By Larry Reichenberger

STRIP TILL TAKES ROOT IN THE PLAINS

Increased root development under strip tillage allows crops to use water more efficiently

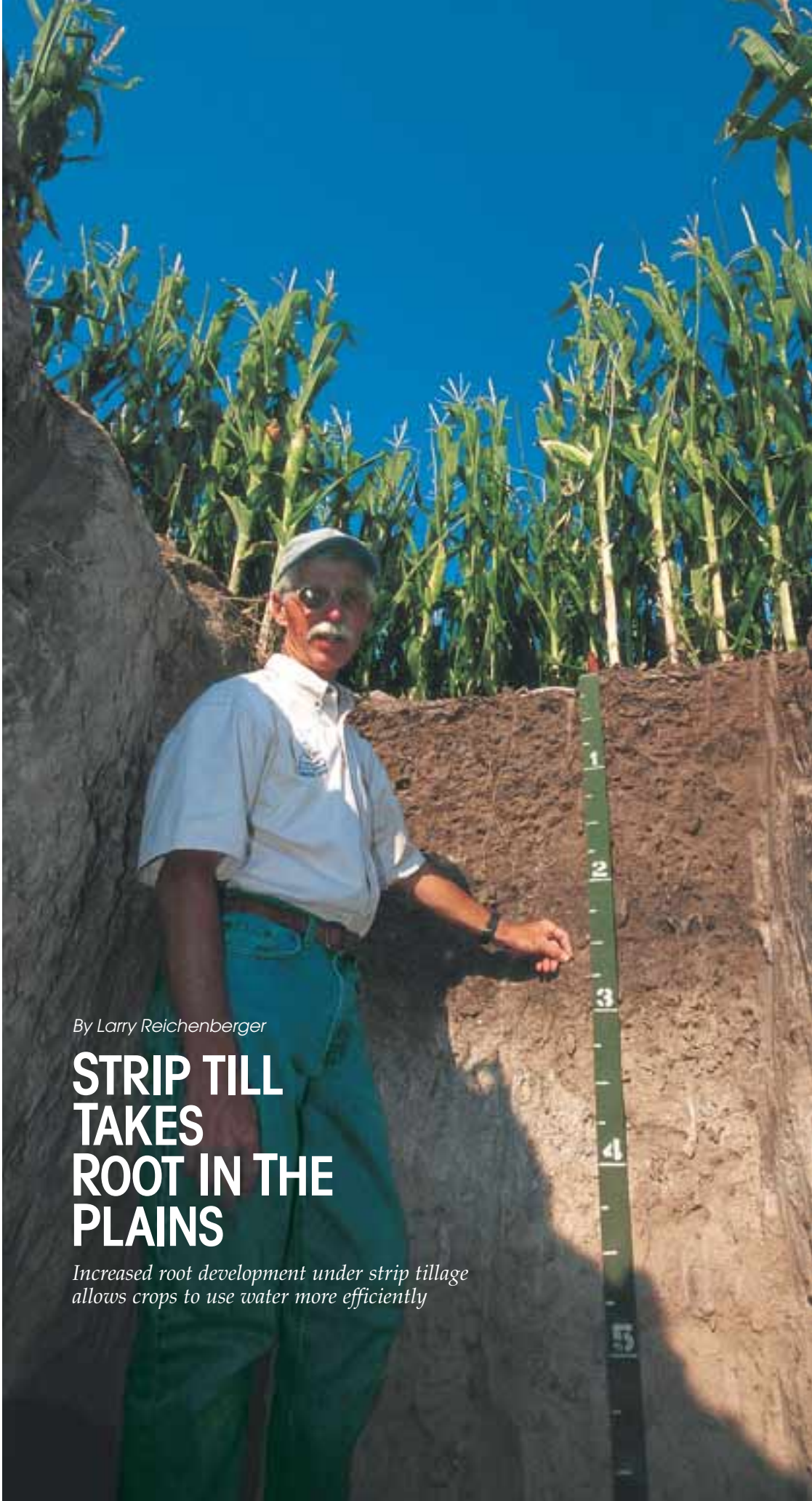
Strip tillage may involve only a narrow band of soil on the surface, but its impact reaches far and wide. Researchers in the Great Plains are finding that strip till boosts water infiltration and root growth. Because of that, it improves the water-use efficiency of corn and other crops. In turn, that factor promises to prolong the economic stability of a region where the water supply is dwindling.

"With strip tillage, it looks like we've found a way to grow good corn with less water," says Mike Petersen, a USDA-NRCS soil scientist at Greeley, Colo. "Our goal is to produce corn with 18 inches of water instead of the 28 to 30 inches that are now used. With strip tillage, we increase the rate of infiltration so less rainfall and irrigation water is lost. And, when combined with deep fertilization, roots are encouraged to venture deeper into the soil to utilize stored moisture and nutrients."

More roots. After three years of work at the Irrigation Research Foundation farm in Yuma, Colo., Petersen has the numbers to prove that under strip till, roots grow deeper, longer, and more dense. In strip tillage, corn roots went a maximum of 74 inches deep and averaged 65 inches. By contrast, the roots of corn under conventional tillage reached an average depth of only 50 inches.

"The increased depth was matched by an increased lateral spread," Petersen says. "In 2002, the roots from strip-till corn occupied 1.7 times more soil volume than roots from corn grown under conventional tillage. In 2003, strip-till roots occupied 1.2 times as much soil."

However, the most dramatic benefit Petersen has found is in the length of roots. "Not only are roots longer with strip till, but they have more and longer root hairs. We've typically found the total length of roots on a plant under strip till to be three



Mike Petersen credits deep-placed fertilizer and strip tillage for corn-root growth that reached 6 feet last year.

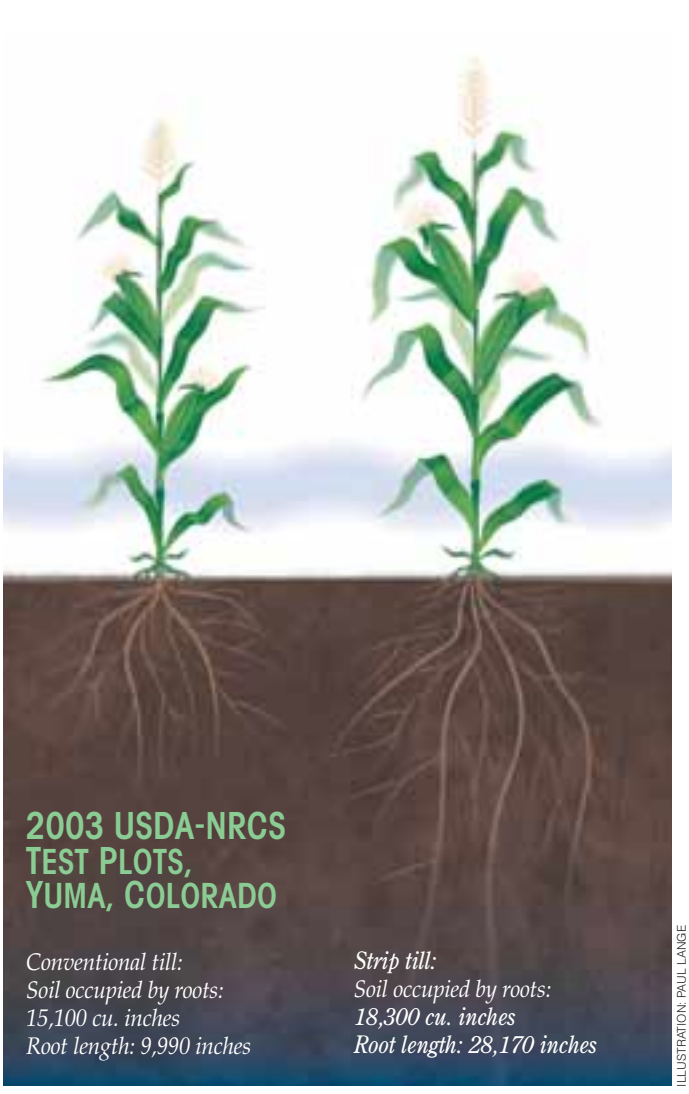


ILLUSTRATION: PAUL LANGE

Stan Townsend strip-tills his corn crop in the fall while injecting zinc, phosphate, and nitrogen fertilizer.

to four times greater than under conventional tillage," he says.

In a drought-stricken 2002, Petersen measured 10,350 inches of root on each strip-tilled plant compared with 3,300 inches on conventional-tilled plants. Last year's more typical growing season allowed greater root growth. He measured 28,170 inches per plant in strip till and 9,990 inches under conventional till.

Petersen, whose strip-till work is supported by Monsanto, believes two factors account for the greater root growth. "The shank used in each row with strip till provides a channel of loose soil for roots to penetrate. Also, fertilizer injected with that shank encourages roots to develop downward. Then, they follow the moisture deeper."

Nearly all of the crop's phosphate needs, and about one-third of its nitrogen requirement, is placed 7 inches below the seed, or 9 inches deep, during the strip-till operation. Those operations were performed two weeks prior to planting in the spring.

Yield comparison. Strip tillage increased corn yields in Petersen's research by 11 and 12 bushels per acre in 2001 and 2002, respectively. Plots yielded 204 and 238 bushels respectively, and strip till's advantage over conventional tillage was 5%.

Yield results were more dramatic in another study where irrigation water was limited. "When we applied 66% of the water corn needed to reach its maximum yield, we had a benefit to strip tillage of 35 bushels per acre," Petersen says. "This is exciting because it indicates farmers can use less water and still maintain their profitability."

In Kansas, agronomist Ray Lamond is finding strip till's benefits extend to dryland production as well. "We compared fall strip till with traditional no-till and found a 15-bushel-per-acre advantage in corn that only yielded 60 bushels per acre because of dry weather," he says.

Lamond found a similar increase in higher-yielding corn at a second site. "We attribute the increase in yield to faster, more uniform emergence, and early growth. Earliness is typically an advantage in our area because it allows the crop to beat summer's hot, dry weather," he says.

Stan Townsend has also seen corn yield advantages for strip tillage. However, the Weskan, Kan., farmer is most excited about the production costs he has saved since adopting the practice in 1996.

"We switched from ridge till to strip till and reduced the hours we spent in the field by 60%," says Townsend. "Our tractors log 1,700 fewer hours a year, and that's a huge savings."

Townsend says a major lesson he has learned is that strip tillage is hybrid sensitive. "We don't know why, but some hybrids do much better than others. We spend a lot of time looking for them," he says.

In addition to increased root growth, Petersen has found strip tillage also impacts water-infiltration rates. "We measured how quickly water would soak into a fine sandy-loam soil under strip tillage and conventional tillage. Over two years, the infiltration rate under strip till was 2.88 inches per hour compared to .57 inches with conventional till."

Less runoff. "More rapid infiltration means less water runoff from rainfall or irrigation," Petersen adds. "That improves crop production while reducing soil erosion."

Petersen says improved water infiltration and increased root growth under strip tillage are also contributing to better soil quality. "After three years of strip tillage, organic-matter levels have increased while staying flat for conventional tillage. Plus, we're counting three times more worms in the strip-till plots."