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Farmers in Nepal Use Urine to Boost Crop Yields

New toilets allow villagers to collect urine to use as fertilizer

By Smriti Mallapaty and Environmental Health News | Monday, December 17, 2012

SOTANG, Nepal – A two-day's walk from the nearest road, over the hills and valleys below Mount Everest, farmer Budhiman Tamang loads a basket of cabbages to take to the weekly market. His cabbages are double the average local size, and since cabbages are sold by the kilo, they double his profit, too.

Two years ago, Tamang couldn't even grow enough cabbages to sell. But since then, he's learned the magic of human urine.

"This is not a cabbage! This is Budhiman!" he declares, lifting a heroically-sized round to the skies.

The Dzi Foundation, a Colorado-based non-profit, along with a local non-governmental organization, started a project last year to build over 1,000 toilets for the nearly 6,500 residents of Sotang, a village in Nepal's northeastern district of Solukhumbu. Each family was offered the choice between a regular squatting pan and a dual-hole pan that collects urine in a separate basin, called an 'ecological sanitation,' or ecosan, toilet. Not given to shying away from new things, Tamang was one of the daring few to opt for the latter: collecting urine to use as fertilizer.

In less than a month, his family of five had filled the 60-liter urine-collection tank. Tamang then had to suppress any urges of disgust to experiment with the golden nutrients on his 500-square-meter vegetable patch.

That year, he made the equivalent of $252 U.S. dollars (NPR 22,000) selling cabbages and cauliflowers, significantly increasing his income. He invested half the amount in shares for a micro-hydro plant that would bring electricity to his locale, and used the rest to buy seed and deposit in a bank for his children's education.

Dr. Roshan Shrestha of UN-HABITAT inaugurates urine bank in Siddhipur, Nepal.
Image: Flickr/Sustainable sanitation

Benefits and Risks

Urine contains mostly water, mixed in with nutrients that plants can quickly and easily absorb. It is often compared to the nitrogen-rich fertilizer urea, except in liquid form and cost-free.

Separating urine at the source saves resources that would otherwise be disposed of as waste through expensive sewage treatment systems.

By replacing mineral fertilizer with urine, farmers also can slightly offset their carbon footprint, and reduce the need for phosphorous

found in reserves that are being depleted. In countries like Nepal, where the supply of mineral fertilizer is limited, urine offers an accessible alternative.

There is nothing new about the use of urine in this region. Among others, farmers of the ethnic Newar community in Kathmandu valley would traditionally pee under their staircases and sprinkle ash on top to later mix into their vegetable garden soils. But as Kathmandu developed, a gradual repugnance rose against such intimate handling of human waste, and new flush toilets secured the sensation.

Efforts in the last decade to re-link urine with agriculture have been backed by sounder science, and particular attention to hygiene.

In 2006, the World Health Organisation (WHO) published four volumes of guidelines on the safe use of wastewater, to which Caroline Schönning, a microbiologist at the Swedish Institute for Communicable Disease Control, contributed.

Urine poses negligible health risks, except in the case of accidental contamination from fecal pathogens, Schönning said. To prevent these pathogens from entering food, WHO proposes a series of behavioral barriers – from separation of urine at the source to applying urine only on soils and not on leaves, prioritizing crops that will be cooked and sanitary handling in the kitchen.

Traces of medicines and hormones that leak into the environment through urine is a concern, says Schönning, but "we don't see it as a big problem." By applying pee on soil, as opposed to circulating it through wastewater treatment systems, we pose "less risk to the environment because there is more degradation in the soil and no exposure to fish and other animals."

Where further research is needed, points out soil scientist Janardan Khadka at Nepal's Central Horticulture Centre, is on whether continuous urine application will affect soil fertility in the long run. The high salt-content in urine could turn soils alkaline, making it harder for plants to access nutrients, said Khadka. The phenomenon is yet to be observed in the field.

Slow uptake

Projects to promote the application of urine in agriculture have spread worldwide over the last decade: from pee collection and transport systems designed for 6,500 users in urban Ouagadougou, Burkina Faso; to research on the application of human urine for carp fish farming in West Bengal, India; and more than 135,000 toilets diverting urine in Sweden.

Still, uptake has been slow.

The biggest challenge in urban settings is collecting and transporting all those sloshing liters of urine to the farmer's fields.

"If an individual produces an average of two liters of urine a day, in a family of six that makes 12 liters a day and 84 liters a week, which is a huge volume, especially if you have to account for three to four months of storage time," said Prajwal Shrestha, program manager at the Kathmandu-based Environment and Public Health Organisation.

"People are scratching their heads over how to arrange collection systems for those families who don't want to or don't have the capacity to use urine and feces on their own," added Anna Richert Stintzing, a consultant for the Stockholm Environment Institute in Sweden, and lead author of a urine and crop production guide published in 2010.

Researchers are now looking into the possibility of solidifying the valuable phosphorous available in urine, or using urine to fortify compost.

Schönning adds that sewage infrastructure in many cities is already built to transport mixed urine, feces and water to large treatment plants which would require a major investment to change. For these reasons, Stintzing sees urine fertilization as having the most potential in rural settings, where the technology can also contribute to food security and sanitation. She said its promotion should focus on local awareness-raising through demonstrations, and the involvement of "farmers in the planning and implementation of sanitation

systems."

From spinach to turmeric

The way farmers in Sotang have caught on to the new fertilizer illustrates how far such local efforts can really go.

In early 2011, the local Solukhumbu Development Society (SDS) and the Dzi Foundation organized four whole-day training sessions for almost 150 farmers, informing them on the proper application and benefits of urine. They also set up a research and demonstration farm site, prepared training manuals and videos, and supported 11 key farmers to take the lead on agricultural innovations.

Marijn Zandee, technical advisor to the Dzi Foundation, describes how people used to stick marigolds in their noses to block out the offensive smell, but in the course of a year have moved from hesitation to habituation.

Where 37 percent of households chose urine-separating toilets in 2011, almost 65 percent opted for them in 2012, with more expected in 2013. Those who opted for the regular toilets have started voicing regret, some even using makeshift containers to collect their urine, and others have considered purchasing an ecosan pan from their own savings.

Farmers have gradually diversified their palette, experimenting with corn, finger millet, squash, tomato, banana, guava, chilli, cauliflower and cabbage.

"We have created the demand for urine through vegetable production," Zandee said.

Families may not produce enough urine to apply on their staple crops, but Zandee has set his stakes on relatively valuable crops in small kitchen gardens.

Dhan Bahadur Basnet, SDS social mobilizer and the first to test claims of the profitability of urine in Sotang, started with spinach. The spinach grew faster and greener, and when cooked, tasted softer and more flavorful. Initially he would offer the spinach to his visitors and ask for their opinion, without telling them of the secret ingredient. Then he tried it on tomatoes, an uncommon fruit in the village, selling up to $460 U.S. dollars (NPR 40,000) worth, or double the average annual income in Sotang – in one season alone.

Word soon spread of his gains, and other farmers started following his lead.

This year, his garden is full of round chillis, kilos of which get carried four days by foot to the Namche bazaar to satisfy the Sherpa communities' appetite for spice. His dream for next year is to use urine to grow turmeric, an herb now imported from India. There's no telling, he said, how far he can go.

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