TILLAGE SYSTEMS FOR DOUBLE-CROPPED WHEAT AND SOYBEANS

J.T. Touchton, C.H. Burmester, and J.D. Norton
Alabama Agricultural Experiment Station, Auburn University

A significant quantity of soybeans grown in the Southeast are double cropped with wheat harvested for grain. This continuous cropping, which should not be confused with crop rotations, requires timely harvesting and planting for optimum yields. The elimination of tillage or the time required for tillage after wheat harvest can help ensure timely planting for soybeans. From 1981 through 1983, two separate studies were conducted by the Alabama Agricultural Experiment Station at six locations (Table 1) to compare the effects of various tillage systems on yields of double-cropped wheat and soybeans. One study consisted of tillage prior to planting wheat (wheat tillage), and the other study consisted of tillage prior to planting soybeans (soybean tillage).

Wheat Tillage

In the wheat tillage test, tillage systems consisted of no-till, disk, chisel plow-disk, chisel plow-drag, turn-disk, and turn-drag. At Brewton, Monroeville, and Prattville, a drag bar was used for the drag treatment, but at the other locations, a roterra was used instead of a drag bar. After wheat harvest, tillage plots were split and soybeans were planted no till without a subsoiler on one side of the plot and no till with an in-row subsoiler on the other side of the plot. Soil types and wheat varieties are listed in Table 1. The soybean variety was either Bragg or Braxton.

For both wheat and soybeans, yield differences were generally not found within the deep tillage treatments (chisel-disk, chisel-drag, turn-disk, and turn-drag). Because of fairly equal yields among these treatments, they will be collectively referred to as deep tillage.

Wheat yields (Table 1) were highly dependent on tillage. No-tillage planted wheat resulted in 11 to 43% yield reductions when compared to deep tillage at all locations. Disk tillage resulted in lower yields than the deep tillage at Headland, Brewton, and Prattville.

During the first two years of the wheat tillage test, subsoiling for soybeans did not affect wheat grain yields. In the third year, wheat following subsoiled soybeans yielded higher than wheat following non-subsoiled soybeans at Headland, Fairhope, and Monroeville. This yield difference (7 bu./acre), which occurred regardless of tillage prior to planting wheat, further illustrates the importance of deep tillage for wheat on some soils.

Table 1. Locations of Wheat Tillage Test, Soils, Wheat Varieties, and 3-year average wheat grain yields.

Location	Soil	Wheat variety		Tillage		
		1980	1981 and 1982	No-till	Disk	Deep
				wheat yield, bu. (acre		
Headland	Dothan fsl	Coker 747	Coker 747	34	41	50
Brewton	Benndale sl	Coker 747	Coker 747	20	25	35
Monroeville	Lucedale scl	Coker 747	Coker 747	44	52	54
Prattville	Bama sl	McNair 1817	Coker 747	29	40	48
Marion Junction	Sumter c	McNair 1003	McNair 1003	32	40	39
Fairhope	Malbis fsl	-------	Coker 762	49	55	55

Soybean yields in Table 2 are averaged over years. At some locations, treatment effects varied among years, but yields averaged over years probably give a more realistic relationship between tillage for wheat and yield of no-tillage soybeans.

On the Lucedale soil at Monroeville, the Sumter soil at Marion Junction, and the Malbis soil at Fairhope, soybean yields were not affected by tillage for wheat or subsoiling for soybeans. (There was not a subsoil treatment at Marion Junction). When considering both wheat and soybean yields, the most economical tillage system on these soils probably would be to disk prior to planting wheat and no-till soybeans without an in-row subsoiler. Row widths, however, must be considered. The subsoiled soybeans were planted in 24 to 36-inch row widths, and the non-subsoiled soybeans were planted in 18 to 24-inch row widths. With wide-row planting (30 to 36-inch row widths), it is highly possible that the subsoiled beans would have yielded higher than the non-subsoiled beans primarily because subsoiling generally results in the largest plants. Large plants are required to close the canopy in wide rows but not in narrow rows.

On the Dothan soil at Headland and the Benndale soil at Brewton, especially on the Benndale soil, in-row subsoiling resulted in higher soybean yields than planting without a subsoiler unless the soil was deep tilled prior to planting wheat. The data from both locations suggest that if wheat is no-till planted or if the soil is disked prior to planting wheat, soybeans should be planted with an in-row subsoiler even if the soybeans are planted in narrow rows, but if the soil is deep tilled prior to planting wheat, there is no need for in-row subsoiling. Since wheat yields at both locations were highest with deep tillage, it appears that the most economical tillage system would be deep tillage for wheat followed by no-till soybeans. The soybeans, however, should be planted in narrow rows.

Table 2. Yield of No-tillage Soybeans as Affected by Tillage Prior to Planting Wheat and In-row Subsoiling for Soybeans.

Location[1]	Subsoiling for soybeans	Tillage prior to wheat planting		
		No-till	Disk	Deep
		bu./acre		
Headland	No	40	41	44
	Yes	43	45	44
Brewton	No	30	36	44
	Yes	46	49	49
Monroeville	No	35	36	36
	Yes	37	37	37
Prattville	No	28	25	28
	Yes	31	29	31
Marion Junction	No	35	30	32
Fairhope	No	49	47	51
	Yes	52	49	50

'Data represent 1 year at Marion Junction, 2 years at Fairhope, and 3 years at all other locations.

On the Bama soil at Prattville, soybean yields were not affected by tillage prior to planting wheat, and regardless of wheat tillage system, there was a consistent yield increase (3 to 4 bu./acre)with in-row subsoiling. Since deep tillage for wheat resulted in a consistently higher wheat yield than no tillage or disk tillage, the most economical tillage system for the Bama soil would be deep tillage for wheat and in-row subsoiling for soybeans.

Tillage Prior to Planting Soybeans

This study was conducted at the same locations as the wheat tillage study. Soil types and varieties are the same as reported in Table 1, except the soil type at Prattville was a Lucedale fsl instead of a Bama sl. Tillage treatments prior to planting soybeans were no till, no till plus in-row subsoiling, disk, chisel plow-disk, chisel plow-drag, turn-disk, and turn-drag. The soil was disked each year prior to planting wheat.

Soybean yields did not differ within deep tillage systems so yields for deep tillage are averaged over the four systems. Except for the Lucedale soil at Prattville, yield differences were found among the four tillage systems shown in Table 3. Wheat yields were not affected by tillage prior to planting soybeans, so the most economical spring tillage should be based on soybean production.

On the Lucedale soil at Prattville and Malbis soil at Fairhope, no-till without subsoiling would be the most economical. On the Dothan soil at Headland and Benndale soil at Brewton, no-till with in-row subsoiling would be the most economical. Disk tillage would be best for the Black Belt soil and either disk tillage or no-till with in-row subsoiling would be best on the Lucedale soil at Monroeville.

Table 3. Yield of Double-cropped Soybeans as Affected by Tillage Prior to Planting Soybeans.

Tillage	Location					
	Headland	Brewton	Monroe-ville	Pratt-ville	Marion Junction	Fairhope
	soybean yield, bu./acre					
No-till	39[1]	24	18	29	16	48
No-till+[2]	43	39	22	29	22	44
Disk	40	22	23	29	28	46
Deep	42	32	24	29	21	51
FLSD(O.lO)	2	4	3	NS	4	5

[1]Yields are averaged over 2 years at Marion Junction and Fairhope and 3 years at all other locations.

[2]No till+ is in row subsoiling.

Summary

The two tests, tillage before wheat and tillage before soybeans, were separate but were located adjacent to each other at all locations except Prattville. When comparing those tests, it is difficult to draw firm conclusions about optimum tillage systems. It appears, however, that tillage prior to planting wheat followed by no-till soybeans is the most economical approach to an optimum tillage system. The degree of tillage prior to planting wheat will vary with soil types, climatic conditions, and many other factors. Based on average yields obtained for both crops in these studies, it appears that optimum tillage prior to planting wheat would be disk tillage on the Malbis, Sumter, and Lucedale soils and deep tillage for the Dothan, Benndale, and Bama soils. The data strongly suggest that if the above tillage systems are used, soybeans can be planted without an in-row subsoiler except for the Bama soil. If in-row subsoilers are not used, row widths probably should be narrow (24 inches or less).