INTRODUCTION

Partner: Gedeon Eugene, President, Université Antéron Firmin (UNAF)
Location: Cap-Haïtien, Haiti

Motivation:
- Almost 50% of food is imported
- 40% of households in chronic food insecurity
- Up to 35% of basic food crop is lost in post-harvest chain

Food Processing in Haiti:
"This is where value is added and where the most profit can be realized, yet there is almost no food processing industry in Haiti..."

GOAL AND OBJECTIVES

To design a commercial food laboratory for students at UNAF where they can learn the skills and technology needed to produce quality, shelf-stable food products that can be transferred into a sustainable microbusiness
- Preserve raw ingredients for the off-season
- Enable small-scale production for local community
- Provide hands-on learning for UNAF students
- Be a business opportunity for the students and community

CONSTRANTS

- Water quality
- Inputs/resources
- Technical experience of users
- Energy use
- Implementation cost

GLOBAL AND SOCIETAL IMPACT

- Capacity building
- Supply chain development
- Encourage entrepreneurship
- Creation of jobs
- Partnership development

FOOD SAFETY CONSIDERATIONS

Mango:
- Most common fruit grown in Haiti, but spoils very rapidly
- Sweet, fibrous stone fruit
- Approximately 30% waste (peel, stone, and fibrous flesh)

Product Selection:
- Mango Jam
- Mango Nectar

Mango Products:
- High-acid
- Low water activity
- Risk of spoilage and disease
- Target microorganisms: Escherichia coli

Bacteria: Leuconostoc mesenteroides, Alcaligenes eutrophus, Zygosaccharomyces bailii
Fungi: Pichia membranifaciens, Penicillium expansum
Foodborne Pathogens: Salmonella, Listeria monocytogenes

PROCESSING REQUIREMENTS

<table>
<thead>
<tr>
<th>Batch Size</th>
<th>Juice Jam Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>200 L</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>125 149 min</td>
</tr>
<tr>
<td>Mango Input</td>
<td>170 90 kg</td>
</tr>
<tr>
<td>Mango Waste</td>
<td>51 27 kg</td>
</tr>
<tr>
<td>Water Req. for Product</td>
<td>128 - L</td>
</tr>
<tr>
<td>Water Req. for Processing</td>
<td>737 712 L</td>
</tr>
<tr>
<td>Thermal Load</td>
<td>153.1 137.5 MJ</td>
</tr>
</tbody>
</table>

PRODUCT RECIPE

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Functionality</th>
<th>Mass Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Mango</td>
<td>Flavor, Color, Body</td>
<td>49.5 30.0</td>
</tr>
<tr>
<td>Sugar</td>
<td>Sweetener</td>
<td>49.5 8.7</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>Lowers pH</td>
<td>0.6 0.5</td>
</tr>
<tr>
<td>Pectin</td>
<td>Gelling Agent</td>
<td>0.5 -</td>
</tr>
<tr>
<td>Water</td>
<td>Reduce Viscosity</td>
<td>- 60.8</td>
</tr>
</tbody>
</table>

SUSTAINABILITY: REVERSE OSMOSIS

Optimization Goal: To minimize the cost of producing sterile water by changing the pressure required by the pump to produce 6.0 x 10^-5 m³/s.

ECONOMICS

Product: Mango Jam, Mango Nectar
Cost:
- Manufacturing Cost: $24,000
- Direct Production Cost: $10,000
- Raw Material Cost: $4,000
- Capital Investment: $10,000

Total Product Cost: $38,000
Total Income: $96,000

FUTURE WORK

- Design course curriculum to introduce students to food processing
- Find and train project manager
- Address sustainability hurdles
- Identify local market opportunities

IMPLEMENTATION

The partner is invested in this project (will be constructing a new building on the university property) and eager to implement as a microbusiness for UNA.