Milling Performance and Grain Procurement Practices

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Flour Miller Perspective: Hedging The Wheat Market

• **Action**: Sell Flour

• **Reaction**: Buy Futures Wheat Contract

• **Action**: Purchase Cash Wheat

• **Reaction**: Sell Wheat Futures Contract
Wheat Draw Area Example: North Dakota

https://www.researchgate.net/publication/237730219_NORTH_DAKOTA_STRATEGIC_FREIGHT_ANALYSIS_Item_III_Shuttle_Trains/figures?lo=1
Conflict Between Procurement and Production

Differing Perspectives of Success Creates Conflict!
Results in failure to maximize opportunity and profit for the company!

A large majority (72%), of C-suite executives surveyed ranked cost savings and cost avoidance as their primary measure for procurement success.
Measures of Success

**Grain Buyer-Acquisition**
- Cost
  - Lowest Cash Market Cost
- Delivery
  - On Time
  - Low cost
- Quality
  - Meets Grain Grading Standards
  - Meets Technical Standards

**Miller-Transformation**
- Yield
  - Low Cleaning Loss
  - High Flour Yield
  - Moisture Gain
- Rate
  - Uninterrupted
  - Maximum
- Quality
  - Meets Flour Specifications
Technical Standards Impact Fixed Cost

Transformation Costs-Fixed

• General & Administrative
• Maintenance
• Insurance
• Property Taxes
• Depreciation
• Interest
Technical Standards Impact Variable Cost

Transformation Costs-Variable

• Labor: Yearly Wages Benefits, Overtime
• Utilities: Electricity, Water, Fuel
• Cost of Goods Sold*
  • Wheat Price FOB elevator
  • Transportation cost
  • Insurance transportation cost
  • Demurrage
  • Elevation cost
  • Switching cost

Cost of Goods Sold* Cont’d

• Unloading cost
• Other wheat delivery costs
• In-elevator handling cost
• Storage cost
• Fumigation cost
• Shrinkage cost
• Bagging material
Gross Margin: Cost and Profit

Cost Fixed and Variable ($/Flour Unit) vs. Profit ($/Flour Unit) vs. Yield (Raw Wheat/Flour Unit)
Some Technical Standards beyond Official Grade

Suitability or Quality
- Moisture
- Protein
- Falling Number
- DON-Vomitoxin
- Pesticide Residue

Premium/Discount Schedule Differentiation
- Test Weight (lbs./bu.)
- Kernel Weight (TKW)
- Kernel Size
What is the Impact on Yield and Value

- Test Weight
- Kernel Weight
- Kernel Diameter

VS.

- Yield
- Value

Kansas Crop Quality Samples: N= 153

Mill Management Economic Model developed by Flores et. al at Kansas State University
See Transactions of the ASAE vol. 36(4):1143-1149, July-August 1993

## The Wheat Crop

<table>
<thead>
<tr>
<th>N=153</th>
<th>Weight (mg)</th>
<th>Size (mm)</th>
<th>Test Weight (lbs./bu.)</th>
<th>Flour Yield (%)</th>
<th>Income ($/bu)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
<td>27.84</td>
<td>2.28</td>
<td>76.3</td>
<td>71.60</td>
<td>4.25</td>
</tr>
<tr>
<td><strong>St.Dev.</strong></td>
<td>2.55</td>
<td>0.12</td>
<td>2.7</td>
<td>1.70</td>
<td>13.75</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>22.75</td>
<td>2.03</td>
<td>69.5</td>
<td>65.08</td>
<td>-28.64</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>35.53</td>
<td>2.65</td>
<td>81.1</td>
<td>75.07</td>
<td>31.33</td>
</tr>
</tbody>
</table>
Simple Linear Regression

\[ \hat{y} = \beta_0 + \beta_1 X_1 + \varepsilon \]

\[ \hat{y}_1 = \beta_0 + \beta_1 X_1 \]
\[ \hat{y}_2 = \beta_0 + \beta_1 X_2 \]

\[ \hat{y}_1 - \hat{y}_2 = (\beta_0 + \beta_1 X_1) - (\beta_0 + \beta_1 X_2) \]
\[ \hat{y}_1 - \hat{y}_2 = \beta_1 (X_1 - X_2) \]

\[ \beta_1 \text{ Confidence Interval is the key} \]
Yield and Test Weight

![Graph showing the relationship between Yield Change (%) and Test Weight Change (Kg/HL). The graph features two lines: one for Upper and one for Lower. The Y-axis represents Yield Change (%) ranging from 0.00 to 3.50, and the X-axis represents Test Weight Change (Kg/HL) ranging from 0.00 to 4.00.]
Yield and Kernel Weight

![Graph showing relationship between Yield Change (%) and Kernel Weight Change (mg). The graph has two lines: one for Upper and another for Lower. The Y-axis represents Yield Change (%) ranging from 0.00 to 3.00, and the X-axis represents Kernel Weight Change (mg) ranging from 0.00 to 10.00.]
Yield and Kernel Diameter

![Graph showing change in % yield vs. change in diameter (mm). The graph compares 'Upper' and 'Lower' with blue and red lines, respectively. The x-axis represents change in diameter (mm) from 0.00 to 0.80, while the y-axis represents change in % yield from 0.0 to 10.0. The diagram includes annotations for 'Thickenss' and 'Width'.]
Yield and Profit

Graph showing the relationship between yield increase (%) and net profit ($/MT). The graph includes two lines:
- Upper line
- Lower line

Yield Increase (%) on the x-axis, Net Profit ($/MT) on the y-axis.
What is the impact of improvement and what is it worth?

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Average</th>
<th>5% Increase</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yield (%)</td>
<td>Profit ($/MT)</td>
</tr>
<tr>
<td>Test Weight (Kg/Hl)</td>
<td>76.33</td>
<td>3.8165</td>
<td>1.34 — 2.36</td>
</tr>
<tr>
<td>Kernel Weight (mg)</td>
<td>27.8</td>
<td>1.39</td>
<td>0.18 — 0.76</td>
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<tr>
<td>Kernel Diameter (mm)</td>
<td>2.28</td>
<td>0.114</td>
<td>0.42 — 1.38</td>
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</tbody>
</table>
## R and R² Values

<table>
<thead>
<tr>
<th>Measure</th>
<th>Yield (%)</th>
<th>Profit ($/MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>R²</td>
</tr>
<tr>
<td>Test Weight (Kg/Hl)</td>
<td>0.76</td>
<td>0.58</td>
</tr>
<tr>
<td>Kernel Weight (mg)</td>
<td>0.47</td>
<td>0.22</td>
</tr>
<tr>
<td>Kernel Diameter (mm)</td>
<td>0.52</td>
<td>0.25</td>
</tr>
<tr>
<td>Profit ($/MT)</td>
<td>0.81</td>
<td>0.66</td>
</tr>
</tbody>
</table>
Profit and Test Weight

Net Profit ($/MT)

Test Weight Change (Kg/Hl)

Upper
Lower
Profit and Kernel Weight

![Graph showing the relationship between Profit Change ($/MT) and Kernel Weight Change (mg). The graph includes two lines: one for Upper and one for Lower. The y-axis ranges from $0.00 to $70.00, while the x-axis ranges from 0.00 to 12.00.]
Profit and Kernel Diameter

![Graph showing the relationship between profit change ($/MT) and kernel diameter change (mm).]
Balancing Act: Whose Success Counts?

The Company

Economic Decisions
Economic Consequences

Procurement

Technical Decisions
Technical Consequences

Operations
Operations: Monetize Impact of Raw Materials on Costs and Productivity

Fixed and Variable Cost as a Result of 

• Yields 
• Quality Cost 
• Flow Rates 
• Unplanned Down Time 
• Repair Cost