

Farmer networks hold key to agricultural innovation in developing countries, study finds

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Farmers in Mexico's Yaqui Valley use a nitrogen sensor to optimize fertilizer application, thus reducing costs and agricultural runoff. Credit: Ivan Ortiz-Monasterio, Stanford University

New technologies can improve agricultural sustainability in developing countries, but only with the engagement of local farmers and the social and economic networks they depend on, say Stanford University researchers. Their findings are published in the May 23 online edition of the *Proceedings of the National Academy of Sciences (PNAS)*.

"Most people tend to think that technology information flows to [farmers](#) through a direct pipeline from scientists, but that isn't true," said lead author Ellen McCullough, a former research fellow at Stanford's Program on [Food Security](#) and the Environment, now at the [Bill and](#)

[Melinda Gates Foundation.](#)

The study was co-authored by Pamela Matson, dean of the School of [Earth Sciences](#) and senior fellow at the Woods Institute for the Environment at Stanford.

To better understand how farmers decide to adopt new technologies, the researchers interviewed growers, farm credit unions and agricultural experts in the Yaqui Valley in Sonora, Mexico – the birthplace of the "green revolution" in wheat and one of Mexico's most productive breadbaskets.

Matson and other Stanford researchers have been working in the Yaqui Valley for nearly 20 years. Among their objectives is demonstrating how science can inform agricultural policy in an area grappling with the kinds of environmental challenges that plague other intensive farming regions.

While Yaqui Valley supplies most of Mexico's wheat, the environmental costs are high, according to the Stanford researchers. Valley farms pollute local drinking water, wreck coastal ecosystems and foul the air with particulates that cause a variety of diseases.

"If scientists want to offer solutions to manage these environmental impacts, they need to understand what influences farmers' decisions about technology and production strategies," McCullough said.

Credit union clout

In Yaqui Valley, credit unions hold sway among the majority of farmers, McCullough said. In addition to providing loans, crop insurance, fertilizer and seed, credit unions have taken over the government's role in providing technical expertise and management advice.

Valley growers also have a long history of working with the Mexico-based International Maize and Wheat Improvement Center, a world-renowned agricultural research center known by its Spanish acronym, CIMMYT.

But interviews conducted for the PNAS study revealed that most farmers take their cues from local credit unions and not from experts at CIMMYT. As an example, McCullough pointed to a collaborative effort between CIMMYT scientists and farmers to develop a nitrogen diagnostic tool that reduces fertilizer use without sacrificing crop yields.

The device, which gives real-time readings of nitrogen levels in the soil, proved early on that it could save farmers 12 to 17 percent of their profits. Yet most farmers rejected the new technology until CIMMYT researchers finally convinced credit union officials that it was a worthwhile investment.

"The most successful innovations that have been adopted by farmers in the Yaqui Valley have come from collaborations among researchers, farmers and local establishments, like the credit unions," McCullough said. Because of their considerable influence among farmers, credit unions should be included in any effort to effect environmental change in the region, she added.

"The Yaqui case negates the simplistic view of the one-way flow of scientific information from the agricultural research community to the user community," Matson said. "If researchers seek to produce relevant knowledge that ultimately influences decision making, they must recognize the dynamics of the local knowledge system and participate purposefully and strategically in it."

Provided by Stanford University

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