

2003 MAFMA Final Report

Project Title **Optimization of Wheat Flour Tortilla Ingredients
for Food Service Uses**

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1. Objective Summary

The objective of this study was to determine the effects of critical tortilla ingredients and process conditions on wheat flour tortilla production and quality. Quality factors of particular interest to the food service industry were evaluated (separation/stickiness, color, thickness, firmness, etc.)

2. Objective Accomplishments

Experimentation was conducted using wheat flour tortilla formulations that varied the ingredients and process (hot press) conditions as shown in Table 1. Fixed amounts are shown in *italics*, while ingredients that were allowed to vary according to a Response Surface Methodology (RSM) analytical design are shown in **bold**.

Table 1 – Wheat Flour Tortilla Ingredient Variables

Ingredient	Amount (g)	% (Flour Basis)
<i>Flour</i>	<i>1000</i>	<i>100</i>
<i>Salt</i>	<i>17</i>	<i>1.7</i>
<i>Potassium Sorbate</i>	<i>5</i>	<i>0.5</i>
Baking Powder (DA,Encapsulated)	0 – 15	0 – 1.5
Fumaric Acid	0 – 3	0 – 0.3
Carboxyl Methyl Cellulose	0 – 10	0 – 1.0
Shortening	0 – 150	0 – 15
L-Cysteine	0 – 0.03	0 – 30 ppm
<i>Water</i>	<i>530</i>	<i>53</i>
Hot-Press Time		0.6 – 1.5 sec

Wheat flour tortilla systems were found to be very complex. For example, increasing shortening amounts generally decreased tortilla stickiness (as defined by their ability to separate after being stacked), but shortening levels interacted with baking powder amounts. There was no similar interaction found between shortening levels and wheat quality as measured by Falling Number (Figures 1 and 2).

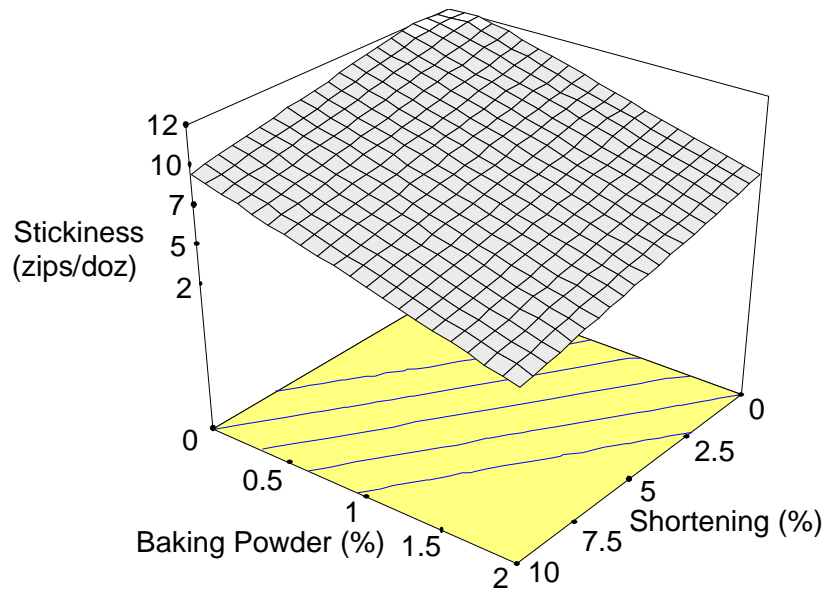


Figure 1: Interaction of Baking Powder and Shortening on Tortilla Stickiness.

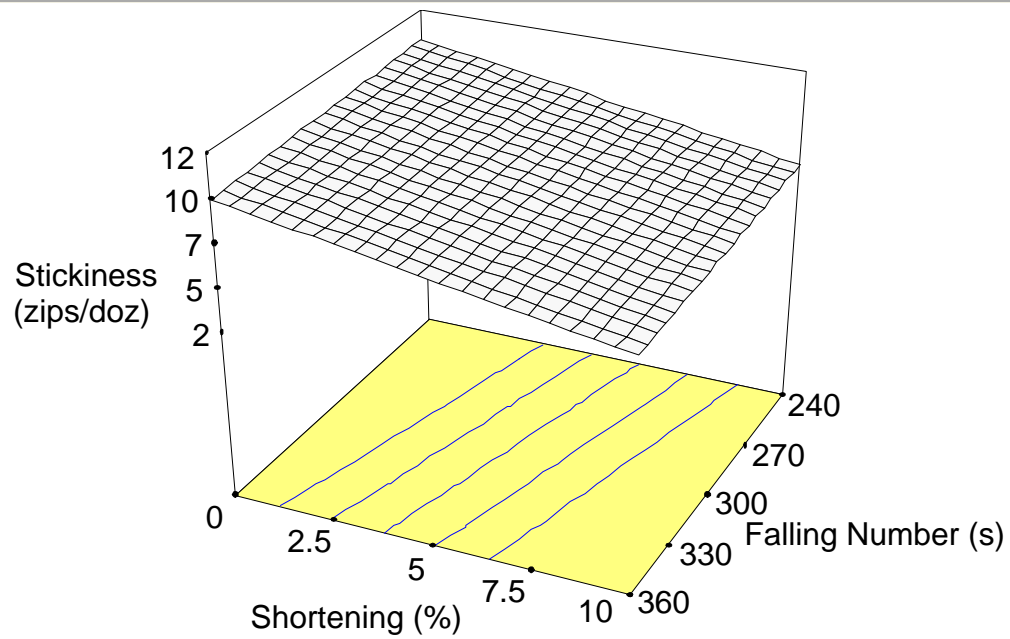


Figure 2: Interaction of Baking Powder and Falling Number on Tortilla Stickiness.

There were several additional important findings and interactions between ingredients that were also discovered. In summary, we recommended to the industry the following:

To Reduce Stickiness:

- Sufficiently cool the tortillas prior to packaging.
- Avoid use of reducing agents such as used in bread making (L-Cysteine)
- Optimize levels of shortening

To Increase Opacity:

- Increase baking powder levels
- Use less shortening
- Use less acid (while maintaining enough to ensure microbial safety)
- Reduce hot-press processing times
- Use CMC (or other gums/hydrocolloids) in the tortilla formulation

To Reduce Firmness:

- Increase baking powder levels
- Increase shortening amounts – but amounts over 10-15% can cause stickiness
- Decrease hot-press processing times

To Improve Color:

- Increase baking powder levels
- Modestly decrease shortening amounts
- Decrease acid levels

What is key to these findings is that wheat tortilla formulations need to be *optimized*, rather than simply “automatically” increasing or decreasing particular ingredients or altering process conditions. Many of our response surfaces show interactions, and several of our recommendations are contradictory (for example, to improve color and opacity you would reduce shortening, but if you had a stickiness problem you would need to increase shortening).

3. Unexpected findings, if any

- Excessively high amounts of shortening can create sticky tortillas.
- The degree of interaction between ingredients on end-product functionality.

4. Practical impacts of research efforts.

a. Short Term Impacts

Research data was presented at two meetings of the AACC, including a special tortilla symposium. Industry members, including members from the Tortilla Industry Association, attended the symposium. We have no specific knowledge of how industry partners have modified their processing and/or ingredient formulations based on these results – but it is likely that these results have been used for troubleshooting purposes. In addition, at least 2 significant ingredient vendor sponsored proprietary research projects were supported at the University of Nebraska based on the recognition that our organization and its PI had particular knowledge in the area of wheat flour tortilla processing.

b. Long Term Impacts

Once published, this research is likely to have a more substantial impact on industry operations. In addition, the PI has realized that it is critical to pursue this research (and related research on corn tortillas) as it relates to stickiness.

Stickiness in food systems is a vitally important trait (sometimes beneficial, sometimes detrimental) that is poorly understood. The PI has devoted time of one Ph.D.-level graduate student to increasing scientific knowledge in this area on a fundamental basis, as well as in (applied) food systems.

5. Publications resulting from this research.

Publications are in early draft form.