PHOTO: SUSAN WINSOR

MEET THE SOIL WARRIOR

MARK BAUER HAD A CONSERVATION EPIPHANY THE FIRST TIME HE HAD A BIRD'S EYE VIEW OF HIS FIELDS.

BY SUSAN WINSOR

An ultralight plane ride changed the way Mark Bauer farmed. "Seeing how much the fields' topography changed in a few short years, I thought, 'I can't keep farming this way. This has to be lowering our productivity.'" Bauer has also changed the way other growers farm, by inventing the Soil Warrior tillage system. In 2005, he and his wife Sue launched Environmental Tillage Systems (ETS) to manufacture and market a two-pass tillage implement that he invented to conserve soil.

The first pass in the fall tills the top 8-9 in. of soil in a 10-in.-wide strip while applying fertilizer. The 30-in. cogwheels and serrated coulters mix fertilizer and residue with the soil.

The spring pass uses two 20-in. wavy coulters to fluff and condition just the top 3-4 in. of soil, adding nitrogen, in 10-in. strips.

"So you are only tilling one-third of the field (in the strip)," Bauer says. "The Soil Warrior leaves residue, root masses and rocks in place and bands fertilizer, saving energy and soil. It honors the tradition of heavy tillage in the fall and a shallow fluff and condition in the spring," Bauer says. "It's actually more like conventional tillage than strip-till; but it tills in a strip.

WHEN HE'S NOT involved with ETS, Bauer farms 1,600 acres of corn and soybeans near Faribault, MN. The Soil Warrior approach of two passes of strip-tilling combined with precision fertilizer placement is a dramatic change from his former conventional practice. Before, he chopped stalks, had the co-op spread P and K, then V-ripped his cold, heavy Minnesota soils in the fall; then made two spring passes with a soil finisher, along with a couple trips with the rock-picker. "I tried no-till, but just couldn't get predictable yields in variable weather," he says.

"In this area (southern Minnesota), you see people adopt strip-till for two years and then abandon it," Bauer says.

By rolling over soil aggregates and rocks instead of through them, the Soil Warrior avoids that problem, Bauer says. And his fuel consumption dropped from about 7 gal./acre to 2.1 gal./acre for fall and spring tillage, which includes fertilizer application. He no longer picks rocks.

"As we farm this way, the soil takes on different characteristics through the process of sequestering carbon and increasing levels of humus. The soil becomes more active, creating unique challenges for tilling and fertilizer incorporation."

South Central Technical College Farm Business Management Instructor Gene Kuntz sees the Soil Warrior as a way to save soil and reduce expenses. He and two colleagues track 200 farm families'

◀ "Without that view from the plane, I don't think I would have built that first machine," says Mark Bauer, a Faribault, MN, grower. He designed the Soil Warrior to incorporate more residue into the soil, while applying fall and spring fertilizer and reducing trips.

expenses, including the Bauers'.

"You're providing an environment where last year's crop residue has actually decayed in four months. Its rapid decay turns into organic matter, releasing nutrients for the crop," he says. "You are preserving or improving yields, while hugely reducing fuel and fertilizer inputs. It's pretty impressive."

Kuntz' analysis of Bauer's farm records shows an average of 58% reduction in fuel use by switching from conventional tillage to the Soil Warrior, based on four years' data.

Bringing Bauer's vision of limited tillage concept to life took some doing. His engineer brother Jay made computerized blueprints for Mark's vision of a tillage/fertilizer combination unit. They used air springs instead of mechanical springs, and made sure the fertilizer cart was easily maneuverable.

ETS NOW MANUFACTURES and ships Soil Warrior implements worldwide, including Australia, New Zealand and Canada.

"The Soil Warrior is the most complex and expensive of its 19 competitors," Bauer notes. "But it can handle any soil condition without plugging up. There are no other two-pass tillage systems on the market. The customers attracted to this want more control of fertilizer placement. They're trying to push their yields higher and enhance the bottom line, and they believe that total surface tillage is a dated concept."

Every Soil Warrior pass applies fertilizer. And since P and K do not move in the soil, Bauer designed his implement to thoroughly incorporate the fertilizer instead of leaving it in a band.

The advantages of the Soil Warrior are somewhat complex, says Brad Carlson, Minnesota Extension educator for Rice and Steele counties. "It improves three factors known to boost yields: soil structure, soil organic matter and root penetration," he says. Carlson's academic training in soil physics leads him to conclude that incorporating soil residue by pushing it into the soil instead of out of the way (as with a tillage shank) preserves soil structure. That in turn helps plant rooting and soil water retention, he says.

"Another advantage is that the farmer gets better fertilizer placement, and takes control of that activity. I've received many comments about it from farmers, who think it's a big deal," he says.

"I believe that over time there will be significant improvements in soil structure and drainage, which in turn lead to larger plant root systems that explore more of the soil profile. Therefore the roots are more drought-resistant and more efficient at recovering nutrients from the soil," Carlson adds.

"And, the mode of action of the fall unit leaves a wavy bottom of the trench, and this makes the strip significantly less prone to washing out on slopes.

"The main disadvantage to the Soil Warrior," Carlson says, "is the same as for strip-till: The expense of equipment purchase requires a farmer to jump into the deep end of the pool all at once without being able to try it out."

ENHANCING THE SOIL is critical to agriculture's long-term sustainability, says Jerry Hatfield, laboratory director of the USDA-ARS National Laboratory for Agriculture and the Environment, Ames, IA. "Managing residue to increase soil organic matter and build a viable soil biological system are the keys to a healthy soil." It becomes more efficient at supplying water, oxygen and nutrients to growing plants, Hatfield says.

We cannot keep farming the way we do now, Bauer says. "You can't begin to imagine the amount of soil that moves from just a 2-in. rain. It took millions of years for our soils to accumulate the carbon they have; now we can replenish that carbon by leaving more residue.

"I can't change the world but I can change what I have control over, and tillage is a piece of it." CSD

PHOTO: SUE BAUER

▲ The Soil Warrior's first pass in the fall tills the top 8-9 in. of soil in a strip while applying fertilizer. The 30-in. cogwheels and serrated coulters mix fertilizer and residue with the soil. It makes another spring pass using two 20-in. wavy coulters to fluff and condition the top 3-4 in. of soil, adding nitrogen, in strips.