When Jean de Dieu Twagirimana, resident of Cyuve, a nested village in Northern Rwanda decided to start recycling human urine into organic fertilizers in 2019, his main ambition was to distribute a cheaper product for local farmers aiming at improving their agricultural harvest.

In this remote rural area, a kilogram of urine aided fertilizers sells at Rwf100 ($0.1 USD) compared to some Rwf700 ($0.1 USD) for chemical fertilizers which makes it much more affordable for local smallholding farmers

Recycled human urine is being used by a homemade plant as a fertilizer with low risk of transferring antibiotic-resistant to the environment in Musanze, a remote rural district in Northern Rwanda.

Urine is made up of 95% water and 5% waste products. Human pee is rich in the ingredients commonly used in commercial fertilizers such as potassium, phosphorus, nitrogen, and traces of other nutrients needed for crops and plants to grow.

According to the Stockholm Environment Institute, a person can produce as much urine per year to fertilize 300-400 square meters or roughly 3200-4300 square feet of crops

Twagirimana’s innovation is creating also new incomes for locals, where the neighbouring communities sell a 20-liter container of urine at Rwf1,000 (USD $1). Twagirimana says the new recycling plant is now giving an added value from the waste that was useless in the past.

The process which normally takes up to 2 days maximum starts by mixing fresh urine collected and stored with other organic waste that comes from either an animal or a plant such as rotten vegetables and fruits, to make good fertilizers. Some of these organic wastes are mostly collected by residents from households, markets, and landfills in these rural areas.

A jerrycan which is normally used to hold 20 litres is mixed with 500 Kg of organic waste before being applied as effective fertilizers with a proportion of least 4 kg/acre.

“This method has proved to improve the soil long after the plants have taken the nutrients they need,” says Helen Mukangwabije a maize grower from Burera, a

district in Northern Rwanda.

Yet the demand is not higher in this remote rural region, Twagirimana is able to sell 5,000 Kg of processed urine fertilizers to local smallholder farmers at an affordable price per planting season.

In the last agricultural season C 2022 which ended in August this year, 72 farmers have purchased urine fertilizers compared to 46 orders in the previous season.

Smallholder farmers in remote rural Rwanda confirm the efficacy of organic fertilizers.

Farming solution

Until recently in Rwanda, the demand for additional fertilizer sources was low since agricultural land was generally fertile and farmers practiced land consolidation. The total arable land is about 1.4 million hectares, which is 52 per cent of the total surface area of the country, according to official estimates by the Ministry of Agriculture

Whereas handling human waste is often surrounded by cultural norms and taboos,

which restrict its use in agriculture, Twagirimana is convinced that to this farming solution is to adopt appropriate collection and storage systems.

“Urine fertilizer has proven to be a potential solution to soil productivity problems in this area”, he said during an exclusive interview with Rwanda Dispatch.

Vestine Musanabera, a smallholding resident in Musanze sold 40 jerricans of urine in the last two months since the demand started, thus taking home Rwf 40,000 (USD$40).

Behind several homesteads in this remote rural area, urine is collected using basins and stored in covered containers behind donors’ homes for two weeks in order to protect against pathogens.

urine is collected using basins and stored in covered containers like jerrycans

“Depending on the volume collected, jerrycans which are mostly used as water containers in most of households seems the safest of all of the approaches to keep the urine for long period,” Musanabera said.

“The recycling innovation is now helping us raise income as local communities are

now taking advantage to the waste that was useless in the past," she says.

When Rwandan farmers adapt this homegrown solution, urine is not applied as a foliar spray, as many organic fertilizers often are, but rather directly to the soil near the base of the plants instead. During the processing phase, they only dilute a jerrycan used to hold 20 liters of fresh urine with a small quantity of alkalizing agent to one, mixing only as much as they will use. The urine is stored for at least 6 months in a sealed jerrycans before using it as fertilizer after it was mixed with other organic wastes

Environmental implications

Latest estimates by Rwanda Environmental Management Authority (REMA) indicates that in Rwanda, environmental challenges have not been adequately addressed to allow poor farmers to reliably depend on their own production to support purchase of required inputs such as fertilizers.

An important component of the entire fertilizer business management is the financing, according to the report.

Whereas there are initiatives to provide financing through the Development Bank of Rwanda, the Central Bank, Rwanda People's Bank and several micro-finance banking institutions, small scale farmers facing challenges to take advantage of these arrangements are now trying to use solutions such urine aided fertilizers as a partial and potential solution to soil productivity problems.

As pressure on land is growing in the country, both farmers and agronomists are now seeking appropriate strategies to sustainably produce more on existing farmland.

Apart from fertilizers, a range of soil fertility management methods are practised, including crop rotation, intercropping with nitrogen-fixing crops, composting and crop residue management, in combination with various soil conservation measures.

Fertilizers contain nutrients that play a key role in agriculture productivity, which explains the importance of their timely availability in farming seasons.

In response to these harsh livelihood conditions, farmers in Musanze district have increasingly begun to organize themselves to use organic fertilizers produced locally such as the newly established recycling plant.

The move is expected to switch from generic to tailor-made fertilizers as part of the efforts to reduce the cost of fertilizers, as well as boosting agricultural output and farmers' income.

Fertilizer uptake is still 'very' low in Rwanda considering the needed quantity per hectare to increase productivity.

The Rwandan government seeks to increase custom-made fertilizers use to 75 Kilogrammes per hectare up from the current 46 kilogrammes.

According to Dr Charles Bucagu, Deputy Director General in charge of Agriculture Development at Rwanda Agriculture and Animal Resources Development Board (RAB), establishing a domestic fertiliser plant is key to boost custom-made fertilizers in the country.

Human urine is composed primarily of water (95%). The rest is urea (2%), creatinine (0.1%), uric acid (0.03%), chloride, sodium, potassium, sulphate, ammonium, phosphate and other ions and molecules in lesser amounts.

Environmental experts say that the most nutrient-rich part of wastewater is human urine, which makes up less than 1% of the total volume but contains 80% of the nitrogen and 50% of the phosphorus.

The recycling processes

After collecting large quantity of urines, the next step consists of evaporating the water from urine to keep the valuable nitrogen which is in the form of urea, a chemical that is used as the world's most commonly applied nitrogen fertiliser in Rwanda.

Using this technique, Twagirimana's new plant has developed a process using alkalising agent, a chemical product that reduce the volume of urine and transform it into solid fertilizer.

Urine makes a great fertilizer where by one liter contains approximately 10 grams of nitrogen, 2 grams of potassium, and 1 gram of phosphorus, plus other minerals needed by the plant.

To use the fertiliser, the two existing machines mix it with water in the ratio of 200 milligram of manure to 20 litres of water instantly. This can spray an acre of land.

The mixture is put in a pump and sprayed on the crops.

Until recently there has not been any support from government or local administration but farmers like Twagirimana is now trying to take advantage of the new practice by collecting large volume of urines and provide a containment area large enough for process fertilisers.

“The only challenge is about storage means for processed urine which has to be used the same day it is made,” Twagirimana says.

Now farm growers like Vincent Havugimana, the President of the Federation of Irish Potato Farmers’ in Musanze is convinced that organic farming, using urine to make fertilizer is becoming increasingly popular in this remote rural area amid growing concerns for food safety.

“Using chemical fertilizers has been most of the time causing the soil to harden and degrade, but the organic manure from urine is slowly helping the land regain nutrients,” says Havugimana who has been using urine fertilizer on his farm since last year.

Although there is now scientific evidence to support claims that urine can be used as a fertiliser considering its composition of nitrogen and phosphorus two chemical products which have been used for generations to help plants grow, health experts warn the higher risk of infection during urine collection.

While across these remote rural areas in Rwanda, the large quantity of urine is collected in jerry cans, Dr Claude Ruhamyambuga, a medical doctor in Musanze stress the need to adopt the urine collection method which limits contamination.

Meanwhile, Laetitia Mukangwije, a smallholder farmer from Burera, another district in Northern Rwanda takes into delight to notice that the prices of fertilizer mainstays of major crops cultivation in this mountainous highland, have never been lower than before in the area.

“In the past, farmers were sometimes forced to leave their crops to rot, but the new locally made fertilizer is now vital part for most farmers,” Mukangwije said.

The mother of six was able to effectively use fertilizers made from urine to increase her crop production. She said that since adopting new farming method, she has

generated a slightly higher income than she did when using inconsistent chemical fertilizers.

As crops typically respond positively to nutrient inputs, the 52 years-old mother, grower of climbing beans has been able to apply organic fertilizers in amounts recommended by the district agricultural extension services.

In the last agricultural season, she planted 25 kilos of an improved variety of seeds on one-acre piece of land.

“The use of this kind of fertilizers has resulted in high farm productivity, and I was able to harvest 150 Kilos of beans compared to about 60 Kilos before,” she says.