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AGRONOMY RESEARCH CENTER

Long Term Tillage Study

Introduction

Early evaluation of reduced tillage systems in the Midwest centered on well-drained and/or erosive soils. Due to reduced water erosion and savings in soil moisture, systems leaving 70% or more of the soil surface residue covered often increased yield potential on these soils. These findings could not be generalized, however, to the dark silty clay loam soils of the Central Corn Belt where soil moisture and erosion were less severe problems.

Beginning in 1975, a range of tillage systems have been compared annually on Chalmers silty clay loam soil (4% OM) at the Purdue Agronomy Research Center in West-central Indiana. Our goal was to determine long-term yield potential of the different systems and to determine changes in soil characteristics and crop growth that could be associated with yield differences. Plow, chisel, ridge, and no-till systems were compared for continuous corn, corn following soybeans, soybeans following corn, and continuous soybeans. Plots were 12 rows wide and 150 feet long. Row width was 30 inches for both corn and soybeans.

The following cultural practices have been used since the study began. Plowing and chiseling were done in the fall with one disking and one field cultivation for spring seedbed preparation. For the ridge system, ridges were made at cultivation in corn and after harvest in soybeans. A flat disk was used to

scrape ridges at planting. For no-till planting, a one-inch fluted or bubble coulter was used ahead of disk openers. All treatments except no-till were cultivated once.

Starter fertilizer was used for all corn plots, but not for soybeans. Placement was two inches to the side and below the seed. Nitrogen source for corn was anhydrous ammonia, either pre-plant or side-dress. Phosphorus and potassium were surface-applied every other year and lime was surface-applied as needed.

Herbicides were applied at planting. They included atrazine, Bladex, and Dual for all corn, plus either Roundup or Gramoxone Extra for burndown on ridge and no-till plots. Lorox L and Dual were used for all soybeans, with burndown the same as for corn. Where needed, plots were hand weeded to be sure that weed control did not limit yield. Counter was band-applied at planting for corn rootworm control. Chemical control for cutworms, stalk borers, bean leaf beetle, and spider mites was used as needed.

Three corn hybrids and four soybean varieties have been used during the 20 years of the project. Average planting date was May 4 for corn and May 10 for soybeans.

1994

Equipment used:

Primary tillage included the use of an International Harvester 5 18 inch bottom semi-mounted moldboard plow on the plow treatments and a DMI 7 shank chisel plow equipped with 4 inch twisted chisel points on 15 inch centers for the chisel treatment. Nitrogen was applied preplant at a depth of 6 to 7 inches with a 5-knife 30-inch anhydrous ammonia applicator equipped with one coulter and one sealing wing per knife. The outside knives (#1

and #5) were reduced to 1/2 rate and after the first pass through the plots, an outside knife was placed back in the previous outside knife track to give a full rate. This method of knife placement gives us a marker for guiding the equipment for uniform application. Secondary tillage for plow and chisel included the use of a 15 foot pull type tandem disk and a 15 foot fully mounted field cultivator with a rear mounted harrow. Corn and soybeans were

planted with a John Deere Max-Emerge 4 -row 30-inch planter equipped with a 1 inch fluted 8-wave coulter per row mounted on a Rawson brand toolbar. Rawson fertilizer openers behind a ripple coulter opened a slot for starter fertilizer placement. When planting the ridge treatment, a Hiniker row cleaner with horizontally mounted disks scraped 1” off the ridge tops and stabilized the planter. All plots except no-till were cultivated with a 4-row 30-inch Hiniker

ridging cultivator to control weeds and aerate the soil. The ridging wings were raised (and inoperative for “level” cultivating) on the plow and chisel plots. Ridge-till soybean plots were re-ridged after harvest. All corn plots were harvested with a White model 7300 combine equipped with a 4-row 30-inch cornhead. All soybean plots were harvested with a John Deere model 3300 combine equipped with a 10-foot grain platform with pickup reel.

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

- Dr. Scott Abney, Botany and Plant Pathology
Dr. Abney conducted a study to evaluate late season foliage diseases and root rots on plow and no-till soybeans.
- Don Griffith and Terry D. West, Agronomy
D. Griffith and T. West studied long term affects of tillage and rotation by measuring plant population, growth, and yield on all plots.
- Dr. David Mengel, Agronomy.
Dr. Mengel conducted extensive soil sampling to determine fertility and organic matter levels.
- Dr. Eileen Kladviko, Agronomy.
Dr. Kladviko measured aggregate stability of surface soil and made earthworm counts.

<u>CULTURAL PRACTICES USED 1994</u>				
Long Term Tillage Study, Agronomy Research Center				
Item	<u>Corn</u>		<u>Soybean</u>	
	Date	Application	Date	Application
Nitrogen fertilizer	4/21	NH ₃ @ 200 lb/ac N in row middles		None
Secondary tillage	4/25	Disk once on plow and chisel treatments	5/16	Disk once on plow and chisel treatments
	4/26	Field cultivate once on plow and chisel treatments	5/17	Field cultivate once on plow and chisel treatments
Hybrid/Variety planted	4/26	Beck's 6565	5/17	Edison
Seeding rate	4/26	26,100 plants per acre	5/17	49 lb/ac
Starter fertilizer/planter	4/26	34-0-0 @ 95 lb/ac, 2 inches to the side and 2 inches below the seed		None
Insecticide/planter	4/26	Counter 15G, 9 lb/ac, 8 inch band over row		None
Weed control	4/26	<u>At planting (with planter):</u> Bladex 4L 3 pt/ac Atrazine 4L 3 pt/ac Dual II 3 pt/ac Gramoxone Extra 2 pt/ac Spreader 2 pt/100 gallon water <i>All broadcast with flat fan nozzles at 40 psi and 40 gallons water/ac.</i>	5/17	<u>At planting (with planter):</u> Lorox L 2.4 pt/ac Dual 8E 3 pt/ac Gramoxone Extra 2 pt/ac Spreader 2 pt/100 gallon water <i>All broadcast with flat fan nozzles at 40 psi and 40 gallons water/ac.</i>
Cultivation	6/7	Plow and chisel treatments	6/20	Plow and chisel treatments
	6/11	Ridge treatment (reridge)	10/17	Ridge treatment (reridge)
Harvest	10/4	Center 4 of 12 rows, 150 ft	10/3	Center 4 of 12 rows, 150 ft
Primary tillage	10/18	Fall plow on plow treatment	10/18	Fall plow on plow treatment
	10/18	Fall chisel on chisel treatment	10/18	Fall chisel on chisel treatment

Stand, growth, and yield -- Corn.

Corn response in these long-term plots tended to follow past trends with one major exception. Germination and emergence delay for no-till corn after corn was much greater than in previous years. While much of this seed eventually emerged (6,750 plants per acre from 4 weeks after planting to 8 weeks after planting) these plants produced little grain. While seeding depth was variable in these plots, it did not appear to be much different than in past years. Soil temperatures were cooler than normal and there was heavy rain about a week after

planting, followed by an extended dry period (Figure 1.). Growth and maturity was delayed for no-till continuous corn and yield was greatly reduced, compared to other systems. Maturity and yield difference among plow, chisel and ridge systems in continuous corn were not statistically significantly different ($P = 0.05$).

When corn followed soybeans, growth and maturity were similar for all systems, but no-till yield (203 bu/ac) was reduced. There was no obvious cause for the reduced yield.

Table 1. Corn population, height at 4 and 8 weeks after planting, maturity and yield as affected by tillage and rotation, Chalmers silty clay loam, Agronomy Research Center, 1994.*

Previous Crop	Tillage	Stand 4 weeks	Height 4 weeks	Height 8 weeks	Harvest Moisture	Yield @15.5%
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		ppa	in	in	%	bu/ac
Corn	Plow	27190a**	7.5a	59.1a	25.7b	215.6a
	Chisel	26880a	7.1a	57.8ab	26.3b	201.5a
	Ridge***	26030a	7.2a	54.5b	27.0b	205.2a
	No-till	16810b****	3.7b	39.6c	30.0a	125.2b
Soybean	Plow	26560	7.4	59.8	25.5	215.9a
	Chisel	27160	7.7	61.8	24.9	225.2a
	Ridge***	26410	7.6	59.9	25.6	218.3a
	No-till	27060	7.7	62.3	25.4	202.9b

*Average of 4 replications.

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

***Height at 8 weeks measured after ridging. Ridge height was 4 to 5 inches.

****Final stand in no-till continuous corn was 23590 plants per acre.

Stand, growth, and yield -- Soybeans.

The data (Table 2) reflect no differences due to tillage system but rotation soybean yields were about 10% greater than continuous soybean yields for

all tillage systems. Soybean stands were about 35% greater than intended, which lead to lodging in all plots. Soybean seed was smaller than in past years and we did not adjust planter setting to compensate.

Table 2. Soybean population, height at 4 and 8 weeks after planting, maturity and yield as affected by tillage and rotation, Chalmers silty clay loam, Agronomy Research Center, 1994.*

Previous Crop	Tillage	Stand 4 weeks	Height 4 weeks	Height 8 weeks	Harvest Moisture	Yield @13.0%
		ppf	in	in	%	bu/ac
Corn	Plow	13.2	9.3	27.0	11.2	53.4
	Chisel	13.5	9.7	27.0	11.0	51.2
	Ridge	13.3	9.3	27.5	11.4	51.0
	No-till	12.6	8.2	26.1	11.0	52.8
Soybean	Plow	13.2	9.1	26.5	11.2	47.4
	Chisel	13.5	9.1	26.7	10.9	46.3
	Ridge	13.2	8.9	26.2	11.1	45.9
	No-till	13.7	9.6	27.0	11.0	46.1

*Average of 4 replications.

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

Table 3. Analysis of variance summary, tillage data, Agronomy Research Center, 1994.

Variable	Stand 4 weeks	Height 4 weeks	Height 8 weeks	Harvest Moisture	Yield bu/ac
-----Significance Level-----					
Corn					
Tillage	.01	.01	.01	.01	.01
Previous crop	.01	.01	.01	.01	.01
Tillage x previous crop	.01	.01	.01	.01	.01
Soybean					
Tillage	NS	NS	NS	NS	NS
Previous crop	NS	NS	NS	NS	.01
Tillage x previous crop	.01	.01	.01	NS	NS

Plans for 1995

Continue the Long Term study with these modifications:

- Drill soybeans in the plow, chisel and no-till treatments.
- Shift continuous no-till corn rows 4 to 6 inches off last year's row.

Long Term Yields (Table 4.)

Average corn yields for chisel and ridge systems are reduced only 3 % or less, compared to plowing, in continuous corn and these systems are equal to plowing for corn after soybeans. No-till average yield is 14% less in continuous corn and 3 % less for corn after soybeans, compared to plowing. In continuous corn, there is a tendency for greater reduction in no-till yields with time. Rotation corn yields were better than continuous corn yields by 5%

with plowing, 7-8% with chisel and ridge, and by 15% with no-till.

Soybean response to tillage shows long-term average yield with plowing about 5% better than yields with chisel, ridge, and no-till systems. There appears to be tendency for no-till soybean yields to be more competitive with time. Rotation soybean yields have consistently been better than continuous soybean yields by 7-10%.

Separate page for Table 4.

Strip Preparation Study

What is strip preparation?

- The concept of preparing a residue free and/or tilled strip for each row in soil that is not tilled before planting.

Why strip preparation?

- To provide a warmer, drier and less dense soil in the row area, more uniform seed depth, improved seed-soil contact and reduced allelopathy.
- More favorable in-row soil may provide more vigorous early rooting, speed crop maturity, and increase yield compared to standard no-till planting.
- To provide improved control of soil erosion compared to full width tillage.
- To increase net profits.

Objective of this study.

- To determine the affect of strip preparation on corn and soybean emergence, growth, maturity and yield in central and northern Indiana.
- To determine the effect of residue removal and zone tillage on soil temperature.

No-till planting of corn or soybean into heavy residue sometimes reduces yield potential in northern Indiana and on poorly drained soils in central and southern Indiana. The combination of cool soil temperature and dense soil tends to slow growth and maturity, compared to a conventional seedbed.

Studies in Ontario, Iowa and Minnesota indicate that some form of residue removal or strip tillage for each row may overcome the early-season problems of no-till fields. This would allow for competitive yield potential while maintaining soil conservation, improved water quality and cost reduction benefits of no-till. This study will evaluate currently available strip preparation attachments such as "trash whippers" and multiple fluted coulters under Indiana conditions and allow development of new strip preparation techniques. Field activities conducted in 1993 were to establish plot location and cropping sequence. The data from 1994 is presented in this report

Treatments include plow, standard no-till, multiple coulters and Purdue "mini-tiller," all with and without removal of residue from the row area. Rawson brand coulters tilled an eight inch wide band approximately 2-4 inches deep with a one inch waffle coulters in front followed by two 2 inch fluted coulters. The mini-tiller is a 5 inch blade attached behind a rippled coulters and set 4 - 5 inches deep to lift and loosen soil in the row area. Standard no-till treatment included a ripple coulters ahead of seeding units. Dawn trash whippers provided removal of residue from the row area.

<u>CULTURAL PRACTICES USED 1994</u> Strip Preparation Study, Agronomy Research Center		
Item	Date	Application
Secondary tillage	4/25	Disk once on plow treatment
	4/25	Field cultivate once on plow treatment
Hybrid planted	4/25	Pioneer 3394
Seeding rate	4/25	26,100 plants per acre
Starter fertilizer/planter	4/25	34-0-0 @ 95 lb/ac, 2 inches to the side and 2 inches below the seed
Insecticide/planter	4/25	Counter 15G, 9 lb/ac, 8 inch band over row
Spring strip preparation/planter	4/25	<u>3 Coulter treatment in and between old rows</u> : one 1 inch fluted 8 wave center coulter with one 2 inch fluted 8 wave coulter 4 inches to each side of the center coulter <u>3 Coulter with residue removed treatment in and between old rows</u> : one 1 inch fluted 8 wave center coulter with one 2 inch fluted 8 wave coulter 4 inches to each side of the center coulter. Row cleaners used ahead of coulters to remove residue from row area. <u>Residue removed treatment in and between old rows</u> : Row cleaners used to remove residue from new row area.
Weed control	4/26	<u>At planting (with planter)</u> : Bladex 4L 3 pt/ac Atrazine 4L 3 pt/ac Dual II 3 pt/ac Gramoxone Extra 2 pt/ac Spreader 2 pt/100 gallon water <i>All broadcast with flat fan nozzles at 40 psi and 40 gallons water/ac.</i>
Cultivation	6/7	Plow treatment, once
Nitrogen fertilizer	6/11	NH ₃ @ 180 lb/ac N in row middles, sidedressed
Harvest	10/5	All 4 rows, 110 ft
Fall strip preparation/toolbar	10/6	<u>3 Coulter treatment in and between old rows</u> : one 1 inch fluted 8 wave center coulter with one 2 inch fluted 8 wave 4 inches to each side of the center coulter <u>3 Coulter with residue removed treatment in and between old rows</u> : one 1 inch fluted 8 wave center coulter with one 2 inch fluted 8 wave 4 inches to each side of the center coulter. Row cleaners used ahead of coulters to remove residue from row area. <u>Residue removed treatment in and between old rows</u> : Row cleaners used to remove residue from row area.
	11/3	<u>Fertilizer applicator treatment in and between old rows</u> : Applied N-Serve stabilized NH ₃ @ 200 lb/ac with 5 knife applicator equipped with 2 covering disks per shank.
Primary tillage	10/13	Fall plow on plow treatment

Table 5. Corn population, height at 4 and 8 weeks after planting, days to 50% tassel, maturity and yield as affected by strip preparation, row location, and timing of strip preparation, Agronomy Research Center, 1994.*

Treatment	Days to 50% Emergence**	Stand 4 weeks ppa	Height 4 weeks in	Height 8 weeks in	50 % Tassel days	Harvest Moisture %	Yield @ 15.5% bu/ac
Continuous corn							
Fall plow	15	25708	7.3	57.3	78.2	19.5	223.5
In old row:							
Fall, row cleaners	18	24083	6.1	43.5	82.5	19.8	178.7
Fall, 3 coulters	21	21833	5.3	38.6	83.2	20.2	171.0
Fall, row cleaners & 3 coulters	19	24583	5.8	41.2	82.2	20.0	181.6
Fall, NH3 band	19	22667	5.9	40.1	82.2	20.7	184.4
Spring, row cleaners	21	21625	5.4	42.5	82.5	20.3	174.1
Spring, 3 coulters	21	22250	5.8	39.6	83.0	20.5	171.6
Spring, row cleaners & 3 coulters	19	21958	6.1	43.6	81.5	20.2	171.9
Spring, no-till	21	21500	4.5	38.5	83.7	20.6	162.6
Between old rows							
Fall, row cleaners	19	25500	6.3	42.5	81.7	19.5	189.8
Fall, 3 coulters	18	25375	6.4	43.4	81.5	19.7	187.1
Fall, row cleaners & 3 coulters	17	25708	6.6	42.9	80.2	20.2	188.7
Fall, NH3 band	18	24625	5.8	45.5	82.0	20.2	194.6
Spring, row cleaners	20	22375	5.8	43.5	81.2	18.8	178.9
Spring, 3 coulters	19	24125	5.8	42.5	81.5	20.0	181.4
Spring, row cleaners & 3 coulters	19	22958	5.8	43.4	81.7	19.9	176.9
Spring, no-till	19	24958	6.1	41.7	82.5	20.3	183.8
Corn after soybeans							
Fall plow	14	26125	7.8	58.3	78.2	19.4	223.2
Fall, row cleaners	14	26792	7.6	55.5	78.2	19.6	225.7
Fall, 3 coulters	15	26375	6.8	49.3	79.5	20.2	223.2
Fall, row cleaners & 3 coulters	15	26458	7.4	52.4	79.0	19.9	228.0
Fall, NH3 band	15	26667	7.2	53.3	78.7	19.7	229.9
Spring, row cleaners	17	24958	7.2	53.5	79.5	20.1	214.9
Spring, 3 coulters	17	25333	6.6	48.5	80.5	20.7	211.3
Spring, row cleaners & 3 coulters	17	23917	6.7	49.0	80.5	20.3	211.3
Spring, no-till	16	25667	7.1	49.3	79.5	20.5	216.6

*Average of 4 replications.

**Average of 2 replications.

Soil Temperatures:

To document the effect of strip preparation on soil temperatures, we used electronic thermometers to record daily maximum and minimum temperatures. The sensor part of the each

thermometer was buried (being careful not to disturb the soil structure or residue cover) at 4 inches below the soil surface, directly in the new seed row. Data was recorded on 41 out of 42 days

Conclusions from Midwest strip preparation research.

- Not likely to be beneficial where traditional no-till planting is successful.
- May not improve yields consistently in corn/soybean rotation, even on poorly drained soil.
- Moving residue should improve no-till continuous corn yields on dark poorly drained soil, but not likely to equal yields with full width tillage.

- Where needed, it may be more beneficial when done in the fall than when done at planting.
- May provide more uniform seedling emergence in uneven residue or uneven soil surface.

Challenges with strip preparation.

- Wet soils under heavy residue.
- Use on erodible land.
- Maintaining depth on different soils.
- Removing residue without leaving a depression.

NORTHEAST PURDUE AGRICULTURAL CENTER

As stated earlier in this report, no-till planting of corn or soybeans into heavy residue sometimes reduces yield potential in northern Indiana. The combination of cool soil temperature and dense soil tends to slow growth and maturity, compared to a conventional seedbed. In these studies we are investigating forms of shallow strip preparation for each row, which may overcome the early-season problems of no-till fields.

Treatments are evaluated for continuous corn on Boyer and Rawson sandy loams at the Schrader farm and for corn after no-till drilled soybeans on Blount silt loam at the Kyler farm.

Treatments include spring chisel plowing as the conventional soil tillage system, standard no-till, splitting no-till middles, row cleaners, multiple coulters and the Purdue "mini-tiller" (loosens soil to 4" depth under the row). Fall and spring timing of strip preparation is another variable at Schrader. All plots were planted with a John Deere Max-Emerge planter equipped with commercially available strip preparation attachments, except for the Purdue mini-tiller. Disking provides the secondary tillage in conventional plots. All plots are machine harvested and samples were weighed in a portable electronic weigh buggy.

Strip Preparation Study -- Schrader Farm

<u>CULTURAL PRACTICES USED 1994</u>		
Strip Preparation Study, Schrader Farm, Northeast Purdue Agricultural Center		
Item	Date	Application
Fall strip preparation	10/26/93	<u>3 Coulter with residue removed treatment between rows</u> : one 1 inch fluted 8 wave center coultter with one 2 inch fluted 8 wave coultter 4 inches to each side of the center coultter. Row cleaners used ahead of coultters to remove residue from row area.
Primary tillage	4/26	<u>Mini-tiller between rows</u> : one 1 inch fluted 8 wave center coultter with ripple coultter in front of mini-tiller. Mini-tiller operated at a depth of 4 inches.
Secondary tillage	5/3	Spring chisel (4 inch twisted chisel points) on chisel treatment
	5/4	Disk once on chisel treatment
Strip preparation	5/4	<u>Mini-tiller between rows</u> : one 1 inch fluted 8 wave center coultter with ripple coultter in front of mini-tiller. Mini-tiller operated at a depth of 4 inches.
	5/4	Row cleaner treatment: no coultters
	5/4	<u>3 Coulter treatment in and between old rows</u> : one 1 inch fluted 8 wave center coultter with one 2 inch fluted 8 wave coultter 4 inches to each side of the center coultter
Hybrid planted	5/4	Pioneer 3394
Seeding rate	5/4	26,100 plants per acre
Starter fertilizer/planter	5/4	18-46-0 @ 113 lb/ac, 2 inches to the side and 2 inches below the seed
Insecticide/planter	5/4	Force 15G, 9 lb/ac, 8 inch band over row
Weed control	5/2	<u>Early preplant (with ATV sprayer at 12 mph)</u> : Roundup 2 pt/ac 2,4,-D ester 2 pt ac Spreader 4 pt/100 gallons of water (3.2 ounce/ac) Ammonium sulfate 17 lb/100 gallons of water (0.75 lb/ac) <i>All broadcast with flat fan nozzles spaced at 20", at 30 psi, and 6 gallons water/ac.</i>
	5/4	<u>At planting (with planter)</u> : Extrazine 2.4 lb/ac Dual 8E 2 pt/ac Roundup 2 pt/ac <i>All broadcast with flat fan nozzles spaced at 30", at 40 psi and 40 gallons water/ac.</i>
Nitrogen fertilizer	6/13	NH ₃ @ 170 lb/ac N in row middles, sidedressed
Cultivation	6/14	Chisel treatment, once
Harvest	10/5	All 8 rows, 150 ft
Fall strip preparation	11/17/94	<u>3 Coulter with residue removed treatment between rows</u> : one 1 inch fluted 8 wave center coultter with one 2 inch fluted 8 wave coultter 4 inches to each side of the center coultter. Row cleaners used ahead of coultters to remove residue from row area.
		<u>Mini-tiller with residue removed between rows</u> : <i>not completed</i>
Bulk P and K	10/26	200 lb/ac 0-46-0 and 200 lb/ac 0-0-60
Lime	2/10/93	Dolomitic limestone 2 ton/ac

Stand, growth and yield

Traditional no-till planting in the old row had significantly lower stand than all other treatments and chiseled corn was taller than corn in other systems at 4 and 8 weeks after planting. Differences

in moisture and yield were not statistically significant ($P = .05$) even though yields ranged from 130.6 bushels per acre (no-till in row) to 143.3 bushels per acre (chisel), an indication of variability in the trial.

Table 6. Corn population, height at 4 and 8 weeks after planting, maturity and yield as affected by tillage, continuous corn, Boyer sandy loam and Rawson sandy loam, Schrader Farm, NEPAC, 1994.*

Tillage	Stand	Height	Height	Harvest	Yield
	4 weeks	4 weeks	8 weeks	Moisture	@15.5%
	ppa	in	in	%	bu/ac
Chisel	25810a**	12.7a	66.3a	17.4	143.3
No-till	23410b	8.6b	51.5b	19.3	130.6
No-till (split middles)	25340a	9.1b	54.3b	18.7	137.7
Row cleaners (split middles)	25810a	9.9b	55.3b	18.6	137.1
Coulters, spring (split middles)	25440a	9.8b	58.6b	17.4	134.6
Coulters, fall (split middles)	25280a	9.4b	53.7b	18.7	139.1
Mini-till, spring (split middles)	25690a	10.3b	56.9b	17.7	139.0
Mini-till, fall (split middles)	25280a	10.3b	55.9b	17.7	131.1
ANOVA sig. level	.01	.01	.01	NS	NS

*Average of 4 replications

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

Table 7. Continuous corn yield summary, bu/ac, Rawson sandy loam, NEPAC, 1992-1994*.

Tillage	1992	1993	1994
Chisel	195.8	171.2	143.3
No-till	186.2	152.8	130.6
No-till between old rows	----	158.6	137.7
Row cleaners (RC) on old row	179.7	156.5	----
Row cleaners between old rows	----	----	137.1
3 coulters, spring, on old row	185.5	149.2	----
3 coulters, spring, between old rows	----	----	134.6
3 coulters, fall, on old row	187.2	163.5	----
3 coulters + RC, fall between old rows	----	----	139.1
Mini-till, spring, on old rows	179.1	154.0	----
Mini-till, spring, between old rows	----	----	139.0
Mini-till, fall, on old rows	181.5	151.5	----
Mini-till, fall, between old rows	----	----	131.1
Annual average	185.0	157.2	136.6

*Average of 4 replications.

To document the effect of strip preparation on soil temperatures, we used electronic thermometers to record daily maximum and minimum temperatures. The sensor part of the each thermometer was buried (being careful not to disturb the soil structure or residue cover) at 4 inches below the soil surface, directly in the new seed row. Data was recorded on 34 out of 35 days. All methods of

strip preparation and the traditional no-till in row middles increased daily maximum temperature 2.5 degrees or more as compared to traditional no-till in old row. Multiple coulters in the row middles, when used in the fall, increased soil temperatures equal to full width tillage. Note that the daily minimum of the chisel treatment averaged 2.5 degrees warmer than all of the other treatments.

Strip Preparation Study -- Kyler Farm

<u>CULTURAL PRACTICES USED 1994</u>		
Strip Preparation Study, Kyler Farm, Northeast Purdue Agricultural Center		
Item	Date	Application
Primary tillage	4/26	Spring chisel (4 inch twisted chisel points) on chisel treatment
Secondary tillage	5/11	Disk once on chisel treatment
Hybrid planted	5/11	Pioneer 3394
Strip preparation	5/11	<u>Mini-tiller</u> : one 1 inch fluted 8 wave center coulters with ripple coulters in front of mini-tiller. Mini-tiller operated at a depth of 4 inches.
	5/11	Row cleaner treatment: one 1 inch fluted 8 wave center coulters
	5/11	<u>3 Coulters treatment</u> : one 1 inch fluted 8 wave center coulters with one 2 inch fluted 8 wave coulters 4 inches to each side of the center coulters
Seeding rate	5/11	26,100 plants per acre
Starter fertilizer/planter	5/11	18-46-0 @ 113 lb/ac, 2 inches to the side and 2 inches below the seed
Insecticide/planter	5/11	Force 15G, 9 lb/ac, 8 inch band
Weed control	5/11	<u>At planting (with planter)</u> :
		Extrazine 2.5 lb/ac
		Dual II 2 pt/ac
		Roundup 4 pt/ac
<i>All broadcast with flat fan nozzles spaced at 30", at 40 psi and 40 gallons water/ac.</i>		
Nitrogen fertilizer	6/17	NH ₃ @ 170 lb/ac N in row middles, sidedressed
Cultivation	6/20	Chisel treatment, once
Harvest	10/14	All 8 rows, 100 ft
Lime	2/10/93	Dolomitic limestone 2 ton/ac

Stand, growth and yield

Using row cleaners caused reduced stand on this soil in 1994. In drilled soybean stubble on the Blount soil, traditional no-till was equal to or better than the

chisel system, and strip preparation did not improve corn yield. Three-year data from this trial (Table 9) show similar results.

Table 8. Corn population, height at 4 and 8 weeks after planting, maturity and yield as affected by tillage, rotation corn/soybean, Blount silt loam, Kyler Farm, NEPAC, 1994.*

Tillage	Stand 4 weeks ppa	Height 4 weeks in	Height 8 weeks in	Harvest Moisture %	Yield @15.5% bu/ac
Chisel	22250a**	11.4	56.7	21.8	119.8
No-till	23880a	12.3	61.0	21.7	126.3
Row cleaners	19670b	11.1	57.6	21.5	118.2
Coulters	24250a	12.0	60.4	21.4	125.2
Mini-till	24170a	11.8	62.3	21.0	127.6
ANOVA sig. level	.01	NS	NS	NS	NS

*Average of 4 replications.

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

Table 9. Long term corn population, height at 4 and 8 weeks after planting, maturity and yield as affected by tillage, rotation corn/soybean, Blount silt loam, Kyler Farm, NEPAC, 1992-1994.*

Tillage	Stand	Height	Height	Harvest	Yield
	4 weeks	4 weeks	8 weeks	Moisture	@15.5%
	ppa	in	in	%	bu/ac
Chisel	23130b**	11.8	57.8	26.2	155.9
No-till	24670a	12.4	57.1	26.5	153.4
Row cleaners	22970b	11.8	55.1	26.6	151.5
Coulters	24670a	12.0	55.9	26.8	154.9
Mini-till	23880ab	12.5	56.8	26.1	156.6
ANOV sig. level	.05	NS	NS	NS	NS

*Average of 4 replications.

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

THROCKMORTON PURDUE AGRICULTURAL CENTER

These plots, now in their 10+ year, are used by the National Soil Erosion Laboratory to study the long term effect of reduced tillage on soil physical properties and soil erosion. They were also used in 1994 to study the effect of shallow tillage and incorporation on the movement of Bladex herbicide on this rolling silt loam soil. Treatments include plow, chisel, ridge and no-till planting for continuous corn, corn after soybeans, soybeans after corn, and continuous soybeans. There is no replication.

<u>CULTURAL PRACTICES USED 1994</u>				
Rainulator - Tillage Study, Throckmorton Purdue Agricultural Center				
Item	<u>Corn</u>		<u>Soybean</u>	
	Date	Application	Date	Application
Hybrid/Variety planted	5/24	Pioneer 3394	5/24	Golden Harvest H-1271
Seeding rate	5/24	26,100 plants per acre	5/24	49 lb/ac
Starter fertilizer/planter	5/24	34-0-0 @ 95 lb/ac, 2 inches to the side and 2 inches below the seed		None
Insecticide/planter	5/24	Counter 15G, 9 lb/ac, 8 inch band over row		None
Weed control	5/24	<u>At planting (with planter):</u> Broadstrike 2 pt/ac Dual II 2 pt/ac Roundup 2 pt/ac <i>All broadcast with flat fan nozzles at 40 psi and 40 gallons water/ac.</i>	5/24	<u>At planting (with planter):</u> Lorox L 2.4 pt/ac Dual 8E 2 pt/ac Roundup 2 pt/ac <i>All broadcast with flat fan nozzles at 40 psi and 40 gallons water/ac.</i>
Nitrogen fertilizer	6/28	34-0-0 @150 lb/ac, hand spread		
Cultivation	6/30	Plow and chisel treatments	6/30	Plow and chisel treatments
No harvest data taken				