CAMPUS TILLAGE PROJECT ENDING SUMMARY

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This season was the 10th consecutive season for the plots in soybean and sugar beet in 2014 and the 8th season for the area in corn. Treatments used consecutively throughout the years were conventional tillage, strip-till and no-till production. Conventional till was one or more chisel passes in the fall to a depth of 8 inches, followed by one spring field cultivator pass before planting. The only variation to this was in particularly wet autumns when use of a chisel plow was impractical. In these years (two) a large tillage disc was used to make two to three passes depending on the residue load, then field cultivator before planting. Strip-till was a strip-till tool between the previous year rows, with the shank set at 8 inches. The exceptions to this were two years when the autumn was too wet to use the fall strip-till option. In these years (two) the strip-till unit was used in the spring with the shanks detached, and the residue cleaners moved aggressively between the rows to clear the planting path and disturb the soil surface slightly. The planter (6-row, 22 inch row, John Deere Maxi-Merge) was equipped with residue managers. No-till received no tillage in any year, and the planter residue managers were set to move residue from the seeding rows only. Fertilizer was applied to the surface in the spring. Phosphate and potassium were not necessary due to high soil test levels. Zinc was applied before corn using zinc sulfate at rates intended to build soil test levels in the early years of the study. Subsequent years found higher than critical soil test Zn levels, so no additional Zn was applied.

2014 METHODS

Soybean, corn and sugar beet were planted May 28 under good soil planting conditions. Emergence of soybean was excellent. Immediately following emergence, jack rabbit herd grazing began and soybeans were not able to grow more than to the 2nd trifoliate stage at any time during the summer. By mid-July, the soybeans were grazed clean to the soil surface by jack rabbits and no yield data was possible.

Soil test levels for the area in corn and sugar beet trials are in Table 1. Topdress/side-dress N was applied to 4-leaf sugar beets and 4-7 leaf corn July 3. Significant rain fell shortly after in-season N application. Jack rabbits were actively eating sugar beet soon after they eliminated soybean many plots were completely lost or stand reduced so that harvest would be meaningless. Enough unaffected plots remained so that analysis of treatments was possible. Corn was not affected by jack rabbits.

Table 1. Soil test levels for 2014 sugar beet and corn areas, campus tillage studies.

	Depth	N lb/acre	P, ppm	K, ppm	Zn, ppm	pH
Sugar beet	0-6 inches	11	16	320	6.2	7.2
	6-24 inches	45				
Corn	0-6 inches	48	21	370	1.6	7.8
	6-24 inches	114				

The sugar beet trial is a randomized complete block design with 3 tillage treatments (conventional, strip-till, no-till) and 12 replications, less 5 for rabbit grazing. The corn trial is a randomized complete block design with 3 tillage treatments and 6 replications. There is a soil salinity gradient from west to east across blocks, so corn yields were adjusted for salinity trend before ANOVA. Sugar beet followed corn and corn followed soybean.

2014 RESULTS

Corn yields adjusted for soil salinity gradient ranged from 130 to 137 bushels per acre, with no differences between tillage treatments. There were no differences in sugar beet tonnage, net sugar per ton or revenue per acre between tillage treatments.

Soil penetrometer readings were taken to 10 inches in depth July 14 for soybean and the 13 inch depth in the sugar beet trial. In the soybean area, there were no differences in readings with tillage for any depth. In the sugar beet trial, conventional tillage was lower in density at the 3 and 4 inch depth, but not at any other depth to 13 inches.

SUMMARY OF ALL YEARS

There was no year in which real yield or quality of corn, soybean and sugar beet was reduced with no-till or strip-till systems. There were two wetter seasons in which strip-till and no-till was higher in yield compared to conventional

tillage. The complete summaries of all years are in the Sugarbeet Research and Extension Reports from 2006 through 2014. The soil biology changed through the years with no-till and strip-till implementation. A paper was written using data from a fall post-harvest soil sampling, which indicated that soil biology mass more than doubled during the previous 6 years of no-till and strip-till (Awale et al., 2013). In 2013, the sugar beet yield and quality samples were hand-harvested. During harvest, the harvester did not sink into any no-till or strip-till plot more than a fraction of an inch. In the conventional tillage plot, the harvester sank into the mud at least 4 inches in every plot. In addition, an earthworm was present on every sugar beet pulled at harvest in the no-till and strip-till plots. No earthworms were seen on any sugar beet pulled in the conventional tillage plots.

No traffic pan developed after years of no-till and strip-till production. Surface soil density tended to be lower in the surface few inches, however, the increase in density did not influence corn, soybean or sugar beet production. Soil density, indicated from penetrometer readings, were similar in all tillage systems below 4-inches in depth.

The series of years of the campus tillage plot project indicated that strip-till is practical in high clay soils in the Red River Valley. Growers would more successfully implement the system by using the following tips:

- Follow the combine with the strip-till unit to ensure the strips are made in the fall. If the trip is too early to apply fall N, phosphate and potassium could be applied. If the field is dry enough after the 'safe' date for N application later in the fall, N can be applied using the strips produced earlier. If not, growers should use other options in the spring.
- Leave stalks standing as much as possible. The stalks will hold leaves and prevent them from blowing or floating and making thick mats in areas within and around the field. The space in-between stalk rows will be easier to make the strip-till pass and plant into the following spring.
- In a sugar beet rotation, the field surface will look like it was tilled following sugar beet harvest. A cover crop of small grain, such as rye, would help hold the soil from blowing if the weather becomes dry. Improved soil aggregation with no-till and strip-till would help prevent serious wind erosion even without a cover crop.

References

Awale, R., A. Chatterjee, and D. Franzen. 2013. Tillage and N-fertilizer influences on selected organic carbon fractions in a North Dakota silty clay soil. Soil and Tillage Research 134:213-222.