Tillage Systems in Corn and Soybean Production

Trial Objective

- Tillage systems and operations have evolved over the years to meet specific production and/or environmental objectives. Considerations, such as soil and water conservation, input costs, labor efficiency, timing of tillage, crop rotation, soil health, short- and long-term land usage, crop nutrient management, and weed and pest management, are what drive tillage decisions on the farm.
- With improvements in tillage implements and herbicide technologies, farmers have access to an array of tillage options, ranging from conventional tillage to minimum tillage to no-till. Many farms do not use a single tillage type for all operations. Instead, a different tillage type is often deployed to meet the productivity requirement of each piece of land. Once decided, the piece of land is managed with that tillage type for several years.
- As such, it becomes necessary to periodically evaluate the continued suitability of tillage systems.
- The objective of this trial was to evaluate corn and soybean productivity responses to conventional and strip tillage systems.

Research Site Details

Location	2018 Crop	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Huxley, IA	**Soybean**	Clay loam	Corn	Strip tillage and conventional	5/17/2018	10/19/2018	60	140K
Huxley, IA	**Corn**	Clay loam	Corn	Strip tillage and conventional	5/9/2018	9/27/2018	225	34K

- A 112 RM corn product and a 2.4 MG soybean product were used in the trial.
- The corn trial was on 60 x 500 ft long plots. The soybean trial was on 60 x 350 ft long plots. The trial was planted in 30-inch row spacing with two replications.
- Conventional tillage consisted of a chisel plow followed by a soil finisher. The chisel plow consisted of a two-gang disk unit followed by ripping shanks that went about 18 inches deep followed by a set of chisels to smooth out the soil surface and incorporate residue. The soil finisher unit was comprised of a disk gang, a cultivator, and tine harrow units.
- Strip tillage was carried out in conjunction with liquid nitrogen application. The strip-till bar unit consisted of a no-till coulter in the front, followed by a liquid nitrogen knife, followed by a Vulcan strip-till unit comprised of row cleaners, no-till coulters that penetrated 2-3 inches deep and 7 inches wide, and a rolling basket to break any large soil clumps and smooth the soil surface for planting.
- All tillage operations were carried out in the spring.
- All corn treatments received 140 lb/acre of nitrogen pre-planting, followed by a side dress of another 40 lb/acre at the VT growth stage. 32% urea ammonium nitrate (UAN) was used as the nitrogen source.
- Weed management consisted of pre- and post-emergence programs in both crops.
- Conventional tillage was used at the research site in previous years.

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Figure 1. The tillage systems used in the corn and soybean trials. Left panel: strip tillage in corn (top) and soybean (bottom). Right panel: conventional tillage in corn (top) and soybean (bottom).

Understanding the Results

Table 1. Effects of two tillage systems on the agronomic performance of corn and soybean. The early stand count was taken at the V4 growth stage. Harvest population was measured a few days before harvesting. Corn was planted at 34,000 seeds/acre and soybean at 140,000 seeds/acre.

Crop	Tillage	Early Stand Count (1000 seeds/acre)	Harvest Population (1000 seeds/acre)	Grain Moisture (%)
Corn	Conventional	34.3	34.6	17.04
	Strip	33.8	33.4	17.01
Soybean	Conventional	105.6	93.5	12.35
	Strip	103.9	98.8	12.25

- In both crops, tillage did not have a major impact on stand establishment and plant population (Table 1).
- Grain moisture content was not affected by tillage in either crop (Table 1).
- There was a substantial yield difference between tillage systems in both crops, with strip tillage out-yielding conventional tillage (Figure 2).

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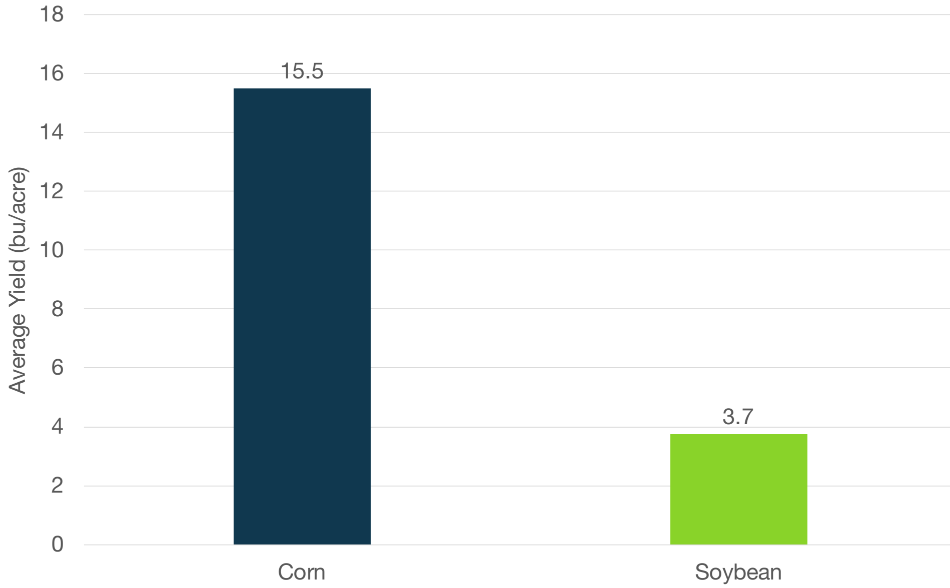

Figure 2. Average yield advantage of strip tillage over conventional tillage in corn and soybean production systems.

What Does This Mean For Your Farm?

- Conservation tillage practices, including strip tillage, allow for better water infiltration through the soil profile instead of the wash-off/run-off associated with conventional tillage systems. This improved soil moisture profile, along with its associated soil nutrients, could explain the difference in yield observed. This is especially true considering that the weather conditions at the research site during the trial were wet and rainy in May and June followed by a dry July.
- The advantages of strip tillage, such as improved soil heath, structure, and increased organic matter, cannot be the reason for the yield advantages realized as it takes several years for these soil characteristics to develop.
- It should be noted that crop yield response to tillage could be widely variable and site-specific, as impacted by environmental factors, soil type and drainage, and the cropping sequence. Thus, it requires multiple years of research to truly determine the productivity of tillage systems.
- Most tillage operations start in the fall after harvest and then are left to weather/over-winter before being finished off in the spring for planting. Due to environmental conditions, all tillage operations in this trial were carried out in the spring and thus may not fully reflect the exact effects of tillage on cropping systems. Therefore, this trial will be repeated in the coming years to determine the best tillage system for the site.
- Irrespective of the crop chosen, the right tillage type should be the one that provides the best economic returns while still ensuring better environmental stewardship.

Legal Statements