CORN AND SOYBEAN RESPONSE TO ROTATION AND TILLAGE ON A PRAIRIE CLAY SOIL, A FOUR YEAR SUMMARY

N.W. Buehring[1], M.P. Harrison[1], and R.R. Dobbs[1]

[1]Northeast Branch Experiment Station, North Mississippi Research and Extension Center, Mississippi State University, Verona, MS 38879

ABSTRACT: A study to evaluate corn and soybean response to a corn-soybean rotation and selected tillage systems was initiated in the fall of 1999 on a Prairie clay soil (Catalpa silty clay loam) and was continued in 2004. Corn hybrids (116 day maturity) used in the study were Terral TV 2140 RR in 2003 and 2004 and Pioneer 3223 in 2001 and 2002. Both corn and soybean showed a positive response to rotation. Three of four years, no-till corn rotated after no-till winter cover crop (Paradana Balansa clover, self reseeding system)/no-till soybean; no-till corn rotated after a fall coulter-chisel-harrow (FCH), a one-pass operation reduced tillage (stale seedbed) system with soybean; and no-till corn rotated after no-till soybeans had higher yield than continuous no-till corn. No-till soybean following no-till corn, no-till soybean following corn with a winter cover crop, and continuous no-till soybean showed no yield difference all four years. FCH soybean following no-till corn produced greater yield than no-till soybean following no-till corn 2 of 4 years and was greater than continuous no-till soybean 3 of 4 years. FCH continuous soybeans produced greater yield than continuous no-till soybean 2 of 4 years. The 4-year average indicated FCH soybean following no-till corn produced 5.7 bu/ac more than no-till soybean following no-till corn; and 7.1 bu/ac more than continuous no-till soybean. In comparison to no-till corn following no-till soybean or continuous no-till moncrops of corn and soybean, no-till corn and FCH soybean in a 2-year rotation maximized soybean yield over the long term.

CITATION: Buehring, N.W., M.P. Harrison, and R.R. Dobbs. 2005. Corn and soybean response to rotation and tillage on a Prairie clay soil, four year report. Annual Report 2004 of the North Mississippi Research and Extension Center. Mississippi Agricultural & Forestry Experiment Station Information Bulletin 419:100-102.

KEYWORDS: Corn, rotation, soybean, tillage

MATERIALS AND METHODS: A field study initiated in the fall of 1999 to evaluate corn and soybean response to a corn-soybean rotation with selected reduced and no-till tillage systems was continued in 2004. The study was conducted as a randomized complete block design with 4 replications. The corn tillage and rotation following soybean treatments are listed in Table 1. The soybean tillage and rotation following corn treatments are listed in Table 2. The winter cover crop Paradana Balansa clover was established by a self-reseeding system from a seed crop produced in 2000. The plot size was 8 (30 inch) rows x 60 ft. A fertilizer consisting of a blend of 200 lb/ac of muriate of potash + 100 lb/ac of super phosphate (0-46-0) + 200 lb/ac of sulfo-mag was applied annually. Nitrogen fertilizer solution (32% UAN) at 180 lb N/A was applied to all corn plots at the 6 leaf stage as a sidedress application 6 inches from the row and 2 inches deep.

The FCH stale seedbed treatments were applied in the fall of each year, except 2002 (Table 1). In the fall of 2002 excessive rainfall delayed the fall FCH operation until 1/29/03. All treatments were planted with a no-till planter equipped with residue removers and colters. Roundup WEATHERMAX (glyphosate) + Clarity (dicamba) at 1.0 + 0.25 lb ai/ac were applied in March of each year as a burndown to the winter cover crop and entire study area. Terral 2140RR corn hybrid in 2003 and 2004, and Pioneer 3223 in 2001 and 2002 were planted no-till in late March and early April of each year at 28,000 seed/ac in 30-inch rows. Roundup Ready MG IV soybean varieties were planted no-till in 30-inch rows in late April. Weeds were controlled in both soybean and corn plots with appropriate herbicides.

The center 2 rows in each corn plot were harvested with a plot combine for grain yield in early to mid September. The center 2 rows of the soybean plots were harvested for grain yield 7 to 10 days after maturity. All grain samples were weighed; and seed moisture and test weight were determined with Dickey John GAC® 2000 grain analysis computer. Corn and soybean grain yields were adjusted to 15 and 13% seed moisture, respectively. All data were subjected to Analysis of Variance and means were separated using Fisher Protected LSD calculated at the 5% significance level.

RESULTS AND DISCUSSION: The corn mean yield for 2001, 2002, 2003, and 2004 was 138.8, 154.9, 131.3 and 126.2 bu/ac, respectively. Three of 4 years, no-till corn following no-till soybean, following no-till soybean with a winter cover, or following FCH soybean, all produced greater yield than continuous no-till corn. All tillage rotation treatments for corn in the study, however, showed no yield differences all 4 years of the study.
With soybeans, no-till continuous soybean and no-till soybean in rotation with no-till corn showed no yield differences all 4 years of the study. The addition of a winter cover crop following no-till corn did not improve yield. However, the one pass FCH stale seedbed system produced higher yield than continuous no-till soybean and no-till soybean following no-till corn 2 of 4 years. FCH continuous soybean 4-year average yield was 7.1 bu/ac greater than continuous no-till soybean. The 4-year average yield for FCH soybean following no-till corn was 5.2 bu/ac greater than continuous FCH and 7.1 bu/ac greater than no-till continuous soybean. No-till soybean following no-till corn, 4-year average, yield was only 1.4 bu/ac greater than continuous no-till soybeans. The 4-year results indicated that no-till corn in a 2-year rotation with FCH soybean maximized corn and soybean yield on a prairie clay soil.

COOPERATORS: None

PUBLICATIONS: Buehring, N.W., M.P. Harrison, and R.R. Dobbs. 2003. Corn and soybean response to rotation and tillage on a Prairie clay soil. Annual Report 2002 of the North Mississippi Research and Extension Center. Mississippi Agricultural & Forestry Experiment Station Information Bulletin 398:54-56.

Table 1. Corn hybrid yield response to tillage and rotation on a Prairie clay soil in 2001-2004, Verona, MS.

Rotation/tillage systems	2001	2002	2003	2004	4 yr Mean
	----------bu/ac----------				
I. Continuous corn					
1. No-till (NT)	105.3	151.8	94.2	107.4	114.7
II. Corn rotated after soybeans					
2. NT corn after NT soybean (Bn)	148.2	163.0	139.7	132.7	145.9
3. NT corn after W. cover crop/NT Bn	147.6	146.5	152.0	129.0	143.8
4. NT corn after coulter-chisel-harrow (FCH) BN	153.9	158.3	139.3	135.9	146.9
Mean	138.8	154.9	131.3	126.2	137.8
LSD (.05)	12.2	NS	33.9	11.0	
% CV	9.2	3.5	16.2	5.5	

Table 2. Soybean yield response to tillage and rotation on a Prairie clay soil in 2001-2004, Verona, MS.

Rotation/tillage systems	2001	2002	2003 Yield	2004	4 yr Mean
	----------bu/ac----------				
I. Continuous soybean					
1. No-till (NT)	38.1	37.6	38.6	53.4	41.9
2. Fall coulter-chisel-harrow (FCH)	41.0	45.8	36.0	52.2	43.8
II. Soybeans rotated after corn					
3. NT Bn after NT corn	37.2	39.0	41.9	55.2	43.3
4. FCH Bn after NT corn	45.5	49.4	44.5	56.5	49.0
5. NT BN after w. cover crop/NT corn	38.9	40.4	35.4	52.3	41.8
Mean	40.2	42.4	39.3	54.0	44.0
LSD (.05)	5.2	4.8	5.2	NS	
% CV	8.4	3.5	8.7	7.7	