

A COMPOSTING MACHINE BASED ON SOLAR ENERGY: AN AGRO- ECOLOGICAL BOOM



Researchers at the Universidad del Rosario invented a machine which transforms two species of invasive plants that cause environmental harm into compost for crops of onions, potatoes and strawberries. It is a pioneering effort in Colombia.

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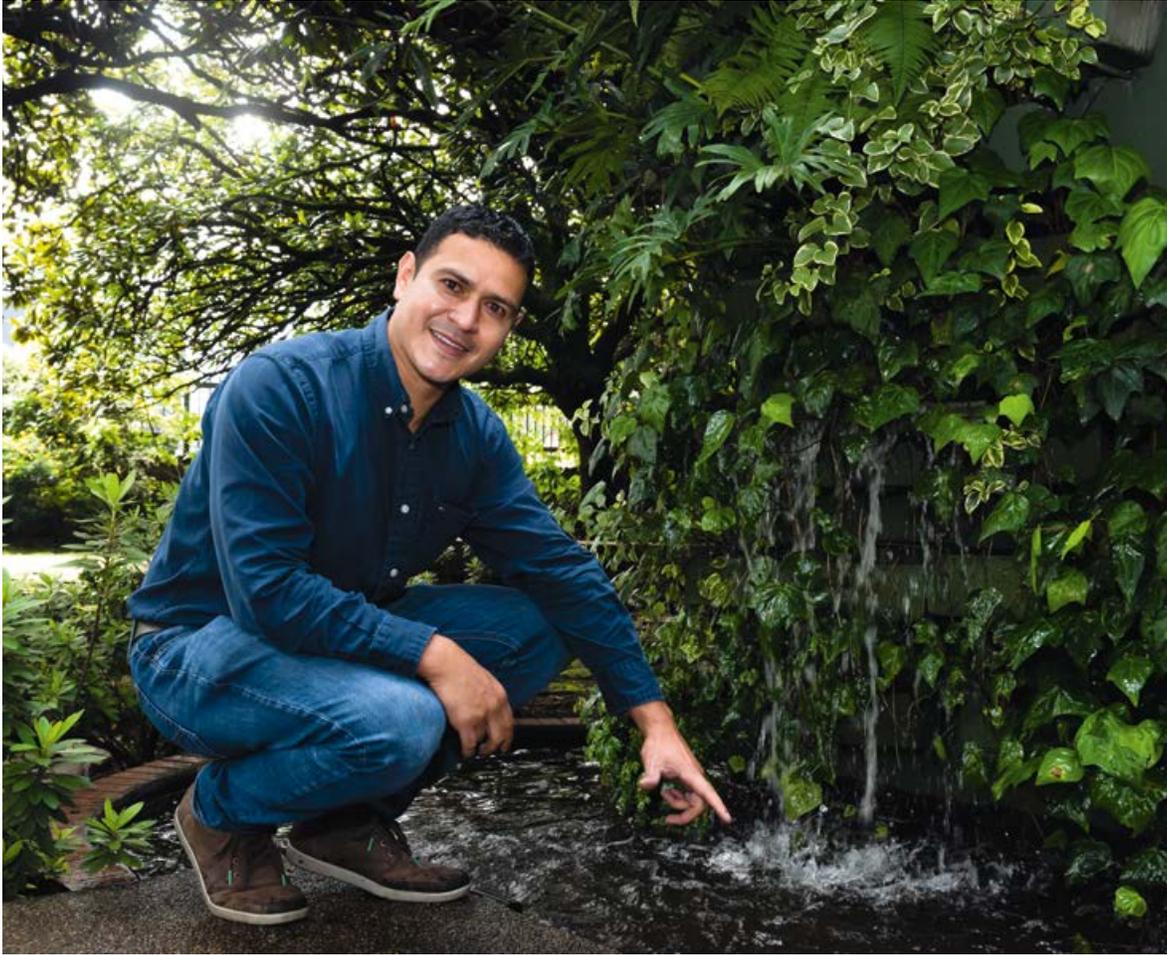
An informal chat between a physicist and an ecologist over a cup of coffee was the start of a solution to environmental problems in the form of a new composting machine, which works with solar energy and is unprecedented in Colombia. What triggered this invention, which will not only benefit the environment but Colombian agriculture as well, was concern about the environmental harm done by two species of invasive plants, which grow on the shores of lakes in the surroundings of Bogotá and whose vulgar names are *helecho* (fern) and *junco de agua* (water rush/reed). Their botanical ones are *Azolla filiculoides* and *Typha latifolia*, and when they are cut for land restoration projects, they leave residues and bad odors, with a proliferation of vectors.

The researchers are the physicist Fredy Mesa and the ecologist Francisco Escobedo, professors at the Faculty of Natural Sciences and Mathematics of the Universidad del Rosario, who joined forces and combined their knowledge to do the job. “We formed a team to find a solution to a local problem with technology. We already had an initial idea and Francisco guided us in how we might come to use a product which is usually thrown out,” Mesa relates.

For professor Escobedo, there were evidences that the decomposition of these plants acted normally when they were composted, a situation which led them to think of using this product and speeding the process up in order to turn it into fertilizer. With the support of the physicist Mesa and due to the limited electricity supply at the *laguna Chocolate* (lake) in the municipality of Une, where the study took place, they resorted to a clean and efficient modern system, solar energy, that is, the use of photovoltaic panels to enable the system to operate, which is economic and environmental-friendly.

One of the limitations which small farmers in Colombia face when it comes to producing compost – a product which supplies key nutrients to their crops – is precisely the lack of electricity. Therefore, most of them make compost manually, which requires a lot of time and a strong physical effort.

“Our aim was to eliminate the small farmer’s need to rotate a drum in a mechanical way. Basically, we began by thinking about



“We formed a team to find a solution to a local problem through the use of technology,” explains Fredy Mesa.

the kind of bio-reactor that would be needed, what the system would be like – the chamber the material would be put in – and what would be needed to avoid moving it by hand, that is, how to install some automatic casters or rollers which would be able to turn that drum, which we call the bio-reactor,” professor Mesa explains.

So, after thinking about it and doing studies and tests, the machine was invented, which they plan to patent, and according to their estimates, it will have a useful life of up to 25 years, so long as its mechanical systems are subjected to maintenance on a regular basis.

An environmental solution which helps agriculture

The *Azolla filiculoides* and *Typha latifolia* plants, which served as the inputs for this study, grow in lakes and wetlands and are classified as invasive because they affect the quality of the water and environment where they spread. Paradoxically, they are no longer regarded as a problem because they have turned into a double solution.

The procedure for obtaining a patent generally takes two years. The application has already been made, thanks to a competition, sponsored by Colciencias, which the researchers won. After that, it will be scaled up to industrial standards and then the machine can be commercialized. It is estimated that that will happen in around three years.

The researcher Escobedo explains that when these two species are dug up, the organic material which is being degraded becomes a potential danger for the environment, because it emits a large amount of carbon dioxide (CO₂), which causes grave atmospheric harms and leads to an increase in global warming. “This machine allows to close the carbon cycle with regard to greenhouse gas-effect emissions. We reuse that organic material, the result of restoration projects, so that other plants may grow and capture the CO₂. To sum up, we are talking about a solution for ecological restoration,” he remarks.

The problem is that alarming amounts of carbon dioxide are annually emitted in the world. During the U.N.'s Annual Conference on Climate Change last year, the Global Carbon Project and the University of East Anglia (United Kingdom) revealed that there was a 2.7% increase of such emissions in 2018.

In the case of Colombia, a study, made in 2016 by its Institute of Hydrology, Meteorology and Environmental Studies (Ideam, in its Spanish initials) and the United Nations Development Programme (UNDP), reported a 15% increase in CO₂ emissions in the past twenty years. At that time, Bogotá was responsible for 10.58 million tons of CO₂ (MTON).

These data show the urgent need to work with science to reduce environmental impacts and highlight the importance of this machine, which will reduce the greenhouse gas-effect and, at the same time, produce compost through clean technologies.

The compost which is obtained by this system can be used on crops of potatoes, onions and strawberries. "We made an analysis of the two plants and found that they had nutrients which are used to fertilize products in the region, which was perfect for us to advance," says Escobedo. It is worth stressing that 37% of the potatoes in Colombia are grown in Cundinamarca, (the Department where the plants were studied): It is one of the leading crops in Colombia, with 2,690,585 tons grown in 2018, reports the Colombian Ministry of Agriculture.

In this case, it is as though science were knocking on the doors of the community. It means that technology is entering into the homes of many small farmers who currently must pay for the transport of agrochemicals, which are sold in Bogotá, about two hours by road from the town of Une. Once they have this machine in their houses, they can produce their own compost.

With this invention, the process for producing compost, which usually takes six months, can be done in only six weeks, which will boost their earnings and overall efficiency. "We are reducing the process by thirty weeks, and that means saving a lot of money. You don't have to use trucks to transport the material, everything is local and it can be used on the crops in the region," the researcher Mesa stresses.

A pioneering machine

This machine, which is on the point of being put on the market, is a landmark in the development of a new technology in Colombia. "There is still not a system in the country which works with motors run by solar energy and with micro-controllers, electronic systems for the supply of oxygen and the measurement of temperature and PH, which are sent via a data logger. There is no system that is autonomous and produces these highly feasible results in accordance with the Colombian norm which regulates these kinds of products," professor Fredy Mesa points out.



"This machine allows to close the carbon cycle with regard to greenhouse gas effect emissions," Francisco Escobedo remarks.



With the help of physics, the researchers dealt with the problem of the limited electricity supply at the *laguna Chocolate* (lake) in the town of Une, Cundinamarca, where they undertook their research and resorted to a clean, modern and efficient system – solar energy – with the use of photo-voltaic panels which operate the system in a way that is economical and friendly to the environment.

The procedure for obtaining a patent generally takes two years. The application has already been made, thanks to a competition, sponsored by the government's Administrative Department of Science, Technology and Innovation (Colciencias), which the researchers won. After that, it will be scaled up to industrial standards and then the machine can be commercialized. It is estimated that that will happen in around three years.

Once the requisites for its commercialization are completed, the idea is train small farmers so they can operate it in a simple way. While the product has a cost, it would be accessible for such farmers, who would save money in the transport and purchase of agro-chemicals.

The hope is that this machine will serve as a pilot program whose functioning will be replicated in other regions of the country and with other kinds of plants, so that its use spreads to a larger number of crops. "It may benefit many regions, even Bogotá, which, while it has interconnected systems, does not count on fast and efficient methods to produce compost, despite being a mega-city. In addition, we have begun to explore many fields in which physics can collaborate with many ecological and nano-technological projects," Mesa comments.

For now, this physicist and this forestry engineer have promised that they will keep drinking coffee together and discuss the possibility of scaling up projects and uniting different fields of science, with the aim of a country that is more technological but also more kind to the environment. ■