1986

TILLAGE RESEARCH RESULTS - 1986

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AGRONOMY FARM - LONG TIME STUDY

Corn was planted on April 29 and soybeans on May 28 with a John Deere Max-Emerge planter. As in 1985, 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. A standard shovel type cultivator was used in the plow and chisel plots and a Hiniker ridging cultivator served in the ridge plots. Post sprays were applied with a shielded sprayer and a Hahn High Boy. Corn was harvested with a John Deere 4420 combine and samples weighed with a portable electronic scale. Soybeans were harvested with a Hege plot combine with samples bagged and later weighed on a dial type scale.

After harvest, chisel plots were chiseled with a new DMI 7 shank coulter-chisel equipped with 4" twisted shanks. Following corn, plow plots were chopped with a 6 row flail chopper. Plowing was accomplished with a 5 bottom plow. P & K was spread with a Gandy 10' gravity flow applicator. Nitrogen was applied preplant with an NH_3 applicator equipped with coulters and 2 "wings" per knife.

In corn, pre-emergence herbicides applied at planting gave adequate weed control. In soybeans a preplant application of 2,4-D gave moderate control of dandelion and marestail in no-till and ridge B/B. All soybeans received pre-emergence herbicides at planting and a post-directed spray of 2,4-DB to control morning glory and hedge bindweed.

European corn borer infestations required the use of an insecticide. Control of the pest was unsatisfactory and may have led to some reduction in yield.

Early in 1986 a decision was made to open this study to allow new research to be conducted. Below is a summary of the new and old research planned:

Abney - evaluate late season foliage diseases and root rots in soybeans only. Use fumigation, innoculations and fumicides with susceptible Gr 2 varieties.

Edwards - study arthropod diversity and abundance. Sample soil and surface arthropods 5 times during season. (Not in ridge plots.)

Griffith - measure stand, plant growth and yield, all plots.

Kladivko - measure soil temperature at 3 depths in C/C and C/B of Rep III; aggregate stability in corn and soybeans; earthworms in no-till and plow plots.

Mannering - determine % surface residue cover, all plots.

Mengel - incremental soil samples, horizontal and vertical, in ridge plots preplant; plant analysis of corn and soybeans.

Turco - study buildup of deleterious microoganisms with continuous cropping, especially in no-till. Study in corn and soybeans.

Rep I corn data was not used in 1986 due to flooding. A 3.3 inch rainfall occured 1 day after planting and a 2.42 inch rainfall the following week. Each time the previous crop residue matted together on plots at the edges of the ponded area. Ponded water remained on the plots 7 to 14 days. This caused excessive N loss and left the plots unsuitable for obtaining reliable data.

CULTURAL PRACTICES USED 1986
Agronomy Farm Tillage Study

	Corn	Soybeans
Hybrid/Variety	Beck's 65X	Century
Date planted	April 29	May 28
Seeding Rate	26,100 ppa	49 lbs/ac
Seedbed Preparation	Disk once and field cultivate once on plow & chisel plots	Same
Fertilizer	100#/ac 28-28-0 starter 250#/ac N as NH_3 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1984.	No starter No N Same
Insecticide	Counter 15G, band, 9 lbs/ac Ambush 2EC, broadcast 6.4 oz./ac	No insecticide
Weed Control	At planting: Paraquat 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	Pre-plant: 2,4-D 1 pt/ac on B/B no-till and B/B ridge plots At planting: Roundup 4 pt/ac on no-till and ridge plots Dual 8E 3 pt/ac Lorox 4L 2.4 pt/ac Post-directed: 2,4-DB 1.5 pt/ac
Cultivation	Plow, chisel and ridge once	Same
Harvest area	4 rows x 150'	2 rows x 150'

Stand, growth and yield.

Corn - When corn followed corn, plow yielded 169.5 bu/ac, chisel 167.6 bu/ac, ridge 161.7 bu/ac and no-till significantly lower than plow, chisel and ridge at 149.1 bu/ac. No-till showed slower growth through the year and a significantly higher grain moisture at harvest.

When corn followed soybeans, plow, chisel and ridge yielded 190.0 bu/ac to 190.5 bu/ac while no-till yielded significantly lower at 178.5 bu/ac. All treatment yields were better in rotation than in continuous corn.

Using Entemology publication E-17 "European Corn Borer" as a guide, we have determined that corn yields may have been reduced 10-12 bu/ac due to borer damage. This figure was arrived at by multiplying the anticipated yield of 176 bu/ac across treatments by the yield loss figure (Table 1 of E-17) of 6.6% for pre-tassel infestations. The level of infestiation was practically 100% with no differences noted due to treatment. This yield loss is based on physiological stresses. Losses due to stalk breakage and/or ear dropage appeared insignificant. The anticipated yield was calculated by averaging the last 6 years of yield data for all treatments.

Table 1. Corn response to tillage and previous crop, Chalmers si.c.l., 1986.[a]

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	23,500	17.5	61.6	26.0	169.5
	Chisel	25,200	17.1	57.3	27.1	167.6
	Ridge	24,300	15.3	52.9[b]	28.5	161.7
	No-till	24,100	14.0	51.7	30.3	149.1
Soybeans	Plow	23,900	18.2	62.9	28.5	190.3
	Chisel,	23,000	18.5	63.0	28.4	190.0
	Ridge	23,800	17.8	55.7[b]	28.8	190.5
	No-till	24,200	17.6	60.9	30.9	178.5

[a]Average of 3 replications.

[b]Height measured from top of ridge.

Soybeans - Plant population in the plow treatment was significantly greater (.05 level) than the other treatments. The influence of tillage on plant height was significant only at 8 weeks (.05 level). Rotation showed a significant advantage (.01 level) at 4 weeks height and at harvest (.05 level). Rotation beans yielded 4.8 bu/ac better than continuous soybeans.

Areas within continuous soybean no-till and ridge plots developed severely stunted growth symptoms in 1984 and 1985 which reduced yields. As reported last year, an effort to identify the cause was begun, but, to our surprise no symptoms developed in 1986!

Table 2. Soybean response to tillage and previous crop, Chalmers si.c.l., 30" rows, 1986.[a]

Prev. Crop	Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 13%
		ppf	in	in	%	bu/ac
Corn	Plow	7.1	7.3	27.4	13.9	48.3
	Chisel	6.2	6.9	24.7	13.6	47.5
	Ridge	6.3	6.9	25.9	13.3	47.0
	No-till	6.3	7.1	25.5	13.8	45.7
Soybeans	Plow	6.6	6.6	26.3	13.6	43.7
	Chisel	7.0	6.9	26.9	13.7	42.1
	Ridge	6.2	6.4	25.8	13.3	42.6
	No-till	6.5	6.7	25.8	13.6	40.7

[a]Average of 4 replications.

Table 3. ANOV summary, Agronomy Farm tillage data, 1986.

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

Table 4. Corn yield summary, bu/ac, Chalmers si.c.l., Agronomy Farm, 1975-1986.

Previous Crop	Tillage	1975	1976	1977	1978	1979	1980	1981[a]	1982	1983	1984	1985	1986	75-86 Avg.	80-86 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	168.9	174.0
	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	162.9	167.4
	Ridge	-	-	-	-	-	142.6	166.6	203.2	148.6	176.2	187.2	161.7	-	169.4
	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	152.6	150.5
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	177.9	189.0
	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	175.8	185.0
	Ridge	-	-	-	-	-	164.2	173.6	216.6	176.8	200.2	207.5	190.5	-	189.9
	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	172.0	181.4
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		

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

Soybean yield summary, Chalmers si.c.l., Agronomy Farm, 1975-1986.

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	53.6	55.6
	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	52.5	53.2
	Ridge	-	-	-	-	-	55.0	47.6	61.4	57.0	48.1	54.9	47.0	-	53.0
	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	49.0	50.3
Soybeans	Fall Plow	52.7	4.80	40.3	38.2	47.9	54.3	49.7	55.4	57.7	54.6	49.8	43.7	50.2	52.2
	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	48.1	49.0
	Ridge	-	-	-	-	-[a]	48.1	45.6	53.1	56.8	50.0	44.3	42.6	-	48.7
	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	45.0	46.8
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		

AGRONOMY FARM -- PARAPLOW STUDY

Equipment used in this experiment was the same as for the Long Time Tillage Study, except for the paraplow. The paraplow treatment and the paraplow-moldboard treatment were paraplowed in the fall of 1985. For the 1987 crop, only replications I, IV, V and VIII were paraplowed in the fall of 1986. The other replications will be paraplowed every other year. Although we had planned to switch from a paraplow with 20" leg spacings to one of 30" spacings with the help of the Howard Rotovator Company, such a model was not made available. Hopefully one can be acquired for next year. This would enable us to control wheel traffic patterns and prevent a planter row from falling into an open slot left by a paraplow leg.

Similar to the Long Time Tillage Study, the corn yields may have been reduced 10-12 bu/ac by European corn borers. An application of Ambush insecticide applied too late and without enough carrier to run down into the whorls of the corn plants, gave inadequate control of the pest. Again there was nearly 100% infestation with no differences noted due to tillage treatment.

Paraplowing in a no-till environment resulted in a 11.7 bu/ac advantage over no-till (significant at .01). Paraplowing showed no advantage when followed with a moldboard plow versus moldboard only. Those plots moldboard plowed yielded significantly (.01) better than no-till or paraplow-no-till.

So the question is, "In a no-till environment, how does paraplowing help?". Perhaps the answer is that by paraplowing the root zone aeration is improved which allows for quicker soil warm up in the spring. And, with the soil loosened, corn root growth may be enhanced.

CULTURAL PRACTICES USED -- 1986
Agronomy Farm Paraplow Study

Hybrid	Beck's 65X
Date planted	April 25
Seeding rate	26,100 ppa
Seedbed preparation	Disk once and field cultivate once on moldboard-plow and paraplow-moldboard plots
Fertilizer	100 #/ac 28-28-0 starter 250 #/ac preplant N as NH_3 0-115-210 (N-P_2O_5 - K_2O) broadcast in fall of 1984.
Insecticide	Counter 15 G, band, 9 lbs/ac Ambush 2EC, broadcast, 6.4 oz/ac

Weed control	At planting: Paraquat 2 pt/ac on no-till and paraplow X-77 2 pt/100 gal. water Bladex 4L 3 pt/ac Atrazine 4L 3 pt/ac Dual 8E 3 pt/ac
Cultivation	Moldboard-plow and paraplow-moldboard
Harvest area	4 rows x 116'

Table 5. Corn response to paraplowing, corn after corn, Agronomy Farm, 1986.

Tillage	Stand 8 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15 1/2%
	ppa	in.	%	bu/ac
Paraplow	23.2	57.5	26.6	161.8
No-till	23.3	53.9	26.5	150.1
Moldboard	24.3	60.3	25.8	172.0
Para. + Mold.	23.8	60.9	25.8	172.1
ANOV sig. Level	NS	.01	.01	.01

AGRONOMY FARM -- STRIP CROPPING ON RIDGES STUDY

This study is designed to evaluate corn and soybean response to 8 row alternating strips and 2 levels of management. With this being the establishment year for the study, the results may have been influenced by improper sequencing of the previous crop.

CULTURAL PRACTICES USED -- 1986
Agronomy Farm Strip Crop on Ridges

	Corn	Soybeans
Hybrid/Variety	Beck's 65X	Century
Date planted	April 23	May 23
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 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1984 Standard input N: All rows 200 lb/ac preplant 100 #/ac 28-28-0 as starter 0-115-210 (N-P_2O_5 - K_2O) broadcast in fall of 1984	No N Same No starter Same
Insecticide	Counter 15 G, band, 9 lbs/ac Ambush 2EC, broadcast, 6.4 oz/ac	No insecticide
Weed control	Paraquat 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	Paraquat 2 pt/ac X-77 2 pt/100 gal. water Dual 8E 3 pt/ac

Cultivation	Once	Once
Ridging	At cultivation	After harvest
Harvest area	2 1,000th acre samples/row	Individual rows 80' & 100'

Corn - Eight row strips of corn bordered by soybeans were compared to the middle 8 rows of a 16 row "non-stripped" corn plot. The strip corn, without varying population or N, yielded 15.9 bu/ac higher than non-stripped corn. Note that the yield increase came from rows 1, 2, 7, 8 as was expected. The middle 4 rows of the strip corn varied only slightly from the non-strip average.

To represent a high level of management, we attempted to increase the population of rows 1 and 8 by 29% and rows 2 and 6 by 12%. We achieved a 17.3% and 11.2% increase, respectively. Another part of our high management was to split-apply side-dress NH_3 by doubling the rate on knives between rows 1-2 and 7-8. This raised the average rate/ac by 15 lbs N.

Strip high management yielded 11.9 bu/ac better than average management strip corn and 27.8 bu/ac better than average management non-strip corn. The high management versus average management in non-strip corn yielded 5.1 bu/ac better. So, it appears that stripping and high management inputs led to increased corn yields.

Similar to the long time tillage study, infestations of European corn borers reduced yields 10-12 bu/ac. An application of Ambush insecticide did not give control.

Table 6. Corn response to strip cropping on ridges, Agronomy FArm, 1986.

	Strip				Non-Strip			
	Regular Management				Regular Management			
Row	Stand 4 wks	Hieght 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)	23.5	53.8	24.9	215.3	21.8	57.4	24.7	172.0
2	23.9	58.2	25.5	197.4	23.0	57.5	24.9	181.0
3	23.4	57.3	25.4	192.5	24.4	57.9	25.1	180.7
4	22.9	58.6	25.1	184.1	23.6	58.6	24.9	185.6
5	22.9	58.3	24.7	185.2	23.9	58.9	24.7	183.3
6	23.5	56.4	25.0	188.5	24.0	58.6	24.2	195.9
7	22.6	57.9	24.2	199.6	22.6	54.5	24.7	180.7
8(east)	22.8	54.8	25.1	224.3	22.9	56.8	25.3	180.9
Avg.	23.2	56.9	25.0	198.4	23.3	57.2	24.8	182.5
	High Management				High Management			
1(west)	29.4	53.9	25.9	240.6	25.8	57.9	24.6	180.4
2	26.3	57.8	25.0	197.6	26.6	57.0	24.5	193.0
3	23.1	57.0	24.6	192.6	24.4	57.9	24.0	180.9
4	24.9	58.5	25.3	191.0	23.9	58.8	23.3	186.7
5	25.5	59.3	24.0	203.1	24.0	60.8	24.0	191.7
6	23.6	60.4	25.5	191.5	23.5	57.8	23.7	189.1
7	27.0	55.9	24.7	206.2	27.3	58.8	24.5	185.3
8(east)	28.3	57.9	24.4	259.7	29.6	58.6	24.9	193.4
Avg.	26.0	57.6	24.9	210.3	25.6	58.4	24.2	187.6

Soybeans - Although non-strip soybeans out yielded strip soybeans by 6.8 bu/ac it was significant at only the .10 level. It is interesting to note that each non-strip row yielded higher than its counterpart strip row, even for rows in the middle of the strip. We can't really explain this. Previous experience has shown a strip average yield loss for beans of 2-4 bu/ac. The major yield loss in strips was found in rows 1 and 8, as expected due to shading by the corn. Only 1 managment level was used.

Table 7. Soybean response to strip cropping on ridges, Agronomy Farm, 1986.

	Strip		Non-Strip	
Row	Moisture	Yield @ 13%	Moisture	Yield @ 13%
	%	bu/ac	%	bu/ac
1(west)	14.0	34.7	13.8	50.4
2	13.4	45.5	13.6	49.2
3	13.5	46.7	13.5	49.8
4	13.4	46.0	13.3	51.5
5	13.5	47.4	13.4	51.1
6	13.2	47.5	13.4	49.4
7	13.4	45.4	13.4	49.1
8(east)	13.3	32.2	13.5	49.6
Avg.	13.5	43.2	13.5	50.0

Table 8. ANOV summary, strip cropping on ridges data, Agronomy Farm, 1986.

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

Costs and Returns of Stripping

Increased costs (per acre) associated with the high management treatment include:

$2.38	10.25% increase in seed population (Beck's 65X, $70/bag)
1.35	15 lbs N/ac increase x $.09/lb
5.46	Additional pass with NH_3 applicator (1986 EC 130)
$9.19	Total

Corn valued at $1.60/bu cash price at elevator.
Soybeans valued at $4.75/bu cash price at elevator.

1. High management strips vs regular management non-strip:

27.8 bu/ac increase of corn x $1.60/bu =	$44.48	gain
6.8 bu/ac loss of soybeans x 4.75/bu =	32.30	loss
	$12.18	
Minus additional costs	- 9.19	
	$ 2.99	net profit

2. Regular management strips vs regular management non-strip:

15.9 bu/ac increase of corn x $1.60/bu =	$25.44	
6.8 bu/ac loss of soybeans x 4.75/bu =	32.30	
	$ 6.86	net loss

3. High management strip corn vs regular management strip corn:

11.9 bu/ac increase x $1.60/bu =	$19.04	
additional costs	-9.19	
	$ 9.85	net gain

As the value of corn increases relative to soybeans, the profits from stripping become more significant. These values were calculated with elevator cash prices, however, if corn deficiency payments were included the dollar benefits of stripping would be much greater.

SEPAC

LONG TIME TILLAGE STUDY

Corn was planted on May 5 and soybeans on May 8 with a John-Deere Max-Emerge planter. A Hiniker ridge scraper was used rather than SEPAC's ridge-planter to avoid the planter performance differences experienced last year. Primary tillage included the use of a 5-bottom plow and a 7-shank Glenco coulter chisel on appropriate treatments. Each plow and chisel 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 in 1986 due to sufficient ridge height left after planting in 1985. All NH_3 was applied pre-plant. Corn was harvested with a J.D. 4425 combine and samples weighed with a portable electronic scale. Soybeans were harvested with Dr. Mengel's Hege plot combine with samples bagged, dried due to foreign material content and later weighed with a dial scale.

In corn, pre-emergence herbicides gave adequate control of weeds except for fall panicum in the no-till plots. In soybeans, pre-emergence herbicides gave good control through the first 5-7 weeks. After that, smartweed, fall panicum, cocklebur and vines came on very strong, especially in no-till plots. For 1987 we plan to switch to post-emergence herbicides to control these weeds.

CULTURAL PRACTICES USED - 1986
SEPAC Tillage Study

	Corn	Soybeans
Hybrid/Variety	Pioneer 3184	Williams '82
Date planted	May 5	May 8
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	200 lb N/ac as NH_3 113# 18-46-0 starter 0-115-210 (N-P_2O_5-K_2O) broadcast in fall of 1985	No N No starter Same
Insecticide	Counter 15 G 9 lbs/ac	None
Weed control	At planting: Roundup 3 pt/ac on no-till and ridge Bladex 4L 1.5 pt/ac Atrazine 4L 1.5 pt/ac Dual 8E 2 pt/ac Paraquat 2 pt/ac on chisel and disk X-77 2 pt/100 gal. water	At planting: Roundup 3 pt/ac on no-till and ridge Lorox 4L 1¼ pt/ac Dual 8E 2 pt/ac
Cultivation	Once (except no-till)	Once (except no-till)
Harvest area	4-30" rows x 200' (Reps I, II) 4-30" rows x 270' (Reps III, IV)	2-30" rows x 50' 12 6 1/3" drill rows x 50

Stand, growth and yield.

Corn - Ridge and no-till had a significant (.05 level) reduction of stand as compared to fall chisel. There was no significant differences in the tilled plots. No-till corn grew significantly (.01) more rapidly than the other treatments in both rotation and continuous cropping. No-till yields were significantly (.01) highest in rotation and continuous corn. Continuous corn yielded better than rotation corn in plow chisel and disk plots, but less than rotation corn in ridge and no-till plots. No insect problems developed.

Soybeans - Plant populations were uniform in all treatments. No-till showed a very significant height advantage through the year, however there were no significant differences in yields among treatments. As in previous years, a drill strip was

planted in all soybean plots except the ridge treatment. As an average, the drill strips yielded 4.8 bu/ac higher (9.9%).

Lodging was severe in all treatments in 1986 but occurred first in no-till due to the better early growth. Both lodging and weed competition (vines and fall panicum) appeared to reduce no-till yields more than other treatments.

Table 9. Response to tillage and previous crop, Clermont si.l., SEPAC, 1986.

Prev. Crop	Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield @ 15½%		
		ppa	in.	in.	%	bu/ac		
		Corn						
Corn	Plow	27.7	23.7	82.2	20.7	146.6		
	Chisel	25.4	24.9	83.2	20.9	150.7		
	Disk	25.4	25.0	82.8	20.7	155.5		
	Ridge	24.0	22.3	79.4	20.6	142.5		
	No-till	23.6	24.0	84.8	21.0	162.4		
Soybean	Plow	24.6	22.9	79.7	21.6	139.4		
	Chisel	25.5	24.9	77.0	21.2	129.0		
	Disk	25.0	24.1	79.0	21.1	144.3		
	Ridge	24.4	23.7	80.4	21.9	153.6		
	No-till	24.9	26.9	89.0	21.8	172.4		
		Soybean 30" rows					Drill strip	
		ppf	in.	in.	%	bu/ac-13%	%	bu/ac-13%
Corn	Plow	8.7	6.5	20.4	-	48.8	-	50.6
	Chisel	8.4	7.1	20.6	-	48.5	-	54.1
	Disk	8.4	7.0	20.6	-	49.8	-	54.6
	Ridge	8.2	7.2	21.2	-	47.1	-	--
	No-till	8.4	8.7	24.0	-	48.3	-	53.8

Table 10. ANOV summary, tillage data, SEPAC, 1986.

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

Table 11. 1980-86 yield summary, bu/ac, SEPAC tillage.

Previous Crop	Tillage	Corn 1980	1981	1982	1983	1984	1985	1986	1980-86 Avg.	1983-86 Avg.
Corn	Plow, spring	113.5	123.3	186.8	53.3	145.3	180.5	146.6	135.6	131.4
	Chisel, fall	121.8	131.4	194.4	58.0	154.6	185.8	150.7	142.4	137.2
	Disk, spring	117.0	125.21	181.4	50.7	145.8	176.8	155.5	136.0	132.2
	Ridge	---	---	---	52.1	150.8	179.7	142.5	---	131.3
	No-Till	104.9	104.6	159.9	66.2	155.5	178.1	162.4	133.1	140.6
Soybeans	Plow, spring	116.2	122.0	196.6	48.5	149.4	185.5	139.4	136.7	130.7
	Chisel, fall	112.0	118.9	187.3	64.5	141.6	183.1	129.0	133.8	129.5
	Disk, spring	119.5	120.0	195.8	70.9	150.8	182.2	144.2	140.5	137.0
	Ridge	---	---	---	64.3	155.5	185.1	153.6	---	139.7
	No-Till	119.6	115.5	197.2	75.8	165.0	181.4	172.4	146.7	148.6
	Yearly Average	115.6	120.1	187.4	60.4	151.4	181.8	149.6		

		Soybeans 1980	1981	1982	1983	1984	1985	1986	1980-86 Avg.	1981-86 Avg.	1983-86 Avg.
Corn	Plow, spring	38.9	43.1	52.0	23.0	36.5	53.6	48.8	42.3	42.8	40.5
	Chisel, fall	39.6	41.4	51.1	30.1	39.0	53.0	48.5	43.3	43.8	42.7
	Disk, spring	40.0	38.6	51.9	37.2	37.4	51.4	49.8	43.8	44.4	45.0
	Ridge	--	--	--	35.6	40.6	54.0	47.1	--	--	44.3
	No-Till	18.7[a]	42.2	49.4	39.6	40.1	54.0	48.3	41.8	45.6	45.5
	Yearly Average	34.3	41.3	51.1	33.1	38.7	53.2	48.5			

[a]Phytophthora root rot reduced yield.

Table 12. Drilled (10") bean yield summary, Clermont si.l., SEPAC, 1986.

Tillage	1981	1982	1983	1984	1985	1986	81-86 Avg
	bu/ac						
Plow	42.9	57.8	25.0	37.0	61.8	50.6	45.9
Chisel	38.5	65.2	26.8	43.0	59.5	54.1	47.9
Disk	40.8	62.7	38.0	46.0	59.9	54.6	50.3
No-till	56.7	72.9	50.4	48.0	73.1	53.8	59.2

SEPAC

PARAPLOW STUDY - 1986

The paraplow we now have is a 4 leg model set on 20" centers for a working width of 80". Each leg leaves a 2-4" high ridge of soil and a slot where the leg moves through the soil. When a 30" row planter is used and the ridge has not settled, difficulties with seed placement occur. The row may be planted in the slot and left uncovered or the planter gauge wheels may ride the ridge resulting in non-uniform seed depth. The solution is to set the legs on 30" centers offset 10" from the row. This would also put the tractor in a traffic pattern consistant with other field operations.

An ill-fated attempt was made to accomplish this. The geometry of the frame allowed the use of only 2 legs set on 30" centers, for a working width of 60". Two passes of the paraplow were required for each pass of the planter. This led to inconsistancies in row-to-slot spacings.

One month after paraplowing and chiseling, the paraplowed soil had not settled, leaving the seedbed too rough to plant. Prior to planting corn on May 6, the tilled and paraplowed plots were worked with a Glenco soil finisher. Tilled plots were cultivated with a conventional cultivator. All plots were harvested with a J.D. 4425 combine and samples weighed in weigh buggy.

No stand or height measurements were taken. Yields probably do not reflect a true response to paraplowing due to difficulties encountered when paraplowing and planting.

CULTURAL PRACTICES USED - 1986

SEPAC PARAPLOW STUDY

Hybrid	Pioneer 3184
Previous crop	Soybeans
Date planted	May 6
Seeding rate	26,100 ppa
Seedbed preparation	For chisel, paraplow + chisel and paraplow: 2 passes with soil finisher
Fertilizer	200# N/ac as NH_3 113# 18-46-0 starter
Insecticide	Counter 15 G 9#/ac
Weed control	Paraquat 2 pt/ac on no-till X-77 2 pt/100 gal. water Bladex 4L 1.5 pt/ac Atrazine 4L 1.5 pt/ac Dual 8E 2 pt/ac
Cultivation	Once on tilled plots
Harvest area	4-30" rows x 204'

Table 13. Corn response to paraplowing, SEPAC, 1986.

Tillage	Yield @ 15½%	ANOV Variable	ANOV significance level
	bu/ac	Tillage	.05
Paraplow	171.9		
No-till	168.6		
Chisel	158.2		
Para.-chisel	160.1		

DAVIS PAC

PARAPLOW STUDY - 1986

It is questionable whether the data obtained this year present a valid comparison of the treatments. Within 4 days after planting, a 4.04" rainfall occurred which flooded some plots. The next 4 weeks continued to be wet with a total rainfall of 3.21 inches. On the 6th week after planting another storm dropped 4.66 inches of rain, again flooding some plots. Field mice damaged 4 no-till and 3 paraplow plots. Due to flooding and mice damage, 4 of the 8 replications were not used in calculating the yields.

CULTURAL PRACTICES USED - 1986

DAVIS PAC

Hybrid	Pioneer 3352
Date planted	May 30
Seeding rate	26,100 ppa
Seedbed preparation	For moldboard, paraplow + moldboard: field cultivate and rotera.
Fertilizer	113#/ac 18-46-0 starter 150# N/ac as NH_3
Insecticide	Counter 15 G, 9#/ac
Weed control	Pre-plant: Roundup for thistles, 4 pt/ac At planting: Bladex 4L 2 pt/ac Atrazine 4L 2 pt/ac Dual 8E 2 pt/ac Paraquat 2 pt/ac on paraplow and no-till X-77 2 pt/100 gal. water
Cultivation	Once on moldboard, paraplow + moldboard
Harvest area	4-30" rows x 205'

Stand, growth and yield

Stand differences between treatments were not significant. Plant growth was significant (.05) at 4 weeks but not at 8 weeks between treatments. Plant heights varied greatly within plots probably as a result of the flooding. No-till yielded significantly (.01) lower than the other treatments. Paraplow showed a significant (.01) 11.4 bu/ac advantage over no-till, however it yielded 9-11 bu/ac lower than the

tilled treatments. It may be that paraplowing in a no-till environment enhances soil aeration and root growth but not as well as moldboarding.

Table 14. Corn response to paraplowing, corn after corn, Davis PAC, 1986.

Tillage	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield[a] @ 15½%
	ppa	in.	in.	%	bu/ac
Paraplow	22.4	29.7	81.7	30.1	125.6
No-till	23.6	28.7	75.1	31.6	114.2
Moldboard	24.4	31.2	84.0	29.2	136.8
Paraplow-Mold.	23.4	30.0	78.2	28.8	134.8

[a]Average of 4 replications.

Table 15. ANOV summary, parplow study, Davis PAC, 1986

Variable	Stand 4 wks.	Height 4 wks.	Height 8 wks.	Harv. Moist.	Yield
	--------- significance level ---------				
Tillage	NS	.05	NS	NS	.05

Table 16. 2 year summary, paraplow study, David PAC.

Tillage	1985	1986	Average
	------- bu/ac ------		
Paraplow	147.9	125.6	136.8
No-till	141.7	114.2	128.0
Moldboard	145.0	136.8	140.1
Paraplow + moldboard	148.0	134.8	141.4

Table 17. Rainfall from planting to harvest, 3 locations, 1986.

Week ending	Planting & Harvest Dates	Amount inches	Planting & Harvest Dates	Amount inches	Planting & Harvest Dates	Amount inches
5- 5	4-29	3.30				
5-12		2.42	5-5	.38		
5-19		1.15		1.20		
5-27		.13		.62		
6- 2		1.64		.90	5-30	.22
6- 6		1.23		.54		4.04
6-16		.13		.32		.71
6-23		.33		0.00		1.30
6-30		.67		.09		.59
7- 7		1.00		2.43		.61
7-14		2.98		1.15		4.66
7-21		0.00		.45		.02
7-28		.06		.59		.12
8- 4		.14		.16		0.00
8-11		.99		.91		1.54
8-18		.01		0.00		.40
8-25		0.00		.17		.25
9- 2		1.00		.98		.77
9- 8		.09		.32		.16
9-15	9-17	.94		2.30		.77
9-22		15.79		.31		2.86
9-29				1.22		1.05
10- 6			10-10	2.37		2.13
10-14				17.41	10-17	.33
10-21						22.53

LOG OF ACTIVITIES - 1986

April	7	AF, apply NH_3, tillage study, strip study.
	8	AF, apply NH_3, paraplow study, Diagnostic Center (250 lb N/ac), Field Day demo plots.
	9	SEPAC, apply NH_3 to tillage and paraplow studies. SEPAC, paraplowed, disked.
	10	SEPAC, plowed tillage study, chiseled paraplow study.
	11	AF, apply NH_3 for T. Bauman (200 lb N/ac) and at Animal Science farm by Village Pantry.
	18	AF, applied NH_3 for Steinhardt (200 lb N/ac).
	23	AF, plant corn on strip study, disc on tillage study and paraplow study.
	24	AF, field cultivate on tillage and paraplow studies.
	25	AF, plant corn on paraplow study, Diagnostic Center, Field Day demo plots.
	26	AF, spread zinc phosphide for field mouse control on strip study.
	29	AF, plant corn on tillage study.
May	5	SEPAC, disc and soil finish, plant corn on tillage study, soil finish on paraplow study.
	6	SEPAC, plant corn on paraplow study.
	8	SEPAC, disc and soil finish, plant soybeans on tillage study.
	9	Pinney PAC, apply NH_3 for T. Bauman (180 lbs N/ac).
	13	Davis PAC, plant corn and soybeans for E. Kladivko.
	16	AF, spray 2,4-D on B/B no-till and B/B ridge plots of tillage study.
	21	AF, strip study corn 4 weeks stand count, marked harvest areas.
	23	AF, plant soybeans on strip study, plant corn and soybeans for T. Bauman on Animal Science farm, plant soybeans on Diagnostic Center, paraplow study. Corn 4 weeks stand and height.
	24	AF, plant corn for Steinhardt.
	28	AF, plant soybeans on tillage study (including S. Abney's).
	30	Davis PAC, plant corn on paraplow study.
	31	AF, tillage study corn 4 weeks stand and height.
June	2	Davis PAC, plant corn and soybeans for Gordon.
	3	Davis PAC, plant corn and soybeans for Gordon.
	4	AF, cultivate corn on paraplow, tillage and Diagnostic Center.
	5	AF, sidedress NH_3 on strip study.
	6	SEPAC, tillage study 4 week corn and soybean stand and height.
	10	SEPAC, cultivate and ridge corn on tillage study and paraplow study.
	11	AF, ridge corn on strip study.
	12	AF, ridge corn on tillage study and Diagnostic Center.
	13	Throckmorten PAC, plant corn and soybeans for E. Kladivko.
	17	AF, strip study corn 8 week height and stand.
	18	AF Field Day.
	20	AF, paraplow study corn 8 week height and stand, spray Ambush insecticide on tillage, strip and paraplow studies (on corn only).
	23	AF, cultivate Steinhardt's corn, tillage study, and Diagnostic Center soybeans. Tillage study corn 8 week height.
	24	Davis PAC, apply NH_3 for E. Kladivko (200 lb N/ac), paraplow study (150 lb N/ac) and Gordon (150 lb N/ac).
	25	Davis PAC, finish NH_3 for Gordon.
	26	AF, cultivate ridge soybean plots in tillage and strip studies.

27 Davis PAC, ridge for E. Kladivko, cultivate for E. Kladivko and on paraplow study.
30 SEPAC, tillage study 8 week corn height.

July 1 Davis PAC, paraplow study corn 4 week stand and height.
2 SEPAC, tillage study corn and soybeans 8 week height.
9 Davis PAC, ridge Gordon's, ridge and cultivate for E. Kladivko, cultivate in paraplow study.
17 AF, directed-sprayed 2,4-DB on tillage study soybeans.
21 AF, ridge for T. Bauman, ridge soybeans on Diagnostic Center.
22 AF, tillage study soybeans 8 week height.
23 Davis PAC, paraplow study corn 8 week height. AF, ridge soybeans for D. Mengel and C. Daughtry.

Sept. 9 AF, harvest 1/2 of strip study corn.
17 AF, harvest tillage study corn.
18 AF, harvest paraplow study corn, finish harvest of strip study corn.
25 AF, harvest strip study soybeans (Hege).
26 AF, finish harvest of strip study soybeans.
30 SEPAC, helped P. Walker harvest soybeans.

Oct. 3 AF, hauled combine for S. Zachary of Botany.
6 AF, helped M. Holmes weigh soybeans.
7 AF, harvest tillage study soybeans (Swearingin's Hege).
8 AF, weigh tillage study soybeans.
9 SEPAC, harvest tillage study soybeans (Mengel's Hege) and 1/2 of tillage study corn.
10 SEPAC, finish harvest of tillage study corn, harvest paraplow corn.
15 AF, harvest Steinhardt's corn.
16 AF, cleaned and weighed SEPAC soybeans.
17 Davis PAC, harvest paraplow corn.
21 AF, fertilize paraplow, Steinhardt's and strip studies (Gandy, setting = 76 for 500 lbs material/acre).
22 AF, fertilize strip soybeans and tillage study. Glean tillage study soybeans.
28 AF, chopped stalks on tillage, paraplow and Steinhardt's studies.
31 AF, ridge tillage, strip and T. Bauman's studies.

Nov. 3 AF, moldboard plowed tillage study and Steinhardt's, chisel plowed tillage study.
4 AF, finish moldboard plow in Steinhardt's.
6 AF, paraplow in paraplow study.
7 AF, moldboard plow in paraplow study.
13 Davis PAC, paraplowed in paraplow study.
14 Davis PAC, moldboard plow in paraplow study.

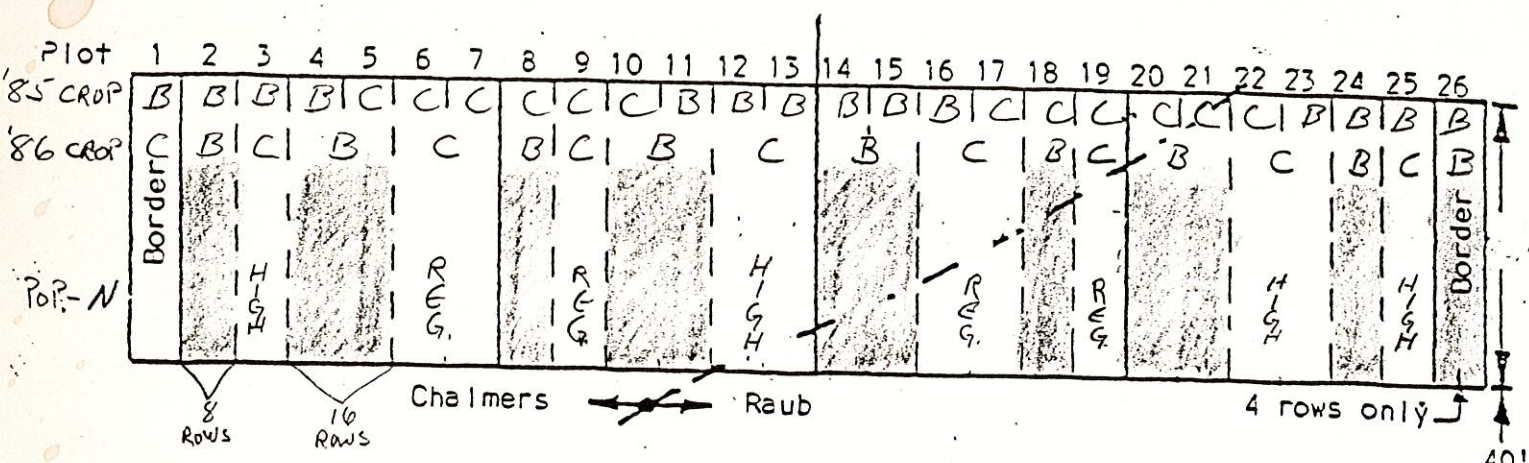
STRIP CROP, Till - Planting ~~Equipment~~ Study -- 1986

Agronomy Farm

Row Width -- 30"

Griffith-Parsons

Row Direction N - S



40'

Note: Border plots to be used for warmup/adjustment

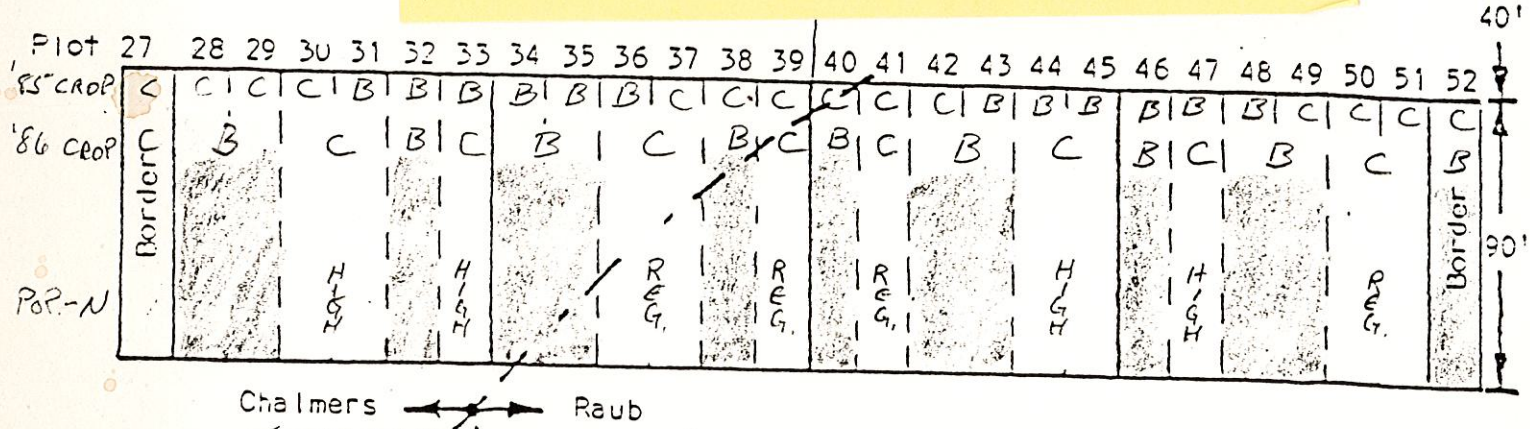
3/86

SDP

Is this workable? For the high pop-N in 8 row stripes, do we increase in just outside rows or are all 8 rows? Not room to do both. I am assuming we need 4 border rows to get "non-strip" yield accuracy - thus harvest center 8 of 16.

DRG

40'



40'

TREATMENTS

CORN

8-ROW STRIP
REG POP-N
HIGH POP-N
NON-STRIP (16 ROWS)
REG. POP-N
HIGH POP-N

BEANS

8-ROW STRIP
NON-STRIP (16 ROWS)

Plot Size: 8-30" rows
2 passes w/4-row planter

HARVEST - ALL INDIVIDUAL ROWS IN 8 ROW PLOTS, CENTER 8 OF EACH 16 ROW PLOT.

N
W E
S

PURDUE UNIVERSITY inter office memorandum

To All cooperators on long-term tillage plots at the Agronomy Farm

From Don Griffith

Date March 7, 1986

Subject 1986 Plans

Since so many of us will be working in the same tillage plots at the Agronomy Farm this year, we will have to make a special effort to avoid disrupting each others efforts. The attached diagram of individual 12-row plots is an attempt at "assigned" areas within plots. The "research planned" gives a general idea of what each of us will be doing, without going into detail.

Listed below are the operations which we have traditionally performed in these plots. The dates listed are goals to aim at if weather cooperates. Let me know how these operations fit into your plans and if we need to make changes. If we are at cross-purposes somewhere we need to know that now. For example, Rich, how would we handle economic infestations of cutworms, bean leaf beetles or spider mites without killing your arthropods?

Let me know if you plan to use the long-term SEPAC tillage plots for similar studies. Similar "assigned" areas can be planned there.

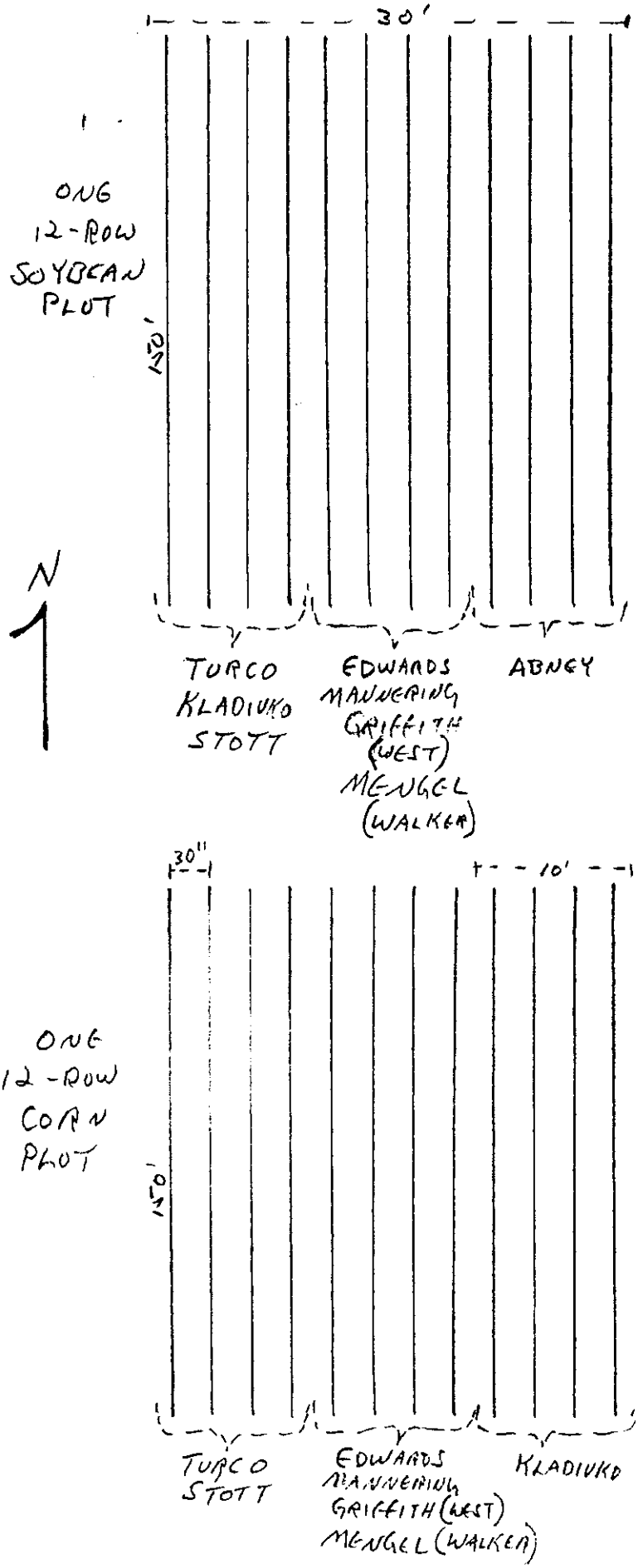
Apply NH_3 to all corn plots -- mid-April.
Disk and field cultivate, plow and chisel corn plots.
Plant corn as soon as possible after 4-25.
(Includes pre-emerg herbicides, counter insecticide, 28-28-0 starter fertilizer, and Becks 65X hybrid.)
Disk and field cultivate, plow and chisel bean plots.
Plant beans as soon as possible after 5-10.
(Includes Century 84 seed at 9 seeds/ft, and pre-emerg herbicides.)
Cultivate all plow and chisel corn and bean plots once.
Ridge corn at 18" and beans at first bloom.
Spray as necessary (possibly Basagran or Blazer on beans, Basagran on corn, insecticides for cutworms, bean leaf beetles or spider mites.)
Harvest center 4 rows for yield check.
Bulk spread P & K in fall of '85 and '87
Chop stalks in plow and chisel corn.
Fall plow and chisel for both corn and beans.

cc: M. W. Phillips

FORM C
APPROVED FOR USE IN
PURDUE UNIVERSITY

LONG-TERM TILLAGE PLOTS

AGRONOMY FARM - 1986



RESEARCH PLANNED

Abney - evaluate late season diseases and root rots in soybeans only. Will use fumigation, innoculation and fumigides with susceptible Gr 2 variety.

Edwards - study arthropod diversity and abundance. Both soil and surface arthropods sampled 5 times during season. (Not in ridged plots.)

Griffith - measure stands, plant growth and yield, all plots.

Kladivko - measure soil temperature at 3 depths, C/C and C/B reps I and III; aggregate stability, corn and beans; earthworms in no-till and plowed plots.

Mannering - determine % surface residue cover, all plots.

Mengel - incremental soil sampling, horizontal and vertical, in ridged plots preplant; plus plant analysis, corn and beans.

Turco and Stott - study of buildup of deleterious microorganisms with continuous cropping, especially in no-till. Treatments: continuous vs rotation, plow vs no-till, and fumigated vs non-fumigated. Study in both corn and beans.