

Overseas Varietal Analysis

2013 Crop Soft Red Winter Wheat

Sponsored by:
U.S. Wheat Associates

**Assessments of Wheat and Flour Samples
Completed by:**

**China
Dominican Republic
Indonesia
Malaysia
Mexico
Philippines
Thailand**

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EXECUTIVE SUMMARY OF INTERNATIONAL COOPERATORS' RESULTS

Wheat Sources and Characteristics

The 2013 U.S. Wheat Associates Overseas Varietal Analysis project evaluated ten soft red winter wheat (SRW) varieties: Shirley from Virginia; WB-196 and LCS News from Ohio; SY Harrison, Havoc and Vandal from Arkansas; LA754, LA841 and TV8861 from Louisiana; and Bess from Illinois. WB-196, LCS News, TV8861, SY Harrison, Havoc, Vandal and Bess were graded U.S. #1. Shirley, LA841 and LA754 were graded U.S. #2, mainly due to low test weight for the first two and high percentage of damaged kernel for the third. Wheat grain samples of ten varieties were evaluated for grain characteristics, milled using a Miag Multomat pilot mill, and assessed for flour composition, solvent absorption characteristics and sugar-snap cooking baking quality by the Soft Wheat Quality Laboratory. Farinograph and alveograph parameters of flour samples were conducted by the Wheat Marketing Center, OR. Wheat flours were further tested by the 11 overseas cooperators from China, the Dominican Republic, Indonesia, Malaysia, Mexico, the Philippines and Thailand for making cookies, sponge cakes, chiffon cakes and southern-style Chinese steam buns.

The ten OVA varieties ranged from 59.3 to 61.2 lb/bu in test weight, 32.9 to 51.4 g in 1000 kernel weight, 8.6 to 10.8% in grain protein content and -3.4 to 16.4 in single kernel characterization system (SKCS) kernel hardness. Falling number of grain ranged from 299 in LCS News to 400 in Shirley. Flour yield of the ten entries ranged from 71.8 to 74.5%, with flour ash content of 0.33 to 0.40%. Flour protein content was lowest in WB-196 (5.8%) and highest in LA754 (8.4%). Flours exhibited small differences in water and sodium solvent retention capacities (SRCs) of 52.7 to 57.6% and 67.3 to 76.7%, respectively. LA754, LA841 and LCS News had much greater sucrose and lactic acid SRCs than others, probably due to their high protein content and/or strong gluten protein. LA754 and LA841 exhibited much greater farinograph dough stability and alveograph W values than other varieties, indicating their strong gluten protein. SY Harrison produced sugar-snap cookies of the largest diameter, followed by Havoc and TV8861, while LCS News produced the smallest cookie.

The summary that follows is primarily based on the rankings in Table 3-1. The relative ranks of SRW varieties for baking cookies, sponge cakes and chiffon cakes varied widely among cooperators, possibly due to differences in formulas, baking procedures and preferences.

Product Preferences

- 1) Among all cooperators that evaluated the entries for baking cookies, LA841 and TV8861 were ranked highest followed by Shirley, SY Harrison and WB-196, which were all rated higher than the average ranking of the cooperator standard flours (controls). LCS News showed the lowest average ranking for baking cookies.
- 2) For baking sponge cakes, the cooperator standard flours exhibited a higher average ranking than the OVA varieties. Among the OVA varieties, Bess exhibited the highest ranking (3.3), followed by LA841 (3.8) and LA754 (5.5). Shirley and SY Harrison were lowest in average rankings for baking sponge cakes (9.0).
- 3) Bess performed best for baking chiffon cakes with an average ranking of 3.3, which was higher than the average ranking of the cooperator standard flours (3.8). Shirley, Havoc and LA754 exhibited intermediate average rankings of 4.5-5.5.

- 4) The rankings of SRW wheat flours for baking cookies are correlated with those for making steam buns ($r=0.61$). The rankings for baking sponge cakes are correlated with those for baking chiffon cakes ($r=0.53$) and steam buns ($r=0.65$). There was a significant correlation between the rankings for making chiffon cakes and for making steam buns ($r=0.64$).
- 5) LA841 ranked highest for making steam buns and higher than the cooperator standard flours, followed by WB-196 and LA754. Bess and Shirley ranked tenth and eleventh, respectively, for making steam buns.

The overall average rankings for preparation of cookies, sponge cakes, chiffon cakes and steam buns were highest for LA841 and Bess (3.8), followed by TV8861 (4.7) and Shirley (4.9). LCS News ranked last in the overall average ranking, due to its ranking lowest for baking cookies and chiffon cakes, and its low ranking (ninth) for making steam buns.

Summary of Cultivars

This summary is primarily based on the grain characteristics, flour composition, solvent absorption capacity, dough rheological properties and sugar-snap cookie baking test performed by the SWQL (Tables 2-1, 2-2 & 2-3), and the rankings and desirability scores for making cookies, sponge cakes, chiffon cakes and steam buns (Tables 3-1, 3-2, 3-3, 3-4, 3-5 & 3-6).

Shirley exhibited an excellent break flour yield (73.6%), low flour protein content (6.6%), but higher ash content (0.40%) than others. With relatively high water and sodium carbonate SRCs, the lowest lactic acid SRC (indicative of extremely mellow/weak protein) and low protein content, Shirley produced sugar-snap cookies of an intermediate diameter. Shirley was rated as the second highest in desirability for baking cookies and the highest for baking chiffon cakes, and had an intermediate overall desirability score for preparation of all products.

WB-196 was lowest in flour protein and ash contents, and exhibited relatively high water and sodium carbonate SRCs comparable to those of Shirley; additionally, WB-196 produced sugar-snap cookies of comparable diameter, and had a similar desirability score for baking cookies, to Shirley.

SY Harrison exhibited the lowest SKCS kernel hardness, intermediate flour protein, lowest starch damage content, and lowest water, sodium carbonate and sucrose SRC values, and produced a sugar-snap cookie with the largest diameter. SY Harrison received the highest average desirability score for quality of cookie from the cooperators and ranked second for baking cookies.

LA754 and LA841 shared similar grain and flour characteristics, and had comparable water, sodium carbonate, sucrose and lactic acid SRC values. They produced sugar-snap cookies of similar diameter; however, LA841 had a higher desirability score for products and a higher overall average quality ranking than LA754. LA841 had the best average rank of 4.3 among the entries (Table 3-1). LA841 ranked third in overall average quality for making baked goods.

TV8861 and Havoc were similar in flour protein content, SRC parameters and diameters of sugar-snap cookies, which were intermediate among the entries. TV8861 exhibited a higher overall desirability score (7.1) for baking and a higher average ranking (5.5) than Havoc (6.7 for overall desirability and 6.4 for average ranking).

Vandal and LCS News shared similarly low protein content of flour (6.5-6.6%) and relatively high water and sodium carbonate SRC values compared to other entries. Vandal had significantly lower sucrose and lactic SRCs, and produced cookies with larger diameters than LCS News. Although they were similar in desirability scores for baking, Vandal exhibited a slightly higher overall desirability score and overall average quality ranking than LCS News. They were ranked ninth and tenth in overall average quality (Table 3-1).

Bess was intermediate in flour protein content and all four SRC tests, and produced sugar-snap cookies of relatively small diameter among the ten varieties. It had consistently higher desirability scores for flour quality, dough and batter properties, baked products and overall baking quality. Bess ranked second in overall average quality.

Recommendations for Class

SRW wheat is well documented as having soft kernel texture of less than 16.4 SKCS kernel hardness (Table 2-1), and low flour protein content of less than 8.4% (Table 2-2) as we observed in the 2013 crop entries. Varietal differences are still evident in break flour yield, which ranged from 30.4 to 39.3%, in absorption capacity (88.5 to 104.7% in sucrose SRC) and in protein strength measured by lactic acid SRC (75.8 to 114.4%). Even though all the entries showed relatively good performance in sugar-snap cookie baking, SY Harrison, which had the lowest kernel hardness and consequently highest break flour yield, still produced sugar-snap cookies of the largest diameter.

As observed in overall quality ranking of the SRW wheat entries, it is apparent that each cooperator has a somewhat different preference standard even for the same type of product. The overall preference rankings of the entries for baking cookies, sponge cakes, chiffon cakes and steam buns varied widely depending on the cooperator. Furthermore, the most preferred variety for baking cookies was not the one for baking sponge cakes. LA841 was ranked highest for baking cookies and steam buns, but Bess was the most preferred variety for baking sponge cakes and chiffon cakes. Compared to the cooperator standard flours (controls), five SRW wheat varieties had equal or higher rankings for baking cookies. None showed better rankings for baking sponge cakes, while one showed a higher ranking for baking chiffon cakes and one was ranked higher for making steam buns. These results indicate that there are needs for clearly identifying and improving the quality attributes required for making sponge cakes, chiffon cakes and steam buns specific to each overseas SRW wheat buyer. Desirability scores of the SRW wheat entries in flour characteristics for making cookies and sponge cakes were all lower than the overseas cooperator standard flours (controls).

LA841 and Bess received the highest overall average quality ranking. It is interesting to note that LA841 exhibited the highest lactic acid SRC, indicative of protein strength, while Bess had an intermediate value, indicating that protein quality differences had minimal influence on the overall average quality ranking of flour. Targets for protein content and gluten protein strength of SRW wheat preferred for making each soft wheat product in each overseas country still need to be identified to meet specific buyer's demands for end-use quality of SRW wheat.

CHAPTER 1. Introduction

Project Background

For over fifty years the Soft Wheat Quality Laboratory (SWQL) of the Agricultural Research Service, United States Department of Agriculture, has completed comparative physical, chemical, dough handling (rheological), milling and end-product analyses of promising wheat lines prior to their release by state universities and private breeding programs. Based on these results and other agronomic trait analyses, wheat varieties are selected for commercial release. Since on average 50% of wheat grown in the United States is exported, similar variety quality analyses are needed from international users of U.S. wheat so that those wheat breeders can design wheat varieties to satisfy both U.S. and international markets.

Through the Overseas Varietal Analysis (OVA) program of the U.S. Wheat Associates, information on wheat and flour quality from international users will be shared with the U.S. wheat industry on a variety basis. Wheat samples are submitted to the SWQL by variety name from respective wheat class regions of the United States. Samples of varieties are milled and distributed to international cooperators through arrangements made by the U.S. Wheat Associates foreign offices (FOS). Cooperators analyze flour samples for physical, chemical, dough-handling (rheological), milling and end-processing properties. The international cooperators rate the samples for “overall acceptability”, and the data are compiled for distribution to U.S. producers, breeders, wheat quality laboratories, the grain trade and participating international cooperators.

Project Purpose

The Overseas Varietal Analysis program evaluates the quality of soft red wheat varieties in cooperation with international millers and bakers. The specific purpose of the cooperative study is to enhance the milling and end-processing quality of soft red wheat to better meet the needs of international customers.

Project Approach

The Soft Wheat Quality Laboratory provided flour samples of ten soft red winter wheat varieties to overseas cooperators along with milling, baking and dough rheology test information. The methods used for milling and flour evaluation by the Soft Wheat Quality Laboratory were standard procedures of the laboratory and are described in the appendix to this report.

Cooperators were asked to evaluate the samples using their standard methods and compare the results to a local control flour. Cooperators were asked to provide: 1) results of their flour evaluations including proximate analysis, rheology and baking evaluations, 2) a numerical rating of each flour for dough properties, baked product quality and overall performance and 3) a ranking of the flours for suitability to the cooperator’s market. As part of the ranking, cooperators also provided comments about the likes and dislikes of the flour. Separate from the analysis of OVA flour samples, each cooperator completed a preference survey describing their flour specifications and targeted end-uses for the flour.

Interpretation of the results was based on trends in the data using correlation analysis. Measured flour quality was correlated with individual cooperator rankings and overall rankings. The

qualities of the most preferred varieties were also compared to the least preferred varieties. Rather than trying to recommend one variety over another, the summaries recommend directions for future improvement of varieties and for improved marketing of specific quality wheat to customers.

Sample selection and Soft Wheat Quality Laboratory Methods

The Soft Wheat Quality Laboratory contacts seed producers within soft red winter wheat member states of the U.S. Wheat Associates. Together with the seed producers, the laboratory selects new varieties and established varieties that represent the range of quality present in the crop production areas supplying the export markets of the U.S. Grain is then obtained from commercial seed fields of the variety to ensure identity of the grain. In some cases, it is necessary to go to an adjacent state to obtain pure commercially grown seed of a targeted variety.

Grain is received in September, milled at the laboratory in December and January, and shipped to cooperators shortly thereafter. Included with the shipment is a preliminary quality evaluation. This year, that information included physical and chemical properties of the grain and flour, milling characteristics, alveograph information, solvent retention capacity, and cookie bake data. The complete methods for the Soft Wheat Quality Laboratory are given in Appendix I to this report.

Cooperator Evaluation

Cooperators evaluate the flour samples for quality as it is important to them in their market. This commonly includes baking tests, but also physical and chemical evaluations. Based on these evaluations and the information provided by the Soft Wheat Quality Laboratory, cooperators are asked to evaluate and comment on the flour samples. The questions to which they respond are listed below. The cooperators provide comments, and rate the quality of the flour using a 1 to 9 scale (9 being best). They also rank the varieties in comparison to each other and to a local control flour. The numerical evaluations and ranks of the varietal flour samples are used for summarizing the performance of the variety.

The questions asked of the cooperators are:

Question 1 - Based on the flour data provided or your analysis, please score the overall flour quality of these varieties.

Question 2 - Based on your analysis or the rheology data provided, please score the overall dough or batter handling/processing performance of these varieties.

Question 3 - Based on your analysis please score the end-product performance of these varietal samples.

Question 4 - Based on your review please score the overall acceptability of these varietal samples.

Overall Report Format

The SWQL evaluation results of the entries for grain characteristics, milling performance, flour composition, solvent absorption capacities and sugar-snap cookie baking quality were

summarized in figures and tables. The results of the cooperators were compiled into summary tables of numerical scores. The physical, chemical, and baking evaluations of the varietal flours are presented in table format within the section for each cooperator. The comments from cooperators are summarized in the narrative descriptions in tables.

The appendices to the report are included in the printed form. They contain information on methods used by the Soft Wheat Quality Laboratory, the alveograph and mixograph images of flour samples, and the baking formulas for products made during the U.S. Wheat Associates' Singapore Workshop.

CHAPTER 2. USDA-ARS Soft Wheat Quality Laboratory Evaluation Results

Grain Characteristics and Milling Quality (Tables 2-1, 2-2 & 2-3: Figures 2-1, 2-2, 2-3, 2-4 & 2-5)

Test weights of grain were greater than 60 lb/bu in eight SRW wheat varieties and ranged from 59.3 to 59.5 lb/bu in two varieties. All had greater test weights than the minimum requirement (58 lb/bu) for U.S. grade 2. SY Harrison exhibited a notably lower SKCS kernel hardness value (-3.4) than other varieties, for which hardness ranged from 6.2 to 16.4. LA754 was highest in kernel weight and diameter. Falling number of grain in the varieties was greater than 328 with the exception of LCS News, whose value was 299.

Break flour yield and straight grade flour yield of the SWQL Miag Multomat flour mill ranged from 30.4 to 39.3% and from 71.8 to 74.5%, respectively. SY Harrison exhibited the highest break flour yield, apparently the result of the lowest kernel hardness. LA754, being highest in kernel weight and diameter, exhibited the highest straight grade flour yield with the lowest amount of break flour.

Ash curves were used to measure milling characteristics of the varieties in a long-flow mill. The mill stream analysis depicts the increase in flour ash as a function of flour recovery. Cumulative ash curves should have flat lines initially with the redust, first two break, grader and first two middlings flour streams, then increasing curves with the addition of the third break and remaining middling streams of flour. All ten varieties had flour ash curves typical of a good-milling wheat grain, showing small increases in ash content until the cumulative flour yield exceeded 60%, and then steep increases with flour yield over 60%.

Flour Composition, Biochemical and Rheological Properties (Tables 2-3 & 2-4)

Flour protein content of the ten varieties ranged from 5.8% in WB-196 to 8.4% in LA754, falling into the typical protein content range of SRW wheat. Ash content of straight grade flour was lower than 0.40% in all ten varieties. Damaged starch content was lowest in SY Harrison, corresponding to its low kernel hardness, and highest in Shirley and LCS News.

Water and sodium carbonate SRC values exhibited rather small differences among the ten varieties, and ranged from 52.7 to 57.6% and from 67.3 to 76.7%, respectively. The ten varieties exhibited significant differences in sucrose and lactic acid SRC values, which ranged from 88.5 to 104.7% and 75.8 to 114.4%, respectively. LA754, LA841 and LCS News had relatively higher sucrose and lactic acid SRC values (of over 101.8%) than other varieties.

LA754 and LA841, having relatively strong gluten protein as determined by lactic acid SRC, also exhibited significantly longer mixograph peak time, longer farinograph dough development time and higher stability, and much higher alveograph W values than other varieties. LCS News and Bess showed intermediate farinograph dough development time and stability, and alveograph W values.

Sugar-Snap Cookie Baking Quality

For the sugar-snap cookie test, the traditional preference is for larger diameters. Cookie

diameters of the ten varieties ranged from 17.1 to 18.5 cm, and fell into the typical range for SRW wheat. SY Harrison produced a sugar-snap cookie of the largest diameter. Diameter of sugar-snap cookies exhibited significant relationships with break flour yield, starch damage, sodium carbonate and sucrose SRC values, mixograph absorption and alveograph W values.

Table 2- 1 Yield of flour mill streams of ten soft red winter wheat varieties

Flour Stream	Shirley	Lion	SY Harrison	LA 754	LA 841	TV 8861	Havoc	Vandal	LCS News	Bess	Mean	Min	Max
1st Bk	9.9	10.1	12.0	8.5	9.0	11.6	10.3	11.1	10.7	9.9	10.3	8.5	12.0
2nd Bk	9.3	9.8	12.2	8.0	9.1	11.8	8.9	11.7	8.9	10.6	10.0	8.0	12.2
Grader	4.6	4.7	6.3	4.3	5.7	5.9	4.8	6.4	5.0	5.0	5.3	4.3	6.4
3rd Bk	10.0	8.7	8.7	9.5	8.4	7.6	8.3	7.7	8.9	8.0	8.6	7.6	10.0
Total Break	33.8	33.3	39.3	30.4	32.3	36.9	32.4	36.9	33.4	33.5	34.2	30.4	39.3
1st Mids	16.6	15.7	15.8	17.1	14.3	16.0	17.6	13.5	15.2	14.1	15.6	13.5	17.6
2nd Mids	6.5	7.7	6.5	8.4	8.4	7.7	8.4	7.7	7.9	8.8	7.8	6.5	8.8
3rd Mids	4.8	5.1	3.6	6.1	5.1	3.4	4.5	4.1	4.5	5.0	4.6	3.4	6.1
ReDust	7.2	6.4	6.1	8.2	7.9	6.6	7.7	6.3	6.3	6.1	6.9	6.1	8.2
4th Mids	3.0	3.0	2.0	3.0	3.1	1.9	2.0	2.8	2.8	3.0	2.7	1.9	3.1
5th Mids	1.7	1.5	1.1	1.3	1.5	1.1	1.0	1.7	1.6	1.7	1.4	1.0	1.7
Total Mids	39.8	39.6	35.1	44.1	40.2	36.6	41.1	36.0	38.4	38.7	39.0	35.1	44.1
Total Flour	73.6	72.9	74.3	74.5	72.5	73.5	73.5	72.8	71.8	72.2	73.2	71.8	74.5
Bk Shorts	7.5	6.8	6.5	6.1	5.8	6.6	6.4	7.2	8.9	7.7	7.0	5.8	8.9
Red Dog	1.4	1.0	0.8	0.9	1.0	1.0	0.8	1.3	1.3	1.3	1.1	0.8	1.4
Tail Shorts	0.5	0.3	0.3	0.3	0.3	0.3	0.2	0.4	0.5	0.4	0.3	0.2	0.5
Bran	16.8	18.8	17.7	17.9	20.0	18.0	18.7	18.3	17.0	18.1	18.1	16.8	20.0
Total Byproduct	26.2	26.9	25.3	25.2	27.2	25.9	26.1	27.2	27.8	27.5	26.5	25.2	27.8

Table 2- 2 Grain Characteristics of SRW Wheat Varieties

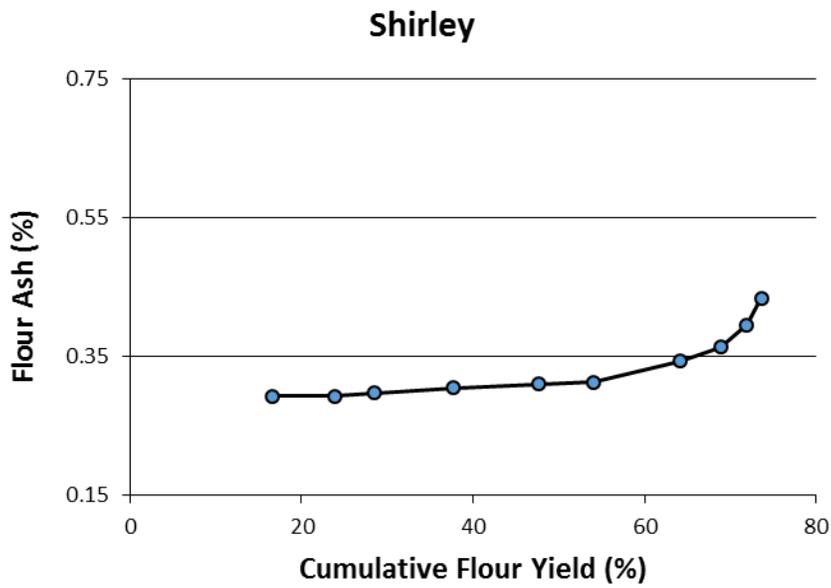
Variety	Test Weight (lb/bu)	Thousand Kernel Weight (g)	Protein (%, 12% mb)	SKCS Kernel Hardness	Kernel Weight (mg)	Kernel Diameter (mm)	Falling Number (sec)
Shirley	59.3	41.1	8.7	9.9	40.1	2.5	400
WB-196	60.3	35.5	7.7	6.4	35.1	2.3	328
SY Harrison	61.2	38.7	9.0	-3.4	36.7	2.4	341
LA754	60.0	51.4	10.5	6.2	50.1	3.0	370
LA841	59.5	36.6	9.9	9.3	34.5	2.6	359
TV8861	61.2	37.3	9.1	10.8	36.4	2.3	383
Havoc	60.7	35.7	9.3	16.4	35.0	2.4	330
Vandal	61.1	44.5	8.6	4.3	41.8	2.6	340
LCS News	60.2	38.4	9.0	13.5	36.1	2.5	299
Bess	60.3	32.9	9.5	12.6	32.4	2.2	362

Table 2- 3 Milling Yield, Composition, Falling Number and Solvent Retention Capacities of SRW Wheat Flours

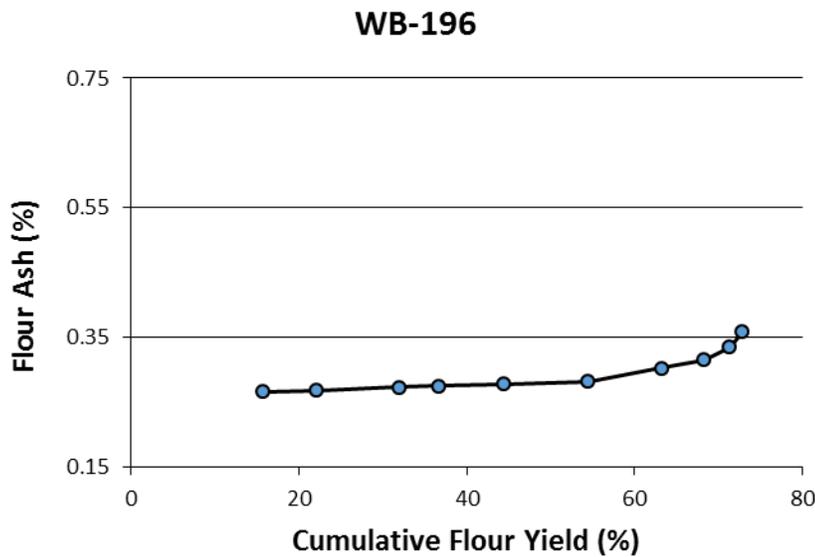
Variety	Miag Milling		Protein (%)	Moisture (%)	Ash (%)	Flour Color (L*)	Alpha-Amylase (CU/g)	Starch Damage (%)	Solvent Retention Capacity (%)			
	Break Flour Yield (%)	Straight Grade Flour Yield (%)							Water (%)	Sodium Carbonate (%)	Sucrose (%)	Lactic Acid (%)
Shirley	33.8	73.6	6.6	13.5	0.40	92.8	0.068	2.95	57.3	76.6	98.0	75.8
WB-196	33.3	72.9	5.8	13.8	0.33	93.5	0.031	2.03	57.1	75.0	95.3	91.8
SY Harrison	39.3	74.3	6.8	13.2	0.39	93.4	0.047	1.02	54.3	71.0	88.5	87.1
LA754	30.4	74.5	8.4	13.4	0.38	93.3	0.048	2.67	55.7	71.3	101.8	109.1
LA841	32.3	72.5	7.8	13.3	0.37	93.2	0.029	2.11	54.8	74.2	104.7	114.4
TV8861	36.9	73.5	7.0	13.4	0.40	93.2	0.031	1.46	54.9	69.5	94.0	82.7
Havoc	32.4	73.5	7.3	13.2	0.36	93.0	0.028	2.39	52.7	67.3	92.3	83.7
Vandal	36.9	72.8	6.5	13.4	0.38	93.6	0.037	1.44	57.6	75.6	98.6	95.0
LCS News	33.4	71.8	6.6	13.8	0.35	93.1	0.066	2.95	57.6	76.7	103.4	106.6
Bess	33.5	72.2	7.4	13.5	0.36	93.4	0.026	1.58	56.3	75.3	97.8	94.9

Table 2- 4 Dough Rheological Characteristics and Sugar Snap cookie Diameter of SRW Wheat Flours

Variety	Mixograph		Farinograph:				Alveograph:				Sugar Snap Cookie Diameter (cm)
	Abs. (%)	Peak Time (min)	Abs. (%)	Dev. Time (min)	Stability (min)	MTI (FU)	P (mm)	L (mm)	P/L	W (10 ⁻⁴ joules)	
Shirley	55	0.8	52.6	0.9	0.8	133	33	60	0.55	56	17.6
WB-196	54	0.9	51.2	0.9	0.7	141	40	64	0.63	78	17.6
SY Harrison	53	0.6	49.8	0.9	0.8	154	28	109	0.26	84	18.5
LA754	56	2.7	53.0	1.4	2.2	63	47	141	0.33	183	17.3
LA841	55	3.5	51.0	1.2	2.0	74	46	127	0.36	167	17.4
TV8861	54	1.0	51.3	0.9	0.6	163	37	92	0.40	102	17.9
Havoc	54	1.5	49.7	0.8	0.9	131	26	143	0.18	88	18.1
Vandal	56	0.7	51.5	0.9	0.7	141	50	47	1.06	87	17.8
LCS News	57	0.6	53.5	1.0	1.0	123	70	45	1.56	124	17.1
Bess	54	0.7	53.5	1.0	1.2	93	53	78	0.68	119	17.2



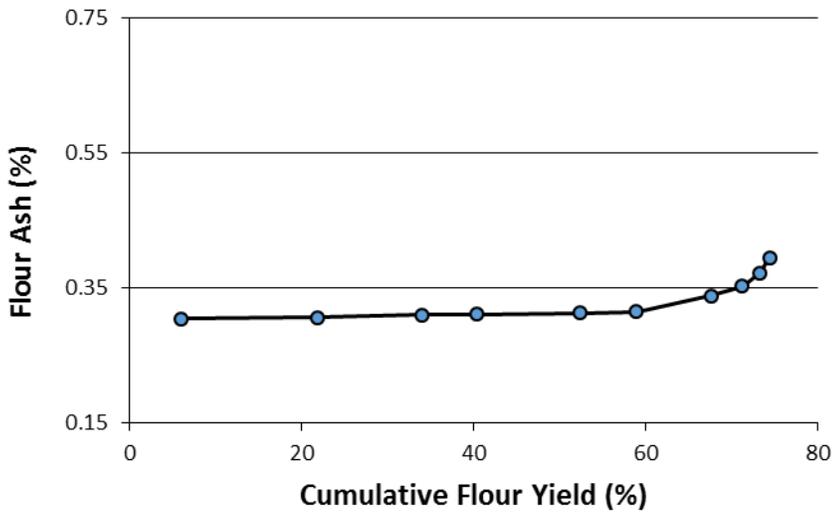
Meal Stream	Yield (%)	Ash (%)
1st Bk	9.9	0.332
2nd Bk	9.3	0.326
Grader	4.6	0.321
3rd Bk	10.0	0.509
1st Mids	16.6	0.293
2nd Mids	6.5	0.335
3rd Mids	4.8	0.634
ReDust	7.2	0.294
4th Mids	3.0	1.128
5th Mids	1.7	2.016
Bk Shorts	7.5	4.010
Red Dog	1.4	2.642
Tail Shorts	0.5	3.197
Bran	16.8	4.975



Meal Stream	Yield (%)	Ash (%)
1st Bk	10.1	0.30
2nd Bk	9.8	0.29
Grader	4.7	0.29
3rd Bk	8.7	0.43
1st Mids	15.7	0.27
2nd Mids	7.7	0.29
3rd Mids	5.1	0.48
ReDust	6.4	0.27
4th Mids	3.0	0.77
5th Mids	1.5	1.45
Bk Shorts	6.8	3.59
Red Dog	1.0	2.45
Tail Shorts	0.3	3.08
Bran	18.8	5.00

Figure 2- 1 Ash curves, and yields and ash contents of flour meal streams of Shirley and WB-196.

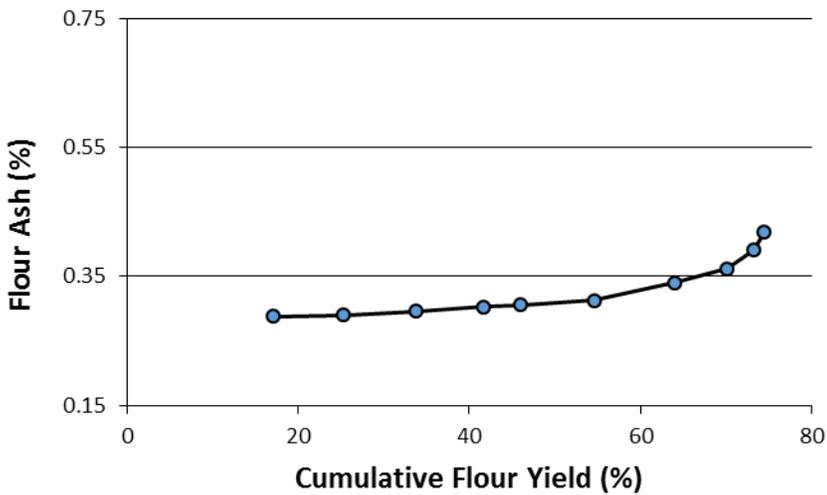
SY Harrison



SY Harrison

Meal Stream	Yield (%)	Ash (%)
1st Bk	12.0	0.32
2nd Bk	12.2	0.32
Grader	6.3	0.32
3rd Bk	8.7	0.49
1st Mids	15.8	0.31
2nd Mids	6.5	0.33
3rd Mids	3.6	0.62
ReDust	6.1	0.30
4th Mids	2.0	1.06
5th Mids	1.1	1.88
Bk Shorts	6.5	3.91
Red Dog	0.8	2.72
Tail Shorts	0.3	3.17
Bran	17.7	5.02

LA 754

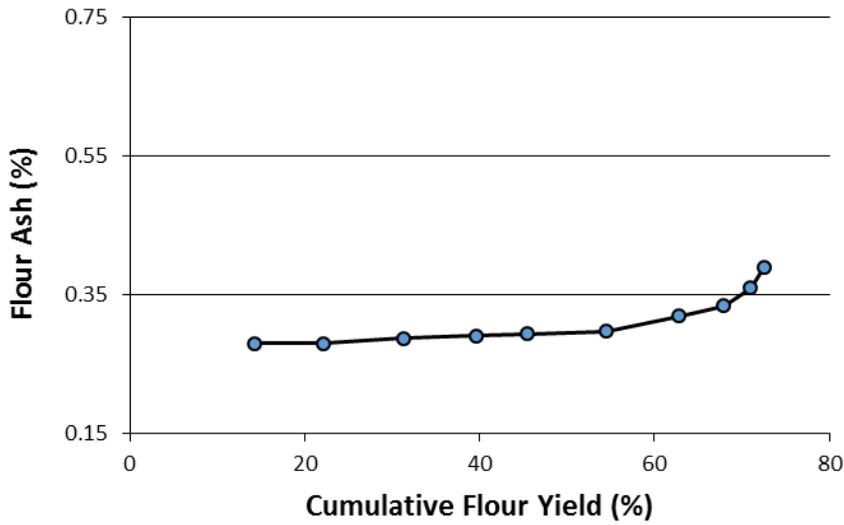


LA 754

Meal Stream	Yield (%)	Ash (%)
1st Bk	8.5	0.35
2nd Bk	8.0	0.33
Grader	4.3	0.33
3rd Bk	9.5	0.50
1st Mids	17.1	0.29
2nd Mids	8.4	0.32
3rd Mids	6.1	0.59
ReDust	8.2	0.29
4th Mids	3.0	1.05
5th Mids	1.3	2.05
Bk Shorts	6.1	4.36
Red Dog	0.9	2.80
Tail Shorts	0.3	3.18
Bran	17.9	5.62

Figure 2- 2 Ash curves, and yields and ash contents of flour meal streams of SY Harrison and LA 754.

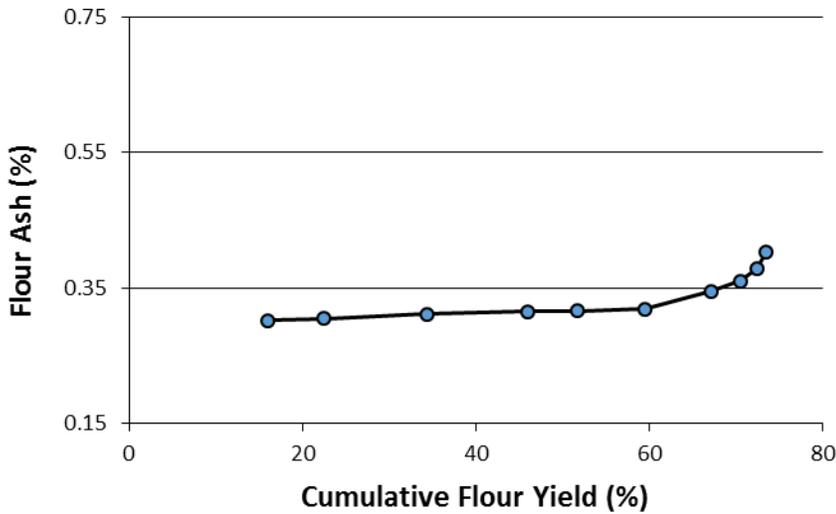
LA 841



LA 841

Meal Stream	Yield (%)	Ash (%)
1st Bk	9.0	0.31
2nd Bk	9.1	0.30
Grader	5.7	0.31
3rd Bk	8.4	0.46
1st Mids	14.3	0.28
2nd Mids	8.4	0.31
3rd Mids	5.1	0.51
ReDust	7.9	0.28
4th Mids	3.1	0.93
5th Mids	1.5	1.77
Bk Shorts	5.8	3.92
Red Dog	1.0	2.35
Tail Shorts	0.3	2.74
Bran	20.0	5.44

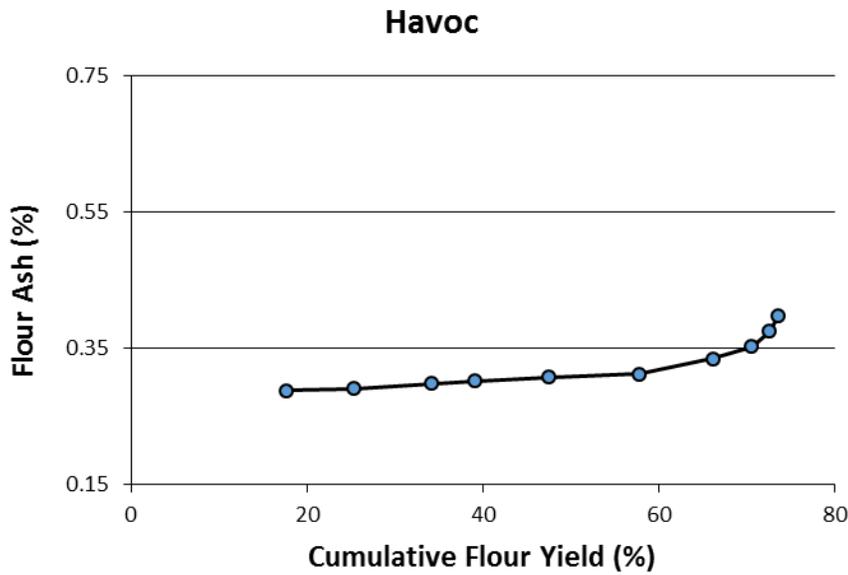
TV 8861



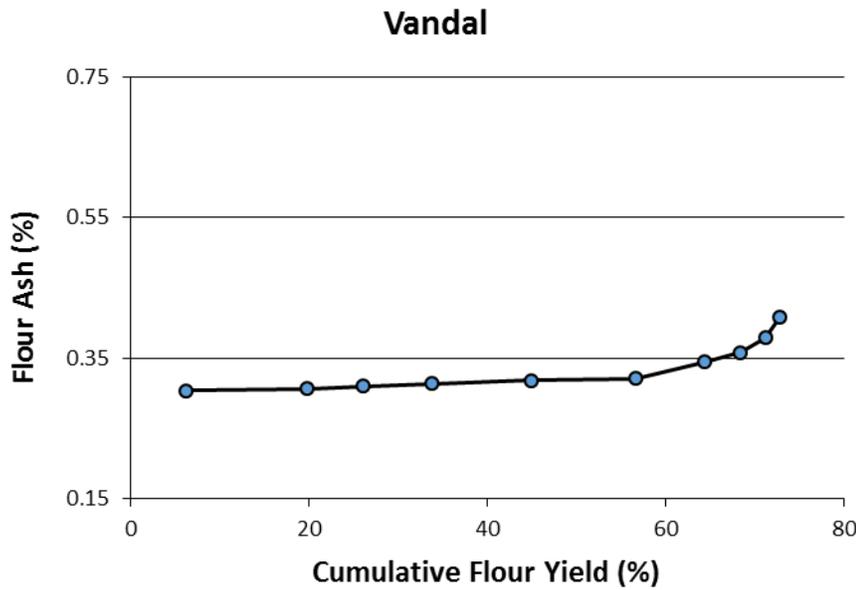
TV 8861

Meal Stream	Yield (%)	Ash (%)
1st Bk	11.6	0.33
2nd Bk	11.8	0.32
Grader	5.9	0.33
3rd Bk	7.6	0.54
1st Mids	16.0	0.30
2nd Mids	7.7	0.34
3rd Mids	3.4	0.66
ReDust	6.6	0.31
4th Mids	1.9	1.06
5th Mids	1.1	2.04
Bk Shorts	6.6	3.80
Red Dog	1.0	2.82
Tail Shorts	0.3	3.17
Bran	18.0	5.05

Figure 2- 3 Ash curves, and yields and ash contents of flour meal streams of LA 841 and TV 8861.

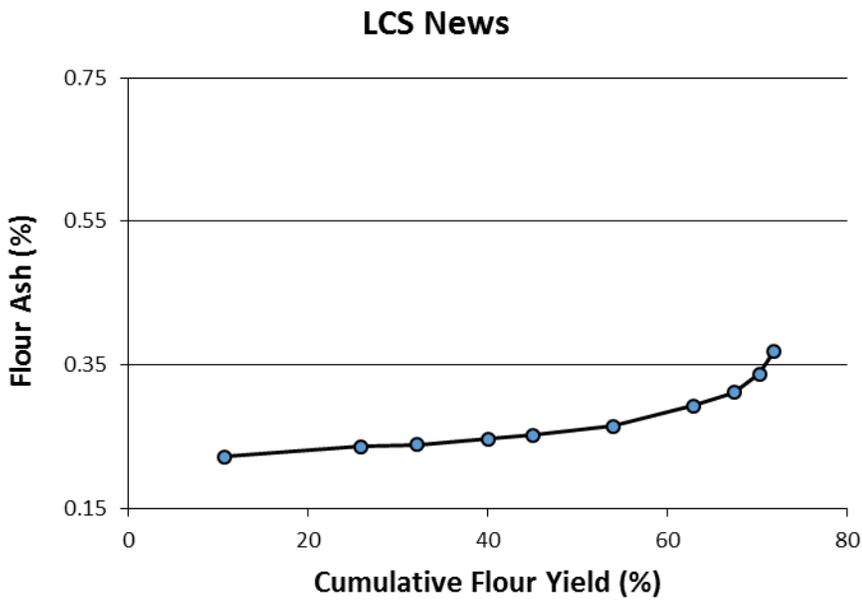


Havoc		
Meal Stream	Yield (%)	Ash (%)
1st Bk	10.3	0.33
2nd Bk	8.9	0.32
Grader	4.8	0.33
3rd Bk	8.3	0.49
1st Mids	17.6	0.29
2nd Mids	8.4	0.33
3rd Mids	4.5	0.62
ReDust	7.7	0.30
4th Mids	2.0	1.15
5th Mids	1.0	2.09
Bk Shorts	6.4	3.48
Red Dog	0.8	2.43
Tail Shorts	0.2	2.74
Bran	18.7	5.15

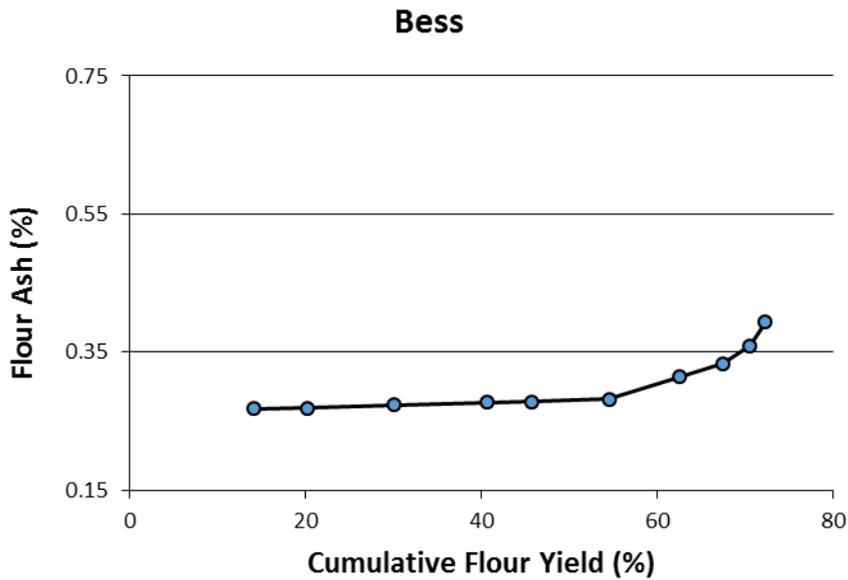


Vandal		
Meal Stream	Yield (%)	Ash (%)
1st Bk	11.1	0.33
2nd Bk	11.7	0.33
Grader	6.4	0.32
3rd Bk	7.7	0.52
1st Mids	13.5	0.31
2nd Mids	7.7	0.33
3rd Mids	4.1	0.57
ReDust	6.3	0.30
4th Mids	2.8	0.90
5th Mids	1.7	1.66
Bk Shorts	7.2	4.07
Red Dog	1.3	2.33
Tail Shorts	0.4	3.02
Bran	18.3	5.17

Figure 2- 4 Ash curves, and yields and ash contents of flour meal streams of Havoc and Vandal.



LCS News		
Meal Stream	Yield (%)	Ash (%)
1st Bk	10.7	0.22
2nd Bk	8.9	0.33
Grader	5.0	0.29
3rd Bk	8.9	0.47
1st Mids	15.2	0.25
2nd Mids	7.9	0.28
3rd Mids	4.5	0.57
ReDust	6.3	0.25
4th Mids	2.8	0.94
5th Mids	1.6	1.76
Bk Shorts	8.9	3.70
Red Dog	1.3	2.61
Tail Shorts	0.5	3.03
Bran	17.0	4.41



Bess		
Meal Stream	Yield (%)	Ash (%)
1st Bk	9.9	0.28
2nd Bk	10.6	0.29
Grader	5.0	0.29
3rd Bk	8.0	0.54
1st Mids	14.1	0.27
2nd Mids	8.8	0.30
3rd Mids	5.0	0.57
ReDust	6.1	0.27
4th Mids	3.0	0.92
5th Mids	1.7	1.82
Bk Shorts	7.7	4.07
Red Dog	1.3	2.87
Tail Shorts	0.4	3.28
Bran	18.1	5.12

Figure 2- 5 Ash curves, and yields and ash contents of flour meal streams of LCS News and Bess.

CHAPTER 3. Cooperator Rankings and Scores by Product

Introduction

The cooperators compared flours of the ten SRW wheat varieties to their own quality standard flours for suitability in making cookies, sponge cakes, chiffon cakes and steam buns. The varieties were ranked from 1 for most preferred to 9 for least preferred. The cooperators were also asked to respond to four questions addressing overall flour quality, dough or batter handling performance, end-product performance and overall acceptability. Scores were assigned to each sample in response to these questions. The scores were reported on a scale of 1 to 9, with the preferred varieties receiving the higher scores.

Cookies (Tables 3-1, 2, 3, 4 & 5)

The preference ranking of each variety fluctuated largely among the nine cooperators, indicating that there are large differences in the preferred quality attributes of cookies and consequently in flour quality requirements among cooperators. Based on the average rankings, LA841 and TV8861 were equally the most preferred flours for baking cookies (with a ranking of 4.2), followed by Shirley, SY Harrison and WB-196 with rankings of 4.4, 4.4 and 5.0, respectively. These four varieties received equal to or higher than average rankings compared to that of the cooperator standard flours (controls).

LA841 and TV8861 received relatively high, but not the highest, desirability scores for flour quality, dough handling properties and cookie baking performance. TV8861, however, had the highest overall desirability score for cookie baking performance. Compared to the cooperator standard flours, all ten of the OVA varieties had lower desirability scores for flour quality, while several varieties received comparable or higher desirability scores for dough handling properties and cookie baking performance, and for overall desirability.

The average rankings of the OVA varieties show no significant relationship with flour composition, SRC test values, dough rheological properties or sugar-snap cookie diameter. However, the average desirability scores of the varieties for flour quality exhibited significant correlations with flour protein content, mixograph peak time, farinograph dough development time and stability, and alveograph L and W values, indicating that the desirability scores of SRW wheat varieties assigned by the cooperators were heavily influenced by protein content and gluten protein characteristics.

Cakes (Tables 3-1, 2, 3, 4 & 5)

The quality ranking and desirability scores of the OVA varieties for baking sponge cakes were evaluated by six cooperators and those for chiffon cakes by four cooperators. For baking sponge cakes, the cooperator standard flour received the highest average ranking of 2.7, and was closely followed by Bess and LA841 with average rankings of 3.3 and 3.8, respectively. Shirley and SY Harrison were ranked last with the same average ranking of 9.0, mainly due to their lower scores for end-product performance than other varieties. Desirability scores of Shirley and SY Harrison were lower than 5.9, while they ranged from 6.4 to 8.0 for other varieties. It is not apparent why these two varieties received relatively low desirability scores in sponge cake performance and the lowest average ranking for making sponge cakes. Shirley and SY Harrison received the same average ranking of 4.4 for baking cookies, which was higher than the rankings of the cooperator

standards and six other varieties. This again indicates the differences in quality characteristics of flour required for making cookies and cakes. No correlation existed between the average rankings for making cookies and cakes. Interestingly, LA841 received the highest average ranking (4.2) for making cookies and the second highest average ranking (3.8) after Bess (3.3) for baking sponge cakes, showing the possibility of developing SRW wheat varieties suitable for making both cookies and cakes. The evident difference between LA841, Shirley and SY Harrison existed in gluten protein strength. While Shirley and SY Harrison had relatively weak and mellow protein, LA841 exhibited the strongest protein among the entries. The average ranking of the OVA varieties for baking sponge cakes showed significant correlations with flour protein content ($r=0.604$), lactic acid SRC value ($r=0.629$) and alveograph W value ($r=0.729$).

Bess had the highest average ranking of 2.0 for making chiffon cakes, probably due to its relatively high desirability scores for flour quality and product performance, and was followed by Shirley with an average ranking of 4.5. WB-196 and TV8861 exhibited average rankings of 8.3 and 8.0, respectively. Bess exhibited intermediate values among the ten varieties for flour composition, SRC tests and dough rheological property tests, but had the lowest α -amylase activity.

Steam Buns (Tables 3-1, 2, 3, 4 & 5)

Steam bun making quality of the OVA varieties was evaluated by a Chinese cooperator. LA841 received the first rank, while Shirley was ranked eleventh in overall quality for making steam buns, also showing contrasting desirability in flour quality, dough handling properties and product performance with the highest scores for the former and the lowest ones for the latter. LA841 contains relatively strong protein, but Shirley has weak protein as demonstrated by lactic acid SRC and dough properties (determined from mixograph, farinograph and alveograph values), suggesting that flour of strong protein is preferred for making steam buns.

Summary

Half of the OVA SRW wheat varieties were rated as equal to or higher than the cooperator standard flour for making cookies. These varieties all had protein content lower than 7.8%, but showed considerable variations in break flour yield, starch damage, solvent absorption capacities and protein strength, making it difficult to determine the conclusive flour quality characteristics preferred by cooperators for making cookies. The average rankings of the OVA varieties for baking cookies showed no significant relationships with flour characteristics, except with mixograph absorption. Similarly, flour characteristics preferred by the cooperators for making chiffon cakes were not evident from the ten varieties tested this year, even though Bess was the most preferred variety by the cooperators.

For baking sponge cakes, Bess and LA841 received higher average rankings than others, even though they were identified to contain strong protein as demonstrated by lactic acid SRC and dough rheology tests. Significant correlations between the variety average rankings for making sponge cakes and protein content and quality parameters also lend support to the idea that protein characteristics of the wheat varieties heavily influenced the cooperators' preferences for making sponge cakes. Similarly, higher rankings for making steam buns were largely observed in the varieties possessing strong protein characteristics. The diversity of SRW wheat produced in the

eastern United States was again observed in grain hardness, absorption capacity, protein strength and rheological properties.

Table 3- 1 Rankings of 10 soft red winter wheat varieties for making cookies, sponge cakes, chiffon cakes and steam bun*

Product	Cooperator	Control*	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Cookie	China -GB	2	5	8	3	higher	4	6	7	11	10	9
Cookie	Indo_Bogasari	8	4	1	3	11	2	6	10	7	9	5
Cookie	Indo_PK	3	4	5	6	11	8	1	2	9	10	7
Cookie	Msia_SFFM	4	11	10	9	8	1	2	6	5	7	3
Cookie	Mexico_HM	.	6	4	2	1	5	7	10	9	8	3
Cookie	Phil_MSMC	1	3	10	11	7	6	2	4	5	9	8
Cookie	Phil_PPMC	7	5	1	2	11	4	3	6	8	10	9
Cookie	Phil_RFM	5	1	3	2	11	4	6	9	10	8	7
Cookie	Thai_UFM	10	1	3	2	11	4	5	7	8	9	6
	Average	5.0	4.4	5.0	4.4	8.9	4.2	4.2	6.8	8.0	8.9	6.3
Sponge Cake	China -GB	2	11	9	7	4	3	8	6	5	10	1
Sponge Cake	Dominican Rep	2	9	11	10	4	1	5	7	6	8	3
Sponge Cake	Indo_Bogasari	5	9	2	7	10	4	6	8	11	3	1
Sponge Cake	Ind_PK	1	3	7	11	8	5	9	6	2	4	10
Sponge Cake	Msia_SFFM	5	11	10	9	2	6	1	4	8	7	3
Sponge Cake	Thai_UFM	1	11	8	10	5	4	6	7	9	3	2
	Average	2.7	9.0	7.8	9.0	5.5	3.8	5.8	6.3	6.8	5.8	3.3
Chiffon Cake	China_YK	2	6	8	1	11	5	10	9	7	4	3
Chiffon Cake	Phil_MSMC	1	6	10	9	3	5	7	4	8	11	2
Chiffon Cake	Phil_PPMC	8	4	7	10	1	9	5	3	6	11	2
Chiffon Cake	Phil_RFM	4	2	8	9	7	5	10	.	6	3	1
	Average	3.8	4.5	8.3	7.3	5.5	6.0	8.0	5.3	6.8	7.3	2.0
Steam Bun	China_YK	2	11	3	7	4	1	5	8	6	9	10
	Overall Average	3.9	6.2	6.4	6.5	6.9	4.3	5.5	6.4	7.3	7.7	4.8

* 1 = Very poor/ 9 = Excellent; **Local flour.

Table 3- 2 Desirability scores of 10 soft red winter wheat **flours** for making cookie, sponge cake, chiffon cake and steam bun*

Product	Cooperator	Control 1**	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Cookies	China_GB	8.0	6.0	4.5	7.3	9.0	8.5	7.0	7.8	6.5	4.0	7.5
Cookies	Indo_Bogasari	7.0	7.0	7.0	6.0	6.0	6.5	8.0	6.0	6.0	6.5	7.0
Cookies	Indo_PK	7.0	5.0	6.0	6.0	5.5	6.0	7.0	5.5	6.0	6.0	7.0
Cookies	Msia_SFFM	7.0	6.0	6.5	7.5	8.0	7.5	8.0	6.5	8.0	6.5	7.5
Cookies	Phil_MSMC	7.0	6.5	6.0	5.5	7.0	6.0	6.0	6.0	6.0	6.3	6.5
Cookies	Phil_PPMC	8.0	6.0	6.0	6.0	8.0	8.0	6.0	6.0	5.0	5.5	6.0
Cookies	Phil_RFM	7.0	6.0	6.0	6.0	6.5	6.5	6.0	6.0	6.0	6.0	6.0
Cookies	Thai_UFM	7.0	5.5	4.5	5.5	6.0	5.5	5.5	5.5	5.0	5.0	5.0
Cookies	Mexico_HM	.	7.6	6.8	8.2	8.0	8.2	8.2	8.2	7.5	6.8	8.1
	Average	7.3	6.2	5.9	6.4	7.1	7.0	6.9	6.4	6.2	5.8	6.7
Sponge Cake	China_GB	8.0	6.0	4.5	7.3	9.0	8.5	7.0	7.8	6.5	4.0	7.5
Sponge Cake	Dominican Rep	.	5.0	4.5	5.0	6.5	7.0	7.5	6.0	5.5	6.0	7.5
Sponge Cake	Indo_Bogasari	7.0	7.0	7.0	6.5	6.0	7.0	6.5	6.5	6.0	6.0	6.5
Sponge Cake	Indo_PK	7.0	5.0	6.0	6.0	5.5	6.0	7.0	5.5	6.0	6.0	7.0
Sponge Cake	Msia_SFFM	7.0	6.0	6.5	7.5	8.0	7.5	8.0	6.5	8.0	6.5	7.5
Sponge Cake	Thai_UFM	7.0	5.5	4.5	5.5	6.0	5.5	5.5	5.5	5.0	5.0	5.0
	Average	7.2	5.8	5.5	6.3	6.8	6.9	6.9	6.3	6.2	5.6	6.8
Chiffon Cake	China_YK	8.0	7.0	8.0	7.8	8.2	8.2	7.3	7.5	7.8	7.5	8.5
Chiffon Cake	Phil_MSMC	7.0	6.5	5.0	5.2	7.0	6.5	5.7	6.3	5.0	5.5	8.0
Chiffon Cake	Phil_PPMC	7.0	5.5	5.0	5.5	9.0	8.0	7.0	6.0	5.0	5.0	6.5
Chiffon Cake	Phil_RFM	7.0	6.0	6.0	6.0	7.0	7.0	6.0	6.0	6.0	6.0	6.0
	Average	7.3	6.3	6.0	6.1	7.8	7.4	6.5	6.5	6.0	6.0	7.3
Steam Bun	China_YK	8.0	7.0	8.0	7.8	8.2	8.2	7.3	7.5	7.8	7.5	8.5
	Overall Average	7.3	6.1	5.9	6.4	7.2	7.1	6.8	6.4	6.2	5.9	7.0

* 1 = Very poor/ 9 = Excellent; **Local flour.

Table 3- 3 Desirability scores of **dough** of 10 soft red winter wheat flours for making cookie and steam bun*

Product	Cooperator	Control**	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Cookies	China_GB	7.0	6.5	6.5	6.5	6.5	6.0	6.5	6.5	6.5	6.5	6.5
Cookies	Indo_Bogasari	7.0	7.0	7.0	7.0	7.0	8.0	8.0	8.0	8.0	8.0	8.0
Cookies	Indo_PK	7.0	7.0	7.0	5.0	4.0	8.0	8.0	8.0	8.0	8.0	8.0
Cookies	Msia_SFFM	7.0	7.5	7.5	7.0	6.5	8.0	7.5	8.0	7.5	8.0	8.0
Cookies	Phil_MSMC	7.0	7.0	6.0	6.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Cookies	Phil_PFMC	6.0	7.0	7.0	6.0	7.0	9.0	9.0	9.0	9.0	9.0	9.0
Cookies	Phil_RFM	7.0	6.0	6.0	6.0	5.0	7.0	7.0	7.0	7.0	7.0	7.0
Cookies	Thai_UFM	7.0	6.7	6.7	6.0	6.5	7.0	7.0	7.0	7.0	7.0	7.0
Cookies	Mexico_HM	.	7.3	9.1	8.9	8.7	7.5	7.2	6.9	6.5	7.8	8.1
	Average	6.9	6.9	7.0	6.5	6.6	7.6	7.6	7.6	7.5	7.7	7.7
Steam Bun	China_YK	8.0	6.0	8.0	7.3	7.5	8.0	7.0	7.5	7.3	7.0	7.1
	Overall Average	7.0	6.8	7.1	6.6	6.7	7.7	7.5	7.6	7.5	7.6	7.7

* 1 = Very poor/ 9 = Excellent; **Local flour.

Table 3- 4 Desirability scores of **batter** of 10 soft red winter wheat flours for making sponge cake and Chiffon cake*

Product	Cooperators	Control**	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Sponge Cake	China_GB	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Sponge Cake	Dominican Rep	8.0	6.5	6.5	5.0	8.0	8.0	6.0	6.0	6.0	6.0	7.0
Sponge Cake	Indo_Bogasari	7.0	8.0	8.0	7.5	7.5	8.0	7.5	8.0	8.0	7.5	7.0
Sponge Cake	Indo_PK	7.0	9.0	8.0	9.0	8.0	8.0	9.0	9.0	8.0	9.0	8.0
Sponge Cake	Msia_SFFM	7.0	8.0	8.0	7.5	7.0	7.5	8.0	8.0	7.5	8.0	7.5
Sponge Cake	Thai_UFM	7.0	6.5	6.5	6.8	7.0	6.5	6.8	6.5	6.5	6.8	7.0
	Average	7.3	7.7	7.5	7.3	7.6	7.7	7.6	7.6	7.3	7.6	7.4
Chiffon Cake	China_YK	8.0	6.0	8.0	7.3	7.5	8.0	7.0	7.5	7.3	7.0	7.1
Chiffon Cake	Phil_MSMC	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Chiffon Cake	Phil_PFMC	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Chiffon Cake	Phil_RFM	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
	Average	7.3	6.8	7.3	7.1	7.1	7.3	7.0	7.1	7.1	7.0	7.0
	Overall Average	7.3	7.3	7.4	7.2	7.4	7.5	7.3	7.4	7.2	7.3	7.3

* 1 = Very poor/ 9 = Excellent; **Local flour.

Table 3- 5 Desirability scores for **quality of cookie, sponge cake, chiffon cake and steam bun** of 10 soft red winter wheat flours*

Product	Cooperators	Control**	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Cookies	China_GB	8.0	7.5	7.3	7.0	7.8	6.0	6.5	5.0	3.0	5.5	4.0
Cookies	Indo_Bogasari	7.0	8.0	9.0	9.0	6.0	8.5	6.5	6.5	7.5	7.0	7.5
Cookies	Indo_PK	7.0	9.0	8.0	8.0	8.0	9.0	9.0	7.5	7.5	8.0	7.5
Cookies	Msia_SFFM	7.0	8.5	7.5	7.5	6.0	7.8	7.0	6.5	6.5	6.8	6.8
Cookies	Phil_MSMC	7.0	7.0	7.0	7.0	5.0	6.0	7.0	6.0	6.0	5.0	5.0
Cookies	Phil_PPMC	6.0	7.0	9.0	9.0	5.0	7.5	7.0	6.0	6.0	5.5	5.0
Cookies	Phil_RFM	7.0	7.0	7.0	8.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Cookies	Thai_UFM	7.0	9.0	8.5	8.8	6.0	8.3	8.0	7.5	7.0	7.0	7.8
Cookies	Mexico_HM	.	8.2	7.8	8.1	9.6	8.2	6.7	6.7	7.5	6.7	8.2
	Average	7.0	7.9	7.9	8.0	6.7	7.6	7.2	6.5	6.4	6.5	6.5
Sponge Cake	China_GB	8.5	5.5	8.3	6.0	7.0	7.8	6.3	6.5	8.0	7.5	9.0
Sponge Cake	Dominican Rep	7.5	7.5	6.0	6.5	7.5	8.0	8.0	8.0	9.0	7.5	8.5
Sponge Cake	Indo_Bogasari	7.0	5.5	7.5	6.5	7.0	7.5	7.0	6.0	6.0	8.5	9.0
Sponge Cake	Indo_PK	7.0	5.0	5.0	4.5	5.0	6.0	5.5	5.0	5.0	6.5	6.5
Sponge Cake	Msia_SFFM	7.0	6.5	6.8	6.5	8.0	7.0	7.8	7.0	6.0	7.0	8.0
Sponge Cake	Thai_UFM	7.0	5.0	6.0	5.5	6.3	6.5	6.3	6.0	5.8	6.5	6.8
	Average	7.3	5.8	6.6	5.9	6.8	7.1	6.8	6.4	6.6	7.3	8.0
Chiffon Cake	China_YK	8.0	7.0	7.5	8.0	6.0	7.5	6.0	7.0	7.5	7.5	8.0
Chiffon Cake	Phil_MSMC	7.0	6.7	6.1	6.2	6.8	6.4	6.4	6.6	6.3	5.9	7.1
Chiffon Cake	Phil_PPMC	6.0	9.0	7.0	5.5	8.0	5.0	8.0	9.0	8.0	7.0	9.0
Chiffon Cake	Phil_RFM	7.0	7.0	7.0	7.0	7.0	6.0	8.0	7.0	7.0	6.0	8.0
	Average	7.0	7.4	6.9	6.7	7.0	6.2	7.1	7.4	7.2	6.6	8.0
Steam Bun	China_YK	8.0	5.0	7.8	7.5	7.5	8.0	7.5	6.8	7.0	6.5	7.0
	Overall Average	7.2	7.0	7.3	7.1	6.8	7.2	7.1	6.7	6.7	6.7	7.3

* 1 = Very poor/ 9 = Excellent; **Local flour.

Table 3- 6 Overall desirability scores of 10 soft red winter wheat flours for making cookie, sponge cake, chiffon cake and steam bun*

Product	Cooperators	Control**	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Cookies	China_GB	8.3	7.5	6.0	8.0	8.5	7.8	7.3	7.0	4.0	4.5	5.5
Cookies	Indo_Bogasari	7.0	8.0	8.0	8.0	6.5	7.5	7.0	7.0	6.5	6.5	7.0
Cookies	Indo_PK	7.0	5.0	5.0	5.0	4.5	4.5	9.0	7.0	8.0	4.5	8.0
Cookies	Msia_SFFM	7.0	6.0	6.5	6.7	6.8	7.2	7.0	6.8	6.8	6.5	7.0
Cookies	Phil_MSMC	7.0	6.8	6.3	6.2	6.7	6.7	7.0	6.7	6.7	6.4	6.5
Cookies	Phil_PFMC	6.0	7.0	7.0	7.0	5.0	6.0	9.0	7.0	7.0	5.0	7.0
Cookies	Phil_RFM	7.0	5.0	5.0	5.0	7.0	7.0	5.0	5.0	5.0	6.0	6.0
Cookies	Thai_UFM	7.0	9.0	8.5	8.8	6.0	8.3	8.0	7.5	7.0	7.0	7.8
Cookies	Mexico_HM	.	7.4	8.2	7.5	9.4	7.9	7.5	7.1	7.1	7.7	8.2
	Average	7.0	6.9	6.7	6.9	6.7	7.0	7.4	6.8	6.5	6.0	7.0
Sponge Cake	China_GB	8.8	5.0	6.5	7.3	8.3	8.5	7.0	7.5	8.0	6.0	9.0
Sponge Cake	Dominican Rep	7.5	6.0	6.0	6.5	8.0	8.0	7.0	7.0	7.0	7.0	7.5
Sponge Cake	Indo_Bogasari	7.0	7.0	8.0	7.0	6.5	6.5	7.0	7.0	6.5	7.5	9.0
Sponge Cake	Indo_PK	7.0	5.0	4.5	4.5	5.0	3.5	5.5	5.0	5.0	6.0	5.5
Sponge Cake	Msia_SFFM	7.0	6.0	6.0	6.5	7.5	6.9	8.0	7.2	6.5	6.5	7.5
Sponge Cake	Thai_UFM	7.0	5.0	6.0	5.5	6.3	6.5	6.3	6.0	5.8	6.5	6.8
	Average	7.4	5.7	6.2	6.2	6.9	6.7	6.8	6.6	6.5	6.6	7.6
Chiffon Cake	China_YK	8.0	7.6	6.7	8.5	5.0	7.2	5.0	6.7	7.0	7.4	7.5
Chiffon Cake	Phil_MSMC	7.0	6.5	6.0	5.5	6.0	6.0	6.5	6.5	6.5	5.0	6.5
Chiffon Cake	Phil_PFMC	6.0	7.5	7.0	6.0	9.0	6.0	7.0	8.0	6.0	5.0	9.0
Chiffon Cake	Phil_RFM	7.0	7.0	6.0	6.0	7.0	7.0	7.0	6.0	6.0	7.0	7.0
	Average	7.0	7.2	6.4	6.5	6.8	6.6	6.4	6.8	6.4	6.1	7.5
Steam Bun	China_YK	8.0	5.0	7.8	7.2	7.3	8.0	7.1	6.8	7.0	6.9	6.8
	Overall Average	7.2	6.5	6.6	6.6	6.8	6.8	7.0	6.7	6.5	6.2	7.3

* 1 = Very poor/ 9 = Excellent; **Local flour.

CHAPTER 4. Singapore Overseas Varietal Analysis Cooperator Workshop

The cooperators from Indonesia, Malaysia, the Philippines and Thailand evaluated the SRW wheat OVA samples for quality of baking cookies, sponge cakes and chiffon cakes. The formulas and protocols for products are given in Appendix VI. The cooperators' assessments for the OVA varieties for making cookies, sponge cakes and chiffon cakes are summarized in the sections for each cooperator. A brief description of each product and preferences of the OVA flour samples for making each product are included below.

Cookies (Table 4-1 & 4-2; Figure 4-1, 4-4 & 4-5)

The cookie formulation used for the workshop is similar to the AACCI Approved Method 10-52.01 sugar snap cookie method but at a lower sugar concentration. The results of the test for the OVA samples are similar to expectations of performance based on the sugar-snap cookies produced in the SWQL. While the diameters of cookies baked in the workshop didn't show significant correlation with sugar-snap cookies baked by the SWQL, the stack height and diameter-to-stack height ratio of the Singapore Workshop cookies were significantly correlated to the diameters of the sugar-snap cookies baked by the SWQL ($r = -0.86$ and 0.95 , respectively). The OVA varieties typically produced cookies of larger diameter than the cooperator standard flours.

Slightly sticky cookie dough was observed for Shirley and WB-196, sticky dough for SY Harrison, and slightly crumbly dough for LA754, while the remaining six varieties produced soft dough with good handling properties. SY Harrison and LA754 similarly baked cookies of much larger diameter than other varieties, despite their contrasting characteristics. LA754 exhibited much higher protein content, sucrose SRC and lactic acid SRC values than SY Harrison (Table 2-2); nevertheless, it produced cookies of the largest diameter in the Singapore Workshop, suggesting that diameter may not be a sufficient indicator of flour quality for making cookies. Shirley produced the softest cookies, followed by LA841, TV8861 and WB-196. Hardness of cookies determined in the Workshop more closely corresponded to the average rankings of flour for making cookies (Table 3-1).

Sponge Cakes (Table 4-3; Figure 4-2, 4-6 & 4-7)

Sponge cake is baked using equal amounts of flour and sugar with fresh eggs, but without the use of baking powder. Leavening for the sponge cake is achieved by the foam from whipped eggs. Volume and firmness of the cake are important measures of quality. All of the OVA test flours exhibited sponge cake volume indices within the range of the volume indices of the cooperator standard flours. Bess had the highest sponge cake volume index, followed by LA754 and Havoc, while LA754 produced the softest cakes, followed by TV8861 and Bess. Bess was the highest ranked variety for making sponge cakes (Table 3-1). SY Harrison, which was highest in break flour yield, lowest in starch damage and relatively low in protein content and all four SRC test values (Table 2-2), was observed to produce sponge cakes of the second highest firmness. Vandal showed the second highest break flour yield among the ten varieties, was relatively low in protein content and low in solvent retention capacity values, but still produced the firmest sponge cakes. Fine flour particle size, low protein content, low water absorption capacity and weak protein strength were not necessarily the required factors for increased volume and decreased firmness of sponge cakes prepared by the cooperators.

Chiffon Cakes (Table 4-4; Figure 4-3, 4-8 & 4-9)

Chiffon cake is a high ratio sugar-to-flour cake. However, volume and texture of chiffon cakes derive from foamed egg whites along with chemical leavening. Volume and uniformity of the cakes are important measures of cake quality. The chiffon cake volume indices of the OVA varieties were comparable to or slightly lower than those of the cooperator standard flours. The OVA varieties showed relatively small differences in the volume index of chiffon cake, ranging from 222 to 239. LA754 had the highest chiffon cake volume index, followed by SY Harrison, Havoc, LA841 and TV8861. Bess produced chiffon cake which ranked seventh for volume index, but was the softest in texture.

Table 4- 1 Dough and Cookie Characteristics of Singapore Bake Workshop Control Flours and SRW Wheat Flours*

Control/SRW Wheat Flour	Dough Characteristics	Weight Loss (%)	Diameter (cm)	Diameter Increase (%)	Height (cm)	Diameter/Height
Bogasari Cookie FL	Soft, Very sticky	12.8	31.0	22.6	5.2	5.96
Pundi K. Cookie FL	Soft, Slight Sticky	13.3	31.9	24.8	5.0	6.38
SFFM Cookie FL	Soft, Slight Sticky	12.2	29.3	18.1	5.1	5.75
UFM Cookie FL	Soft, Good handling	10.1	30.9	22.3	5.2	5.94
MSMC Cookie FL	Soft, Sticky	13.5	33.5	28.4	4.6	7.28
PFMC Cookie FL	Soft, Very Sticky	11.5	32.3	25.7	5.0	6.46
RFM Cookie FL	Soft, Good handling	13.5	31.5	23.8	5.1	6.18
Shirley	Soft, Slight Sticky	12.4	35.6	32.6	4.5	7.91
WB-196	Soft, Slight Sticky	13.5	34.3	30.0	4.3	7.98
SY Harrison	Soft, Sticky	14.4	36.5	34.2	4.0	9.13
LA754	Slight Crumbly	12.4	37.8	36.5	5.4	7.00
LA841	Soft, Good handling	13.2	33.8	29.0	4.8	7.04
TV8861	Soft, Good handling	13.5	34.0	29.4	4.3	7.91
Havoc	Soft, Good handling	12.5	34.9	31.2	4.0	8.73
Vandal	Soft, Good handling	12.4	34.4	30.2	4.1	8.39
LCS News	Soft, Good handling	12.2	33.0	27.3	4.9	6.73
Bess	Soft, Good handling	12.4	32.7	26.6	4.9	6.67

*Total of 4 cookies.

Table 4- 2 Textural Characteristics of Cookies Prepared from Singapore Bake Workshop Control Flours and SRW Wheat Flours

Control/SRW Wheat Flour	Hardness (g)	Brittleness (time difference 1:2)	Crispness (number of peaks)
Bogasari Cookie FL	10302	0.044	40
Pundi K. Cookie FL	10487	0.030	40
SFFM Cookie FL	6868	0.015	40
UFM Cookie FL	10013	0.016	36
MSMC Cookie FL	2997	0.010	62
PFMC Cookie FL	9593	0.014	35
RFM Cookie FL	8238	0.020	52
Shirley	3266	0.010	63
WB-196	6981	0.012	57
SY Harrison	6381	0.015	64
LA754	9452	0.055	8
LA841	4591	0.020	53
TV8861	5741	0.025	33
Havoc	11066	0.025	45
Vandal	13445	0.017	44
LCS News	9533	0.030	49
Bess	10473	0.017	48

Table 4- 3 Sponge Cake Characteristics of Singapore Bake Workshop Control Flours and SRW Wheat Flours*

Control/SRW Wheat Flour	Shrinkage Value (cm)	Volume Index	Symmetry Index	Uniformity Index	Firmness (g)
Bogasari Cake FL	1.87	431	15.8	3.9	480
Pundi Kencana Cake FL	3.57	406	31.5	-3.8	706
SFFM Cookie FL	2.93	382	32.6	-5.8	851
UFM Cake FL	1.63	441	42.7	-2.6	568
MSMC Cake FI	0.37	442	38.5	2.4	629
MSMC Cookie FI	4.67	423	7.1	-6.8	470
PFMC Cake FL	4.70	422	20.2	-2.3	521
PFMC Cookie FL	1.60	411	37.1	-3.5	717
RFM Cake FL	0.87	463	42.5	7.1	499
RFM Cookie FL	6.33	424	31.3	-5.0	717
Shirley	0.40	403	45.5	0.8	922
WB-196	4.23	390	38.2	4.8	874
SY Harrison	2.43	399	37.6	-1.4	1079
LA754	4.07	438	35.9	5.0	586
LA841	3.80	389	37.5	-4.6	931
TV8861	4.13	415	37.3	2.7	621
Havoc	5.00	430	38.6	-7.1	816
Vandal	2.73	382	40.7	-5.1	1274
LCS News	4.40	413	48.2	0.3	976
Bess	6.43	440	33.9	0.9	668

*Shrinkage value: lesser value represents less side shrinkage; Volume Index: greater value represents bigger cake volume;
Symmetry Index: 0 value represents perfect symmetry & lesser value represents less crust convex;
Uniformity Index: 0 value represents perfect uniformity.

Table 4- 4 Chiffon Cake Characteristics of Singapore Bake Workshop Control Flours and SRW Wheat Flours*

Control/SRW Wheat Flour	Shrinkage Value (cm)	Volume Index	Symmetry Index	Uniformity Index	Firmness (g)
Bogasari Cake FL	6.3	226	-50.1	1.3	539
Pundi Kencana Cake FL	5.3	239	-8.60	2.5	434
SFFM Cookie FL	9.1	218	-6.58	-1.1	445
UFM Cake FL	6.4	241	-2.79	-1.0	369
MSMC Cake FI	6.3	244	-13.5	-1.2	435
MSMC Cookie FI	8.7	245	2.42	-0.8	417
PFMC Cake FL	6.1	247	-5.74	-0.1	426
PFMC Cookie FL	5.4	245	-4.08	-0.4	451
RFM Cake FL	5.4	249	-11.2	2.2	384
RFM Cookie FL	5.7	230	-2.30	2.7	433
Shirley	8.3	235	-1.42	0.0	417
WB-196	7.4	227	-25.4	-0.7	423
SY Harrison	6.4	238	-32.7	0.7	407
LA754	5.2	239	-30.7	0.6	399
LA841	6.7	237	-20.0	3.4	424
TV8861	6.9	236	-7.55	2.1	399
Havoc	4.4	238	-11.5	0.4	375
Vandal	9.5	225	-18.3	3.5	408
LCS News	7.7	222	-27.2	2.6	378
Bess	6.1	231	-10.4	-0.9	335

*Shrinkage value: lesser value represents less side shrinkage; Volume Index: greater value represents bigger cake volume;

Symmetry Index: 0 value represents perfect symmetry & lesser value represents less crust convex;

Uniformity Index: 0 value represents perfect uniformity.

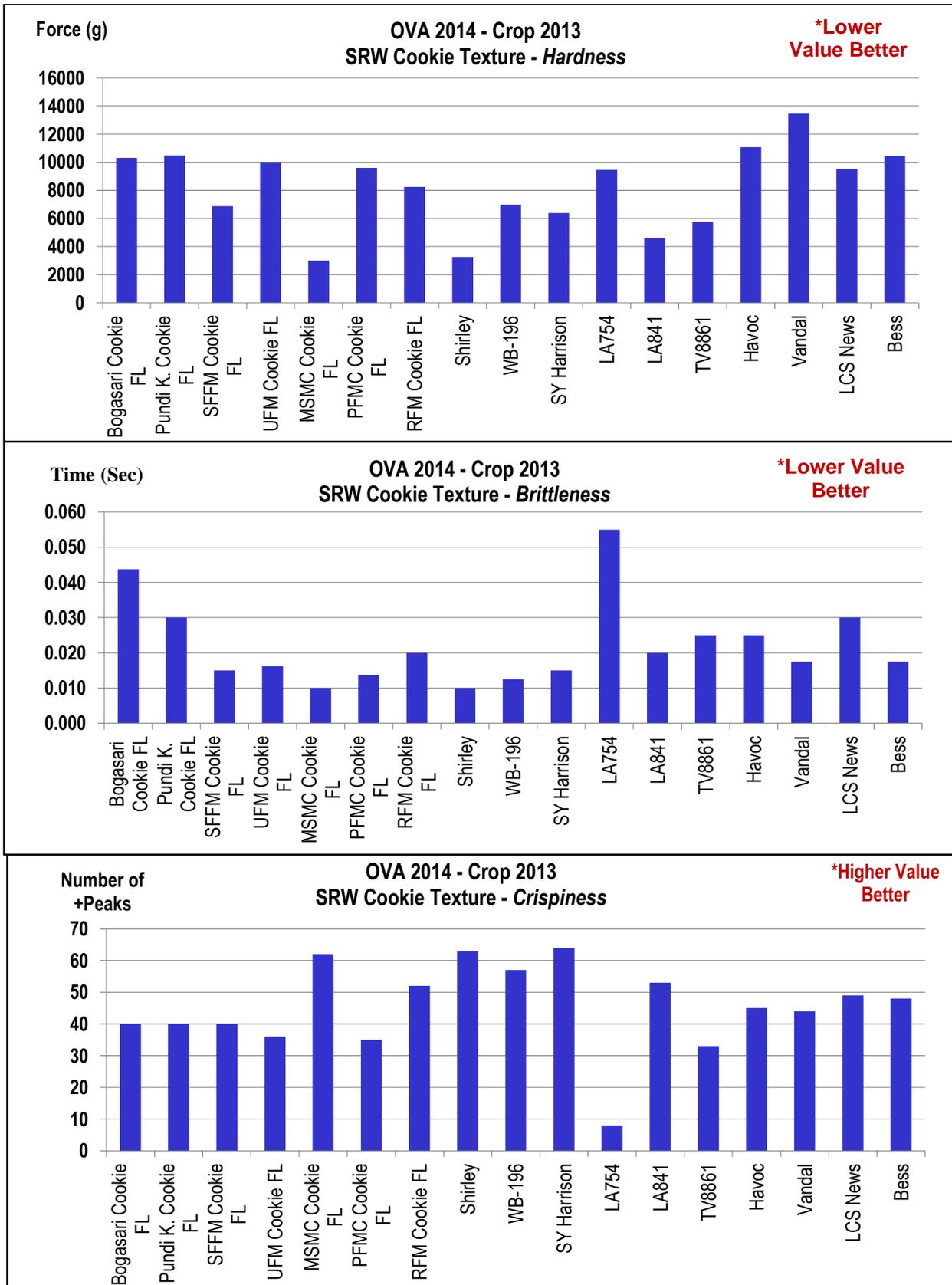


Figure 4- 1 Textural characteristics of cookies baked from Singapore Bake Workshop control and SRW wheat flours.

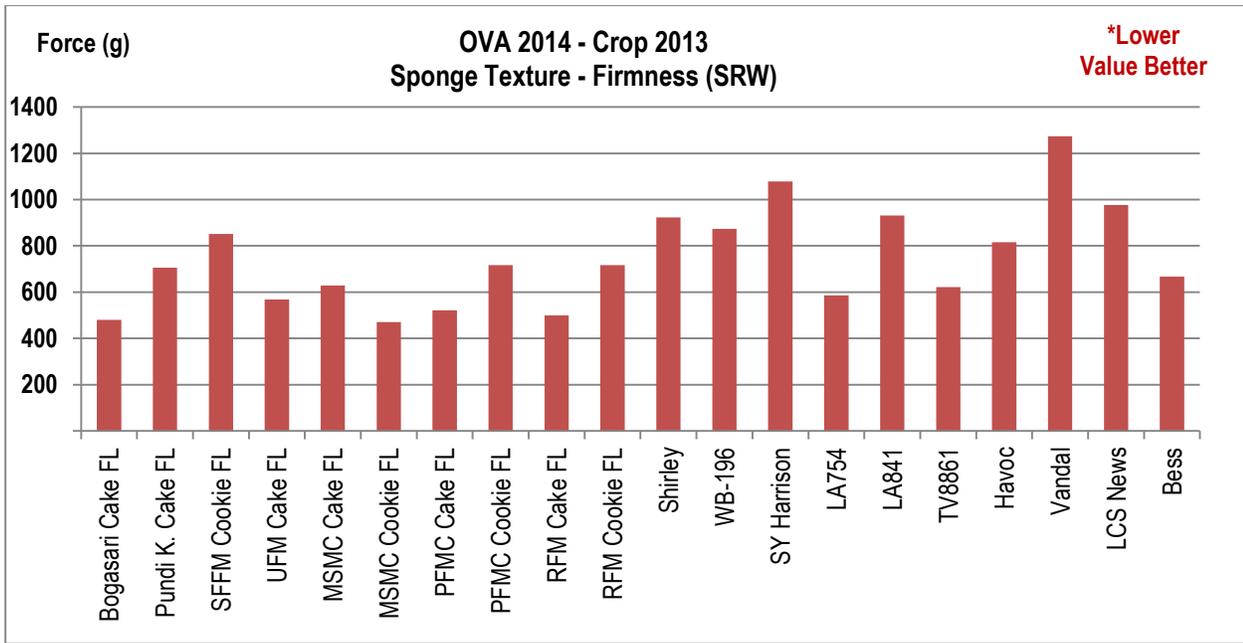


Figure 4- 2 Firmness of sponge cake baked from Singapore Bake Workshop control and SRW wheat flours.

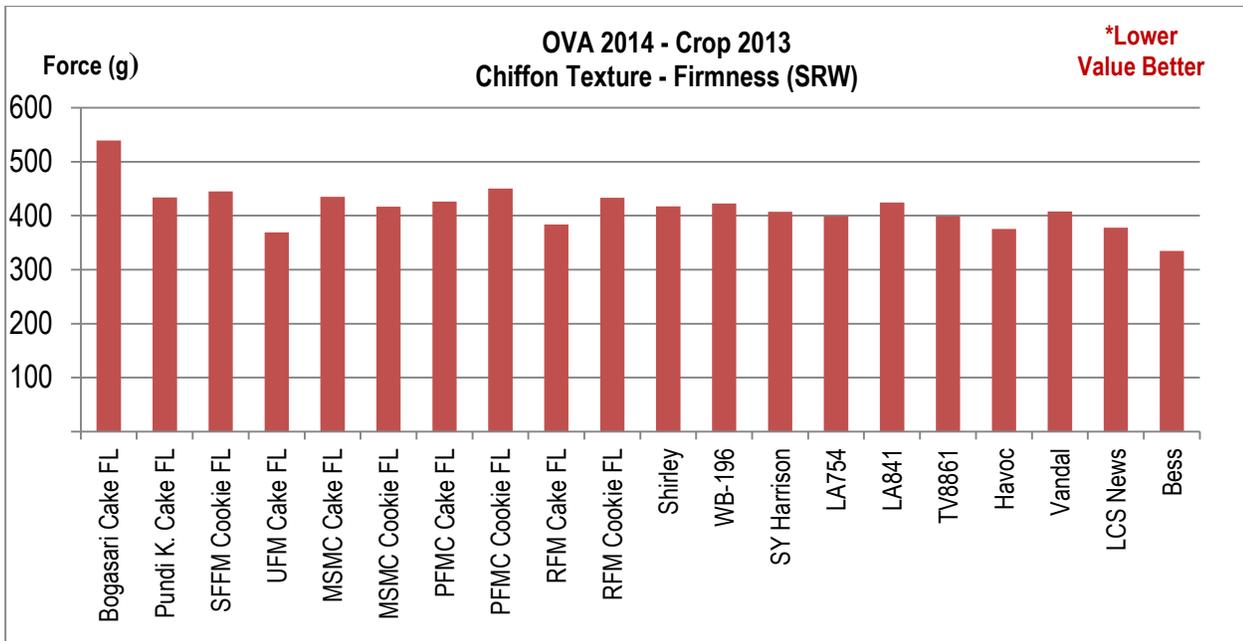
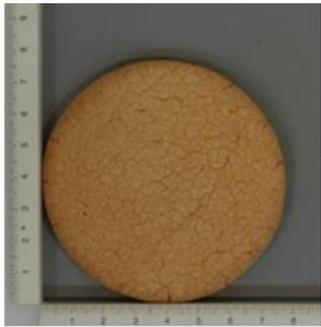
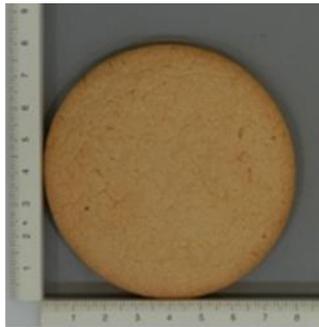


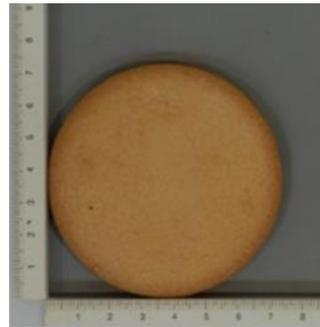
Figure 4- 3 Firmness of chiffon cake baked from Singapore Bake Workshop control and SRW wheat flours.



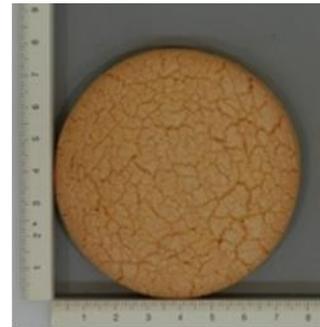
Indonesia/Bogasari



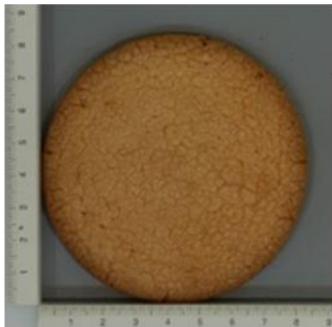
Indonesia/Pundi



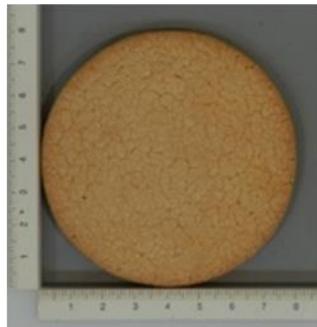
Malaysia/SFFM



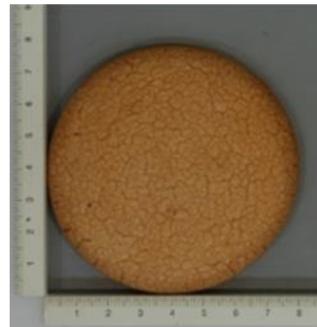
Thailand/UFM



Philippines/MSMC



Philippines/PFMC



Philippines/RFM

Figure 4- 4 Sugar-snap cookies baked from the cooperator standard flours in the Singapore Baking Workshop.

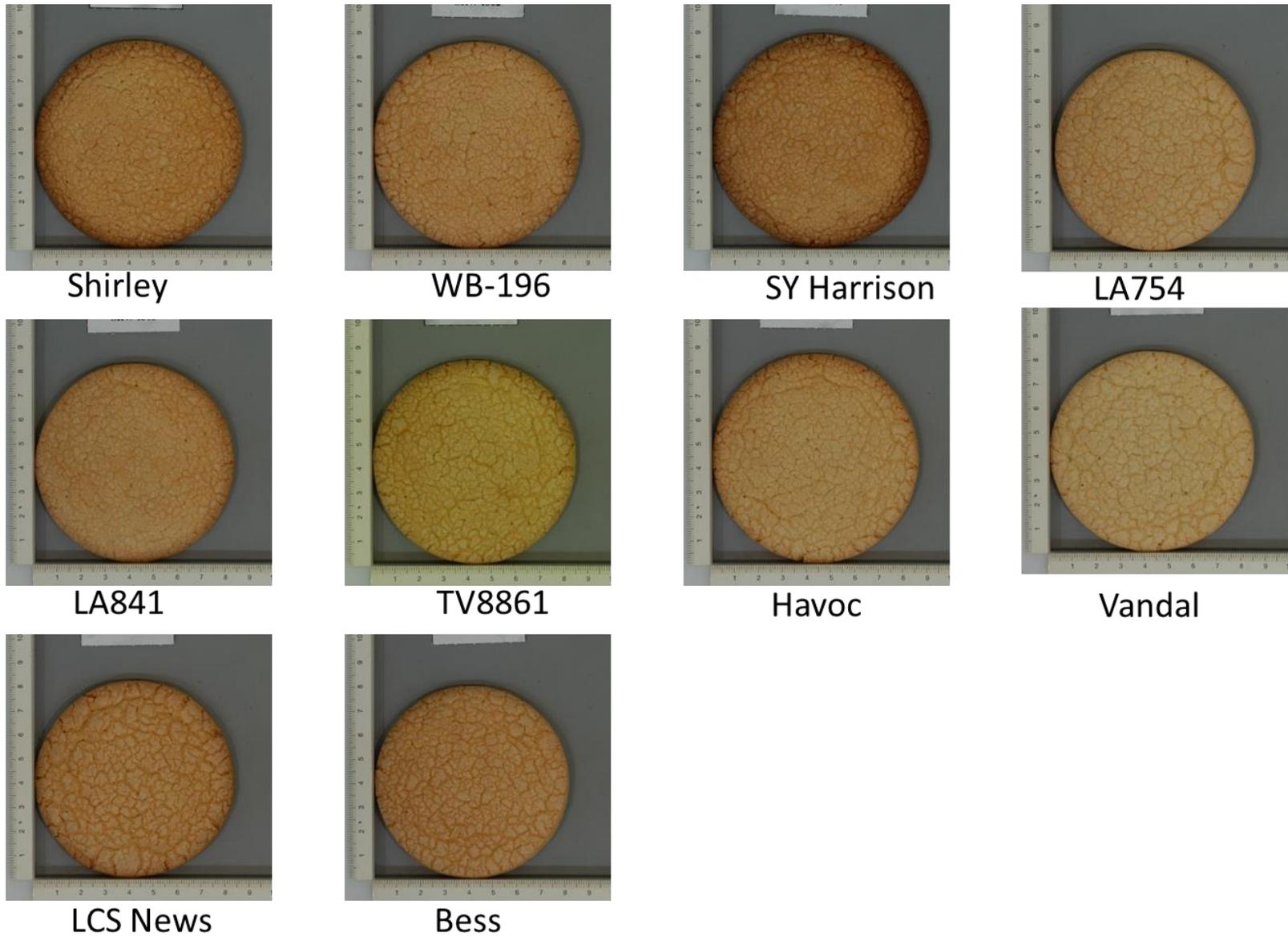


Figure 4- 5 Sugar-snap cookies baked from the OVA SRW wheat flours in the Singapore baking workshop.



Indonesia/Bogasari Cake



Indonesia/Pundi Cake



Malaysia/SFFM Cookie



Thailand/UFM Cake



Philippines/MSMC Cake



Philippines/MSMC Cookie



Philippines/PFMC Cake



Philippines/PFMC Cookie



Philippines/RFM Cake



Philippines/RFM Cookie

Figure 4- 6 Sponge cakes baked from the cooperator standard flours in the Singapore baking workshop.



Shirley



WB-196



SY Harrison



LA754



LA841



TV8861



Havoc



Vandal



LCS News



Bess

Figure 4- 7 Sponge cakes baked from the OVA SRW wheat flours in the Singapore baking workshop.



Indonesia/Bogasari Cake



Indonesia/Pundi Cake



Malaysia/SFFM Cookie



Thailand/UFM Cake



Thailand/UFM Cookie



Philippines/MSMC Cake



Philippines/MSMC Cookie



Philippines/PFMC Cake



Philippines/PFMC Cookie



Philippines/RFM Cake



Philippines/RFM Cookie

Figure 4- 8 Chiffon cakes baked from the cooperator standard flours in the Singapore baking workshop.



Shirley



WB-196



SY Harrison



LA754



LA841



TV8861



Havoc



Vandal



LCS News



Bess

Figure 4- 9 Chiffon cakes baked from the OVA SRW wheat flours in the Singapore baking workshop.

CHAPTER 5. Flour, Dough and Product Evaluations by Cooperators

Table 5- 1 Target End Products and Quality Preferences in China/Guangdong

Primary End Product Uses for SRW	Primary Flour Used	Used Only in Blend with Other Flours
Cake	x	
Cookie	x	

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Wet Gluten (%)	minimum 20.0	21.0 - 23.5
Absorption (%)	minimum 50.0	more than 53

Table 5- 2 Overall Flour Quality and Cookie Dough Properties of SRW Wheat Evaluated in China/Guangdong

SRW Flour	Overall Flour Quality			Dough/Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control	8	Good gluten, High water absorption		7	Handles well	
Shirley	6		low gluten & protein	6.5		A little sticky
WB-196	4.5		low gluten & protein, Poor Falling Number	6.5		A little sticky
SY Harrison	7.3	Good gluten	Poor water absorption	6.5		A little sticky
LA754	9	Good gluten, High water absorption, Good flour color		6.5		A little sticky
LA841	8.5	Good gluten, High water absorption, Good flour color		6		sticky
TV8861	7	Good flour color	low gluten & protein	6.5		A little sticky
Havoc	7.8	Good gluten & flour color		6.5		A little sticky
Vandal	6.5		low gluten & poorer gluten quality	6.5		A little sticky
LCS News	4		low gluten & poorer gluten quality, Poor Falling Number	6.5		A little sticky
Bess	7.5	Good gluten & flour color	Poor Falling Number	6.5		A little sticky

* 1 = Very poor/ 9 = Excellent

Table 5- 3 Overall Cookie Baking Performance of SRW Wheat Evaluated in China/Guangdong

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control	8	higher volume, Acceptable texture		8.3	Good end product performance	
Shirley	7.5	higher volume, Acceptable texture		7.5	Good end product performance	
WB-196	7.3	higher volume		6	Average	
SY Harrison	7	higher volume		8	Good end product performance	
LA754	7.8	higher volume, Acceptable texture		8.5	Good end product performance	
LA841	6	Average		7.8	Good end product performance	
TV8861	6.5	Average		7.3	Good flour color	Poor end product performance
Havoc	5		Poor crumb uniformity, sticky, poor texture	7	Good gluten & flour color	Poor crumb uniformity, sticky, poor texture
Vandal	3		Poor crumb uniformity, sticky, poor texture	4		Poor end product performance Lower volume
LCS News	5.5		Poor crumb uniformity, sticky, poor texture	4.5		Poor end product performance Lower volume
Bess	4		Poor crumb uniformity, sticky, poor texture	5.5		Poor end product performance Lower volume

* 1 = Very poor/ 9 = Excellent

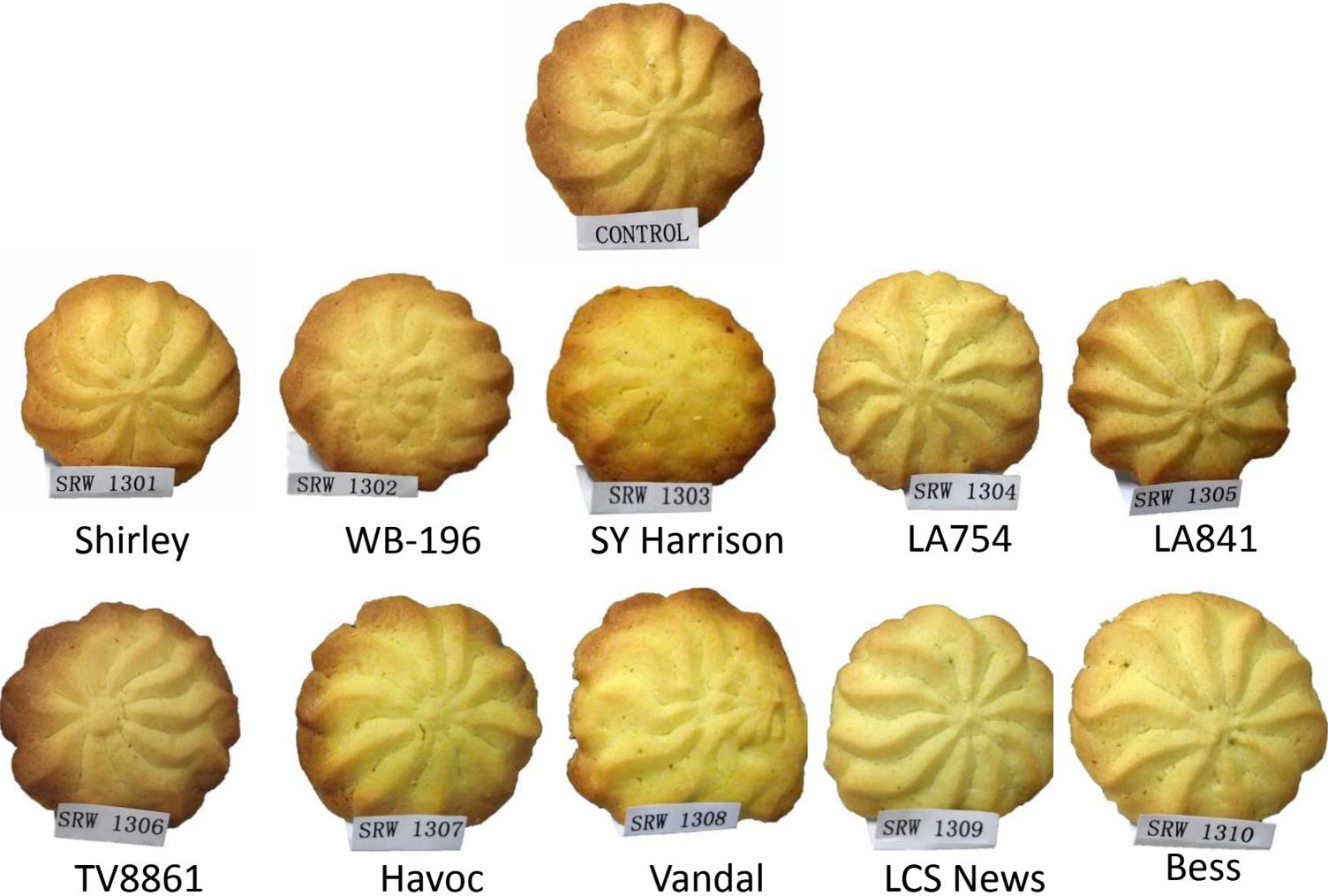


Figure 5- 1 Cookies baked from the OVA SRW wheat flours in China/Guangdong

Table 5- 4 Overall Flour Quality and cake Batter Properties of SRW Wheat Evaluated in China/Guangdong

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control	8.0	Good gluten,High water absorption		8	Handles well	
Shirley	6.0		low gluten & protein	8.0	Handles well	
WB-196	4.5		low gluten & protein,Poor Falling Number	8.0	Handles well	
SY Harrison	7.3	Good gluten	Poor water absorption	8.0	Handles well	
LA754	9.0	Good gluten,High water absorption, Good flour color		8.0	Handles well	
LA841	8.5	Good gluten,High water absorption, Good flour color		8.0	Handles well	
TV8861	7.0	Good flour color	low gluten & protein	8.0	Handles well	
Havoc	7.8	Good gluten & flour color		8.0	Handles well	
Vandal	6.5		low gluten & poorer gluten quality	8.0	Handles well	
LCS News	4.0		low gluten & poorer gluten quality,Poor Falling Number	8.0	Handles well	
Bess	7.5	Good gluten & flour color	Poor Falling Number	8.0	Handles well	

* 1 = Very poor/ 9 = Excellent.

Table 5- 5 Overall Cake Baking Performance of SRW Wheat Evaluated in China/Guangdong

SRW Flour	Cake Baking Performance			Overall Acceptability for Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control	8.5	Uniform crumb, soft texture, higher volume		8.8	Good end product performance	
Shirley	5.5		Lower volume, Un-uniform crumb, sticky, poor texture	5.0		Poor end product performance Lower volume
WB-196	8.3	Uniform crumb, soft texture, higher volume		6.5		low gluten & protein, Poor Falling Number
SY Harrison	6.0		Lower volume, Un-uniform crumb, sticky, poor texture	7.3		Poor end product performance Lower volume
LA754	7.0		Un-uniform crumb,	8.3	Good end product performance	
LA841	7.8	Uniform crumb, soft texture, higher volume		8.5	Good end product performance	
TV8861	6.3		Lower volume, Un-uniform crumb, poor texture	7.0		Poor end product performance
Havoc	6.5		Lower volume, Un-uniform crumb, poor texture	7.5	Good gluten & flour color	Poor end product performance
Vandal	8.0	Uniform crumb, soft texture, higher volume		8.0	Good end product performance	
LCS News	7.5	higher volume	Un-uniform crumb,	6.0		Poor end product performance Lower volume
Bess	9.0	Uniform crumb, soft texture, higher volume		9.0	Good end product performance	

* 1 = Very poor/ 9 = Excellent



Figure 5- 2 Cakes baked from the OVA SRW wheat flours in China/Guangdong

Table 5- 6 Target End Products and Quality Preferences in China/Yihai Kerry

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Southern Steam Bun	x	
Sponge Cake	x	

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)

Table 5- 7 Flour Quality and Dough/Batter Properties for Stam Bun/Sponge Cake Evaluated in China/Yihai Kerry

SRW Flour	Overall Flour Quality			Dough/Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	8	Moderate extensibility and spring, high water absorption		8	High water absorption, white color	
Shirley	7		Yellow and dark color	6	Good extensibility, shapes easily	Dough is yellow color
WB-196	8	White color, low ash content	Slightly low water absorption	8	Good extensibility, shapes easily	
SY Harrison	7.8	Good extensibility	Slightly low water absorption	7.3	Good extensibility, shapes easily	Dough is slightly yellow color
LA754	8.2	White color		7.5	Good extensibility, shapes easily	
LA841	8.2	White color		8	White color dough	
TV8861	7.3		Low water absorption, poor extensibility, slightly brittle	7		Difficult to roll to smooth surface, slightly brittle
Havoc	7.5		Slightly low water absorption	7.5	Good extensibility, shapes easily	
Vandal	7.8	Good extensibility and spring, low ash content		7.3	Good spring	Shapes slowly
LCS News	7.5		Poor extensibility, slightly brittle	7		Difficult to roll to smooth surface, slightly brittle
Bess	8.5	Low ash content, white color		7.1		Shapes slowly

* 1 = Very poor/ 9 = Excellent

Table 5- 8 Southern Steam Bun Baking Performance of SRW Wheat Evaluated in China/Yihai Kerry

SRW Flour	Southern Steam Bun Baking Performance			Overall Acceptability for Steam Bun Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	8	White color, good upright shape, fine texture		8	White color, good upright shape, fine texture, refreshing and smooth taste	
Shirley	5		Yellow color, normal upright shape, coarse texture	5		Yellow color, normal upright shape, coarse texture, soft taste
WB-196	7.8	Fine texture, high volume, slightly yellow color		7.8	Light yellow color, high volume, fine texture, soft and smooth taste	Slightly low water absorption
SY Harrison	7.5	Coarse texture, high volume	Slightly yellow color	7.2	High volume	Slightly low water absorption, yellow color, coarse texture and slightly firm taste
LA754	7.5	White color, good upright shape, fine texture	Normal spring	7.3	Shapes easily, white color, good outlook, fine texture	Slightly firm and stiff taste, small volume
LA841	8	White color, good upright shape, fine texture		8	White color, good outlook, fine texture	Slightly firm and stiff taste
TV8861	7.5	Slightly yellow color, good upright shape, fine texture	Normal spring	7.1	Light yellow color, good outlook, fine texture	Slightly low water absorption, brittle, difficult to roll and extend, slightly small volume, normal taste
Havoc	6.8	Slightly yellow color	Normal upright shape, coarse texture	6.8		Slightly low water absorption, coarse texture, soft taste
Vandal	7	Good upright shape, fine texture	Pale color, flaky and thin skin, not smooth surface	7	Dough has good spring, fine texture	Steamed bread is pale color, normal al dente, some have flaky and thin skin, and water spots
LCS News	6.5	Good upright shape	Dark color, coarse texture, some have water spots, thin skin, not smooth surface	6.9	High water absorption, good upright shape	Difficult to roll and extend, slightly brittle, coarse texture, some have flaky skin and water spots, normal taste
Bess	7	White color	Coarse texture, normal upright shape, some have water spots, thin skin	6.8	White color	Coarse texture, normal upright shape, some have water spots and thin skin

* 1 = Very poor/ 9 = Excellent

Table 5- 9 Chiffon Cake Baking Performance of SRW Wheat Evaluated in China/Yihai Kerry.

SRW Flour	Sponge Cake Baking Performance			Overall Acceptability for Sponge Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	8	Good color, good proofing		8	Soft and smooth taste	
Shirley	7	Smooth surface	Coarse surface, dark color	7.6	Uniform and fine texture, white color	Normal proofing
WB-196	7.5	Thin skin, good color		6.7	Uniform texture	Weak proofing, small volume, light yellow color
SY Harrison	8	Good proofing, high volume, smooth surface	Deep color	8.5	Good height, uniform and fine texture, soft and smooth taste	
LA754	6		Saddle shape, poor proofing	5		Slim waist, sticky taste, not soft & puffed
LA841	7.5	Good color	slightly shrunken skin	7.2	White color, uniform texture	Normal proofing, texture is not puffed and soft enough
TV8861	6		Deep color, poor upright shape	5		Deep yellow color, tight texture
Havoc	7	Smooth surface	poor color	6.7		Weak proofing, not soft and puffed
Vandal	7.5	Good color		7	Uniform texture and natural color	
LCS News	7.5	Smooth surface		7.4		Slightly coarse texture
Bess	8	Smooth surface and thin skin		7.5	Uniform and fine texture	Shrunken in the middle

* 1 = Very poor/ 9 = Excellent

Table 5- 10 Target End Products and Quality Preferences in Dominican Republic

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Sponge cake	x	

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Farinograph Stability	max. 5.0 minutes	1.4-3 minutes
P/L	max 0.8	0.35-0.65
Water absorption	max. 55%	50-54
W 10E-4J	max. 180	100-150
Protein 12% mb (wheat)	max. 10.5	9.8-10.5

Table 5- 11 Flour Quality and Batter Properties for Sweet Bread Evaluated in Dominican Republic

SRW Flour	Overall Flour Quality			Dough/Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1				8	good rheological characteristics	
Shirley	5	good amount of falling number, good water absorption	protein low, w too low	6.5	normal absorption	w too low
WB-196	4.5	normal absorption	protein too low	6.5		w low
SY Harrison	5	good amount of falling number	protein low	5		water absorption too low, w low
LA754	6.5	good protein	w high	8	good rheological characteristics	
LA841	7	good protein	w slightly high	8	good rheological characteristics	
TV8861	7.5	good water absorption, good w	protein slightly low	6		w slightly low
Havoc	6	good amount of falling number	p/l too low	6		p/l low, w slightly low
Vandal	5.5	good amount of falling number	protein low, p/l too high	6		p/l too high, water absorption too low
LCS News	6	good w, good water absorption	p/l too high, protein low	6	good water absorption	p/l too high
Bess	7.5	good w, good water absorption	protein slightly low	7	good rheological characteristics	

* 1 = Very poor/ 9 = Excellent

Table 5- 12 Sponge Cake Baking Performance of SRW Wheat Evaluated in Dominican Republic

SRW Flour	Sponge Cake Baking Performance			Overall Acceptability for Sweet Bread Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.5	good texture		7.5	good flour quality	
Shirley	7.5	good texture		6	water absorption	prefer higher protein, prefer better gluten quality, prefer w much higher
WB-196	6			6		prefer higher protein
SY Harrison	6.5			6.5		prefer higher absorption water
LA754	7.5	good texture		8	good wheat and flour quality	
LA841	8	good texture	volume too low	8	good wheat and flour quality	
TV8861	8	good texture		7	good texture and volume	
Havoc	8	normal volume		7	good texture and volume	prefer higher w, prefer higher p/l
Vandal	9	good volume, good texture		7	good texture and volume	prefer higher protein
LCS News	7.5	good texture		7	good texture and volume	prefer higher protein, prefer lower p/l
Bess	8.5	good texture		7.5	good texture and volume	prefer higher protein

* 1 = Very poor/ 9 = Excellent; ** Removed due to scab damage.

Table 5- 13 Target End Products and Quality Preferences in Indonesia/Bogasari

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cake		x
Cookie		x
Wafer	x	
Coating flour for frying products		x
Indonesian traditional cake (Bolu)		x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Test weight	79 - 81 kg/hl	80 - 83 kg/hl
Wheat moisture	maximum 12.5%	10 - 11.5%
Wheat ash (dry basis)	maximum 1.60%	1.45 - 1,55%
Wheat Falling number	375 - 420 sec	350 - 400 sec
Flour protein (dry basis)	maximum 10%	9.5 - 10.0%
Water absorption	maximum 58%	56 - 58%
SRC - Water	50 - 70%	
SRC - Pentosan (50% Sucrose)	85 - 125%	
SRC - Glutenin (5% Lactic Acid)	80 - 115%	---
SRC - Damaged starch (5% Na2CO3)	75 - 100%	---
P/L on Alveogram	0.6 - 0.8	---
W on Alveogram	140 - 160	---
Cookie volume	6 - 7	8 - 9
Cookie spread	6 - 7	8 - 9

Table 5- 14 Flour Quality and Batter Properties for Baking Sponge Cake in Indonesia/Bogasari

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	Good in protein content, Good SRC, Good water absorption, Good P/L on alveogram, Good W on alveogram	NA	7	Handles well	Thick batter
Shirley	7	Good in protein content, Good SRC, Good water absorption, Good P/L on alveogram	NA	8	Handles well, Flowy batter	NA
WB-196	7	Good in protein content, Good SRC, Good water absorption, Good P/L on alveogram	NA	8	Handles well, Flowy batter	NA
SY Harrison	6.5	Good in protein content, Good SRC, Good water absorption	NA	7.5	Handles well, Flowy batter	Slurry batter
LA754	6	Good in protein content, Good SRC, Good water absorption	High W on alveogram	7.5	Handles well	Thick batter
LA841	7	Good in protein content, Good SRC, Good water absorption, Good W on alveogram	High W on alveogram	8	Handles well, Flowy batter	NA
TV8861	6.5	Good in protein content, Good SRC, Good water absorption	NA	7.5	Handles well, Flowy batter	Slurry batter
Havoc	6.5	Good in protein content, Good SRC, Good water absorption	NA	8	Handles well, Flowy batter	NA
Vandal	6	Good in protein content, Good SRC, Good water absorption	High P/L on alveogram	8	Handles well, Flowy batter	NA
LCS News	6	Good in protein content, Good SRC, Good water absorption	High P/L on alveogram	7.5	Handles well, Flowy batter	Slurry batter
Bess	6.5	Good in protein content, Good SRC, Good water absorption	NA	7	Handles well	Thick batter

* 1 = Very poor/ 9 = Excellent

Table 5- 15 Sponge Cake Baking Performance of SRW Wheat Evaluated in Indonesia/Bogasari

SRW Flour	Sponge Cake Baking Performance			Overall Acceptability for Sponge Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	Good cake volume, Less side shrinkage, Good texture, Nice eating quality	Poor cake symmetry, Very concave High side Shrinkage, Less crust color, Poor crust character, Less crumb color, Low eating quality / gummy	7.0	Nice wheat and flour quality	NA
Shirley	5.5	Good uniformity, Less side shrinkage	Less crust color	7.0	Nice wheat and flour quality	NA
WB-196	7.5	Acceptable cake performance, Good texture, Nice eating quality, Good crumb color	Less crust color	8.0	Nice wheat and flour quality, Acceptable cake application	NA
SY Harrison	6.5	Good uniformity, Less side shrinkage	Less crust color	7.0	Nice wheat and flour quality	NA
LA754	7	Good cake volume, Good texture, Nice eating quality	Less uniformity, High side shrinkage, High streak	6.5	Nice wheat quality, Acceptable flour quality	Prefer lower W on alveogram
LA841	7.5	Acceptable cake performance, Good crust color, Good crumb, Good crust performance	High streak	6.5	Nice wheat and flour quality, Acceptable cake application	Prefer lower W on alveogram
TV8861	7	Good crumb color, Good texture, Good uniformity	High side shrinkage, High streak	7.0	Nice wheat and flour quality	NA
Havoc	6	Good cake volume, Good crumb color	Less uniformity, High side shrinkage, High streak, Poor crust color	7.0	Nice wheat and flour quality	NA
Vandal	6	Less side shrinkage	Less uniformity, High streak, Poor crust color	6.5	Nice wheat quality, Acceptable flour quality	Prefer lower P/L on alveogram
LCS News	8.5	Good cake performance, Good uniformity, Good texture, Nice eating quality	High side shrinkage	7.5	Nice wheat quality, Acceptable flour quality, Good cake performance	Prefer lower P/L on alveogram
Bess	9	Satisfied cake performance, Good cake volume, Good uniformity, Good crust color, Good texture, Nice eating quality	High side shrinkage	9.0	Nice wheat and flour quality, Good cake performance	NA

* 1 = Very poor/ 9 = Excellent

Table 5- 16 Flour Quality and Dough Properties for Baking Cookie in Indonesia/Bogasari

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Good in protein, Good SRC, Good water absorption, Good P/L on alveogram, Good W on alveogram	NA	7.0	Handles well, Soft batter	Very sticky batter
Shirley	7.0	Good in protein, Good SRC, Good water absorption, Good P/L on alveogram	NA	7.0	Handles well, Soft batter	Slightly sticky batter
WB-196	7.0	Good in protein, Good SRC, Good flour color, Good water absorption, Good P/L on alveogram	NA	7.0	Handles well, Soft batter	Slightly sticky batter
SY Harrison	6.0	Good in protein, Good SRC, Good water absorption	NA	7.0	Handles well, Soft batter	Sticky batter
LA754	6.0	Good in protein, Good SRC, Good flour color, Good water absorption	High in W of Alveogram	7.0	Handles well, Soft batter	Slightly crumbly batter
LA841	6.5	Good in protein, Good SRC, Good flour color, Good water absorption, Good P/L on alveogram	High in W of Alveogram	8.0	Good handling, Soft batter	NA
TV8861	8.0	Good in protein, Good SRC, Good flour color, Good water absorption, Good P/L on alveogram, Good W on alveogram	NA	8.0	Good handling, Soft batter	NA
Havoc	6.0	Good in protein, Good SRC, Good water absorption	NA	8.0	Good handling, Soft batter	NA
Vandal	6.0	Good in protein, Good SRC, Good flour color, Good water absorption	High P/L on alveogram	8.0	Good handling, Soft batter	NA
LCS News	6.5	Good in protein, Good SRC, Good flour color, Good water absorption, Good W on alveogram	High P/L on alveogram	8.0	Good handling, Soft batter	NA
Bess	7.0	Good in protein, Good SRC, Good flour color, Good water absorption, Good W on alveogram	NA	8.0	Good handling, Soft batter	NA

* 1 = Very poor/ 9 = Excellent

Table 5- 17 Cookie Baking Performance of SRW Wheat Evaluated in Indonesia/Bogasari

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Acceptable cookie performance, Soft texture, High percent weight loss, Good crispiness	Hard texture	7.0	Nice wheat and flour quality	NA
Shirley	8.0	Good cookie performance, Good spread, Soft texture, Less brittleness, Very good crispiness	NA	8.0	Nice wheat and flour quality	NA
WB-196	9.0	Good cookie performance, Good spread, Soft texture, Less brittleness, Good crispiness, High percent weight loss	NA	8.0	Nice wheat and flour quality, Good cookie performance	NA
SY Harrison	9.0	Good cookie performance, Good spread, Soft texture, Less brittleness, Very good crispiness, High percent weight loss	NA	8.0	Nice wheat and flour quality, Good cookie performance	NA
LA754	6.0	Good crispiness, Soft texture	Very low spread, Hard texture, Very high brittleness, Very low crispiness	6.5	Nice wheat and flour quality	Prefer low W on alveogram
LA841	8.5	Good cookie performance, Soft texture, Less brittleness, Good crispiness, High percent weight loss	NA	7.5	Nice wheat and flour quality, Good cookie performance	Prefer low W on alveogram
TV8861	6.5	Soft texture, High percent weight loss	Low crispiness	7.0	Nice wheat and flour quality	NA
Havoc	6.5	Acceptable cookie performance, Good spread, Good crispiness	Hard texture, Low spread	7.0	Nice wheat and flour quality	NA
Vandal	7.5	Acceptable cookie performance, Good spread, Less brittleness, Good crispiness	Very hard texture	6.5	Nice wheat and flour quality	Prefer low P/L on alveogram
LCS News	7.0	Acceptable cookie performance, Good crispiness, Soft texture	Very hard texture	6.5	Nice wheat and flour quality	Prefer low P/L on alveogram
Bess	7.5	Acceptable cookie performance, Less brittleness, Good crispiness, Soft texture	Hard texture	7.0	Nice wheat and flour quality	NA

* 1 = Very poor/ 9 = Excellent

Table 5- 18 Target End Products and Quality Preferences in Indonesia/Pundi encana

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cake	x	
Ice cream cone	x	
Chiffon cake	x	
Flat wafer	x	

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Test weight	min 80 kg/hl	84 kg/hl
Flour protein	max 9.0% (as is)	8.0 - 8.5% (as is)
Extraction rate	70-75 %	72-75%
Water absorption	56-60%	57-59%
SRC - Water	50 -70	50 - 60
SRC - Pentosan	80 -120	80 - 100
SRC - Lactic Acid	85 - 115	85 - 100
SRC - Sodium Carbonate	60 - 100	60 - 90
Falling Number	300 - 500	300 - 450

Table 5- 19 Flour Quality and Batter Properties for Baking Sponge Cake in Indonesia/Pundi Kencana

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	High test weight, Good falling number, Good wheat moisture (low), Good lactic acid value	NA	7.0	NA	Thick batter, Poor specific gravity
Shirley	5.0	Good protein content, Good TKW, Good falling number, Good lactic acid value, Good water absorption	High wheat moisture, Too low stability in farino	9.0	Flowy batter, Good specific gravity	NA
WB-196	6.0	Good protein content, Good ash content, Good lactic acid value, Good water absorption	Too low stability	8.0	Flowy batter	Poor specific gravity
SY Harrison	6.0	Good protein content, Good falling number, Good lactic acid value	Too low water absorption, Too low stability	9.0	Good specific gravity, flowy batter	NA
LA754	5.5	good TKW, Good falling number, Good water absorption	Protein is too high (Prefer max. 95% as is)	8.0	Good specific gravity	Thick batter
LA841	6.0	Good protein content, Good ash content	Too high lactic acid content (Prefer max. 95%), Too low stability in farino	8.0	Flowy batter	Poor specific gravity
TV8861	7.0	Good protein content, Good lactic acid value, Good falling number	NA	9.0	Flowy batter, Good specific gravity	NA
Havoc	5.5	Good protein content, Good falling number, Good lactic acid value	Too low water absorption, Too low stability in farino	9.0	Good specific gravity, flowy batter	NA
Vandal	6.0	Good TKW, Good protein content, Good lactic acid value	Too low stability in farino	8.0	Flowy batter	Poor specific gravity
LCS News	6.0	Good protein content, Good water absorption	Too high lactic acid content	9.0	Good specific gravity, flowy batter	NA
Bess	7.0	Good protein content, Good falling number, Good lactic acid value, Good water absorption	NA	8.0	Good specific gravity	Thick batter

* 1 = Very poor/ 9 = Excellent.

Table 5- 20 Sponge Cake Baking Performance of SRW Wheat Evaluated in Indonesia/Pundi Kencana

SRW Flour	Sponge Cake Baking Performance			Overall Acceptability for Sponge Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	Acceptable texture, Acceptable grain, Acceptable eating quality, Good crust color	High shrinkage value, Slightly low cake volume	7	Good protein content, Good lactic acid value, Good gluten content	Prefer good batter characteristic, Good cake volume
Shirley	5	Acceptable grain, Good uniformity index	Darker crust color, Slight chewy, Dry & streaky grain, Low cake volume	5	Good protein content, Good lactic acid value, Flowy batter, Low Specific Gravity	Darker crust color, Slight chewy, Dry & streaky grain, Low cake volume, Too high wheat moisture
WB-196	5	Good texture, Good crumb color	Darker crust color, Slight chewy, Dry & streaky grain, Low cake volume	4.5	Good protein content, Good lactic acid value, Good flowy batter	Too low stability, Poor specific gravity, Darker crust color, Chewy bite, Dry & streaky crumb, Low cake volume
SY Harrison	4.5	Acceptable grain	Slight darker crust color, Low cake volume, Streaky grain	4.5	Good protein content, Good lactic acid value, Good flowy batter, Good specific gravity	Too low water absorption, Too low stability, Darker crust color, Low cake volume, Dry & streaky crumb
LA754	5	Acceptable grain	Darker crust color, Dry & streaky	5	Good TKW, Good specific gravity	Prefer lower protein, Too thick batter, Darker crust color, Dry & streaky crumb
LA841	6	Acceptable crust color, Acceptable crumb color, Acceptable grain	Slight chewy, Low cake volume & collapse, Streaky grain	3.5	Good protein content, Good ash content, Flowy batter, Good crust & crumb color	Too high lactic acid, Too low stability in farino, High specific gravity, Slightly chewy bite, Low cake volume & collapse, Dry & streaky crumb
TV8861	5.5	Acceptable grain, Good cake volume	Darker crust color, Streaky grain	5.5	Good protein content, Good lactic acid value, Flowy batter, Good specific gravity, Good cake volume	Darker crust color
Havoc	5	Good crumb color	Slight coarser in grain, Slight chewy & streaky, Low cake volume	5	Good protein content, Good lactic acid value, Good specific gravity, Flowy batter	Too low water absorption, Too low in stability in farino, Coarser grain, Dry & streaky crumb, Low cake volume
Vandal	5	Finer grain	Chewy & dry, Streaky grain, Low cake volume	5	Good TKW, Good protein content, Good lactic acid value, Flowy batter	Too low stability in farino, Poor specific gravity, Chewy bite, Dry & streaky crumb, Low cake volume
LCS News	6.5	Finer grain, Very good crumb color, Very good volume index	Chewy texture & streaky slightly chewy	6	Good protein content, Good specific gravity, Flowy batter, Very good crumb color, Very good cake volume	Too high lactic acid content, Chewy cake texture, Streaky crumb
Bess	6.5	Finer grain, Very good crumb color, Good cake volume	Dry & streaky, slightly gummy	5.5	Good wheat characteristic, Good specific gravity, Good cake volume	Thick batter, Dry & streaky crumb, Slight chewy bite

* 1 = Very poor/ 9 = Excellent

Table 5- 21 Flour Quality and Dough Properties for Baking Cookie in Indonesia/Pundi Kencana

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	High test weight, Good falling number, Good wheat moisture (low), Good lactic acid value	NA	7	Soft dough	Slightly sticky
Shirley	5.0	Good protein content, Good TKW, Good falling number, Good lactic acid value, Good water absorption	High wheat moisture, Too low stability in farino	7	Soft dough	Slightly sticky
WB-196	6.0	Good protein content, Good ash content, Good lactic acid value, Good water absorption	Too low stability	7	Soft dough	Slightly sticky
SY Harrison	6.0	Good protein content, Good falling number, Good lactic acid value	Too low water absorption, Too low stability	5	Soft dough	Sticky
LA754	5.5	Good TKW, Good falling number, Good water absorption	Protein is too high	4	NA	Dry, crumbly dough
LA841	6.0	Good protein content, Good ash content	Too high lactic acid content, (Prefer max. 95%), Too low stability in farino	8	Soft dough, Handles well	NA
TV8861	7.0	Good protein content, Good lactic acid value, Good falling number	NA	8	Soft dough, Handles well	NA
Havoc	5.5	Good protein content, Good falling number, Good lactic acid value	Too low water absorption	8	Soft dough, Handles well	NA
Vandal	6.0	Good TKW, Good protein content, Good lactic acid value	Too low stability in farino	8	Soft dough, Handles well	NA
LCS News	6.0	Good protein content, Good water absorption	Too high lactic acid content	8	Soft dough, Handles well	NA
Bess	7.0	Good protein content, Good falling number, Good lactic acid value, Good water absorption	NA	8	Soft dough, Handles well	NA

* 1 = Very poor/ 9 = Excellent;

Table 5- 22 Cookie Baking Performance of SRW Wheat Evaluated in Indonesia/Pundi Kencana

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	Acceptable texture Good cookie spread	NA	7.0	Nice wheat and flour quality, Good cookie product	Dough slightly sticky
Shirley	9	Very good texture Good cookie spread	NA	5.0	Good flour quality, Good cookie product	Too high wheat moisture, Dough slightly sticky
WB-196	8	Good texture Good cookie spread	NA	5.0	Good wheat & flour quality, Good cookie product	Slightly too low stability, Slightly sticky product
SY Harrison	8	Good texture Good cookie spread	NA	5.0	Good lactic acid value, Acceptable product	Too low water absorption, Slightly sticky product
LA754	8	Good texture Good cookie spread	NA	4.5	Acceptable cookie product	Prefer lower protein, Dough is too dry & crumbly
LA841	9	Very good texture Good cookie spread	NA	4.5	Very good cookie product	Prefer lower lactic acid value, (Prefer below 95%)
TV8861	9	Very good texture Good cookie spread	NA	9.0	Very good cookie product, Soft dough & handles well, Good flour quality	NA
Havoc	7.5	Acceptable texture Good cookie spread	NA	7.0	Acceptable cookie product, Soft dough & handles well, Good lactic acid value	Too low water absorption
Vandal	7.5	Acceptable texture Good cookie spread	NA	8.0	Nice wheat and flour quality, Acceptable cookie product, Soft dough & handles well	NA
LCS News	8	Acceptable texture Good cookie spread	NA	4.5	Acceptable cookie product, Soft dough & handles well	Prefer lower lactic acid value
Bess	7.5	Acceptable texture, Slightly better cookie spread	NA	8.0	Good lactic acid value, Soft dough & handles well, Acceptable cookie product	NA

* 1 = Very poor/ 9 = Excellent

Table 5- 23 Target End Products and Quality Preferences in Malaysia

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cookies & sweet biscuit	x	x
Sponge & pound cake	x	x
Frying batter	x	x
Chinese style pastries	x	
Waffle	x	x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Flour Yield (Base on Commercial Extraction)	78% (min)	> 80%
Falling Number	300 (min)	350 - 450
Test Weight	73 (min)	> 78
Flour Protein (as - is)	9.5 (max)	7.5 - 9.0
Flour Wet Gluten	26.0 (max)	18- 23
Farinograph water absorption	60 (max)	55- 58
Farinograph Dough Development time	5 (max)	1 - 4minutes
Farinograph Stability	8 (max)	3 - 6 minutes
Extensograph energy (area)	90 cm ² (max)	50 - 80 cm ²

Table 5- 24 Flour Quality and Batter Properties for Baking Sponge Cake in Malaysia

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Good test weight, Good 1000 kernel weight	NA	7.0	NA	High Farinograph absorption
Shirley	6.0	NA	Too high wheat moisture	8.0	Good flowy batter characteristics	NA
WB-196	6.5	NA	Rather low wheat protein	8.0	Good flowy batter characteristics	NA
SY Harrison	7.5	NA	NA	7.5	Good flowy batter characteristics	Low Farinograph absorption
LA754	8.0	Good 1000 kernel weight	NA	7.0	NA	Low Farinograph MTI, Rather thick batter
LA841	7.5	NA	Low test weight, High wheat moisture	7.5	Good flowy batter characteristics	Low Farinograph MTI
TV8861	8.0	Satisfactory wheat and flour characteristics	NA	8.0	Good flowy batter characteristics	NA
Havoc	6.5	NA	High wheat moisture	8.0	Good flowy batter characteristics	NA
Vandal	8.0	Good 1000 kernel weight	Prefer lower wheat moisture	7.5	Good flowy batter characteristics	Low Farinograph absorption
LCS News	6.5	NA	Low falling number, High wheat moisture	8.0	Good flowy batter characteristics	NA
Bess	7.5	NA	High wheat moisture	7.5	NA	Rather thick batter

* 1 = Very poor/ 9 = Excellent

Table 5- 25 Sponge Cake Baking Performance of SRW Wheat Evaluated in Malaysia

SRW Flour	Sponge Cake Baking Performance			Overall Acceptability for Sponge Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	NA	Poor cookie spread ratio	7.0	NA	High Farinograph absorption
Shirley	6.5	NA	Coarser grain, Dry crumb	6.0	NA	Too high wheat moisture
WB-196	6.8	NA	Small cake volume, Lack of softness	6.0	NA	Rather low wheat protein
SY Harrison	6.5	NA	Lack of softness	6.5	NA	Low Farinograph absorption
LA754	8.0	Good texture & volume	NA	7.5	Good 1000 kernel weight, Good end product	Low Farinograph MTI
LA841	7.0	NA	Small cake volume, Lack of softness	6.9	NA	Low test weight
TV8861	7.8	Good texture	NA	8.0	Good wheat characteristics, Good end product	NA
Havoc	7.0	Good volume & grain	Lack of symmetry	7.2	NA	High wheat moisture
Vandal	6.0	NA	Small cake volume, Lack of softness	6.5	NA	High wheat moisture, Low Farinograph absorption
LCS News	7.0	NA	Lack of softness	6.5	NA	High wheat moisture, Softer end product
Bess	8.0	Good texture & volume	NA	7.5	Good end product	High wheat moisture

* 1 = Very poor/ 9 = Excellent

Table 5- 26 Flour Quality and Dough Properties for Baking Cookie in Malaysia

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	Good test weight, Good 1000 kernel weight	NA	7	NA	High Farinograph absorption
Shirley	6	NA	Too high wheat moisture	7.5	Similar dough characteristics as control	NA
WB-196	6.5	NA	Rather low wheat protein	7.5	Similar dough characteristics as control	NA
SY Harrison	7.5	NA	NA	7	Similar dough characteristics as control	Low Farinograph absorption
LA754	8	Good 1000 kernel weight	NA	6.5	NA	Slightly crumbly dough
LA841	7.5	NA	Low test weight, High wheat moisture	8	Soft & good handling dough	NA
TV8861	8	Satisfactory wheat and flour characteristics	NA	7.5	Soft & good handling dough	Low Farinograph absorption
Havoc	6.5	NA	High wheat moisture	8	Soft & good handling dough	NA
Vandal	8	Good 1000 kernel weight	Prefer lower wheat moisture	7.5	Soft & good handling dough	Low Farinograph absorption
LCS News	6.5	NA	Low falling number, High wheat moisture	8	Soft & good handling dough	NA
Bess	7.5	NA	High wheat moisture	8	Soft & good handling dough	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 27 Cookie Baking Performance of SRW Wheat Evaluated in Malaysia

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	NA	Poor cookie spread ratio	7	NA	High Farinograph absorption
Shirley	8.5	Good hardness, Good brittleness , Good crispiness	NA	6	Good end product	Too high wheat moisture
WB-196	7.5	Good crispines	NA	6.5	NA	Rather low wheat protein
SY Harrison	7.5	Good crispines	NA	6.7	NA	Low Farinograph absorption
LA754	6	NA	Poor brittleness, Poor crispiness	6.8	Good 1000 kernel weight	Poor brittleness, Poor crispiness
LA841	7.8	Good crispines	NA	7.2	Good end product	Low test weight, High wheat moisture
TV8861	7	NA	Poor crispines	7	NA	Low Farinograph absorption
Havoc	6.5	NA	Rather hard cookie	6.8	NA	High wheat moisture, Rather hard end product
Vandal	6.5	NA	Rather hard cookie	6.8	NA	High wheat moisture, Rather hard end product
LCS News	6.8	Reasonable crispness	Too hard cookie, Poor brittleness	6.5	NA	Low Falling Number, High wheat moisture
Bess	6.8	NA	Too hard cookie	7	NA	High wheat moisture

* 1 = Very poor/ 9 = Excellent

Table 5- 28 Target End Products and Quality Preferences in Mexico

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cookies	x	

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Ash	maximum .530	.480 - .500
Gluten	maximum 30 %	25 - 30 %
Gluten Index	70%	> 80%

Table 5- 29 Flour Quality and Dough Properties for Baking Cookie in Mexico

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1						
Shirley	7.6	Good absorption	Low W	7.3	Good absorption	Low W
WB-196	6.8	Good absorption	Low protein, low W	9.1	Good absorption, Good color, Good protein, High ITM UB	
SY Harrison	8.2	Good absorption, Good W		8.9	Good absorption, Good color, high ITM UB	
LA754	8	Good absorption, Good W	Low BTU	8.7	Good absorption, Good color, Good protein, High ITM UB	Low stability
LA841	8.2	Good absorption, Good W		7.5	Good absorption, High W	Low color compared to the rest of samples
TV8861	8.2	Good absorption, Good W		7.2	Good absorption, Good color	
Havoc	8.2	Good absorption, Good W		6.9	Good absorption, Good color	High P/L
Vandal	7.5	Good absorption, Good W	Low protein	6.5	Good color	Low absorption
LCS News	6.8	Good absorption, Good W	too tough, low protein, low falling numbers	7.8		
Bess	8.1	Good absorption, Good W		8.1		

* 1 = Very poor/ 9 = Excellent

Table 5- 30 Cookie Baking Performance of SRW Wheat Evaluated in Mexico

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1						
Shirley	8.2	Good crumb color	Appearance irregular	7.4	Good absorption	Low protein, Low strength (W), Low gluten
WB-196	7.8	Acceptable appearance, Good crumb color	Very extensible	8.2	Good absorption	Low strength (W)
SY Harrison	8.1	Good color, Good diameter and height	Appearance irregular	7.5	Good absorption	Low Protein, Low gluten
LA754	9.6	Acceptable texture, Good crumb color, good cookie size		9.4	Good absorption, Acceptable strength (W), Good development, High stability	
LA841	8.2	Good size, Good crumb color	Appearance irregular	7.9	Acceptable strength (W)	Low color, low protein
TV8861	6.7		Appearance irregular, Very little, big crumb, bad color, wet appearance	7.5		Low gluten amount
Havoc	6.7	Good crumb color	Appearance not acceptable, big crumb	7.1	Acceptable strength	Low protein, low absorption, low gluten, low stability
Vandal	7.5	Good crumb color	Appearance irregular, Very extensible	7.1	Acceptable strength	Low protein, low gluten
LCS News	6.7			7.7	Acceptable strength, Good absorption	Low protein, low gluten, high p/l
Bess	8.2	Appearance acceptable, acceptable color	Appearance acceptable, small size	8.2	Acceptable strength, Good absorption	

* 1 = Very poor/ 9 = Excellent.

Table 5- 31 Target End Products and Quality Preferences in Philippines/MSMC

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Other Flours
Cookies	X	
Biscuits	X	

Quality Preferences	Acceptable Quality (Medium Quality)	Preferred Quality (High Quality)
Ash content	0.5	maximum 0.52
Water absorption	minimum 52	52-54
Farinograph stability	maximum 5 min	3-4mins
Protein content	minimum 8.00	8.00-9.00
Moisture	maximum 13.0	12.00-13.00

Table 5- 32 Flour Quality and Dough Properties for Baking Cookie in Philippines/MSMC

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Acceptable flour analysis	NA	7.0	NA	Slightly sticky dough
Shirley	6.5	Acceptable ash content	Low protein content, low parinograph Stability	7.0	NA	Slightly sticky dough
WB-196	6.0	Low ash content	Too low protein content, low water absorption & farinograph stability	6.0	NA	Sticky dough
SY Harrison	5.5	Low ash content	Too low water absorption, low protein content, low farinograph stability	6.0	NA	Slightly crumbly
LA754	7.0	Acceptable flour analysis	NA	8.0	Good handling	NA
LA841	6.0	Low ash content	Too low protein content, low water absorption & farinograph stability	8.0	Good handling	NA
TV8861	6.0	Low ash content	Too low protein content, low water absorption & farinograph stability	8.0	Good handling	NA
Havoc	6.0	Low ash content	Too low protein content, low water absorption & farinograph stability	8.0	Good handling	NA
Vandal	6.0	Low ash content	Too low protein content, low water absorption & farinograph stability	8.0	Good handling	NA
LCS News	6.3	Low ash content, acceptable water absorption	Too low protein content	8.0	Good handling	NA
Bess	6.0	Low ash content, acceptable water absorption	Low protein content	8.0	Good handling	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 33 Cookie Baking Performance of SRW Wheat Evaluated in Philippines/MSMC

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Acceptable texture	NA	7.0	Acceptable flour analysis	Slightly sticky dough, low protein content & farinograph stability
Shirley	7.0	Acceptable texture, acceptable spread	NA	6.8	Acceptable ash content & texture	Low protein content
WB-196	7.0	Acceptable texture, acceptable spread	NA	6.3	Low ash content, Acceptable spread & texture	Too low protein content, low water absorption & farinograph stability
SY Harrison	7.0	Acceptable texture, acceptable spread	NA	6.2	Low ash content, Acceptable spread & texture	Too low water absorption, low protein content & farinograph absorption
LA754	5.0	NA	Poor texture & spread	6.7	Acceptable flour analysis, good handling	Poor texture
LA841	6.0	Acceptable texture	Poor spread	6.7	Low ash content, good handling, acceptable texture	Low water absorption, poor spread, low protein content
TV8861	7.0	Acceptable texture, acceptable spread	NA	7.0	Low ash content, good handling, acceptable spread	Low water absorption & protein content
Havoc	6.0	Good spread	Poor texture	6.7	Good spread, low ash content	Poor texture, too low water absorption, low farinograph stability
Vandal	6.0	Good spread	Poor texture	6.7	Low ash content, good spread & handling	Too low protein content, slightly low water absorption
LCS News	5.0	NA	Poor spread & texture	6.4	Low ash content, acceptable water absorption	Too Low protein content, poor texture
Bess	5.0	NA	Slight poor texture & poor spread	6.5	Low ash content, acceptable water absorption	Low protein content, slightly poor texture

* 1 = Very poor/ 9 = Excellent

Table 5- 34 Target End Products and Quality Preferences in Philippines/PFMC

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cake	x	
Cookie & Cracker	x	
Wafer	x	
Noodles		x
Spring Rolls	x	
Pancake	x	
Frying Flour	x	
Gravy	x	
Pasta		x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Flour Protein	9.0 Maximum	8.5 Maximum
Flour Ash	0.500 Maximum	0.480 Maximum
Wet Gluten	24.0 - 28.0	28.0 Maximum
Water Absorption	53.0 - 58.0	53.0 - 56.0

Table 5- 35 Flour Quality and Dough Properties for Baking Cookie in Philippines/PFMC

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	8.0	Good protein & gluten quantity, Low ash content, Good water absorption	High moisture	6.0	NA	Soft & sticky
Shirley	6.0	Acceptable milling extraction, Acceptable water absorption, Low ash content	High wheat defects, High wheat moisture, Yellowish flour color, Low protein quantity	7.0	NA	Soft & slightly sticky
WB-196	6.0	Low ash content	Slightly low milling extraction, Poor protein quantity, Low water absorption	7.0	NA	Soft & slightly sticky
SY Harrison	6.0	Slightly good milling extraction, Low ash content	Low protein quantity, Low water absorption	6.0	NA	Soft & sticky
LA754	8.0	Acceptable protein quantity, Slightly good milling extraction, Good water absorption	High defects	7.0	NA	Slightly crumbly
LA841	8.0	Acceptable protein quantity, Low ash content	Slightly poor milling extraction, Low water absorption	9.0	Soft & good handling	NA
TV8861	6.0	Low ash content	Slightly low protein quantity, Low water absorption	9.0	Soft & good handling	NA
Havoc	6.0	Low ash content	Slightly low protein quantity, Low water absorption	9.0	Soft & good handling	NA
Vandal	5.0	Low ash content	Slightly poor milling extraction, Very low protein quantity, Low water absorption	9.0	Soft & good handling	NA
LCS News	5.5	Low ash content, Good water absorption	Poor milling extraction, Very low protein quantity	9.0	Soft & good handling	NA
Bess	6.0	Low ash content, Good water absorption	Slightly poor milling extraction, Low protein quantity	9.0	Soft & good handling	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 36 Cookie Baking Performance of SRW Wheat Evaluated in Philippines/PFMC

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	6.0	Acceptable texture	Low percent weight loss, Poor spread	6.0	Good flour analysis	Prefer good batter handling
Shirley	7.0	Good texture, Good spread	Low percent weight loss	7.0	Good end product characteristics	Prefer good dough handling, Prefer slightly higher protein quantity
WB-196	9.0	Good texture, High percent weight loss, Good spread, Hard, brittle & crispy texture	NA	7.0	Good end product characteristics	Prefer good dough handling, Prefer slightly higher protein quantity
SY Harrison	9.0	Good texture, Acceptable weight loss, Good spread, Hard & brittle, Crispy texture	NA	7.0	Good end product characteristics	Prefer good dough handling, Prefer slightly higher protein quantity
LA754	5.0	NA	Poor spread, Low percent weight loss, Poor texture	5.0	Slightly good flour analysis	Prefer good end product characteristics, Prefer good batter handling
LA841	7.5	High weight loss, Good texture	Poor spread	6.0	Good batter handling, Slightly good flour quality	Prefer more spread
TV8861	7.0	High weight loss, Good texture, Slightly hard & brittle, Acceptable weight loss, Slight crispy texture	NA	9.0	Good end product characteristics, Good batter handling, Good batter handling	Prefer slightly higher protein quantity
Havoc	6.0	Good spread, Acceptable weight loss	Poor texture	7.0	Good batter handling, Acceptable end product characteristics, Good batter handling	Prefer good texture, Prefer slightly higher protein quantity
Vandal	6.0	Good spread, Acceptable weight loss	Poor texture	7.0	Acceptable end product characteristics	Prefer higher protein quantity, Prefer good texture
LCS News	5.5	Acceptable weight loss	Poor spread, Poor texture	5.0	Good batter handling	Prefer higher protein quantity, Prefer good end product characteristics
Bess	5.0	Acceptable weight loss, Acceptable texture	Poor spread	7.0	Good batter handling, Acceptable end product characteristics	Prefer higher protein quantity, Prefer more spread

* 1 = Very poor/ 9 = Excellent.

Table 5- 37 Target End Products and Quality Preferences in Philippines/RFM

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cakes	x	
Cookies	x	
Crackers		x
Wafer	x	
Cones	x	
Spring Roll	x	
Snacks		x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Wet gluten content	NA	24 minimum
Farinograph stability	NA	1.5 minimum
Protein content	NA	24 minimum

Table 5- 38 Flour Quality and Dough Properties for Baking Cookie in Philippines/RFM

SRW Flour	Overall Flour Quality			Dough Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	High protein content, High gluten content, Long Farinograph stability, High water absorption	NA	7.0	Good handling	NA
Shirley	6.0	NA	Very low protein content, Very short Farinograph stability, Low ash content	6.0	NA	Slightly sticky dough
WB-196	6.0	NA	Very low protein content, Very short Farinograph stability, Very low ash content	6.0	NA	Slightly sticky dough
SY Harrison	6.0	NA	Very low protein content, Very short Farinograph stability, Very low ash content, Very low water absorption	6.0	NA	Sticky dough
LA754	6.5	Good protein content, Good Farinograph stability	Very low ash content, Slight low water absorption	5.0	NA	Slightly crumbly
LA841	6.5	Good Farinograph stability	Slightly low protein, Very low water absorption, Very low ash content	7.0	Good handling	Very low water absorption
TV8861	6.0	NA	Very low protein content, Very short Farinograph stability, Very low water absorption	7.0	Good handling	Very short Farinograph stability, very low water absorption
Havoc	6.0	NA	Very short Farinograph stability, Low protein content, Very low ash content, Very low water absorption	7.0	Good handling	Very short Farinograph stability, very low water absorption
Vandal	6.0	NA	Very short Farinograph stability, Low protein content, Very low ash content, Very low water absorption	7.0	Good handling	Very short Farinograph stability, very low water absorption
LCS News	6.0	NA	Short Farinograph stability, Low protein content, Very low ash content, Very low water absorption	7.0	Good handling	Short Farinograph stability
Bess	6.0	NA	Slight short Farinograph stability, Slight low protein content	7.0	good handling	Slight short Farinograph stability

* 1 = Very poor/ 9 = Excellent.

Table 5- 39 Cookie Baking Performance of SRW Wheat Evaluated in Philippines/RFM

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7	Good spread, Hard texture	Less crispy	7	Good wheat & flour quality	NA
Shirley	7	Good spread	Dark cookie color, Less cracks on cookie surface	5	NA	Very short Farinograph stability
WB-196	7	Good spread, Good color	Less cracks on cookie surface Dark cookie color, Less cracks on cookie surface	5	NA	Very short Farinograph stability
SY Harrison	8	Excellent spread	Dark cookie color, Less cracks on cookie surface	5	NA	Very short Farinograph stability
LA754	7	Good spread	Light brown color	7	Good flour quality	NA
LA841	7	Good spread, Good color	Less cracks on cookie surface	7	Good flour quality	NA
TV8861	7	Good spread, Good color, Good cracks on cookie surface	NA	5	NA	Very short Farinograph stability
Havoc	7	Good spread	Less cracks on cookie surface, Less hard	5	NA	Very short Farinograph stability
Vandal	7	Good spread, Good cracks on cookie surface	Very light color, Less crispy	5	NA	Very short Farinograph stability
LCS News	7	Good spread, Good cracks on cookie surface	Less hard	6	Slight good flour quality	NA
Bess	7	Good spread	Less hard	6	Slight good flour quality	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 40 Target End Products and Quality Preferences in Philippines/MSMC

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Oher Flours
Cake	X	

Quality Preferences	Acceptable Quality (Dedium Quality)	Preferred Quality (High Quality)
Ash content	0.38	maximum 0.48
Water absorption	minimum 52	52-55
Farinograph stability	maximum 5 mins	3-4mins
Protein content	minimum 7.5	7.5-8.00
Moisture	maximum 13.0	12.00-13.00

Table 5- 41 Flour Quality and Dough Properties for Baking Chiffon Cake in Philippines/MSMC

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Acceptable flour analysis, good milling extraction	NA	7.0	Smooth & flowy	NA
Shirley	6.5	Good flour color, acceptable absorption	Low Farinograph stability, low protein content	7.0	Smooth & flowy	NA
WB-196	5.0	Low ash content, low starch damage	Low water absorption, low protein content & farinograph stability	7.0	Smooth & flowy	NA
SY Harrison	5.2	Low ash content	Too Low water absorption, low farinograph stability	7.0	Smooth & flowy	NA
LA754	7.0	Acceptable Flour analysis, Low ash & starch damage	NA	7.0	Smooth & flowy	NA
LA841	6.5	Low ash content & starch damage	Low water absorption	7.0	Smooth & flowy	NA
TV8861	5.7	Good flour color	Low water absorption, Low Farinograph stability	7.0	Smooth & flowy	NA
Havoc	6.3	Low ash content	Low absorption & farinograph stability	7.0	Smooth & flowy	NA
Vandal	5.0	Low ash content	Low water absorption & low farinograph stability, too low protein	7.0	Smooth & flowy	NA
LCS News	5.5	Acceptable water absorption, low ash content	Too low protein content	7.0	Smooth & flowy	NA
Bess	8.0	Low Ash Content, acceptable water absorption low starch damage	NA	7.0	Smooth & flowy	NA

* 1 = Very poor/ 9 = Excellent

Table 5- 42 Chiffon Cake Baking Performance of SRW Wheat in Philippines/MSMC

SRW Flour	Chiffon Cake Baking Performance			Overall Acceptability for Chiffon Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Good cake height, external, internal & crumb color	NA	7.0	Acceptable flour analysis & end product quality	NA
Shirley	6.7	Good cake height, symmetry, crust characteristics	Slightly dark crust color	6.5	Acceptable water absorption, good cake height & crust characteristics, acceptable product	Low Farinograph stability & protein content, slightly dark crust color
WB-196	6.1	Good volume	Shrinkage at center, dark crust color	6.0	Good volume, low ash content	Dark crust color, low water absorption & farinograph stability, too low protein content
SY Harrison	6.2	Acceptable crumb color	Poor symmetry & crust characteristics, shrinkage at the center	5.5	Acceptable crumb color	Poor end product, too low water absorption, low farinograph stability
LA754	6.8	Good volume & grain characteristics, acceptable texture	Shrinkage at the center, dark crust color	6.0	Good volume, acceptable flour analysis & end product	Shrinkage at the center
LA841	6.4	Good volume	Slightly shrink at the center, poor internal characteristics	6.0	Good volume	Poor internal characteristics, low water absorption
TV8861	6.4	Good symmetry, average volume	Dark crust, inferior crumb color	6.5	Good symmetry, average volume	Inferior crumb color, low water absorption & farinograph stability
Havoc	6.6	Good symmetry & crust characteristics	Inferior crumb color	6.5	Low ash content, good symmetry & crust characteristics	Low water absorption & farinograph stability
Vandal	6.3	Acceptable crust character	Poor color of Crumb & crust, poor texture, slight big holes in crumb	6.5	Low ash content	Low water absorption & farinograph stability, too low protein content, poor texture
LCS News	5.9	NA	Poor symmetry, poor texture & volume, shrinkage at the center	5.0	Acceptable water absorption, low ash content	Poor symmetry & texture & volume, shrinkage at the center, too low protein content
Bess	7.1	Good symmetry & grain characteristics, acceptable texture	Dark crust color, inferior crumb color	6.5	Good symmetry, good grain characteristics, acceptable texture, low ash content, acceptable water absorption	Dark crust color, inferior crumb color

* 1 = Very poor/ 9 = Excellent.

Table 5- 43 Target End Products and Quality Preferences in Philippines/PFMC

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Other Flours
Cake	x	
Cookie & Cracker	x	
Wafer	x	
Noodles		x
Spring Rolls	x	
Pancake	x	
Frying Flour	x	
Gravy	x	
Pasta		x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Flour Protein	9.0 maximum	8.5 maximum
Flour Ash	0.500 maximum	0.480 maximum
Wet Gluten	24.0 - 28.0	28.0 Maximum
Water Absorption	53.0 - 58.0	53.0 - 56.0

Table 5- 44 Flour Quality and Batter Properties for Baking Chiffon Cake in Philippines/PFMC

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Good protein and gluten quantity, Low ash content, Good water absorption	High moisture	7.0	Slightly good batter handling	Slightly thick batter
Control 2	6.0	Acceptable protein quantity, Good water absorption, Acceptable ash content	High moisture	7.0	Slightly good batter handling	Slightly thick batter
Shirley	5.5	Acceptable water absorption, Low ash content	Low milling extraction, High wheat defects, High wheat moisture, Yellowish flour color, Low protein quantity	7.0	Slightly good batter handling	Slightly thick batter
WB-196	5.0	Low ash content, Acceptable water absorption	Low milling extraction, Very low protein quantity, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
SY Harrison	5.5	Slightly good milling extraction, Low ash content	Low protein quantity, Low water absorption, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
LA754	9.0	Good protein quantity, Slightly good milling extraction, Good water absorption, Low ash content	High defects, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
LA841	8.0	Acceptable protein quantity, Low ash content, Acceptable water absorption	Low milling extraction, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
TV8861	7.0	Acceptable protein quantity, Low ash content, Acceptable water absorption	Low milling extraction, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
Havoc	6.0	Acceptable protein quantity, Low ash content	Low water absorption, Low milling extraction, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
Vandal	5.0	Low ash content, Acceptable water absorption	Low milling extraction, Low protein quantity, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
LCS News	5.0	Low ash content, Good water absorption	High defects, Poor milling extraction, Low protein quantity, Low falling number, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter
Bess	6.5	Acceptable protein quantity, Low ash content, Acceptable water absorption	Low milling extraction, High wheat moisture	7.0	Slightly good batter handling	Slightly thick batter

* 1 = Very poor/ 9 = Excellent.

Table 5- 45 Chiffon Cake Baking Performance of SRW Wheat in Philippines/PFMC

SRW Flour	Chiffon Cake Baking Performance			Overall Acceptability for Chiffon Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	6	Good volume, Symmetrical, Fine grain	Firm texture, slightly dull crumb color	6	Good flour analysis	Prefer softer texture, Prefer good crumb color
Control 2	5	Good volume, Acceptable grain	Not symmetrical, Firm texture, Dull crumb color	5	Acceptable flour analysis, Acceptable end product characteristics	Prefer softer texture
Shirley	9	Acceptable volume, Acceptable grain and texture, Good crumb color, Symmetrical, Acceptable external characteristics	NA	7.5	Acceptable end product characteristics	Prefer better flour analysis, Slightly higher protein quantity
WB-196	7	Fine grain, Acceptable texture, Good crumb color	Poor volume, Not symmetrical	7	Good internal characteristics	Prefer better flour analysis, Prefer good external characteristics, Slightly higher protein quantity
SY Harrison	5.5	Acceptable volume, Acceptable texture, Good crumb color	Not symmetrical, Open grain	6	Acceptable end product characteristics	Prefer better flour analysis, Prefer fine grain, Slightly higher protein quantity
LA754	8	Acceptable volume, Symmetrical, Acceptable grain, Excellent texture, Good crumb color	NA	9	Good flour analysis, Excellent end product characteristics	NA
LA841	5	Acceptable volume, Good crumb color	Not symmetrical, Low middle, Cracked crust, Open gain (holes), Firm texture	6	Acceptable flour analysis	Slightly inferior end product characteristics
TV8861	8	Acceptable volume, Good external characteristics, Acceptable grain, Soft texture	Reddish crumb color	7	Acceptable flour analysis, Good end product characteristics	Prefer good crumb color
Havoc	9	Acceptable volume, Acceptable external characteristics, Acceptable grain, Excellent texture, Good crumb color	NA	8	Acceptable flour analysis, Good end product characteristics	NA
Vandal	8	Symmetrical, Good grain, Soft texture, Good crumb color	Poor volume	6	Good end product characteristics	Prefer slightly higher protein quantity, Prefer good volume
LCS News	7	Excellent texture, Good crumb color	Poor volume, Not symmetrical, Poor external characteristics, Open grain	5	NA	Prefer good flour analysis, Prefer good end product characteristics
Bess	9	Acceptable volume, Good external characteristics, Fine grain, Excellent texture, Good crumb color	NA	9	Acceptable flour analysis, Excellent end product characteristics	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 46 Target End Products and Quality Preferences in Philippines/RFM

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Other Flours
Cakes	x	
Cookies	x	
Crackers		x
Wafer	x	
Cones	x	
Spring Roll	x	
Snacks		x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Wet gluten content	NA	24 minimum
Farinograph stability	NA	1.5 minimum
Protein content	NA	24 minimum

Table 5- 47 Flour Quality and Batter Properties for Baking Chiffon Cake in Philippines/RFM

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1 (cake flour)	7	High protein content, Low ash content, Long Farinograph stability, High water absorption	Slightly low gluten content	7	Smooth & flowy batter	NA
Control 2 (cookie flour)	7	High protein content, High gluten content, Long Farinograph stability, High water absorption	Slightly high ash content	7	Smooth & flowy batter	NA
Shirley	6	Good ash content	Very short Farinograph stability, Very low water absorption, Low protein content	7	Smooth & flowy batter	NA
WB-196	6	NA	Very short Farinograph stability, Very low protein content	7	Smooth & flowy batter	NA
SY Harrison	6	NA	Very low protein content, Very low water absorption, Very short Farinograph stability	7	Smooth & flowy batter	Very low water absorption
LA754	7	High protein content, Good ash content, Good Farinograph stability	NA	7	Smooth & flowy batter	NA
LA841	7	Good protein content, Good ash content, Good Farinograph stability	Low water absorption	7	Smooth & flowy batter	NA
TV8861	6	Good protein content, Good ash content	Very short Farinograph stability, Very low water absorption	7	Smooth & flowy batter	NA
Havoc	6	Good protein content, Good ash content	Very short Farinograph stability, Very low water absorption	7	Smooth & flowy batter	Very low water absorption
Vandal	6	Good ash content	Very low protein content, Very short Farinograph stability, Low water absorption	7	Smooth & flowy batter	NA
LCS News	6	Good ash content	Slight short Farinograph stability, Low water absorption	7	Smooth & flowy batter	NA
Bess	6	Good protein content, Good ash content	Slight short Farinograph stability, Low water absorption	7	Smooth & flowy batter	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 48 Chiffon Cake Baking Performance of SRW Wheat in Philippines/RFM

SRW Flour	Chiffon Cake Baking Performance			Overall Acceptability for Chiffon Cake Baking		
	Score *	Qualities Liked	Quality Disliked	Score *	Qualities Liked	Quality Disliked
Control 1 (cake flour)	7	Fine & uniform grains, Very good crust color, Good crumb color	Slight shrinkage at the center	7.0	Good flour quality	NA
Control 2 (cookie flour)	7.5	Fine & uniform grains, Good volume	Slightly yellowish grains	7	Good flour quality	NA
Shirley	7	Fine grains, Good symmetry, Good volume	Yellowish crumb	7.0	NA	Very short Farinograph stability
WB-196	7	Good symmetry, Fine grains	Yellowish crumb	6.0	NA	Very short Farinograph stability
SY Harrison	7	Fine grains	Shrinkage at the center, Yellowish crumb	6.0	NA	Very short Farinograph stability
LA754	7	Good symmetry, Fine grains	Shrinkage at the center, Yellowish crumb	7.0	Good flour quality	NA
LA841	6	Good crust color	Poor symmetry, Non uniform grains, Shrinkage at the center	7.0	Good flour quality	NA
TV8861	8	Very good symmetry, Good volume, Fine & uniform grains	Yellowish crumb	7.0	Good protein content	Very short Farinograph stability
Havoc	7	Fine grains, Good symmetry, Good volume	Yellowish crumb	6.0	Good protein content	Very short Farinograph stability
Vandal	7	Fine grains, Good symmetry, Good volume	Yellowish crumb	6.0	NA	Very short Farinograph stability
LCS News	6	NA	Poor symmetry, Yellowish crumb, Non uniform grains	7.0	Good flour quality	NA
Bess	8	Very good volume, Good symmetry	Yellowish crumb	7.0	Good flour quality	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 49 Target End Products and Quality Preferences in Thailand

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Other Flours
Cookie		x

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Protein content	10.0-11.0%	10.2-10.7%
Extraction rate	70-75 %	72-75%
Water absorption	56-60%	57-59%
Extensibility at 135 min.	160-175 mins.	160-170 mins.

Table 5- 50 Flour Quality and Dough Properties for Baking Cookie in Thailand

SRW Flour	Overall Flour Quality			Dough Properties		
	Score *	Qualities Liked	Quality Disliked	Score *	Qualities Liked	Quality Disliked
Control 1	7.0	Good flour yield, Good ash content	NA	7.0	Handles well	NA
Shirley	5.5	Low ash	Low Protein	6.7	Handles well	NA
WB-196	4.5	Low ash	Low Protein	6.7	Handles well	NA
SY Harrison	5.5	Low ash	Low Protein	6.0	NA	Sticky dough
LA754	6.0	Low ash	Low Protein	6.5	NA	Crumbly dough
LA841	5.5	Low ash	Low Protein	7.0	Handles well	NA
TV8861	5.5	Low ash	Low Protein	7.0	Handles well	NA
Havoc	5.5	Low ash	Low Protein	7.0	Handles well	NA
Vandal	5.0	Low ash	Low Protein	7.0	Handles well	NA
LCS News	5.0	Low ash	Low Protein	7.0	Handles well	NA
Bess	5.0	Low ash	Low Protein	7.0	Handles well	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 51 Cookie Baking Performance of SRW Wheat Evaluated in Thailand

SRW Flour	Cookie Baking Performance			Overall Acceptability for Cookie Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Acceptable texture	Poor spread percentage	7.0	Acceptable texture	Poor spread percentage
Shirley	9.0	Good texture, Good spread percentage	NA	9.0	Good texture, Good spread percentage	NA
WB-196	8.5	Good texture, Good spread percentage	NA	8.5	Good texture, Good spread percentage	NA
SY Harrison	8.8	Good texture, Good spread percentage	NA	8.8	Good texture, Good spread percentage	NA
LA754	6.0	Good spread percentage	Less cookie crispiness	6.0	Good spread percentage	Less crispiness, Crumbly dough, Less brittleness
LA841	8.3	Good spread percentage	Less cookie brittleness	8.3	Good spread percentage	Less cookie brittleness
TV8861	8.0	Good spread percentage	Less cookie brittleness	8.0	Good spread percentage	Less cookie brittleness
Havoc	7.5	Good spread percentage	Less cookie brittleness	7.5	Good spread percentage	Less cookie brittleness
Vandal	7.0	Good spread percentage	Less cookie brittleness	7.0	Good spread percentage	Less cookie brittleness
LCS News	7.0	Good spread percentage	Less cookie brittleness	7.0	Good spread percentage	Less cookie brittleness
Bess	7.8	Good spread percentage	Less cookie brittleness	7.8	Good spread percentage	Less cookie brittleness

* 1 = Very poor/ 9 = Excellent.

Table 5- 52 Target End Products and Quality Preferences in Thailand

Primary End Product Uses for SRW	Primary Flour Used	Used Only in blend with Other Flours
Cake		X

Quality Preferences	Acceptable Quality (Minimum Quality)	Preferred Quality (High Quality)
Protein content	10.0-11.0%	10.2-10.7%
Extraction rate	70-75 %	72-75%
Water absorption	56-60%	57-59%
Extensibility at 135 min.	160-175 mins.	160-170 mins.

Table 5- 53 Flour Quality and Batter Properties for Baking Sponge Cake in Thailand

SRW Flour	Overall Flour Quality			Batter Properties		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Good flour yield, Good ash content	NA	7.0	Good whipping ability	NA
Shirley	5.5	Low ash content	Low protein content	6.5	NA	NA
WB-196	4.5	Low ash content	Low protein content	6.5	NA	NA
SY Harrison	5.5	Low ash content	Low protein content	6.8	Acceptable whipping ability	NA
LA754	6.0	Low ash content	Low protein content	7.0	Good whipping ability	NA
LA841	5.5	Low ash content	Low protein content	6.5	NA	NA
TV8861	5.5	Low ash content	Low protein content	6.8	Acceptable whipping ability	NA
Havoc	5.5	Low ash content	Low protein content	6.5	NA	NA
Vandal	5.0	Low ash content	Low protein content	6.5	NA	NA
LCS News	5.0	Low ash content	Low protein content	6.8	Acceptable whipping ability	NA
Bess	5.0	Low ash content	Low protein content	7.0	Good whipping ability	NA

* 1 = Very poor/ 9 = Excellent.

Table 5- 54 Sponge Cake Baking Performance of SRW Wheat Evaluated in Thailand

SRW Flour	Sponge Cake Baking Performance			Overall Acceptability for Sponge Cake Baking		
	Score*	Qualities Liked	Quality Disliked	Score*	Qualities Liked	Quality Disliked
Control 1	7.0	Good texture, Fine grain	NA	7.0	Good whipping ability, Good cake texture, Fine grain	NA
Shirley	5.0	NA	Dry cake texture, Small cake volume	5.0	Low ash content	Dry cake texture, Small cake volume
WB-196	6.0	NA	Dry cake texture, Small cake volume	6.0	Low ash content	Dry cake texture, Small cake volume
SY Harrison	5.5	NA	Dry cake texture, Small cake volume	5.5	Low ash content	Dry cake texture, Small cake volume
LA754	6.3	Good cake volume, Good symmetry, Fine grain	Dry cake texture	6.3	Good cake volume, Good symmetry, Fine grain, Low ash	Dry cake texture
LA841	6.5	Fine grain	Dry cake texture, Small cake volume	6.5	Fine grain, Low ash content	Dry cake texture, Small cake volume
TV8861	6.3	Fine grain	Dry cake texture	6.3	Fine grain, Low ash content	Dry cake texture
Havoc	6.0	NA	Dry cake texture	6.0	Low ash content	Dry cake texture
Vandal	5.8	NA	Dry cake texture, Small cake volume	5.8	Low ash content	Dry cake texture, Small cake volume
LCS News	6.5	Fine grain	Dry cake texture	6.5	Fine grain, Low ash content	Dry cake texture
Bess	6.8	Good cake volume, Good symmetry, Fine grain	Slight dry cake texture	6.8	Good cake volume, Good symmetry, Fine grain, Low ash content	Slight dry cake texture

* 1 = Very poor/ 9 = Excellent.

APPENDIX

Appendix I. Methods of the Soft Wheat Quality Laboratory

PART I: PRELIMINARY QUALITY DATA INCLUDED IN THE SHIPMENT OF FLOUR

Laboratory Test Milling

Based on average whole grain moisture, of a subset of the group to be milled, samples are tempered to 15.0% moisture. Sample preparation for moisture determination uses the Tag-Heppenstall corrugated rolls. Tempered grain samples are milled after 36 hours to allow for equal water distribution throughout the kernel.

Samples are milled in a controlled temperature and humidity room (19 – 21 C and RH 57% - 62%). Milling is conducted on a modified Quadrumat Senior flour mill. Prior to sample analysis, mill should be operating, warm, and equilibrated (33 C + /- 1.0). Standard sample size for micro milling is 80 g. Tempered grain is milled and the product recovered for sifting on a Great Western Sifter Box. The sifter should have 40 mesh and a 94 mesh screen to separate mill product into bran (above 40), middling fractions (mids – material recovered between 40 mesh and 94 mesh screen) and flour (through 94 screen and recovered in the flour pan on the bottom).

To calculate softness equivalent (a modified particle size index), the weights of the bran and mids are recorded. The mids are added back to the flour that passed through the 94 mesh screen to produce the final flour product for analysis.

Flour yield

Flour yield “as is” is calculated as the bran weight (over 40 weight) subtracted from the grain weight, divided by grain weight and times 100 to equal “as is” flour yield. Flour yield is calculated to a 15% grain moisture basis as follows: Flour moisture is regressed to predict the grain moisture of the wheat when it went into the Quad Mill using the formula Initial grain moisture = $1.3429 \times (\text{flour moisture}) - 4$. The flour yields are corrected back to 15% grain moisture after estimating the initial grain moisture using the formula Flour Yield_(15%) = Flour Yield_(as is) - $1.61\% \times (15\% - \text{Actual flour moisture})$.

Softness Equivalent

Softness Equivalent (as is) is calculated from the fraction of mill product that is in the mids, with smaller amounts of mids correlating to smaller particle size, greater break flour yield, and greater softness equivalent. The mids weight (over 94) is subtracted from the unadjusted flour yield to calculate the quantity of fine flour that passed through the 94 mesh, which is divided by the unadjusted flour yield and multiplied by 100%. Softness Equivalent at 15% grain moisture is calculated using the estimated grain moisture prior to milling (see milling formulas). The softness equivalents are adjusted to 15% grain moisture with the formula Softness Equivalent_(15%) = Softness Equivalent_(as is) - $1.08\% \times (15\% - \text{Actual flour moisture})$.

Mill Score

Mill score represents a standard adjustment based on flour yield by comparing the test variety to a check. The check variety produces a score that can be used as a handicap against its traditional

expected yield, and the test variety mill score is adjusted to the same degree as the check. This method relates test varieties providing a score that is independent of the environmental influences.

Kernel and Whole Wheat Tests

Test Weight: (AACC Method 55-10) Weight per Winchester bushel of cleaned wheat subsequent to the removal of dockage using a Carter-Day dockage cleaner. Units are recorded as pounds/bushel (lb/bu) and kilograms/hectoliter (kg/hl).

1000 Kernel Weight: Units are recorded as grams/1000 kernels of cleaned wheat. There is little difference between 1000-kernel weight and milling quality when considering shriveled-free grain. However, small kernelled varieties that have 1000-kernel weight below 30 grams likely will have reduced milling yield of about .75%.

Single Kernel Characterization System (SKCS): (AACC Method 55-31) SKCS distribution showing % soft (A), semi-soft (B), semi-hard (C), and hard (D); SKCS hardness index; SKCS moisture content; SKCS kernel size; and SKCS kernel weight; along with standard deviations.

Whole Wheat Moisture: (AACC Method 44-15A) Air-oven method.

Whole Wheat Crude Protein: Nitrogen combustion analysis using Elementar Nitrogen Analyzer. Units are recorded in % protein converted from nitrogen x 5.7 and expressed on 12% moisture basis.

Whole Wheat Falling Numbers: (AACC Method 56-81B) Units are expressed in seconds using the Perten Falling Number instrument.

Whole Wheat - Amylase Activity: (AACC Method 22-06) Units are expressed in alpha amylase activity as SKB units/gram (@ 25°C).

PART II: PREPARATION OF FLOUR FOR SHIPMENT TO COOPERATORS

Miag Multomat Mill

The Miag Multomat Mill is a pneumatic conveyance system consisting of eight pair of 254 mm diameter x 102 mm wide rolls, and ten sifting passages. Three pair are corrugated break rolls and five pair are smooth rolls utilized in the reduction process. Each sifting passage contains six separate sieves. The two top sieves for each of the break rolls are intended to be used as scalp screens for the bran. The third break sieving unit of the Soft Wheat Quality Laboratory (SWQL) Miag Multomat Mill was modified so that the top four sieves are employed to scalp bran. That modification increased the final bran sieving surface by 100%.

Milling Procedure: All SRW varieties are tempered to a 14.5% moisture level. Tempered wheat is held for at least 24 hours in order for the moisture to equilibrate throughout the grain. Wheat is introduced into the first break rolls at a rate of 54.4 Kg/hour (80 #/hour). Straight grade flour is a blend of ten flour streams, the three break flour streams and the five reduction streams, plus the grader flour from the break streams and the duster flour from the reduction streams. The

straight grade flour mean volume diameter is about 75 microns with ash content usually between 0.34% and 0.48%.

Flour generated by the (SWQL) Miag Multomat Mill very nearly represents that of commercially produced straight grade flour. Bran, head shorts, tail shorts and red dog are by-products which are not included with the flour. Flour yields vary between 68% and 78% which is variety dependent due to milling quality differences and/or grain condition. Recovery of all mill products is usually about 99%. Least significant differences for straight grade flour yield and break flour yield are 0.75% and 0.82%, respectively.

Flour Tests

Flour Moisture: (AACC Method 44-15A) Units are expressed as % of flour.

Flour Ash: (AACC Method 08-01) Basic method, expressed on 14% moisture basis.

Flour Falling Numbers: (AACC Method 56-81B) Units are expressed in seconds using the Perten Falling Numbers instrument.

Flour Amylase activity: (AACC Method 22-06) Units are expressed in α -amylase activity as SKB units/gram (@ 25°C).

Flour Crude Protein: Protein determined by NIR using a Unity Spectra Star 2200 NIR instrument calibrated by nitrogen combustion analysis using Elementar Nitrogen Analyzer. Units are recorded in % protein converted from nitrogen x 5.7 and expressed on 14% moisture basis.

Flour protein differences among varieties can be a reliable indicator of genetic variation provided the varieties are grown together, but can vary from year to year at any given location. Flour protein from a single, non-composite sample may not be representative. Based on the Soft Wheat Quality Laboratory grow-outs, protein can vary as much 1.5 % for a variety grown at various locations in the same ½ acre field.

Protein quality is an evaluation of “elasticity” or gluten strength and is not the same as protein quantity. A variety possessing a low quantity of protein could still exhibit strong gluten strength. Gluten strength is thought to be a desirable characteristic for cracker production. Gluten strength is measured using a Mixograph and is graded on a scale of 1-8, with 1 as weakest and 8 as strongest. Evaluation of gluten strength using the Mixograph or Farinograph is difficult for soft wheat flours that are 8.5% protein and lower. Since the representative protein range for breeders’ samples is 8-9%, many of these flours are not adequately evaluated using the Mixograph or Farinograph methods. The Lactic Acid SRC, which does not require mixing action to assess gluten, tends to be a better measurement of protein quality when evaluating soft wheat varieties. Lactic acid hydrates the native matrix of insoluble polymeric protein (IPP) present in the flour.

Flour Falling Numbers: (AACC Method 56-81B) Units are expressed in seconds using the Perten Falling Numbers instrument. Numbers above 400 seconds reflect factors other than alpha

amylase activity (such as particle size). The correlation between alpha amylase activity and falling number is best for samples with falling number values between 200 and 300 seconds. For cake flours and batters, 350 seconds is a common minimum value. For breakfast cereals or cookies and other high sugar products values of 250 seconds are more common cut-off values.

Flour Damaged Starch: Chopin SDMatic starch damage instrument using the supplied AACC calibration. Starch damage is a measure of the damage to the starch granule occurring during the milling process.

Alveograph Evaluations

Alveographs were conducted with the gracious assistance of the Wheat Marketing Center in Portland Oregon.

Solvent Retention Capacity Test (SRC): (Flour Lactic Acid, Sucrose, Water, and Sodium Carbonate Retention Capacities AACC Method 56-11)

Units are expressed as %.

Water SRC is a global measure of the water affinity of the macro-polymers (starch, arabinoxylans, gluten, and gliadins). It is often the best predictor of baked product performance. Water SRC is correlated to Farinograph water absorption but does not directly measure the absorption of the glutenin macropolymer hydration during mixing as does the Farinograph. Water SRC is negatively correlated to flour yield and softness equivalent among flour samples milled on the Quad advanced flour mill ($r=-0.43$ and $r=-0.45$, respectively). Lower water values are desired for cookies, cakes, and crackers with target values below 51% on small experimental mills and 54% on commercial or long-flow experimental mills.

Sucrose SRC is a measure of arabinoxylans (also known as pentosans) content, which can strongly affect water absorption in baked products. Water soluble arabinoxylans are thought to be the fraction that most greatly increases sucrose SRC. Sucrose SRC probably is the best predictor of cookie quality with sugar snap cookie diameters decreasing by 0.07 cm for each percentage point increase in sucrose SRC. The negative correlation between wire-cut cookie and sucrose SRC values is $r=-0.66$ ($p<0.0001$). Sucrose SRC typically increases in wheat samples with lower flour yield ($r=-0.31$) and lower softness equivalent ($r=-0.23$). The cross hydration of gliadins by sucrose also causes sucrose SRC values to be correlated to flour protein ($r=0.52$) and lactic acid SRC ($r=0.62$). Soft wheat flours for cookies typically have a target of 95% or less when used by the US baking industry for biscuits and crackers. Sucrose SRC values increase by 1% for every 5% increase in lactic acid SRC. The 95% target value can be exceeded in flour samples where a higher lactic acid SRC is required for product manufacture since the higher sucrose SRC is due to gluten hydration and not to swelling of the water soluble arabinoxylans.

Sodium carbonate SRC is a very alkaline solution that ionizes the ends of starch polymers increasing the water binding capacity of the molecule. Sodium carbonate SRC increases with starch damage. Sodium carbonate is an effective predictor of milling yield and is negatively correlated to flour yield on the Quad advanced milling system ($r=-0.48$, $p<0.0001$). It also is one of several predictors of cookie diameter ($r=-0.22$, $p<0.0001$). Normal values for good milling soft varieties are 68% or less.

Lactic acid SRC measures gluten strength. Typical values are below 85% for “weak” soft varieties and above 105% or 110% for “strong” gluten soft varieties. See the above discussion of protein quality in this section for additional details of the lactic acid SRC. Lactic acid SRC results correlate to the SDS-sedimentation test. The lactic acid SRC is also correlated to flour protein concentration, but the effect is dependent on genotypes and growing conditions. The SWQL typically reports a protein-corrected lactic acid SRC value to remove some of the inherent protein fluctuation not due to variety genetics. Lactic acid is corrected to 9% protein using the assumption of a 7% increase in lactic acid SRC for every 1% increase in flour protein. On average across 2007 and 2009, the change in lactic acid SRC value was closer to 2% for every 1% protein.

PART III. EXPERIMENTAL BAKED PRODUCT TESTS

Sugar snap Cookie: (AACC method 10-52.02, Micro Method)

See new method presented in this document. Diameter and stack height of cookies baked according to this method are measured and used to evaluate flour baking quality. All data reported in this report were produced using the accepted method prior to December, 2009.

Cookie spread determined within a location is a reliable indicator of the source variety’s genetic characteristics. However, cookie spread, unlike milling quality, is greatly influenced by environmental conditions. An absolute single value for cookie spread could be misleading. Within a location the single value is significantly important in comparison to known standards. The average cookie spread for three different examples of a variety is representative of that wheat.

Varieties with larger cookie spreads tend to release moisture efficiently during the baking process due to lower water absorption while varieties yielding smaller diameter cookies tend to be higher in water absorption and hold the moisture longer during baking.

The best single predictor of cookie diameter is sucrose SRC. The strong negative correlation of sucrose SRC to cookie diameter ($r=-0.66$, $p<0.0001$) has led to its adoption in lieu of baking cookies for most samples. The best prediction model for cookie diameter among grain samples milled on the Quadrumat advanced system uses a combination of sucrose SRC, softness equivalent, and flour protein ($R^2=0.61$). These three measures are combined into the baking quality score used in Quad Micro milling with the baking quality score favoring lower sucrose SRC and flour protein and greater softness equivalent values.

Varieties that possess excellent milling properties nearly always produce large diameter cookie spreads. Poor milling varieties nearly always produce smaller cookie spreads. Varieties that are very soft in granulation usually produce good cookie spreads.

Statistical Analysis

Correlation analysis was used for all tests of significance. The primary correlations were of a quality measure with a score or a rank provided by the cooperator with the purpose of trying to identify the basis of the cooperator’s preference. Ten pairs of observations were used for each correlation. The magnitude of the correlation was expressed as a correlation coefficient “r” with significance expressed as a “p” value. The r value is the square root of the R^2 value of a

regression coefficient and the p value is the probability of obtaining that correlation coefficient by random chance alone.

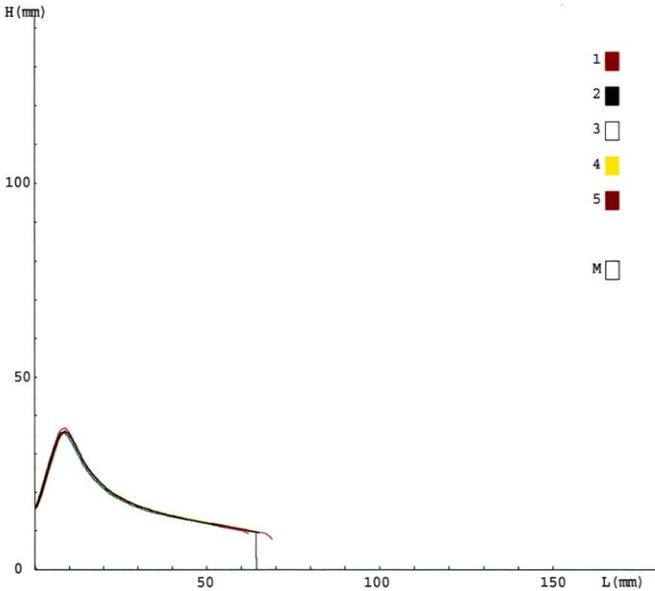
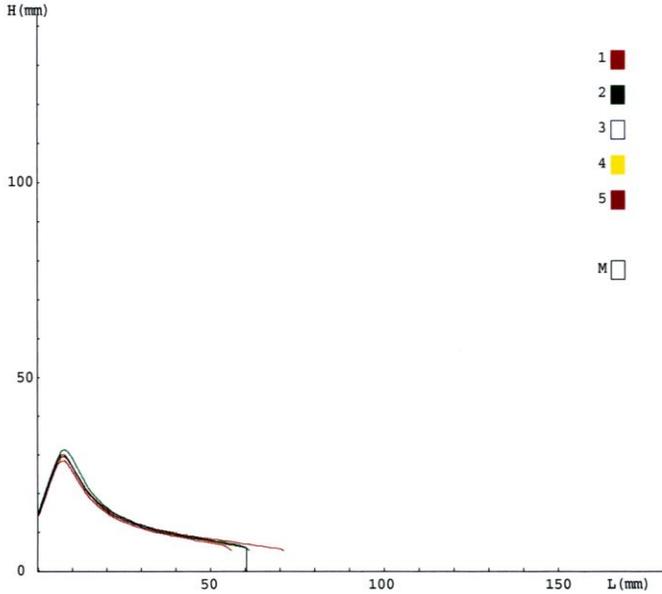
Appendix II. Alveograms of 2013 OVA Flour Samples

Shirley

WB196

ALVEOLINK NG		ALVEO CH	CHOPIN
WHEAT MARKETING CENTER 1200 NW NAITO PARKWAY SUITE 230 PORTLAND OREGON 97209			
DATE: 02/06/2014		SAMPLE IDENTIFICATION: 120140033	
TIME: 11:54 am		FILE NAME : 02060009A114	
PARAMETERS		RESULTS	
LAB. TEMP. :	LAB. HYGROM. :	P	= 33 mmH2O
FLOUR :	MILL :	L	= 60 mm
MOISTURE : 13.60 %		G	= 17.2
PROTEIN :	FN VALUE :	W	= 56 10E-4J
S.D. :	W.A. :	P/L	= 0.55
ZELENY :		Ie	= 31.9 %
ASH CONT. :	EXTRAC.R. :	W(0)	= 0 10E-4J
GLUTEN :			
COMMENTS WOOSTER		V:d2.8C +5.9	

ALVEOLINK NG		ALVEO CH	CHOPIN
WHEAT MARKETING CENTER 1200 NW NAITO PARKWAY SUITE 230 PORTLAND OREGON 97209			
DATE: 02/06/2014		SAMPLE IDENTIFICATION: 120140032	
TIME: 11:41 am		FILE NAME : 02060008A114	
PARAMETERS		RESULTS	
LAB. TEMP. :	LAB. HYGROM. :	P	= 40 mmH2O
FLOUR :	MILL :	L	= 64 mm
MOISTURE : 13.90 %		G	= 17.8
PROTEIN :	FN VALUE :	W	= 78 10E-4J
S.D. :	W.A. :	P/L	= 0.62
ZELENY :		Ie	= 38.8 %
ASH CONT. :	EXTRAC.R. :	W(0)	= 0 10E-4J
GLUTEN :			
COMMENTS WOOSTER		V:d2.8C +5.9	



SY Harrison

LA754

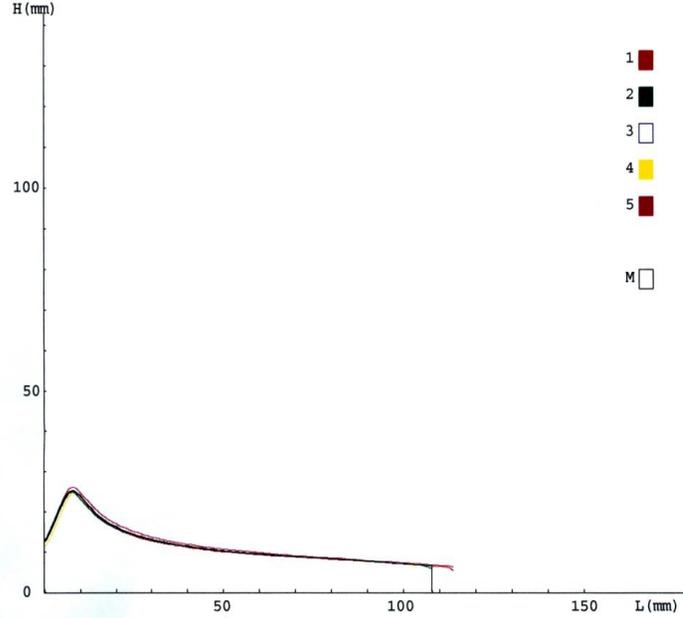
ALVEOLINK NG ALVEO CH CHOPIN

WHEAT MARKETING CENTER
1200 NW NAITO PARKWAY
SUITE 230
PORTLAND OREGON 97209

DATE: 02/06/2014 SAMPLE IDENTIFICATION: 120140025
TIME: 10:09 am FILE NAME : 02060001A114

PARAMETERS		RESULTS
LAB. TEMP. :	LAB. HYGROM. :	P = 28 mmH2O
FLOUR :	MILL :	L = 109 mm
MOISTURE : 13.20 %		G = 23.2
PROTEIN :	FN VALUE :	W = 84 10E-4J
S.D. :	W.A. :	P/L = 0.26
ZELENY :		Ie = 46.0 %
ASH CONT. :	EXTRAC.R. :	W(0) = 0 10E-4J
GLUTEN :		

COMMENTS
WOOSTER
v:d2.8C +5.9



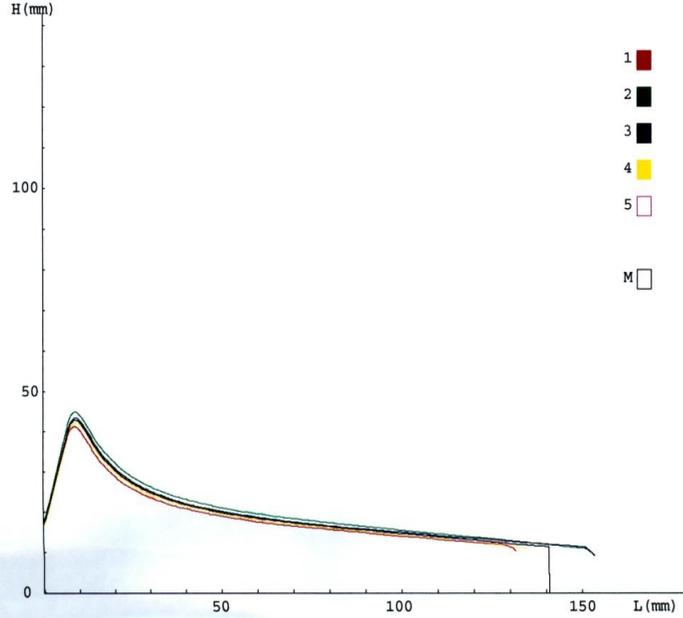
ALVEOLINK NG ALVEO CH CHOPIN

WHEAT MARKETING CENTER
1200 NW NAITO PARKWAY
SUITE 230
PORTLAND OREGON 97209

DATE: 02/06/2014 SAMPLE IDENTIFICATION: 120140030
TIME: 11:16 am FILE NAME : 02060006A114

PARAMETERS		RESULTS
LAB. TEMP. :	LAB. HYGROM. :	P = 47 mmH2O
FLOUR :	MILL :	L = 141 mm
MOISTURE : 13.40 %		G = 26.4
PROTEIN :	FN VALUE :	W = 183 10E-4J
S.D. :	W.A. :	P/L = 0.33
ZELENY :		Ie = 51.8 %
ASH CONT. :	EXTRAC.R. :	W(0) = 0 10E-4J
GLUTEN :		

COMMENTS
v:d2.8C +5.9

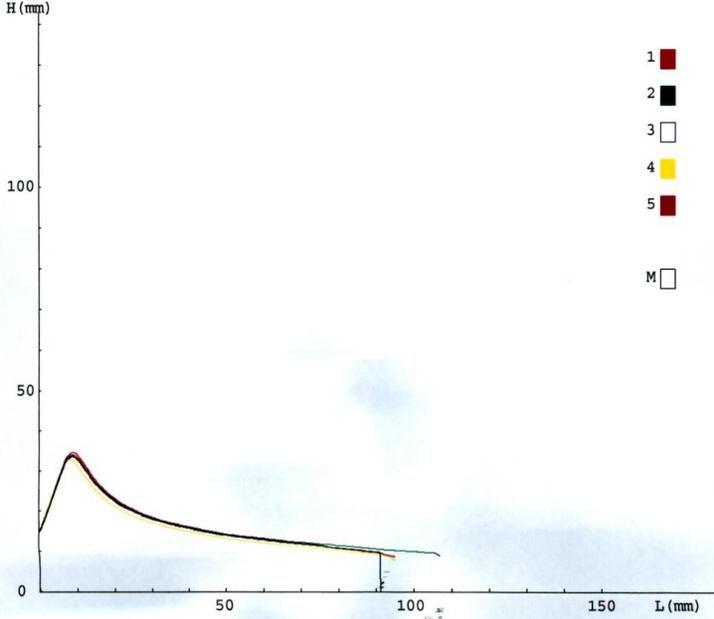
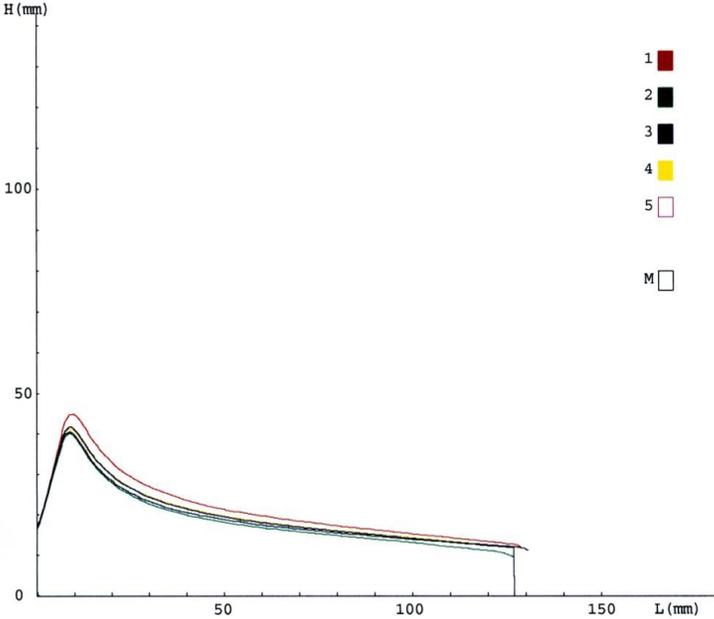


LA841

TV8861

ALVEOLINK NG		ALVEO CH		CHOPIN	
WHEAT MARKETING CENTER 1200 NW NAITO PARKWAY SUITE 230 PORTLAND OREGON 97209					
DATE: 02/06/2014 TIME: 11:27 am		SAMPLE IDENTIFICATION: 120140031 FILE NAME : 02060007A114			
PARAMETERS		RESULTS			
LAB.TEMP.:	LAB.HYGROM.:	P	= 46 mmH2O		
FLOUR :	MILL :	L	= 127 mm		
MOISTURE : 13.40 %		G	= 25.1		
PROTEIN :	FN VALUE :	W	= 167 10E-4J		
S.D. :	W.A. :	P/L	= 0.36		
ZELENY :		Ie	= 51.9 %		
ASH CONT.:	EXTRAC.R.:	W(0)	= 0 10E-4J		
GLUTEN :					
COMMENTS WOOSTER				V:d2.8C +5.9	

ALVEOLINK NG		ALVEO CH		CHOPIN	
WHEAT MARKETING CENTER 1200 NW NAITO PARKWAY SUITE 230 PORTLAND OREGON 97209					
DATE: 02/06/2014 TIME: 12:06 pm		SAMPLE IDENTIFICATION: 120140034 FILE NAME : 02060010A114			
PARAMETERS		RESULTS			
LAB.TEMP.:	LAB.HYGROM.:	P	= 37 mmH2O		
FLOUR :	MILL :	L	= 92 mm		
MOISTURE : 13.55 %		G	= 21.4		
PROTEIN :	FN VALUE :	W	= 102 10E-4J		
S.D. :	W.A. :	P/L	= 0.40		
ZELENY :		Ie	= 47.4 %		
ASH CONT.:	EXTRAC.R.:	W(0)	= 0 10E-4J		
GLUTEN :					
COMMENTS WOOSTER				V:d2.8C +5.9	

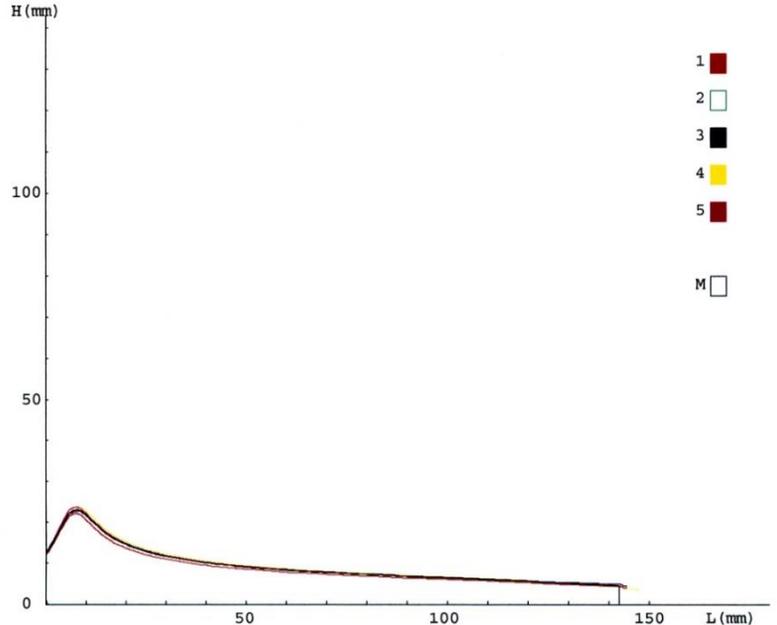


Havoc

Vandal

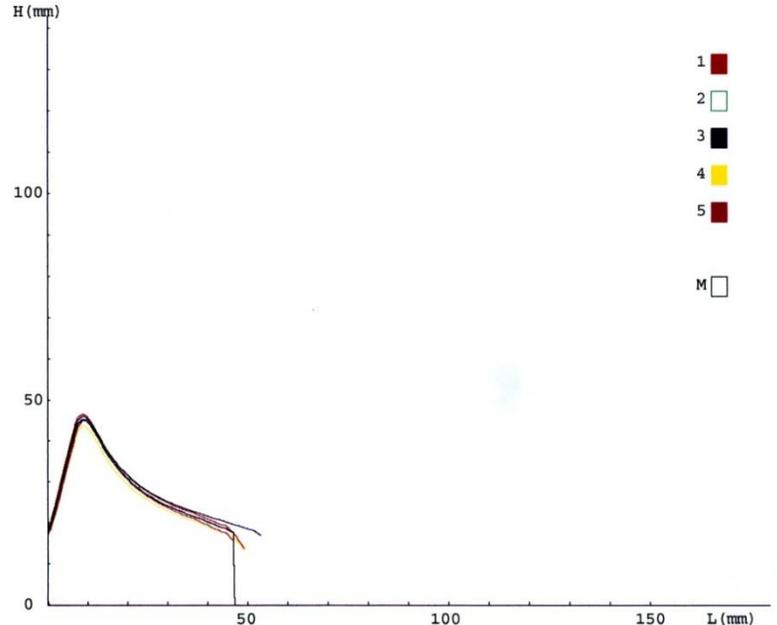
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DATE: 02/06/2014 TIME: 10:36 am	SAMPLE IDENTIFICATION: 120140027 FILE NAME : 02060003A114																																			
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COMMENTS WOOSTER		V:d2.8C +5.9																																		



ALVEOLINK NG ALVEO CH CHOPIN

WHEAT MARKETING CENTER 1200 NW NAITO PARKWAY SUITE 230 PORTLAND OREGON 97209																																				
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Ie	= 45.3 %																																			
W(0)	= 0 10E-4J																																			
COMMENTS WOOSTER		V:d2.8C +5.9																																		



LCS News

Bess

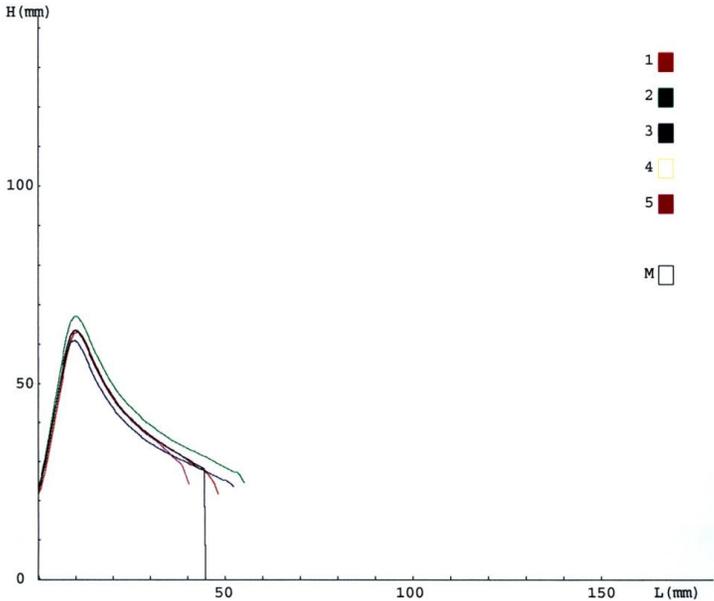
ALVEOLINK NG ALVEO CH CHOPIN

WHEAT MARKETING CENTER
1200 NW NAITO PARKWAY
SUITE 230
PORTLAND OREGON 97209

DATE: 02/06/2014 SAMPLE IDENTIFICATION: 120140026
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PARAMETERS		RESULTS
LAB. TEMP. :	LAB. HYGROM. :	P = 70 mmH2O
FLOUR :	MILL :	L = 45 mm
MOISTURE : 13.85 %		G = 14.9
PROTEIN :	FN VALUE :	W = 124 10E-4J
S.D. :	W.A. :	P/L = 1.56
ZELENY :		Ie = 48.8 %
ASH CONT. :	EXTRAC.R. :	W(0) = 0 10E-4J
GLUTEN :		

COMMENTS
WOOSTER
V:d2.8C +5.9



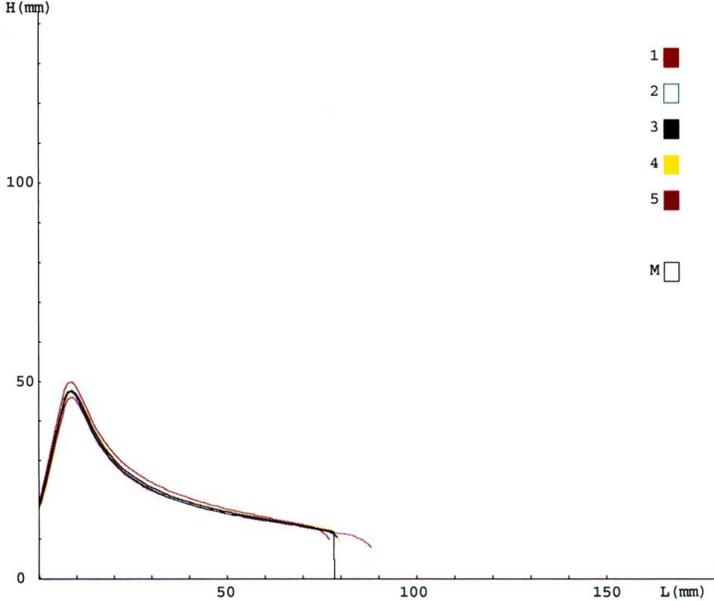
ALVEOLINK NG ALVEO CH CHOPIN

WHEAT MARKETING CENTER
1200 NW NAITO PARKWAY
SUITE 230
PORTLAND OREGON 97209

DATE: 02/06/2014 SAMPLE IDENTIFICATION: 120140028
TIME: 10:48 am FILE NAME : 02060004A114

PARAMETERS		RESULTS
LAB. TEMP. :	LAB. HYGROM. :	P = 53 mmH2O
FLOUR :	MILL :	L = 78 mm
MOISTURE : 13.60 %		G = 19.7
PROTEIN :	FN VALUE :	W = 119 10E-4J
S.D. :	W.A. :	P/L = 0.68
ZELENY :		Ie = 40.8 %
ASH CONT. :	EXTRAC.R. :	W(0) = 0 10E-4J
GLUTEN :		

COMMENTS
WOOSTER
V:d2.8C +5.9



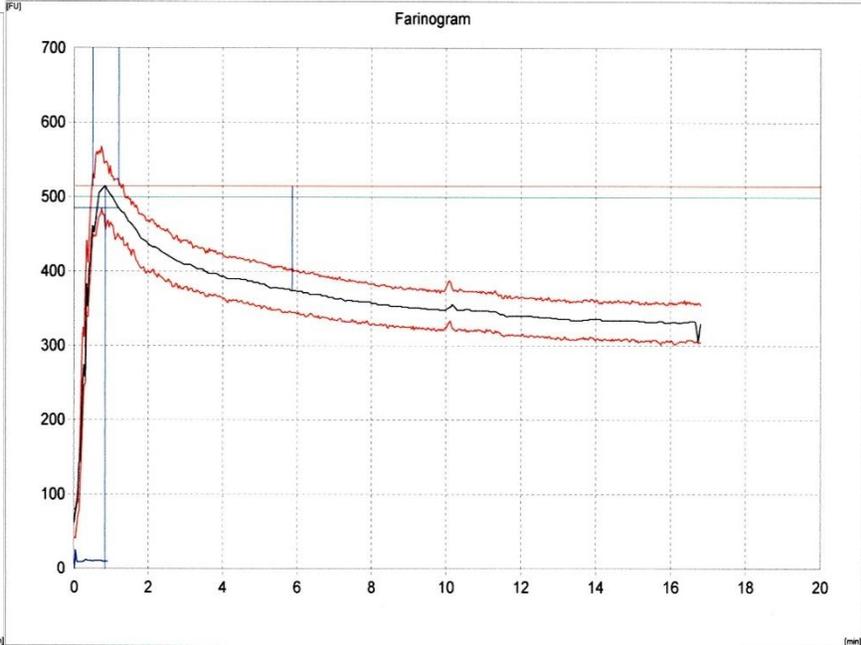
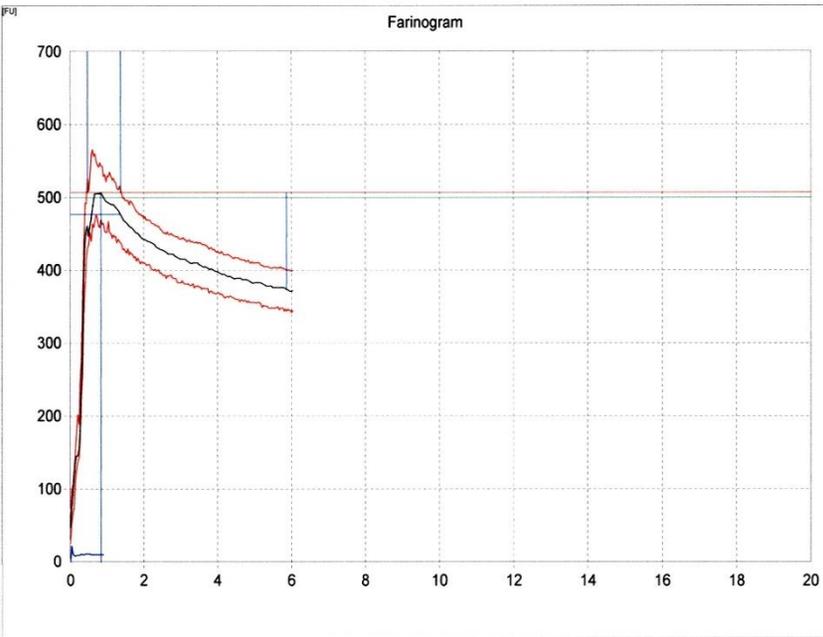
Appendix III. Farinograms of 2013 OVA Flour Samples

Shirley

Mixer: 50 g Speed: 63 1/min Moisture content: 13.6 %
 Consistency 507 FU with waterabsorption 52.9 %
 Waterabsorption (corrected for 500 FU): 53.1 %
 Waterabsorption (corrected to 14.0 %): 52.6 %
 Development time: 0.9 min
 Stability: 0.9 min
 Toleranceindex (MTI): 133 FU
 Time to breakdown: 1.4 min
 Farinograph quality number: 14
 Remarks: WOOSTER

WB196

Mixer: 50 g Speed: 63 1/min Moisture content: 13.9 %
 Consistency 515 FU with waterabsorption 50.9 %
 Waterabsorption (corrected for 500 FU): 51.3 %
 Waterabsorption (corrected to 14.0 %): 51.2 %
 Development time: 0.9 min
 Stability: 0.7 min
 Toleranceindex (MTI): 141 FU
 Time to breakdown: 1.2 min
 Farinograph quality number: 12
 Remarks: WOOSTER



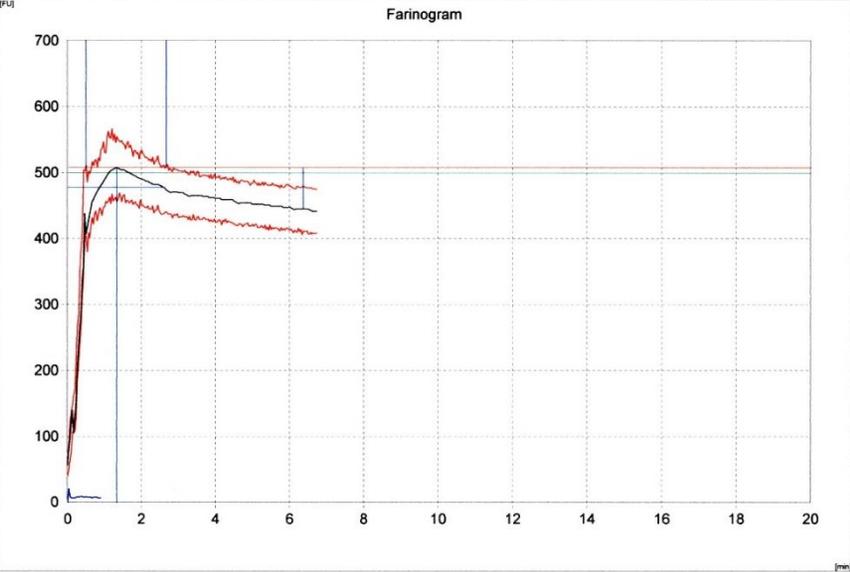
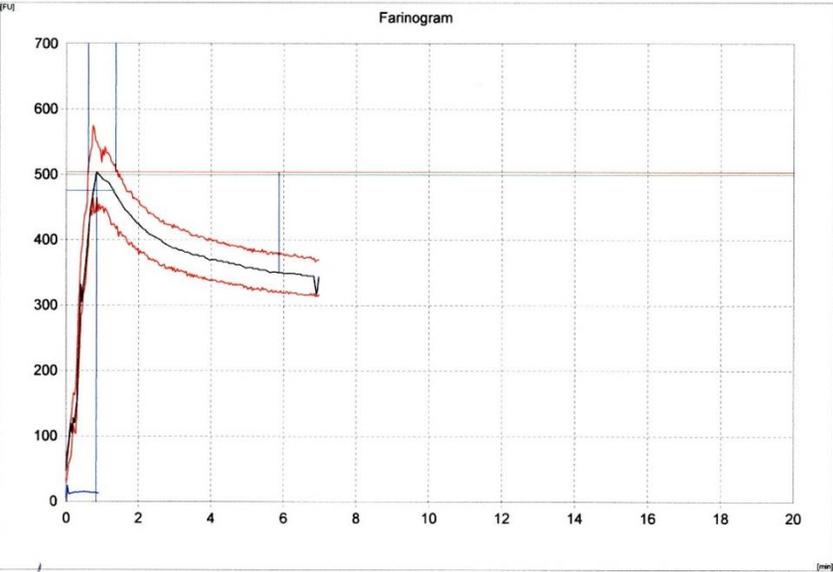
SY Harrison

LA754

Mixer: 50 g Speed: 63 1/min Moisture content: 13.2 %
Consistency 504 FU with waterabsorption 50.6 %

Waterabsorption (corrected for 500 FU): 50.7 %
Waterabsorption (corrected to 14.0 %): 49.8 %
Development time: 0.9 min
Stability: 0.8 min
Toleranceindex (MTI): 154 FU
Time to breakdown: 1.3 min
Farinograph quality number: 13
Remarks: WOOSTER

Waterabsorption (corrected for 500 FU): 53.7 %
Waterabsorption (corrected to 14.0 %): 53.0 %
Development time: 1.4 min
Stability: 2.2 min
Toleranceindex (MTI): 63 FU
Time to breakdown: 2.6 min
Farinograph quality number: 26
Remarks: WOOSTER

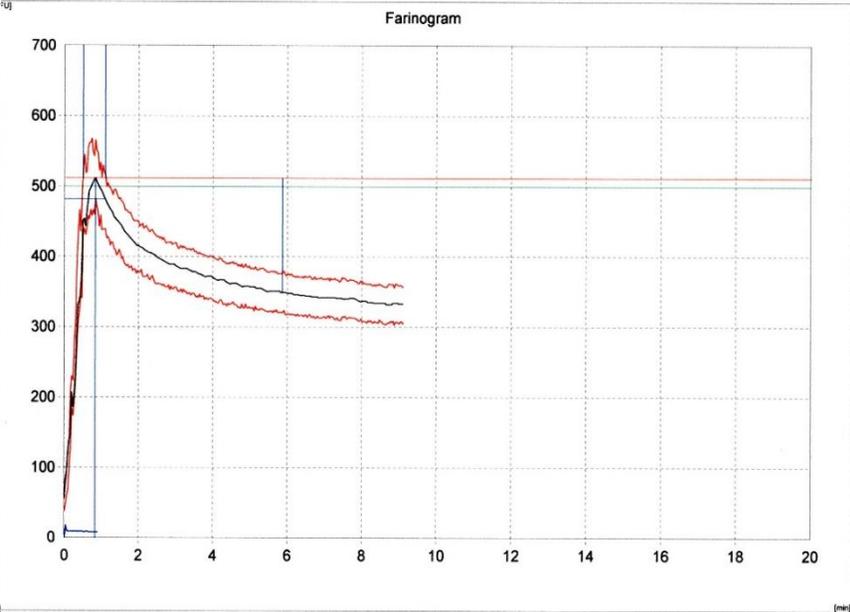
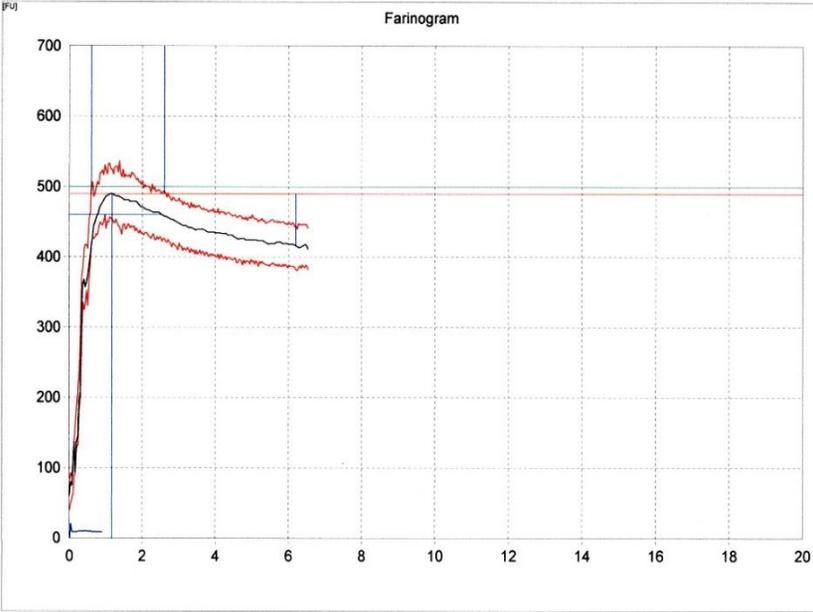


LA841

Waterabsorption (corrected for 500 FU): 51.7 %
Waterabsorption (corrected to 14.0 %): 51.0 %
Development time: 1.2 min
Stability: 2.0 min
Toleranceindex (MTI): 74 FU
Time to breakdown: 2.5 min
Farinograph quality number: 25
Remarks: WOOSTER

TV8861

Waterabsorption (corrected for 500 FU): 51.8 %
Waterabsorption (corrected to 14.0 %): 51.2 %
Development time: 0.9 min
Stability: 0.6 min
Toleranceindex (MTI): 163 FU
Time to breakdown: 1.1 min
Farinograph quality number: 11
Remarks: WOOSTER

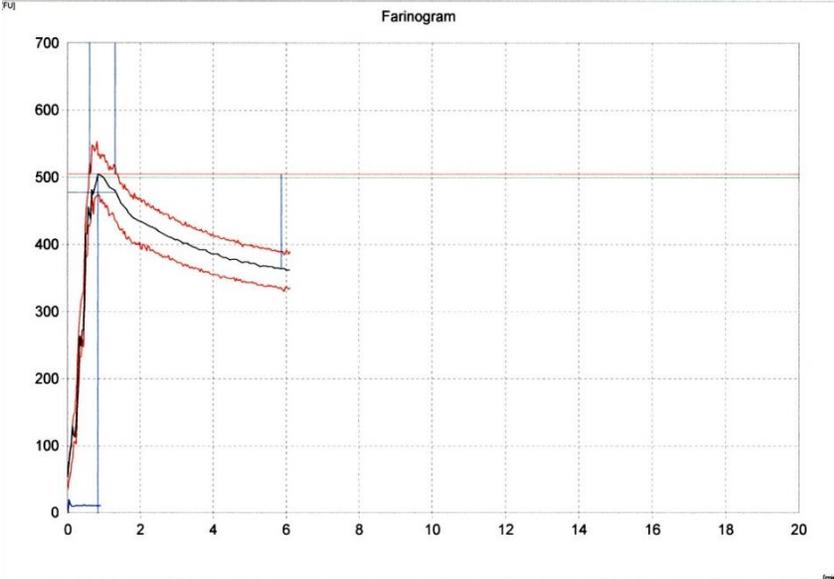
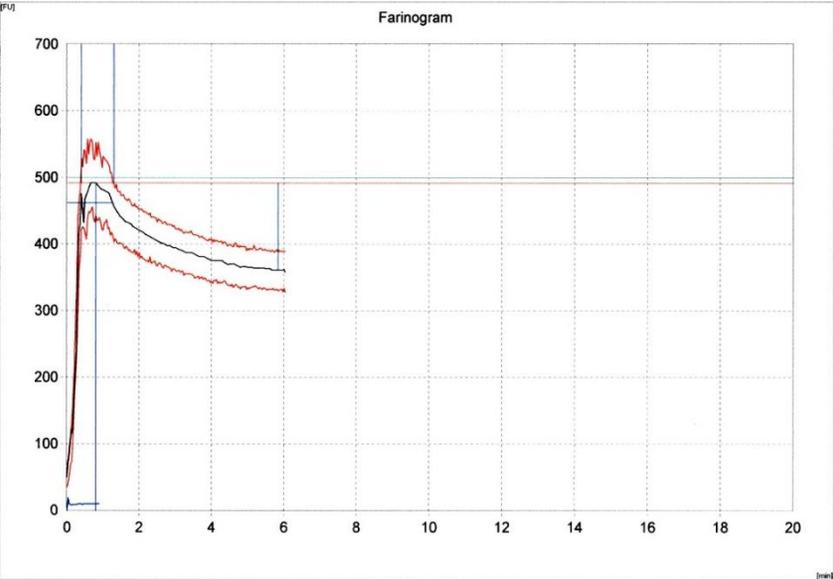


Havoc

Waterabsorption (corrected for 500 FU): 50.6 %
Waterabsorption (corrected to 14.0 %): 49.8 %
Development time: 0.8 min
Stability: 0.9 min
Toleranceindex (MTI): 131 FU
Time to breakdown: 1.3 min
Farinograph quality number: 13
Remarks: WOOSTER

Vandal

Waterabsorption (corrected for 500 FU): 52.1 %
Waterabsorption (corrected to 14.0 %): 51.5 %
Development time: 0.9 min
Stability: 0.7 min
Toleranceindex (MTI): 141 FU
Time to breakdown: 1.3 min
Farinograph quality number: 13
Remarks: WOOSTER



LCS News

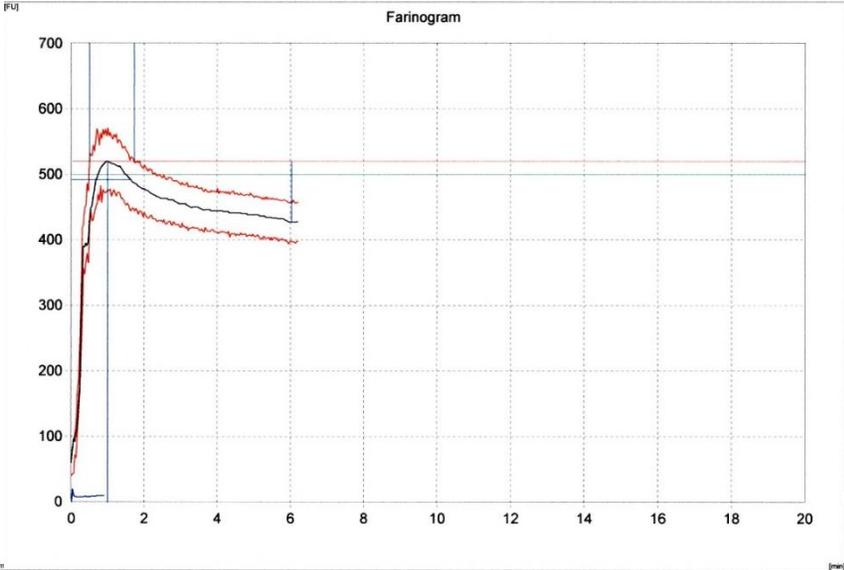
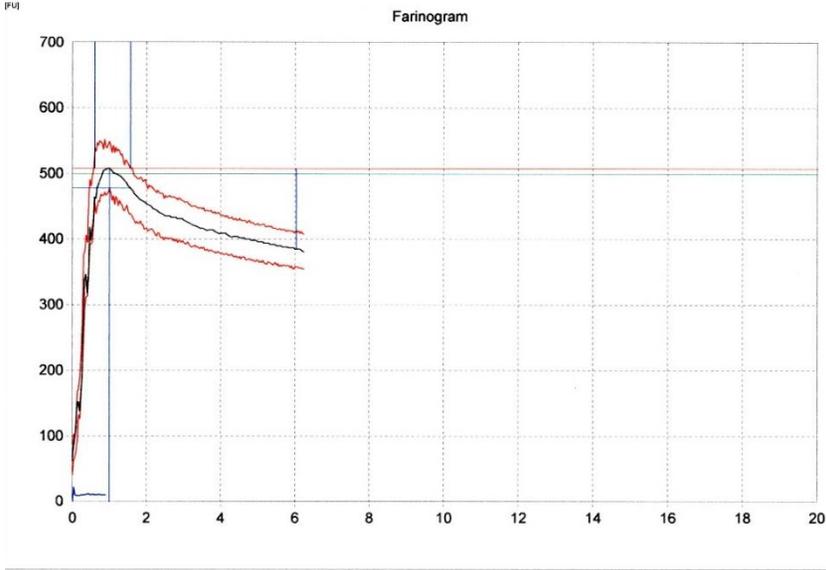
Mixer: 50 g Speed: 63 1/min
 Consistency 508 FU with waterabsorption 53.5 %
 Moisture content: 13.8 %

Waterabsorption (corrected for 500 FU): 53.7 %
 Waterabsorption (corrected to 14.0 %): 53.5 %
 Development time: 1.0 min
 Stability: 1.0 min
 Toleranceindex (MTI): 123 FU
 Time to breakdown: 1.6 min
 Farinograph quality number: 16
 Remarks: WOOSTER

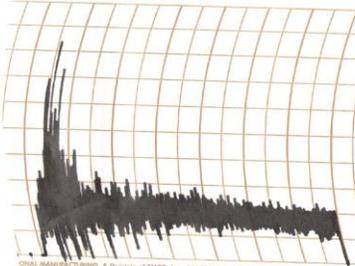
Bess

Mixer: 50 g Speed: 63 1/min
 Consistency 520 FU with waterabsorption 53.5 %
 Moisture content: 13.6 %

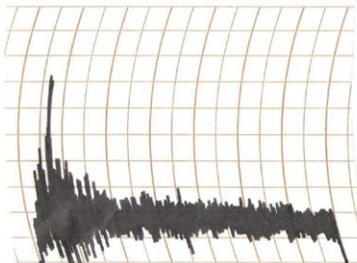
Waterabsorption (corrected for 500 FU): 54.0 %
 Waterabsorption (corrected to 14.0 %): 53.5 %
 Development time: 1.0 min
 Stability: 1.2 min
 Toleranceindex (MTI): 93 FU
 Time to breakdown: 1.6 min
 Farinograph quality number: 16
 Remarks: WOOSTER



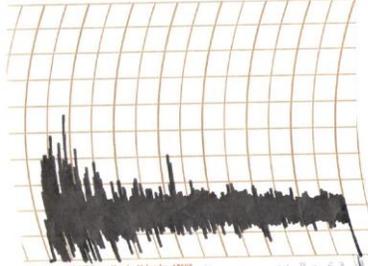
Appendix IV. Mixograms of 2012 OVA Flour Samples



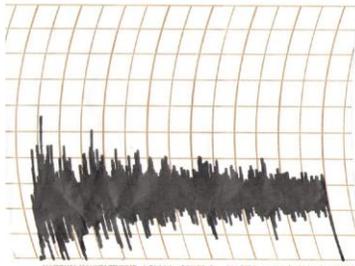
Shirley



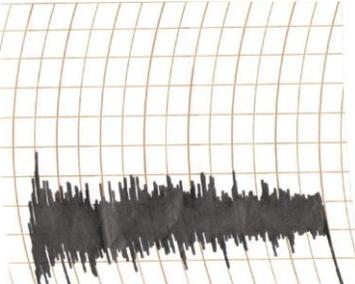
WB-196



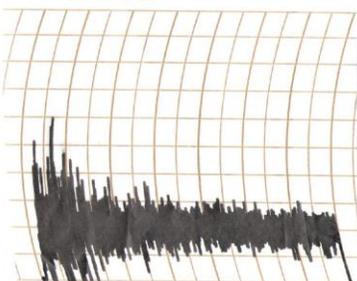
SY Harrison



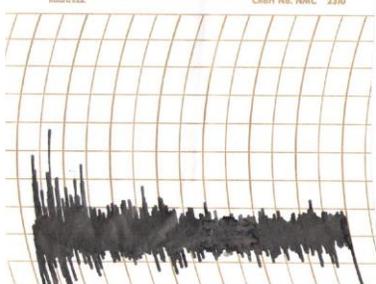
LA754



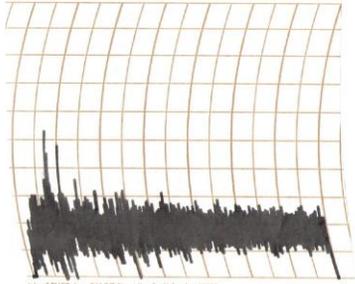
LA841



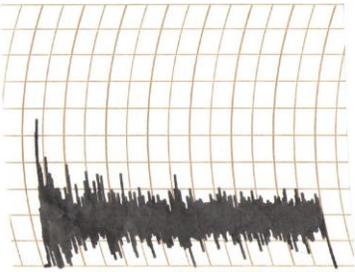
TV8861



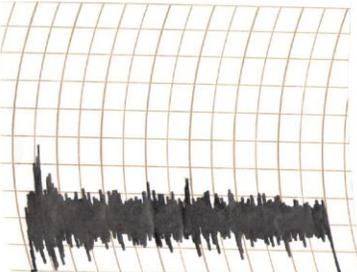
Havoc



Vandal



LCS News



Bess

Appendix V. Analysis of OVA 2013 Variety Flours and Standard Flours (Controls) Used by Cooperators**China-Guangdong**

Flour Characteristic	Control	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Moisture (%) corrected to 14% mb	12	12.4	12.6	12.3	11.8	12	12.3	11.9	12.4	12.5	12.2
Ash (%) 14%/0% moisture basis	0.41	0.46	0.38	0.42	0.43	0.45	0.47	0.44	0.44	0.35	0.41
Wet Gluten (%)	20.4	14.5	13.3	18.5	22.6	21.1	17.3	20.5	14.6	12.1	19
Gluten Index	75	50	93	68	65	89	87	62	99	92	54
Falling Number (sec)	313	352	271	324	350	321	345	284	313	296	291
Farinograph:											
Peak Time (min)	0.4	0.3	0.3	0.3	0.5	0.3	0.4	0.4	0.3	0.4	0.5
Stability (min)	1.1	1.2	0.9	1.2	2.1	1.6	1.1	1.1	1.2	0.9	1.4
Absorption (%)	54.5	51.9	50.2	49.1	52.2	50.9	50.2	49.5	50.7	53.2	52.8
Wire Cut Cookies											
Diameter (cm)	6.72	6.67	6.90	6.90	6.50	6.80	6.53	7.10	7.57	6.90	7.13
Stack Height (cm)											
Texture-Force (g)	18	17	19	17	19	18	20	20	19	19	19
Loaf Volume (cc)	35	34	40	39	36	39	44	44	43	41	43
Cookie Spread Ratio	1.94	2.00	2.16	2.29	1.89	2.17	2.20	2.20	2.26	2.16	2.26
Sponge Cake: (Volume (cc))	1120	1040	1070	1045	1050	1095	1055	1060	1100	1075	1120
Total Score	8.5	5.5	8.3	6.0	7.0	7.8	6.3	6.5	8.0	7.5	9.0

China-Yihai Kerry

Flour Characteristic	Control	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Color: L*		93.58	94.55	94.05	94.02	94.13	94.13	94.05	94.27	93.87	94.2
a*		2.52	2.86	2.91	3.14	3.31	2.9	2.83	2.93	2.83	2.88
b*		4.73	2.89	3.41	1.84	1.41	2.89	3.22	2.43	2.76	2.85
Protein (%) 14%/0% moisture basis		6.6	5.9	6.8	8.2	7.7	6.5	6.9	6.6	6.7	7.4
Moisture (%) corrected to 14% mb		13.1	13.3	12.9	13	12.9	12.5	12.7	12.9	13.2	13
Ash (%) 14%/0% moisture basis		0.41	0.38	0.4	0.4	0.4	0.4	0.4	0.39	0.4	0.39
Wet Gluten (%)		14.4	14.8	18.7	25	22.9	18	17	16	16.7	21.9
Gluten Index		86.2	86.4	92	90.4	87.6	91	90	88	91.2	88.4
Falling Number (sec)		360.00	304.00	380.00	410.00	402.00	348.00	385.00	347.00	310.00	410.00
Starch Damage (%)		3.5	2.74	2.63	3.4	2.71	1.5	2.5	2.3	3.3	2.5
Water/50% Sucrose		50.2/89.2	50.2/86.4	49.6/81.9	48.7/92.8	50.6/95.1	49.8/86.3	49.41/82.09/	54.14/87.2	55.2/95.3/	51.3/85.3
5% Lactic Acid/5% Na ₂ CO ₃		75.5/74.3	91/70.6	85.3/64.9	107.32/66.8	112.3/70.5	80.6/67.1	83.85/63.33	94.22/70.48	105.75/70.4	92.6/70.1
Farinograph:											
Peak Time (min)		0.9	0.9	1	1.5	1.5	1	0.9	1.2	1	1.4
Stability (min)		0.8	0.9	1.3	3.7	2	0.9	1.2	0.9	0.9	1.8
Absorption (%)		52.5	50.3	49.3	53.3	51.5	50.6	50.3	51	53.4	53
Alveograph:											
P (mm)		30	42.16	31.36	33		31.6	18	36	44.44	60
L (mm)		60	68	112	103.09		79	75	45	44.92	60
P/L Ratio		0.5	0.62	0.28	0.32	0.45	0.4	0.24	0.8	0.99	0.5
W (10 ⁻⁴ joules)		82	95	132	127.9	105.948	80	75	78	82.4	92

Dominican Republic

Flour Characteristic	Control	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Flour Color											
L*	95.01	95.37	96.21	*95.57	95.57	95.6	96.6	96.06	96.46	96.01	95.97
a*	-0.95	-1.88	-1.36	-1.42	-1.04	-0.84	-1.41	-1.47	-1.4	-1.36	-1.23
b*	8.32	10.53	8.47	8.96	7.42	6.84	8.03	8.81	8.24	7.98	7.77
Protein (%) 14% moisture basis	8.22	6.82	6.07	7.11	8.54	8.03	6.87	7.36	6.58	6.5	7.34
Protein (%) 0% moisture basis	9.79	8.12	7.23	8.46	10.17	9.56	8.18	8.76	7.83	7.74	8.74
Moisture (%) corrected to 14% mb	12.44	12.61	13.14	12.74	12.85	12.81	12.82	12.74	13.06	13.32	13.13
Ash (%) 14% moisture basis	0.452	0.41	0.366	0.397	0.386	0.386	0.411	0.376	0.422	0.375	0.389
Ash (%)0% moisture basis	0.538	0.488	0.436	0.473	0.460	0.460	0.489	0.448	0.502	0.446	0.463
Wet Gluten (%)	21.28	no formo	13.46	17.64	23.68	20.72	17.9	21.47	15.35	8.88	18.92
Gluten Index	92.67	no formo	91.68	85.37	80.79	92.95	94.66	71.24	98.63	99.61	90.55
Falling Number (sec)	323	373	308	318	337	343	369	306	310	298	353
Starch Damage (%)	2.99	4.62	3.53	2.07	3.53	3.4	2.37	3.77	2.56	4.32	4.01
Farinograph:											
Peak Time (min)	1.4	0.9	0.7	0.9	1.4	1	0.9	0.9	0.9	0.9	1.2
Stability (min)	1.6	0.5	0.6	0.7	3.9	1.1	0.8	0.9	0.8	0.7	1.3
Absorption (%)	49.9	506	49.2	46.9	51.3	50.3	48.9	48.4	48.7	52.4	51.6
Alveograph											
P (mm)	38	29	38	29	50	45	39	27	53	60	46
L (mm)	104	81	62	87	90	78	74	103	40	39	69
P/L Ratio	0.37	0.36	0.61	0.33	0.56	0.58	0.53	0.26	1.33	1.54	0.67
W (10 ⁻⁴ joules)	115	54	73	73	144	116	91	77	83	93	94
Baking Evaluation:											
Loaf Volume (cc)	62	64	48	54	61	66	64	65	71	62	66
Cookie Spread Ratio	84	82	77	80	84	83	83	83	84	84	84

Mexico

Flour Characteristic	Control	Shirley	WB-196	SY Harrison	LA754	LA841	TV8861	Havoc	Vandal	LCS News	Bess
Protein (%) 14%/0% moisture basis		6.36	8.10	7.20	8.94	6.10	6.80	6.38	6.13	6.50	7.83
Moisture (%) corrected to 14% mb		13.17	13.30	13.18	13.30	13.24	13.19	13.21	12.94	13.70	13.32
Ash (%) 14%/0% moisture basis		0.424	0.34	0.388	0.381	0.374	0.385	0.367	0.387	0.345	0.367
Wet Gluten (%)		16.05	20.34	18.63	22.13	19	17.03	15.57	14.82	12	19.22
Gluten Index		65.74	83.18	94.02	97.79	97.83	94.75	98.63	95.18	98.04	88.32
Falling Number (sec)		424	386	378	344	358	370	371	347	333	382
Farinograph:											
Peak Time (min)		1.2	1.2	1.2	1.7	1.5	1.2	1.2	1.2	1.2	1.5
Stability (min)		1.5	1.3	1.6	1.6	2.2	1.1	1	1.4	1.2	1.5
Absorption (%)		51.8	50.5	50	54.2	51.4	50.7	49.8	50.3	53.7	53.1
Alveograph: P (mm)		29	38	29	54	47	38	49	52	66	49
L (mm)		56	64	86	109	95	63	44	47	41	68
P/L Ratio		0.52	0.59	0.34	0.5	0.49	0.6	1.11	1.11	1.61	0.72
W (10 ⁻⁴ joules)		44	72	72	167	136	82	80	89	105	95
Wire Cut Cookies											
Diameter (cm)		7.69	8.17	7.94	7.23	7.78	6.98	7.88	8.15	7.57	7.67
Stack Height (cm)		0.95	1.05	0.93	1.21	1.06	1.14	0.91	1.08	1.12	1.19

Indonesia-Bogasari

Flour Characteristic	Cake	Cookie	Bread 1	Bread 2
	ASW (40%) + U.S. SW (60%)	ASW (20%) + U.S. SW (80%)	CWRS (80%)+CWRS (15%)	CWRS (40%)+CWRS (60%)
Wheat Origin/Class				
Commercial Mill Extraction (%)			58.00	68.00
Lab Mill Extraction (%)	76.3	76.00	58.00	68.00
Color: L*	93.22	93.46	92.28	91.93
a*	-0.53	-0.56	-0.48	-0.45
b*	9.88	9.13	10.56	11.13
Flour Moisture (%)	13.80	13.10	13.20	14.00
Protein (%) - Dry Basis	10.16	10.21	13.56	14.85
Protein (%) - 14% M.B.	8.74	8.78	11.66	12.77
Ash (%) - Dry Basis	0.63	0.61	0.45	0.54
Ash (%) - 14% M.B.	0.54	0.52	0.39	0.46
Wet Gluten (%)	24.1	23.6	35.1	35.9
Gluten Index	92	90	86	84
Falling Number (Sec)	382	365	393	378
Amylograph Viscosity 65 g (BU)	431	469	809	742
Starch Damage (%)				
Maltose Value (mg/10g)	2.33	2.00	1.18	2.00
Solvent Retention Capacity (SRC)				
Water	64.32	63.60	69.85	62.49
Pentosan (50% Sucrose)	111.72	102.66	114.60	100.53
Glutenin (5% Lactic Acid)	101.27	97.63	135.94	118.58
Damaged Starch (5% Na ₂ CO ₃)	88.47	80.25	96.00	96.60
Farinograph				
Absorption (%)	57.10	58.00	63.90	66.60
Arrival Time (min)	1.00	1.00	3.00	3.00
Peak Time (min)	4.00	4.00	10.70	8.30
Departure Time (min)	7.00	5.90	30.90	21.20
Stability (min)	6.00	4.90	27.90	18.20
Mixing Tolerance Index (MTI)	52	60	4	20
Extensograph				
Resistance (BU) - @ 45 mins	249	257	260	262
Extensibility (cm)	14.20	15.60	20.10	16.80
Area (sq cm)	55.00	66.00	114.00	142.00
Resistance (BU) - @ 90 mins	300	284	291	276
Extensibility (cm)	13.40	14.00	19.10	19.72
Area (sq cm)	61.00	62.00	115.00	110.40
Resistance (BU) - @ 135 mins	305	290	250	310
Extensibility (cm)	14.20	13.00	18.60	20.20
Area (sq cm)	69.00	56.00	100.00	112.40
Alveograph				
P (mm)	49.00	50.00	90.00	113.00
L (mm)	101.00	97.00	116.00	104.00
P/L Ratio	0.49	0.51	0.77	1.09
W (10 ⁻⁴ joules)	130.00	130.00	350.00	442.00

Indonesia-Pundi Kencana

Flour Characteristic	Cake	Cookie	Bread 1
Wheat Origin / Class	U.S. SW	U.S. SW	U.S. NS (10%) + AH (10%)
Color: L*	91.68	91.68	90.46
a*	-0.09	-0.09	0.05
b*	8.75	8.75	10.14
Flour Moisture (%)	12.98	12.98	13.22
Protein (%) - Dry Basis	10.11	10.11	14.81
Protein (%) - 14% M.B.	8.70	8.70	12.73
Ash (%) - Dry Basis	0.53	0.53	0.51
Ash (%) - 14% M.B.	0.45	0.45	0.44
Wet Gluten (%)	23.50	23.50	37.00
Gluten Index			
Falling Number (Sec)	407	407	590
Amylograph Viscosity 65 g (BU)			
Starch Damage (%)	3.977	3.977	7.134
Maltose Value (mg/10g)			
Solvent Retention Capacity (SRC)			
Water	56.69	56.69	66.12
Pentosan (50% Sucrose)	96.99	96.99	111.66
Glutenin (5% Lactic Acid)	86.33	86.33	142.55
Damaged Starch (5% Na ₂ CO ₃)	76.25	76.25	85.85
Farinograph			
Absorption (%)	56.5	56.5	64.2
Arrival Time (min)	0.8	0.8	5.9
Peak Time (min)	1.7	1.7	16.2
Departure Time (min)	3.2	3.2	39.4
Stability (min)	2.4	2.4	36.8
Mixing Tolerance Index (MTI)	91	91	5
Extensograph			
Resistance (BU) - @ 45 mins	144	144	432
Extensibility (cm)	15.7	15.7	18.0
Area (sq cm)	38	38	156
Resistance (BU) - @ 90 mins	178	178	470
Extensibility (cm)	14.7	14.7	16.5
Area (sq cm)	42	42	156
Resistance (BU) - @ 135 mins	200	200	542
Extensibility (cm)	13.5	13.5	15.6
Area (sq cm)	43	43	161
Rapid Viscosity Analyzer (RVA)			
Peak Viscosity	2867	2867	3176
Breakdown	868	868	991
Final Viscosity	3095	3095	3387
Remarks	Patent Flour	Clear Flour	

Malaysia-SFFM

Flour Characteristic	Cookie	Bread 1
Wheat Type / Class	APW (100%)	CWRS (85%)+AH (15%)
Commercial Mill Extraction (%)	74	75
Color: L*	92.24	91.35
a*	-1.4	-1.14
b*	9.94	10.27
Flour Moisture (%)	13.71	13.83
Protein (%) - Dry Basis	10.97	15.05
Protein (%) - 14% M.B.	9.43	12.94
Ash (%) - Dry Basis	0.57	0.59
Ash (%) - 14% M.B.	0.49	0.51
Wet Gluten (%)	26.60	36.10
Gluten Index	93.75	82.85
Falling Number (Sec)	503	520
Farinograph		
Absorption (%)	63.5	65
Arrival Time (min)	2.0	3.3
Peak Time (min)	4.5	8
Departure Time (min)	8.0	13.8
Stability (min)	6.3	10.5
Mixing Tolerance Index (MTI)	50.0	30.0
Extensograph		
Resistance (BU) - @ 45 mins	190	273
Extensibility (cm)	184	198
Area (sq cm)	66	116
Resistance (BU) - @ 90 mins	204	306
Extensibility (cm)	179	188
Area (sq cm)	67	120
Resistance (BU) - @ 135 mins	224	302
Extensibility (cm)	161	180
Area (sq cm)	62	110
Remarks	APW 10.5	

Philippines-MSMC

Flour Characteristic	Cake	Cookie	Bread 1
Wheat Type / Class	U.S. SW	U.S. SW	U.S NS (80%)+U.S. NS (20%)
Commercial Mill Extraction (%)	5.2	70.2	75.0
Lab Mill Extraction (%)			
Color: L*	92.35	91.46	89.90
a*	-2.95	-2.75	-2.42
b*	7.03	7.55	8.68
Flour Moisture (%)	12.03	12.77	13.06
Protein (%) - Dry Basis	9.44	10.95	15.79
Protein (%) - 14% M.B.	8.11	9.41	13.58
Ash (%) - Dry Basis	0.37	0.57	0.64
Ash (%) - 14% M.B.	0.32	0.49	0.55
Wet Gluten (%)	23.8	24.5	35.6
Starch Damage (%)	7.78	8.11	12.58
Farinograph			
Absorption (%)	55.0	54.0	67.0
Arrival Time (min)	0.8	0.8	2.5
Peak Time (min)	1.55	1.5	8.2
Departure Time (min)	5.9	3.9	16.5
Stability (min)	5.1	3.1	14.0
Mixing Tolerance Index (MTI)	65	100	30
Extensograph			
Resistance (BU) - @ 45 mins	250	161	278
Extensibility (cm)	150.0	186.0	215.0
Area (sq cm)			
Resistance (BU) - @ 90 mins	300	183	290
Extensibility (cm)	123.0	174.5	202.0
Area (sq cm)			
Resistance (BU) - @ 135 mins	330	203	330
Extensibility (cm)	109.0	151.0	179.0
Area (sq cm)			
Remarks	Patent Flour	Clear Flour	

Philippines-PFMC

Flour Characteristic	Cake	Cookie	Bread 1
Wheat Type / Class	U.S. SW	U.S. SW	CWRS
Commercial Mill Extraction (%)	79.0	79.0	77.0
Flour Moisture (%)	12.36	12.17	13.04
Protein (%) - Dry Basis	9.30	11.10	15.26
Protein (%) - 14% M.B.	8.00	9.55	13.12
Ash (%) - Dry Basis	0.41	0.51	0.69
Ash (%) - 14% M.B.	0.35	0.44	0.59
Wet Gluten (%)	22.9	26.7	40.2
Gluten Index			87.1
Maltose Value (mg/10g)	121	106	213
Farinograph			
Absorption (%)	54.4	54.7	68.4
Arrival Time (min)	1.2	1.5	6.2
Peak Time (min)			
Departure Time (min)			
Stability (min)	1.5	2.6	7.4
Mixing Tolerance Index (MTI)	82	78	32
Extensograph			
Resistance (BU) - @ 45 mins	180	128	182
Extensibility (cm)	172	190	250
Area (sq cm)			
Resistance (BU) - @ 90 mins	258	162	188
Extensibility (cm)	138	169	230
Area (sq cm)			
Resistance (BU) - @ 135 mins	220	168	195
Extensibility (cm)	131	162	226
Area (sq cm)			
Remarks	Patent Flour	Clear Flour	CWRS 14

Philippines-RFM

Flour Characteristic	Cake	Cookie	Bread 1	Bread 2
Wheat Type / Class	U.S. SW	U.S. SW	U.S. DNS	U.S. DNS
Commercial Mill Extraction (%)	3.0	78.0	77.5	77.5
Lab Mill Extraction (%)		65.8	65.0	65.0
Color: L*	91.39	89.75	87.64	86.12
a*	-2.05	-1.79	-1.62	-1.27
b*	7.75	8.49	9.58	10.15
Flour Moisture (%)	12.91	12.58	13.2	13.05
Protein (%) - Dry Basis	8.17	9.88	13.83	14.77
Protein (%) - 14% M.B.	8.07	9.72	13.7	14.61
Ash (%) - Dry Basis	0.34	0.54	0.55	0.81
Ash (%) - 14% M.B.	0.34	0.53	0.55	0.80
Wet Gluten (%)	20.8	25.7	36.7	37.8
Gluten Index	72	73	92	83
Falling Number (Sec)	380	379	423	427
Amylograph Viscosity 65 g (BU)	611	440	608	400
Starch Damage (%)	5.3	5.0	6.0	5.9
Farinograph				
Absorption (%)	55.30	56.20	66.80	67.07
Arrival Time (min)	0.5	1.2	3.4	1.1
Peak Time (min)	1.6	2.4	9.1	6.6
Departure Time (min)	4.5	5.0	14.2	9.5
Stability (min)	4.0	3.8	10.8	8.4
Mixing Tolerance Index (MTI)	75	91	37	59
Alveograph				
P (mm)	32	36	61	52
L (mm)	59	23	109	122
P/L Ratio	0.54	0.49	0.56	0.43
W (10 ⁻⁴ joules)	60	72	238	190
Remarks	Patent Flour	Clear Flour	Patent Flour	Clear Flour

Thailand-UFM

Flour Characteristic	Cake	Cookie	Bread 1
Wheat Type / Class	U.S. WW	U.S. WW	U.S. DNS
Commercial Mill Extraction (%)			
Lab Mill Extraction (%)	42.50	67.95	69.64
Flour Moisture (%)	12.30	11.87	12.65
Protein (%) - Dry Basis	9.77	10.44	15.64
Protein (%) - 14% M.B.	8.40	8.98	13.45
Ash (%) - Dry Basis	0.42	0.52	0.60
Ash (%) - 14% M.B.	0.36	0.45	0.52
Wet Gluten (%)	25.9	27.2	39.0
Gluten Index			
Falling Number (Sec)	385	367	414
Amylograph Viscosity 65 g (BU)	550	450	890
Starch Damage (%)	7.25	6.45	9.10
Maltose Value (mg/10g)	168.4	182.3	203.1
Farinograph			
Absorption (%)	56.9	59.1	66.4
Arrival Time (min)	1.0	1.0	3.0
Peak Time (min)	1.5	1.5	14.0
Departure Time (min)	6.3	6.5	>25.0
Stability (min)	5.0	4.5	>25.0
Mixing Tolerance Index (MTI)	40	45	5
Extensograph			
Resistance (BU) - @ 45 mins	310	240	370
Extensibility (cm)	144	169	210
Area (sq cm)	74	81	192
Resistance (BU) - @ 90 mins	420	270	430
Extensibility (cm)	123	162	201
Area (sq cm)	86	103	208
Resistance (BU) - @ 135 mins	440	285	450
Extensibility (cm)	126	157	190
Area (sq cm)	97	98	201
Remarks	Patent Flour	Straight Run	DNS 14.5

Appendix VI. Formulas and Procedures of Cookie, Sponge Cake and Chiffon Cakes Baked in the Singapore Bake Workshop

Cookie Baking Test

Ingredients	%	gm
Flour	100	250.0
Castor Sugar	6.7	16.8
Powdered Sugar	44.5	111.3
Salt	0.3	0.6
Water	22.2	55.5
Shortening	30	75.0
Milk Solid Non Fat	3	7.5
Ammomium Bicarbonate	0.5	1.3
Sodium Bicarbonate	0.5	1.1
Total	207.63	519.08

Procedure:

1. Dissolve the castor sugar, salt & milk solid with the water and keep the solution in the fridge for 1 hours.
2. Cream shortening & powdered sugar together with a paddle attachment at low speed for 1 minute. Scrape bowl.
3. Continue to mix at medium speed for another 2 minutes. Scrape bowl at interval of every 1 minute.
4. Dispense require amount of milk solution, then dissolve the sodium & ammomium bicarbonates in the solution.
5. Add in the milk solution into the fat mixture while mixing at medium within 45 seconds. Scrape bowl.
6. Continue to mix at medium speed for another 3 minutes.
7. Finally, add in the sieved flour and mix at low speed for 20 seconds. Scrape bowl.
8. Finish off the mixing with another 10 seconds at low speed.
9. Remove the mixed dough from mixer and divide into 6 equal dough balls.
10. Arrange the dough balls in a vertical manner of 3 rows x 2 columns.
11. Sheet the dough to a thickness of 8mm and cut out Ø 5cm round dough pieces.
12. Transfer the dough pieces onto greased tray and bake them at 220°C (Top) & 210°C (Bottom) for 10 minutes.
13. Remove baked cookies from hot tray and allow to cool on wire rack for 20 minutes before packing.
14. Keep the cookies overnight before evaluating for color & texture characteristics.

Sponge Cake Baking Test

Ingredients	%	gm
Wheat Flour	100	160.0
Sugar (Type: Fine Granule)	100	160.0
Salt	2	3.2
Whole Eggs	200	320.0
Emulsifier (Type: Emulpals 110)	12	19.2
Total	414.0	662.4

Procedure:

Mixing - Sponge Batter

1. Sift the flour. Set aside.
2. Add the eggs, sugar, salt & emulsifier into the mixing bowl & blend well.
3. Then add in the sifted flour & blend well.
4. Whisk the mixture at high speed for 3 minutes.
5. Then change to medium speed & continue whisking for another 1 minute.
6. Finally, complete the mixing with low Speed mixing for 1 minute.
7. Check & note down the specific gravity and batter temperature.

Depositing & Baking

1. Deposit 300gm of the batter into 2 round Ø 6 inches lined cake mold.
2. Bake the cake at 190°C for 30 minutes. (Lower top heat and higher bottom heat)
3. Remove from oven & drop the baked cakes from a height of about 10cm.
4. De-pan the baked cake & allow to cool completely.
5. Keep the cooled cakes in plastic bags for next day evaluation.

Chiffon Cake Baking Test

Ingredients	%	gm
Wheat Flour	100.0	125.0
Powdered Sugar	110.0	137.5
Salt	0.50	0.63
Emulsifier (<i>Type: Emulpals 110</i>)	12.0	15.0
Baking Powder	2.0	2.5
Vegetable Oil	80.0	100.0
Water	20.0	25.0
Whole Eggs	234.0	292.5
Total	558.5	698.1

Procedure:

Mixing - Batter

1. Sieve the flour, baking powder, powdered sugar & salt together into the mixing bowl.
2. Add in the emulsifier, eggs & water.
3. Combine all ingredients together at low speed for 1 minute.
4. Change to high speed & continue mixing for another 5 minutes.
5. Change to low speed & continue mixing for another 1 minute, meanwhile add in the oil slowly.
6. Check the temperature & specific gravity of the batter.

Pre & Post Baking Procedures

1. Deposit 200gm of the chiffon batter into 2 x Ø 6 inches baking pan.
2. Knock the bottom of the pan lightly with fingers to release any big bubbles from the batter.
3. Bake the cake at 180°C for 30 minutes. (Lower top heat and higher bottom heat)
4. Drop the baked cake from a height of about 10cm immediately after removing from oven.
5. De-pan after cooling & store the cooled cake in plastic bag for next day evaluation.

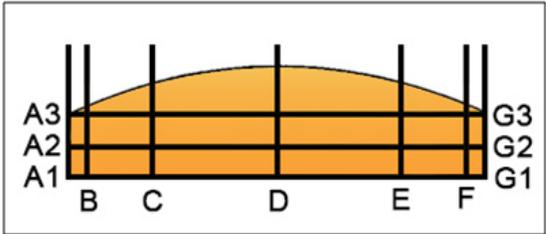
Results Calculations for Sponge Cakes and Chiffon Cakes

Shrinkage Value: $15.3\text{cm} - \frac{(A1 \text{ to } G1) + (A2 \text{ to } G2) + (A3 \text{ to } G3)}{2}$
 (Internal Pan ϕ)

Volume Index: Point B + Point C + Point D

Symmetry Index: $2 \times \text{Point C} - \text{Point B} - \text{Point D}$

Uniformity Index: Point B - Point D



Point A1 to G1 = Bottom ϕ of cake
Point A2 to G2 = Center ϕ of cake
Point A3 to G3 = Top ϕ of cake
Point B = 1cm from left edge
Point C = 4cm from left edge
Point D = Centre of cake
Point E = 4cm from right edge
Point F = 1cm from right edge

Result Interpretations

Shrinkage Value: Lesser value represents less sides shrinkage

Volume Index: Greater value represents bigger cake volume

Symmetry Index: 0 value represents perfect Symmetry
 Lesser value represents less crust convex
 Negative value represents crust is concave

Uniformity Index: 0 value represents perfect uniformity
 Positive value represents Point B is higher than Point D
 Negative value represents Point D is higher than Point B