USDA Pecan Postharvest – Cracking

**Team Members:** Niloofer Rezaei, Matthew Bowen
**Faculty Advisor:** Dr. Ben Wagner

### Motivation

- **Limited Optimization:** Current high-throughput pecan cracking technologies lack sufficient optimization, leading to increased costs and reduced product quality.
- **Insufficient Research:** Limited research exists on the impact of cracking methods on half yield, which is crucial for improving processing methods and minimizing waste.
- **Lack of System Feedback:** The absence of feedback mechanisms in pecan cracking processes hinders continuous improvement and adaptability.

### Experimental Process

- **Take Diameter Measurements**
- **Record Diameter Measurements**
- **Count out # of Nuts for Sample**
- **Record Target Moisture**
- **Check Nuts for Deformities**
- **Moisturize**
- **Set Machine & Record Settings**
- **Visual Inspection**
- **CRACK**
- **Sample within 0.1% of Target?**
- **Yes:**
  - **Greater than 1 Hour Shelf Moisture?**
  - **Yes:**
    - **CRACK**
  - **No:**
    - **Visual Inspection**
- **No:**
  - **Sample within 0.1% of Target?**
  - **Yes:**
    - **Set Machine & Record Settings**
  - **No:**
    - **Visual Inspection**

### Meyer DOE

<table>
<thead>
<tr>
<th>Research Objective (RO)</th>
<th>Independent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO 1</td>
<td>Displacement Screw Setting</td>
</tr>
<tr>
<td>RO 2</td>
<td>Preload Spring Stiffness</td>
</tr>
<tr>
<td>RO 3</td>
<td>Motor Speed</td>
</tr>
<tr>
<td></td>
<td>Impactor Profile</td>
</tr>
</tbody>
</table>

### JC DOE

<table>
<thead>
<tr>
<th>Research Objective (RO)</th>
<th>Independent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO 1</td>
<td>Contacting Plate Frequency</td>
</tr>
<tr>
<td></td>
<td>Throughput</td>
</tr>
<tr>
<td>RO 2</td>
<td>Impactor Plate Relative Position</td>
</tr>
<tr>
<td>RO 3</td>
<td>Impactor Plate Insert Geometry</td>
</tr>
</tbody>
</table>

### Future Directions

- **Intelligent Process Control:** Use sensors and AI for real-time monitoring and machine adjustments.
- **Enhanced Connectivity & Maintenance:** Employ IoT and analytics to optimize communication, minimize downtime, and maximize equipment lifespan.

**Sponsor/Client:** USDA