No-Tillage Update Report - Alabama

D.W. Reeves, D.H. Rickerl, C.B. Elkins,
and J.T. Touchton

Slit-Tillage

Slit-tillage is the cutting of a narrow slit through a plowpan to promote deep rooting. One of the primary advantages of slit-tillage over subsoiling is that on coarse-textured soils slit-tillage produces a long-term residual effect, whereas the effects of subsoiling last only for one season. In 1985 we found 5-year-old slits that were still functional in promoting soybean root growth through a plowpan.

In the second year of an experiment on a Dothan soil at Headland, Alabama, yields of peanuts, corn, and soybeans grown with slit-tillage were equal to yields with in-row subsoiling. Yields with no-till were 62, 86, and 64 percent of maximum yields of corn, peanuts, and soybeans, respectively. It appears that on this soil, some form of tillage is essential for maximum crop yields.

Starter Fertilizer and Lime Placement For No-till Grain Sorghum

A field study was initiated in 1985 to evaluate the response of grain sorghum to starter fertilizer placement, in-row tillage to disrupt tillage pans, and deep injection of lime to amend subsoil acidity. The study was conducted on a Hartsells fine sandy loam. A factorial arrangement of 3 tillage-placement methods x 5 soil amendments was incorporated in a randomized complete block of 4 replications. The amendments included 1) starter fertilizer (20 lb/acre each of N and P_2O_5; 2) 700 lb/acre dolomitic limestone slurry in a water base with an anionfc'polymer to aid in suspension; 3) starter fertilizer + lime; 4) a polymer check; and 5) a water-only check. The amendments were placed either 1) in the subsoiler track (16-in depth); 2) in a narrow slit (3/16 in wide, 7 in deep) below the subsoiler shank; cr 3) incorporated with a fluted coulter 3-5 inches beside the row to a 3-inch depth.

Substantial increases in plant growth occurred only when starter or starter + lime were applied in conjunction with sore form of deep tillage (subsoiler or slit) (Table 1).

Table 1. Effect of amendment and application method on early season plant growth and grain yield.

Application	Amendment water	lime	polymer	starter	starter + lime
	---------g dry mt/lft row-------------				
Slit	5.7	6.7	5.3	13.3	11.9
Subsoil	5.9	6.4	6.6	i9.8	11.1
3 x 3	4.4	4.4	6.6	7.5	6.6
$LSD_{0.10}$ = 3.0					
	-----grain yield, bu/acre---------				
Slit	58	61	62	69	74
Subsoi1	70	65	63	83	67
3 x 3	58	58	58	66	57
$LSD_{0.10}$ = 8.3					

Grain yield generally followed the same trend as plant growth (Table 1). Maximum grain yield (83 bu/acre) occurred when starter was applied in the subsoiler track. Averaged over amendments, yields were *59,* 65, and 60 bu/acre ($LSD_{0.10}$ = 3.7) for subsoiliny, slit-tillage, and no deep tillage, respectively.

Previous research has shorn that soybean yield response *to* slit tillage improves with each successive season which is due to the cumulative effect of residual slits. After 3 seasons, yields from slit-tillages surpassed those of conventionally subsoiled plots. Whether the injection of lime into acid subsoils can further improve crop performance remains to be proved. The test will be continued on a number of coarse-textured, essily compacted soils with acid Bt horizons throughout the Southeastern Coastal Plain.

Tillage Systems for Double Cropped Wheat and Grain Sorghum

Research conducted from 1981 *to* 1984 demonstrated that the best tillage system for dcuble-cropped wheat and soybean was deep tillage prior to planting wheat and no tillage prior to planting soybean (Proceedinps of the Seventh Annnual No-tillage Systems Conference, pp. 146-150). Tillage systems prior to planting wheat were no tillage, disk, chisel plow, and turn plow. Soybean was planted with and without in-row subsoiling. Wheat yield differences between deep tillage systems (chisel and turn) were generally irsignificant. A key finding of this research was that yield of soybean following deep tillage for wheat was as high without as with in-row subsoiling even on soils with root restricting hardpans. The soils used in this research (Table 2) are typical coastal plain soils. The Benndale and Dothan soils had well defined root restricting tillage pans. Tillage pans existed in the Lucedale soils, but they were generally not well defined and yield response to in-row subsoiling was not consistant.

In 1984, the summer crop was changed from soybean to grain sorghum. Wheat yields in 1984 and 1985 followed the same treatment trends as previous years. Grain sorghum yields (Table 2), however, did not follow the same trends as soybean. Regardless of tillage system prior to planting wheat, in-row subsoiling was needed for top sorghum yields. On Benndale and Dothan sandy loam soils, deep tillage prior to planting wheat resulted in higher sorghum yields than no tillage prior to planting wheat, but this tillage did not substitute for in-row subsoiling at sorghum planting.

Table 2. No tillage sorghum yield (2 year average) as affected by tillage prior to planting wheat and in-row subsoiling at sorghum planting.

	Soil type and in-row subsoiling					
	Lucedale sl		Benndale sl		Dothan sl	
Tillage before wheat.	SS[1/]	NSS	SS	NSS	SS	NSS
	---------------sorghum yield, bu/acre------------					
No-till	70	63	51	30	55	24
Disk	65	56	50	41	60	23
Deep	65	60	55	42	61	44

1/ SS = in-row subsoiled at sorghum planting; NSS = not subsoiled

Cropping Systems for No Tillage Corn Production

When winter cover crops are harvested for grain, cut for hay, or used for grazing, their use will generally off-set production costs and a cost free mulch is available for the summer crop. It is not always feasible, however, to use the winter cover crops as cash crops and the production costs have to be charged to the summer crop. When winter cover crops cannot be used as cash crops, planting annual legumes which produce N that can he used by subsequent grain crops can help off-set and sometimes eliminate costs of growing the legume.

Early maturing legumes, especially when planted early in the fall, can provide adequate mulch for conservation tillage and sufficient N for summer crops which have low N requirements and relatively late optimum planting dates. These legumes, however, generally do not provide adequate N for corn, which has to be planted early and has a high N requirement. Since soybean will sometimes provide up to 1/3 of the N needed by corn, growing corn in rotation with soybean in a cropping system with reseeding clover may eliminate the need for applying N fertilizer to corn.

This study was conducted on a Wynnville sandy loam soil at the Sand Mountain Substation in North Alabama and on a Dothan sandy loam soil at the Wiregrass Substation in the Coastal Plains of South Alabama. The two year cropping systems were 1) fallow-corn-fallow-corn, 2) clover-corn-clover-corn, 3) fallow-soybean-fallow-corn, and 4) clover-soybean-reseeded clover-corn. The clover was 'Tibee' crimson clover. Sidedress N rates for corn were 0, 60, 120, and 180 lb/acre. Irrigation was used at the Coastal Plain location but not at Sand Mountain.

At corn planting, higher clover yield and total N but lower N concentration at Sand Mountain than the Coastal Plain location (Tahle 3) are attributed to a later corn planting date at the Sand Mountain location (18 April vs 27 March). Higher yield and N production for clover following soybean than corn at both locations is due to reseeded vs planted clover. When corn was planted in the summer of 84, the clover was at the very early bloom stage and seeds had not been produced; but when soybeans were planted in May of 84 the clover was mature and had produced adeauate seeds for a self seeding system. The self seeded clover in the soybean canopy had established a stand in late August of 1984 while clover following corn was not planted until November.

Table 3. Above ground clover and N yield at corn planting in 1985 as affected by previous crop.

Previous summer Crop	Clover yield and N content					
	Sand Mountain			Coastal Plain		
	Weight	N	N	Weight	N	N
	1b/A	%	1b/A	1b/A	%	lb/A
Corn	3200	2.91	93	1100	4.19	46
Soybean	4240	2.86	121	2430	3.76	91

Corn yield (Table 4) at both locations was good. Judging from the 0 N rate at both locations, soybeans preceedinc corn will provide as much N to the corn as a winter legume. The clover-soybean-clover system however, was by far superior to any of the single legume crops preceedinp ccrn. Although the preceeding legume crops contributed N to the corn, they had no effect on the amount of N fertilizer required (120 lb/acre) for optimum yields at the Sand Mountain location. They did, however affect yields which were 110, 130, 130, 160 bu/acre for systems 1, 2, 3, and 4, respectively. At the Coastal Plain location, the preceedinp cropping systems did not affect yield potental but did affect N fertilizer requirement. When corn followed the clover-soybcan-clover system, 60 lb/acre of N fertilizer was adequate and 120 to 180 lb/acre were required for the other preceeding cropping systems.

Table 4. Corn grain yield as affected by previous crops and sidedress N.

Previous Crop			Sidedress N rate, lb/acre							
Winter	Summer	Winter	Sand Mountain				Coastal Plain			
83/84	84	84/85	0	60	120	180	0	60	120	180
			----- 1985 corn yield, bu/acre -----							
Fallow	Corn	Fallow	10	70	110	110	60	140	160	180
Fallow	Soybean	Fallow	40	100	120	130	90	130	170	170
Clover	Corn	Clover	50	100	130	130	90	140	150	170
Clover	Soybean	Clover	80	140	160	160	140	170	180	170
FLSD (.10)				14				26		

Tillage In-row Subsoiling, and Starter Fertilizer for Peanuts

This study was conducted for 3 years in the Coastal Plain (Wiregrass Substation, Headland) of Alabama. The soil which was a Dothan fsl, contained a root restricting hard pan 8 to 10 inches deep. Except for the starter fertilizer treatments, fertilizer and lime was applied according to soil test recommendations. Treatment variables consisted of tillage (disk-chisel-disk and no tillage into killed rye), fertilizer combinations, in-row subsoiling, and fertilizer placement. The liquid fertilizer combinations were: none, N alone, N-P, and N-P-K. Application rate was 150 lb/acre of total material and nutrient rates were 22 lb/acre N, 22 lb/acre P_2O_5 and 8 lb/acre K_2O. Subsoiling (10 to 12 inch depth) was with an in-row subsoil planting unit. For nonsubsoiled treatments, the same planting unit was used but without subsoilers. Fertilizer placement was deep and 3 X 2. For the deep placement, a tube was welded behind the subsoiler shank and the fertilizer was placed near the bottom of the track. The peanuts were planted on twin 7-inch rows on 36-inch centers and the 3 X 2 placement was directly between the paired rows and two inches deep.

Each year interactions occurred between tillage and in-row subsoiling (Table 5). Within the conventional tillage system, in-row subsoiling reduced yields, but it, increased yields within the no-tillage system. In 1983, yields were low and the only response to the starter fertilizers was a yield reduction from the 3 X 2 placed N-P-K. Yields were good in 1984 (3700 lb/acre) and excellent in 1985 (4900 lb/acre). Within the conventional tillage system, the starter fertilizers improved yields in 1984 (up to 900 lb/acre), but had no effect in 1985. In 1984, maximum response was obtained with the application of N alone. Within the no tillage system there was a positive yield response to starter fertilizers both years. The 3 X 2 placed starters were superior to the deep placed starters in 1984 (3660 vs 3300 lb/acre) but not in 1985. With the 3 X 2 placed fertilizer in conjunction with in-row suboiling (which was the superior treatment), N alone was as effective in improvina yields as the N-P and N-P-K combinations.

Table 5. Peanut yield on the Dothan soil at the Wiregrass Substation as affected by tillage, starter fertilizer, in-row subsoiling and fertilizer placement.

Starter fertilizer [1]	In-row subsoiling	Fertilizer placement	Year and Tillage [2] 1983 CT	1983 NT	1984 CT	1984 NT	1985 CT	1985 NT
			--------- lb/acre --------					
None	Yes	--	2431	1830	2977	3176	3986	4301
	No	--	2817	1742	2946	2347	4392	3805
15-0-0	Yes	Deep	2512	2416	3131	3291	4192	4477
	Yes	3 x 2	2651	1815	3279	3630	3981	4677
	No	3 x 2	2939	2184	3860	2571	4101	3733
15-15-0	Yes	Deep	2425	2236	2862	3158	4162	4513
	Yes	3 x 2	1893	1771	3225	3757	4144	4628
	No	3 x 2	2707	2198	3781	2595	4380	3896
15-15-5	Yes	Deep	2300	2222	3104	3461	4274	4840
	Yes	3 x 2	2120	2163	3315	3600	3878	4858
	No	3 x 2	2288	1655	3721	2214	4646	3974
FLSD (0.10)			484		488		323	

1/ Application rate was 150 lb/acre.

2/ CT = conventional and NT = no tillage.