

South African ‘fly farm’ recycles food waste nutrients

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Animal nutrition expert Elsje Pieterse says livestock feed made from maggots could reduce both large-scale and small-scale food waste.

“I was born in Namibia in the middle of a drought, so every drop of water is essential to me,” says Elsje Pieterse, sitting in her office at the University of Stellenbosch in South Africa, where she teaches animal management science and nutrition.

Pieterse’s career-long quest for ways to break down waste without using landfill sites, which can contaminate the water table, led her to a surprising resource: maggots, or fly larvae. More than 20 years ago, Pieterse became passionate about the promise of recycling nutrients by harvesting insects as a protein source for livestock. Until recently, though, the easy availability of cheap fishmeal and soy made it impossible for her to find a financial backer for her pet project. “Only when the resources started running out [did] they notice that there was a need for it,” says Pieterse, who holds a doctorate in



Elsje Pieterse

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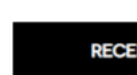
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Food waste:



10 new tools

“ It’s a very palatable product, the black soldier fly maggots.”
— Elsje Pieterse

Entrepreneur Jason Drew saw that need, and when his call came in 2007, Pieterse was ready for it. In 2009 Drew helped found Cape Town-based AgriProtein to develop large-scale, sustainable sources of natural protein. Today, Pieterse is on the company’s advisory board and leads its animal nutrition research. AgriProtein’s first industrial-scale factory, a “fly farm” north of Cape Town that harvests fly larvae raised on waste nutrients, broke ground in May 2014, and two sites are scheduled to be operational by 2015.

High-flying farm work

AgriProtein has focused on flies because the insects have the same chemical composition as fishmeal, says Pieterse. Fly larvae in the company’s giant “fly cages” dine on biodegradable waste originating from human food production, such as vegetable peelings and pig intestines, for several days before being harvested, quickly washed and dried, and then milled and bagged. The resulting MagMeal product is a shelf-stable, protein-rich feed for fish, pigs and chickens, with a price tag comparable to that of other animal feeds with similar nutrition concentration.

Pieterse says her team originally started with the ordinary house fly, *Musca domestica*, but it proved to be too difficult to harvest. Switching to the black soldier fly, *Hermetia*, resulted in the best yields and the fewest complications, with the larvae efficiently breaking down food waste within days.

Currently the researchers are testing eight types of insects (including flies) at the lab farm, and all of the neighboring food producers—vineyards, bakeries—have become potential suppliers of nutrients through their food waste.

To extend AgriProtein’s product range to meet the needs of other farmers, Pieterse says the researchers recently finished trials of feed designed for ruminants such as cattle, and an ostrich study in South Africa’s Karoo desert is expected to start in October 2014. Aquaculture farmers have shown the most interest in the maggot-based feed so far, but as AgriProtein scales up production, it plans to enter the feed market for other animals too.

Insects with good taste

In this era of food transparency, will consumers reject maggot-fed chicken because of the association with rotting meat, or embrace it as a closed loop solution that happens to taste good?

“Generally, people initially go, ‘eww.’ And then if you start speaking about it, they say they’d never thought of that,” says Pieterse, adding that many people around the world already are open to skipping the middle man, as it were, and eating insects directly. “They are more reluctant about maggots, which is understandable. But the crickets, the mealworms, even the cockroaches—people are willing to try.

“It’s a very palatable product, the black soldier fly maggots,” she adds. “I haven’t seen a single animal which does not naturally start consuming them. I’m one of those people who has eight species of pets in my house. The cats, the dogs, the monkey, the geese, the ducks, the rabbits—everything starts consuming [the maggots].”

In fact, chickens raised on the larvae meal produce meat with a higher sustained juiciness value than fishmeal-fed birds, according to a sensory panel done at the University of Stellenbosch’s food science department

Healthy people, healthy communities

The concept of nutrient recycling also holds promise for small-scale food waste solutions, says Pieterse. Last year, AgriProtein won the **Innovation Prize for Africa** along with \$100,000, in part because of the value the project offers to small-scale farmers and local communities.

For example, AgriProtein's nonprofit leg, **Biocycle**, has been piloting a project in the rural South African town of Klipheuwel. "All the waste that comes from the community, as well as the sewage, goes into a production system with the black soldier fly," Pieterse says. "We're busy finalizing the food safety trials now, and we should have answers in five or six months. It's very promising.

"If you enhance sanitation, you enhance the health of the community," she adds. And in terms of food security, the larvae that are produced from the sanitation process go into the production of eggs and meat (through animal feed), which increases the nutritional status of the community.

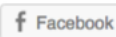
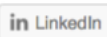
Maggot-fed chicken also produce meat with high iron content that can help prevent anemia, which is prevalent in Africa.

On a larger scale, Pieterse is hopeful that providing farmers with both a method of waste removal and a more affordable protein source will bring down production costs and ultimately mean more affordable meat prices.

"The animal science world is working very hard on reducing the footprint of animal products," says Pieterse, who predicts that animal products will be a major part of people's diets in 2050 because a little can go a long way. "If you look at the nutritional composition of an animal product versus, say, a vegetable, it's much more concentrated. You have to consume less to get the same amount of nutrients—especially protein and energy."

She also believes insect protein will play a larger role in the decades to come because of its sustainability and high productivity. "It doesn't emit greenhouse gas, except for a bit of carbon dioxide and ammonia, which can be harvested and returned into the system," says Pieterse.

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Rebecca L. Weber is a journalist based in South Africa who covers social justice, health and food, often with a sustainability and/or business angle. She writes for *CNN*, the *New York Times*, *USA Today*, and many other publications.

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