1980

PURDUE TILLAGE STUDIES

Agronomy Farm - Longtime Study

Corn plots were planted on May 5/6 and soybeans were planted on May 15. Little rain for 3 weeks ahead and one week after corn planting caused delayed germination in both plow and chisel plots, but was more severe with chiseling.

There was little rain after soybean planting until two early June rains of 2 inches each. These circumstances caused severe Sencor damage on soybeans, and Rep. II was replanted. These same rains caused ponding water on Rep. I, so no corn or bean data was taken from Rep. I. Although July and August rainfall was erratic, plants did not devleop severe deficiency symptoms.

High winds on July 21 caused some stalk breakage in corn plots. Broken plants in the harvest area ranged from 2% to 10%. This data was not correlated with yield, however.

The ridge-plant treatment was changed starting in 1980. These plots were planted with a Buffalo till planter which was rented from Fleischer Manufacturers. Ridges were made in the fall of '79 for the 1980 crop, then planted with a wide sweep ahead of units instead of riding the ridge-top as in the past. For 1981, ridges were made at lay-by time in corn and after harvest in beans with a Buffalo disk-hiller cultivator which was rented from the Tippecanoe Co. S&WCD.

Cultural practices used included:

	CORN	SOYBEANS
Hybrid or Variety	Beck's 65X	Woodworth (Amsoy 71 in replanted plots)
Seed Rate	26,000/Ac	48 lbs./Ac.
Seedbed Preparation	Disk 1 and field cult. 1 for plow and chisel	Disk 1 and field cult. 1 for plow and chisel
Fertilizer	250 lbs/Ac N as NH_3 100 lbs/Ac 28-28-0 starter 200 lbs/Ac 0-45-0 + 300 lbs/Ac 0-0-60, Fall '80	No N No Starter Same as corn
Insecticide	Counter in row - 9 lbs/Ac	None
Weed Control	Pre-emergence	Pre-emergence

	CORN	SOYBEANS
	Aatrex 4L - 3 pts. + Bladex 4L - 3 pts. + Dual 8E - 3 pts. + Paraquat - 1 pt. + surf. (No-till and till plant only)	Lexone - 1 pt. + Dual 8E - 3 pts. + Paraquat - 1 pt. + surf. (No-till & till plant only)
	Postemergence - directed on no-till and till-plant : Evik - 2 lbs. + surf.	Early postemergence: Basagran - 1 qt. Hoelon - 1 1/3 qt.
	Cultivated once except no-till	Late postemergence: Roundup directed - 1 1/2 qt. (no-till only)
	Hand hoed milkweeds	Cultivated once except no-till
Harvest Area	4 rows X 150'	Hand hoed milkweeds
		2 rows X 50'

The post-directed use of Evik on no-till corn and Roundup on no-till soybeans was primarily for late germinating foxtail. The herbicide treatments used effectively controlled all weeds except patches of hedge bindweed and late germinating morning glory in soybeans. While these vines are becoming more of a problem each year, they did not appear to effect yields.

Insect and disease damage did not appear to be significant in either corn or soybeans, although no-till continuous corn showed some anthracnose infection early in the season.

Stand, Growth and Yield

Corn - Stands were about equal in plow, chisel and no-till plots, although there was 20-30% late germination due to dry soil in chisel and plow plots. Reduced stands in till-plant plots are probably due to slippage of the planter drive mechanism or improper rate settings.

Height measurement showed till-plant slightly ahead of other systems at 4 weeks. At 8 weeks, there was little difference after soybean, but no-till corn was shorter than other treatments after corn. No-till after corn was still slightly delayed at tasseling and all plots tasseled 2-3 days sooner after soybeans. Accuracy of the Dickey-John moisture meter used at harvest was not adequate to determine small differences in harvest moisture.

Chisel and no-till yields were reduced, compared to plowing and till-planting, with greater reductions in continuous corn than in alternate cropping. Across all tillage systems, yields were 19 bu/ac. better after beans than in continuous corn. ANOV showed reponse to previous crop and tillage to both be significant at the 5% level but the previous crop X tillage interaction was not significant.

.e. 1. Corn Response to Tillage and Previous Crop, Chalmers, si. c. l., 1980[a/]

Prev. Crop	Tillage	Stand @ 4 Wks. ppa	Height 4 Wks. inches	Height 8 Wks. inches	50% Tassel days	Harv. Moist. %	Yield @ 15½%M Bu/Ac
Corn	Plow	23,200	12.8	65.2	76.3	22.4	149.3
	Chisel	24,000	11.4	62.2	77.3	23.5	136.0
	Till-Plant	19,200	13.1	63.4	77.0	22.7	142.6
	No-Till	23,000	11.2	58.3	78.0	23.1	134.4
Beans	Plow	23,900	13.0	68.4	74.7	22.1	166.0
	Chisel	23,400	12.5	66.9	75.0	22.6	159.4
	Till-Plant	22,200	15.0	69.2	74.3	22.4	164.2
	No-Till	24,400	13.2	67.4	74.3	24.2	155.8

[a/]All data avg. of 3 reps. Rep. I had water damage on June 1.

Soybeans - Although till-plant stands were slightly reduced, all were adequate for top yields. At 8 weeks, beans in plowed plots were slightly taller than in other systems and all beans were taller in rotation than continuous cropping. Harvest moistures were not significantly different.

Following corn, only no-till bean yields were below plowed plot yields. In continuous beans, chisel, till-plant and no-till yields were all reduced. Weed control was not a factor in influencing bean yields this year, and diseases and insects did not appear to be important factors in 1980. While herbicide carryover damage was not uniform within plots or between treatments, greatest damage was in plots with least residue and least damage was in no-till plots. Yield data do not appear to be associated with herbicide damage.

Table 2. Soybean Response to Tillage and Previous Crop, Chalmers, si. c. l, 1980[a/]

Prev. Crop	Tillage	Stand @ 8 Wks. ppf	Height 8 Wks. inches	Harv. Moist. %	Yield @ 15½% M Bu/Ac
Corn	Plow	6.2	15.1	10.5	54.4
	Chisel	6.6	13.5	10.5	54.6
	Till-Plant	5.7	13.5	10.1	55.0
	No-Till	6.7	14.2	10.3	51.8
Beans	Plow	7.0	16.0	10.4	54.3
	Chisel	6.9	14.8	10.5	50.7
	Till-Plant	5.9	14.2	10.4	48.1
	No-Till	7.2	14.9	10.2	49.5

[a/]Avg. of 3 reps.

ANOV for 1980 Data

Table 3. ANOV Summary, Agronomy Farm Tillage Data, 1980

Variable	CORN						SOYBEANS			
	Stand 4 Wks.	Height 4 Wks.	Height 8 Wks.	Tassel-ing	Harv. Moist.	Bu/ Ac	Stand 8 Wks.	Height 8 Wks.	Harv. Moist.	Bu/ Ac
	Significance Level									
Tillage	.05	.05	.10	NS	NS	.05	.05	.10	NS	.05
Prev. Crop	NS	.10	.01	.10	NS	.01	NS	.05	NS	NS
Till X Prev. Crop	NS	NS	NS	NS	NS	NS	NS	NS	NS	.05

Tillage significantly affected most parameters measured in 1980. Only very large responses to previous crop were significant, since omitting one rep. reduced degrees of freedom.

Long-Time Yield Trends

Six-year average yields show slight reductions for chiseling and no-till in continuous corn and even smaller differences for corn in rotation. The last 2 years, yields have shown a great advantage for rotation, no matter what the tillage. Soybean yields have been relatively consistent throughout the project, with no-till yield 3-4 bu/ac below plow and chisel yields and all yields reduced 3-4 bu/ac in continuous cropping.

Table 4. Corn yield repsonse to tillage & prev. crop, Chalmers si.c.l, 1975-80

Prev. Crop	Tillage	Bu/Ac 1975	1976	1977	1978	1979	1980	75-80 Avg.
Corn	Plow	176.1	140.4	137.8	146.8	205.1	149.3	159.2
	Chisel	165.0	147.4	135.5	144.7[a/]	190.8	136.0	153.2
	Ridge (Till '80)	141.4	154.7	137.2	135.5[a/]	191.3	142.6	---
	No-Till	165.4	153.7	136.3	146.1	176.6	134.4	152.1
Soybeans	Plow	167.4	145.1	146.1	145.4	209.5	166.0	163.2
	Chisel	177.1	140.8	149.5	140.2[a/]	206.7	159.4	162.3
	Ridge (Till '80)	149.5	154.7	147.8	142.1[a/]	194.8	164.2	---
	No-Till	175.2	143.4	144.4	142.8	187.6	155.8	158.2

[a/] Planted 1 week later in 1978.

Tab . Soybean yield response to tillage & prev. crop, Chalmers si.c.l., 1975-80

Crop	Tillage	Bu/Ac 1975	1976	1977	1978	1979	1980	75-80 Avg.
Corn	Plow	56.4	54.4	55.4	39.3	48.6	54.4	51.4
	Chisel	57.6	50.7	54.1	45.0	49.5	54.6	51.9
	Ridge (Till '80)	49.9	50.9	50.4	39.4	48.3[a/]	55.0	--
	No-Till	56.0	48.3	52.1	36.2	43.5	51.8	48.0
Soybeans	Plow	52.7	48.0	50.3	38.2	47.9	54.3	48.6
	Chisel	52.2	45.5	48.8	37.8	49.2	50.7	47.4
	Ridge (Till '80)	49.1	46.0	47.5	35.2	45.9[a/]	48.1	--
	No-Till	47.8	41.4	44.6	34.1	45.0	49.5	43.7

[a/] Ridges were disked down and soybeans replanted in 1979.

Other Data in 1980

Other investigations conducted in 1980 using plots in this experiment will be reported later.

A. Mannering (Cruse)

Percent residue cover - all treatments
Soil temperature of 4" with maximum thermometers
Soil moisture with neutron probe
Soil density with Troxler density guage

B. Mengel (Cruse, West)

Root sampling in increments by depth for both corn and beans
pH and fertilizer distribution by depth, all plots
Plant tissue analysis, corn only

C. VanScoyoc (McCracken)

Root weights
Amount of residue and rate of decomposition
Aggregate stability for plow and no-till continuous cropping

SEPAC TILLAGE TRIALS

1980 was the first year of data for the intendend cropping sequence and tillage in this experiment. However, beds were made in early May for the 1980 crop - not in the fall as intended. All other tillage was also done in the spring. Rain and wet soil delayed all spring operations. NH_3 was applied on 5-29 and two no-till plots planted on that date before the rains came. Further planting was delayed until June 9-10. Because of the late date, we switched to an early corn hybrid.

Cultural practices used were:

	CORN	SOYBEANS
Hybrid - Variety	P-3780	Woodworth
Date Planted	June 9	June 10
Seeding Rate	24,000/ac	48 lbs/ac
Nitrogen	170 lb/ac as NH_3 [a/]	None
Starter Fertilizer	100 lb/ac 7-22-5	None
Weed Control	Preemergence: Aatrex 4L - 1 qt. Bladex 4L - 1 qt. Dual 8E - 3 pt. Paraquat - 1 qt. + surf. Post-dir.: Lorox 50 W - 2lbs. (no-till only) Cultivated once except no-till and beds	Preemergence: Sencor - 1/2 pt. Dual 8E - 3 pt. Paraquat - 1 qt. + surf. Post-dir.: Roundup - 3 pts. (no-till and beds only) Postemergence: BASF 9052 (no-till only) Cultivated once except no-till and beds.
Insecticide	Counter 15G - 9 lbs/ac	None
Harvest	4 rows full length	4 rows full length

[a/] Two knives on top of each bed in bedded plots. Between rows in other plots.

The 2-row beds had well defined "shoulders" at the edge at planting and were barely wide enought for 2-30 inch rows. We had great difficulty in keeping the planter from sliding off the bed so that one row was in a furrow. As a result, 1980 data does not represent a well managed bed system.

Stand, Growth and Yield

Corn - Stands were adequate in all non-bedded plots and early growth tended to favor those with least tillage. By 8 weeks, however, no-till growth had fallen behind in continuous corn. In yield, only no-till continuous corn was below other non-bedded plots. Both plant growth and yield for the beds show the effect of one row partially in a furrow. Hand yield checks from continuous corn plots where only corn rows on the bed were checked show yields equal to plow, chisel and disk systems.

Soybeans - There was little difference in stand, growth and yield among plow, chisel, disk and bed plots. No-till bean plots were severely infected with phytophthora root rot. Yield was reduced by 30 bu/ac in Reps. I and II and 10 bu/ac in Reps. III and IV. Apparently, surface drainage was better in Reps. III and IV. The variety used was tolerant to the disease in tilled plots but not in the dense no-till plots. Williams '79, a phytophthora resistant variety, will be used in 1981.

Table 6. Crop Response to Tillage, Clermont si.l., 1980

Prev. Crop	Tillage	CORN Stand 4 Wks.	CORN Height 4 Wks.	CORN Height 8 Wks.	CORN Harv. Moist.	CORN Yield /ac.	SOYBEANS Stand 4 Wks.	SOYBEANS Height 8 Wks.	SOYBEANS Harv. Moist.	SOYBEANS Yield /ac.
		ppa	inches	inches	%	bu.	ppf	inches	%	bu.
Corn	Plow	22,400	31.9	98.3	17.1	113.5	8.0	26.0	11.8	38.9
	Chisel	21,400	35.1	102.7	16.4	121.8	7.8	26.8	11.7	39.6
	Disk	21,300	34.6	100.7	17.2	117.0	8.4	26.7	12.3	40.0
	Bed	21,200	29.8	88.4	18.0	97.6	7.6	25.6	11.8	35.6
	No-Till	21,600	35.7	94.3	16.6	104.9	5.0	19.9	12.2	18.7
Beans	Plow	21,550	31.4	98.6	17.7	116.2				
	Chisel	22,425	34.0	101.2	16.8	112.0				
	Disk	21,850	37.0	101.0	17.3	119.5				
	Bed	19,850	30.1	85.9	18.6	91.2				
	No-Till	22,600	39.2	101.6	16.4	119.6				

Other SEPAC Data

Soil temperatures were monitored between 3 and 5 PM for 4 weeks after planting. Due to the late planting date, there was little difference among treatments.

Evandro Mantovani (Agr. Eng. grad student) measured soil moisture weekly with the neutron probe. He also documented soil weathering during the season in bedded and plowed plots. Micro-relief meter readings were recorded before planting, after planting, and after harvest.

Beds for 1981

Bedded plots were disked, then beds were reformed in November for the 1981 crop. By using a bedder with more space between the disks on each side of the bed and reducing forward speed, beds with more gentle slopes on the edges were formed. They should present fewer problems at planting. In a seperate trial, beds were made both with the Purdue bedder used this fall and with the J. D. bedder used for 1980. They will be evaluated this spring as to configuration and ease of planting.

NO-TILL CORN DEMONSTRATIONS - 1980

FELDUN-PURDUE AGR. CENTER

Previous Crop	J. D. Max-emerg no-till planter		Buffalo slot planter	
	Harv. pop. ppa	Yield bu/ac	Harv. pop. ppa	Yield bu/ac
Corn	23,000	91	18,916	98
Wheat cover	23,583	127	21,667	139
Perennial sod	21,667	113	20,083	117
Soybeans	23,000	115	20,333	127

Planted - May 9
Herbicides applied - May 13

Seeding rate - 26,000/ac
Hybrid - Becks 65X
Insecticide - Counter 15G @9 lbs/ac with planter.
Plus Lannate broadcast at planting on 2 sod plots for armyworm control.
Zinc phosphide broadcast at planting in perennial sod for mouse control.
160 lbs/ac N as NH_3 applied side dress on May 28.

Four herbicide treatments were evaluated in each tillage block. They were all applied in 60 gals. of water per acre.

A. Lasso 4E - 2 1/2 qts + Bladex 80W - 2 1/2 lbs + Aatrex 9-0 - 1.1 lbs + Paraquat - 1 qt + surfactant.

B. Lasso 4E - 2 1/2 qts + Aatrex 4L - 2 qts + Paraquat - 1 qt + surfactant.

C. Dual 8E - 2 1/2 pts + Aatrex 4L - 2 qts + Paraquat - 1 qt + surfactant.

D. Lasso 4E - 2 1/2 qts + Aatrex 9-0 - 2.2 lbs + Roundup - 1 1/2 qts.

All herbicide treatments gave satisfactory control of existing vegetation and germinating weeds, but the treatment with Dual gave slightly longer control of germinating grasses. A few perennial vines escaped all herbicide treatments.

CHRONOLOGY OF EVENTS, 1980 TILLAGE PLOTS

April 21	Applied NH_3 at Agronomy Farm
May 1-2	Plow, chisel, disk and bed at SEPAC
May 3	Disk at Agronomy Farm
May 4	Field cultivate at Agronomy Farm
May 5-6	Planted all corn at Agronomy Farm including experiments for Mengel, Steinhardt and Nelson
May 8	Planted no-till demos at Feldun PAC
May 9	Installed soil temp. thermometers at Agronomy Farm
May 15	Planted all soybeans at Agronomy Farm, including Mengel's
May 27	Rotary hoed, plowed aand chisel beans at Agronomy Farm
May 28	Applied NH_3 to Feldun no-till demos
May 29	Applied NH_3 to all SEPAC corn, including Mengel's
May 30	Planted 2 no-till plots at SEPAC - rained out
June 6	Sprayed Hoelon on all tillage beans at Agronomy Farm. Also, applied Basagram on Mengel's beans.
June 9-10	Planted all tillage corn and bean plots at SEPAC except bean beds
June 11	Planted bean beds at SEPAC
June 12	Replanted Rep. II and 1/2 of Rep. 1 beans at Agronomy Farm
June 13	Cultivated all corn tillage plots except no-till at Agronomy Farm
June 14	Cultivated all bean tillage plots except no-till in early planting.
June 18	Ridged Buffalo corn plots at Agronomy Farm
June 24	Direct sprayed no-till corn at Agronomy Farm with Evik
July 17	Direct sprayed Roundup on no-till beans at Agronomy Farm
July 25	Direct sprayed Roundup on no-till beans at SEPAC
August 5	Sprayed no-till beans at SEPAC with BASF 9052
September 26	Harvest Mengel's beans at Agronomy Farm
October 1	Harvest all tillage beans at SEPAC
October 7	Harvest all tillage beans at Agronomy Farm
October 8	Harvest all tillage corn at Agronomy Farm
October 9	Harvest Mengel's corn at Agronomy Farm
October 14	Harvest all corn tillage at SEPAC
October 16-17	Spreak P & K and chopped stalks, Agronomy Farm tillage
October 20	Plowed and chiseled Agronomy Farm tillage
November 12	Made beds at SEPAC