

1983 PURDUE TILLAGE STUDIES
AT THE AGRONOMY FARM AND SEPAC

The 1983 growing season was characterized by a warm April, cold wet May and a very hot dry summer (June-Aug.). At the Agronomy Farm there was no significant rain in June and below normal rainfall in July and August. SEPAC was under drouth stress conditions from mid-June on. Both locations had above normal temperature throughout the summer, including 100^o+ readings which may have affected corn pollination. Cultural practices used and dates of field operations for experiments at both locations are attached at the end of this report.

AGRONOMY FARM -- LONG-TIME STUDY

Corn was planted May 10 and soybeans May 12. As in 1981 and 1982, bean plots were split with one drill strip vs. 8-30" rows (N-S) and all pre-emergence vs. all post-emergence herbicides (E-W). In addition, all no-till bean plots had Paraquat at planting. In no-till bean plots, especially cont. bean no-till plots, serious marestalk infestations escaped all treatments. To obtain no-till yields for the long-term average, 4 of the 8, 30 inch rows with pre-emergence herbicide were hand weeded this year. Marv Swearingin will report on yields with drilled vs. 30" not hand weeded.

Weed control did not appear to be a yield-limiting factor in any corn plots. Cut worm damage was not sufficient in any tillage treatment to justify spraying this year.

Stand, growth and yield

Corn -- No-till corn after corn yield was reduced over 40% compared to other tillage treatments (Table 1), not consistent with the average 5% drop for the previous 8 years. No-till corn after beans was equal to plowing in 1983 and almost 50% better than no-till corn after corn. Other tillage system yields averaged 16% better in rotation, a greater advantage than in past years.

Stand, growth and maturity measurements were not significantly different than in past years. No-till C/C was 9" shorter than plowed at 8 weeks, but this is not unusual on Chalmers soil. Soil temperatures taken at planting and for the next 3 weeks at a 4" depth showed no-till C/C about 10^oF colder than plowed. In past years this difference has been closer to 5^oF.

It seems reasonable to assume that the temperature reduction slowed rooting in no-till C/C more than usual. This, followed by the hot, dry June led to greater stress and reduced yield for no-till C/C. The possible roll of allelopathy in reducing yield could not be determined.

Previous experience in our tillage research, especially at Feldun PAC, has shown no-till corn to be the first to stress when drouth starts in June, but usually the last to stress when drouth starts after mid-July.

The corn yields after beans seem unusually high for this stress year; a tribute to the water holding capacity of our Chalmers soil, no doubt.

Soybeans -- No-till bean yields (Table 2) were reduced 10 to 15%, about twice the usual reduction, with no significant difference among other tillage treatments. The high bean yields (50-60 bu/ac), again, are surprising in this stress year.

ANOV Summary

Table 2 shows that tillage, previous crop and their interaction all influenced corn growth and yield due to the great affect of no-till C/C. Only tillage influenced height and yield of soybeans, however.

Long-time average yields

Yields are grouped into 4 and 9 year averages in Table 4. The last 4 years allows comparisons which include true till-planting. In previous years we were attempting to ridge-top plant with stand reduction some years due to equipment problems. Till-plant has had yields which are competitive with plowed yields on this poorly drained soil, both in monoculture and rotation. No-till yields in rotation have shown only slight reductions, 2.5% for corn and 7.3% for soybeans.

AGRONOMY FARM -- TILL-PLANT EQUIPMENT STUDY

This was the third year for Sam Parson's study which compares ridge scraping attachments for a standard J. D. Max emerge planter. Double ~~deck~~ ^{disk} furrowers, v-wing bed toppers and a 10" Buffalo till-planter sweep were compared. Other treatments included use of the standard J. D. one inch no-till coulter and no attachment in ridge planting. Ridges are made at cultivating time in continuous corn. Plots are 8 rows wide with 4 reps on Chalmers soil and 4 reps on Raub soil. Planting was on May 9 and fertility, pest control and seeding rate were the same as for the long-time tillage study.

As in past years, the 3 ridge scrapers produced equal stands and yields (Table 5). Contrary to the previous 2 years, however, there was significant yield reduction for not scraping the ridge top. Reduction was greater on the darker soil. Was this, as supposed in the no-till C/C plots, a response to reduced soil temperature? Plant growth was reduced only slightly in the "no-till" ridges. Does this tend to support the allelopathic effect theory?

Combine harvest in this study continues to compact 2 of every 4 rows (and ridges) with wheel tracks. Hand sampling of these rows separately in 1982 showed a 10 bu/ac yield reduction in compacted rows. The same comparisons showed an even greater yield drop in 1983 for rows with over-row compaction (Table 6). Two 1/1000 acre subplots were sampled in both compacted and uncompact rows of each main plot. Percent yield loss was greater on the lower O.M. Raub soil, but compacted row yields were less in each ridge scraping treatment.

The same harvest pattern has been followed for 9 years in our long-time study. It seems reasonable to assume that we will find the same row to row yield variation in that experiment not only on ridged plots, but on no-till plots, also.

SEPAC TILLAGE TRIALS

Corn was planted June 1 and soybeans June 2 after a very wet May. Soil in till-plant ridges was still so wet at planting that ridge scrapers were set to just remove residue from ridges, leaving the seeded area more elevated than usual. No-till plots were also wet, causing slot closing problems. Seedbed preparation in plow, chisel and disk plots may have caused "disk pan" compaction due to wet soil conditions. Another heavy rain on the evening of June 2, immediately after bean planting caused serious surface sealing on all tilled

plots on this one % O.M. soil. The rest of the summer was very hot and dry.

Soybean plots were split with row width and herbicides similar to those at the Agronomy Farm. Only yields with 30" rows and preemergence herbicides were included here.

Corn data

No-till corn grew much more rapidly and showed less stress than corn in other tillage systems in this unusual weather year, even in C/C (Table 7). Plowed corn was 15" shorter than no-till corn at 8 weeks, with other systems intermediate. Yields followed the same pattern, but even no-till yields were very low (60-70 bu/ac), probably because of high temperatures influencing pollination. Four-year average yields (Table 9) still show no-till yields to be lower than those for plowing in C/C, but better than for plowing after beans.

Soybean data

Plant growth and yield were essentially inversely related to amount of tillage, with plowed worst and no-till best. Compaction and crusting in the tilled plots and moisture saved in no-till plots were major factors influencing yield. Three-year average yields for no-till beans after corn are 4.3 bu/ac higher than for plowing.

Table 1. Corn response to tillage and previous crop, Chalmers si. c. 1., 1983^{a/}.

Prev. Crop	Tillage	Stand,	Height,	Height,	Harv.	Yield/ac
		4 wks.	4 wks.	8 wks.	moist.	@ 15 1/2%
		ppa	in.	in.	%	Bu
Corn	Plow	25,467	11.1	68.3	22.8	144.2
	Chisel	25,200	10.5	67.1	23.3	139.3
	Till-plant	24,767	11.0	64.6	23.3	148.6
	No-till	24,233	8.8	59.2	24.0	83.7
Soybeans	Plow	25,367	10.0	67.8	23.5	166.4
	Chisel	25,633	11.1	71.5	23.2	170.7
	Till-plant	24,133	11.6	71.8	23.3	176.8
	No-till	24,667	11.0	69.2	24.0	163.4

^{a/} Average of 3 reps.

Table 2. Soybean response to tillage and previous crop, Chalmers si. c. 1., 1983^{a/}.

Prev. Crop	Tillage	Stand	Height,	Height,	Harv.	Yield/ac
		4 wks.	4 wks.	8 wks.	moist.	@ 15 1/2%
		ppf	in.	in.	%	Bu
Corn	Plow	7.7	4.1	22.9	11.4	60.3
	Chisel	7.5	3.9	21.2	11.2	59.0
	Till-plant	7.6	3.8	21.3	11.1	56.9
	No-till	7.6	3.6	17.3	11.4	50.9
Soybeans	Plow	7.7	4.4	23.0	11.7	57.7
	Chisel	7.7	4.2	23.6	11.6	54.8
	Till-plant	7.6	4.1	23.6	11.0	56.8
	No-till	7.7	4.0	17.6	11.4	51.4

^{a/} Average of 4 reps.

Table 3. ANOV summary, Agronomy Farm tillage data, 1983.

<u>Variable</u>	<u>Stand, 4 wks.</u>	<u>Height, 4 wks.</u>	<u>Height 8 wks.</u>	<u>Harv. moist.</u>	<u>Bu/ac</u>
----- Sig. level -----					
Corn					
Tillage	.10	.01	.01	.05	.01
Previous crop	NS	NS	.01	NS	.01
Tillage x prev. crop	NS	.01	.01	NS	.01
Soybeans					
Tillage	NS	NS	.01	NS	.01
Previous crop	NS	.05	NS	NS	NS
Tillage x prev. crop	NS	NS	NS	NS	NS

Table 4. Long-time average yield summary, Agronomy Farm.

<u>Prev. Crop</u>	<u>Tillage</u>	<u>Corn</u>		<u>Soybeans</u>	
		<u>1980-83</u>	<u>1975-83</u>	<u>1980-83</u>	<u>1975-83</u>
----- Bu/ac -----					
Corn	Plow	167.9	164.2	56.6	53.4
	Chisel	159.2	157.8	54.2	52.6
	Till-plant	165.2	-	55.3	-
	No-till	142.9	150.0	52.3	49.5
Soybeans	Plow	180.3	170.5	54.3	50.5
	Chisel	177.4	169.3	50.4	48.3
	Till-plant	182.8	-	50.9	-
	No-till	175.7	166.2	48.9	45.4

Table 5. Corn response to till-planting equipment, Agronomy Farm, 1983.

Soil	Equipment	Stand, 4 wks.	Height, 4 wks.	Height, 8 wks.	Harv. moist.	Yield @ 15 1/2%
		ppa	in.	in.	%	Bu.
Chalmers si. c. 1.	Sweep	24,100	9.22	65.3	23.2	144.1
	V-wing	24,200	9.32	64.4	22.9	146.2
	Disks	24,325	8.65	62.8	23.0	141.6
	Coulter	24,175	7.22	62.1	22.9	127.9
	None	23,900	9.25	63.5	23.5	113.2
Raub si. 1.	Sweep	24,100	8.40	62.1	23.1	116.7
	V-wing	24,550	8.82	63.8	22.8	113.2
	Disks	25,525	8.65	60.0	23.1	119.5
	Coulter	25,075	8.75	61.2	23.0	105.4
	None	24,200	8.77	60.1	24.0	99.8
Sig. level	Soil	NS	NS	NS	NS	.05
	Eq.	NS	NS	.10	.05	.01
	Soil x eq.	NS	NS	NS	NS	NS

Table 6. Corn response to till-planting equipment and harvest row compaction, Agronomy Farm, 1983.

Soil	Equipment	Ear bearing plants		Yield	
		Comp. row	Uncomp. row	Comp. row	Uncomp. row
		ppa		Bu/ac	
Chalmers si. c. 1.	Sweep	21,750	22,875	145.8	162.0
	V-wing	23,375	23,750	151.3	162.7
	Disks	20,375	22,375	127.1	158.7
	Coulter	22,000	21,375	126.1	134.3
	None	20,125	20,750	114.6	124.2
Raub si. 1.	Sweep	22,000	22,875	113.2	127.5
	V-wing	21,250	22,625	106.7	126.0
	Disks	20,750	23,250	96.8	135.2
	Coulter	21,000	21,375	93.4	114.7
	None	20,375	19,625	99.3	106.9
Avg. Response to row comp.		21,300	22,087	117.4	135.2

ANOVA for yields: soils--.05, tillage--.01, compaction--.01, comp. x tillage--.01.

Table 7. Response to tillage and previous crop, Clermont si. 1, SEPAC, 1983.

Corn						
Prev. Crop	Tillage	Stand, 4 wks.	Height, 4 wks.	Height, 8 wks.	Harv. moist.	Yield/ac @ 15 1/2%
		ppa	in.	in.	%	Bu.
Corn	Plow	21,700	18.2	61.9	30.4	53.3
	Chisel	20,975	22.1	64.8	28.9	58.0
	Disk	20,550	23.2	65.2	30.2	50.7
	Till-plant	19,075	21.5	64.4	30.6	52.1
	No-till	20,725	26.1	77.3	29.0	66.1
Soybeans	Plow	21,075	18.2	61.7	30.7	48.5
	Chisel	21,050	19.5	61.4	29.8	64.5
	Disk	20,000	22.7	66.8	28.8	70.9
	Till-plant	19,325	21.6	64.2	30.3	64.3
	No-till	21,300	28.1	77.3	28.1	75.8

Soybeans						
		ppf	in.	in.	%	Bu (13 1/2%)
Corn	Plow	5.0	4.4	11.2	14.1	23.0
	Chisel	4.8	4.8	13.4	13.9	30.0
	Disk	4.8	4.6	16.1	13.7	37.2
	Till-plant	3.2	4.6	16.2	13.8	35.6
	No-till	4.8	6.3	23.1	13.5	39.6

Table 8. ANOV summary, SEPAC tillage data, 1983.

Variable	Stand, 4 wks.	Height, 4 wks.	Height, 8 wks.	Harv. moist.	Yield
----- Significance level -----					
Corn					
Tillage	.01	.01	.01	.01	.05
Previous crop	NS	NS	NS	NS	NS
Tillage x prev. crop	NS	NS	NS	.05	NS
Soybeans					
Tillage	.05	.01	.01	NS	.01

Table 9. 1980-83 yield summary, SEPAC tillage.

		Corn				
Prev. Crop	Tillage	1980	1981	1982	1983	80-83 Avg.
Corn	Plow	113.5	123.3	186.8	53.3	119.2
	Chisel	121.8	131.4	194.4	58.0	126.4
	Disk	117.0	125.2	181.4	50.7	118.6
	Till	--	--	--	52.1	--
	No-till	104.9	104.6	159.9	66.2	108.9
Beans	Plow	116.2	122.0	196.6	48.5	120.8
	Chisel	112.0	118.9	187.3	64.5	120.7
	Disk	119.5	120.0	195.8	70.9	126.6
	Till	--	--	--	64.3	--
	No-till	119.6	115.5	197.2	75.8	127.0
		Soybeans				
		1980	1981	1982	1983	81-83 Avg.
Corn	Plow	38.9	43.1	52.0	23.0	39.4
	Chisel	39.6	41.4	51.1	30.1	40.9
	Disk	40.0	38.6	51.9	37.2	42.0
	Till	--	--	--	35.6	--
	No-till	18.7 ^{a/}	42.2	49.4	39.6	43.7

^{a/}Phytophthora root rot reduced yield.

CULTURAL PRACTICES USED - 1983

Agronomy Farm

	Corn	Soybeans
Hybrid/variety	Becks 65X	Century
Date planted	May 10	May 12
Seed rate	26,000/acre	49 lbs/acre
Seedbed prep.	Disk once & field cult. once just pre-plant on plow & chisel plots	Same
Fertilizer	250#/A N as NH ₃ pre-plant 100#/A 28-28-0 starter 0-115-210 (N-P ₂ O ₅ - K ₂ O) b'cast fall 1982	No N No starter Same
Insecticide	Counter in row 9#/A	None
Weed control	At planting Paraquat 2 pt/A, No-till & till Bladex 4L, 1.5 qt/A Atrazine 4L, 1.5 qt/A Dual 8E, 3 pts/A	Same Pre-emerg. S 1/2 plots: Lorox L, 2.4 pts/A Dual 8E, 3 pts/A Post-emerg. N 1/2 plots: Basagran, .75 qt/ac + Blazer, .75 qt/ac Poast, 1 pt/A (0.3#AI)
Cultivation	Plow, chisel, ridge = once	Same
Harvest area	4 rows x 150'	2-30" rows x 50' and 4-10" rows x 50'

SEPAC

Hybrid/variety	P-3184	Williams 82
Date planted	June 1	June 2
Seed rate/ac	23,200	49 lbs (30" rows)
Nitrogen	200 lbs/ac as NH ₃	None
Starter fertilizer	18-46-0 @ 115 lbs/ac	None
Insecticide	Counter, 15G, 9 lbs/ac	None
Herbicides	Roundup, 2 qts on no-till & till Paraquat, 1 qt on disk Atrazine 4L, .75 qt Bladex 4L, .75 qt. Dual, 3 pts	Roundup, 2 qts, all plots (Resprayed after rain) Pre-emerg (1/2 plot) Lorox 4 L, 1 1/4 pt, Dual, 3 pts Post-emerg (1/2 plot) Basagran, 1 qt Poast, 1 pt
Seedbed prep.	For plow, chisel, disk Disk 1 early, and disk 1, F. cult. 1 preplant	Same

CULTURAL PRACTICES USED - 1983 (Cont.)

SEPAC

	<u>Corn</u>	<u>Soybeans</u>
Cultivation	Once on P, C, D. R	Same Rotary hoe P, C. D (30" rows only)
Harvest area	4 rows 200', Repts I, II 4 rows 270', Repts III, IV	2 rows 75', Repts I, II 2 rows 100', Repts III, IV

LOG OF ACTIVITIES -- 1983

- April 22 Applied NH₃ to tillage - weed plots at Pinney PAC
25 Applied NH₃ to Mengels tillage plots, Agron. Farm
Made ridges at Throckmorton PAC for field day demos.
26 Applied NH₃ to long term tillage and Parsons plots at Agron. Farm
Made ridges at Feldun PAC for field day demos.
27 Applied NH₃ to all SEPAC corn tillage, including weed plots
Took residue pictures, SEPAC tillage plots
- May 9 Planted Parsons ridged exp. - Agron. Farm
Planted till-plant corn plots in long-term exp. - Agron. Farm
Disked for plow & chisel plots - Agron. Farm
10 Field cultivated plow and chisel plots - Agron. Farm
Planted no-till, plow and chisel corn plots - Agron. Farm
Planted Steinhardt tillage, corn - Agron. Farm
Planted Mengels tillage, corn - Agron. Farm
11 Planted Allen's no-till exp. Agron. Farm
Sprayed for Craig Beyrouthy's exp. Agron. Farm
12 Planted all beans in long-term study at Agron. Farm, both rows
and drilled
Video taped in Wabash Co.
18 Planted no-till drill beans at Throckmorton PAC
Planted Mengels tillage-corn at Throckmorton PAC
20 Planted Gordon's tillage demos (corn & beans) at Davis PAC
31 Planted Kladivko's tillage exp. - Davis PAC
- June 1 Planted all SEPAC tillage corn except ridges
2 Planted SEPAC corn ridges and all tillage soybean
7 Re-sprayed no-till and ridged beans with Round-Up - SEPAC
Took 4-weeks data, Parsons ridges - Agron. Farm
8 Took 4-weeks corn data, main exp. - Agron. Farm
9 Took 4-weeks bean data, main exp. - Agron. Farm
17 Cultivated plow and chisel corn, long-term study, Agron. Farm
18 Cultivated Steinhardts compaction study, Agron. Farm
20 Cultivated all tillage beans (not no-till), Agron. Farm
Made ridges in all till-plant plots (incl. Parsons), Agron. Farm
- July 5 Took 8-weeks corn data - Agron. Farm
7 Made ridges at SEPAC-- long-term study
8 Made ridges at Davis PAC - Kladivko exp. & Gordon's demos.
Took 8-weeks bean data, Agron. Farm
- Sept. 26 Harvested all beans in long-term study, Agron. Farm
28 Hand harvested from Parson's ridges, Agron. Farm
- Oct. 3 Harvested all corn in long-term study and Parson's ridges
Made ridges in bean residue - Agron. Farm
5 Plowed in long-term study - Agron. Farm
7 Chiseled in long-term study and Mengels plots, Agron. Farm
(Used AC with 4" twisted points & coulters, 8" depth)
11 Harvested beans for Mengel + drainage - SEPAC

- Oct. 12 Took bean pre-harvest data SEPAC tillage
17 Hand harvest Kladivko's tillage corn, Davis PAC
19 Harvested Kladivko Throckmorton PAC tillage
28 Machine harvest Kladivko tillage corn - Davis PAC
29 Spread P & K - Davis tillage plots
- Nov. 1 Harvested all tillage and drainage exp. beans - SEPAC
Plowed and chiseled for Davis PAC tillage exp.
4 Harvested all tillage corn - SEPAC
8 Spread P & K on all SEPAC tillage plots
Made ridges in long-term study bean residue - SEPAC
Made ridges in weed-tillage plots, corn & bean residue - SEPAC
9 Chiseled in long-term tillage - SEPAC