend 6	66.5	113.1	86.4	105.5
Blend 7	56.2	76.7	79.1	101.6
Blend 8	66.7	102.2	94.5	120.3

(Kweon et al)

(S.R.C) Capacidad de Retención de Solventes

Para optimizar la extracción en el proceso de molienda se necesita:

Contenido correcto de humedad + Correcto tiempo de reposo + Correcto ajuste de la molienda = Tasa de extracción correcta

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Para optimizar la extracción en el proceso de molienda se necesita:

Correcto tiempo de reposo

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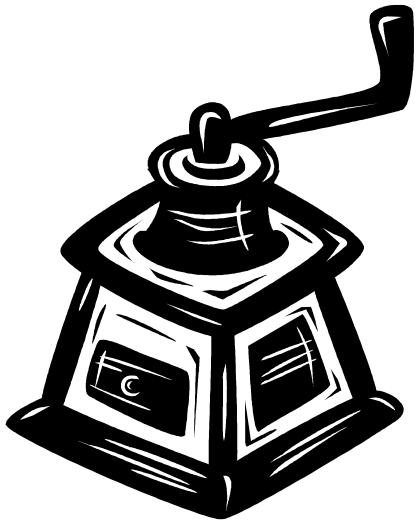
Nivel óptimo de acondicionado a B1 por clase de trigo

Método tradicional

Subjetivo, sin datos, repetibilidad depende del operador (edad e higiene)



Prueba PSI. Mucho mejor.

Repetible, pero los resultados dependen del equipo y del operador.

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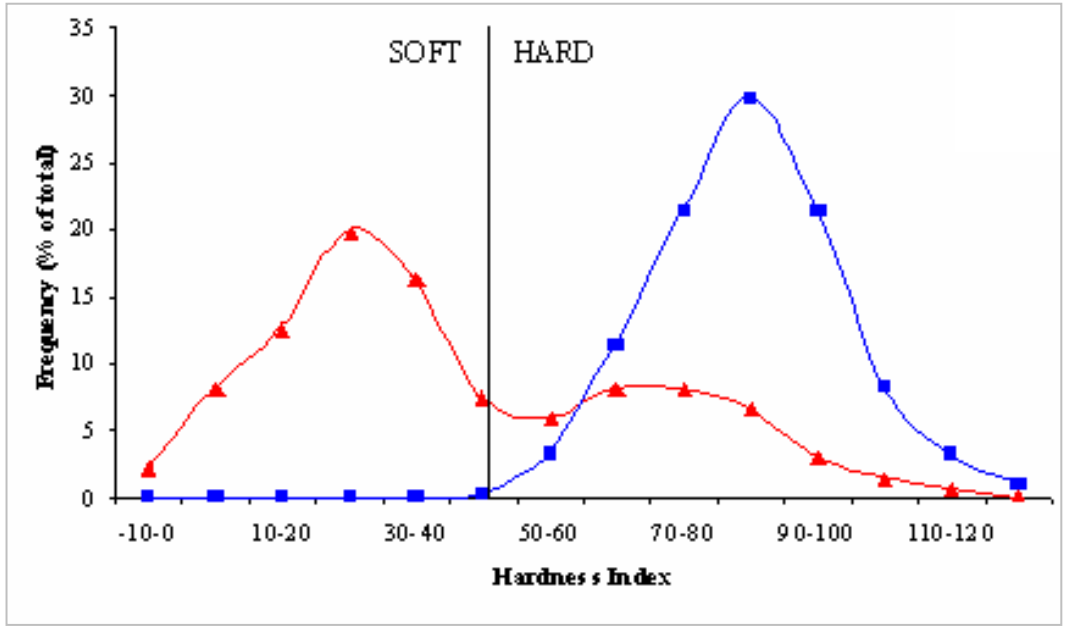
Nivel óptimo de acondicionado a B1 por clase de trigo



Single Kernel Characterization System or SKCS

Refleja la dureza de 300 o mas granos y realiza un promedio esfuerzo realizado para partir el grano. ***(información en el reporte de la cosecha)***

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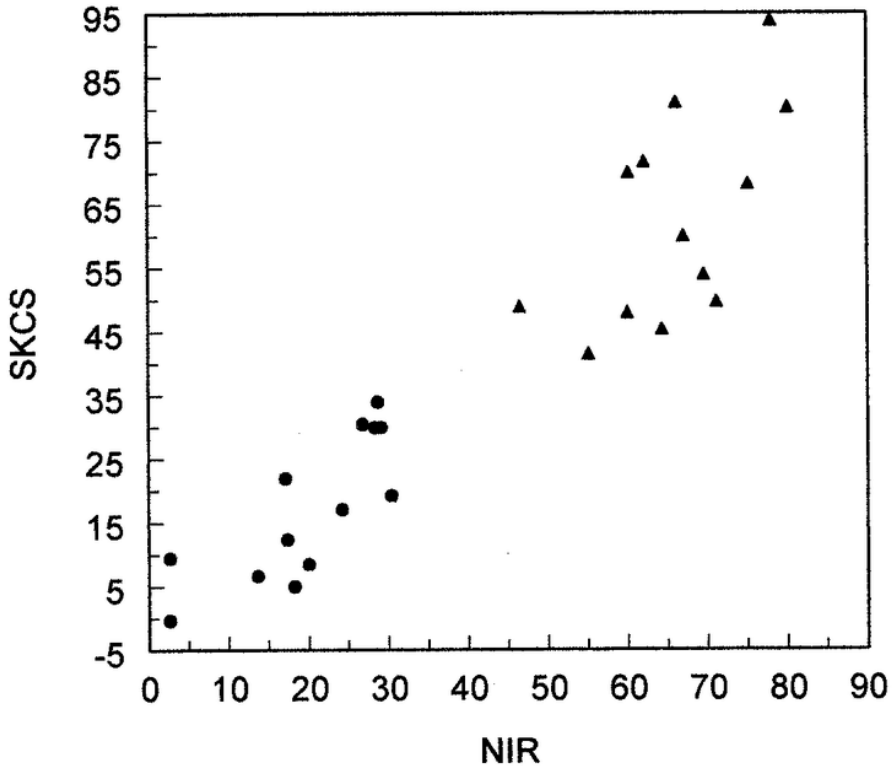
Nivel óptimo de acondicionado a B1 por clase de trigo

Single Kernel Characterization System or SKCS



Bettge and Morris

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Clase de trigo	Humedad (%)	HORAS
HRS	16,5 – 17,5	26 - 48
HRW	15,5 – 16,5	24 – 36
HW	16,0 – 16,5	12 – 24
SRW	15,5 – 16,0	8 – 18
SW	15,5 – 16,0	8 – 14
AUSTRALIANO BLANDO	15,5 – 16,5	8 – 16
INGLES	15,5 – 16,0	12 – 24
CWRS	16,0 – 17,0	26 - 48
FRANCES	15,5 – 16,0	12 – 24
PLATA	15,5 – 16,5	18 - 30

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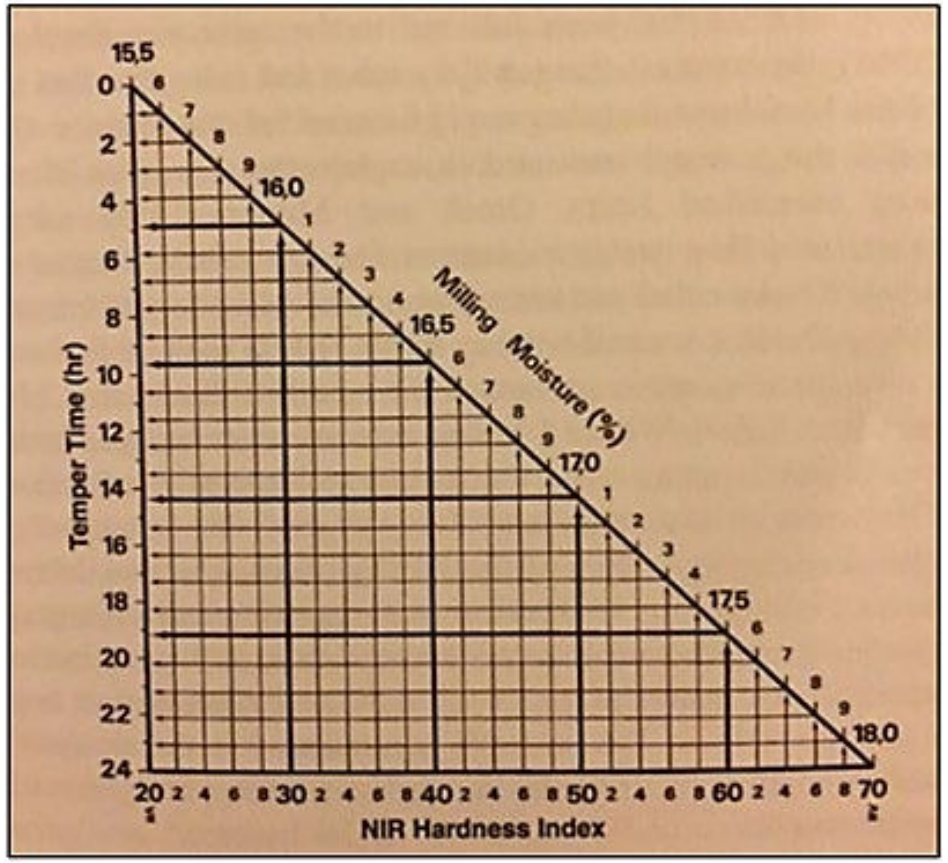
Recomendaciones para un acondicionamiento idóneo

Clase o Categoria	NIR	PSI %
Extra fuerte	≥ 85	≥ 07
Muy Fuerte	73 – 84	08-12
Fuerte	61 – 72	13-16
Medianamente fuerte	49 – 60	17-20
Medianamente suave	37 – 48	21-25
Suave	25 – 36	26-30
Muy suave	13 – 24	31-35
Extra suave	≤ 12	≥ 35

Marie HRUŠKOVÁ and Ivan ŠVEC



Enzo galluzo

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Acondicionado y Ceniza

Mucho mejor calcular humedad de molienda al momento de recibir el trigo y al entrar a proceso.

Temper time	SG ash
1	1.25
2	1.24
3	1.23
4	1.22
5	1.1
6	1.02
7	0.98
8	0.8
9	0.72
10	0.6
11	0.55
12	0.5
13	0.42
14	0.37
15	0.375
16	0.377
17	0.4
18	0.41
19	0.43
20	0.47
21	0.5
22	0.55
23	0.6
24	0.65
25	0.7
26	0.75
27	0.8
28	0.9
29	0.95
30	1.02
31	1.3
32	1.32
33	1.33
34	1.32
35	1.33

IFIM MLU202 –

Projet Fin d'Etudes 2002

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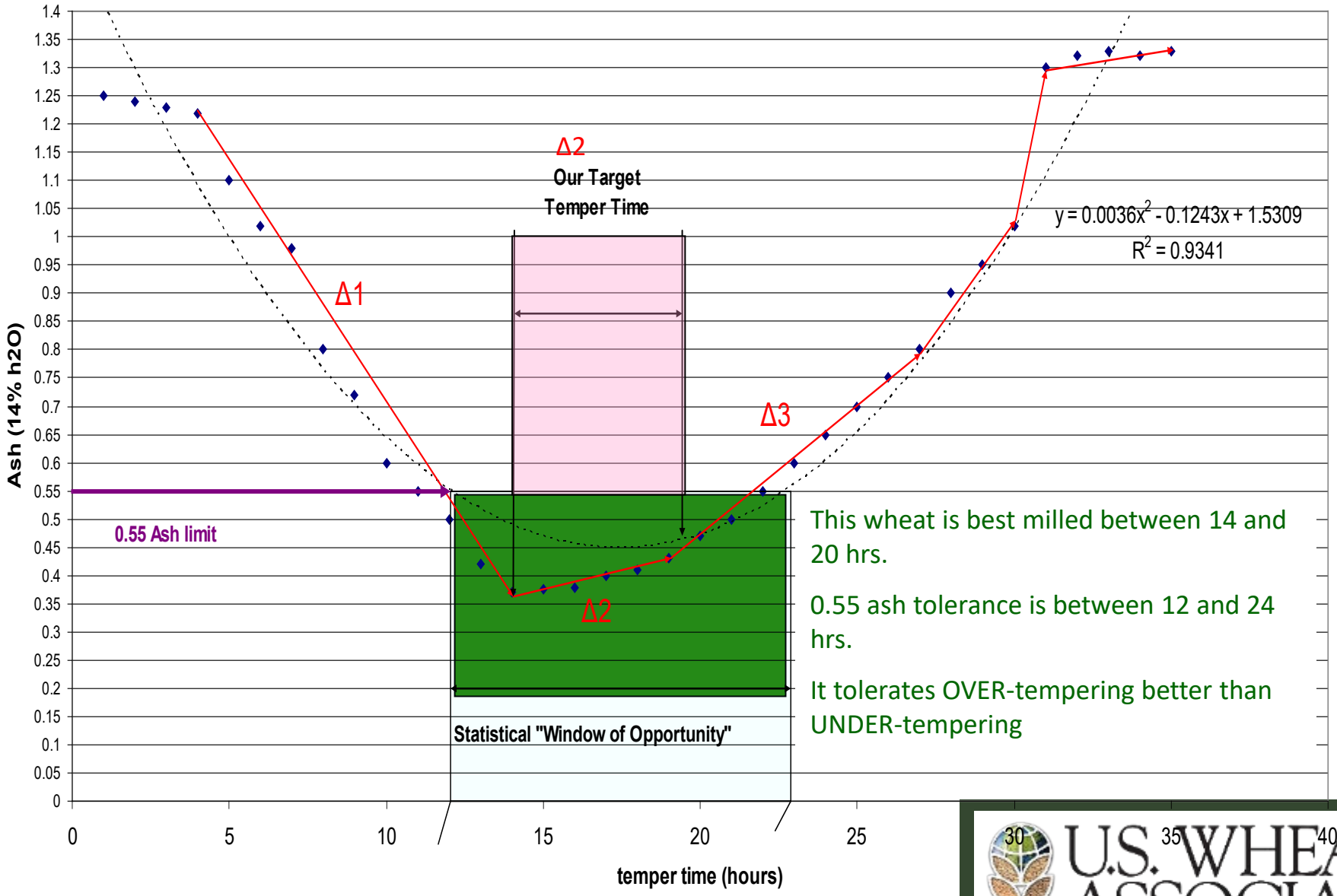
IFIM MLU202 – Projet Fin d'Etudes 2002



This wheat is best milled between 14 and 20 hrs.

0.55 ash tolerance is between 12 and 24 hrs.

It tolerates OVER-tempering better than UNDER-tempering

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Pruebas de acondicionado y molienda en el laboratorio de U.S. Wheat Associates y Universidad Mayor

Andres Saturno, Mario Pennacchiotti e Ivette Olave.

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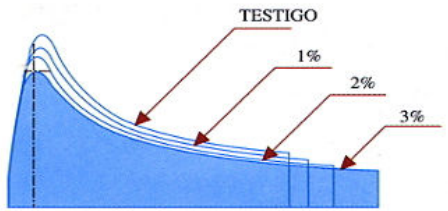
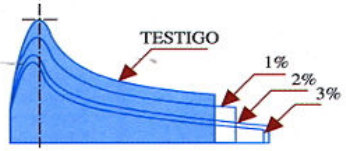
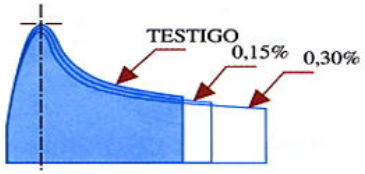


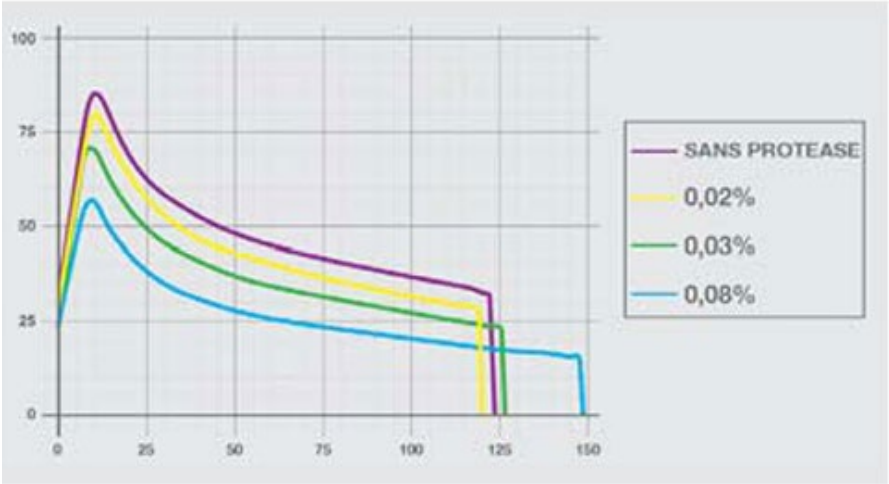
GLUTEN :
aumento de W y de P,
disminución de L.



REDUCTOR :
disminución de W y de P, L
aumenta y luego disminuye en
función de la dosis.



EMULSIFICANTE:
ligera disminución de P,
aumento de W y de L.



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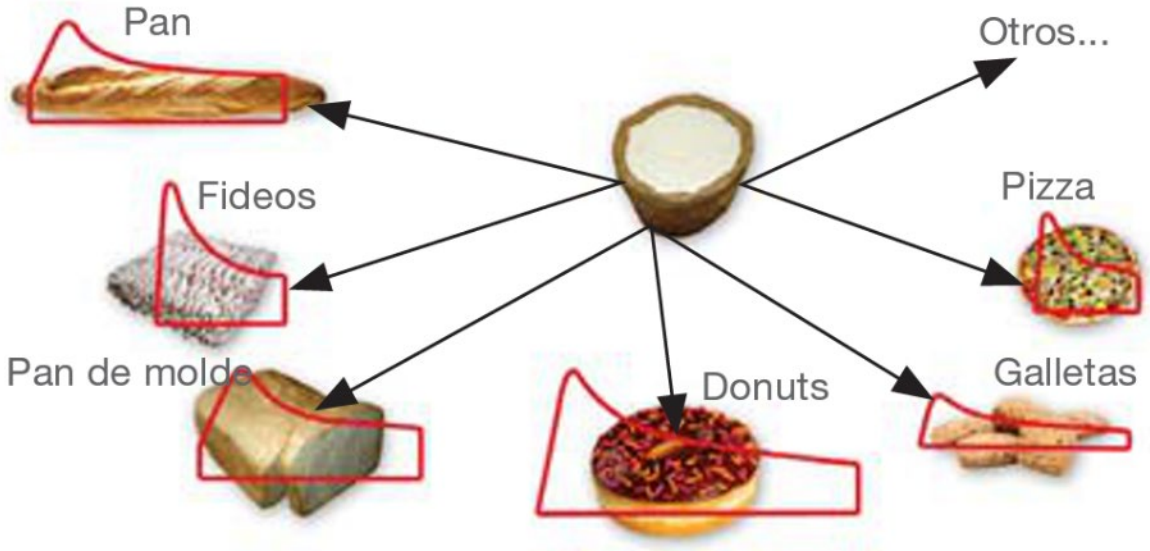

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Wheat Class	Grade	Protein	Test weight	Moisture	Wet Gluten
Soft White Wheat	2	12,1%	81 kg/hl	8,8%	27,85%

3 tempering times = 4, 8 y 18 hours.

Moisture at B1 = 14.9%

Same configuration for the three grindings

Average flour moisture: 13.6%

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Wheat Class	Grade	Protein	Test weight	Moisture	Wet Gluten
Soft White Wheat	2	12,1%	81 hg/hl	8,8%	27,85%

	4 HOURS	8 HOURS	18 HOURS
Protein (NIR)	11.17	11.08	11.24
Moisture	13.36	13.7	13.73
Ash (d.b)	0.63	0.59	0.67
Wet Gluten	34.7%	35.4%	34.6%
Absorption (NIR)	58.13	57.84	58.13
Absorption (Farino)	56	54.4	55
Stability	2:46	3:06	2:12
Starch Damage %	3.97%	3.55%	4.22%
Starch Damage UCD	13.6	11.5	14.7

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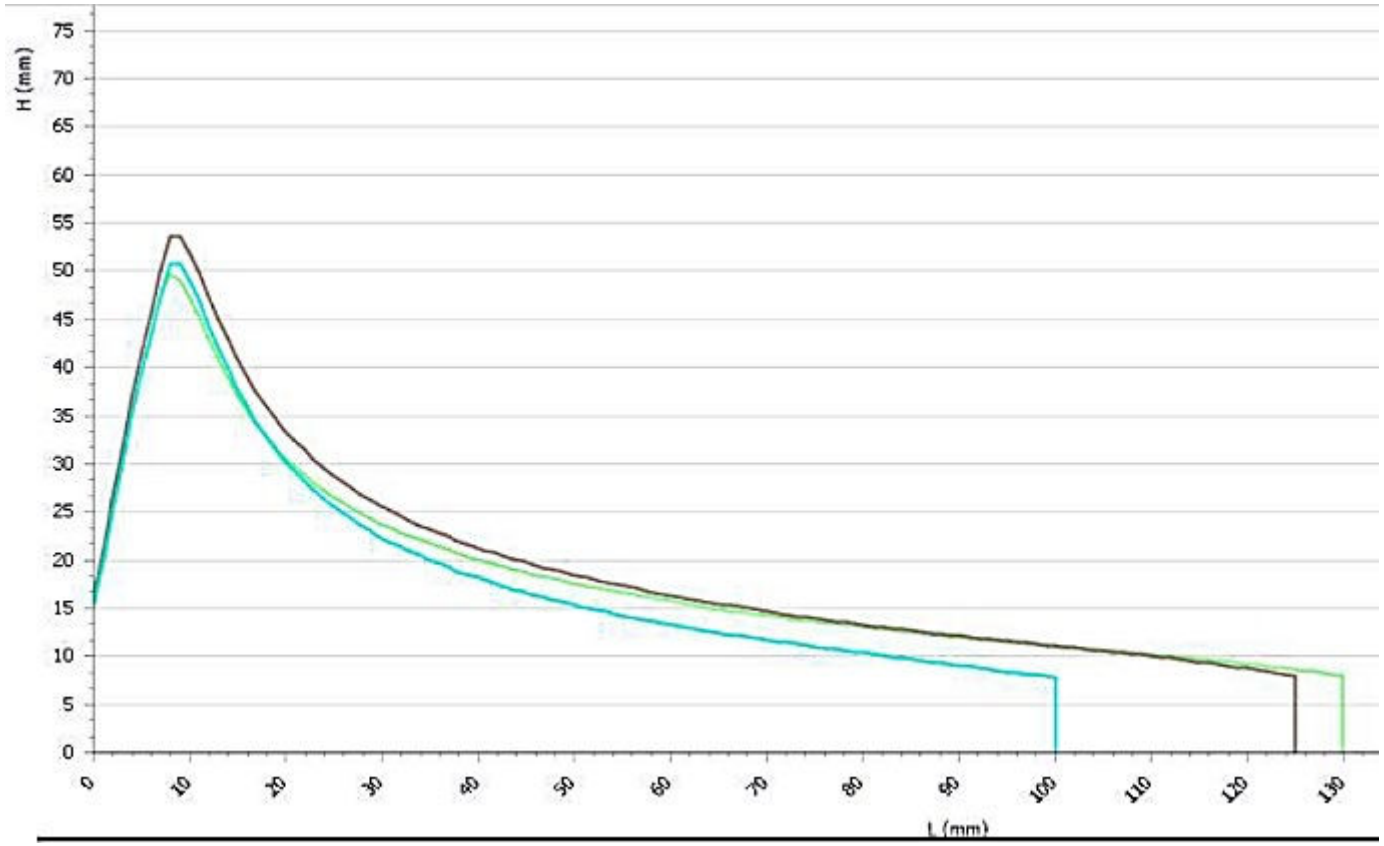

SWW

Nombre	Color	P mmH2O	L mm	G	W 10-4J	P/L	Ie %
SWW 8H		55	129	25,2	159	0,43	40,6
SWW 4H		59	124	24,7	164	0,48	39,9
SWW 18H		56	100	22,2	128	0,56	35,9

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SWW

Solvente	Peso del solvente @ 14% de humedad		
	Harina para Cracker	*Harina para galleta*	*Harina para Wafer*
100% Agua	50 to 70	50 to 70	50 to 70
50% Sacarosa	80 to 110	80 to 110	80 to 110
5% Carbonato de sodio (pH 11)	60 to 85	60 to 85	60 to 85
5% Acido lactico(pH 2)	100 to 120	85 to 100	80 to 100

	4H	8H	18H
Water	56%	55%	57%
Lactic Acid	107%	106%	99%
Sodium Carbonate	76%	70%	78%
Sucrose	108%	101%	109%
(GPI)	58%	62%	53%

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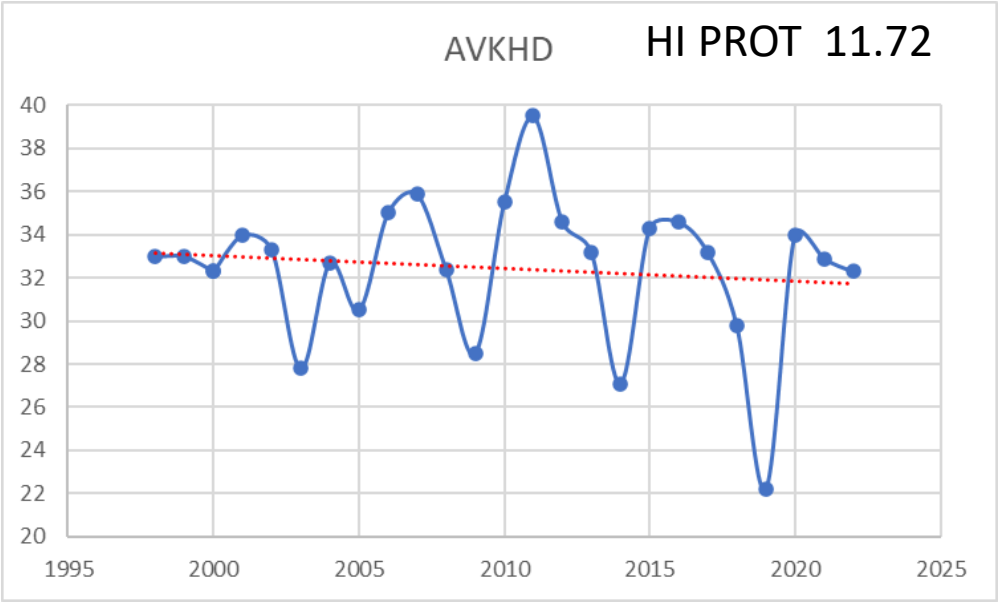
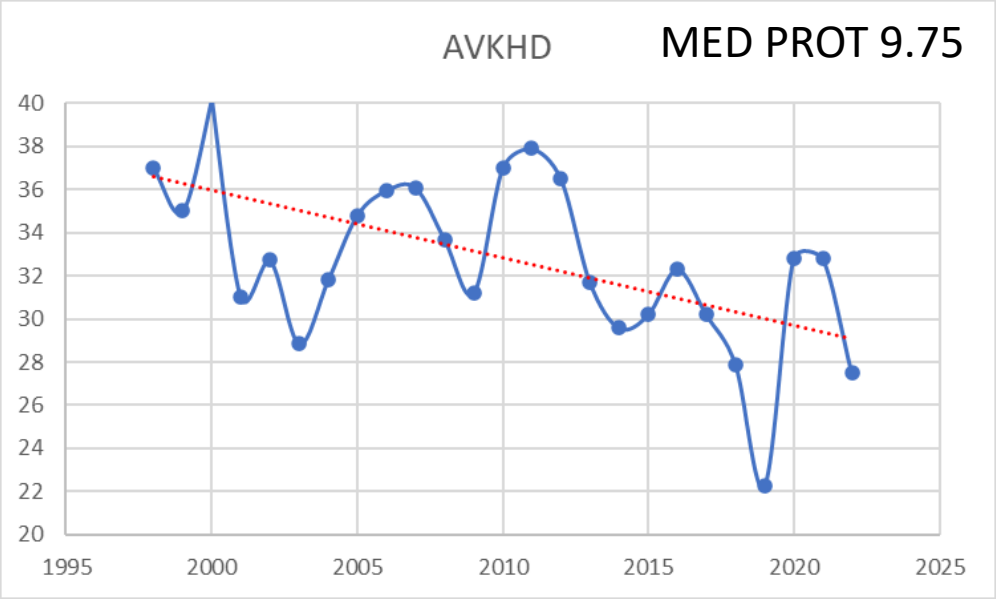
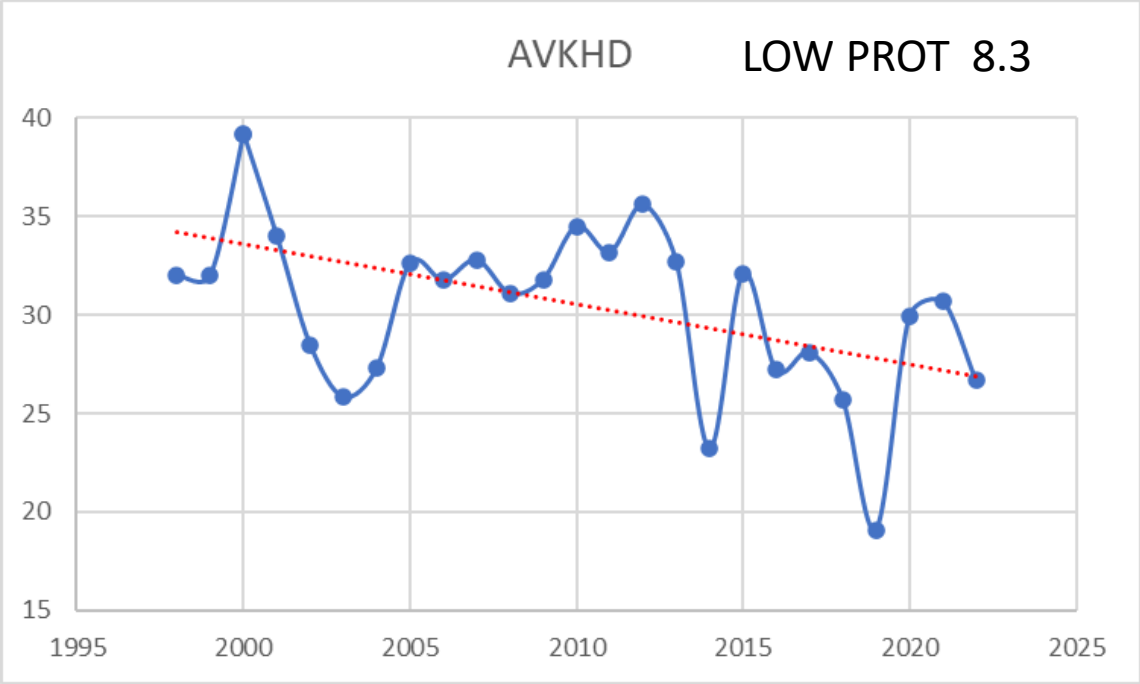




AVERAGE KERNEL HARDNESS SW



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Wheat Class	Grade	Protein	Test weight	Moisture
Soft Red Winter	2	9,3%	78 kg/hl	11,63%

3 tempering times = 4, 8 y 18 horas.

Moisture at B1 = 15,4%

Same configuration for the three grindings

Average flour moisture 13.6%

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Wheat Class	Grade	Protein	Test weight	Moisture
Soft Red Winter	2	9,3%	78 kg/hl	11,63%

	4 HOURS	8 HOURS	18 HOURS
Protein	7.99	8.12	8.69
Moisture	13.16	13.24	13.14
Ash (d.b)	0.63	0.66	0.71
Wet Gluten	20.0%	20.4%	20.2%
Absorption (NIR)	51.06	51.31	51.89
Absorption (Farino)	51.5	52	51.7
Stability	1:12	1:12	1:27
Starch Damage %	3.83%	4.18%	4.22%
Starch Damage UCD	12.9	14.5	14.7

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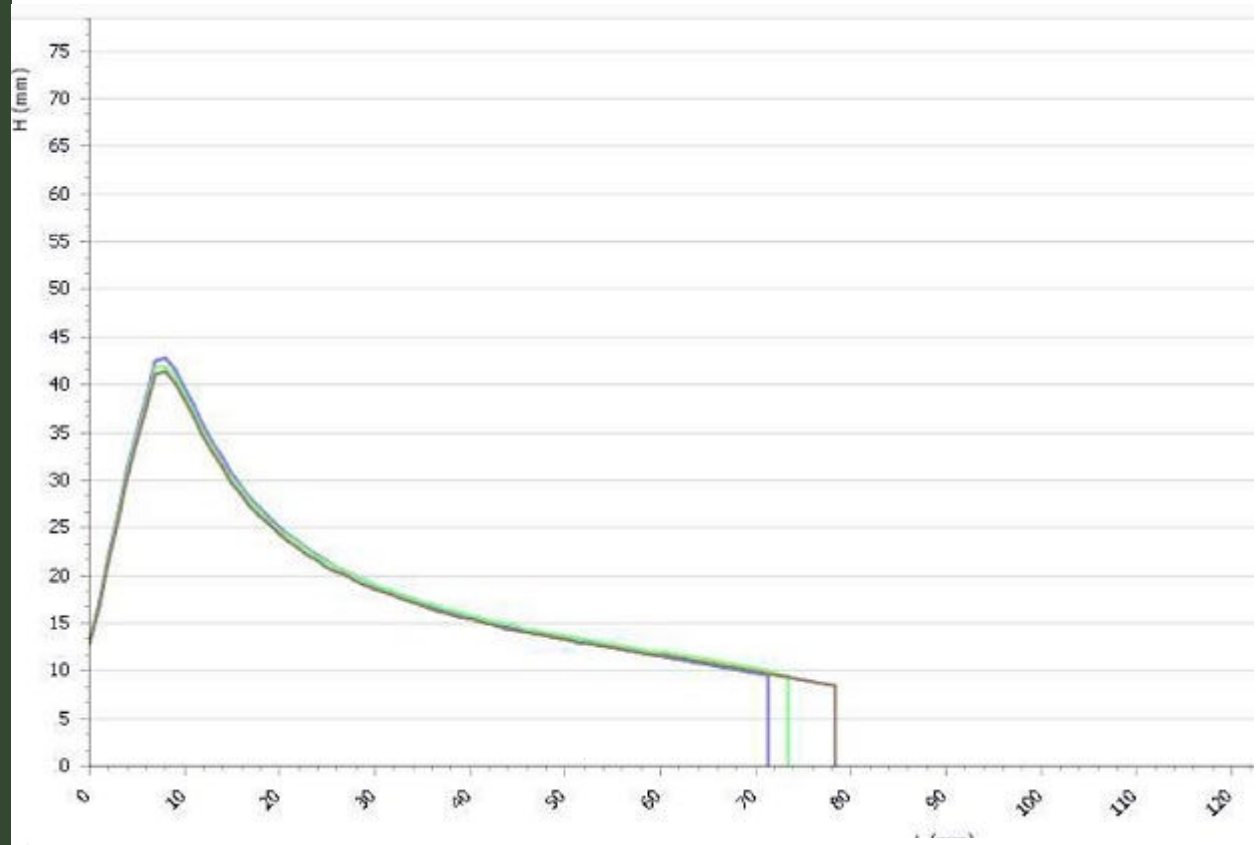

SRW

Nombre	Color	P mmH2O	L mm	G	W 10-4J	P/L	Ie %
SRW 18H		47	71	18,7	93	0,66	36,8
SRW 4H		46	73	19	95	0,63	37,9
SRW 8H		45	78	19,6	96	0,58	37,5

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Solvente	Peso del solvente @ 14% de humedad		
	Harina para Cracker	*Harina para galleta*	*Harina para Wafer*
100% Agua	50 to 70	50 to 70	50 to 70
50% Sacarosa	80 to 110	80 to 110	80 to 110
5% Carbonato de sodio (pH 11)	60 to 85	60 to 85	60 to 85
5% Acido lactico(pH 2)	100 to 120	85 to 100	80 to 100

SRW

	4H	8H	18H
Water	55%	55%	55%
Lactic Acid	93%	92%	91%
Sodium Carbonate	73%	74%	74%
Sucrose	96%	98%	97%
(GPI)	55%	53%	53%

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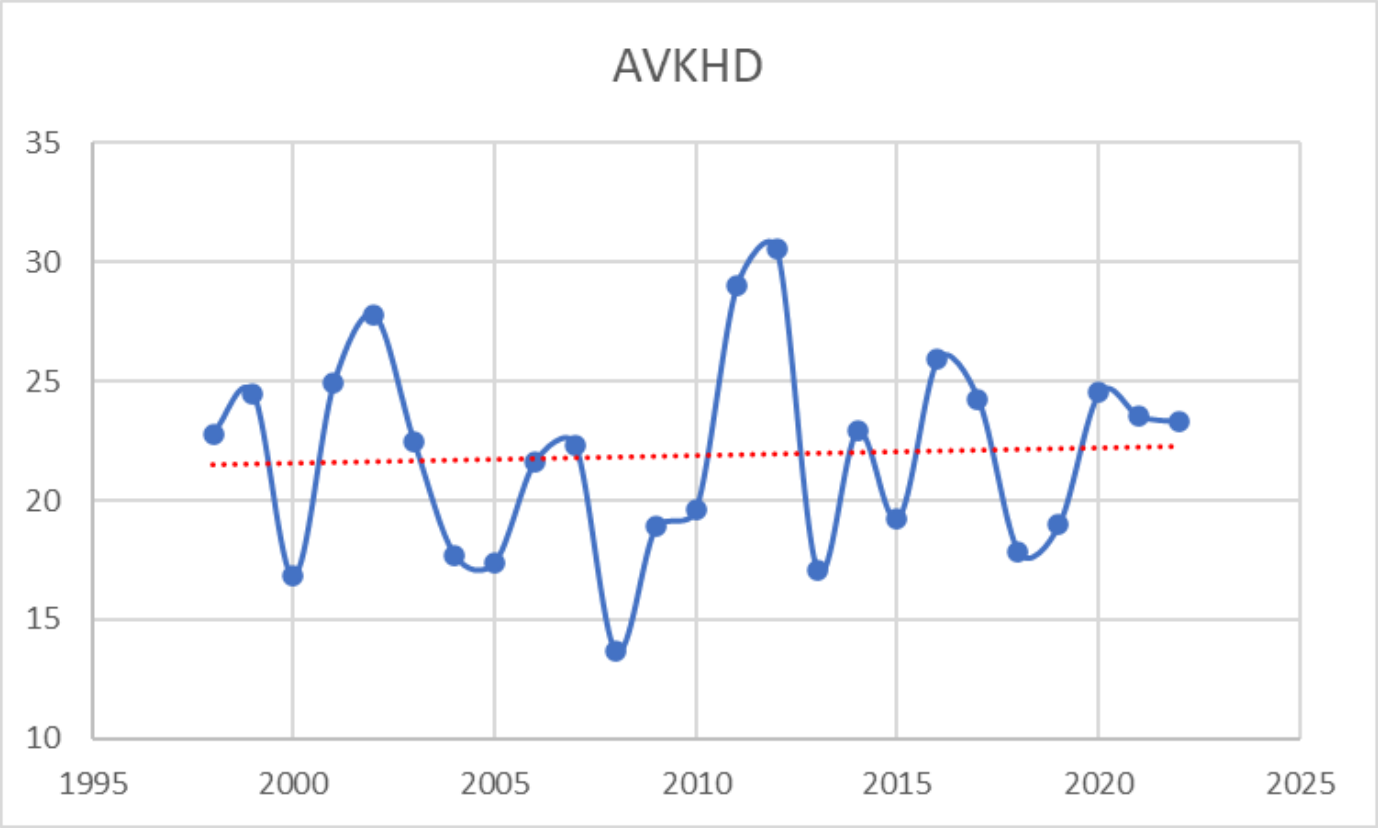
SRW AV PROT 9.86



AVERAGE KERNEL HARDNESS SRW

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Wheat Class	Grade	Protein	Test weight	Moisture	Wet Gluten
Hard Red Winter	2	11,7%	80.9 kg/hl	11,2%	29,3%

3 tempering times = 8, 20 y 30 hours.

Moisture at B1 = 15,8%

Same milling configuration.

Flour moisture average = 14,6%

U.S. WHEAT ASSOCIATES

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Wheat Class	Grade	Protein	Test weight	Moisture	Wet Gluten
Hard Red Winter	2	11,7%	80.9 kg/hl	11,2%	29,3%

	8 HOURS	20 HOURS	30 HOURS
Protein	10.33	9.85	10.27
Moisture	13.99	13.85	14.17
Ash	0.61	0.63	0.63
Wet Gluten	28.78	28.11	28.14
Absorption (NIR)	58.64	58.2	58.56
Absorption (Farino)	57.2	57.4	57
Stability (Farino)	8:19	9:20	7:19
Starch Damage %	6.8%	6.7%	6.8%
Starch Damage UCD	23.2	23	23.4

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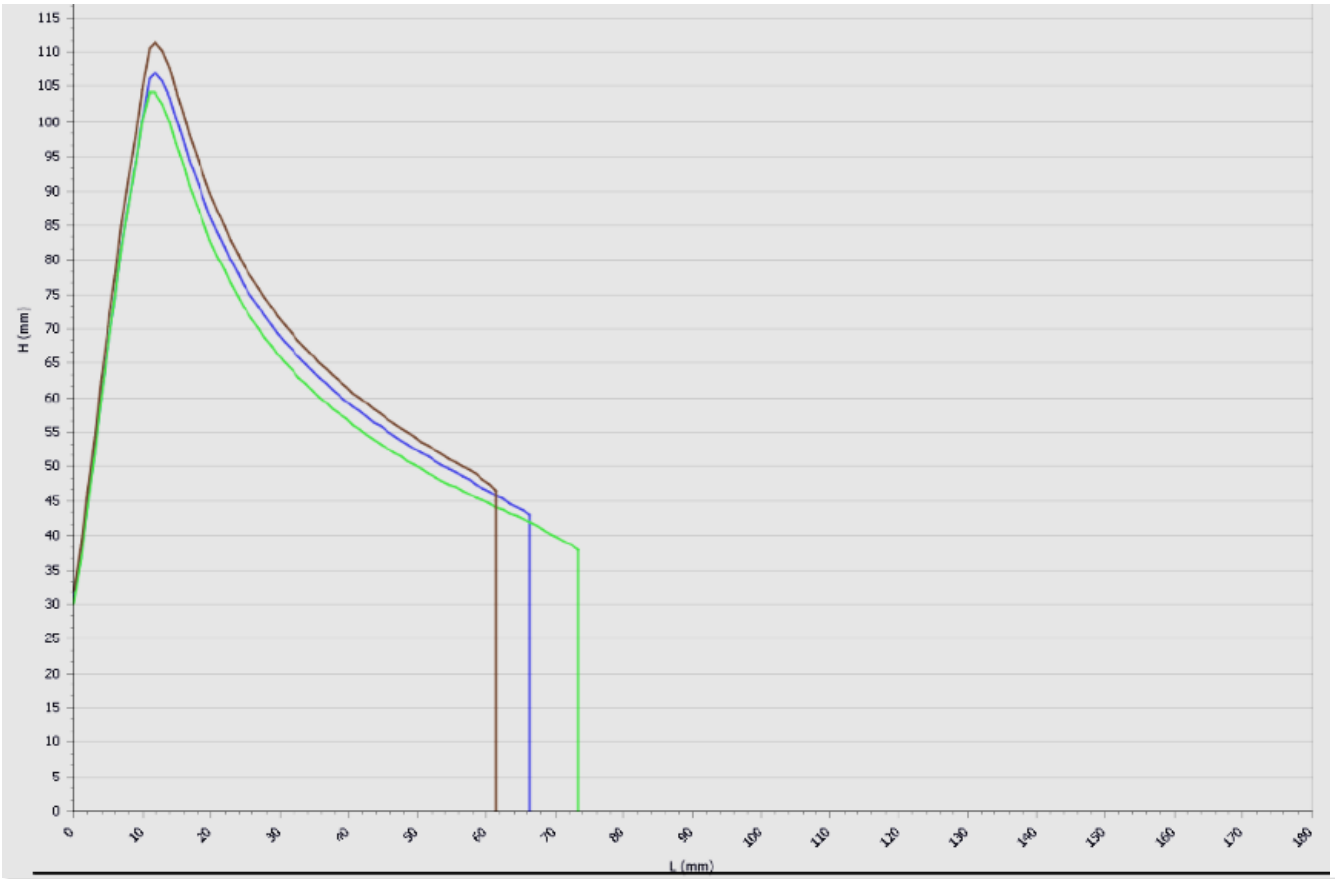

HRW

Nombre	Color	P mmH2O	L mm	G	W 10-4J	P/L	Ie %
HRW 30H		118	66	18	290	1,79	55,6
HRW 20 H		115	73	19	298	1,58	54,5
HRW 8H		123	61	17,3	286	2,02	55,2

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	8H	20H	30H
Water	67%	68%	67%
Lactic Acid	120%	119%	119%
Sodium Carbonate	93%	93%	91%
Sucrose	113%	112%	112%
(GPI)	58%	58.5%	59%

HRW

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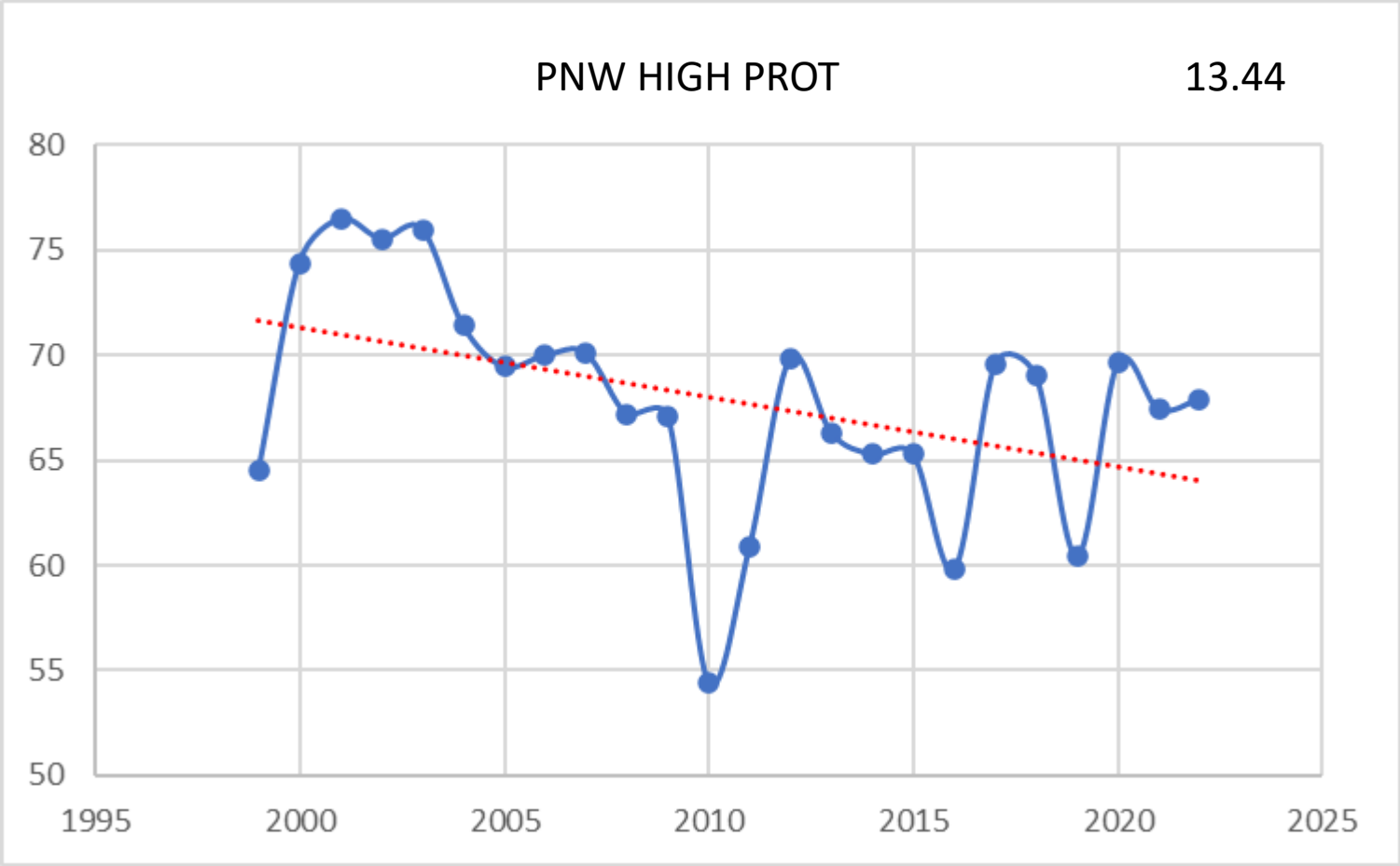

AVERAGE KERNEL HARDNESS HRW

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Wheat Class	Grade	Protein	Test weight	Vitreosity	Wet Gluten	Moisture
Hard Red Spring	2	14,9%	82 kg/hl	80%	36,92%	11,6%

3 tempering times = 8, 26 y 40 hours.

Moisture at B1 = 16.3%

Same milling configuration.

Flour moisture average = 14,6%

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Wheat Class	Grade	Protein	Test weight	Vitreosity	Wet Gluten	Moisture
Hard Red Spring	2	14,9%	82 kg/hl	80%	36,92%	11,6%

	8 HOURS	26 HOURS	40 HOURS
Protein	13.6	13.47	13.65
Moisture	14.41	14.6	14.69
Ash	0.62	0.63	0.65
Wet Gluten	35.16	35.12	34.63
Absorption (NIR)	59.9	59.56	59.55
Absorption (Farino)	63.1	62.9	62.1
Stability	12:49	11:39	10:23
Starch Damage %	7.0%	7.3%	7.0%
Starch Damage UCD	23.7	24.6	23.9

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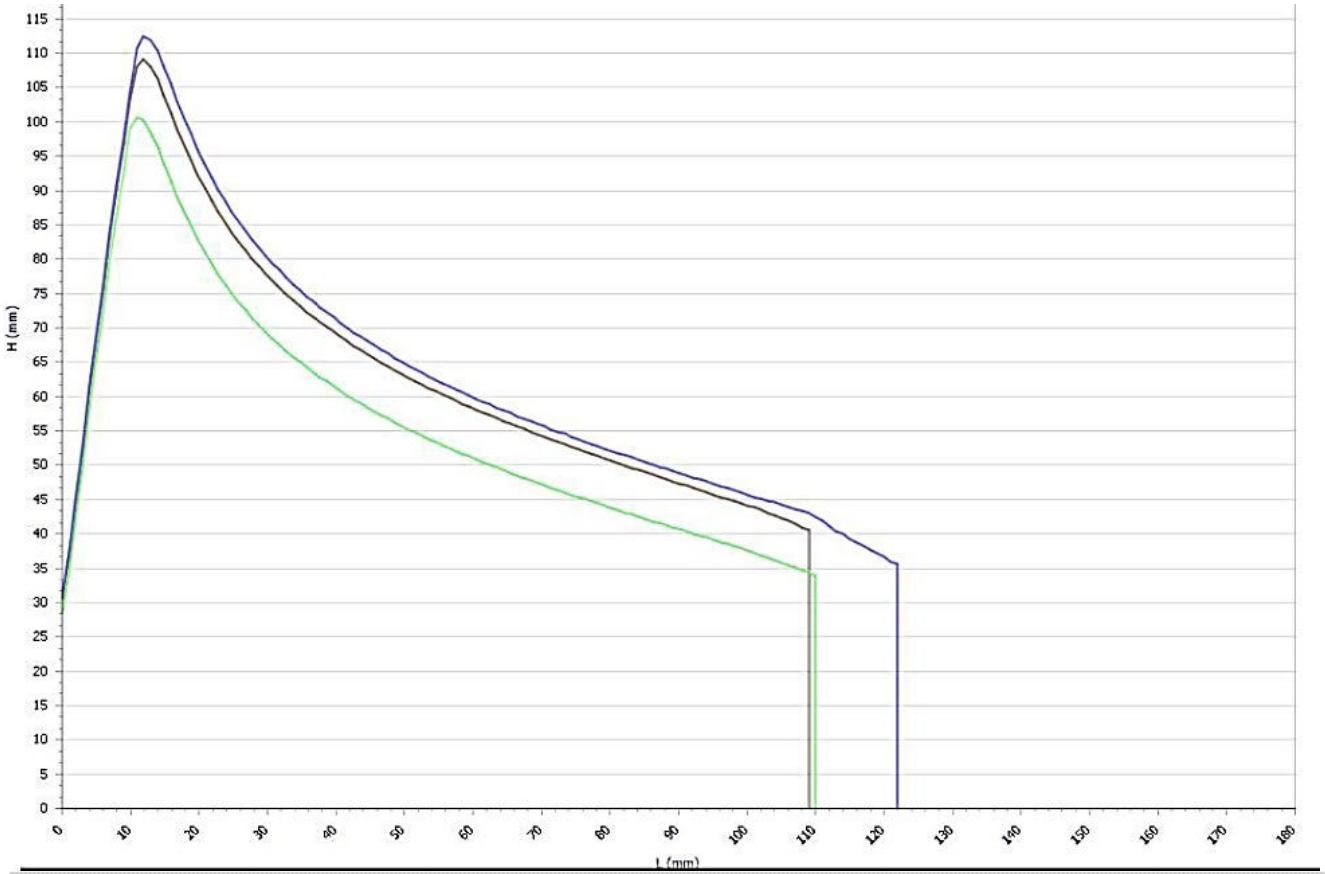

HRS

Nombre	Color	P mmH2O	L mm	G	W 10-4J	P/L	Ie %
HRS 8H		120	109	23,2	459	1,1	63,6
HRS 40H		111	110	23,3	410	1,01	61
HRS 26H		124	121	24,4	506	1,02	63,5

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HRS

	8H	26H	40H
Water	70%	69%	70%
Lactic Acid	162%	166%	159%
Sodium Carbonate	100%	99%	102%
Sucrose	124%	124%	126%
(GPI)	72%	74%	70%

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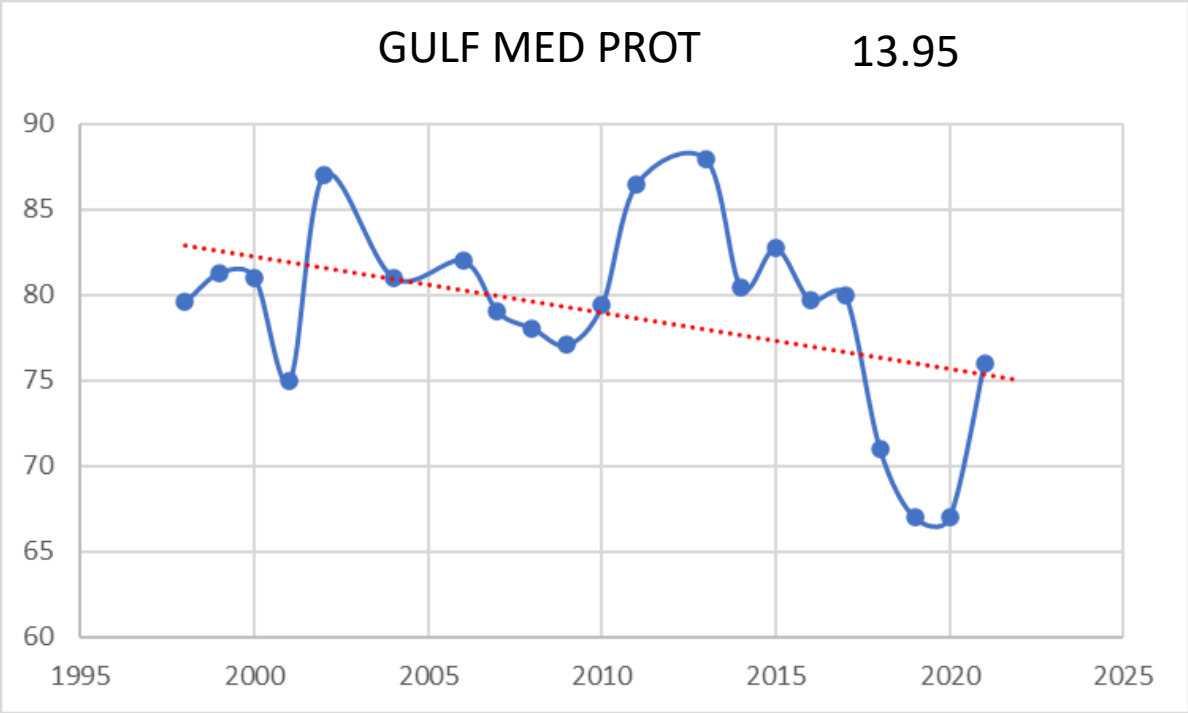

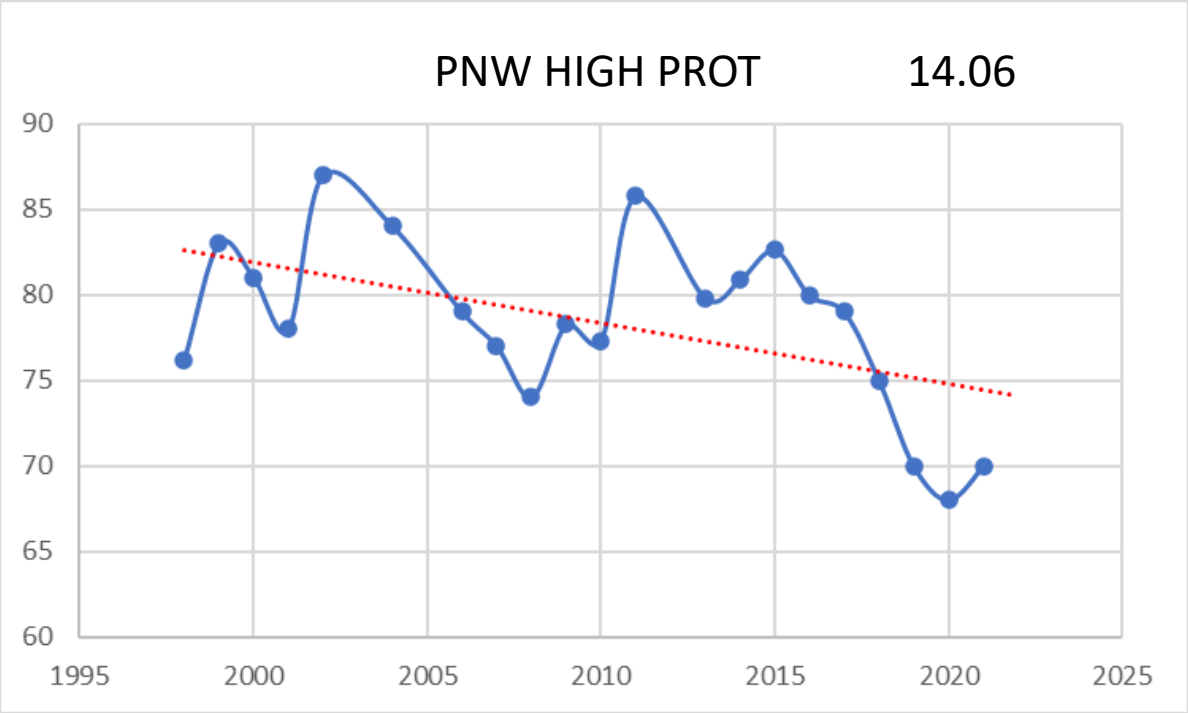

AVERAGE KERNEL HARDNESS HRS

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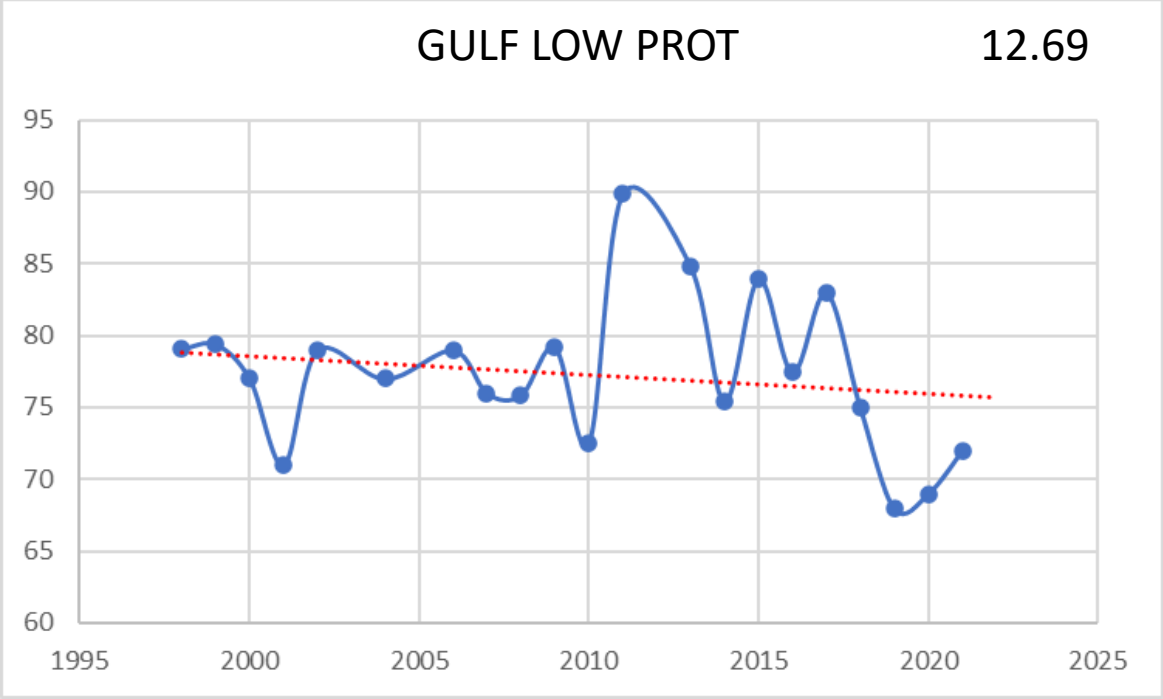

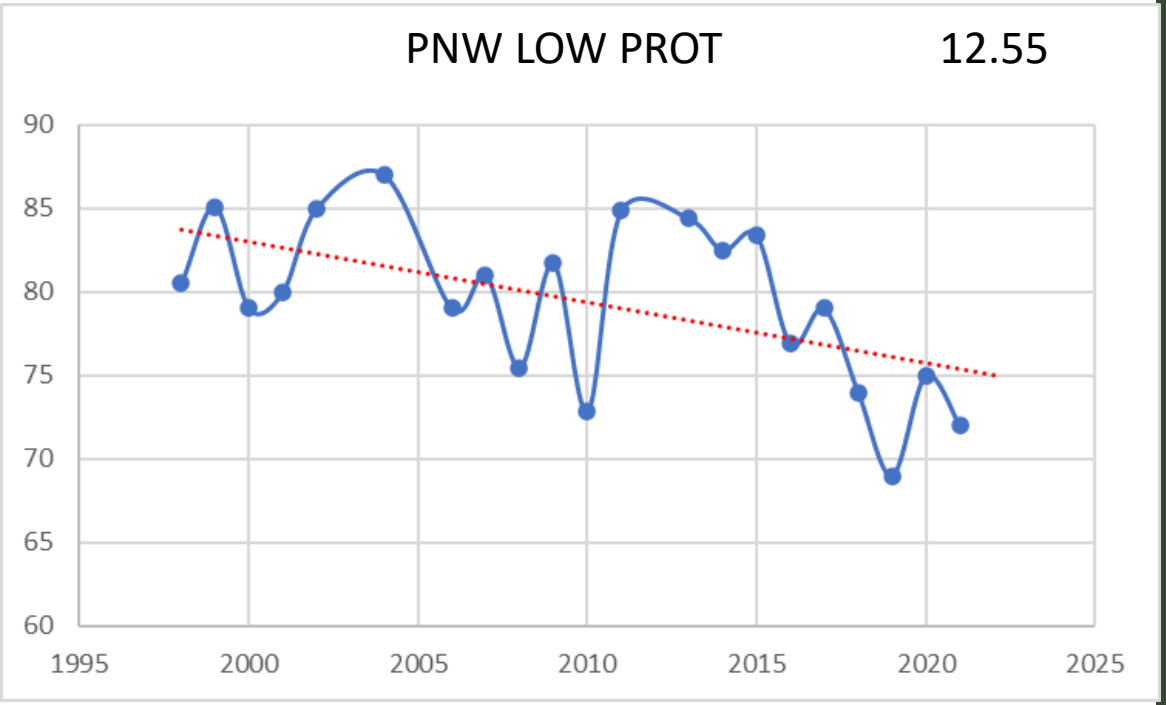

AVERAGE KERNEL HARDNESS HRW

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Capacidad de silo de reposo (ton) = Capacidad de molienda (ton/hr) x Tiempo de reposo (hr)

$$\text{Máximo tiempo de reposo (hr)} = \frac{\text{Capacidad de silo de reposo (ton)}}{\text{Capacidad de molienda (ton/hr)}}$$

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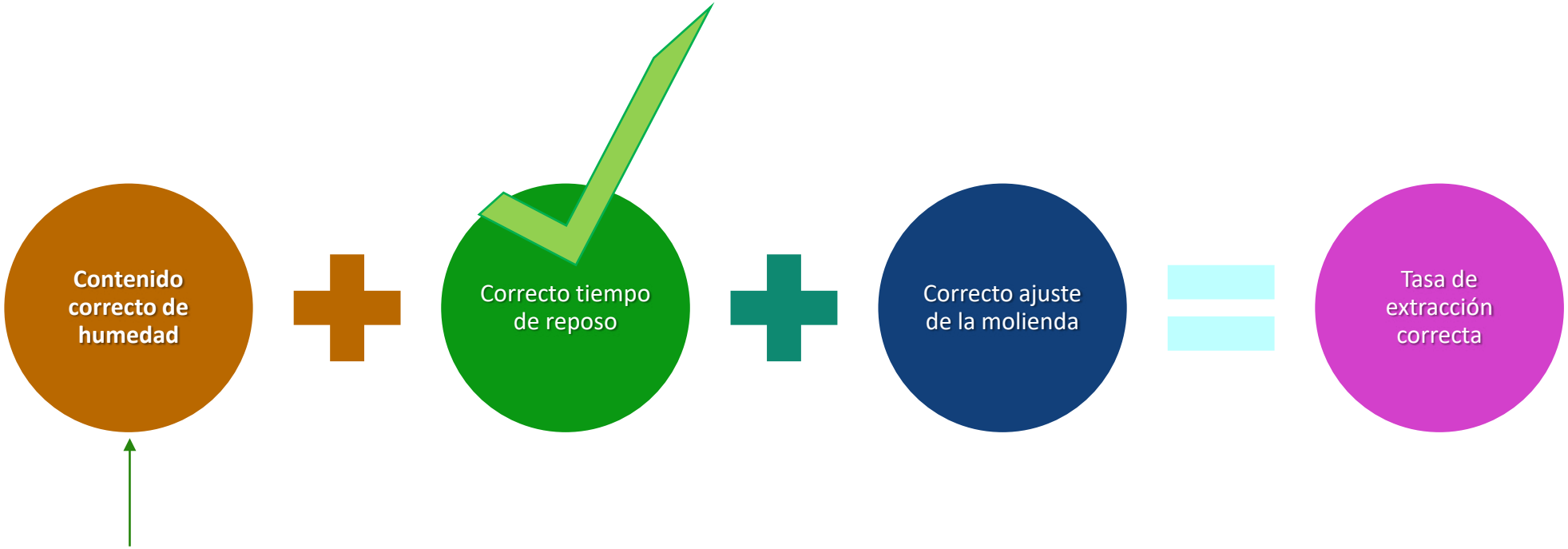
Para optimizar la extracción en el proceso de molienda se necesita:



PROXIMAS INVESTIGACIONES EN EL LABORATORIO:

- Mas pruebas con diferentes tiempos de reposo.
- Pruebas con diferentes humedades.

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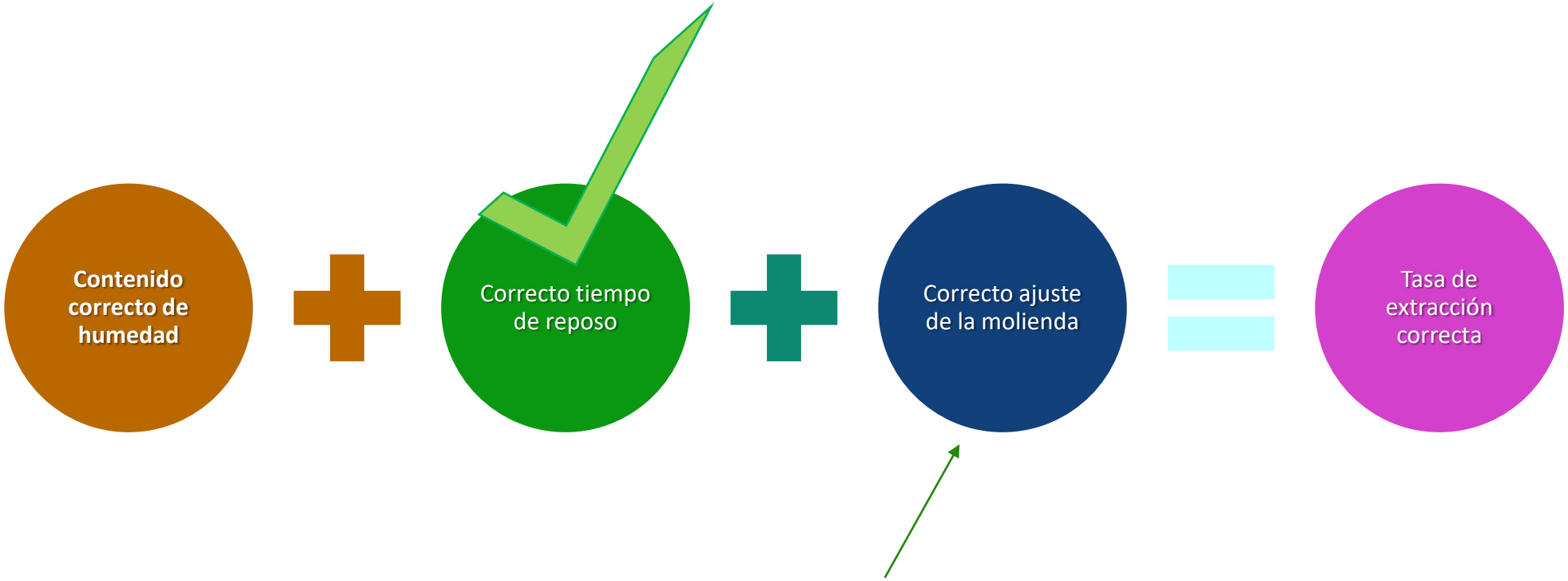
Para optimizar la extracción en el proceso de molienda se necesita:



Esta labor es de cada molinero y de cada molino, en el laboratorio no es lo ideal trabajar en ajustar extracciones.

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Factor adicional a tomar en cuenta la TEMPERATURA

Temperatura del agua para el acondicionado en zonas frescas debe de ser por encima de 25°C.

Y la temperatura del trigo debe estar en el rango de 23°C a 27°C.

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¿Cuánta variabilidad tenemos?

- **En nuestro trigo.**
- **En nuestra molienda.**
- **En nuestra harina.**

¿Cuánto tolera nuestro cliente? (requerimientos).

¿Podemos satisfacer sus necesidades de una manera razonable?

Si no es así, ¿qué podemos hacer para corregir esto?

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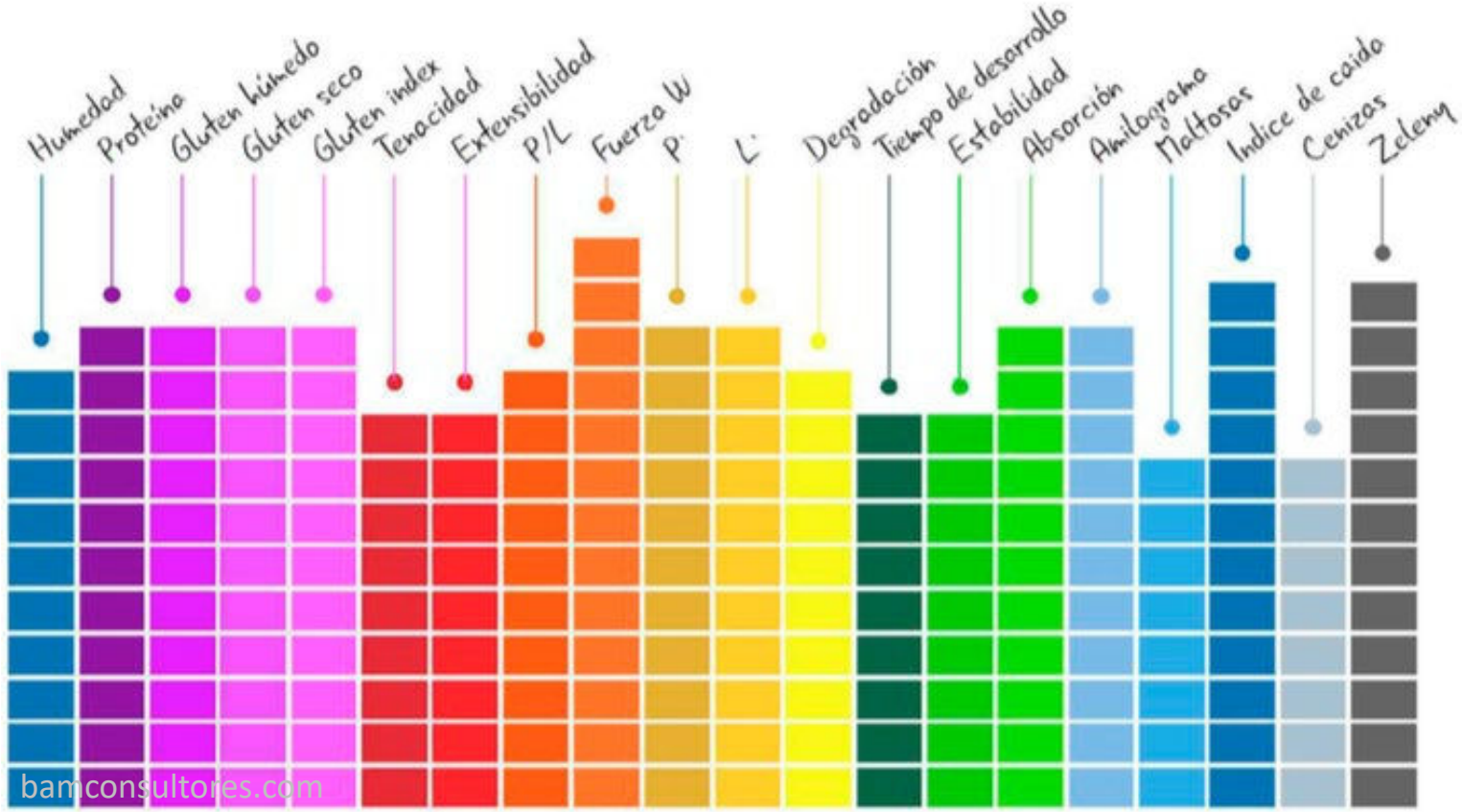

U.S. Wheat Associates Sudamerica

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CONCLUSIONES

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