TILLAGE RESEARCH

ANNUAL REPORT

1989

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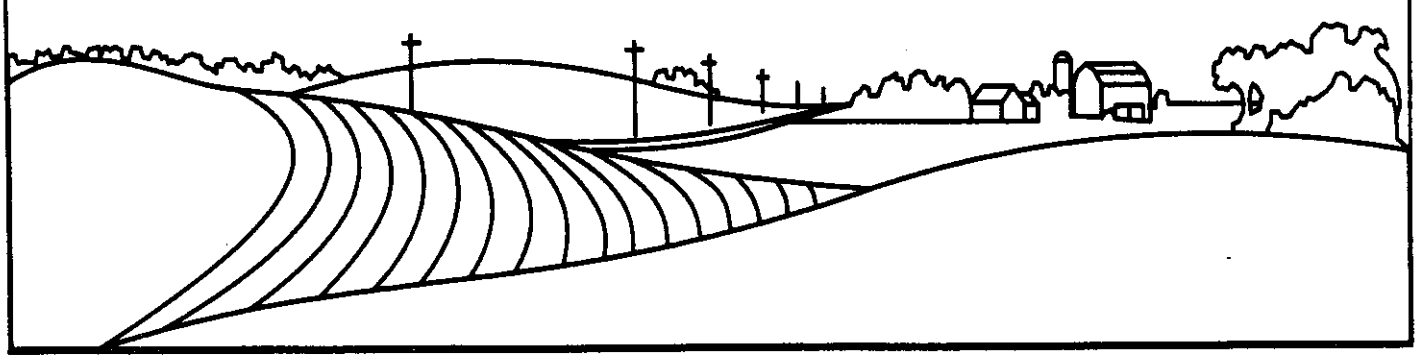

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TILLAGE RESEARCH RESULTS - 1989

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AGRONOMY FARM - LONG TIME STUDY

Corn was planted on April 25 and soybeans on May 12 with a John Deere Max-Emerge 4 row planter. For the 4th year, a Hiniker flat disk row cleaner was used to scrape the ridge tops and stabilize the planter. Plow and chisel plots were tilled with a 15' tandem disk and a 15' field cultivator. Nitrogen was applied 1 week preplant with an anhydrous ammonia applicator equipped with coulters and 1 wing per knife. A standard shovel row crop cultivator was used in the plow and chisel plots and a Hiniker ridging cultivator served in the ridge plots. Corn and soybeans were harvested with a John Deere 4420 combine and samples were weighed with a portable electronic scale. After harvest, chisel plots were chiseled with a DMI 7-shank coulter-chisel equipped with 3" twisted shanks. Plowing was accomplished with a 5 bottom moldboard plow.

Following is a summary of studies conducted on the tillage plots by researchers.

S. Abney, Botany and Plant Pathology - evaluate late season foliage diseases and root rots on all soybeans plots. Used fungicides with a susceptible Gr 2 variety.

D. Griffith and T. West, Agronomy - measure plant population, growth and yield, all plots.

J. V. Mannering and Vlado Bicanic, Agronomy - determine % surface residue cover, all plots, and measure soil density with constant rate penetrometer, rotation ridge plots.

R. Turco, Agronomy - study buildup of deleterious microorganisms with continuous corn cropping, especially in no-till. Also evaluating pesticide movement through the soil profile.

CULTURAL PRACTICES USED 1989
Agronomy Farm Tillage Study

	Corn	Soybeans
Hybrid/Variety	Beck's 65X	Century 84
Date planted	April 25	May 12
Seeding Rate	26,100 ppa	49 lbs/ac
Seedbed Preparation	Disk once and field cultivate once on plow & chisel plots	Same
Fertilizer	113#/ac 18-46-0 starter 250#/ac N as NH_3 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1988.	No starter No N Same
Insecticide	Counter 15G, band, 9 lbs/ac	No insecticide at planting Ambush 6.4 oz/ac for bean leaf beetle
Weed Control	At planting: Gramoxone 2 pt/ac on no-till and ridge X-77 2 pt/100 gal. water Bladex 4L 3pt/ac Atrazine 4L 3pt/ac Dual 8E 3 pt/ac	EPP Round-Up 4 pt/ac and 2,4-D 1.5 pt\ac on no-till and ridge At planting: Dual 8E 3 pt/ac Lorox 4L 2.4 pt/ac
Cultivation	Plow, chisel and ridge once	No cultivation
Harvest area	4 rows x 150'	4 rows x 150'

Stand, growth and yield.

Corn - When corn followed corn, no-till stand at 4 weeks was more than 6000 plants-per-acre (ppa) less than the other tillages. During weeks 2 and 3 after planting, soil temperatures cooled into the upper forty degrees. Then during weeks 4 and 5, a 2 inch plus rainfall occurred in each week, causing some temporary flooding. The cool temperatures and saturated soil seemed to cause more stress on the no-till corn, resulting in fewer plants at 4 weeks.

No-till yield in continous corn was significantly (.01 level) lower than plow, chisel and ridge yields. The reduced plant population and less vigorous plant growth through the season contributed to the 40 bushel/acre yield reduction.

When corn followed soybeans, there were no significant plant population differences. No-till plant height was significantly shorter at 4 weeks than the other systems, most likely due to the cold and wet early season soils. Plowing yielded the lowest of the treatments, but was not different than no-till. Chisel and ridge yielded in the middle 190s and were not different from each other. Treatment yields, except for plow, were higher in rotation than in continuous corn.

Table 1. Corn response to tillage and previous crop, Chalmers si.c.l., 1989.*

Prev. Crop	Tillage	Stand 4 wks	Height 4 wks	Height 8 wks	Harv. Moist.	Yield @ 15 1/2%
		ppa	in	in	%	bu/ac
Corn	Plow	25,917a***	6.4a	56.5a	22.0b	186.3a
	Chisel	26,333a	6.3a	53.3a	22.1b	182.8a
	Ridge	25,833a	5.1b	45.5b**	22.0b	180.8a
	No-till	19,000b	3.5c	28.2c	25.9a	140.1b
Soybeans	Plow	26,041	6.1a	52.4ab	21.2	181.9c
	Chisel	26,750	6.0a	56.4a	21.4	195.5a
	Ridge	25,833	5.8a	49.3bc	21.4	192.5ab
	No-till	25,625	5.0b	46.5c	21.0	184.6bc

*Average of 3 replications.

**Height measured from top of ridge.

***Within rotation, data followed by the same letter are not significantly different according to Student-Newman-Kuels Test (P = .05).

Soybeans - Stand establishment was very successful in all tillage systems and rotations with no significant differences. In continuous soybeans, some unusual results occurred. No-till soybeans were the tallest at 4 and 8 weeks and yielded significantly higher (.01 level) than plow, chisel and ridge. During mid-summer 2 4-week periods of dry weather occurred. The first was from week 6 through week 10 with 1.1" of rain and the second was from week 12 through week 15 with .8" of rain. Moisture deficiency at these crucial stages of plant growth could reduce seed yield ("How A Soybean Plant Develops" Special Report No. 53 Iowa State University of Science and Technology). With more soil moisture available in the no-till treatment, the soybean plants may not have been stressed as much, thus resulting in the higher yields.

When soybeans followed corn, treatment yields were not statistically different. The soil moisture available in the no-till treatment during the dry periods may have allowed the no-till soybeans to be more comparable to the other treatments, than in past years. See Table 2.

Table 2. Soybean response to tillage and previous crop, Chalmers si.c.l., 1989.*

Prev. Crop	Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 13%
		ppf	in	%	bu/ac	
Corn	Plow	11.3	5.0	20.9	12.7	45.9
	Chisel	10.7	4.6	19.6	12.5	45.3
	Ridge	11.1	4.6	18.4	13.1	45.3
	No-till	10.7	4.4	18.5	12.5	43.9
Soybeans	Plow	10.7	4.8	18.0	12.6	37.5c**
	Chisel	10.2	4.8	18.2	12.5	36.6c
	Ridge	11.2	4.9	19.3	12.7	42.1b
	No-till	11.3	5.3	20.7	12.7	47.0a

* Average of 4 replications.

**Within rotation, data followed by the same letter are not statistically different according to Student-Newman-Kuels Test (P = 0.05).

Table 3. ANOV summary, Agronomy Farm tillage data, 1989.

Variable	Stand 4 wks	Height 4 wks	Height 8 wks	Harv. Moist.	Yield bu/ac
	-------- Significance Level --------				
	Corn				
Tillage	.01	.01	.01	.01	.01
Previous Crop	.01	.05	.01	NS	.01
Tillage x Previous Crop	.01	.01	.01	.01	.01
	Soybeans				
Tillage	NS	NS	NS	NS	.01
Previous Crop	NS	NS	NS	NS	NS
Tillage x Previous Crop	NS	NS	.01	NS	.01

Table 4. Corn yield summary, bu/ac, Chalmers si.c.l., Agronomy Farm, 1975-1989.

Previous Crop	Tillage	1975	1976	1977	1978	1979	1980	1981[a]	1982	1983	1984	1985	1986	1987	1988	1989[b]	75-89 Avg.	80-89 Avg.
Corn	Fall Plow	176.1	140.4	137.8	146.8	205.1	149.3	169.0	209.2	144.2	181.8	195.4	169.5	174.4	128.5	186.3	167.7	170.7
	Fall Chisel	165.0	147.4	135.5	144.7	190.8	136.0	170.9	190.4	139.3	182.3	185.5	167.6	172.3	141.2	182.8	163.1	166.8
	Ridge	—	—	—	—	—	142.6	166.6	203.2	148.6	176.2	187.2	161.7	172.8	137.7	180.8	—	167.7
	No-Till	165.4	153.7	136.3	146.1	176.6	134.4	164.6	188.8	83.7	159.0	173.7	149.1	162.6	121.1	140.1	150.4	147.8
Soybeans	Fall Plow	167.4	145.1	146.1	145.4	209.5	166.0	176.4	212.4	166.4	205.6	204.2	190.3	186.1	149.1	181.9	176.8	184.0
	Fall Chisel	177.1	140.8	149.5	140.2	206.7	159.4	170.3	209.1	170.7	198.2	197.5	190.0	177.8	140.4	195.5	175.0	181.1
	Ridge	—	—	—	—	—	164.2	173.6	216.6	176.8	200.2	207.5	190.5	180.4	151.6	192.5	—	185.4
	No-Till	175.2	143.4	144.4	142.8	187.6	155.8	174.6	208.9	163.4	193.3	195.6	178.5	182.0	135.9	184.6	171.2	177.2
	Yearly Average	171.0	145.1	141.6	144.3	196.1	151.0	170.8	204.8	149.1	187.1	193.3	174.7	176.1	138.2	180.6		

[a]Planted May 22, all other years planted prior to May 10.
[b]Planted May 12

Soybean yield summary, Chalmers si.c.l., Agronomy Farm, 1975-1989.

Corn	Fall plow	56.4	54.4	55.4	39.3	48.6	54.4	49.2	62.5	60.3	57.6	56.7	48.3	53.3	46.5	45.9	52.6	53.5
	Fall Chisel	57.6	50.7	54.1	45.0	49.5	54.6	46.2	56.8	59.0	54.2	54.6	47.5	50.2	39.9	45.3	51.0	50.8
	Ridge	—	—	—	—	—	55.0	47.6	61.4	57.0	48.1	54.9	47.0	51.5	40.6	45.3	—	50.8
	No-Till	56.0	48.3	52.1	36.2	43.5	51.8	48.4	58.1	50.9	42.9	54.5	45.7	50.9	34.3	43.9	47.8	46.2
Soybeans	Fall Plow	52.7	48.0	50.3	38.2	47.9	54.3	49.7	55.4	57.7	54.6	49.8	43.7	46.1	36.5	37.5	48.1	48.5
	Fall Chisel	52.2	45.5	48.8	37.8	49.2	50.7	42.8	53.1	54.8	49.8	50.0	42.1	43.7	35.9	36.6	46.4	45.9
	Ridge	—	—	—	—	— [a]	48.1	45.6	53.1	56.8	50.0	44.3	42.6	47.1	35.4	42.1	—	46.5
	No-Till	47.8	41.4	44.6	34.1	45.0	49.5	46.8	47.7	51.4	45.2	46.2	40.7	46.2	37.2	47.0	44.7	45.7
	Yearly Average	53.8	48.1	50.9	38.4	47.3	52.3	47.0	56.0	56.0	50.3	51.4	44.7	48.6	38.3	43.0		

AGRONOMY FARM LONG TERM TILLAGE + PARATILL STUDY

Farmer interest continues in the use of deep tillage in conventional and reduced tillage systems. The Paratill allows for this deep tillage with little disturbance of the soil surface, thus maintaining the soil conservation benefits of reduced tillage systems. The object of this study is to determine if paratilling enhances yield potential in corn and soybeans in 4 tillage systems and 4 rotations. Starting in the fall of 1988, we paratilled the west 4 rows of each plot in the Long Term Tillage Study. Plant growth and yield will be measured and statistically analyzed using standard analysis of variance techniques.

CULTURAL PRACTICES USED 1989
Agronomy Farm Tillage + Paratill Study

	Corn	Soybeans
Hybrid/Variety	Beck's 65X	Century 84
Date planted	April 25	May 12
Seeding Rate	26,100 ppa	49 lbs/ac
Seedbed Preparation	Disk once and field cultivate once on plow & chisel plots	Same
Fertilizer	113#/ac 18-46-0 starter 250#/ac N as NH_3 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1988.	No starter No N Same
Insecticide	Counter 15G, band, 9 lbs/ac	No insecticide at planting Ambush 6.4 oz/ac for bean leaf beetle
Weed Control	At planting: Gramoxone 2 pt/ac on no-till X-77 2 pt/100 gal. water Bladex 4L 3pt/ac Atrazine 4L 3pt/ac Dual 8E 3 pt/ac	EPP Round-Up 4 pt/ac and 2,4-D 1.5 pt/ac on no-till At planting: Dual 8E 3 pt/ac Lorox 4L 2.4 pt/ac
Cultivation	Plow, chisel and ridge once	No cultivation
Harvest area	3 30" rows x 150'	4 30"rows x 150'

Plant growth and yield.

Corn - When corn followed corn, paratilling into the plow, chisel and ridge treatments had little effect on grain yield. Paratilling into the no-till treatment produced yields that were 19.8 bushels per acre better than no-till alone. It is reasonable to assume that a portion of this higher yield is attributable to the soil loosening effects of paratilling in the dense no-till soils. This would account for the more vigorous plant growth noted at 8 weeks and by visual observation through the growing season.

In rotation corn, both chisel and no-till yields were higher by 8 bushels per acre when paratilled. Ridge was unaffected, and plow yields were lower by 11 bushels per acre. It is not understood why the plow yields are lower. For corn yields, the paratill main effect and paratill x tillage interaction were statistically significant (0.08 and 0.04 respectively). See Table 5.

Table 5. Corn response to tillage, paratill and previous crop, Chalmers si.c.l., Agronomy Farm, 1989.*

Prev. Crop	Tillage	Paratill	Height 8 wks.	Harv. Moist.	Yield @ 15 1/2%
			in	%	bu/ac
Corn	Plow	Non-paratill	57.2	21.5	189.2
		Paratill	55.0	22.3	192.1
	Chisel	Non-paratill	52.3	21.9	188.7
		Paratill	52.9	22.5	190.0
	Ridge	Non-paratill	44.5**	22.0	181.0
		Paratill	50.6	22.5	183.2
	No-till	Non-paratill	28.3	26.1	151.4
		Paratill	37.6	24.3	171.2
Soybeans	Plow	Non-paratill	52.4	22.2	195.2
		Paratill	51.2	22.4	183.9
	Chisel	Non-paratill	56.5	22.1	192.9
		Paratill	52.8	22.1	201.3
	Ridge	Non-paratill	47.8	22.8	197.3
		Paratill	50.8	22.5	196.4
	No-till	Non-paratill	46.6	22.6	184.7
		Paratill	47.3	22.3	193.1

*Average of 3 replications.
**Height measured from top of ridge.

Soybeans - No significant differences were noted in the three way interaction of previous crop x tillage x paratill. The main effect of paratilling was significant at the .01 level. This difference was a 1.6 bushel per acre loss for paratilling. There seems no reasonable explanation for paratilling to adversely affect soybean yields. See Table 6.

Table 6. Soybean response to tillage, paratill and previous crop, Chalmers si.c.l., Agronomy Farm, 1989.*

Prev. Crop	Tillage	Paratill	Harv. Moist.	Yield @ 15 1/2%
			%	bu/ac
Corn	Plow	Non-paratill	12.7	45.9
		Paratill	12.5	43.3
	Chisel	Non-paratill	12.5	45.3
		Paratill	12.5	44.6
	Ridge	Non-paratill	13.1	45.3
		Paratill	12.5	44.9
	No-till	Non-paratill	12.5	43.0
		Paratill	12.5	42.1
Soybeans	Plow	Non-paratill	12.6	37.5
		Paratill	12.8	36.5
	Chisel	Non-paratill	12.5	36.6
		Paratill	12.4	36.9
	Ridge	Non-paratill	12.7	42.1
		Paratill	12.4	39.7
	No-till	Non-paratill	12.7	47.0
		Paratill	12.7	41.4

*Average of 3 replications.

Table 7. ANOV summary, Agronomy Farm tillage + paratill data, 1989.

Variable	Height 8 wks.	Harv. Moist.	Yield bu/ac
	-- significance level --		
	Corn		
Rotation	NS	NS	.01
Tillage	.01	.01	.01
Paratill	NS	NS	.08
T x P	.02	.08	.04
R x T x P	NS	NS	NS
	Soybeans		
Rotation	--	NS	NS
Tillage	--	NS	.05
Paratill	--	.05	.01
T x P	--	.06	NS
R x T x P	--	NS	NS

AGRONOMY FARM -- PARATILL STUDY

Equipment used in this experiment was the same as for the Long Time Tillage Study, except for the paratill. The original 4 leg paraplow set on 20" centers was used for the 1986-1988 crops. This machine proved too arduous to maneuver and till at a desired depth. A 4 leg paratill was delivered in the spring of 1988 and was used after harvest for the '89 crop. This new machine also allowed us to better control traffic patterns and seed placement at planting.

One objective of this study was to determine how often paratilling needs to be done. We chose to evaluate this need on a two year basis. Half of the paratill treatments are paratilled annually with the other half biennially.

Date	Crop Year	Treatment
Fall 1985	1986	Annual & biennial plots
Fall 1986	1987	Annuals only
Fall 1987	1988	Annual & biennial plots
Fall 1988	1989	Annuals only

CULTURAL PRACTICES USED -- 1989
Agronomy Farm Paratill Study

Hybrid	Beck's 65X
Date planted	April 24
Seeding rate	26,100 ppa
Seedbed preparation	Disk once and field cultivate once on moldboard-plow and paratill-moldboard plots
Fertilizer	113 #/ac 18-46-0 starter 250 #/ac preplant N as NH_3 0-115-210 (N-P_2O_5 - K_2O) broadcast in fall of 1986.
Insecticide	Counter 15 G, band, 9 lbs/ac
Weed control	At planting: Bladex 4L 3 pt/ac Atrazine 4L 3 pt/ac Dual 8E 3 pt/ac Gromoxone 2 pt/ac X-77 2 pt/100 gal water 5 weeks after planting: 2,4-D amine .5 pt/ac for velvetleaf
Cultivation	Moldboard-plow and paratill-moldboard
Harvest area	4 rows x 116'

The no-till treatment suffered the lowest plant population, shortest plant height through the growing season, highest harvest moisture and lowest yield. With biennial paratilling all measured plant data improved and with annual paratilling all plant data improved significantly (.05 level). For 1989, paratilling of no-till increased yield by 12 to 15 bushels/acre. All moldboard treatments yielded 6 to 12 bushels/acre more than the paratill + no-till treatments. As in the Agronomy Farm Tillage + Paratill Study, plant growth, maturity, and yield benefited from the soil loosening effect of paratilling in the more dense no-till soils. See Table 8.

Table 8. Corn response to paratilling, continuous corn, Agronomy Farm, 1989.

Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15%
	ppf	in	in	%	bu/ac
Annual Paratill, No-till	24,375b*	5.1b	47.8a	22.7b	154.9a
Biennial Paratill, No-till	24,438b	4.3c	38.0b	23.2b	152.0a
No-till	21,563c	3.7d	34.1b	24.6a	130.5b
Annual Paratill, Moldboard	26,125ab	6.3a	53.0a	22.4b	163.9a
Biennial Paratill, Moldboard	27,688a	6.0a	52.6a	22.9b	161.3a
Moldboard	26,125ab	6.3a	52.6a	22.8b	162.7a
ANOV sig. level	.01	.01	.01	.01	.01

*Data followed by the same letter are not significantly different according to Student-Newman-Kuels test (P = .05).

Table 9 gives the 4 year corn yield summary for the paratill study at the Agronomy Farm. On the dark and poorly drained Chalmers silty clay loam, the paratill improved no-till yields a significant (.01 level) 10 to 15 bushels/acre. However, moldboard plowing produced the highest yields. This 4 year study indicates that on this Chalmers si.c.l. soil, paratilling of no-till corn can enhance yield potential.

Table 9. Corn yield summary, bu/ac, in response to paratilling, continuous corn, 1986-1989.

Tillage	1986	1987	1988	1989	Avg.
Annual Paratill, No-till	160.3a*	171.3a	113.0	154.9a	149.9ab
Biennial Paratill, No-till	163.3a	159.2b	107.9	152.0a	145.6b
No-till	147.4b	159.3b	103.2	130.5b	135.1c
Annual Paratill, Moldboard	172.4a	172.9a	114.5	163.9a	155.9a
Biennial Paratill, Moldboard	171.9a	171.0a	115.7	161.3a	155.0a
Moldboard	169.3a	174.4a	110.3	162.7a	154.0a
ANOV sig. level	.01	.01	NS	.01	.01

* Data followed by the same letter are not significantly different according to Student-Newman-Kuels Test (P = .05).

AGRONOMY FARM -- STRIP CROPPING ON RIDGES STUDY

This study is designed to evaluate corn and soybean response to 8 row alternating strips with 2 levels of management for corn. Corn and bean strips are compared to the middle 8 rows of a 16-row "non-stripped" plot. To represent a high level of management for corn we increased seeding rate on rows 1 and 8 by 29% and on rows 2 and 7 by 12%. With the increased population, we also increased N for the outside rows by doubling the rate (from 60 to 120 #/A) on the NH_3 knife between rows 1-2 and 7-8 during side-dress application. This raised the average rate/ac by 15 lbs of N. For the "non-strip" comparison under high management, the 8 harvested rows were treated the same as 8-row strips with regard to seeding rate and N.

CULTURAL PRACTICES USED -- 1989
Agronomy Farm Strip Crop on Ridges

	Corn	Soybeans
Hybrid/Variety	Beck's 65X	Century 84
Date planted	April 21	May 12
Seeding rate	High population: Rows 1 & 8 = 33,150 ppa Rows 2 & 7 = 29,230 ppa Rows 3,4,5, & 6 = 26,100 ppa Standard population All rows = 26,100 ppa	49 lbs/ac
Fertilizer	High input N (as NH_3): All rows 140 lbs/ac preplant Rows 1,2,7,8--90 lbs/ac sidedress Rows 3,4,5,6--60 lbs/ac sidedress 113#/ac 18-46-0 as starter 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1988 Standard input N: All rows 140 lb/ac preplant All rows sidedressed 60 lbs N/ac 113 #/ac 18-46-0 as starter 0-115-210 (N-P_2O_5 - K_2O) broadcast in fall of 1988	No N No starter Same No starter Same
Insecticide	Counter 15 G, band, 9 lbs/ac	No insecticide at planting Ambush 6.4 oz/ac for bean leaf beetle

Weed control	Gramoxone 2 pt/ac X-77 2 pt/100 gal. water Bladex 4L 3 pt/ac Atrazine 4L 3 pt/ac Dual 8E 3 pt/ac	Dual 8E 3 pt/ac Lorox 4L 2.4 pt/ac
Cultivation	No	No
Ridging	At cultivation	After harvest
Harvest area	Individual rows, 50 ft.	Individual rows 80' & 100'

Stand, growth and yield.

Corn - Growth and yield data are given in Table 10. Response to stripping was 15.3 bu/ac with regular management and 11.2 bu/ac with high management (increased population and N). There was little response to management within strip treatment, possibly due to planting seed rate inaccuracies.

Fig. 2 is a comparison of strip and non-strip corn yields with high and average management, by row, over the 4 years of this experiment. Response to stripping was 16.9 bu/ac with high management and 14.6 with average management. A more detailed discussion of this experiment will be submitted to the Journal of Production Agriculture in 1990.

Table 10. Corn response to strip cropping on ridges, Agronomy Farm, 1989.

Row	Strip				Non-Strip			
	Average Management				Average Management			
	Stand 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%	Stand 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%
	ppa	in.	%	bu/ac	ppa	in.	%	bu/ac
1(west)	25,750	37.5	26.5	218.9	28,625	40.8	27.0	193.6
2	23,250	38.8	27.1	185.8	23,875	39.5	25.4	181.4
3	24,625	40.5	26.5	199.8	25,250	40.8	26.2	195.6
4	26,750	40.9	26.2	185.5	25,250	41.4	25.4	186.9
5	27,625	41.3	26.9	186.4	23,250	42.3	26.6	174.9
6	25,375	40.4	26.8	191.1	23,250	43.0	26.6	188.9
7	25,500	41.1	26.7	197.7	24,375	40.9	25.7	177.4
8(east)	27,250	40.4	26.1	246.5	29,875	41.4	26.2	191.0
Avg.	25,766	40.1	26.6	201.5	25,469	41.2	26.1	186.2
	High Management				High Management			
1(west)	32,375	37.9	27.7	215.7	31,875	41.0	28.8	191.4
2	27,000	38.9	26.6	184.7	24,500	40.3	27.0	177.9
3	25,875	41.4	26.9	185.1	25,500	42.3	27.3	192.6
4	28,500	41.2	26.5	190.9	29,250	41.1	26.8	204.8
5	30,125	42.6	26.9	188.5	29,750	42.4	28.4	196.6
6	25,375	41.5	25.7	194.4	24,500	41.9	27.4	178.1
7	25,875	41.5	25.8	195.5	26,000	40.3	26.6	178.9
8(east)	30,500	38.6	26.3	244.7	33,250	40.8	26.7	189.8
Avg.	28,203	40.4	26.5	199.9	28,078	41.2	27.4	188.7

FIG 1. Comparison of strip and non-strip corn yields, by row, Agronomy Farm, 1989.

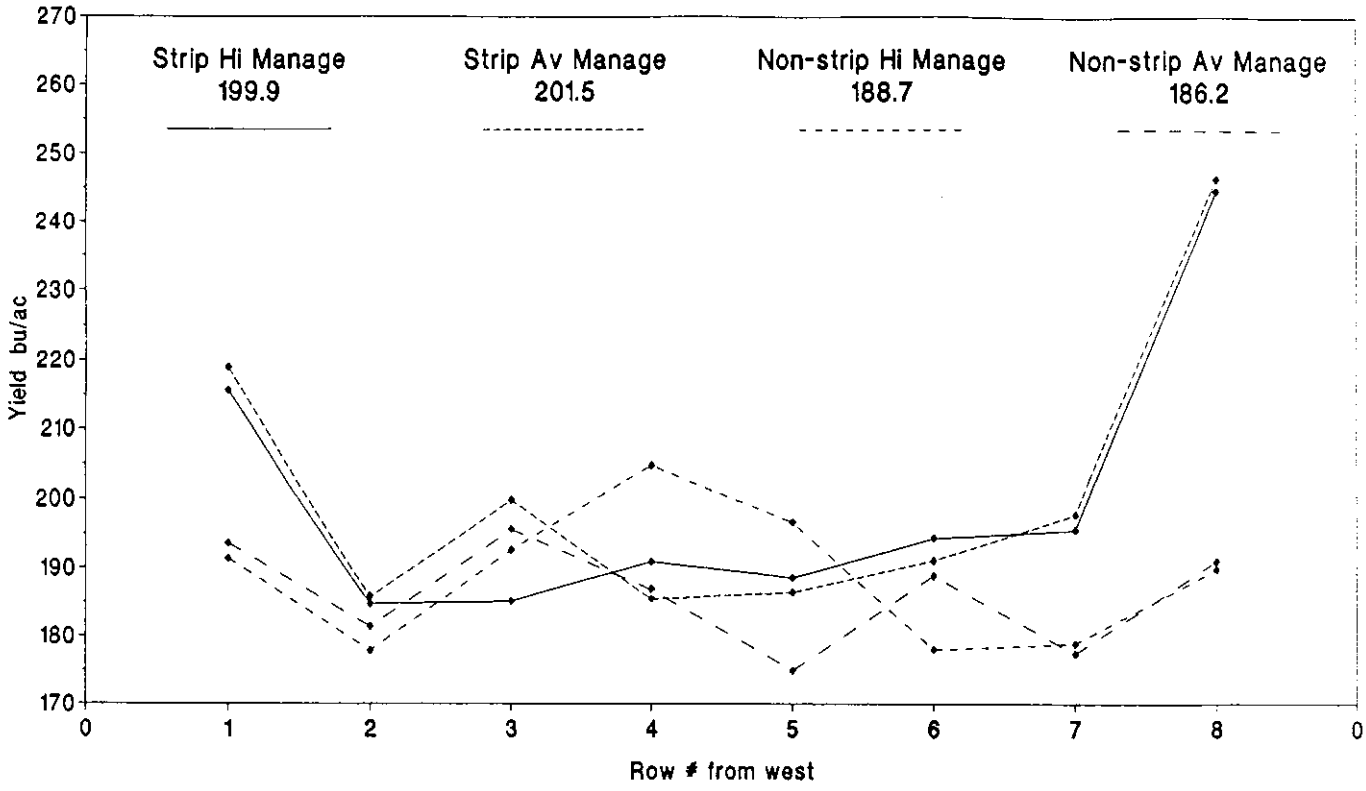
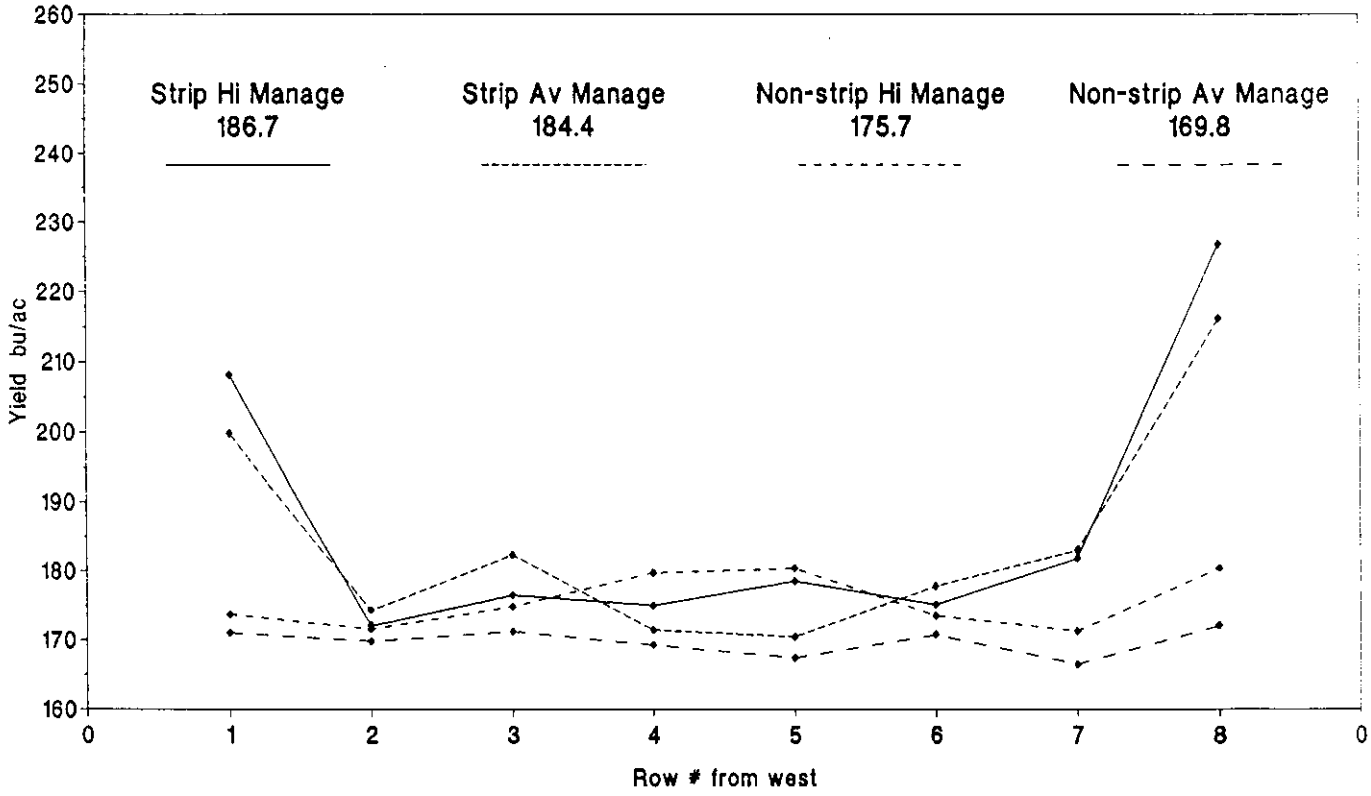


FIG 2. Comparison of strip and non-strip corn yields, by row, Agronomy Farm, 1986-1989



Soybean - 1989 data are given in Table 11. Non-strip soybeans yielded 2.7 bu/ac more than strip soybeans, significant at the .01 level. The greatest yield losses occurred in rows 1, 7 and 8. The 4 year average shows yield losses across all rows of the strip treatment. It appears that the shading effect extends across all 8 rows of soybeans. See Figs. 3 and 4. Only 1 management level was used.

Table 11. Soybean response to strip cropping on ridges, Agronomy Farm, 1989.

	Strip	Non-Strip
Row	Yield @ 13%	Yield @ 13%
	bu/ac	bu/ac
1(west)	31.6c*	39.3
2	40.7a	40.3
3	40.4a	40.1
4	40.5a	41.2
5	39.2a	40.4
6	39.6a	40.4
7	36.7b	38.5
8(east)	28.6d	38.9
Avg.	37.2	39.9

*Data followed by the same letter are not statistically different according to Student-Newman-Kuels test (P = .05).

FIG 3. Comparison of strip and non-strip soybean yields, by row, Agronomy Farm, 1989.

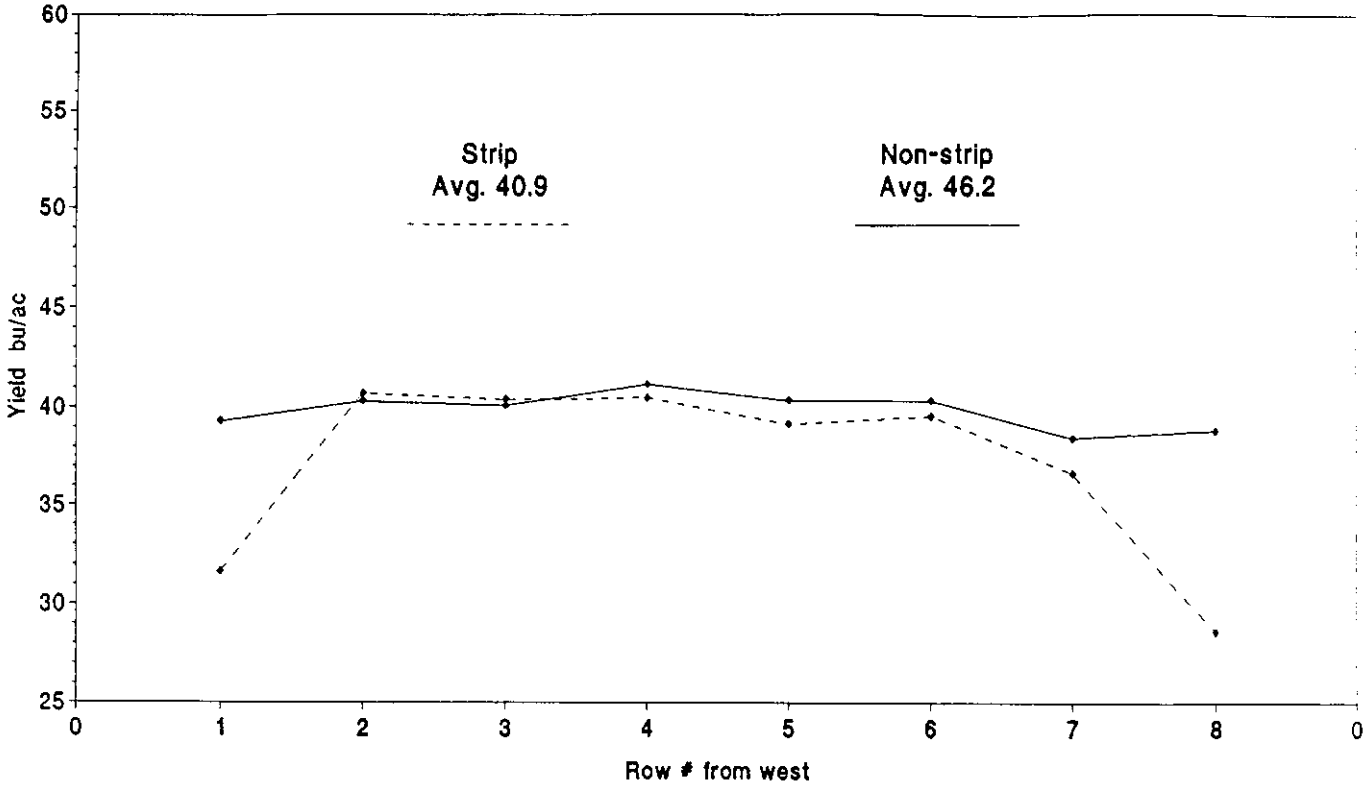


FIG 4. Comparison of strip and non-strip soybean yields, by row, Agronomy Farm, 1986-1989.

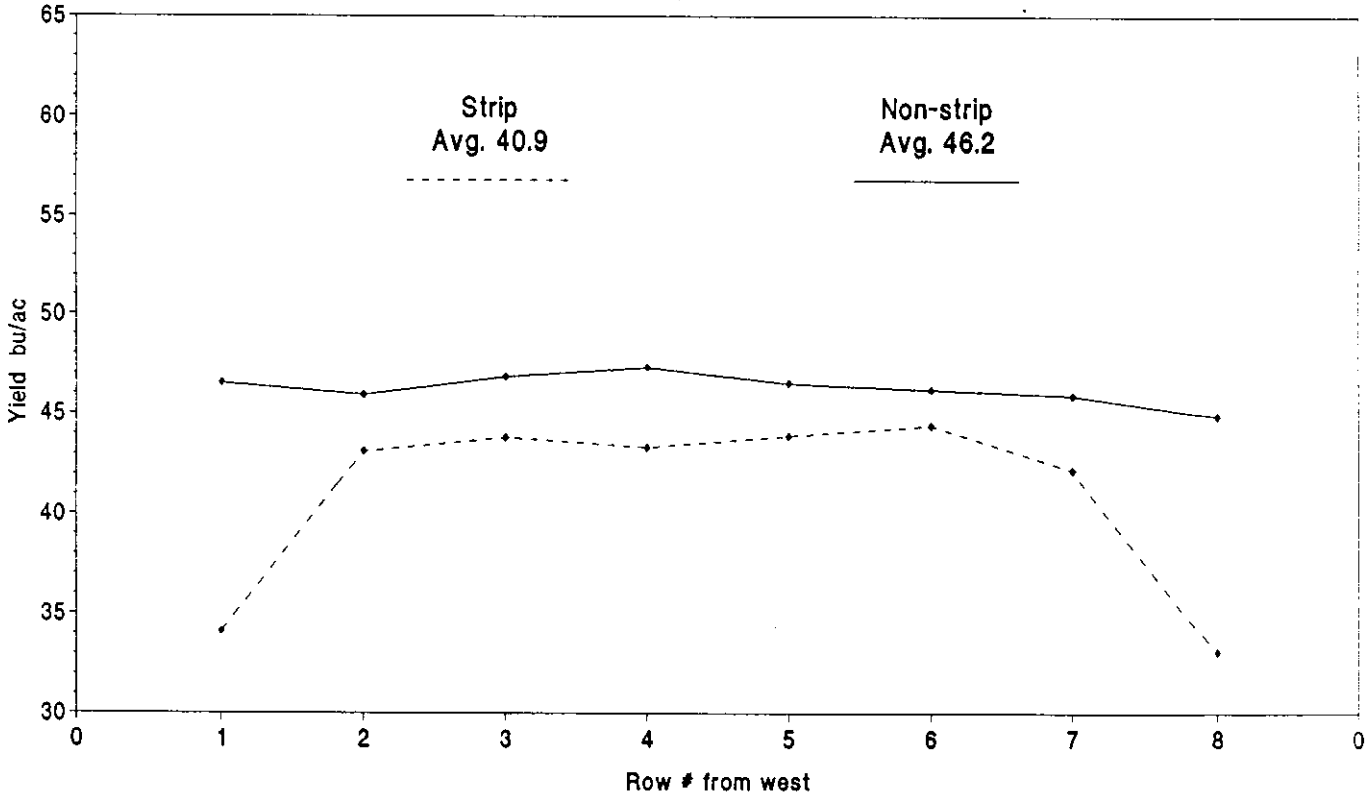


Table 12. ANOV summary, strip cropping on ridges data, Agronomy Farm, 1989.

Variable	Stand 4 wks.	Height 8 wks.	Harv. Moist.	Yield bu/ac
	---- significance level -----			
	Corn			
Strip	NS	NS	NS	.05
Management	.01	NS	NS	NS
Row #	.01	.01	.05	.01
	Soybeans			
Strip	--	--	--	NS
Row #	--	--	--	.01
Strip x Row	--	--	--	.01

SEPAC

LONG TIME TILLAGE STUDY

Corn was planted on June 30. Soybeans were planted on July 1. Primary tillage included the use of a 5-bottom plow and a Glenco coulter chisel on appropriate treatments. Plow and chisel plots received 2 passes with a 15' Glenco soil finisher as secondary tillage. The same tool was used (2 passes) for the shallow tillage disk treatment. Plots were cultivated with a standard shovel type and a Hiniker ridging cultivator. Ridge soybean plots were not re-ridged for the 1990 corn crop due to sufficient ridge height left after the 1989 crop year. All NH_3 was applied pre-plant. Corn and soybeans were harvested with a John Deere 4425 combine and samples were weighed with a portable electronic scale.

CULTURAL PRACTICES USED - 1989
SEPAC Tillage Study

	Corn	Soybeans
Hybrid/Variety	Pioneer 3744	Pella '86
Date planted	June 30	July 1
Seeding rate	26,100 ppa	49 lbs/ac
Seedbed preparation	For plow, chisel - 2 passes with soil finisher For disk - 2 passes with finisher	Same
Fertilizer	100 lb N/ac as NH_3 113# 18-46-0 starter 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1987	No N No starter Same
Insecticide	Counter 15 G 9 lbs/ac	None
Weed control	Preplant: Roundup 5 pts/ac At planting: Bladex 4L 1.5 pts/ac Atrazine 4L 1.5 pts/ac Dual 8E 2 pts/ac No-till & ridge: Roundup 3 pts/ac	Preplant: Roundup 5 pts/ac At planting: Lorox 4L 1 1/4 pts/ac Dual 8E 2 pts/ac No-till & ridge: Roundup 3 pts/ac Post-plant: Blazer 1.5 pt/ac Basagran 1.5 pt/ac Crop oil conc. 1 pt/ac
Cultivation	Once (except no-till)	Once (except no-till)
Harvest area	4-30" rows x length dependent upon plot condition	15' x length dependent upon plot condition

Stand, growth and yield.

Corn - SEPAC suffered through a very wet spring with measurable precipitation occurring on 43% of the days from April 27 to planting on June 30. Total rainfall in this period totaled nearly 10". There were very few back-to-back days when we could have planted the entire corn or soybean crops. Two days after planting, heavy rainfall flooded the plots and reduced corn stands by 1/3 or more. Harvested areas were selected which excluded water ponded areas in all plots. Ponded water was especially damaging to no-till plots where depressional areas were left by old plow dead-furrows. An adequate plant canopy did not develop, thus leading to very poor weed control. Ridge-till had the best plant population, although it was not significantly different. No-till exhibited the tallest plant height through the growing season. No-till also yielded significantly (at the .05 level) the best in both continuous corn and in rotation.

Soybeans - Except for the ridge treatment, all soybeans were drilled at 7.5" with a new John Deere drill. The heavy rainfall after planting caused crusting of the soil surface in tilled plots, resulting in very poor stands in treatments with little surface residue. Weed control was poor in the plots with low populations. The ridge treatment yielded the most at 32.8 bushels/acre, probably due to good stand and adequate weed control. No-till yielded 3.3 bushels/acre less, but not a significant difference (at the .05 level). Plow, chisel and disk yielded 14.4 to 23.4 bushels/acre due to short plant height and extremely poor plant population. See Tables 13 and 14.

Table 13. Response to tillage and previous crop, Clermont si.l., SEPAC, 1989.

Prev. Crop	Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%
		ppa	in.	in.	%	bu/ac
				Corn		
Corn	Plow	17,219	17.1c*	59.3c	37.2	33.0b
	Chisel	17,188	24.0b	70.6bc	36.7	44.6b
	Disk	17,500	24.2b	74.0b	36.9	41.8b
	Ridge	18,000	22.4b	66.3bc	38.1	39.5b
	No-till	17,376	32.8a	88.3a	36.2	60.3a
Soybean	Plow	13,406	15.6c	56.7b	38.1	39.6b
	Chisel	13,625	18.7bc	64.5b	39.6	36.8b
	Disk	15,750	22.3b	70.3b	40.0	45.1b
	Ridge	16,000	20.4bc	66.0b	35.7	39.8b
	No-till	13,875	29.1a	85.1a	36.5	61.2a

		Soybean**	
		%	bu/ac-13%
Corn	Plow	13.5	14.4c
	Chisel	13.7	14.8c
	Disk	13.6	23.4b
	Ridge	13.4	32.8a
	No-till	13.7	29.5a

*Within rotation, data followed by the same letter are not statistically different according to Student-Newman-Kuels test (P = .05).
**Plow, chisel, disk, no-till were drilled. Ridge planted in 30" rows.

Table 14. ANOV summary, tillage data, SEPAC, 1989.

Variable	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield
	-------- significance level ---------				
			Corn		
Tillage	NS	.01	.01	NS	.01
Previous Crop	NS	.05	NS	NS	NS
Tillage x Prev. Crop	NS	NS	NS	NS	NS
			Soybeans		
Tillage				NS	.01

Table 15. 1980-89 yield summary, bu/ac, SEPAC tillage.

Previous Crop	Tillage	Corn 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1980-89 Avg.	1983-89 Avg.
Corn	Plow, spring	113.5	123.3	186.8	53.3	145.3	180.5	146.6	150.7	122.3	33.0	125.5	118.9
	Chisel, fall	121.8	131.4	194.4	58.0	154.6	185.8	150.7	165.7	114.5	44.6	132.2	124.8
	Disk, spring	117.0	125.2	181.4	50.7	145.8	176.8	155.5	148.8	112.0	41.8	125.5	118.8
	Ridge	—	—	—	52.1	150.8	179.7	142.5	139.9	95.2	39.5	----	114.2
	No-Till	104.9	104.6	159.9	66.2	155.5	178.1	162.4	130.1	102.8	60.3	122.5	122.3
Soybeans	Plow, spring	116.2	122.0	196.6	48.5	149.4	185.5	139.4	157.8	120.0	39.6	127.4	120.0
	Chisel, fall	112.0	118.9	187.3	64.5	141.6	183.1	129.0	156.7	108.4	36.8	123.9	117.1
	Disk, spring	119.5	120.0	195.8	70.9	150.8	182.2	144.2	160.6	116.9	45.1	130.6	124.4
	Ridge	—	—	—	64.3	155.5	185.1	153.6	158.1	113.9	39.8	----	124.4
	No-Till	119.6	115.5	197.2	75.8	165.0	181.4	172.4	153.2	118.8	61.2	136.0	132.5
Yearly Average		115.6	120.1	187.4	60.4	151.4	181.8	149.6	152.2	112.5	44.2		

		Soybeans 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[b]	1980-89 Avg.	1981-89 Avg.	1983-89 Avg.
Corn	Plow, spring	38.9	43.1	52.0	23.0	36.5	53.6	48.8	39.0	46.9	14.4	39.7	39.7	37.5
	Chisel, fall	39.6	41.4	51.1	30.1	39.0	53.0	48.5	37.7	40.7	14.8	39.6	39.5	37.7
	Disk, spring	40.0	38.6	51.9	37.2	37.4	51.4	49.8	41.4	43.1	23.4	41.5	41.6	41.1
	Ridge	–	–	–	35.6	40.6	54.0	47.1	41.0	38.8	32.8	----	----	41.4
	No-Till	18.7[a]	42.2	49.4	39.6	40.1	54.0	48.3	48.1	47.9	29.5	41.8	44.3	43.9
Yearly Average		34.3	41.3	51.1	33.1	38.7	53.2	48.5	41.4	43.5	23.0			

[a]Phytophthora root rot reduced yield.

[b]All plots drilled in 7.5" rows except for ridges. Previous years soybeans were in 30" rows.

SEPAC

PARATILL STUDY - 1989

Prior to planting corn on June 27, the tilled plots were worked with a Glenco soil finisher. All plots were harvested with a J.D. 4425 combine and samples were weighed in an electronic weigh buggy.

As at the Agronomy Farm, one objective of this study is to determine how often paratilling needs to be done. We chose to evaluate this need on a two year basis. Half of the paratill treatments are paratilled annually with the other half biennially.

Date	Crop Year	Treatments
Spring 86	1986	Annual & biennial plots
Spring 87	1987	Annual only
Fall 87	1988	Annual & biennial plots
Fall 88	1989	Annual only

CULTURAL PRACTICES USED - 1989

SEPAC PARATILL STUDY

Hybrid	Pioneer 3744
Date planted	June 27
Seeding rate	26,100 ppa
Seedbed preparation	For chisel, paratill + chisel and paratill: 2 passes with soil finisher
Fertilizer	100# N/ac as NH_3 (sidedress) 180# 10-34-0 starter
Insecticide	Counter 15 G 9#/ac
Weed control	Gramoxone 2.5 pt/ac on no-till X-77 1 pt/100 gal. water Bladex 4L 1.5 pt/ac Atrazine 4L 1.5 pt/ac Dual 8E 2 pt/ac
Cultivation	None
Harvest area	4-30" rows x 200'

Stand, growth and yield.

As in the tillage study, planting was delayed because of wet weather. However, we did achieve normal plant populations. This study was planted 3 days earlier than the tillage study and did not experience the germination problems caused in part by the rains of July 3 and 4. There were no significant differences in plant stand or growth through the season. The tilled plots yielded 6.1 bushels more than the no-till plus paratill treatments but this was not statistically significant. See Table 16.

Table 16. Corn response to paratilling, continuous corn, SEPAC, 1989.

Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%
	ppf	in	in	%	bu/ac
Annual Paratill, No-till	24,938	31.4	90.3	38.4ab*	59.3
Biennial Paratill, No-till	25,125	28.3	86.5	39.5a	54.0
No-till	25,688	33.1	91.1	37.1ab	58.9
Annual Paratill, Chisel	23,813	30.8	92.8	36.0b	63.6
Biennial Paratill, Chisel	24,688	27.5	92.4	36.3b	64.9
Chisel	22,750	29.2	84.3	37.2ab	62.0
ANOV sig. level	NS	NS	NS	.05	NS

*Data followed by the same letter are not statistically different according to Student-Newman-Kuels test (P = .05).

This year concludes the paratill study at SEPAC. On this Clermont silt loam soil, there has been no significant response to fall paratilling in the 4 years of this study. Due to the poor structure of this soil, there seems to be no lasting effect of loosening the soil with a paratill into the following growing season.

Table 17. Corn yield summary, bu/ac, in response to paratilling, continuous corn, 1986-1989.

Tillage	1986	1987	1988	1989	Avg.
Annual Paratill, No-till	170.7	136.4	124.6	59.3	122.7
Biennial Paratill, No-till	172.6	133.4	129.0	54.0	122.3
No-till	165.5	132.7	130.2	58.9	121.8
Annual Paratill, Chisel	156.6	123.5	135.8	63.6	119.8
Biennial Paratill, Chisel	158.1	125.7	136.4	64.9	121.3
Chisel	162.4	125.9	135.1	62.0	121.4
ANOV sig. level	NS	NS	NS	NS	NS

DAVIS PAC

PARATILL STUDY - 1989

Frequency of paratilling is being evaluated on a 2 year basis as at the Agronomy Farm and SEPAC.

Date	Crop Year	Treatments
Fall 1984	1985	Annual & biennial plots
Fall 1985	1986	Annual only
Fall 1986	1987	Annual & biennial plots
Fall 1987	1988	Annual only
Fall 1988	1989	Annual & biennial plots

CULTURAL PRACTICES USED - 1989

DAVIS PAC

Hybrid	Pioneer 3737
Date planted	June 9
Seeding rate	26,100 ppa
Seedbed preparation	For moldboard, paratill + moldboard: field cultivate and roterra.
Fertilizer	113#/ac 18-46-0 starter 130# N/ac as NH_3 (sidedress)
Insecticide	Counter 15 G, 9#/ac
Weed control	Pre-plant: Roundup 4 pt/ac Ammonium sulfate 2 lbs/ac X-77 4 pts/ac At planting: Bladex 4L 2 pt/ac Atrazine 4L 2 pt/ac Dual 8E 2 pt/ac
Cultivation	Once on moldboard, paratill + moldboard
Harvest area	4-30" rows x 200' Reps I, II. 4-30" rows x 200' Reps III, IV.

Stand, growth and yield

Plant populations were in the 22,000 to 24,000 range with no significant differences. Plant growth was normal with no differences due to tillage. DAVIS PAC experienced an even wetter growing season than SEPAC with a total of nearly 30" of rain from April 23 to October 23. This caused flooding in Reps III and IV. Even though wet weather delayed planting until June 9, the yields were good, averaging 120.3 bushels per acre for the whole experiment. The moldboard treatments averaged 9.1 bushels per acre more than the no-till treatments. See Table 18.

Table 18. Corn response to paratilling, continuous corn, Davis PAC, 1989.

Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%
	ppa	in	in	%	bu/ac
Annual Paratill, No-till	22,063	21.3	80.1	21.9	110.2b*
Biennial paratill, No-till	23,375	21.7	77.7	20.9	121.1ab
No-till	22,750	21.9	82.4	21.6	114.4ab
Annual Paratill, Moldboard	24,000	23.6	86.6	20.5	127.1a
Biennial Paratill, Moldboard	23,625	23.7	83.1	20.9	124.3a
Moldboard	24,375	23.4	89.4	20.7	124.6a
ANOV sig. level	NS	NS	NS	NS	.01

*Data followed by the same letter are not significantly different according to Student-Newman-Kuels test (P = .05).

This year concludes the paratill study at DAVIS PAC. From Table 19, the data indicates a significant response to treatments in 2 of the 5 years. The 5 year average indicates that paratilling improved no-till yields. The yield increase in the biennial paratilling of both no-till and moldboard is difficult to explain. One would expect less yield increase the further away in time from the paratill operation.

Table 19. Corn yield summary, bu/ac, in response to paratilling, continuous corn, 1985-1989.

Tillage	1985	1986	1987	1988	1989	Avg.
Annual Paratill, No-Till	144.2b*	113.0	100.6	95.0	110.2b	112.6ab
Biennial Paratill, No-till	146.4ab	126.9	95.6	103.0	121.1ab	117.0ab
No-till	141.1b	96.5	92.4	86.9	114.4ab	106.3b
Annual Paratill, Moldboard	145.1b	118.1	105.5	90.3	127.1a	117.2ab
Biennial Paratill, Moldboard	156.1a	126.9	113.3	98.6	124.3a	123.9a
Moldboard	146.6ab	116.2	110.3	93.8	124.6a	118.ab
ANOV sig. level	.05	NS	NS	NS	.01	.05

*Data followed by the same better are not significantly difference according to Student-Newman-Kuels Test (P = .05).

DAVIS PAC T BY 2000 DEMONSTRATIONS

Corn

This non-replicated tillage comparison on the high clay soils of East-central Indiana crossed 3 different soils. On the Glynwood silt loam (2% slope), no-till corn yield was reduced in this wet year. On the highly erodible Morley silty clay loam (10% slope) no-till yields were competitive with chiseling and ridging.

On the poorly drained, depressional Pewamo silty clay loam where no-till is not considered to be competitive, no-till yields were reduced 20+ bushels per acre from the other tillages.

Table 20. Corn response to tillage by soil, corn following soybeans, T by 2000, Davis PAC, 1989.

Soil	Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%
		ppa	in	in	%	bu/ac
Glynwood silt loam, 2% slope	Fall plow	22,500	25.5	87.3	21.0	122.0
	Fall chisel	23,250	24.5	81.0	18.9	131.0
	Ridge	21,750	20.5	74.8	18.9	114.6
	No-till	24,250	27.8	71.3	19.1	77.8
Morley silty clay loam, 10% slope	Fall plow	22,000	22.3	65.0	20.8	88.2
	Fall chisel	23,500	24.5	76.3	18.5	109.2
	Ridge	25,250	24.3	74.3	20.7	117.6
	No-till	21,000	26.0	57.0	20.9	109.5
Pewamo silty clay loam, <1% slope	Fall plow	20,250	19.0	52.3	19.8	99.5
	Fall chisel	20,500	19.0	61.5	20.8	118.9
	Ridge	22,000	27.8	75.0	19.0	106.7
	No-till	22,000	25.0	68.0	19.0	77.2

Soybeans

In this wet year at DAVIS PAC, the best soybean yields were on the Glynwood soil. Plow, chisel and ridge all yielded more than 43 bushels per acre. On the sloping (10%) Morley soil, ridge-tilling yielded the best, no-till the worst and plow and chisel intermediate. Erosion is a major concern on this soil. The ridges in this demonstration run with the slope and channeled the water, causing considerable erosion in the row middles. Plow and chisel also exhibited unacceptable soil loss. In the low area of Pewamo, no-tilling was not competitive. Ridge-till yielded the best with plow and chisel close behind. See Table 21.

Table 21. Soybean response to tillage by soil, drilled soybeans following corn, T by 2000, Davis PAC, 1989.

Soil	Tillage	Harv. Moist.	Yield @ 13%
		%	bu/ac
Glynwood silt loam, 2% slope	Fall plow	15.7	50.7
	Fall chisel	15.7	43.6
	Ridge	15.6	46.5
	No-till	15.9	37.9
Morley silty clay loam, 10% slope	Fall plow	15.6	33.5
	Fall chisel	15.4	35.0
	Ridge	15.6	40.2
	No-till	15.7	28.8
Pewamo silty clay loam, <1% slope	Fall plow	15.1	37.3
	Fall chisel	15.2	36.3
	Ridge	15.4	40.5
	No-till	15.2	26.4

FARM PROGRESS SHOW

CULTURAL PRACTICES USED

Hybrid	DeKalb 550
Date planted	April 26
Seeding rate	26,100 ppa
Seedbed preparation	For moldboard - disc once
Fertilizer	113#/ac 18-46-0 starter 160#N/ac as NH_3 (sidedress)
Insecticide	9#/ac Counter 15G
Weed control	At planting: Atrazine 2.5 pts/ac Dual 2.5 pts/ac Roundup 4 pts/ac on no-till Post-plant 2,4-D .75 pt/ac broadcast Lorox 2 pts/ac directed
Cultivation	Once on moldboard and ridges
Harvest area	4 1,000th acre checks per plot

Stand, growth and yield.

Planting was accomplished early and other field operations were timely. Plant growth was slow due to a cold spell in early May as evidenced by the short plant height at 4 and 8 weeks. A hail storm left the corn very ragged in appearance, however this did not seem to limit yield potential. Stalk lodging was apparent in all treatments, and especially in the ridge treatment. Many ridge farmers experienced unusual lodging for which there is no apparent reason. Even though plant populations were low in the no-till treatments, yields were still good with no-till corn after soybeans yielding the best of this non-replicated demonstration. Ridge and plow yields were equal and no-till continuous corn was lowest but still a respectable 149.2 bushels per acre. On these sloping soils, some form of conservation tillage should be practiced to control erosion. For 1989, no-till gave excellent yields and served as a viable erosion control tillage system. See Table 22.

Table 22. Corn response to tillage and previous crop, Farm Progress Show, Fulton Co., 1989.

Tillage	Previous crop	Stand 4 wks	Height 4 wks	Height 8 wks	Harv. Moist.	Yield @ 15½%
		ppa	in	in	%	bu/ac
No-till	Soybeans	19,000	4.5	34.8	25.9	170.6
No-till	Corn	18,300	3.5	30.4	29.5	149.2
Ridge	Corn	23,300	5.0	33.8	27.9	161.7
Plow	Corn	26,000	5.8	41.5	26.4	162.7

Table 23. Rainfall and Growing Degree Days from Planting to Maturity, 3 locations, corn, 1989.

Week ending	Agronomy Farm Becks 65X (2723) Planting & Maturity* Dates	Rain (inches)	GDD	SEPAC Pioneer 3744 (2612) Planting & Maturity Dates	Rain (inches)	GDD	Davis PAC Pioneer 3737 (2555) Planting & Maturity Dates	Rain (inches)	GDD
	4-25								
5-1		1.33	90		2.12			.99	
5-8		.30	37		.85			.83	
5-16		.57	45		1.49			.63	
5-22		2.54	107		.26			.84	
5-30		2.64	107		2.28			2.53	
6-5		.58	149		1.63			1.74	
6-12		.60	124		.46		6-9	.25	115
6-19		.11	121		.46			.85	118
6-26		.49	176		.46			.03	163
7-3		.49	151	6-30	1.56	157		1.25	158
7-10		.03	183		.45	183		.05	179
7-17		.60	160		.27	159		2.00	157
7-24		1.09	158		.20	165		4.29	167
7-31		.16	175		.54	185		.94	180
8-7		.24	163		.95	179		.69	167
8-14		.10	125		.00	110		.00	115
8-21		.32	142		.50	147		.59	140
8-28		2.57	168		1.55	181		1.00	164
9-4		2.86	130		1.65	146		4.76	133
9-11		.74	158		1.07	163		1.47	163
9-18	9-19	.85	77		.54	107		1.83	86
9-25					.11	87		.00	76
10-2					.01	76		.00	72
10-9					.45	51		.13	50
10-16					.20	96		.08	93
10-23					2.01	41	HARVEST**	1.81	25
10-30					.00	91			
11-6				HARVEST**	.47	27			
Total		17.52	2746		22.54	2351		29.58	2521

*Maturity = black layer formation.

**Corn did not reach maturity before first killing frost.

LOG OF FIELD ACTIVITIES - 1989

April	13	AF-applied NH3 to tillage corn at 250 lbs N/ac. AF-applied NH3 to strip corn at 140 lbs N/ac. AF-applied NH3 to paratill corn at 250 lbs N/ac.
	14	TPAC-applied NH3 to rainulator corn at 160 lbs N/ac.
	20	AF-sprayed 2 qt/ac Roundup and 1.5 pt/ac 2,4-D ester on tillage B/B and B/C no-till as EPP.
	21	AF-plant strip corn.
	22	AF-plant paratill corn.
	25	AF-plant tillage corn. AF-plant diagnostic corn.
	27	FARM PROGRESS SHOW (FPS)-plant tillage corn.
	28	KOSCIOUSCO CO. (KOS)-plant tillage corn, Dan Child's herbicide plots and Mengel's fertilizer plots.
May	3	TPAC-spring plow and chisel rainulator plots.
	8	TPAC-plant rainulator corn and soybeans.
	12	AF-plant tillage soybeans, strip soybeans, diagnostic soybeans, and west end of field 93.
	15	AF-diagnostic second planting date for corn.
	18	AF-strip corn week 4 stand.
	22	AF-paratill corn week 4 stand and height. AF-tillage corn week 4 stand and height.
	23	FPS-corn week 4 stand and height. KOS-corn week 4 stand and height.
	31	FPS-sprayed corn with 2,4D at .75pt/ac.
June	2	AF-paratill, sprayed corn with 2,4D amine at .5pt/ac for velvetleaf. AF-sprayed tillage and strip soybeans with Ambush at 6.4 ounces/ac for bean leaf beetle.
	6	AF-sidedress strip corn with NH3 at 160lbs N/ac.
	7	AF-tillage soybeans week 4 stand and height.
	8	DAVIS PAC (DPAC)-sprayed preplant knockdown herbicides on paratill, Kladivko's, and T-by-2000.
	9	DPAC-plant Kladivko corn, T-by-2000 corn, and paratill corn.
	14	AF-ridge tillage corn and strip corn -cultivate tillage corn and paratill corn.
	15	AF-cultivate tillage, strip, diagnostic and W93 soybeans. AF-ridged diagnostic first date corn planting. -cultivate diagnostic second and third corn.
	16	TPAC-ridge and cultivate corn, cultivate soybeans.
	18	AF-paratill corn week 8 height.
	20	AF-tillage corn week 8 height. FPS-ridge and cultivate demo corn and Mengel's corn. -corn week 8 height. -sprayed corn with Lorox directed for grass.
	21	KOS-sprayed corn with 2,4D amine at 1.5pt/ac. -corn week 8 height.

	23	AF-ridge diagnostic second corn date.
	27	SEPAC-plant paratill corn.
	31	SEPAC-plant tillage corn.
July	1	SEPAC-plant tillage soybeans.
	6	DPAC-T-by-2000 corn week 4 height and height. -paratill week 4 stand and height.
	7	AF-soybean week 8 height. AF-ICI planting demonstration.
	17	DPAC-ridge and cultivate T-by-2000, Kladivko's, and rep 1 and 2 of paratill. -ridge T by 2000 soybeans.
	27	SEPAC-tillage and paratill corn week 4 stand and height.
August	2	SEPAC-ridge and cultivate corn and soybeans.
	3	DPAC-paratill and T-by-2000 corn week 8 height.
	9	KOS-field day.
	25	SEPAC-paratill and tillage corn and soybeans week 8 height.
September	13	AF-field day.
	19	AF-started strip corn harvest.
	26-28	FPS-Farm Progress Show.
October	3	AF-harvest tillage soybeans.
	4	AF-harvest tillage + paratill corn.
	5	AF-harvest tillage corn.
	6	AF-harvest paratill corn.
	9	AF-ridge tillage soybeans.
	10	AF-harvest strip soybeans.
	12	AF-paratill in all tillage plots and chisel in the chisel plots.
	13	AF-ridge strip soybeans.
	16	AF-moldboard plow in tillage plots.
	24	DPAC-harvest T-by-2000 and paratill corn.
	25	DPAC-harvest T-by-2000 soybeans.
	29	AF-finish strip corn harvest.
November	1	SEPAC-harvest tillage and paratill corn. -harvest tillage soybeans.
	14	SEPAC-spread P&K on tillage plots. Gandy setting on 80 and speed 6 mph.