

Update of pancake-making method



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At the AACCI SWFC meeting in Baltimore in 2009

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



volunteered to have **FUN** (that turned into a **STRUGGLE**) evaluating 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

Objective

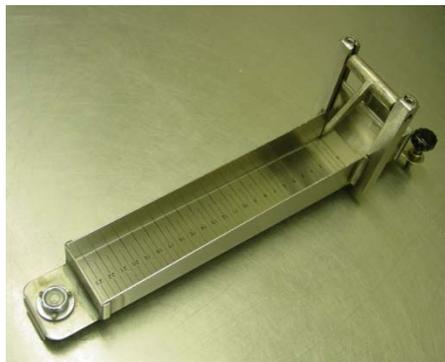
Develop a predictive pancake-making method to distinguish differences in flour performance for a batter-based product

Equipment used for experiments

Mixer (Hobart)



Scoop (# 20)

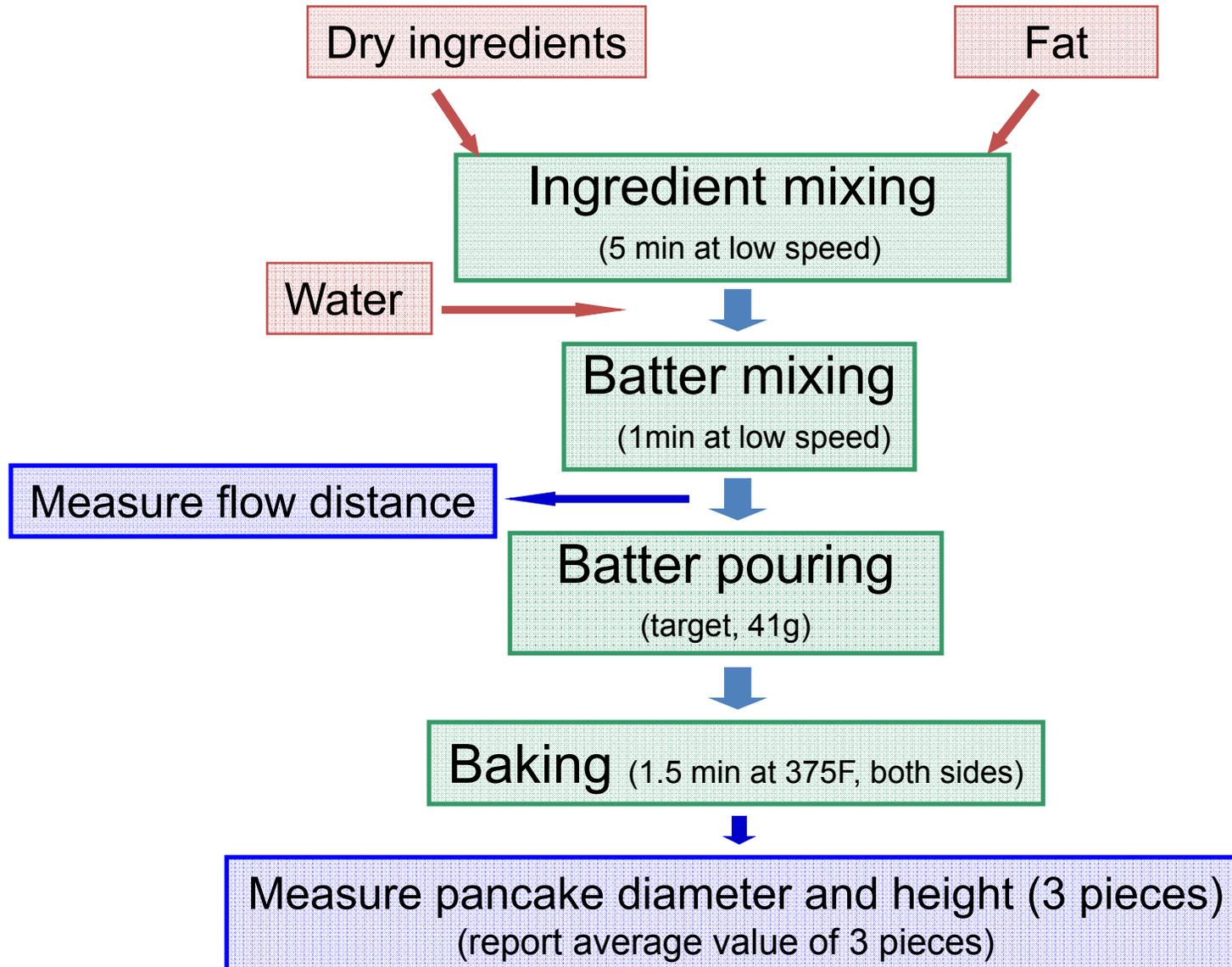


Bostwick viscometer



Baking griddle

Pancake procedure



Flour used for developing the formula and procedure

Flour	SRC			
	Water	Lactic acid	Sodium carbonate	Sucrose
Pioneer 26R12	47.7	96.5	58.0	93.5

Comparison of solid shortening and oil

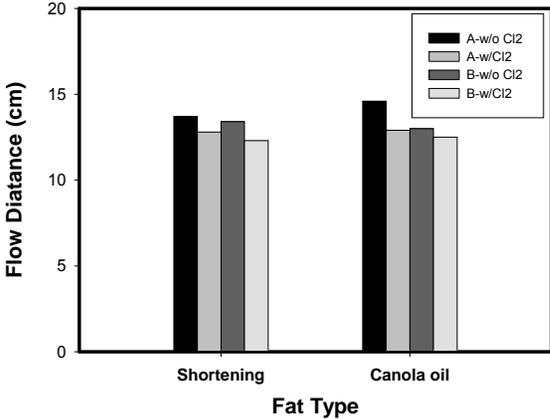
Shortening 5g + water 140g vs Canola oil 5g + water 135g

Tested flours:

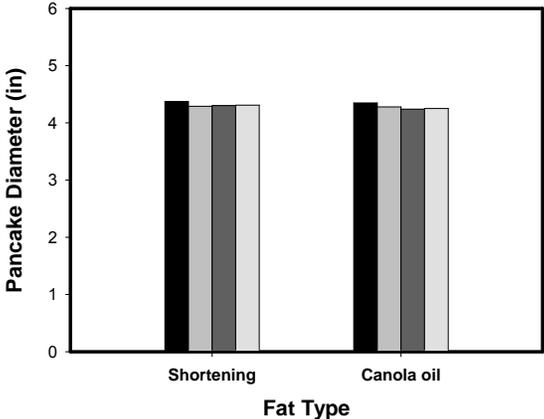
Flour A (unchlorinated, pH 6.1) & Flour A (chlorinated, pH 5.1)

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

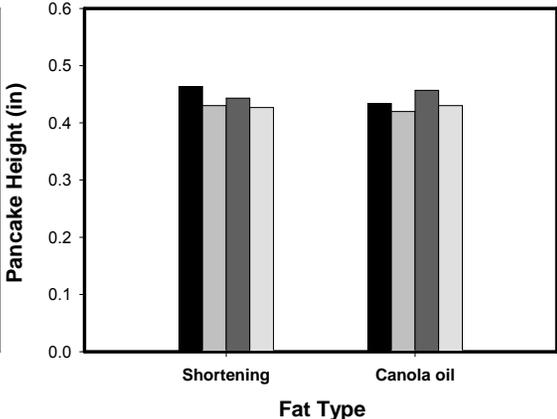
Flow distance



Pancake diameter



Pancake height



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

Chemical leavening using sodium bicarbonate

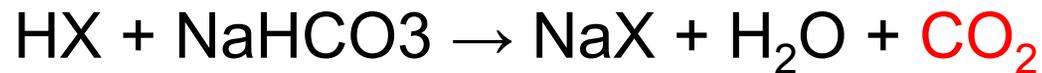
- Thermal release of CO₂:

Sodium bicarbonate

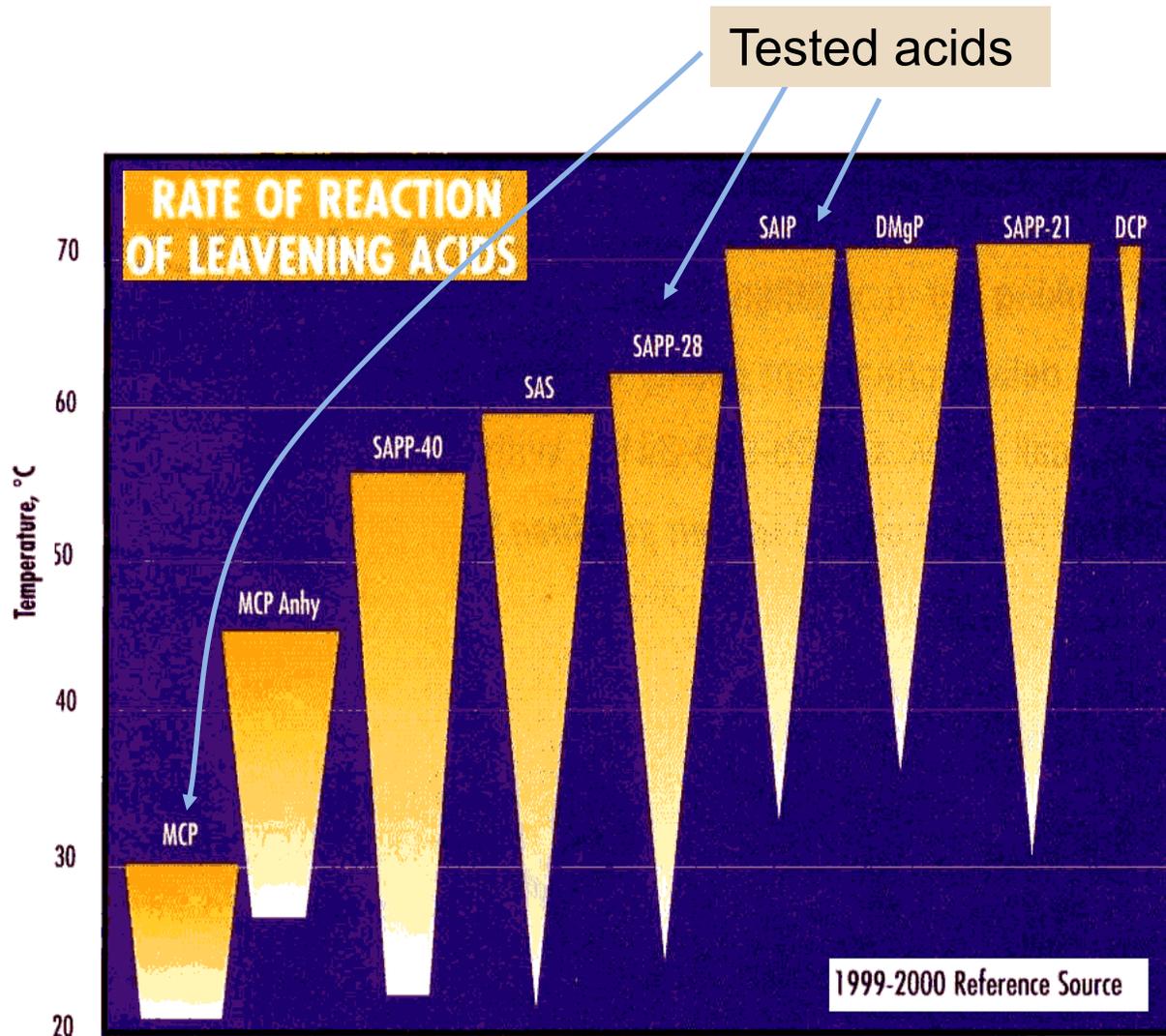


- Acid release of CO₂:

Sodium bicarbonate and leavening acids



Rate of reaction of leavening acids



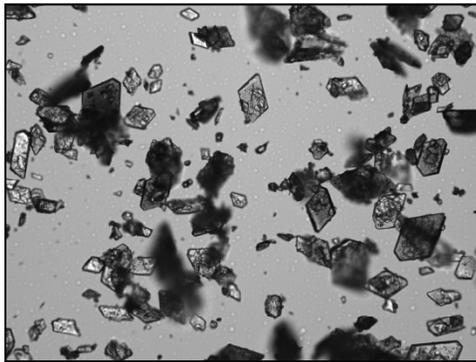
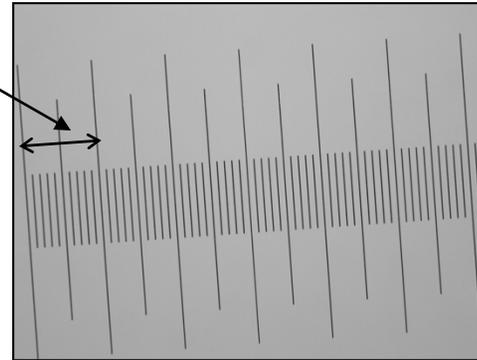
LEAVENING BALANCE

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 tartarate	2.22
Sodium aluminum sulfate (SAS)	0.96
Sodium acid pyrophosphate (SAPP)	1.39
Sodium aluminum phosphate (SALP)	1.00

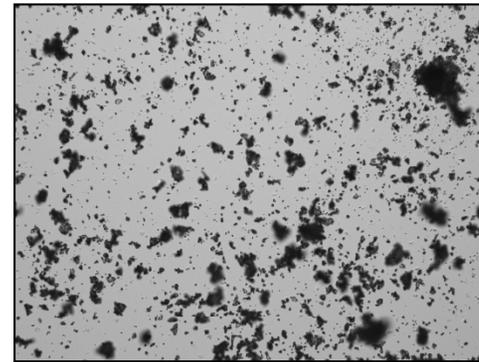
Dilute solution in water only

Leavening acid
(normal light)

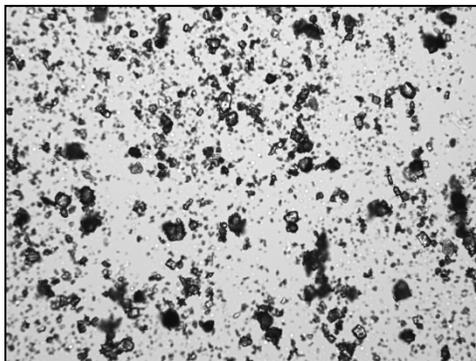
100 μ m



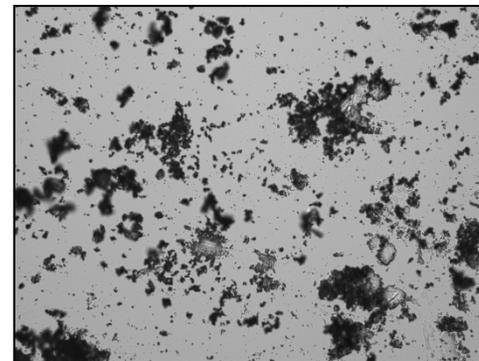
MCP



SAPP 28



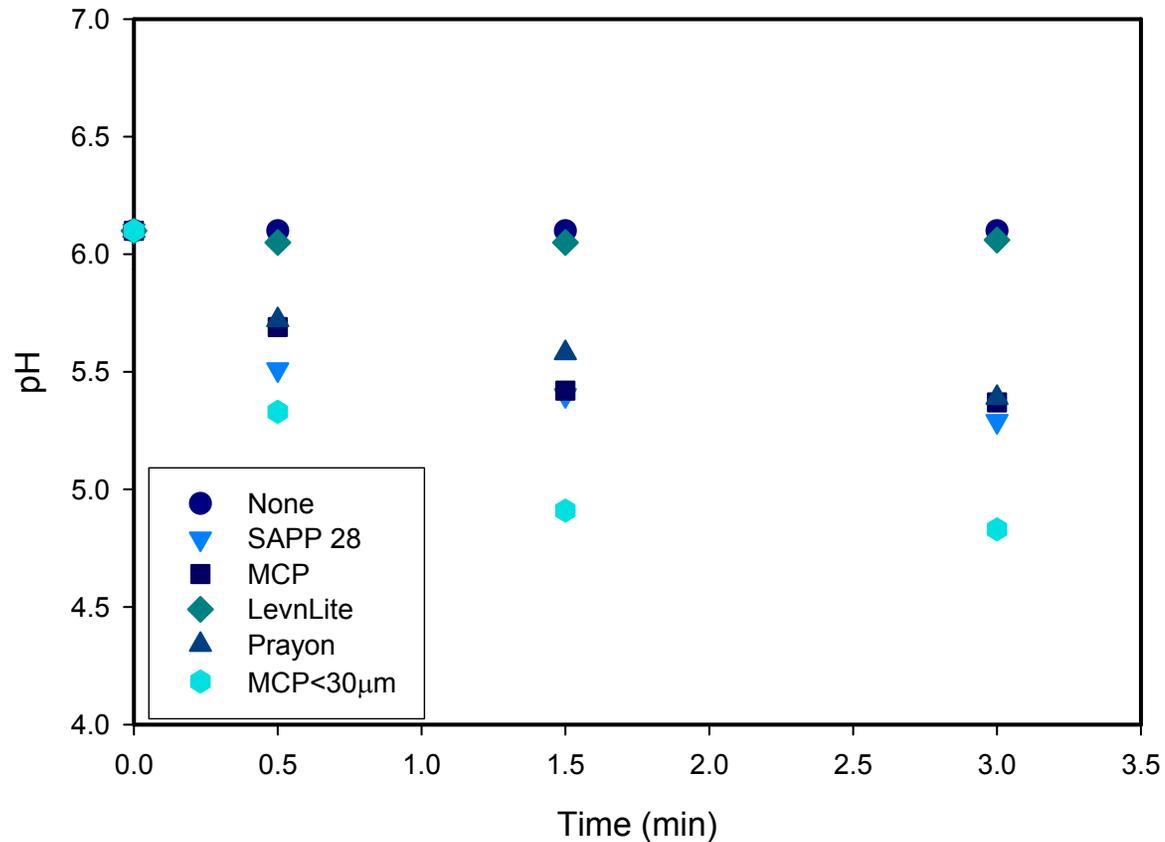
SALP (LevnLite, ICL)



SALP (Acidic, Prayon)

pH profiles of flour slurry with leavening acids

(10g Pioneer 26R12 flour + 50 ml water + various leavening acids)



Flour is a major buffering agent in pancake formula. Rate and extent of dissolution of leavening acids during mixing and baking should be considered for leavening reaction.

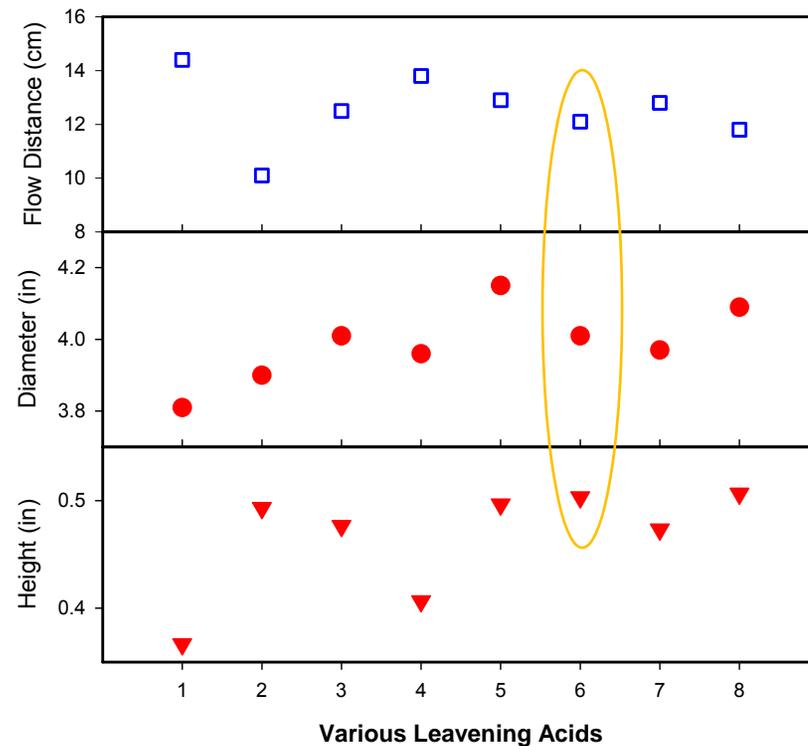
Effect of leavening acids

(Used Pioneer 26R12)

Exp.	Soda	MCP	SAPP	SALP	SALP-A
1	+	-	-	-	-
2	+	++	-	-	-
3*	+	-	+	-	-
4	+	-	-	+	-
5	+	-	-	-	+
6	+	+	+	-	-
7	+	+	-	+	-
8	+	+	-	-	+

SALP, LevnLite; SALP-A, Prayon (acidic)

* A little more tendency of bigger air cells



SAPP 28 and SALP-A showed additional dissolution of acid and release of CO₂ with soda + MCP. SAPP 28 was selected for the AACCI method, because it is more widely used around the world.

Selected ingredients and formula

Ingredient	Formula (g)
Flour	100.0
FG Sugar	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

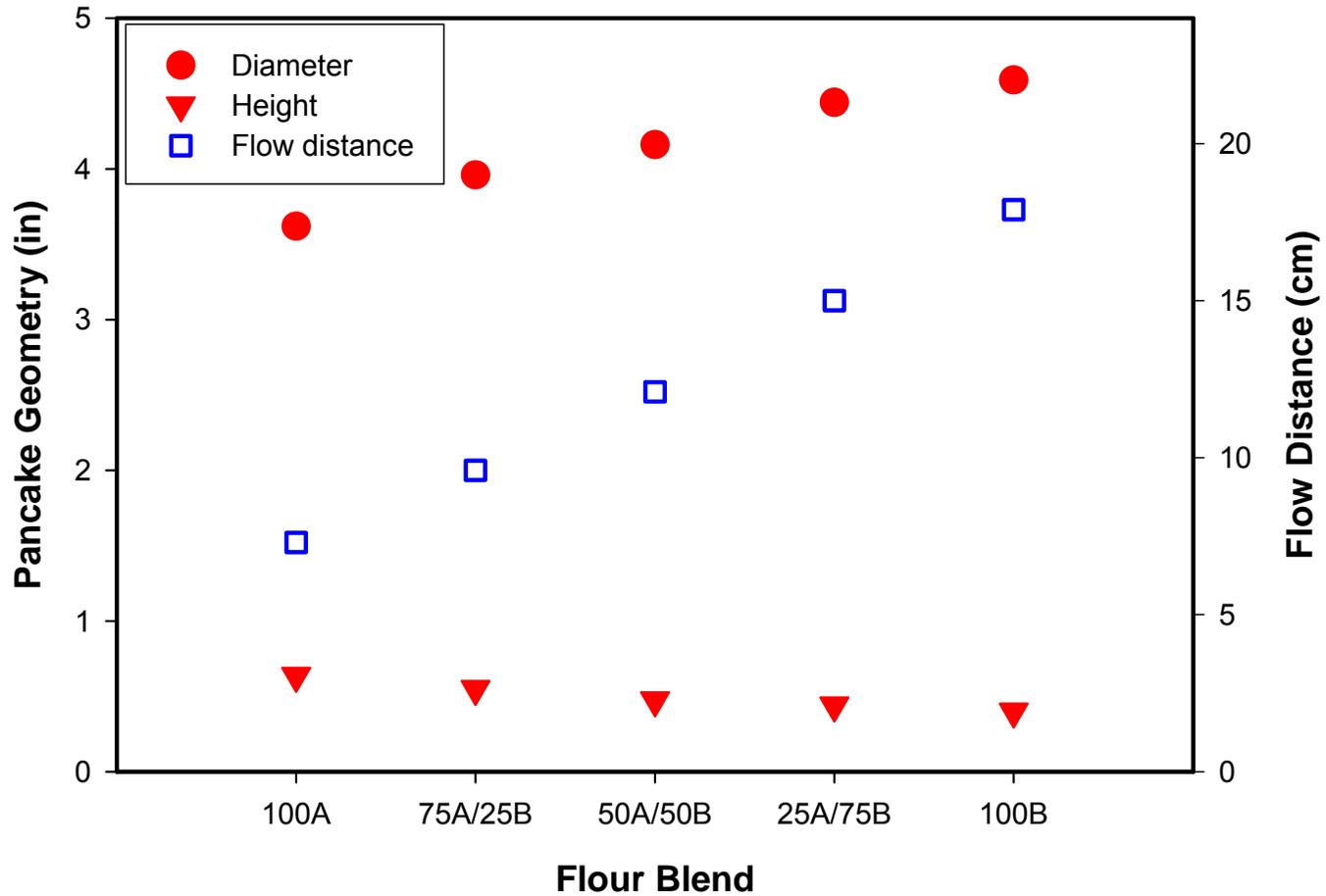
SRC values of flour blends

Flour	Water	Lactic acid	NaCO ₃	Sucrose
Flour A	62.0	115.7	77.5	105.1
3 Flour A + 1 Flour B	58.5	105.8	73.3	100.5
1 Flour A + 2 Flour B	55.0	95.9	69.0	95.9
1 Flour A + 3 Flour B	51.5	86.0	64.8	91.2
Flour B	48.0	76.1	60.5	86.6

A  B

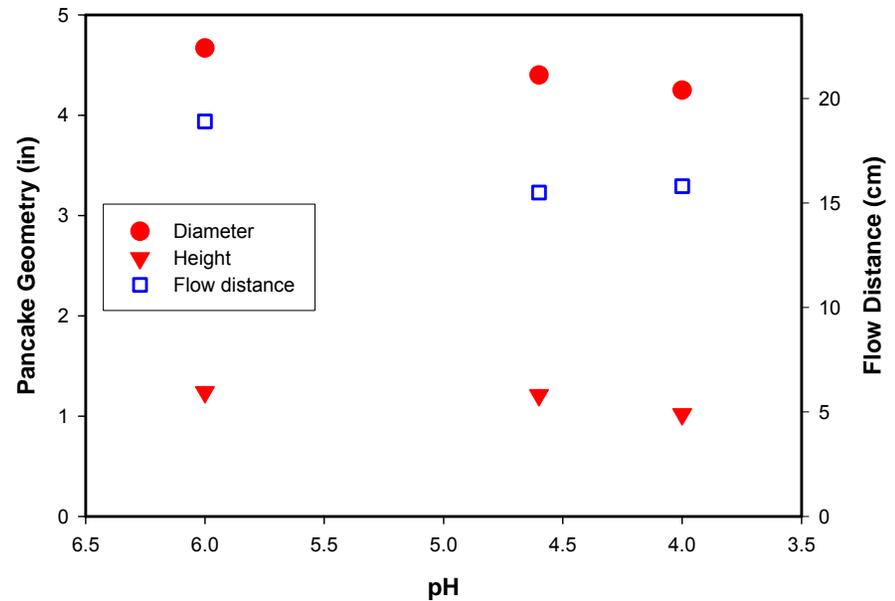


Pancake results of flour blends



Effect of chlorination (Croplan 594W, straight grade flour)

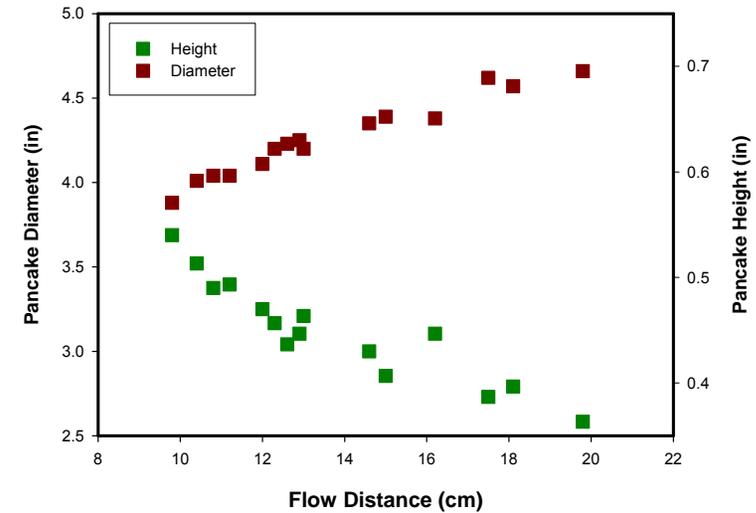
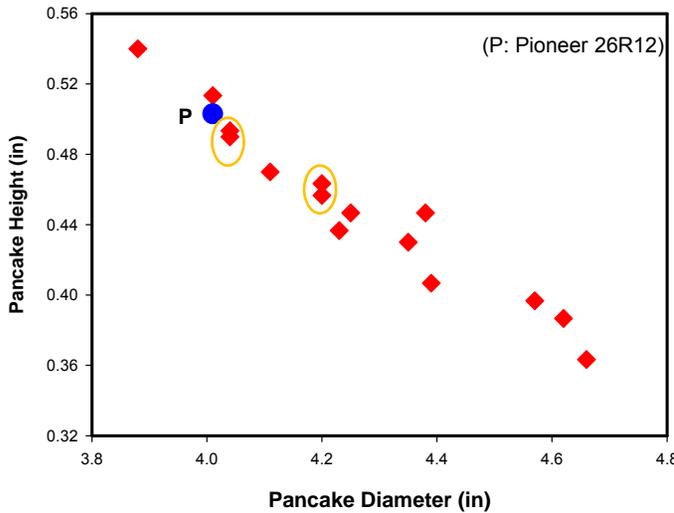
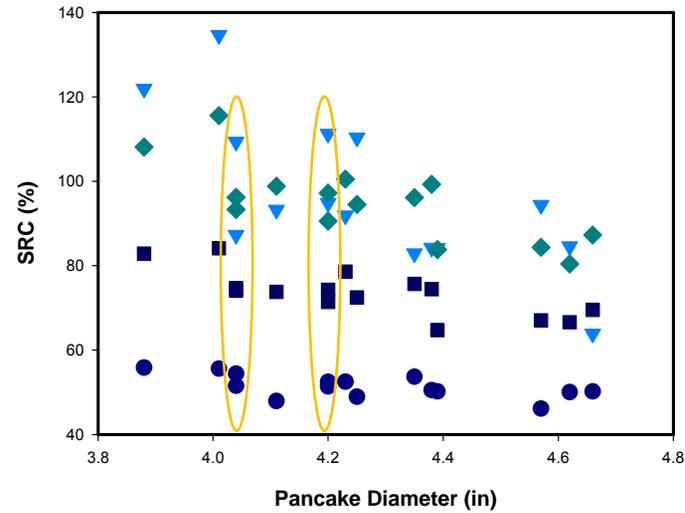
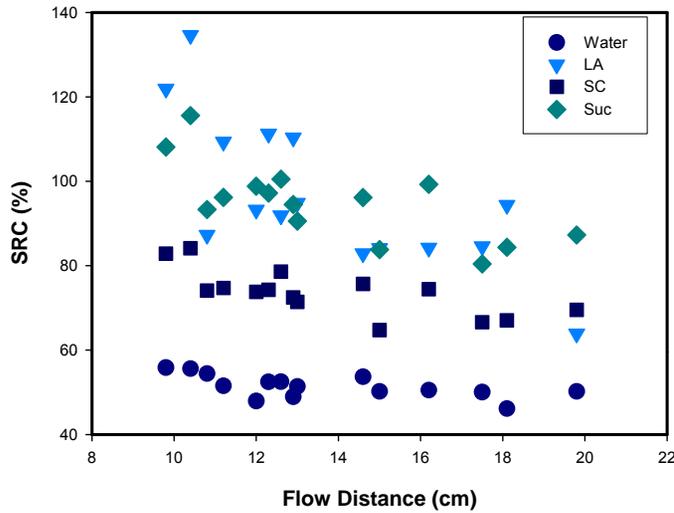
pH of flour	Water	Lactic acid	NaCO ₃	Sucrose
6.0	46.9	83.3	64.5	83.5
4.6	53.4	75.0	65.1	86.3
4.0	54.4	74.3	68.4	100.3



Chlorinated flours show a different trend in pancake geometry

SRC and pancake results with various flours

(2009 QEC samples)



Similar pancake geometry can be made with different flours. Which pancake will be better in eating quality?

Conclusions

- Based on a preliminary investigation of the effects of leavening acids, **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. Canola oil is easy to blend with the dry ingredients, before the water is added, to create a uniform, reproducible batter.
- **Pancake-making performance for two flours or their blends can be predicted from their SRC values.** When SRC values in all four solvents are lower for flour A than the corresponding values for flour B, the flow distance of the batter and diameter of the pancake will be greater for flour A, but the pancake height will be smaller.
- **Chlorinated flours show a different trend in pancake geometry.** With increasing extent of chlorination both pancake diameter and height decrease. Excessively chlorinated flour (pH 4) showed an even greater decrease in pancake height.

There are still questions to be answered!!!

- What happens to the prediction 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?

But the big question is.....

When we have the method to distinguish the pancake-making performance of different flours, will it be useful to breeders, millers, bakers, and product developers?

If we agree that we need to have a method to distinguish flour performance, we will have a pancake collaborative soon!

Acknowledgements

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