Standing Crop Residue for Erosion Control

PEGGY GREB (K8939-9)

Agricultural engineers Fred Fox (left) and Larry Wagner use a scanner to measure the amount of corn residue that remained standing after overwintering.

When ARS agricultural engineer Larry Wagner in Manhattan, Kansas, reads newspaper reports of multi-car accidents caused by blowing dust, he's convinced that changes in farming practices could help save lives and soil. Each year, several serious car accidents are caused by high winds blowing topsoil across highways.

Erosion removes more than 2 billion tons of soil from U.S. cropland annually, and wind erosion causes about 45 percent of this loss. Excessive erosion triggers worries about sediments, nutrients, and pesticides affecting water quality, as well as concerns about air quality and traffic visibility in wind-erosion-prone areas of the West, Midwest, and northern and southern plains.

Wagner and agricultural engineer Fred Fox at ARS' Wind Erosion Research Unit at Manhattan, Kansas, are working on solutions.

"Left standing, crop residue can be 10 times more effective in helping reduce wind erosion than if the same residue were flat," says Wagner.

Years ago, Wagner tediously hand-counted standing stems and measured their heights in the field. But that changed after he visited the National Soil Erosion Research Laboratory in West Lafayette, Indiana, to make use of new, high-tech alternatives.

Evolution of the Scanner

In West Lafayette, ARS soil scientist Chi-hua Huang and co-workers measure soil surface roughness with rather sophisticated machinery. To measure faster and more accurately, Huang developed a laser scanner by combining a 35-mm camera and a low-power laser beam. Instead of film, the camera has electronic circuitry like a video camera. (See "Erosion Can't Hide From Laser Scanner," *Agricultural Research*, September 1991, pp. 14-15.)

Wagner and Fox used the principles from Huang's original laser scanner to detect and measure standing residue while making a new scanner that is lighter to carry. Their evolved device is designed to operate on a small battery pack.

Farmers, crop consultants, and Natural Resources Conservation Service (NRCS) employees can use this lighter weight scanner. "Before now, no one could easily measure standing crop residue," says Fox.

The instrument has a range of 10 inches to 15 feet. The laser optics are mounted on a traversing rail for row measurements or on a turntable to measure standing residue in a 10-foot circle.

This month (July 2-7), Fox will report preliminary results of laboratory trials performed to test the scanner at the International Soil Tillage Research Conference in Fort Worth, Texas.

Fox and Wagner interact closely with farmers in erosion-prone areas of Kansas to team up against erosion. They encourage farmers to delay tillage during dry seasons and to consider no-till.

"Farmers can take other precautions like using rod-type weeders and sweeps to control weeds without flattening all the standing residue. This may prevent the cost of replanting a blown-out crop," says Wagner.

While Huang's original scanner is being used around the world by soil scientists in Australia, China, Austria, and Germany, he now has a much-improved device.

Looking Into the Future

To grasp the idea of how Huang's latest scanner works, imagine passing a 4-meter-long strip of land through a photocopy machine.

"This scanner makes just one pass with an advancing red line—like a copy machine light—instead of a red dot as in the first model. It's a hundred times faster than the original scanner," says Huang.

Huang speaks of landscape on the microtopographic scale—grains of sand, soil clods, rocks, and small depressions rather than mountains and valleys. He measures elevation in thousandths of an inch rather than hundreds of feet. The laser scans 3,000 elevation points a second, profiling a strip 4 meters long by 60 centimeters wide.

Together, soil particles and rocks account for how rough a soil surface is, and roughness affects the amount of soil that can be carried away by water.

"We don't know all the relationships," says Huang, who developed the scanners to find out. "Most of what is assumed about water erosion comes from studying water moving over a river bed. But erosion is different when you're looking at submerged soil."

From the first scanner, Huang and colleagues identified soil structures and correlated some of them to water erosion processes. For example, they found that soil depressions slow erosion by holding water. But when the depressions get full, they start spilling into each other, concentrating the runoff into an erosive stream. The result is that erosion worsens.

The versatility of the scanners is growing. They're used for everything from predicting water erosion to detecting tire ruts in roads, counting earthworm casts, and now measuring standing crop residue.—By **Linda McGraw** and **Don Comis,** ARS.

This research is part of Water Quality and Management (#201), Soil Resource Management (#202), and Air Quality (#203), ARS National Programs described on the World Wide Web at http://www.nps.ars.usda.gov/programs/nrsas.htm.

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Fred Fox (left) and Larry Wagner examine the scanner's laser light pattern on standing wheat residue in the lab.