Strip Tillage Research

Declining soil health and soil erosion are intergenerational issues in Iowa. Average soil loss to erosion in Iowa is estimated to be 6 tons per acre per year, according to the Iowa Natural Resources Conservation Service (NRCS). At this rate, each generation over a typical 40-year farming career will hand down one inch less topsoil to the next generation of farmers.

To increase farm profitability, every input to a cropping system must be examined including tillage. A lower-cost tillage system, such as no-till or strip-till, can be more profitable even if it may be lower yielding. Additionally, these conservation tillage systems can be used to retain soil cover for the prevention of soil erosion by wind and water.

However, no-till systems may not be applicable for some Iowa farms. Some farmers who have tried no-till may have experienced slower drying of the soil in the spring as well as yield losses when compared to conventional tillage. Strip-tillage systems may be a happy medium between no-till and conventional tillage.

In 2017, the Iowa Soybean Association (ISA) On-Farm Network® established a series of farm strip-tillage research trials with non-checkoff funding. The study compared strip-tillage against conventional tillage or no-till.

With strip-tillage, the soil is tilled in rows of 6- to 10-inch strips in the fall or spring, leaving areas of crop residue in between the exposed rows (Figure 1). Because the crop residue has been moved away from the rows, this system has the advantage of faster soil drying in the spring. Less residue in the tilled strips reduces issues that may impair planting. In many cases, strip-till allows placement of nutrients around six inches below the strip of planted seeds.

Strip till represents a system less conducive to soil erosion as residue cover is maintained on 66 percent of a field area. In addition to reduced erosion, keeping residue cover on the field improves soil health by improving aggregate stability, water infiltration and reduces bulk density.

In most of the On-Farm Network trials, a Soil Warrior manufactured by ETS (Figure 2) was used to till the strips. To simplify the comparisons, there was no deep placement of fertilizer in these trials. At each trial site (Figure 3), field length strip-tilled rows were replicated four times and compared with conventionally tilled or no-till rows.

Early stand establishment was monitored in the spring. At harvest, effects of the tillage systems were estimated with a commercial yield monitor, from which the data was cleaned and calibrated for best comparisons. Additionally, aerial images captured in August were used to remove field areas that experienced flooding or other terrain attributes.

Figure 1. Strip-till in a corn after corn rotation.

Figure 2: Soil Warrior strip-till machine.

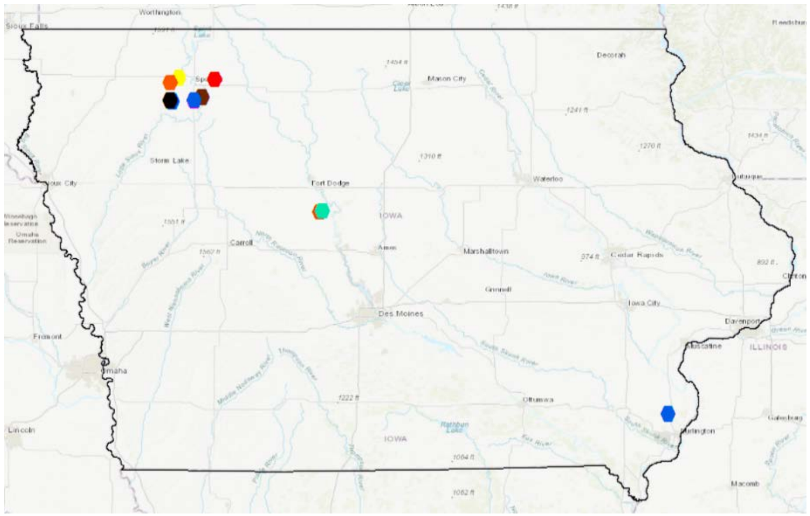

Figure 3. Locations of on-farm trials.

Results:

Strip-till was compared to no-till at four locations in corn after soybeans rotation. On average there was a 5-bushel yield advantage for strip-tillage when compared to no-till (Table 1), but the locations responded differently to tillage systems. Three of four locations realized a positive advantage for strip-till versus no-till, but location 37 showed a negative advantage. At this location, the planter used WAS GPS and the planter was not able to consistently plant on the strips. Therefore, higher end GPS such as RTK is recommended when adopting a strip-till system. strips were made in spring and soil conditions were likely too wet for tillage.

Table 1. Comparisons of Strip-Tillage versus no-till in corn.

Location	Previous Crop	Strip-Till	No-Till	Difference	Pr>t[1]
		--------Yield (bu/A)-------			
23	Soybean	214.7	200.3	14.4	0.004
37	Soybean	221.3	227.1	-5.7	0.08
132	Corn	216.2	208	8.2	0.02
133	Soybean	210.7	202.6	8.2	0.02
Average		216.1	210.9	5.2	0.004

[1]Pr>t is an estimate of the statistical difference in the trial. Values above 0.15 indicate the yield difference is due to chance alone.

In the comparisons of strip-till versus full width conventional tillage, there was an average 5.8 bu/A yield advantage for strip-till (Table 2). This average is skewed by a very large advantage for strip-till at location 24. At this location, strips were made in the fall, but conventional tillage occurred in the spring when soil conditions were likely too wet for tillage.

Table 2. Comparisons of Strip-Tillage versus conventional tillage in corn.

Location	Previous Crop	Strip-Till	No-Till	Difference	Pr>t[1]
		---------Yield (bu/A)--------			
24	Soybean	182.9	163.4	19.5	0.0001
134	Soybean	229.4	228.6	0.9	0.74
135A	Soybean	226.0	219.5	6.5	0.01
135B	Soybean	227.0	226.5	0.43	0.88
136	Soybean	227.5	221.9	5.6	0.001
209	Soybean	185.9	184.0	1.9	0.66
Average	Soybean	215.2	209.4	5.8	0.008

[1]Pr>t is an estimate of the statistical difference in the trial. Values above 0.15 indicate the yield difference is due to chance alone.

The economics of strip-tillage are difficult to quantify. Creating strips requires slightly less labor, fuel and tractor horsepower compared to conventional tillage. Strip-tillage does require high end GPS and RTK capability is recommended to assure the planter stays on the strips. In Table 3 is a cost comparison for various practices. Note that the highest cost strip-tillage pass, variable rate P and K along with nitrogen, is still less than the cost of chisel plow+field cultivate. With the conventional tillage option, a farmer still needs to pay for P, K and nitrogen applications. Finally, a 6 bu/A yield advantage for strip till equates to an additional profit advantage of $22.50.

Table 3. Comparisons of costs for implementing Strip Tillage System.

Practice	Cost/A ($)
Chisel Plow + Field Cultivate	32.3
Straight Strip Till	17.0
Strip-Till with Variable Rate P and K	20.0
Strip-Till with Variable Rate P and K + Nitrogen	25.0
Profit from Yield Advantage	22.5

Conclusions:

This study shows that farmers unable to adopt no-till in their corn production could consider strip-tillage in their operations. Strip tillage represents slightly less labor and fuel costs while providing opportunities to apply fertilizer while making strips. This eliminates extra passes and provides residue cover to reduce wind and water erosion.

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