

# Compendium of rural women's technologies and innovations

Gender, targeting and social inclusion



**Compendiums** illustrate a collection of solutions that have been tested and may be scaled up in similar contexts.

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## Acronyms

AUC	African Union Commission
FAO	Food and Agriculture Organization of the United Nations
FISP	Farmer Input Subsidy Programme of the Government of Malawi
GIZ	German Society for International Cooperation
ISO	International Organization for Standardization
KES	Kenyan shilling
MVP	Millennium Villages Project
MF	Mwandama Fertilizer
PROFIT+	Production, Finance and Improved Technology Plus programme
PSB	pit storage bag
TLC	Total LandCare
TZS	Tanzanian shillings
UIRI	Uganda Industrial Research Institute
WFP	World Food Programme
ZMK	Zambian kwacha

## Introduction

It's a well-worn cliché that women's work is never done. But in many parts of the world, it's still undeniably true. In some parts of sub-Saharan Africa, women work over 16 hours more than men each week. The solution to rural women's drudgery can be found in a more equitable division of labour – and in technologies that lighten the load (Carr and Hartl, 2010). This is why one of the top targets of the proposed **Sustainable Development Goal 5 – attain gender equality, empower women and girls everywhere** – is to “**recognize, reduce and redistribute unpaid care and domestic work through shared responsibility by states, private sector, communities, families, men and women, within the family and the provision of appropriate public services**”.

Gender equality and women's empowerment are central to the mandate of the International Fund for Agricultural Development (IFAD). For IFAD, gender equality means an equitable distribution of labour and household responsibilities, and equal access to education, financial services, basic infrastructure, decision-making and, notably, technology. The important role that time- and labour-saving technologies play in terms of promoting women's well-being, workload reduction and economic empowerment is emphasized in IFAD's policies and reflected in the design of its programmes and projects. To this end, IFAD is continuously looking for new technological solutions to the challenges that poor rural women face, particularly solutions developed by rural women themselves.

In this context, IFAD joined UN Women, the African Union Commission (AUC), the Food and Agriculture Organization (FAO) and the World Food Programme (WFP) to organize the Sharefair on Rural Women's Technologies under the slogan “Improving Food Security, Nutrition and Productive Family Farming in Eastern and Southern Africa”. It was held from 15 to 17 October 2014 at the United Nations Compound in Nairobi, commemorating Rural Women's Day (15 October), World Food Day (16 October) and the International Year of Family Farming.

Nearly 100 innovations from 14 countries of the East and Southern Africa region were exhibited at the Sharefair, covering a wide range of themes, including technologies for agriculture and livestock, value addition and income generation, information management and household use. To encourage the participation of young people in agriculture, four young innovators received awards for developing technologies that address the needs of smallholder farmers and take into consideration the gender dimensions of rural agriculture, food security and nutrition.

This compendium showcases a few of the innovations that were exhibited at the Sharefair, selected on the basis of their labour-reducing potential and relevance to women. The catalogue at the end of the compendium provides abstracts of other technologies presented at the Sharefair, along with contact information of the innovators. The compendium, included in the Toolkit on labour-saving technologies for rural women,<sup>1</sup> is intended as a reference for development practitioners, concerned government entities, private sector investors, and rural women and men who seek to introduce gender-sensitive technologies into their economic activities and everyday life. The primary purpose of this product is to showcase these technologies to various development actors in order for the technologies to reach rural women and be adopted by them.

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<sup>1</sup> IFAD. 2016. *Reducing rural women's domestic workload through labour-saving technologies and practices*. Rome: IFAD.

## Context

Women in sub-Saharan Africa comprise nearly half of the agricultural labour force – the highest average participation rate in the world. Yet studies show that women's agricultural productivity is significantly lower than that of men, with a yield gap ranging between 20 and 30 per cent. If this gap could be closed, agricultural production would increase by between 2.5 and 4 per cent, while the number of undernourished people could decline by 12-17 per cent (FAO, 2011). Considering that an estimated 214 million people – or one in every four – were believed to be undernourished in sub-Saharan Africa in 2014 (FAO, IFAD and WFP, 2014), closing the gender gap in agricultural production could potentially liberate as many as 36 million people from hunger. Clearly, women's contribution to the region's agricultural production and food security is of immense importance, yet it is severely constrained.

One of the main reasons for women's lower agricultural productivity is **time poverty** (Carr and Hartl, 2010). Rural women play multiple roles – as caretakers of their families, farmers, casual labourers and microentrepreneurs – all of which compete for their time.

The other primary reason for women's low agricultural productivity in sub-Saharan Africa is their **unequal access to assets and productive resources** (FAO, 2011). These include land, livestock, improved seed varieties, fertilizer, seasonal labour, extension services and credit. This constraint also applies to technology; women generally possess fewer tools than men, and are seldom given access to modern farming equipment or to means of transport. They also have limited knowledge and skills needed to apply new technologies. The result is poor productivity and significant post-harvest losses, as well as limited access to markets and participation in value chains.

Women's time constraints and unequal access to resources translate into inadequate household consumption and low cash income, perpetuating the cycle of poverty and food insecurity. Therefore, there is a compelling and urgent need for technologies that save women's time, reduce the drudgery of their work and increase productivity across their entire labour profile.

## Technologies for agriculture and livestock-breeding<sup>2</sup>

### Solar-powered Irrigation Pump, United Republic of Tanzania

In 2013, as his final-year project at Sokoine University of Agriculture, Salum Masolwa chose to address one of the concerns of rural women in Morogoro County – access to water for irrigation. He found that most women fetch water for their plots using buckets and watering cans – a heavy and time-consuming chore – because fuel pumps available on the local market are too expensive for them to purchase and operate.

Masolwa designed a solar-powered pump that is mobile, can be easily transported between fields, and stored when not in use. It is composed of a metal casing with wheels, containing a battery, an inverter, an electric water pump, pipes and switches, and a solar panel mounted on top. Connected to four sprinklers, the pump is capable of irrigating one acre for 6-12 hours per day. It can also be used to operate household lights and appliances, as well as to charge mobile phones as an income-generating activity. Assembled with local materials, the solar pump costs TZS 1 million (US\$560).

With support from Innovations in Gender Equality to Promote Household Food Security, a USAID-funded programme implemented by Land O'Lakes International Development,<sup>3</sup> Masolwa piloted the pump with two women's groups that grow vegetables. Since then, Masolwa has manufactured four solar pumps for four women's groups, comprising nearly 400 members, and trained the women how to use the pumps correctly. Members of each group share the solar pump among themselves, moving it from plot to plot. This takes significantly less time and physical effort than fetching water with buckets, while easier access to water has enabled the women to expand their cultivated areas, increase production and improve quality. The solar pumps can also be used in conjunction with storage tanks and drip irrigation. Since they are powered by solar energy, the women do not need to spend any of their cash income on fuel.

Masolwa would like to upgrade the pumps so that they are able to gauge the moisture content of soil and switch on and off automatically. He and his current employer, Feasible Resource (T) Limited Company, are seeking capital for mass production of the pumps.

**For further information, contact Salum Masolwa ([masolwasalum@gmail.com](mailto:masolwasalum@gmail.com)).**



United Republic of Tanzania – Innovator Masolwa showing farmers how to operate the solar irrigation pump.  
Photo courtesy of Salum Masolwa

<sup>2</sup> This section presents 12 technologies selected on the basis of their relevance to women and on the availability of information reported by innovators during the Sharefair.

<sup>3</sup> <https://www.landolakesinc.com/utility/news/company/ECMP2-0176851>

## The Simple Greenhouse, Zambia

Farmer Violet Malama participates in the USAID-supported Production, Finance and Improved Technology Plus (PROFIT+) programme<sup>4</sup> and attends a farmer field school,<sup>5</sup> where she has been learning do-it-yourself methods of setting up irrigation systems, using crop protection products, new planting techniques and conservation farming. Inspired by the results of greenhouse technology promoted by USAID, yet recognizing that most smallholder farmers cannot afford commercially made units, Malama assembled a simple greenhouse using discarded plastic mesh potato sacks stitched together and mounted on tree branch posts. Inside, she placed cheap greenhouse trays on wooden frames and filled them with a recyclable growing medium mixed with ash. Violet planted vegetable seeds in the trays and seeds of indigenous trees – such as moringa (*Moringa oleifera*, a medicinal plant that is also used as fodder) and mubanga (*Pericopsis angolensis*, known for improving soil fertility) – underneath the trays. Soon she began selling seedlings and saplings to local farmers, including other members of the farmer field schools.

In collaboration with PROFIT+ and the Zambia Alliance of Women, Malama has trained around 40 women farmers on how to assemble simple greenhouses. Like Malama, three of them are now operating their own greenhouses; two have recently expanded their capacity from 30 trays to 90-120 trays due to high demand. Together, Malama and her trainees are supplying seedlings to nearly 100 farmers, who previously had to buy seedlings from distant commercial farms or grow them in field nurseries, which usually resulted in a longer maturity period and significant losses.

The technology has substantially improved Malama's income and status, as well as those of her fellow farmers. She has been able to connect her house to the electricity grid, clear more land and cultivate cash crops. She also wants to get involved in food processing. "A lot of fruits and vegetables spoil before farmers are able to sell them," she said, "or they are forced to sell at low prices dictated by middlemen. A local food processing facility would help farmers avoid that and add value to their produce." Other women farmers who have benefited from the greenhouse technology are also engaging in new activities, such as poultry-raising.

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Zambia – Innovator and farmer Malama inspecting her greenhouse.

Photo courtesy of Violet Malama

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<sup>4</sup> <http://www.acdivoca.org/site/ID/zambia-profit-plus>

<sup>5</sup> Farmer field schools are a form of adult education based on a participatory learning approach. <http://www.fao.org/agriculture/ippm/programme/ffs-approach/en/>.

## Spot Fertilizer Applicator, Zambia

Musenga Silwawa is an agriculturalist and currently a practical instructor at the Zambia Centre for Horticultural Training. In 2006, while working as a part-time farmer on a two and a half acre plot, Silwawa experienced how difficult it was to distribute fertilizer by hand. In addition to being very labour-intensive, the process is inaccurate and inconsistent, as well as hazardous to health and the environment. He decided to create a technology that would facilitate spot fertilizer application – digging a pocket beside each plant, placing the fertilizer, and covering it with soil.

Silwawa's spot fertilizer applicator has three main components: the backpack (fertilizer-holding container strapped to the operator's back); the transfer tube (connecting the container to the implement); and the implement (fertilizer placement component). Hand pressure on the implement activates a series of spring loads and valves that control the flow rate of the fertilizer, resulting in accurate, pre-calibrated application. The components, mostly locally manufactured, were sourced from a local hardware shop.

The innovation reduces time spent in the field applying fertilizer by 50 per cent, as well as the associated labour costs. It therefore makes it possible for farmers – especially women – to spend more time on other farm and off-farm activities. It is particularly helpful for elderly farmers and those afflicted with chronic ailments such as HIV/AIDS.

Silwawa received a patent for his innovation from the Zambian Patents and Companies Registration Authority in 2008. It is currently undergoing stringent research and development at the University of Zambia for ISO certification before commercialization. However, interest in the technology has already been expressed by private sector companies, extension officers and environmentalists. Silwawa expects the selling price to be pegged at around ZMK 150.00 (US\$25) – equivalent to two bags of maize grain.

Silwawa's work has been supported by UN Women, the National Technology Business Centre, and the National Science and Technology Council. His technology was shortlisted by the Royal Academy of Engineering in the United Kingdom and he won £10,000 as a runner-up at the prestigious Africa Prize for Engineering Innovation, in 2015.

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Zambia – Farmer testing the spot fertilizer applicator in her field.  
Photo courtesy of Musenga Silwaw

## Mwandama Fertilizer, Malawi

In Malawi, smallholder farmers receive subsidized fertilizer through the Government's Farmer Input Subsidy Programme (FISP), but the quantities provided are usually insufficient to cover the farmers' needs. Devlin Chomboto, an agriculture extension facilitator who works for the Millennium Villages Project (MVP)<sup>6</sup> in Zomba District, developed a composite fertilizer by adding organic components to the FISP fertilizer. The Mwandama Fertilizer (MF) – named after the cluster of villages encompassed by the MVP – is produced by mixing one container (20 litres) of maize husks or bran, one container of chicken or pig manure, half a container of charcoal or wood ash, and 10 kilograms of the inorganic FISP fertilizer. The mixture is moistened and fermented in a closed plastic sack for 21 days. Afterwards, it is spread out in the shade to dry and is then ready to use. One unit of FISP fertilizer makes five units of MF.

A marked difference in terms of health, speed of growth and productivity can be observed between plants that receive FISP fertilizer only and those that receive MF. While MVP is working with research institutions to assess results, district departments of agriculture, non-governmental organizations (NGOs) and individual farmers have already begun adopting the technology. More than 5,000 farmers are currently using MF in the MVP area alone, and farmers from other districts have come to learn about it. Women are particularly interested. MF is cheap and simple for them to make for their own use, as well as for sale to other farmers; women are thus able to increase both their food production and cash income. Since MF was introduced, women's participation at Maera Irrigation Scheme has increased more than threefold.

Given that some households find it difficult to source all components of MF in adequate quantities (for example, maize husks are consumed in times of hunger, while FISP fertilizer can be unaffordable for the poorest households even at subsidized prices), Chomboto is exploring the possibility of involving cooperatives in MF production.

**For further information, contact Devlin Chomboto ([dchomboto2@hotmail.com](mailto:dchomboto2@hotmail.com)).**



Malawi – Impressive difference between a field that received MF (left) and another that received inorganic fertilizer (right).  
Photo courtesy of Devlin Chomboto

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<sup>6</sup> <http://millenniumvillages.org/>

## Electric Incubator, United Republic of Tanzania

A graduate in economics, Simon Titus Malugu decided to start a poultry-farming business in order to meet the market demand for fresh poultry meat, eggs and related products. With a loan and support from the Small Industries Development Organization, Malugu developed an incubator with a capacity of 300 eggs and suitable for eight types of farm birds (fowl, turkey, duck, etc.). The incubator has a wooden frame that houses solar batteries, a thermostat, electric static meter and other components. It can operate either on solar or electric power, and switch automatically between the two. A meter allows the user to monitor electricity consumption. An upward/downward motion of the trays eliminates the need to change the position of incubated eggs. When necessary, the machine can also operate house lights. The incubator costs TZS 500,000 (approximately US\$280).

In the United Republic of Tanzania, the production of day-old chicks is a lucrative business, given that the poultry subsector is underdeveloped and unable to meet market demand. There is also a general preference for indigenous rather than imported chickens.<sup>7</sup> Poultry is traditionally owned and managed by women, and therefore a significant livelihood asset, particularly in households headed by women. In view of this, in 2014, Land O'Lakes International Development offered Simon an opportunity to market his technology through its USAID-supported programme, Innovations in Gender Equality to Promote Household Food Security. Since then, Malugu has sold 10 incubators, primarily to women entrepreneurs and retirees, as well as to convents, and is manufacturing 50 more for women in rural areas. Malugu's incubator is ideally suited for rural women, given its ability to operate on solar energy, as well as its versatility and ease of operation. Affordability might be a challenge. However, it could be resolved through group ownership and access to credit.

Malugu is seeking investors in order to expand his production capacity of incubators and to develop proper user and technical manuals.

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Innovator Malugu demonstrating the electric incubator at the Sharefair in Nairobi.  
Photo courtesy of Amal Magzoub

<sup>7</sup> Research Into Use. 2012. *Taking Poultry Subsector to Scale: A Call for Commercial Expansion of the Indigenous Poultry Industry*. RIU Tanzania Policy Brief 1. Available at: <http://r4d.dfid.gov.uk/PDF/Outputs/ResearchIntoUse/riu040412-tz-policy-brief1.pdf>.

## Technologies for value addition

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### Portable Electrochemical Aflatoxin Testing Kit, Uganda

In Uganda, the majority of farmers are women. One of the constraints they face in marketing their crops is the inability to demonstrate compliance with quality requirements. Contamination of crops with aflatoxin – toxic metabolites produced by certain fungi – is of particular concern. However, the quantification of aflatoxin in local produce is only conducted at three locations (the Department of Food Science and Technology of Makerere University, the Uganda National Bureau of Standards, and a private laboratory) situated far from most areas of crop production and at a cost ranging from US\$36 to US\$90. A participatory study<sup>8</sup> identified the difficulty of accessing this service as a major constraint for women's groups producing heap fermented cassava flour – a product widely traded within the region. The finding prompted the Uganda Industrial Research Institute (UIRI) to seek a technological solution. Paul Alex Wacoo, a M.Sc. student of Biochemistry at Makerere University, and Mathew Ocheng, an electrical engineer at UIRI, were charged with the task.

With support from UIRI and the International Development Research Centre, the two scientists developed a portable aflatoxin B1 testing kit, comprising an electrochemical biosensor and a potentiostat, which records, analyses and displays test results. The kit is highly sensitive and suitable for compliance with FAO food safety standards. It was tested in the field by the Arua Cassava Producers Association, a women's group that was awarded a contract to supply fermented cassava flour to WFP. The group sent samples to Makerere University, some 500 kilometres away, and waited two weeks for the results. They also tried the testing kit on site and obtained results in less than 30 minutes. The technology proved to be accurate, not to mention cost- and time-efficient. It thus has enormous potential to facilitate women's access to market, and also eliminate hazardous practices such as chewing flour in front of potential buyers as proof of safety.

At the Sharefair, Wacoo and Ocheng received the Young Innovators Award in the "Technologies benefiting smallholder farmers" category. The technology has not yet been patented. The innovators are seeking funding for further technology development, testing, production, and marketing.

**For further information, contact Paul Alex Wacoo ([wacooalex@gmail.com](mailto:wacooalex@gmail.com)) and Mathew Ocheng ([mochengo@gmail.com](mailto:mochengo@gmail.com)).**



Innovator Wacoo explaining the operation of the aflatoxin testing kit at the Sharefair in Nairobi. Photo courtesy of Amal Magzoub

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<sup>8</sup>Wendiro et al. 2012. *Traditional science, technology and innovation in the context of a modern incubator research and development agency: strengthening linkages between traditional and modern knowledge systems for social inclusion*. Available at: <http://hdl.handle.net/10625/49173>.

## Solar Dryer, United Republic of Tanzania

Clara Ibihya was concerned about the large losses of fruits and vegetables that occur during the post-harvest period, when supply exceeds demand. She remembered how during her childhood she used to help her mother sun-dry vegetables and fruits, and thus the idea to develop a solar dryer was born.

With support from the Small Industry Development Organization, where she attended a number of trainings, Ibihya established Claphijo Enterprises. The company assembles household and commercial solar dryers using wooden planks and visqueen plastic sheets made for dry climates. A typical dryer for a women's collective costs about TZS 700,000 (US\$390). It can be upgraded with built-in solar panels and fans to dry produce more evenly and quickly. The company also produces dried food products, which have been well accepted in the local markets. An analysis conducted by the Sokoine University of Agriculture in Morogoro confirmed that solar drying reduces moisture content to less than 10 per cent, while retaining most nutrients.

With support from Land O'Lakes International Development, Ibihya trains groups of women and youth how to assemble sun dryers and dry the produce, which is then marketed by her enterprise. About 350 farmers have been engaged to date. She has also transferred the technology to Women's Action for Development, a Namibian NGO.

In 2009, Ibihya won a prize at a business plan competition held by the Tanzanian Private Sector Foundation. She was also a finalist at the prestigious Sankalp Awards for Africa in 2014 and honoured as a Woman of Determination during the commemoration of the United Republic of Tanzania's 50 years of independence. Ibihya would like to venture into production of organic foods and export her produce globally. Finding affordable, good-quality packaging is difficult, as is obtaining certification from the Tanzanian Bureau of Standards and the Tanzanian Food and Drug Authority due to strict infrastructure requirements that are difficult for rural suppliers to meet.

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United Republic of Tanzania – Sun dryer manufactured by Claphijo Enterprises. Photo courtesy of Clara Ibihya

## Post-harvest Pit Storage Bag, Ethiopia

In eastern Ethiopia, farmers traditionally store their grain harvests in underground pits. Moisture migration from the surrounding soil into the pits promotes the growth of mould, which can damage between 30 and 100 per cent of the stored grain.

In 2009, in the context of MercyCorps Ethiopia's Enhancing Post Harvest and Seed System project, Zelalem Belayneh developed an airtight pit storage bag (PSB). Sewn from highly durable, rubberized canvas and with a drawstring closure at the top, the PSB is used as a liner for traditional pit storage. PSB reduces post-harvest losses to nearly 1 per cent and maintains the quality of stored grain, resulting in an 85 per cent reduction in women's labour associated with cleaning and washing stored grain for further processing. The technology is locally made, adaptable to any storage pit, and easily transported and installed. PSB with a 2-ton capacity costs around US\$45 and has a lifespan of three years.

MercyCorps has been promoting the technology in eastern Ethiopia and is planning to expand to other parts of the country. The NGO trains farmers how to handle grain after harvesting, construct pits correctly, and install PSBs. This work is conducted in partnership with USAID, the Office of Agriculture, Fedis Agricultural Research Centre, and Haramaya University. About 4,500 farmers and agropastoralists have adopted the technology so far, of whom around 800 are women.

MercyCorps aims to develop a business model that would see the production, distribution and training taken over entirely by the private sector. However, finding competent companies is problematic, especially for the training component. Other challenges include overcoming the farmers' hesitancy to invest in PSB, despite the fact that US\$1 invested gives a return of US\$4 in terms of grain saved. Hence, the project started out by subsidizing 80 per cent of the cost and gradually reducing that to 50 per cent, intending to eventually phase out the subsidies. However, farmers still need access to credit, particularly during the harvest period, when cash tends to be limited. Local PSB manufacturers also need credit in order to scale up production.

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Ethiopia – Innovator Belayneh displaying pit storage bags at the Sharefair.  
Photo courtesy of Amal Magzoub

## Maize Sheller, Kenya

Dajopen Waste Management is a community-based organization operating in the slums of Kitale, where the accumulation of garbage and waste creates a serious health hazard to the local population. The organization processes organic waste, as well as weeds that grow around the slums, to produce biodegradable fertilizers and pesticides. Plastic waste is melted and moulded to make construction materials. Scrap metal is also collected and recycled to make useful objects.

One such object is the maize sheller developed by a member of Dajopen, David Ngige Muguro. It is made of a short metal pipe with welded ridges on the inside and mounted on a metal stand. When a maize cob is rotated by hand inside the pipe, the ridges disconnect the kernels without damaging them. This is a significant improvement over the traditional method, whereby women shell maize by beating it with broomsticks. This practice damages the kernels and contaminates them with aflatoxin. The sheller was calibrated by the Department of Agricultural Mechanization Services at the Ministry of Agriculture, achieving only 0.001 per cent kernel breakage.

The technology makes it possible to shell four to six bags of maize a day. It costs KES 1,500 (US\$16) per unit. Around 880 units have been sold so far, more than 300 of them to women. In addition to being easy to use, hygienic, and time-saving, the sheller enables women to generate income by shelling and selling maize. It has been patented.

**For further information, contact Dajopen Waste Management ([mdajopenwaste@yahoo.com](mailto:mdajopenwaste@yahoo.com)).**



Kenya – The maize sheller is easier, faster and more hygienic than the traditional method of shelling. Photo courtesy of David Ngige

## Technologies for household use

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### Rocket Stove, Malawi

Most women and girls in rural Africa spend a significant amount of their time collecting firewood for cooking on three-stone open fires. In addition to contributing to deforestation, these fires are a health hazard due to high carbon emissions, especially in kitchens with little or no ventilation. The NGO Total LandCare (TLC) has been working with the Malawi Department of Energy Affairs and the National Cookstove Taskforce to test and improve several cookstove models in terms of efficiency, ease of construction, affordability and market demand. The selected model, based on the “rocket stove” principle, was designed in collaboration with rural women.

The rocket stove can be built in less than 30 minutes, requiring only clay bricks and some metal parts supplied by TLC at a cost of US\$5. It burns more cleanly, uses 60 per cent less firewood than the traditional open fire, and – when used with a metal pot skirt – has a thermal efficiency that is 16 per cent higher. The technology encourages the use of small pieces of wood, which can be gathered closer to home. For women and girls, this frees up time for other productive tasks and school attendance, and reduces their exposure to assaults that occur when they venture too far from their villages. It also eliminates the high incidence of severe burns to small children. Moreover, the technology significantly reduces the pace of deforestation because villagers require less wood for cooking and need only to prune tree branches instead of cutting down trees.

Commencing in 2013, TLC's cookstove project has benefited 20,000 rural households in villages across Malawi, aiming to reach 64,000 by the end of 2015. The initiative has also expanded to Zambia, targeting 35,000 households in collaboration with Community Markets for Conservation.

TLC's work is supported by IFAD, the Royal Norwegian Embassy, USAID, UKAID, Irish Aid and various international corporations. In agreement with the Government of Sweden and C-Quest Capital,<sup>9</sup> TLC's cookstove project participates in a carbon offsets programme. Utilizing GPS and smartphone technology, TLC keeps a record of every household that uses a rocket stove; the information is regularly verified and audited. The high cost of registration and monitoring is the project's main challenge.

**For further information, contact Jordan Kowalke ([jordankowalke@gmail.com](mailto:jordankowalke@gmail.com)).**



Malawi – The rocket stove is more efficient and safer than the traditional three-stone fire.  
Photo courtesy of ©Total LandCare

## Flexi Biogas System, Kenya<sup>10</sup>

An estimated 2.5 billion people rely on traditional biomass fuels (charcoal, dung, firewood) to meet their heating and cooking needs. And more than 80 per cent of these people (over 1.7 billion) live in either sub-Saharan Africa or South-East Asia. In Kenya, firewood is used by 68 per cent of households (and by more than 80 per cent in rural areas), while charcoal is used by 13 per cent.<sup>11</sup> This results in an unsustainable exploitation of already sparse forest resources that, according to the Kenya Forest Service, currently cover only 1.5 per cent of the country's territory. This, in turn, makes firewood gathering – traditionally done by women – increasingly time- and labour-intensive, involving walking long distances. Toxic gases (carbon monoxide, nitrogen oxide) and dust particles from firewood burning in unventilated areas are also a health hazard, as well as detrimental to the environment.<sup>12</sup>

Biogas is a clean, renewable energy, produced from anaerobic fermentation of biomass and solid organic waste. Biogas International Limited, a Kenyan company founded in 2011, has developed a Flexi Biogas system (FBS) that is well suited to the African rural context. FBS is composed of a digester bag made of polyvinyl chloride (PVC) tarpaulin, housed in a greenhouse tunnel. Heat trapped in the tunnel during the day speeds up the fermentation of the organic waste material stored in the digester. This promotes the rapid production of biogas, which is piped through a PVC tube to an appliance, such as a cooking stove. A small household FBS requires an initial load of 1 ton and, subsequently, around 20 kilograms of dung and 20 litres of water daily to meet a family's basic cooking needs. In addition to biogas, the system produces bioslurry, a nutrient-rich by-product used as a fertilizer. FBS is portable and easy to install, manage and maintain. The overall cost of the smallest system is US\$460, including installation.

In collaboration with IFAD, Biogas International has installed 500 FBSs across Kenya and is planning to deploy about 1,000 more units through its Adaptation for Smallholder Agriculture Programme over the course of 2014-2016. FBS is also being piloted in Rwanda, as well as India and Sao Tome and Principe. In an effort to scale up, IFAD and Biogas International are working with the Indian Institute of Technology to improve the reliability of FBS and lower its production costs.



Rwanda – Flexi Biogas systems piloted in the IFAD-funded Kirehe Community-based Watershed Management Project (KWAMP). Photo courtesy of ©Antonio Rota



Rwanda – The innovator Dominic Wanjihia during the installation of a new Flexi Biogas system in KWAMP project area. Photo courtesy of ©Antonio Rota

<sup>10</sup> More information about biogas systems available at: [http://www.ifad.org/knotes/livestock/biogas\\_htd.pdf](http://www.ifad.org/knotes/livestock/biogas_htd.pdf).

<sup>11</sup> <http://www.sciencedirect.com/science/article/pii/S0960148114007101>

<sup>12</sup> According to the World Health Organization, every year, about 4.3 million people die prematurely from illness attributable to the household air pollution caused by the inefficient use of solid fuels (2012, <http://www.who.int/mediacentre/factsheets/fs292/en/>).

By expanding energy access, preserving the environment, and integrating livestock and farming systems, FBS offers numerous benefits to rural people, particularly women. Since adopting FBS, many women have reported an improved quality of life, including reduced workload (they do not have to walk long distances to collect fuelwood, which also reduces safety concerns), better health and more time to develop skills and income-generating activities. It has also had an unexpected impact on gender roles: as one woman remarked, "Whenever I'm not at home or come home late, my husband or my son normally cooks because they find it easy, fast and convenient to cook with biogas compared to firewood."

**For further information, contact Dominic Wanjhia** ([dwanjihia@yahoo.com](mailto:dwanjihia@yahoo.com), [info@biogas.co.ke](mailto:info@biogas.co.ke)).

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### Water-purifying Earthenware, Kenya

Esther Wanjiku from Kiambu County has long been concerned about the poor water quality in her village and seeking a solution to this problem, which has been causing the spread of waterborne diseases.

She enrolled in enterprise creation trainings conducted by the NGOs Hand In Hand Eastern Africa and Plan International, where she learned how to make earthenware pots using local materials – sieved red soil, mixed with water and chlorine – which she glazes in a self-made kiln.

Wanjiku now makes a living by building earthenware purifiers. She has upgraded the earthenware pot by the addition of a plastic bucket (fitted with a lid and tap to prevent water contamination) purchased from the local market. The purifiers have a capacity of 8 litres and take one and a half hours to purify the water they contain.

Wanjiku sells the purifiers on the local market for KES 2,500 (US\$27) per unit. She also tries to raise awareness among people in her village about the dangers of contaminated water and the benefits of using water purifiers. So far, she has sold 40 units to women in Kiambu, who have given her positive feedback about the difference that the purifiers have made in their households in terms of easy access to clean drinking water and marked reduction in sickness among family members and medical expenses. Wanjiku needs funding to be able to expand her production capacity.

**For further information, contact Esther Wanjiku** ([chrstynne@yahoo.com](mailto:chrstynne@yahoo.com)).

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Kenya – Wanjiku's water purifier displayed at the Sharefair in Nairobi.  
Photo courtesy of Amal Magzoub

## Innovating towards women's empowerment

The Sharefair on Rural Women's Technologies offered a valuable opportunity for policymakers and development practitioners to interact with African innovators and learn from their experiences. The technologies that have been developed address rural women's concerns with locally available resources, offering sustainable solutions. Some of these technologies have enabled the innovators – especially rural women – to transform their livelihoods, as well as the livelihoods of their communities. Such inspiring experiences affirm that many obstacles – gender, social, economic, and other – can be overcome with ingenuity and determination, no matter how limited the resources at hand.

The Sharefair gave an opportunity to the innovators to bring attention to the specific challenges that they face. Some of the most common are:

- Access to finance for further product development and mass production;
- Understanding of the technicalities and processes involved in obtaining patent rights;
- Ability to meet quality certification requirements;
- Skills in business management and marketing.

Against these challenges on the supply side, there are even more complex constraints on the demand side. Most rural women have very limited ability to acquire time- and labour-saving technologies even when they are available. They are seldom the decision makers in their families or have control over household resources, especially cash. They might lack information and skills, or be risk-averse, hesitating to invest what little they have in new technologies and practices in case they fail. They are also held back by the failure to bring old technologies – such as electricity – to rural areas, which makes the adoption of new technologies difficult or impossible.

These constraints must be overcome if women's contribution to rural economies is to realize its full potential. Efforts should include:

- Investing more in African research institutions, in terms of material resources and partnerships, and engaging them in finding technological solutions to the specific problems that rural women face;
- Promoting African business incubators, as facilities that give innovators the means to transform ideas into tangible products and technologies;
- Expanding access to finance and microfinance to small and medium-sized enterprises in order to give innovators the means to produce, market and scale up technologies, and rural women the means to acquire and benefit from them;
- Promoting south-south exchanges and innovators' networks to support knowledge-sharing, adaptation and replication of technologies that are transformative for rural women's lives;
- Applying gender-transformative approaches at all levels – political, legislative, administrative, communal and household – to ensure that rural women's priorities, including access to technologies, stay at the forefront of the development agenda and are addressed holistically.

## Catalogue of other technologies presented at the Sharefair that are of particular interest to women

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### Affordable Drip-kit System, Kenya

Utilizing a network of tubes connected to a water storage tank, the system distributes water among plastic packets in which individual seedlings (or seeds) are planted. The plastic packets retain nutrients and save up to 80 per cent of water lost by other systems. The kit can irrigate up to 1,000 seedlings, requiring 15 minutes every two days. The technology is cost-efficient, easily managed, and time- and labour-saving. It facilitates climate adaptation in areas affected by water scarcity and makes food production possible year-round. The kit has been adopted by around 50 farmers, as well as a number of schools.

**For further information, contact Peter Thuo Njuguna ([green.gt.technology@gmail.com](mailto:green.gt.technology@gmail.com)).**



Drip-kit system, Kenya.  
Photo courtesy of Peter Thuo Njuguna

### Locally Produced Substrate, Mozambique

To replace expensive commercial greenhouse substrate, the Agrarian Research Institute of Mozambique developed an inexpensive substrate using local ingredients, including manure and coarse river sand. The substrate produces seedlings of good quality and eliminates the need for chemical fertilizers. Other results include: less cash spent on inputs; increased productivity; less labour and time for women, who can produce seedlings in their homesteads; improved income generation; and improved family nutrition. The technology has not been patented, but has been disseminated freely to rural communities through extension services.

**For further information, contact Beatriz Alberto Nhaulaho ([nbeatrizalberto@gmail.com](mailto:nbeatrizalberto@gmail.com)).**



Greenhouse substrate.  
Photo courtesy of Beatriz Alberto Nhaulaho

## Mushroom Growing the Organic Way, Kenya

An affordable organic method of cultivating mushrooms year-round uses a substrate prepared by boiling agricultural waste such as maize cobs and bean straw. Once cooled, the substrate is spread on top of banana leaves inside a shed constructed with maize and grass stalks. Mushroom seeds are spread on top of that and covered with another layer of substrate, then with banana leaves. With regular watering, the substrate produces up to three harvests. Mexican marigold is used as an insect repellent. The technology has been tested by 15 women's groups in Nakuru County. The innovation received the Young Innovators Award in the "Technologies benefiting smallholder farmers" category.

For further information, contact [Pauline Njeru \(polinjeru@yahoo.com\)](mailto:Pauline.Njeru@yahoo.com).



Mushrooms cultivation displayed at the Sharefair in Nairobi.  
Photo courtesy of Amal Magzoub

## Production of Oyster Mushrooms, Kenya

Galaxy United Youth Group (GUYG) developed a method of cultivating oyster mushrooms in baskets suspended inside sheds. The baskets are filled with substrate made from agricultural waste and inseminated with spawn grown in locally made glove boxes. The baskets produce mushrooms for three to six months. GUYG has transferred the technology to 15 women's and 10 youth groups, as well as 200 farmers, who are now benefiting from a steady, reliable source of income and nutritious food. Air pollution has been reduced, as agricultural waste – previously burned – is now used to make substrate. Compost made from old substrate has improved farm productivity.

For further information, contact [Paul Kisiangani \(kisianganip@yahoo.com\)](mailto:Paul.Kisiangani@yahoo.com).



Cultivating oyster mushrooms in suspended baskets.  
Photo courtesy of Paul Kisiangani

## Organic Biocides, Kenya

GROOTS Kenya, a movement of over 2,000 women-led self-help groups, promotes the use of biocides made from indigenous plants. The biocides are made by soaking crushed plants in water and fermenting for 7-14 days. Around 90 women's groups in Nakuru and Kitui counties, totalling 2,250 members, have been trained by GROOTS Kenya to make biocides for their own use and for sale. In addition to controlling pests and increasing crop yields, the biocides have enabled the farmers to produce organically grown food, which fetches higher market prices. Biocides have also been developed to control termites and other wood-eating insects that infest chicken pens and other wooden structures.

For further information, contact [admin@grootskenya.org](mailto:admin@grootskenya.org), [grootsk@grootskenya.org](http://grootsk@grootskenya.org).



GROOTS Kenya at the Sharefair in Nairobi.  
Photo courtesy of Amal Magzoub

## Metal Silos, Kenya

The Mumoni and Kyoso Organization for Rural Development and Active Participation (MUKY-ORDAP) manufactures metal silos for grain storage. The organization has also invented a simple moisture meter consisting of a transparent plastic water bottle containing some dry salt; when grain is placed in the bottle and shaken, salt sticks to the sides if its moisture content is too high. The silos are sold to families and women's groups. So far 32 women's groups have benefited, in addition to 15 community-based organizations participating in FAO's "Improved Impacts of Emergency Response" initiative.

For further information, contact [ruthsamuel206@gmail.com](mailto:ruthsamuel206@gmail.com), [mukyordap@gmail.com](mailto:mukyordap@gmail.com).



Metal silo displayed at the Sharefair, Nairobi.  
Photo courtesy of Amal Magzoub

## Post-harvest Cooler, Kenya

Circuit General Agencies, a Kenyan company involved in horticultural farming, has developed a charcoal cooler to preserve farm produce. The sides of the cooler, constructed with wooden logs and wire mesh, are filled with charcoal chips. Water poured from the top and absorbed by the chips cools the air inside the structure, creating a favourable environment for preserving fresh produce. A charcoal cooler measuring 10 feet by 10 feet can accommodate 5 tons of fruits and vegetables. The technology has benefited around 10,000 women smallholder farmers by reducing post-harvest losses, increasing incomes and improving family nutrition through retention of nutrients in perishable produce.

For further information, contact [Gideon Kitema \(gideokitema@yahoo.com\)](mailto:gideokitema@yahoo.com).



Charcoal cooler.  
Photo courtesy of Gideon Kitema

## Brick Incubator, Malawi

In rural areas where there is no electricity to operate electric incubators, a brick incubator is an alternative way to meet the local demand for day-old chicks. An incubator with a 45-egg capacity requires 30 bricks for the brick structure, Gmelina arborea charcoal as a heat source, a wet cotton cloth hung inside for humidity, and sand and a piece of flat iron sheet for insulation. The innovation is currently being used by over 50 farmers, among them many women, in the villages in Rumphi and Mzimba districts.

For further information, contact [Dr Susan Chikagwa-Malunga \(koncmalunga@yahoo.com\)](mailto:koncmalunga@yahoo.com).



Brick incubator displayed at the Sharefair, Nairobi.  
Photo courtesy of Amal Magzoub

## Bilha's Chicken Shelters, Kenya

Bilha Wambui from the village of Limuru in Kiambu County constructs chicken shelters using steel wire from used tyres. She collects discarded tyres from her village and other nearby villages, as well as purchases used tyres from traders in the town. The chicken shelters are sold to women in her village, as well as in Thika Town. Bilha runs a lucrative business, employing her husband and a few other villagers. The income she generates enables her to provide for her family's needs, including education for her grandchildren. The availability of affordable shelters has encouraged more villagers to embrace poultry-farming.

For further information, contact Hand in Hand Eastern Africa ([ruth.mungai@handinhand-ea.org](mailto:ruth.mungai@handinhand-ea.org)).



Chicken shelters displayed at the Sharefair, Nairobi. Photo courtesy of Amal Magzoub

## Termites as Feed for Poultry, South Africa

Letlotlo Farmers Agricultural Cooperative uses termites as organic feed for its chickens. The cooperative collects termites from termite hills, leaving the queen and some of the colony to regenerate. The collected termites are dried and preserved. Chickens exclusively fed termites are significantly heavier than those fed commercial feed, while eggs produced by such chickens have higher nutritional value than regular eggs. The cooperative sells its organic chickens and eggs to supermarket chains. It also provides training to other cooperatives. The technology, which has been approved by the South African Bureau of Standards, is particularly suitable for non-arable areas, where other means for income generation and sources of nutrition are limited.

For further information, contact Aletta Hlalele ([abulamson@hotmail.com](mailto:abulamson@hotmail.com)).



Photo courtesy of Amal Magzoub

## Fortified Crop Residue-based Feed Block Supplements, Kenya

The Kenya Agricultural and Livestock Research Organization (KALRO) has developed a feed supplement using pulverized maize stalks, wheat bran, molasses, urea, bentonite, indigenous plants, mineral premixes, dewormer and a yeast culture. This mix is packed into wooden moulds and dried for one to four days. The digestibility of the supplement is around 68 per cent, resulting in a daily weight gain of 0.5 kilograms per cow. KALRO plans to develop an agribusiness that engages vulnerable households in the production and sale of supplement blocks. The supplement can be used to sustain livestock production in areas of scarcity.

For further information, contact Margaret Syomiti ([syomitimargaret@yahoo.com](mailto:syomitimargaret@yahoo.com)).



## Solar Dryer, Kenya

Tree is Life Trust (TILT) developed a sun dryer model that is simple to operate and inexpensive to make. It consists of a rectangular box with a tilted upper lid, which is positioned in an open space with its longitudinal axis in the east-west direction, the tilted cover facing south. The material to be dried is closely spread over the trays provided for the purpose. The side doors are then closed. Once every morning, the dryer is opened, the material remixed and the position of the trays interchanged. The solar dryer takes fewer days to dry varied farm produce than the conventional open-air drying, and demands less effort. TILT has trained 57 community groups to use the technology. The groups have been able to reduce post-harvest losses, thus increasing productivity and food security.

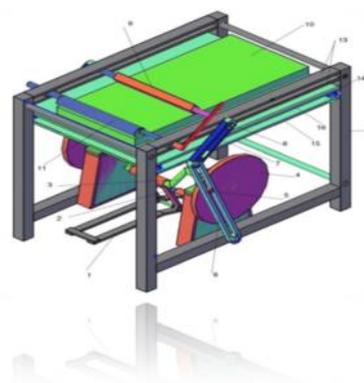


Demonstration at the Sharefair in Nairobi.  
Photo courtesy of Amal Magzoub

For further information, contact [Tree is Life Trust \(treeislifetrust@gmail.com\)](mailto:treeislifetrust@gmail.com).

## Treadle-operated Enset Decorticing Machine, Ethiopia

The decortication of enset, a traditional staple in southern Ethiopia, is traditionally done only by women. It involves placing a leaf sheath on an inclined surface, holding it up with one foot and using both hands to scrape the leaf with a metal scraper – a process that is tedious, tiresome and unhygienic. The treadle-operated enset decorticing machine is a six-fold improvement over the traditional method. It is ergonomic and hygienic (no contact with hands or feet). While not yet available on the market, a unit would cost about US\$750-800 and is intended for joint ownership by women's groups. For his innovation, Girma Gebrewold received "Ethiopia's Best Inventor" award in 2011 and a patent from the Ethiopian Intellectual Property Office in 2013.



For further information, contact [Girma Gebrewold \(Girma.Gebrewold@ata.gov.et\)](mailto:Girma.Gebrewold@ata.gov.et).

### Cocoa Grinder, United Republic of Tanzania

With training and a grant from Land O'Lakes International Development, Calista Ngasakwa designed a cocoa grinder, which she assembled at a local workshop using local materials. Traditionally, cocoa is grinded in mortars; it can take up to seven days to produce 1 kilogram of cocoa powder. The grinder produces 1 kilogram in about ten minutes. Calista rents out her grinder to other women and has also sold one. She would like to establish her own workshop and patent her invention.

For further information, contact Calista Ngasakwa ([merogk@yahoo.com](mailto:merogk@yahoo.com)).



A cocoa grinder displayed at the Sharefair in Nairobi. Photo courtesy of Amal Magzoub

### Clay Oven, Zimbabwe

Kunzwana Women's Association promotes clay oven technology, which makes it possible for women to bake bread for their own consumption as well as for sale. The technology is most suitable for use in rural areas where there is no electricity. The ovens retain heat for up to 24 hours and require relatively little firewood. Kunzwana has supported 50 member clubs in the construction of clay ovens for commercial purposes. The clubs now sell baked products to schoolchildren and community members in nearby villages, achieving a profit margin of more than 40 per cent. The technology has caught on in entire villages, as many homesteads have begun to build their own clay ovens.

For further information, contact Taurai Matope ([kunzwana@kunzwana.co.zw](mailto:kunzwana@kunzwana.co.zw)).



Construction of the clay oven. Photo courtesy of Taurai Matope

### Tabletop Charcoal-fired Clay Oven-dryer, Mozambique

Dr Panfilo Tabora, a professor of environmental science, and Mariquia Obaine, a potter and a member of Association Uerendema, a local women's group, designed a clay oven-dryer that uses 50-70 per cent less charcoal than a traditional stove, decreases cooking time, and eliminates the need for continuous stirring or turning. It has three components: a closed clay dome with a small smoke vent; a small clay stove placed inside the dome; and a fitted clay door cover. The oven can be installed on a tabletop and used to make breads, cakes and pastries, as well as roast meat and fish. The residual heat can last for five to six hours, enough to dry meat, fish, vegetables and fruits for conservation.

For further information, contact Dr Panfilo Tabora ([panfilo.tabora@akdn.org](mailto:panfilo.tabora@akdn.org)).



Charcoal-fired clay oven-dryer displayed at the Sharefair in Nairobi. Photo courtesy of Amal Magzoub

### Maendeleo Jiko Stove, Kenya

Traditional three-stone cooking fires produce a high level of emissions and require about 100 pieces of wood per day. The Mumoni and Kyoso Organization for Rural Development and Active Participation (MUKY-ORDAP) is producing clay stoves (jikos) that use around 21 pieces of wood. With support from UNDP, the organization has trained 11 local artisans (8 women and 3 men) how to manufacture and market the jikos. The training project, which commenced in 2013, is currently active in Tseikuru District and will expand to other districts in the near future.

**For further information, contact**  
[ruthsamuel206@gmail.com](mailto:ruthsamuel206@gmail.com), [mukyordap@gmail.com](mailto:mukyordap@gmail.com).



Clay stove presented at the Sharefair in Nairobi.  
Photo courtesy of Amal Magzoub

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### Hifadhi Stove, Kenya

A rocket stove is an efficient cooking stove, which burns small-diameter wood fuel in a simple high-temperature combustion chamber containing a vertical chimney and a secondary air supply. Bruce Mukuru manufactures his own version of the rocket stove, named Hifadhi – which in Swahili means “sustain” or “protect” – given its efficient use of fuel and low carbon emissions. The stove, manufactured from metal and clay, is portable and can use either charcoal or firewood. Bruce employs women and youth at his workshop, and works in collaboration with the German Society for International Cooperation (GIZ), Climate Pal Ltd., the Ministry of Agriculture and the Ministry of Energy. To date, Bruce has sold over 20,000 Hifadhi stoves.

**For further information, contact Bruce Mukuru**  
[\(mukurubruce@yahoo.com\)](mailto:mukurubruce@yahoo.com).



Hifadhi stove.  
Photo courtesy of Bruce Mukuru

## Hydraulic Presser, Malawi

Chinangwa and Mbatata Roots and Tubers Enterprise (CMRTE) has developed a hydraulic presser that can process cassava into high-quality flour for home consumption, as well as for sale to the confectionary industry. The technology has enhanced production, market and value addition for raw cassava, reduced cassava-processing time, created employment opportunities in the community, increased income levels, and improved food safety. The technology is currently being used by over 2,000 members of the cooperative, and nearly 80 per cent of the users are women. CMRTE and its founder, Chrissie Katundu, have received various awards, including a Trade and Industry Award in 2003, Top Budding Women Entrepreneur Award in 2005, and Global Entrepreneur Award at the United Nations in New York in 2005.

For further information, contact Daniel Sandifolo ([dsandifolo@gmail.com](mailto:dsandifolo@gmail.com)).

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## Tambi Maker, United Republic of Tanzania

Tambi is a local snack made of cassava and ndegu flour. It is usually prepared using a handheld mill/press and takes up to two hours to make 1 kilogram. With a grant and training from Land O'Lakes International Development, Christina Lyombo designed a tambu maker that takes only 15 minutes to make 1 kilogram of the popular snack. It consists of a stove positioned beneath a cooking pot filled with enough cooking oil for deep frying. Above that, held on a stand, is an aluminium pot with a perforated bottom. A plunger is used to press the tambu dough into the perforated pot, from which thin strands of the dough extrude and drop into the hot oil below. Christina sells tambu makers to women and women's groups.

For further information, contact Christina Lyombo (+255787-10-7922).

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