

ANNUAL REPORT

TILLAGE STUDIES, PURDUE AGRONOMY FARM, 1978

The 1978 season was characterized by wet soils in April and May, a four-inch rainstorm with hail damage on June 25, and a "late" fall with adequate rainfall and above average growing degree days in the second half of the growing season. Project activities and dates accomplished are listed in Appendix A.

Plow, chisel, and no-til corn plots were planted on May 3, but ridge plots were delayed one week due to rain. Hybrid used was Becks 65X (1290 seeds/lb.). Seed used at planting showed the following approximate seeding rates per acre: plow-24,586, chisel-24,267, ridge-26,928, and no-til-26,808. These rates may reflect the more firm soil in ridge and no-til plots allowing less slippage of the unit drive wheels.

Herbicides used and rates per acre were: C/C = 2½ qts. Atrazine 4L + 3 qts. Lasso + 2 qts. Roundup + Surfactant at planting. All plots were cultivated once except no-til. C/B = same as above except substitute 2½ qts. Bladex for Atrazine. All soybeans = ¾ lbs. Sencor + 3 qts. Lasso + 2 qts. Roundup + Surfactant at planting. One quart Basagran and one quart experimental Hoelon were applied postemergence in separate trips for nutsedge and foxtail control, respectively. There was no cultivation.

Furadan was banded at planting (13 lbs./ac. of 10g.) for soil insect control.

Giant foxtail was a serious problem in chisel, ridge, and no-til bean plots and in no-til corn plots. It was most severe in no-til continuous bean plots. Control was good in conventional plots. Most foxtail came late after the Hoelon application and the four inch rains on June 25. Hail in this storm stripped bean leaves and foliage did not close in between rows until about four weeks later than usual. Due to water damage from this storm, yields were checked on only three reps of corn and 2 reps of beans. Corn borer infestation was moderately severe. Control measures were needed but not taken.

STAND, GROWTH & YIELD

Corn stands averaged about 80% of the planted seed; a little lower than in past years. No-til stands were slightly lower than other systems both after corn and after beans. No-til corn was slightly shorter than plow and chisel corn, but the difference was less than in past years. Ridge corn growth was slightly reduced due to later planting. There was little difference among corn yields, with no response either to tillage or to previous crop.

There was little difference in soybean population among treatments, ranging from 3½ to 4 plants/ft. No-til beans were 2-3" shorter than beans in other systems at eight weeks after planting. No-til bean yields were lowest both after corn and after beans, but the range in bean yields was amazingly small in view of the differences in foxtail control. With only 2 reps harvested, ANOV would not show these yields to be statistically different.

Table 1. Corn and Soybean Response to Tillage, Chalmers si.c.l., 1978

Prev. Crop	Tillage	Corn				Beans			
		Stand, 4 wks.	Ht. 4 wks.	Ht. 8 wks.	Bu./ac. ^{c/}	Stand, plants/3'	Ht. 4 wks.	Ht. 8 wks.	Bu./ac. ^{d/}
Corn	Plow	20,594	16.8	51.6	146.8	11.0	6.3	16.5	39.3
	Chisel	20,719	16.2	50.6	144.7	10.1	6.4	17.5	45.0
	Ridge ^{a/}	21,688	15.1	47.9	135.5 ^{b/}	11.5	6.5	17.7	39.4
	No-til	19,969	15.3	48.7	146.1	11.0	6.5	14.7	36.2
Beans	Plow	18,938	15.7	51.3	145.4	10.5	6.5	18.1	38.2
	Chisel	20,500	16.9	51.2	140.2	12.1	7.0	17.8	37.8
	Ridge ^{a/}	20,938	16.1	47.5	142.1	11.0	6.2	18.9	35.2
	No-til	18,781	16.3	48.7	142.8	12.8	6.0	15.6	34.1

^{a/} Ridge corn planted one week later than other systems.

^{b/} Cultivator damage may have lowered yield.

^{c/} 1978 yields are averages of 3 reps. only due to water damage in rep. I.

^{d/} 1978 yields are averages of 2 reps. only due to water damage and excessive foxtail in reps. I and II.

Four-year average yields for both corn and beans are summarized in Tables 2 & 3. Although there was year to year variation in response to tillage and cropping sequence, average corn yields vary little. The relatively good performance of no-til corn, especially in continuous cropping, has been surprising. Warm, dry springs in '76 and '77 and a midseason drouth in 1977 may have favored no-til corn, compared to "average" weather conditions. Only in 1977 was there a consistent yield response to rotating crops. There was no obvious reason for lack of response in other years.

Average soybean yields show a consistent yield increase of about 10% for rotation with corn across all tillage systems. Bean yields with plowing and chiseling were nearly equal, while ridge and no-til yields were slightly lower. Competition from foxtail was, no doubt, a factor in reducing yields. Increased phytophthora root rot, documented by Dr. Don Scott, may also have been a factor.

Table 2. Corn Response to Tillage and Previous Crop
Purdue Agronomy Farm, Chalmers si.c.l., 1975-78

Prev. Crop	Tillage	Yield-Bu./Ac.				
		'75	'76	'77	'78 ^{a/}	Avg.
Corn	Plow	176.1	140.4	137.8	146.8	150.3
	Chisel	165.0	147.4	135.5	144.7	148.2
	Ridge	141.4	154.7	137.2	135.5 ^{b/}	142.2
	No-til	165.4	153.7	136.3	146.1	150.4
Soybeans	Plow	167.4	145.1	146.1	145.4	151.0
	Chisel	177.1	140.8	149.5	140.2	151.9
	Ridge	149.5	154.7	147.8	142.1 ^{b/}	148.5
	No-til	175.2	143.4	144.4	142.8	151.5

^{a/} Avg. of 3 reps. instead of 4.

^{b/} Planted one week later in 1978.

Table 3. Soybean Response to Tillage and Previous Crop
Purdue Agronomy Farm, Chalmers si.c.l., 1975-78

Prev. Crop	Tillage	Yield-Bu./Ac.				
		'75	'76	'77	'78 ^{a/}	Avg.
Corn	Plow	56.4	54.4	55.4	39.3	51.4
	Chisel	57.6	50.7	54.1	45.0	51.9
	Ridge	49.9	50.9	50.4	39.4	47.7
	No-til	56.0	48.3	52.1	36.2	48.2
Soybeans	Plow	52.7	48.0	50.3	38.2	47.3
	Chisel	52.2	45.5	48.8	37.8	46.1
	Ridge	49.1	46.0	47.5	35.2	44.5
	No-til	47.8	41.4	44.6	34.1	42.0

^{a/} Avg. of 2 reps. instead of 4.

SOIL TEMPERATURE COMPARISONS

Maximum-Minimum soil temperature sensors were located in plow and no-til plots following both corn and beans. They were placed at a 4" depth in the row in corn plots the day after planting. Temperatures were recorded daily at about 9:00 a.m. for eight weeks after planting.

Table 4. Soil Temperature, °F, 4" depth, first 8 weeks after planting

Prev. Crop	Plow			No-til		
	Max.	Min.	Avg.	Max.	Min.	Avg.
* Corn	66.84	57.11	61.97	63.37	57.32	60.34
* Beans	67.32	56.26	61.79	64.89	57.26	61.07
** Corn	76.07	66.44	71.25	73.00	66.33	69.66
** Beans	75.63	64.52	70.07	72.11	65.74	68.91

* First 4 weeks.

** Second 4 weeks.

Temperature differences due to tillage were less than in previous years, especially in the earlier period. Soils were wet during much of this time, allowing plowed plots less time than usual to dry and warm. Differences due to previous crop were also less than expected.

EFFECT OF LIMING

Liquid lime at 1500 lbs./ac. (50% lime) was applied to all plots before tillage in the fall of 1977. Soil samples by depth were taken before the lime was applied and again in June, 1978.

Table 5. Soil pH response to 1500 lbs./ac. liquid lime

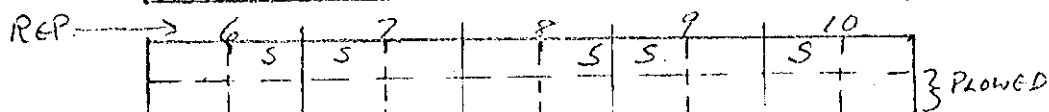
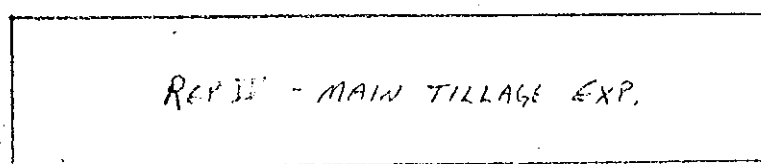
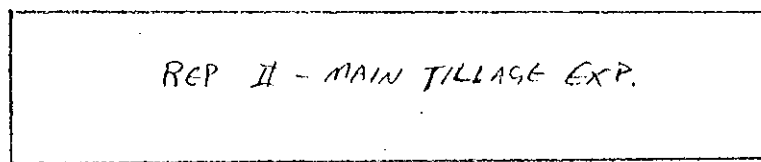
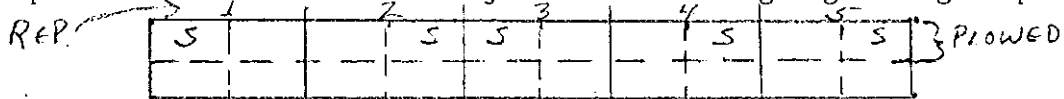
Tillage system	Soil depth, inches	pH reading	
		Before lime applied, fall '77	June, 1978
Plow	0-1	5.91	6.00
	1-2	5.91	6.00
	2-3	5.86	5.95
	3-6	5.70	6.55
Chisel	0-1	6.10	6.15
	1-2	6.04	6.08
	2-3	5.91	6.12
	3-6	5.66	6.02
Ridge	0-1	5.92	6.17
	1-2	5.87	6.17
	2-3	5.94	6.07
	3-6	5.61	6.00
No-til	0-1	6.01	6.35
	1-2	5.87	6.22
	2-3	5.81	6.15
	3-6	5.74	6.12

While pH at the soil surface was highest with no-til after lime application, as might be expected, pH increase in the 3-6 inch zone was about the same with all systems. pH values indicate that more lime should be applied in the fall of 1979.

PLANS FOR 1979

All fall tillage operations were completed in October. We currently plan to use Dr. Moldenhauer's JD maxemerge planter for all plots in 1979. We have not yet decided whether to equip the planter for pre-emergence herbicide application or to apply herbicides in a separate trip. Hoelon will be applied to soybeans post-emergence to control grasses which escape pre-emergence herbicides. Weed control specialists in Botany have indicated that a directed sprayer will be available for weed control in this experiment if all else fails. Surface residue from 1978 fox-tail on no-til plots will tend to inhibit herbicide activity even more than usual.

Subsoil study - to evaluate sub-soil chiseling, the following study was laid out this past fall in border areas adjacent to our on-going tillage experiment.



S = SUBSOIL CHISELED



Tillage x N study - an evaluation of form and placement of N for no-til corn will begin at the Agronomy Farm in 1979. It will be located in a non-fall plowed area west of the demolished house west of county road 500 west. This study is in cooperation with Dr. Darrel Nelson and Dr. Don Huber. The following treatments are planned:

1. Urea surface applied
2. 28% liquid surface applied
3. 28% liquid injected
4. NH_3 injected (all no-til)
5. NH_3 + N-SERVE injected
6. No_3N
7. NH_3 + N-SERVE injected, plowed

The N treatments will be applied as soon as soil conditions permit in the spring. Dr. Moldenhauer's JD max-emerge will be used for planting. Yields will be checked by hand harvesting.

Appendix A.

Chronology of events, 1978, Agronomy Farm Tillage Study.

- April 29 - NH_3 applied to all corn plots
- May 1 - Disced all plow and chisel plots
- May 2 - Chopped stalks in no-til plots
Shaped ridges with Lilliston cultivator
Field cultivated plow and chisel plots
- May 3 - Planted plow, chisel and no-til corn
- May 10 - Planted ridge corn
- May 19 - Field cultivated plow and chisel plots for beans
Planted all bean plots
- May 20 - Planted beans in all border areas
- June 10 - Cultivated all corn plots except no-til C/C
- June 14 - Sprayed all bean plots with Hoelon
- June 18 - Sprayed all bean plots with Basagran
- June 25 - Storm damage, 4" rain and hail
- Oct. 4 - Harvested bean plots, 2 reps. only
Harvested corn plots, 3 reps. only
- Oct. 11 - Chopped stalks for plow and chisel
- Oct. 12 - Applied 222#/Ac. P_2O_5 + 444#/Ac. K_2O all plots
- Oct. 16 - Chiseled and subsoiled
- Oct. 18 - Ridged
- Oct. 21 - Plowed all plow plots