Innovative household composting technology

Innovator, Tulasa Gyawali, with the improved compost chamber she has developed.

Credit: Basanta Rana Bhat

Tulasa Gyawali is an active innovator from Bharatpur-10, Chitwan in Nepal. She has developed an 'improved compost chamber' that has significantly contributed to household-level solid waste management and environmental sustainability. Her low-cost, practical, and community-friendly composting technology has not only addressed the challenges of organic waste in urban areas but also empowered households and communities toward better sanitation, income generation, and urban farming. Initially, Gyawali designed the improved compost chamber herself, based on the compost bin she was using at the time for composting kitchen waste. Later, she got support from an engineer to refine the design of the improved compost chamber.

The improved compost chamber, which is 2 m long, 1 m wide and 1 m high, is constructed using easily available materials such as cement, sand, bricks, and reinforcing iron rods. The walls are constructed of porous brick to allow for optimal aeration, and the chamber has a lid that also allows airflow'. The porous design accelerates the composting process by maintaining proper aerobic conditions. The chamber is also easy to manage and suitable for compact urban spaces.

Within one month, the chamber can be filled to capacity with organic waste generated by a family of ten members, demonstrating its capacity and practicality for medium-sized households. Gyawali's innovation shows efficient rates of decomposition, with only 25% of the initial waste volume remaining after complete decomposition. To make the process faster and more efficient, 50 grams of well-decomposed compost is added for each 5 kilograms of fresh organic waste as a biological starter. About three months is required for complete decomposition of organic solid waste from the kitchen. This innovation is designed to be a continuous feeding system so it does not require multiple bins for a household. From three months after starting to fill the chamber, she is able to collect decomposed organic matter from the bottom of the chamber, while continuously feeding in kitchen organic waste from the top.

The improved compost chamber has been widely shared and/or demonstrated through articles in local newspapers and brochures; community meetings, workshops, and training sessions; learning visits and exposure programmes. It has also been promoted by Bharatpur Metropolitan City across different wards and clusters for improved solid waste management. These efforts have helped replicate the technology in many communities and have strengthened local waste management systems.

The effectiveness of Gyawali's innovation has led to recognition within her community of her leadership capacity as well as her creativity. She has received numerous awards, including the Prize for Women's Creativity in Rural Life by the Women's World Summit Foundation (WWSF) and First Prize in the National Innovation Fair. She continues to receive requests for technical guidance from various sectors and is widely recognised as a resource person for waste management. Her expertise has been sought for training, demonstrations, and community capacity-building events.

The innovation has also positively impacted the broader community. The composting of organic waste has improved the cleanliness and sanitation of homes and the broader community, reducing foul odours, pests, and environmental pollution. The conversion of waste to compost has promoted organic kitchen gardening and provides opportunities for income generation through the sale of compost or through the production of fruit and vegetables. Communities influenced by Gyawarli's

Rooftop gardens making use of compost from the improved chamber.

Credit: Basanta Rana Bhat

innovation are now independently managing solid waste at both household and neighbourhood levels, showing that people are taking collective responsibility. Furthermore, local groups have conducted training on waste management, income-generating activities, and community development, while schools have also benefited through educational programmes supported by the groups.

This example of local innovation shows how community members can develop practical and affordable solutions to challenges that they are experiencing. The leadership and dedication of innovators such as Gyawari continue to inspire communities toward greener and healthier living.

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Locally made fertiliser: an innovation from Gamphahlele, South Africa

Considerable food crop losses in smallholder farming systems of South Africa are usually linked to inherently low soil fertility and pests and diseases. One way of improving crop yields is through the use of synthetic fertilisers. However, the cost of synthetic fertilisers makes this option unattractive to resource-poor smallholder farmers. The Limpopo Prolinnova Task Team (LPTT) visited Mashite village, a rural community situated in the Ga-Mphahlele area of Limpopo Province to explore innovations developed by resource-poor farmers to deal with the challenges they face in their homestead farms. The LPTT includes representatives from the Limpopo Department of Agriculture and Rural Development (LDARD), the University of Limpopo, the University of Venda, and the Eastern and Southern Small-scale Farmers Forum of South Africa. During their visit, the team identified this innovation implemented by a local farmer to improve crop productivity. It was discovered as part of the ELI-FaNS project ("Expanding the Promotion of Local Innovation for Food Security and Healthy Nutrition to Strengthen Resilience with a Focus on Women") coordinated by the Institute of Natural Resources (INR) and supported by Misereor.

The innovation, which has been developed by a smallholder farmer, Mr Makgati, involves mixing manure from different types of livestock to improve soil fertility and crop yields. He has been using this innovation since 2017. The innovation emerged after he lost his job, when his spouse encouraged him to use the home yard for farming. During discussions with members of the LPTT, Mr Makgati explained that vegetable crops generally require generous applications of synthetic fertilisers to achieve good yields but that it is difficult for him to purchase fertilisers because he is unemployed and has no access to credit or other financial resources. This situation encouraged him to look for low-cost alternative strategies to improve soil fertility and subsequently crop yields. He remembered that during primary schooling his principal taught them how to plant using animal manure. Mr Makgathi started using cattle manure to replenish nutrients lost from the soil through crop harvest. However, when he observed the growth of his crop, he realised that using cattle manure alone

Mr Makgati's tomato production using a mixture of manure from different livestock.

Credit: LDARD Team

was not giving results that compared with synthetic fertilisers. He then came up with the idea of mixing manure from different types of livestock to improve vegetable yields.

Mr Makgati hoped and believed that by mixing three different types of animal manure (in his case goat, sheep and cattle manure), the homemade natural fertiliser would be more effective. He collects manure with his light delivery vehicle (known locally as a bakkie) and prepares the natural fertiliser. To date, he has not been measuring the quantity of each manure in the mixture, but even without standard application rates, this innovation has already shown promising results in terms of improving his crop yields. While he has not yet shared the innovation widely within his community, he pointed out that adopting the practice is relatively simple because it requires only the collection of different types of manure, which can be sourced locally from livestock owners. Even for his own farming activities he has had to rely on sourcing cattle and sheep manure from neighbouring livestock owners at a small fee as he only keeps goats.

There is ongoing joint experimentation involving members of the LPTT and Mr Makgati, which is exploring the effect of different combinations of manure sources on plant growth and productivity. In time, the team plans to assess the mineral nutrient content of his homemade fertiliser. This case demonstrates that farmers effectively innovate to solve challenges, and can be supported by other stakeholders such as researchers, extension staff and academics to design trials that assist them to make sound decisions.

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Use of *Ficus* fruit powder to increase sorghum productivity

The arid rural regions of Mali are characterised by the challenges of climate change and low productivity of staple cereals such as sorghum and millet. Researchers recommend the application of the fertiliser diammonium phosphate (DAP) in a microdose of 30 kg/ha to help farmers improve their cereal yields. In a context of limited financial resources to access chemical fertilisers, innovative farmers are developing their own solutions. This is the case with Mr Nanou Coulibaly from the village of Tongouma/Monimpé, Niono district, Ségou region, who developed a local innovation that uses powder of the fruit of the Ficus *gnaphalocarpa*, locally known as Tôrôgongon, to increase the productivity of millet and/or sorghum. Ficus *gnaphalocarpa* is known by many communities for its medicinal and nutritional properties, which is why the innovator used this plant. He used a little water to mix the required amount of powder with the sorghum seed just before planting and reported satisfactory increased yield.

This local innovation was identified and documented through a project titled "Improving food and nutritional security and the resilience of rural populations to climate change through farmer innovation in the Ségou, Mopti, and Dioïla regions", known as PROFEIS-Mali Project, under the umbrella of Prolinnova Mali.

The local multi-stakeholder platform (MSP) in Ségou, constituted of local

NGO staff, researchers and farmer innovators, selected the local innovation for participatory innovation development (PID), a farmer-led joint-experimentation process to evaluate and validate the local innovation. Involving key agricultural and research development stakeholders in the joint experimentation was also a way to move towards mainstreaming the PID approach. This will also help to share the best options using the powder of the fruit of Ficus *gnaphalocarpa* to increase sorghum productivity with a larger farming community and to improve subsequent living conditions of these low-income farmers.

As the farmer had not been systematic with testing application rates, he was unable to indicate the optimal quantity of powder to be used for a given quantity of millet/sorghum seed. Since the innovator's rate was approximately 40 g powder per kg seed, the MSP members together with the farmer innovator agreed on testing four application rates, which were 20 g, 40 g, 60 g and 80 g of powder applied to a kilogram of sorghum seed, mixed in a small amount of water. These application rates were compared against the researcher recommendation (30 kg/ha of PDA as a microdose) and against "the control", which had no powder or fertiliser applied. Each plot consisted of four rows of sorghum, each 5 metres long, the rows spaced 0.75 metres apart and with the sorghum seed planted 0.50 m apart along the ridges.

All the plots where the sorghum was treated with the Ficus powder proved to have higher yields than "the control" showing that the powder was beneficial. For example, the highest grain yield for sorghum was 829 kg/ha, which was for the plot where the application rate was 80 g/kg. The grain yield for the control plot was only 496 kg/ha. The two higher application rates of the Ficus powder gave grain yields higher than those obtained using the researcher recommendation.

The results validated the local innovation in terms of its effectiveness in increasing the sorghum yields of small-scale farmers and were also useful in determining the optimal application rate. These results were shared with community members at the local innovation fair. Through the joint research process that involved members of the MSP together with the farmer innovators, it was found that the application rate of 60 g of powder mixed with 1 kg of sorghum was the most efficient option. Furthermore, this highlighted the importance of collaboration between actors through the MSP for the promotion of the PID approach.

Farmer experimenter Souleymane COULIBALY from Cinzana village in Mali showing the sorghum from the experiment conducted in the rural commune of Cinzana-Gare, Ségou Region.

Credit: Seni Coulibaly

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