Is coffee’s future carbon-neutral?

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EMAIL

A worker at the Coopedota coffee mill in Santa María de Dota spreads out coffee beans to dry in the sun.

SANTA MARÍA DE DOTA, San José – Some Costa Rican coffee will have a special place at this year's United Nations Climate Change Conference in Durban, South Africa, and not just for stimulating the minds of world leaders.

Coopedota, a coffee cooperative based in Santa María de Dota, in the coffee-producing Los Santos region south of San José, will be presented at the conference as an example of green innovation in the face of a changing climate. In March, Coopedota was recognized as the world's first carbon-neutral coffee producer, a distinction achieved by reducing energy use, improving water consumption practices and generating energy from organic material formerly discarded as waste.

"This is work we've been doing for 15 or 16 years," said Iván Solís, who is in charge of energy cogeneration at Coopedota. "It's not something we were able to do in one year. It is a cultural change."

The coffee bean itself only makes up 18 percent of the coffee fruit. Traditionally, the other 82 percent of the fruit, made up of a sugary membrane, a red outer skin and paper-like pulp, is discarded in the quest for that roast-worthy bean.

Costa Rica has ambitious plans for reducing greenhouse gas emissions. The country aims to be the first carbon-neutral state in the world by 2021. A major component of that is making the agricultural sector, including coffee, carbon neutral as well. Obstacles to reaching that goal are substantial – lack of political will and inefficient and outdated transportation infrastructure are two examples – but the successes realized by Coopedota might be a signpost pointing the way to achieving that goal.

According to data provided by the Agriculture and Livestock Ministry, 37 percent of Costa Rica's greenhouse gas emissions are generated by agriculture. Coffee accounts for one quarter of that percentage and is second only to cattle. In terms of total emissions, the coffee sector accounts for some 10 percent of the country's output, and 20 percent of Costa Rica's total greenhouse gas emissions come from nitrogen-based fertilizers.

Additionally, Costa Rica's 50,000 coffee-producing families, 145 coffee mills, 55 coffee roasters and 60 coffee exporters are already feeling the effects of global climate change. This sector, according to data provided by Coopedota, is experiencing a 2 percent loss in productivity annually due to climate-related events. That's causing a big impact on an industry that makes up about 8 percent of Cost Rica's workforce.

Since 1998, Coopedota has earned its green stripes by reducing its environmental footprint. The overall picture, though, is informed by a clever understanding of coffee consumer habits and an awareness of how to capitalize on environmental issues. The idea is called eco-competitiveness, a way of balancing coffee buyers' desire for environmentally responsible java with processes that aid in the overall efficiency of the coffee production cycle.

"Business has soared with a strong demand for our coffee," said Roberto Mata, general manager at Coopedota. "We're not seeing it reflected too much yet in prices, but we're hoping that will improve soon."

Finding the right equilibrium between environmental and economic aspects of coffee production is key, said Hortensia Solís, Coopedota's former sustainability manager, who now works with other Latin American coffee producers. Coopedota is made up of about 800 coffee producers. For the many farmers with families – who are generally a risk-averse group – changes in the way coffee is produced could lead to better returns.

"If there's no economic advantage for the producer," Solís said, "the people aren't going to change anything."

In 2010, according Luis Madrigal, financial officer for Coopedota, the cooperative produced 2.8 million kilograms of coffee. That left 15 million kg of material from the coffee fruit after the beans were removed. In the past, that byproduct would have been wasted, but Coopedota puts it to work.

Dried pulp and husks provide fuel for industrial ovens used to dry the beans, reducing the need for firewood in the ovens.

Organic material goes into a biogas generator, essentially a pit of organic material to which hungry bacteria are added. The bacteria munch on the coffee fruit and emit methane, which is trapped in an expanding bladder stretched over the pit. Still more leftover byproduct is fed through a gasification machine developed by Coopedota with help from the Coffee Institute of Costa Rica. The machine heats the material to high temperatures without actually burning it to create methane.

"The idea is to make a mix of gas from the gasifier [and the biogas bladder] to use to generate electricity," said Iván Solís.

The gas mixture powers a generator that shoots electricity to Coopedota's micro-mills, which are used in processing small batches of beans picked at the very peak of ripeness. These micro-harvests, like specialty wines, fetch a premium price in international markets.

Water used in washing the coffee, mixed with the sweet, sugary membrane – or *miel* – gets the energy-cogeneration treatment at Coopedota by way of an enormous ethanol distillation tower that boils the sugary liquid to generate an anticipated 2,000 liters of ethanol a day. Currently, however, ethanol production is at about 600 liters daily.

"The [distillation] process helps us conserve, be clean and give cheap fuel to our associates," Iván Solís said.

The ethanol is mixed with gasoline, and the co-op sells the fuel mixture to co-op members at a discounted rate.

The Life of Coffee

Almost every step in coffee's life cycle represents an opportunity to make changes that will green up the product and drive down costs for the producer, said Hortensia Solís.

A proposal to create a Nationally Appropriate Mitigation Action (NAMA) for Costa Rica's coffee sector, developed by government agencies, nongovernmental organizations and other climate change mitigation stakeholders, identified four points in coffee's life-cycle when greenhouse gas mitigation action can be taken. The NAMA proposals focus on farms and coffee mills and the stages that produce the most greenhouse gas emissions. There are eight changes identified in the proposal: increasing fertilizer efficiency; increasing shade tree density over coffee crops and reforestation of unused lands; energy reduction in coffee processing facilities – by increasing motor efficiency in transportation and cogeneration of energy at processing facilities; and wastewater treatment.

The coffee sector is Costa Rica's heaviest user of nitrogen-based fertilizers, a major source of emissions. Solís said improving efficiency in just this one facet of coffee production could drive down emissions and prevent producers from over-spending on excessive fertilization.

The NAMA proposal suggests implementation of these eight steps – many of which Coopedota has already put into practice – could increase total coffee production by 5 percent in Costa Rica by 2035. Preliminary calculations also indicate the plan would

reduce carbon dioxide emissions from the coffee sector by 26 million metric tons between 2015 and 2035.

Madrigal, Coopedota's financial officer, said implementing these types of changes at the co-op – treating and recycling wastewater for irrigation, for example – has generated savings to the tune of almost ₡100 million ($200,500) annually.

That's no small change, and it comes from small changes. That is exactly the point for world leaders to take away from Coopedota's presentation at Durban – small changes can have big effects.

Roberto Jiménez, founder of CO2.cr, a climate change advocacy organization that helped in developing the NAMA proposal, said these types of changes could gain traction in the agricultural sector and show the way for other industries to start to change.

"You think, where in Costa Rica can we show the rest of the world that we can really make a difference?" Jiménez said. "This is a new way of thinking and you realize we can't solve [the problem of emissions] today, but we need to start making structural changes today."