Conservation agriculture: Winning the battle for livelihoods and the environment

Improving farm livelihoods is not just about better maize or wheat varieties. It is also about managing those crops in the most sustainable way. By reducing or eliminating tillage, retaining rational amounts of crop residues on fields, and practicing more diverse crop rotations, maize and wheat farmers in developing countries save money, water, and fuel; conserve or improve soil and system productivity; and cut emissions of greenhouse gases.

"This is your life," says UP Singh, an agricultural scientist with Banaras Hindu University in Varanasi, India, as he shows a farmer group the residue left on the ground from the previous crop. "You must leave it on the ground after you harvest to get the most benefit."

The message is a difficult one for his audience to accept, but the farmers listen intently because Singh has been right in the past and they have benefited. CIMMYT partners like Singh introduced them to zero-tillage for their wheat crop. They tried it and found significant improvements in production and savings in fuel, labor, and time. In their traditional farming system, the residues were often chopped and combined with manure from cattle and water buffalo as a fuel for cooking. That is why farmers are reluctant to leave crop residues on the ground.

Research into their farming systems shows that as irrigation water becomes scarcer and more expensive, leaving stubble to preserve moisture and nourish the soil can provide a greater net benefit.

The package of agronomic practices called "conservation agriculture" includes methods to sustain or boost crop yields, while fostering the more efficient and sustainable use of water and other inputs, reducing production costs, improving management of pests and diseases, and enhancing cropping system diversity and resilience. Reduced and zero-tillage practices also reduce the oxidation of soil organic carbon and the associated release of CO_2 into the atmosphere.

Three-quarters of the farmland in sub-Saharan Africa—some 170 million hectares—is seriously degraded, and the region's smallholder maize farmers are in desperate need of ways to improve soil fertility and exploit moisture from increasingly unreliable rains. Over 300 million people in South Asia depend on rice-wheat cropping rotations for food and livelihoods, but degraded soils and dwindling water supplies threaten the region's productivity. Millions of Latin American maize and wheat farmers seek more efficient ways of using water, labor, and inputs like fertilizer, allowing them to compete in global markets.

Through broad, long-term partnerships, solid science, and support for innovation networks that involve farmers directly in testing and promotion, CIMMYT helps foster the adoption of resource-conserving practices, like direct seeding with reduced or zero-tillage and retention of crop residues on the soil surface, by wheat farmers in Latin America and South Asia. In the latter region, as of 2005 farmers on more than two million hectares were benefiting from those practices, and their spread continues. CIMMYT is working with diverse partners in sub-Saharan Africa, Mexico, Central Asia, and China to promote zero-tillage, residue retention, sowing on raised beds, and other practices that improve maize and wheat system productivity, save resources, and foster relevant cropping diversification.

No new technology is perfect, and as adoption of conservation agriculture increases, CIMMYT research will focus on the integrated evaluation of long-term conservation agriculture under different agro-ecological conditions (rainfed vs irrigated, crop rotations, residue management, threshold levels of residue cover); soil nutrient dynamics (organic matter, optimization of N fertilizer management, fertilization, legumes/green manures, macro and micro-nutrient balances over time); soil-borne pathogens and pests vs beneficial soil fauna and flora; water management; soil structure dynamics; weed management; impacts on greenhouse gas emissions; and varieties adapted to conservation agriculture systems.

CIMMYT is promoting conservation agriculture practices, such as keeping crop residues on the surface, among farmers in sub-Saharan Africa. These farmers in Malawi were pleased that the residues helped capture and retain precious moisture for their maize crop.

Our ultimate goal is to improve farm livelihoods based on sustainable, efficient, and environmentally friendlier farming systems, adapted to local needs. ■

For more information:
Ken Sayre, Wheat Agronomist
(k.sayre@cgiar.org) or
Pat Wall, Maize Agronomist
(p.wall@cgiar.org)