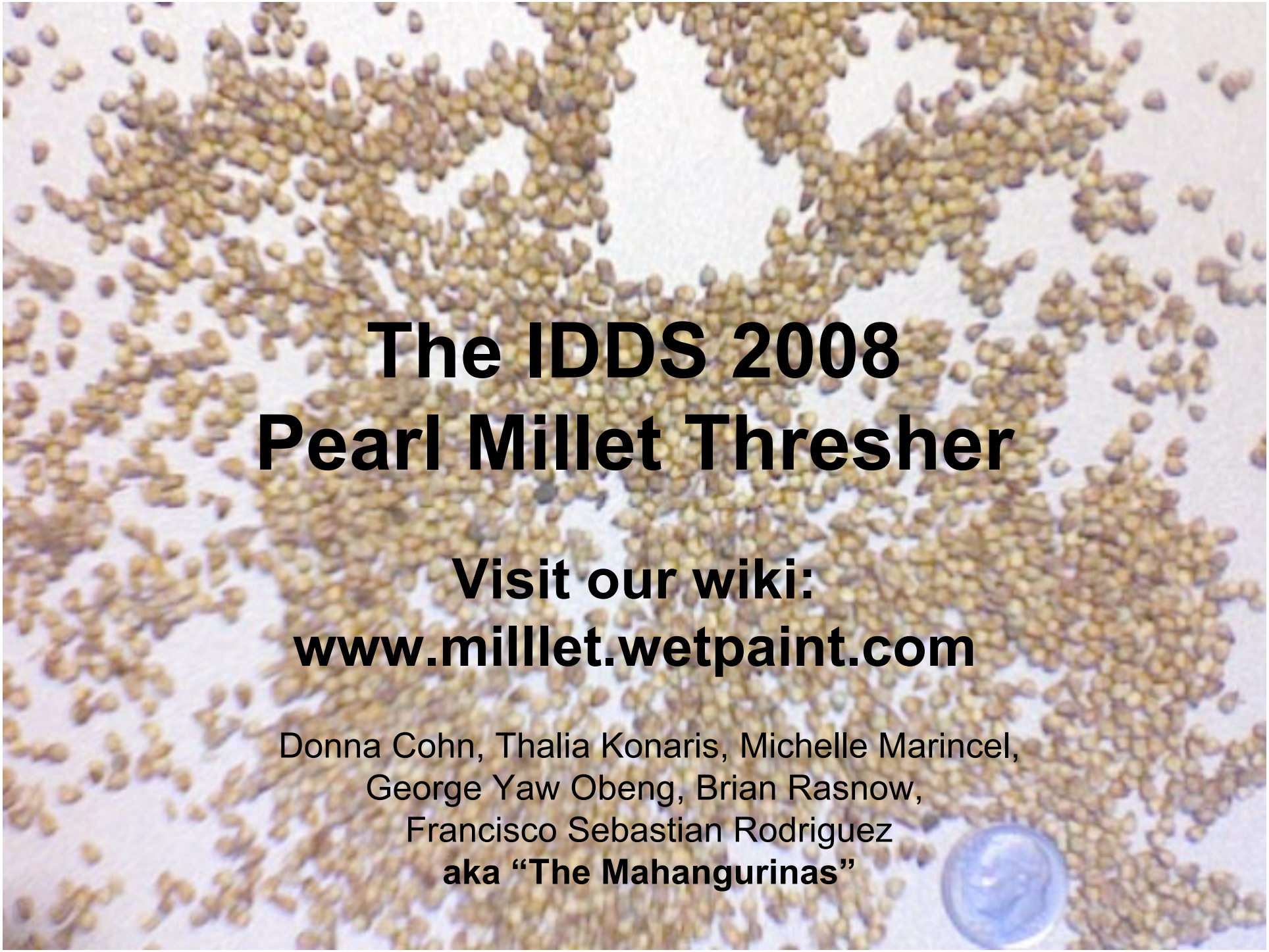


The IDDS 2008 Pearl Millet Thresher

Visit our wiki: www.milllet.wetpaint.com

Donna Cohn, Thalia Konaris, Michelle Marincel,
George Yaw Obeng, Brian Rasnow,
Francisco Sebastian Rodriguez
aka "The Mahangurinas"

Background

- Pearl Millet is a staple grain for millions of African and Indian families
- 75% of the pearl millet grown in Namibia is threshed manually, at ~4kg/hour by mortar and pestle or beating
- A faster, affordable threshing device could improve the health and economics of millions of poor families relying on millet for food or sale.

Problem Statement

- After considering stakeholders, costs, and throughputs, we focused on:

- **How to design a $20, 10kg/hr pearl millet thresher suitable for manufacture and sale in Africa and India?**

Physics of Millet Threshing

- Millet grows on a **panicle** consisting of a **stalk**, **florets**, and **grain**

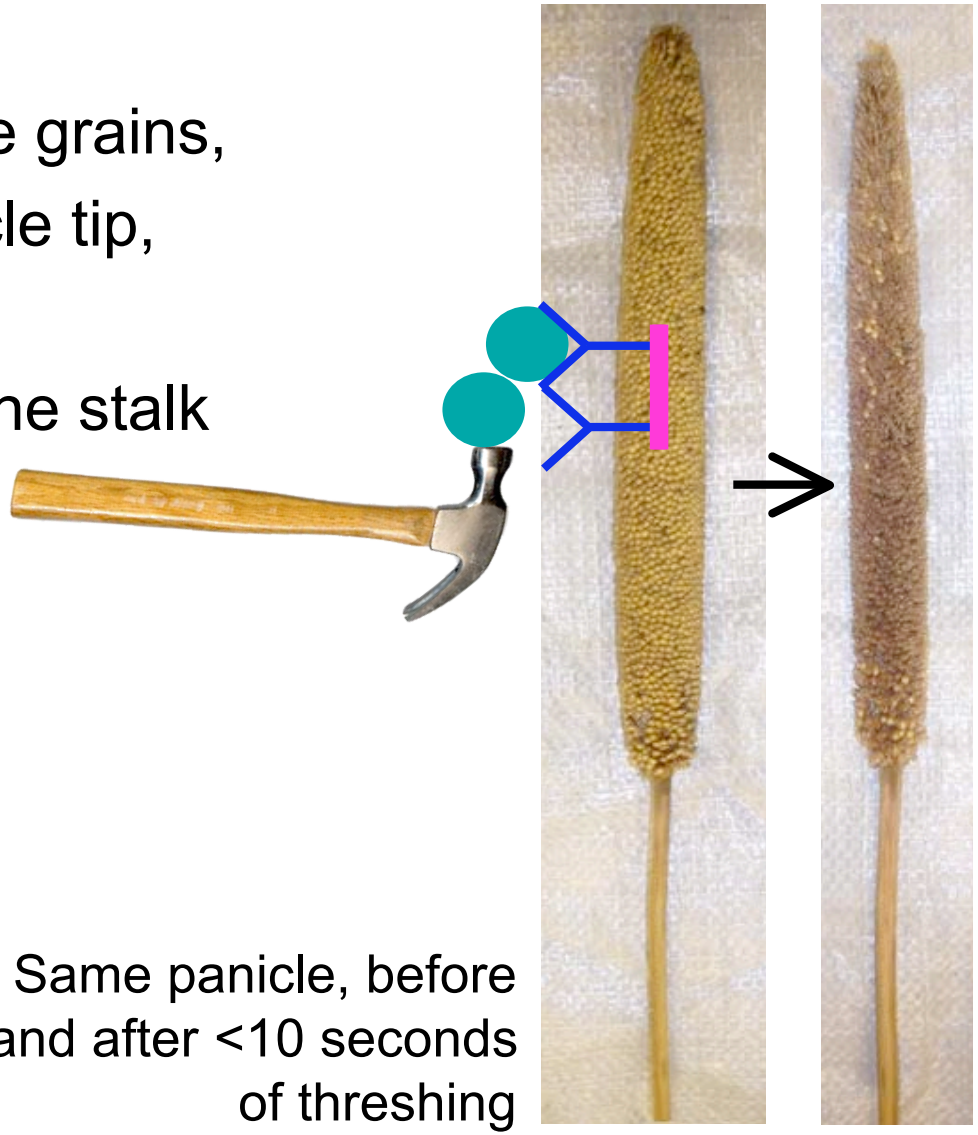


- The panicle has complex physical properties
  - Panicles vary in size over a factor of 2
  - Grinding damages the grain
  - Twisting breaks the stalk
  - Rubbing removes florets from stalk

panicle

We discovered that

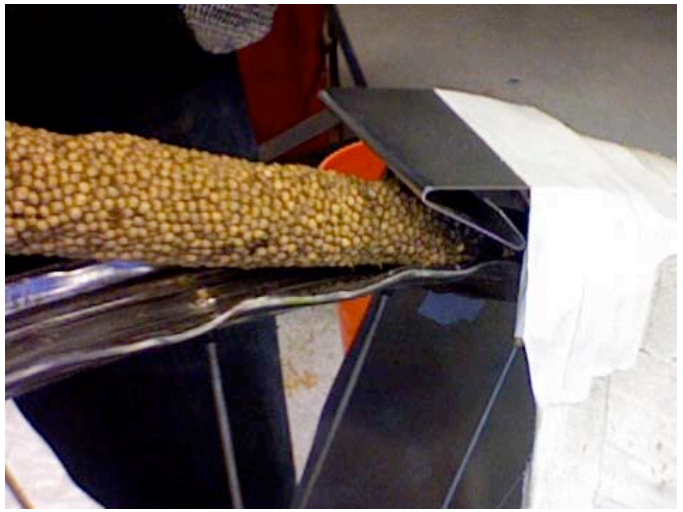
High-speed impact on the grains,
directed toward the panicle tip,
knock off grains
and leave the florets on the stalk



Same panicle, before
and after <10 seconds
of threshing

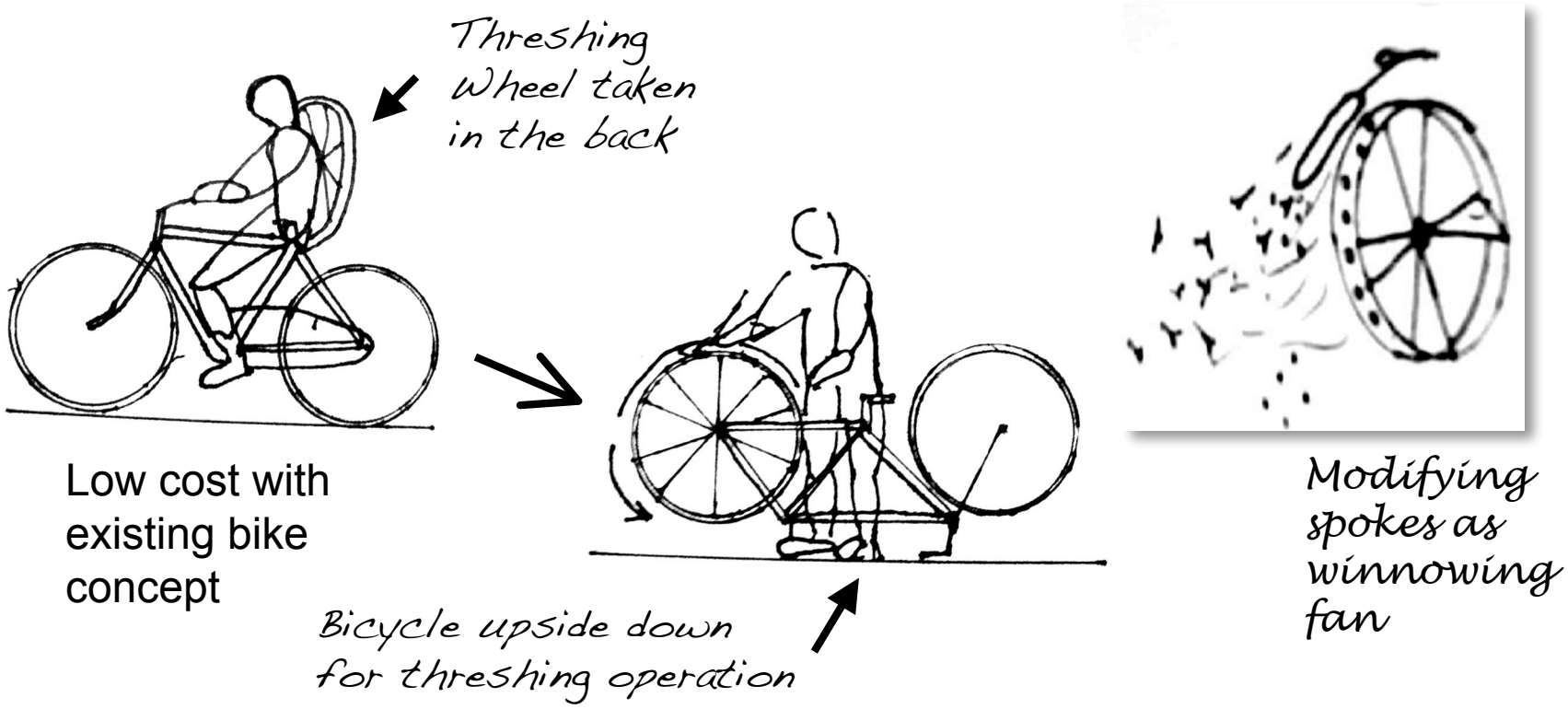
The IDDS Thresher

- Spoke nuts protruding through the rotating rim on an inverted bike efficiently thresh millet
- A soft tin plate bent as a spring presses the millet against the rim
- A grain sack collects the grain and chaff for later winnowing



Future Directions

- Optimize mechanical design
  - Optimize ergonomics, safety, portability, cost, and other important factors determined in the field
  - Winnow to produce clean grain ready for milling or sale



Future Directions

- Conduct market research and field trials in Mali, Ghana, and Namibia
- Validate value proposition
- Develop business/enterprise model

IDDS Pearl Millet Thresher

The Opportunity

In Namibia, 75% of pearl millet is threshed manually.

Pearl millet is a staple grain for millions of Africans and Indians.

Manual threshing is painful, tedious, and produces dirty grain.

Problem statement: How do we design and validate a $20, 10kg/hr millet thresher suitable for local manufacture and sale in Africa and India?

The Technical Solution

A modified, discarded bicycle forms the heart of the IDDS millet thresher. Our prototype

- achieves cost goals of ~$20
- achieves throughput goals of ~10 kg/hr
- is built from locally available materials (many recycled)
- produces clean grain free of florets and stones
- is safe and ergonomic
- is light weight and transportable

Impact

- There could be viable enterprises manufacturing and selling the millet thresher.
- Better understanding the user community is key to proceeding with design, development, and dissemination.
- Two team members will conduct market research and field trials in Ghana and Mali.

Pearl Millet: Technical Highlights

The challenge

Stalk

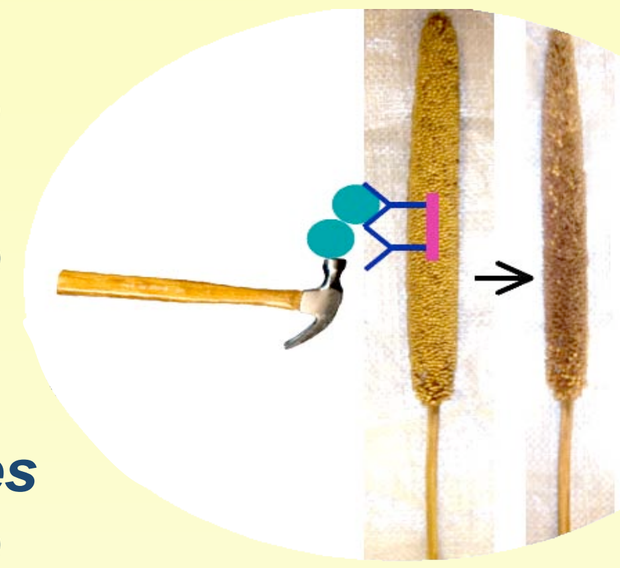
Florets

Grain

Pearl millet has a complex structure that is more difficult to thresh than other grains.

The breakthrough

High-speed impact on each grain, directed towards panicle tip, knocks the grain off the floret and leaves the floret on the stalk.



The prototype solution

High velocity rim, spoke tips act as flickers

Low cost, reliable pedal power

Hole in fender acts as feeder

Steel spring presses millet against rim

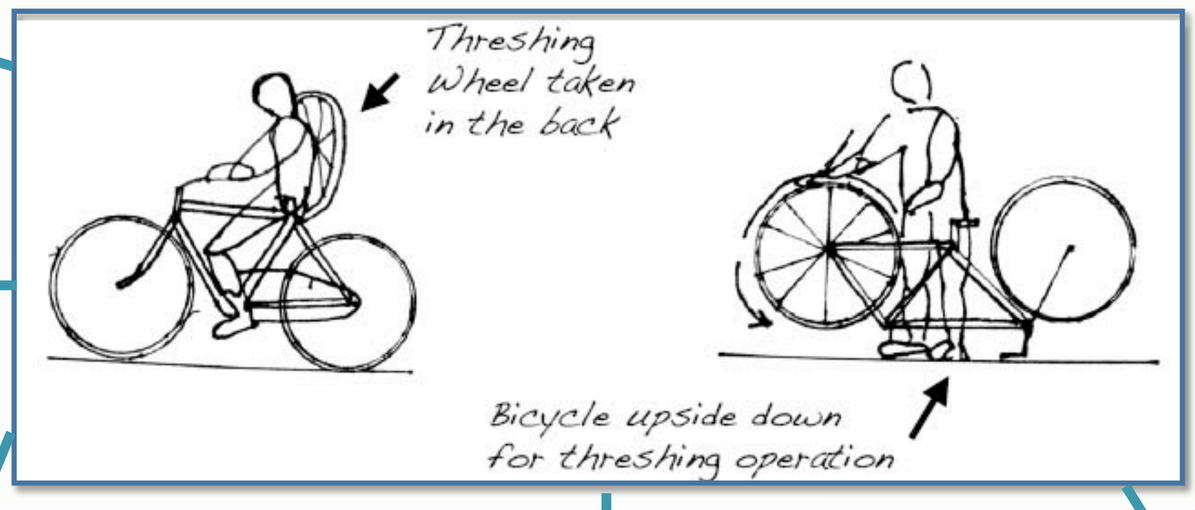
Fender & side panels protect user; guide the grain into sack

Future concepts

Improve Ergonomics

Ensure Safety

Increase Portability



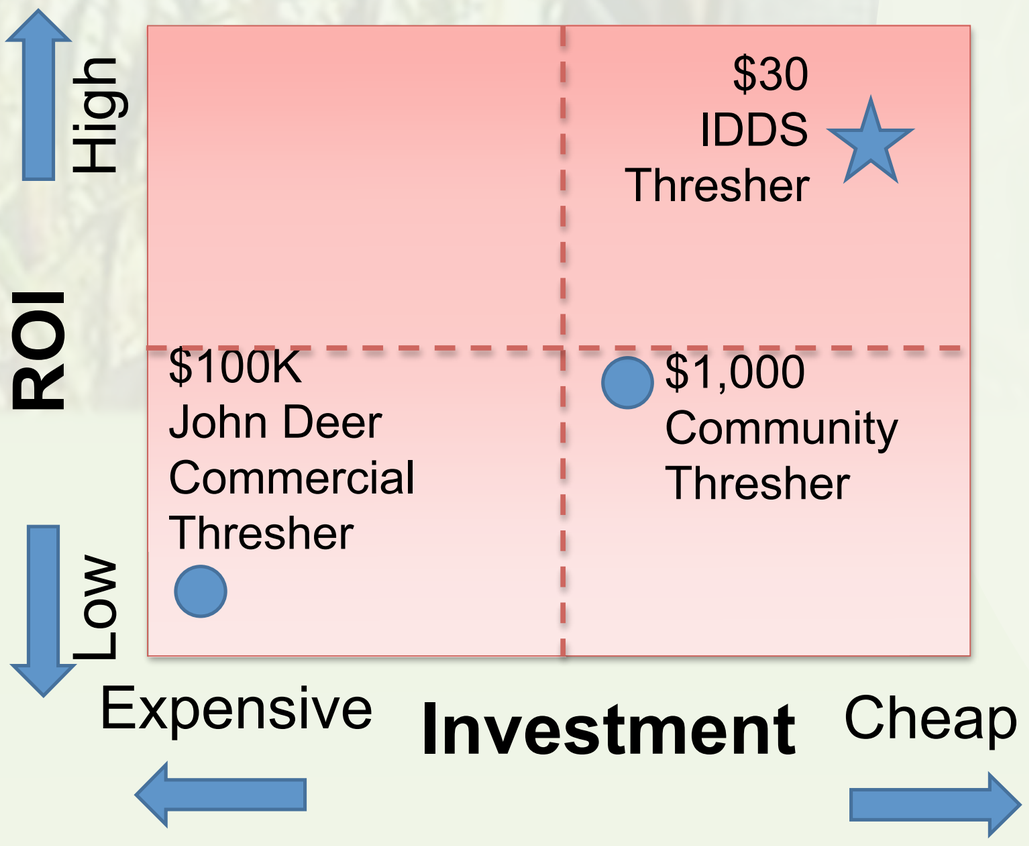
Reduce Cost

Spokes as winnowing fan

As add on to a conventional bike

Pearl Millet: Value Proposition

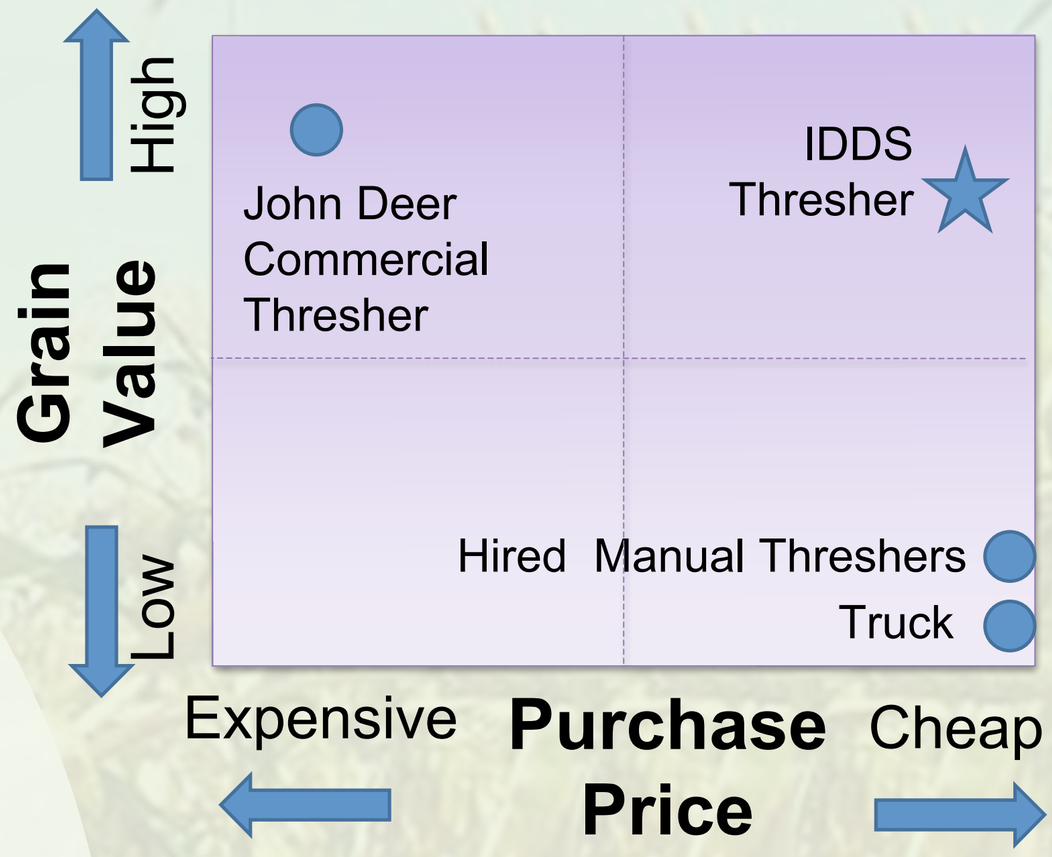
Business Case



Potential for

- Income manufacturing, servicing and selling threshers

Customer Case



Potential for

- Increased free time: 30 days/yr
- Increased income: $60/yr
- Payback: 100% in <1 yr

Next Steps

Market research & field trials in Mali and Ghana, Africa will identify and verify

- Throughput of traditional methods
- Material and price constraints
- Cultural advantages and barriers
- Customer goals and expectations