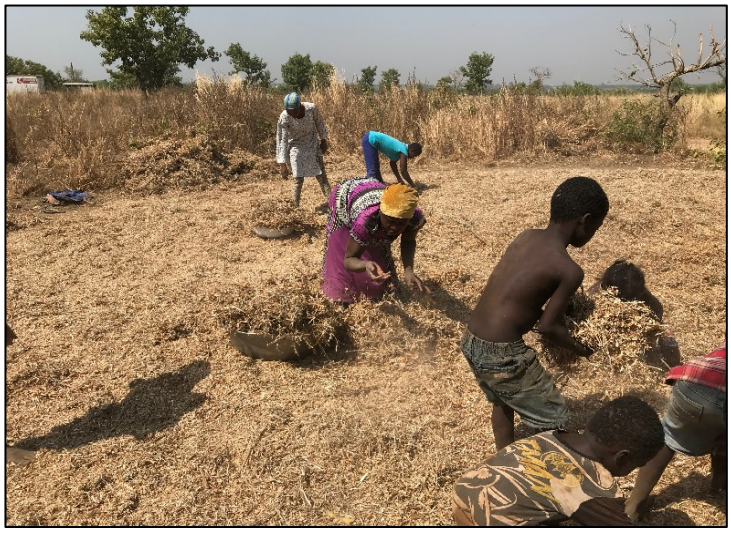
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Soybean Innovation Lab Multi-Crop Thresher Capacity, Efficiency and Operation

In most small farms across Africa, crop threshing is a laborious and difficult process of dislodging grains from pods or racemes using hand power. Like many crops, soybean is often threshed by beating with a stick. Mechanized threshing machines that can harvest crops other than maize are rare in most African farming communities

Through support of the Soybean Innovation Lab (SIL) and the ADM Institute for the Prevention of Postharvest Loss (ADMI), a project was established to evaluate the benefits and challenges of a mechanized thresher that is built by local artisans and can thresh a variety of crops including maize, soybean, cowpea, common bean, millet, sorghum, rice, barley and others.



Top photo: Young boys stick thresh soybean in Northern Ghana. Bottom photo: After the crop is beat, the chaff and seeds are separated by hand. Often women and children do both the stick threshing and the chaff winnowing. (Photos: SIL 2019)

SIL MULTI-CROP THRESHER

The SIL Multi-Crop Thresher (MCT) was developed in 2018 by two Ghanaian designers with over 15 years of design and fabrication experience. Powered by either a tractor PTO or a diesel engine, the SIL MCT was designed to support a thresher service provision business and to service hundreds of small farmers per season. To accomplish this, the thresher had to prove durable, sturdy, fast, efficient, and profitable. Thresher users reported that stick beating one acre of soybean took a group of people up to two weeks of hard manual labor but the same amount of soy could be threshed in four hours with just a few people with the SIL MCT. The resulting grain from the MCT is also free of contaminants such as rocks and sand and is more marketable than stick-threshed grains. An interchangeable concave sieve and a variable speed motor enable the MCT to be used with multiple crops.

PROJECT APPROACH

In order to determine the throughput capacity and threshing efficiency of the SIL MCT, researchers from the University of Missouri tested five threshers being used by service providers and farmers in Northern and Upper West Ghana. The threshers were tested using rice, maize and soybean and determinations were made for fuel use, grain threshed per hour of use, cleaning efficiency, seed damage, seed loss, seed weight, and seed moisture. The five threshers had some variations in design and all lacked the two most recent SIL design modifications, which include a secondary cleaning fan and a feeding shaft to pull soy plants in quicker. Maize ears were fed into the machine with the husk intact, rice included the grain head and about 30 cm of stalk and soy plants were fed in whole.

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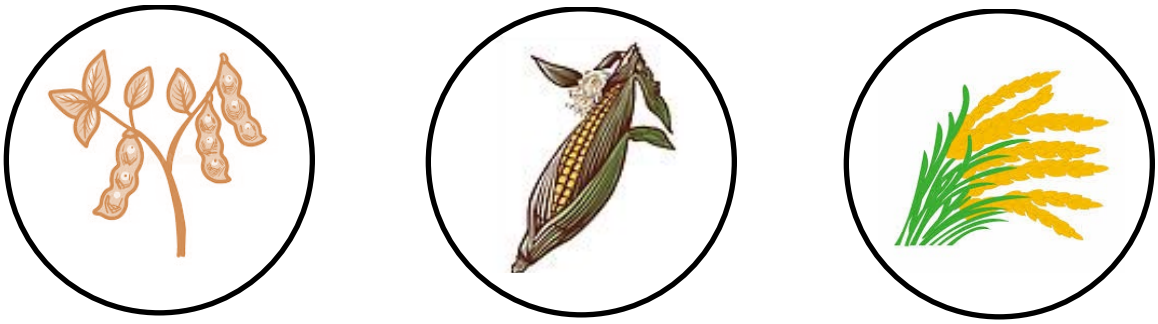
RESULTS

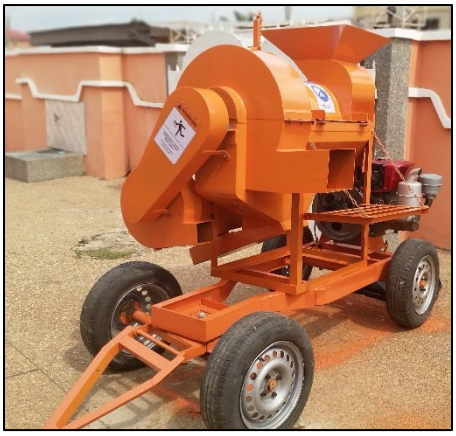
The SIL MCT was found to use approximately 1.5 liters of diesel fuel per hour. Maize has the highest throughput capacity because it is quickly fed into the machine by pouring in containers of maize ears. Seed weight of maize is also high, leading to a higher grain volume per time threshing than any other crop. Rice can also be fed into the machine very rapidly, but the low seed weight of rice leads to a lower throughput capacity. Soybean throughput capacity is slowed significantly by the need to feed the entire soybean plant into the feeder. All brands of threshers will experience these same feeding issues. Average moisture levels of crops during testing were: soybean 12%, maize 14%, rice 13%. Seed weight in g/100 seeds was: soybean 12.2 g/100, maize 27.2 g/100, rice 3.2 g/100. Seed loss and damage was less than 1% for all crops. Some MCT users have reported higher throughput averages than those found below in the SIL field tests. Throughput is also very dependent on the speed of the humans feeding the machine.

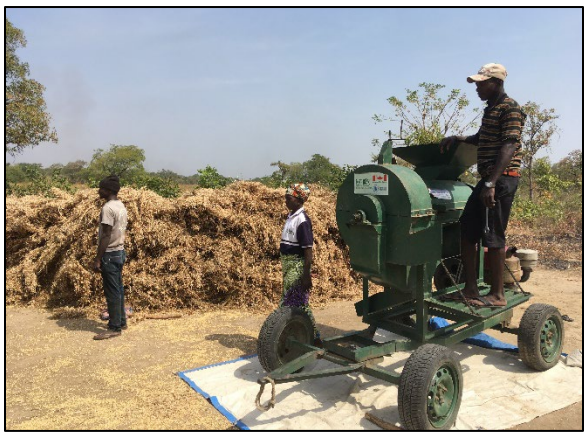


Averages	Soybean	Maize	Rice
Throughput Capacity:	142 kg/hour	2,839 kg/hour	105 kg/hour
Chaff/weight %:	1.8%	0.1%	0.3%

OPERATION

As with all threshers, operator choices can affect performance. The SIL MCT should be run at the correct engine speed for each crop. Fast threshing speed and low grain moisture lead to grain breakage. Dicotyledon plants such as soybean, beans, cowpeas and pigeon peas are more susceptible to breakage than monocot plants like maize and rice. The SIL MCT thresher has two suction fans for chaff removal and three air regulation devices to control chaff removal and seed loss. The air regulators need regular attention during the threshing process to ensure that seed loss is minimized and chaff removal is maximized. The MCT has been field tested in multiple locations by several organizations over four harvest seasons and has been found to be a reliable, durable, efficient thresher that can provide enough capacity to support a service provider and dozens to hundreds of farmers each season. As with all equipment, it should be used as recommended by the manufacturer and will require that the operator pay attention to machine settings for best results.





Left: the SIL MCT can be fabricated locally and is of a size and price appropriate for service providers.
Right: Good operator practices lead to the best threshing results. The MCT delivers fast threshing with good winnowing capacity. Soy capacity is much lower than maize due to need to feed entire soy plant into the machine.

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