Abstract
A sorghum press extracts a nutritious syrup from the stalks of sweet sorghum plants that can be processed to produce a molasses-like sweetener. Through this syrup production, business opportunities are created for the villagers of Dissan, Mali.

Figure 1 (right): Sorghum ear-heads.

Figure 2: The 2009 EWB press.

This year, a fully functional press prototype was made by February and a final press with design iterations was completed by May. The final press was proven to be fully manufacturable in Mali and has a throughput twice that of the 2009 press.

Design Objectives
Feedback from the Malian community and extensive research yielded six important performance criteria.

Table 1: Performance requirements with desired and achieved values.

<table>
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<tr>
<th>Performance Criteria</th>
<th>Value to Meet</th>
<th>Value Achieved</th>
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<tbody>
<tr>
<td>Human Powered Input Torque ≤ 240 N*m</td>
<td>65 N*m</td>
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<tr>
<td>Extracts Sorghum Juice Crush sorghum to ≤ 5.1 mm</td>
<td>✓</td>
<td></td>
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<tr>
<td>Increased Throughput Process sugar cane at ≥ 10 cm/s</td>
<td>14.2 cm/s</td>
<td></td>
</tr>
<tr>
<td>Fully Manufacturable in Mali Confirmed by Scott Lacy</td>
<td>✓</td>
<td></td>
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<tr>
<td>Affordable Retail cost of materials ≤ $550</td>
<td>$381.93</td>
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To determine the best way to harness human power, we tested various power input methods. We found that the walk and push method was best for sustained power output as shown in Fig. 5.

Finite element analysis and testing, shown in Figs. 6 and 7, were performed in order to determine the critical mode of failure for the rollers. After trying different standard materials, a SCH40 steel pipe was determined to be the best choice to combine high strength and low cost.

 Prototyping Results

A prototype was constructed and extensively tested in the winter of 2012. Observations made during testing of the prototype resulted in a refined design including the addition of channels, milled longitudinally on the roller surface, to enhance “gripping” of the stalks during feeding.

Manufacturability and Throughput

To verify our design could be fully manufactured in Mali, we had the most complicated component of our press, the gears, made by Malian machinists. These gears, pictured in Figure 9, have been used successfully in our prototypes.

Testing yielded a throughput of 14.2 cm/s for sugar cane, which is much larger in diameter than sorghum. This value is twice the throughput of the 2009 press, successfully meeting the most important request of the community.

“You knocked this project out of the park…you literally addressed every single concern and request I documented from Dissan farmers who used the first press. You may not fully grasp just how transformative your new press design [will be]. [You have created] an ideal machine to produce and use in Mali!”

---Scott Lacy, Executive Director of African Sky

Acknowledgments

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