Device meant to feed astronauts on Mars may first make debut in Africa

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A team from Purdue University, including Carlos Corvalan (from left), Osvaldo Campanella, Martin Okos and Amudhan Ponrajan, has developed a lightweight food extruder for NASA that could have immediate benefits in African countries. Credit: Purdue Agricultural Communication photo/Tom Campbell

The same piece of Purdue University-developed technology that may

one day feed astronauts on Mars is being adapted to improve production of instant porridges and other ready-to-use products in several African countries.

NASA commissioned Purdue University researchers to develop a scaled-down version of an extruder that could be used to process various grains, including soybeans, during a mission on Mars. Many puffed cereals and snacks, as well as pastas and pet foods are made through extrusion.

Purdue's device uses friction to heat and cook the soybeans, and then separates oil from the soybeans, creating a rope-like substance that can be dried to make flour or combined with other products to make pastas and snacks. The soybean oil can be used for salad dressings or for other cooking needs.

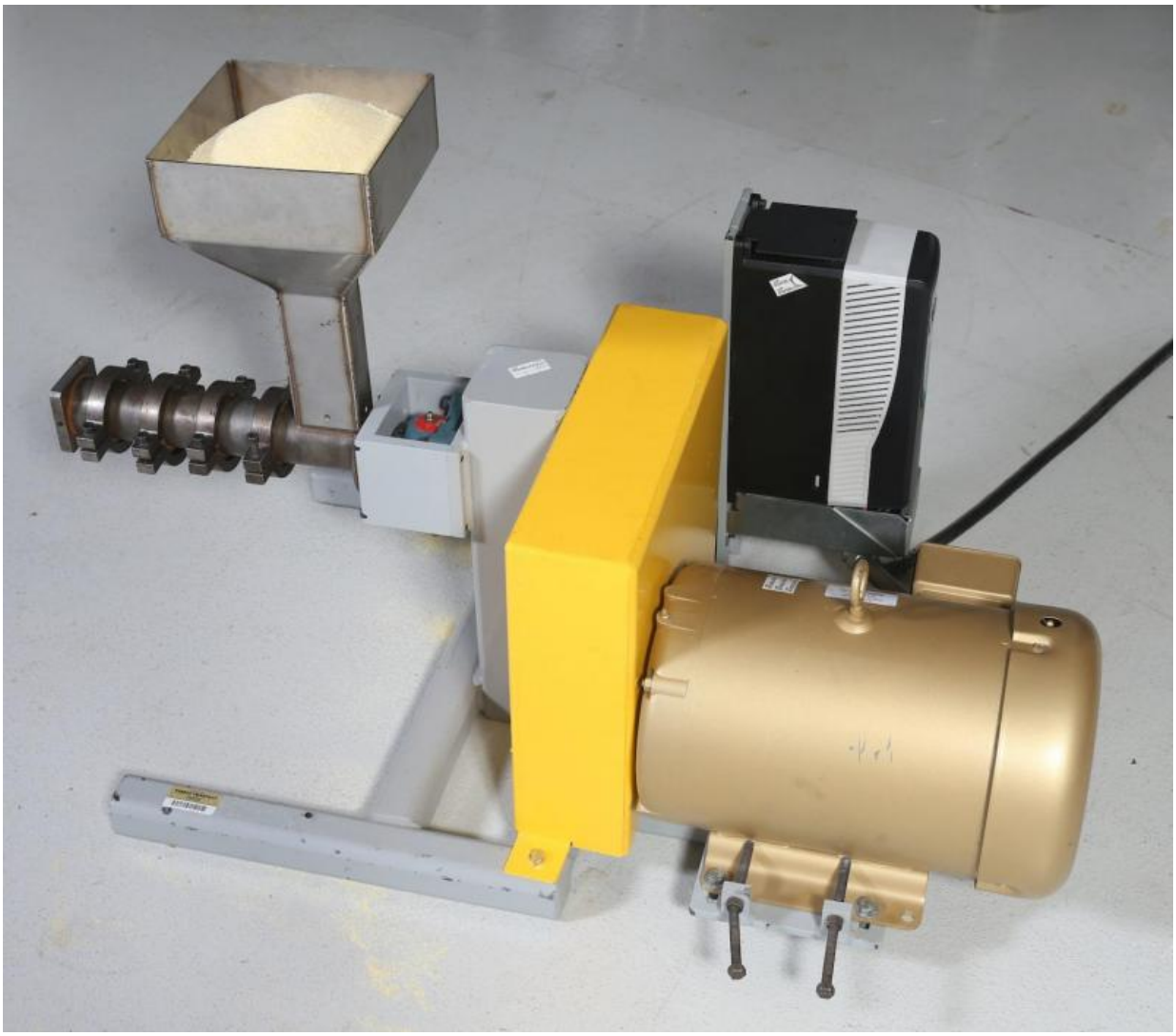
"NASA wanted a way to process food on Mars because it is so expensive to ship food there, something like $200,000 per kilogram," said Martin Okos, a professor of agricultural and biological engineering and one of the project's leaders. "The biggest challenge we faced was scaling down, but we developed an extruder that is down to about 60 pounds per hour. NASA would like an extruder to be 100 times smaller, however more research is needed to reach that goal."

Before the extruder makes its debut on the red planet, however, it is being used to improve food production capacity in Niger, Senegal and Kenya. After working on the NASA prototype, Okos and graduate student Amudhan Ponrajan modified the extruder to work with other types of grains, including pearl millet, teff, corn, rice, wheat, sorghum, chickpeas and lentils, which are more widely grown in developing countries.

Those grains can be milled/ground, mixed with water and pushed through the extruder, which uses a screw to force the product through a

channel where friction heats and cooks the grain. The rope-like product that results, can be dried and ground into flour that, when mixed with water, results in an instant porridge.

Many traditional African porridges made from those grains can be labor-intensive to make. In urban areas, consumers are looking for more convenient alternatives, and the only ones in market are imported and expensive. The extruded grain products can be dried and packaged as "just-add-water" versions of traditional meals.



Components of a lightweight food extruder Purdue engineers designed for NASA. Credit: Purdue Agricultural Communication photo/Tom Campbell

"The processors have a big demand for these products, but they cannot meet the demand," said Moustapha Moussa, a Purdue doctoral student in food science who is one of the leaders of the effort to introduce this technology to African markets. "With this equipment, we think it is going to scale up that production significantly. The product will be available for consumers who need it, and for the producers who have more efficiency to meet the demand."

In West African urban areas, labor-intensive efforts to make products like couscous could be drastically shortened. It can take a crew of 10 women in Niger an entire day to create 30 kilograms of couscous using current methods. With the extruder, the same crew could make 300 kilograms in a day.

The modified extruder for Africa was designed to be relatively inexpensive. Large-scale extruders in U.S. production facilities today cost up to $200,000 and can process hundreds of kilograms per hour. The Purdue-modified extruder can produce 35 kilograms per hour, but it costs only $20,000.

In addition to cost reductions, the extruder had to be modified to work with various grains grown by African farmers. The speed and size of the screw components in the device determine how much heat is created through friction. Soybeans are high in oil content, so they need more friction to cook them. Millet, sorghum and maize are low in oil, so the same amount of friction would burn the grains.

"You want to make sure you're cooking the product, but at the same time

you want to make sure you're not burning the product," Ponrajan said. "There are formulations now for grains grown in Ethiopia, Ghana and Pakistan."

Moussa, Ponrajan, and Bruce R. Hamaker, distinguished professor of food science at Purdue, are working with entrepreneurs in those countries and others, including Senegal, Niger and Kenya, to teach them how to use the device and secure funding to purchase them. They also are testing the market, which so far indicates that consumers are willing to accept the porridges and other products that come from the extruder. They also may be willing to pay more for it when compared to traditional porridges, though the extruded products would cost less than imported instant products.

More market research is needed, and researchers are working to identify formulations that will allow the extruder to be used with more grains. The device meant to feed astronauts on years-long journeys to Mars may one day set off into space, but its impact will likely be felt on Earth much sooner.

"The overarching goal is to improve markets for local farmers growing traditional grains and meeting the changing demands of consumers," Hamaker said. "This has the potential to improve the lives of entrepreneurs and expand the market for healthy cereal grains."

Provided by Purdue University