Design, fabrication and evaluation of soybean thresher for smallholder farmers in Ghana

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Introduction
Soybean is an important grain crop which contributes to soil fertility and improved nutrition. The production of this crop in Ghana is faced with many challenges during planting, harvesting and threshing. Threshing of soybeans is accomplished manually by flogging (photo below). This results in poor threshing and quality of seeds. Manual threshing and harvesting results in 15% losses in crops in Ghana (Silas, 1996).

Although threshers are available in Ghana, they are usually imported from India and China. Imports are typically expensive, too large and heavy for farmers that do not own tractors, and are difficult to repair and find parts for.

This study focuses on the design, fabrication and evaluation of mechanical threshers for smallholder farmers in Ghana. The goal was to produce a thresher that is small, durable and affordable enough to be purchased and used by groups of female farmers.

Objectives
• Design and fabricate both an engine-powered and bicycle-powered thresher.
• Evaluate the performance of the thresher.
• Design a training manual to teach this technology to local blacksmiths in Ghana and other parts of Africa using this design as a prototype.
• Conduct blacksmith training in Africa to teach thresher design and fabrication.

Materials and Methods
A training was conducted in August 2016 for 12 Ghanaian welders at the Tamale Implement Factory by Gabriel Abdulai and the Soybean Innovation Lab. Three threshers were produced and distributed to three rural communities for field testing. A smallholder thresher was also fabricated at the metal shop of the Agricultural Systems Management Department at the University of Missouri. The thresher was evaluated by running the threshing drum at a set speed and feeding 1 kg of soybeans to evaluate its performance.

Results and Discussion
Initial results from testing the thresher show excellent threshing efficiency and cleaning efficiency (100% and 94.81%). They were, however, high losses which could have been associated with low grain moisture content (7.5%) and the type of concave (perforated type) used in the test.

Currently, issues relating to losses in terms of broken seeds and percentage of seed blown out are being worked on by modifying the concave, exit chute, and air blower exit to enhance the crop performance.

Top left photo: Prototype thresher built at MU in 2017. Top right, finished thresher in Ghana. Lower right, three threshers built during 2016 fabricator training led by Gabriel Abdulai.
Photo below: prototype bike-powered thresher built at blacksmith training in Ghana in August 2016. Threshing drum and concave below top right and bottom right.

Funding

Soybeaninnovationlab.Illinois.edu

Reference