Development of a standardized, batter-based, pancake-making method

Meera Kweon, Tom Donelson, Louise Slade*, and Harry Levine*

USDA, ARS, Soft Wheat Quality Lab., Wooster, OH, USA

* Food Polymer Science Consultancy, Morris Plains, NJ, USA

At the AACCI SWFTC meeting in Baltimore in 2009

- Proposal for an official pancake method
- Discussion about the leavening system
- Debate, debate, debate…

- Committee agreed to evaluate various leavening systems.

What are the problems in developing a pancake-making method?

- Absence of standard analytical criteria for pancake-making evaluation.
- A wide range of formulas and mixing procedures.
- A wide range of preferences in eating quality.

Comparison of ingredients and formulas

Ingredient	Cake	Pancake
Sucrose	high	low
Fat	high	low
Water	high	high
Flour	chlorinated	unchlorinated or chlorinated
TS*	high	medium
%S**	high	low

* TS = sucrose + water; **%S = 100 x sucrose/(sucrose + water)

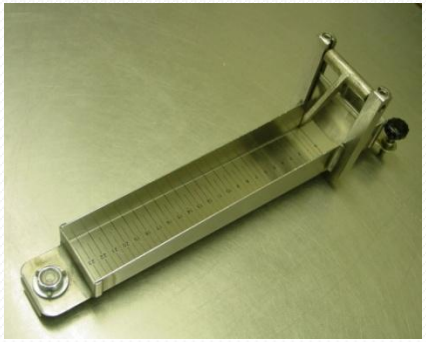
Objective

Develop a predictive, standardized, batter-based, pancake-making method
to distinguish differences in flour performance
for a batter-based product.

Equipment used for experiments

Mixer (Hobart)

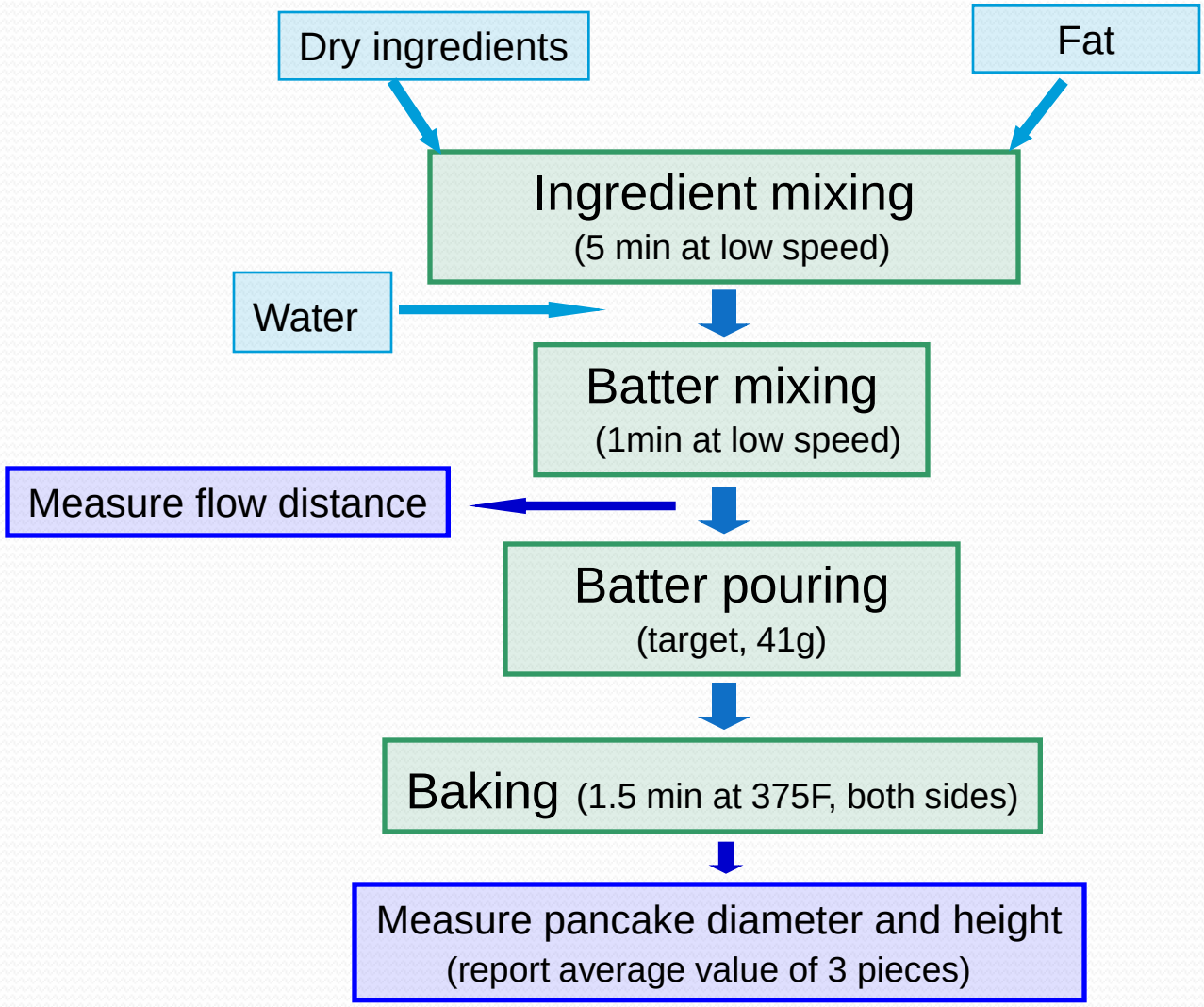
Scoop (# 20)



Bostwick viscometer

Baking griddle

Pancake procedure



Experiments

1) Developing the formula and procedure

- Fat type:

  Solid shortening vs Canola oil

- Leavening system:

  Soda (sodium bicarbonate) alone

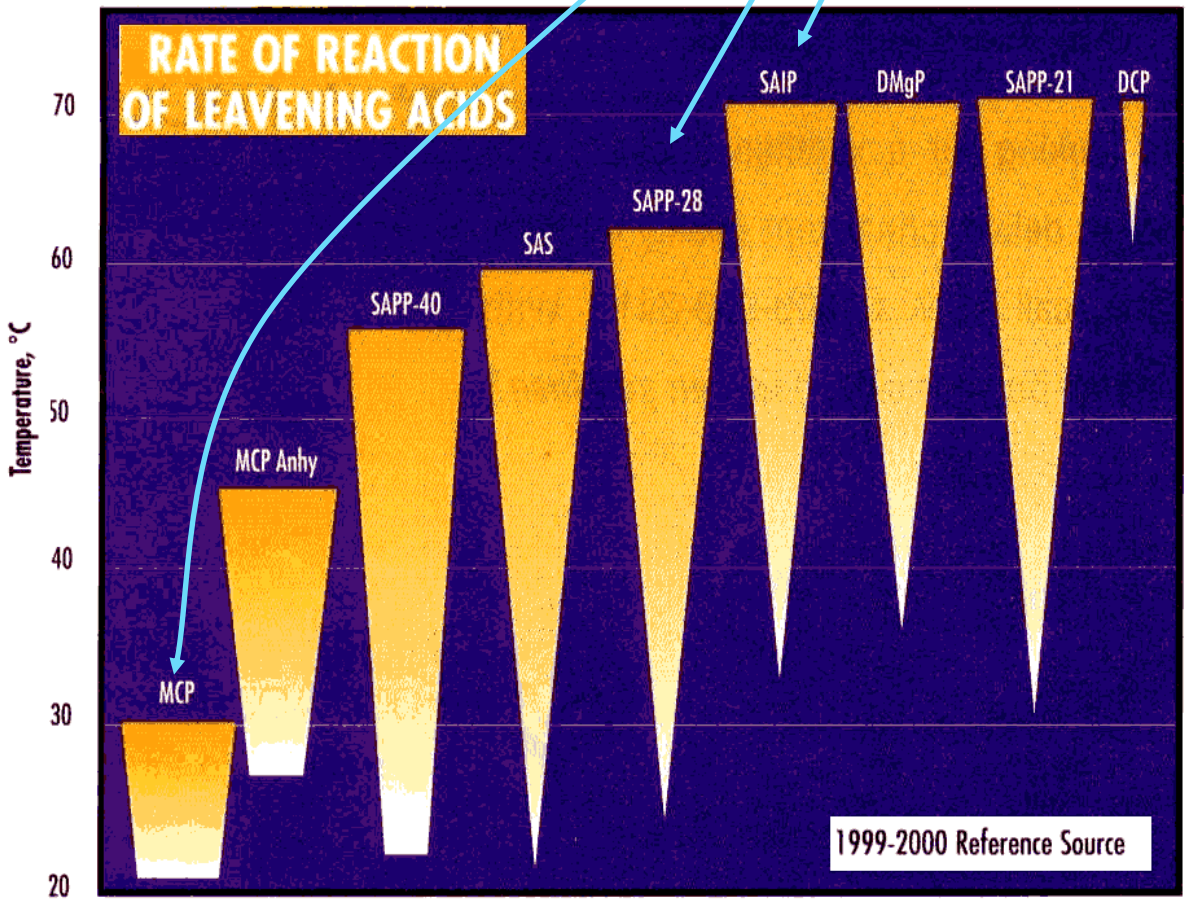
  Soda and leavening acids

2) Evaluating the developed method

- Flour blends
- Chlorinated flours
- Various flours

Leavening acids

Tested acids



LEAVENING BALANCE

ACID	Molecular Weight Relative to Soda = 1
Dicalcium phosphate, dihydrate (DCP)	2.86
Dimagnesium phosphate (DMgP)	2.50
Glucono-delta-lactone (GLD)	2.22
Monocalcium phosphate, monohydrate (MCP)	1.25
Coated monocalcium phosphate, anhydrous (AMCP)	1.20
Potassium acid tartate	2.22
Sodium aluminum sulfate (SAS)	0.96
Sodium acid pyrophosphate (SAPP)	1.39
Sodium aluminum phosphate (SALP)	1.00

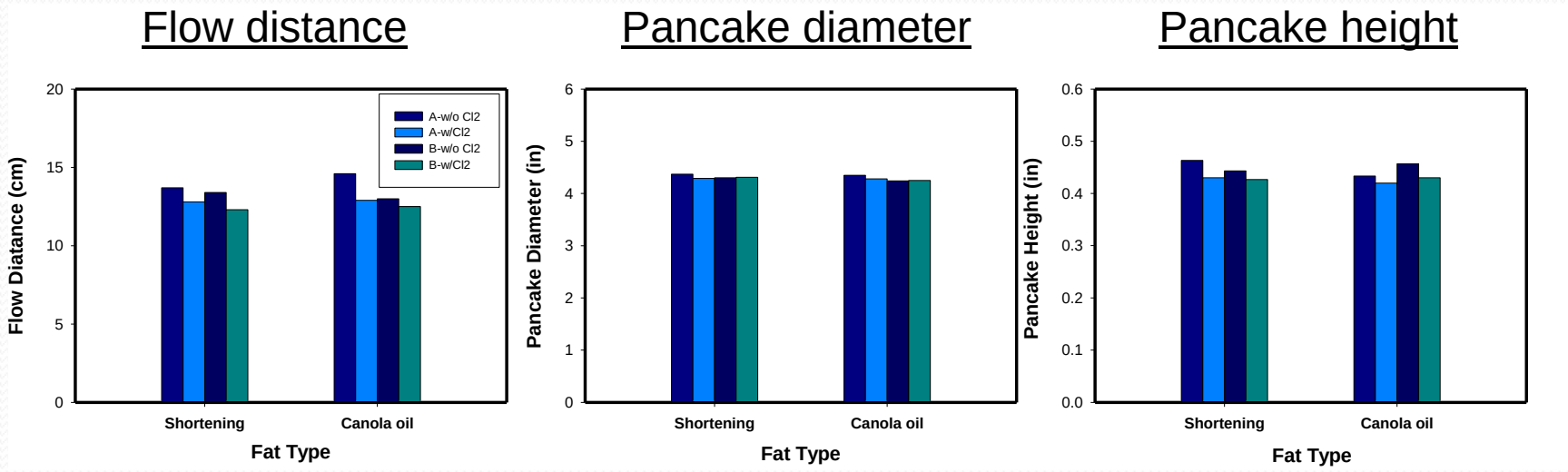
Dilute solution in water only

Comparison of solid shortening and oil

Shortening 5g + water 140g vs Canola oil 5g + water 135g

Tested flours:

Flour A (unchlorinated, pH 6.1) & Flour A (chlorinated, pH 5.1)
Flour B (unchlorinated, pH 6.3) & Flour B (chlorinated, pH 5.1)



Pancake-making performance with liquid canola oil was very similar to that with solid shortening.

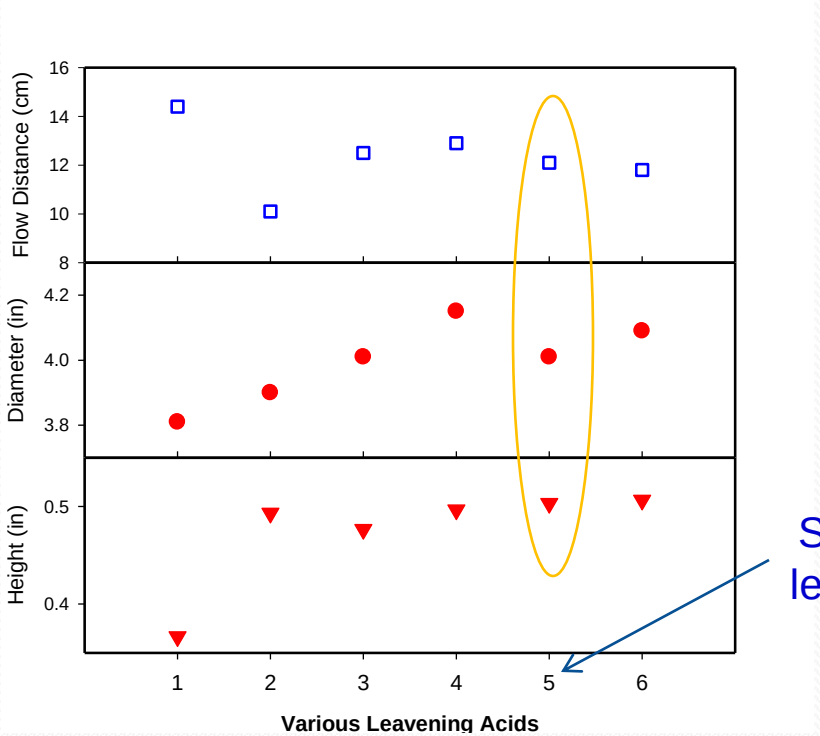
Effect of leavening acids

(Used Pioneer 26R12 flour)

SRC values: Water, 47%; Lactic acid, 97%; NaC, 58%; Suc, 94%

Exp.	Soda	MCP	SAPP	SALP
1	+	-	-	-
2	+	+	-	-
3*	+	-	+	-
4	+	-	-	+
5	+	+	+	-
6	+	+	-	+

SAPP, ICL (SAPP 28); SALP, Prayon (acidic)
* A little greater tendency for bigger air cells



SAPP 28 and SALP showed additional dissolution of acid and release of CO_2 with soda + MCP. SAPP 28 was selected for the standard method, because it is more widely used around the world.

Selected ingredients and formula

Ingredient	Formula (g)
Flour	100.0
Fine granulated sucrose	10
Dextrose (anhydrous)	3
Salt	1.5
Sodium bicarbonate	2.25
Monocalcium phosphate	0.38
SAPP 28	2.70
Canola oil	5
Water	135.0
TS	145
% S	7

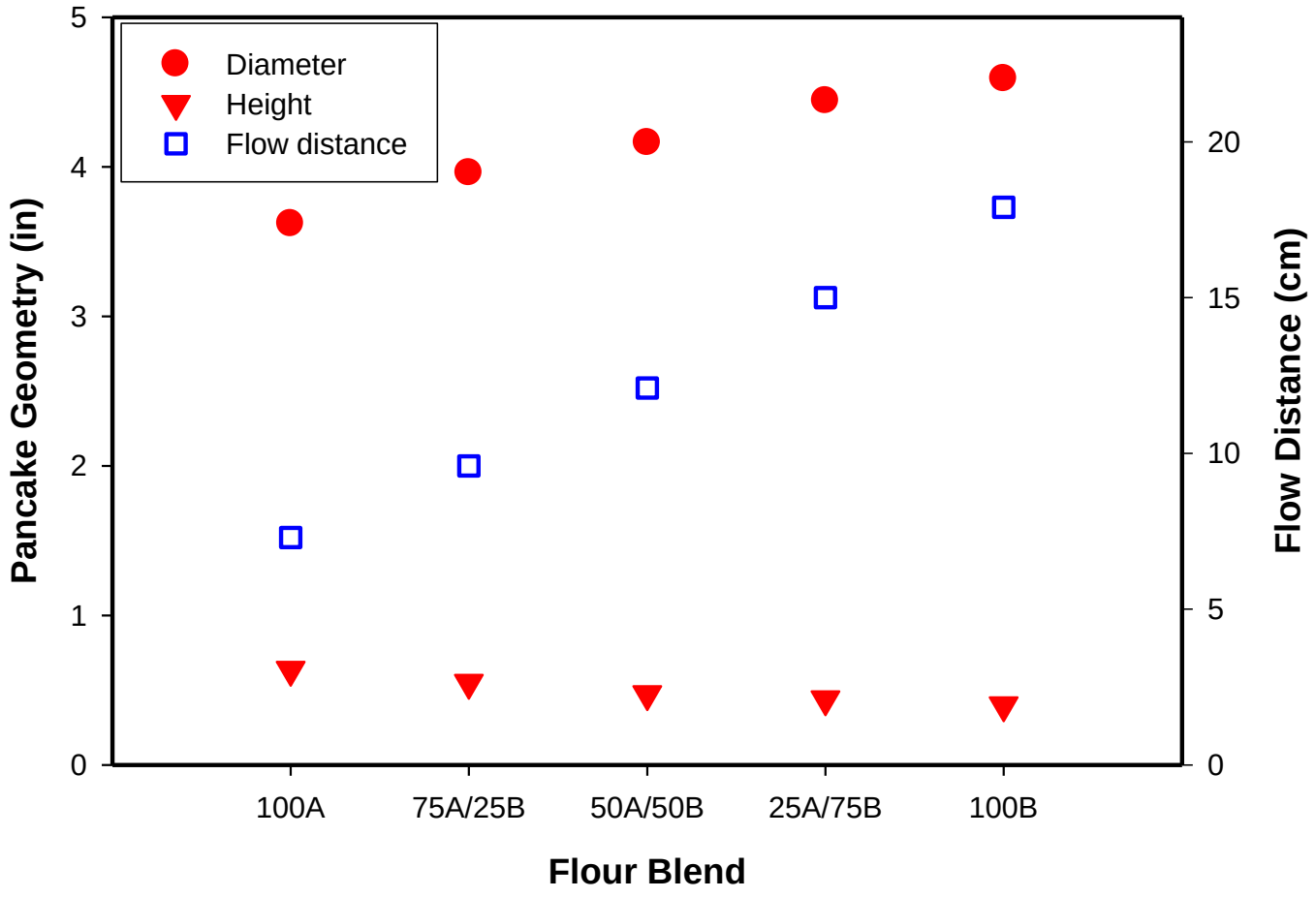
SRC values of flour blends

Flour blend	Water	Lactic acid	$NaCO_3$	Sucrose
Flour A (100A)	62.0	115.7	77.5	105.1
75 A/25 B	58.5	105.8	73.3	100.5
50 A/50 B	55.0	95.9	69.0	95.9
25 A/75 B	51.5	86.0	64.8	91.2
Flour B (100B)	48.0	76.1	60.5	86.6

decrease

A → B

Pancake results of flour blends



Effect of chlorination

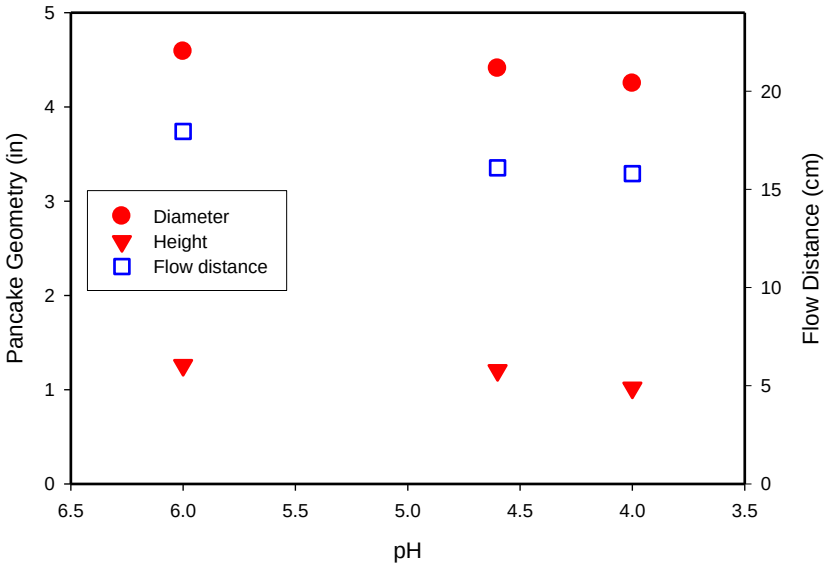
(Croplan 594W, straight grade flour)

pH of flour	Water	Lactic acid	$NaCO_3$	Sucrose
6.0	46.9	83.3	64.5	83.5
4.6	53.4	75.0	65.1	86.3
4.0	54.4	74.3	68.4	100.3

Top

Bottom

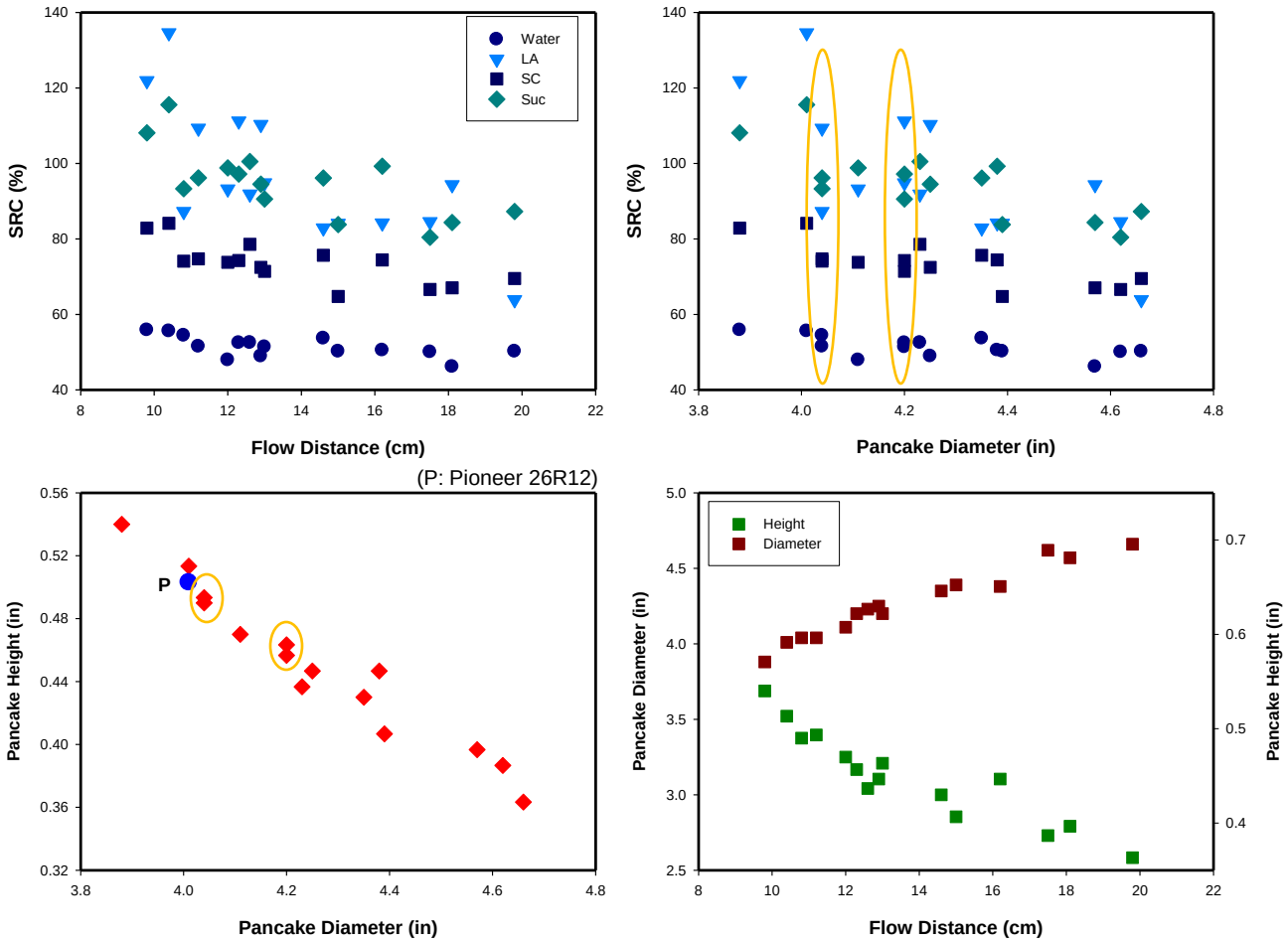
Side



Chlorinated flours show a different trend in pancake geometry.

SRC and pancake results with various flours

(2009 QEC samples)



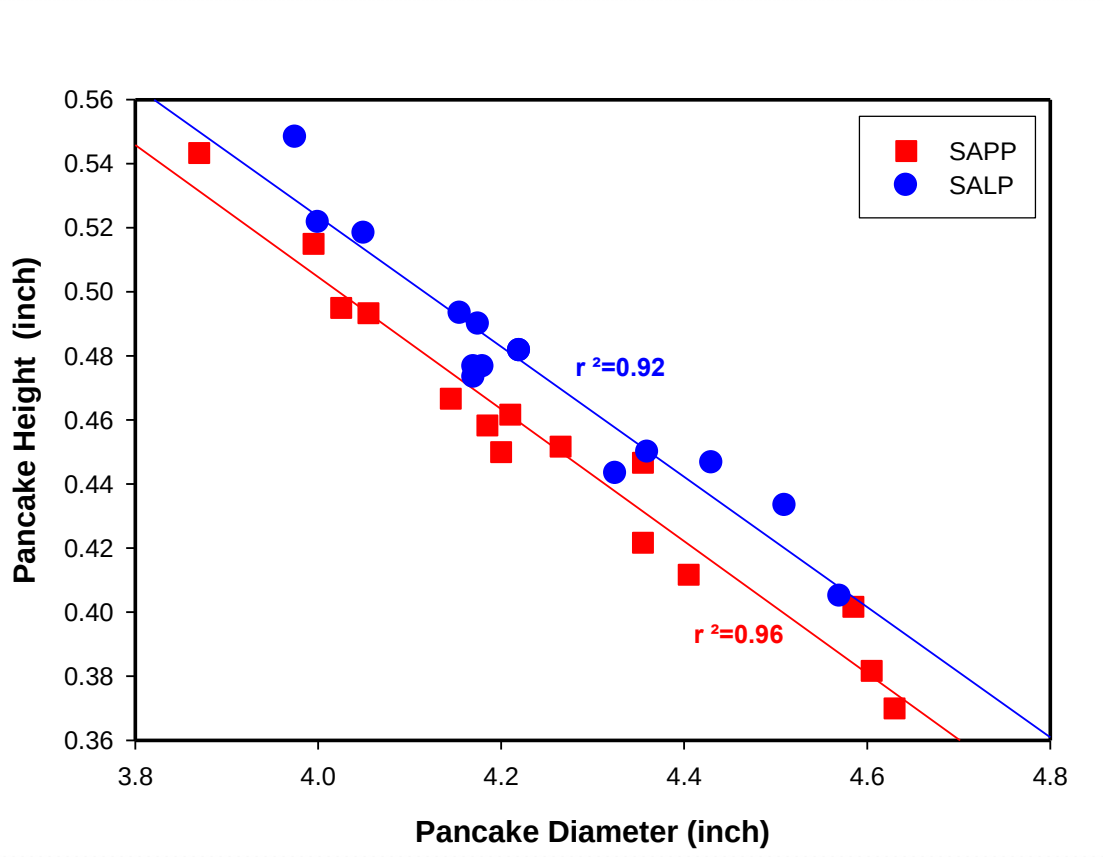
Correlations of flour SRC with pancake results

Variable	Water	Lactic acid	Sodium carbonate	Sucrose
Flow distance	-0.63*	-0.74**	-0.72**	-0.72**
Diameter	-0.63*	-0.73**	-0.76***	-0.77***
Height	0.65**	0.78***	0.80***	0.80***

*, ** and ***, correlations (r) significant at $p<0.05$, 0.01, and 0.001, respectively.

Pancake results with SAPP vs SALP

(2009 QEC samples)



Spearman's rank correlation

Flow distance	0.96
Diameter	0.90
Height	0.88

Conclusions

- Soda (2.25g), MCP (0.38g), and SAPP 28 (2.7g) were selected as the leavening system for a diagnostic formula to distinguish differences in flour performance for pancake baking.
- Pancake-making performance with liquid canola oil was very similar to that with solid shortening, with only a minor adjustment in the water level.
- Pancake-making performance for two flours or their blends can be predicted from their SRC values.
- Chlorinated flours show a different trend in pancake geometry.
- Pancakes formulated with SAPP and SALP showed a good agreement in ranking in batter flow distance, pancake diameter, and height.

Still questions to be answered!

- What happens to the predictions for pancake-making performance of two flours, when their SRC patterns are more complex?
- Although very similar pancakes can be made with different flours, what criteria will be used for sensory evaluation?
- How can the method be applied to meet consumer preferences?
- Is there a "gold standard" for consumer preference?

Acknowledgements

SWQL

- Scott Beil
- Edward Souza

Outside SWQL

- Art Bettge
- Gang Guo
- Barbara Heidolph
- CJ Lin
- Angie Monical
- Zory Quinde-Axtell
- Edmund Tanhehco

THANK YOU