MULCHES, COVER CROPS, CROP RESIDUES, N-FIXING LEGUMES, ETC.

R. N. GALLAHER

INTRODUCTION

The southern region of the USA has some of the most diversified agricultural production systems in the world. This is brought about, in part because of the relatively long warm growing period and adaptation of a wide range of crops. The warm climate, high annual rainfall and the unique soil geology of the South causes our soils to be highly erodible and infertile under natural conditions. Large inputs of fertilizer are required to maximize production. Although much of the South receives about 50 inches of rainfall annually, distribution is uneven most years and many soils have low water holding capacity causing droughty conditions. Proper amounts and timing of both fertilizer and water applications are required to obtain maximum production on a year-round multicropping basis. The rapid increase in the use of no-tillage and other forms of conservation tillage to plant crops into sod crops, mulch crops, and crop residues has multiplied the problems incurred with fertilizer, cultivar, weed, other pest, and irrigation management.

MULTICROPPING SYSTEMS

Several categories of multicropping systems adapted to the South are in Table 1. Other possibilities exist but those listed illustrate the magnitude of the problem facing agricultural scientists in providing research data on tillage, cropping systems, cultivars, weeds, other pests, water, and fertility management.

Table 1. Categories of Multicropping Systems in the South

Category	Winter Crops	Summer Crops	Category	Winter Crops	Summer Crops
1	Forage	Forage	6	Vegetable	Agronomic
2	Forage	Seed	7	Agronomic	Vegetable
3	Cover	Forage/seed	8	Fallow	Agronomics
4	Seed	Forage	9	Fallow	Vegetables
5	Seed	Seed	10	Vegetables	Vegetables

Numerous multicropping systems within each category listed in Table 1 have been practiced in the past, are in production at present, and will by economic necessity increase in the future by farmers in the South. An example of possible double cropping systems in category one include winter crops of wheat, oats, rye, barley, ryegrass, vetch, lupine, alfalfa, crimson clover, red clover, and white clovers for forage. These crops can be

R. N. Gallaher is Professor of Agronomy, University of Florida, Gainesville 32611

succeeded by corn, sorghum, sudax, millet, soybean, tropical grasses, peanuts, and other crops for forage. Eleven winter forages followed by seven Summer forages makes 77 possible multicropping system combinations. Management of these systems make matters even more complicated depending on tillage practice, soil type, type of farm animals produced, selection of cultivars, whether irrigation or natural rainfall is used, and availability of labor, storage facilities, and specialized equipment needed.

In general management becomes more difficult as we go down the categories from one to 10. Over 300 combinations of multicropping systems are possible within the 10 categories. Timing for planting some crops may necessitate using no-tillage for some systems in order to plant early or to utilize crop residues for conservation.

MULTICROPPING MINIMUM TILLAGE PROGRESS

Agricultural Experiment Stations, such as the University of Georgia, Mississippi State University, and North Carolina State University initiated intensive multicropping minimum tillage systems research projects in the early 1970's. Other Land Grant institutions, such as the University of Florida initiated intensive multicropping minimum tillage efforts in research and extension in the mid 1970's. By 1981 most all Agricultural Experiment Stations in the South had begun major programs in multicropping and minimum tillage systems.

The Southeastern no-tillage systems conference was initiated in 1978 by the combined efforts of individuals in the Agricultural Experiment Stations along with support from others. This conference has been a major factor in allowing farmers and Scientists to interact within and across state lines in the South. Exchange of ideas played a significant role in extending research from the University to the farmer which has helped multicropping minimum tillage systems to be adapted in the South.

Data in Table 2 gives statistics on the major summer and winter crops in the South in 1974 versus 1981. Acreages and yield data were calculated from USDA Crop Production Annual Summary reports. Total acreage increased by 13.5 million for summer crops and by 1.3 million for winter crops in the USA excluding the South. Significant increases occurred for corn, soybeans, and wheat in the nonsouth states. Much of the soybean and wheat acreage occurred in states that border the South, such as Illinois, where double cropping minimum tillage management is on the rise.

The major change in the South was with the eight million acre increase in soybeans and 12.5 million acre increase in wheat during the 8-year period. Most of this increase began in about 1977 with a steady rise through 1981. We know from statistics in Florida that the increase continued in 1982 but many other southern states are in a leveling off period. The multicropping and minimum tillage research, extension, and teaching efforts from Agricultural Experiment Stations in the 1970's paralleled the increased soybean and wheat acreage.

As much a8 75% of the increased soybean and wheat acreage was likely in various multicropping systems and a large portion of one or both crops were planted with minimum tillage. Minimum tillage acreage has also increased

Table 2, Acreage, Yield, and Estimated Value of Major Crops Grown in the *South* in 1974 Versus 1981

CHANGE IN ACREAGE OF SUMMER CROPS IN THE USA EXCLUDING THE SOUTH

CROP	1974	1981	CHANGE
	ACRES (X 1000)		
CORN	65,154	71,947	+ 6,793
SOYBEAN	32,237	38,435	+ 6,198
SORGHUM	8,955	9,034	+ 79
COTTON	2,414	2,928	+ 514
PEANUT	129	104	- 25
TOTAL	108,889	122,448	+13,559

CHANGE IN ACREAGE OF WINTER CROPS IN THE USA EXCLUDING THE SOUTH

CROP	1974	1981	CHANGE
	ACRES (X 1000)		
WHEAT	65,409	70,229	+ 4,020
OATS	14,770	11,157	- 3,613
RYE	2,194	1,477	- 717
BARLEY	8,563	9,406	+ 843
TOTAL	90,936	92,269	+ 1,333

CHANGE IN ACREAGE OF SUMMER CROPS IN THE SOUTH

CROP	1974	1981	CHANGE
	ACRES (X 1000)		
CORN	12,633	12,206	- 427
SOYBEAN	21,270	29,565	+ 8,295
SORGHUM	8,721	6,990	- 1,731
COTTON	11,285	11,291	+ 106
PEANUT	1,391	1,409	+ 18
TOTAL	55,300	61,561	+ 6,261

CHANGE IN ACREAGE OF WINTER CROPS IN THE SOUTH

CROP	1974	1981	CHANGE
	ACRES (X 1000)		
WHEAT	5,945	18,635	+12,690
OATS	3,197	2,409	- 788
RYE	1,006	1,117	+ 111
BARLEY	431	335	- 96
TOTAL	10,579	22,576	+11,997

CHANGE IN YIELD OF SUMMER CROPS IN THE SOUTH

CROP	1974	1981	CHANGE
	BU/A (LB/A-COTTON & PEANUT)		
CORN	60.5	76	+ 15.5
SOYBEAN	23.5	24	+ 0.5
SORGHUM	45	51	+ 6.0
COTTON	394	492	+ 98
PEANUT	2,309	2,596	+ 287

CHANGE IN YIELD OF WINTER CROPS IN THE SOUTH

CROP	1974	1981	CHANGE
	BU/A		
WHEAT	26	40	+ 14.0
OATS	34	52	+ 18.0
RYE	18.5	24	+ 5.5
BARLEY	37	53	+ 16.0

CHANGE IN VALUE OF SUMMER CROPS IN THE SOUTH

CROP	1974	1981	CHANGE
	MILLIONS OF DOLLARS		
CORN 1	2,293	2,783	+ 490
SOYBEAN 2	3,499	4,967	+ 1,468
SORGHUM 3	981	891	- 90
COTTON 4	4,446	5,604	+ 1,158
PEANUT 5	771	878	+ 107
TOTAL	11,990	15,123	+ 3,133

1=$3/BU, 2=$7/BU, 3=$2.5/BU, 4=$1/LB, 5=$.24/LB

CHANGE IN VALUE OF WINTER CROPS IN THE SOUTH

CROP	1974	1981	CHANGE
	MILLIONS OF DOLLARS		
WHEAT 1	580	2,795	+ 2,215
OATS 2	179	214	+ 35
RYE 3	65	94	+ 29
BARLEY 4	48	53	+ 5
TOTAL	872	3,156	+ 2,284

1=$3.75/BU, 2=$1.65/BU, 3=$3.50/BU, 4=$3.00/BU

dramatically from the mid 1970's through 1982. According to "No-Tillage Farmer" magazine survey report, about 60% of the approximately **12** million acres of no-tillage in the USA is practiced in the South. The evidence indicate that the Land Grant Colleges in the South are doing a good job in research, Teaching, and extension efforts. They are providing information to southern farmers on the long growing season rnulticropping advantages and how minimum tillage is an excellent management tool to aid in multicropping success while saving soil and other costly resources at the same time.

Table 2 data indicate that southern farmers are adapting better management derived from experiment stations in all categories of research. Note that yield per acre increased by all crops during the 8-year period and that gross value of both summer and winter crops increased by 5.5 billion dollars in 1981 over 1974. Increased wheat and soybeans that were grown predominantly in multicropping minimum tillage systems in 1981 contributed over 3.5 billion dollars to the gross value over 1974.

An example of some multicropping minimum tillage systems adapted to the deep South are given in Table **3.** Sunflower and corn were planted in late February followed by sunflower, grain sorghum, and soybeans planted in late July in a minimum of three acre blocks in research verification farm plots. Note that not only choice of cropping system is important in maximizing production and profit but that the multiplicity of genetic cultivars complicate the management decisions. Sixty-three combination of choices are shown but the most profit under these conditions would be Pioneer brand **3320** corn followed by Cobb soybeans in the same warm season. Thousands of multicropping minimum tillage system management choices are available to our farmers in the South that include the use of mulches, cover crops, crop residues, and N-fixing legumes. The scientists of the Agricultural Experiment Stations and Cooperative Extension Service will continue to provide the answers as support is made available from various sources in society.

Table 3, Yield, Gross Sales, and Estimated Profits from Warm Season Double-Cropping No-Tillage Systems on the Parash Farn in Alachua County, Florida in 1982 by R. N. Gallaher.

Crop Sequence	Cultivar	Yield	Gross Sales	Profit After Cost of Variable	Profit After Cost of Total
		Sunflowers			
1 st. DO 164		1455 #/a	$138.23	$ 25.48	$ -16.43
1 st. DO 843		1861 #/a	176.80	64.05	22.14
1 st. DO 705		2238 #/a	212.61	99.86	57.95
		Corn			
1 st. P-B-3320		135 bu/a	398.25	268.08	226.17
1 st. GK 748		132 bu/a	389.40	259.23	217.32
1 st. DK XL71		123 bu/a	362.85	232.68	190.77
1 st. ASG 777		116 bu/a	342.20	212.03	170.12
1 st. CKR 19		112 bu/a	330.40	200.23	158.32
1 st. F-4507A		109 bu/a	321.55	191.38	149.47
2 nd. DO 705		520 #/a	$ 49.40	$ -21.60	$ -37.25
		Grain Sorghum			
2 nd. F-G522DR		67 bu/a	134.00	48.52	30.70
2 nd. DK BR64		69 bu/a	138.01	52.52	34.70
2 nd. GK 8020		76 bu/a	152.00	66.52	48.70
		–9%&=mi			
2 nd. Bragg		31 bu/a	151.91	51.24	31.14
2 nd. Coker 488		33 bu/a	161.71	61.01	40.94
2 nd. Cobb		40 bu/a	196.00	95.34	75.21

F=Funks, DK=DeKalb, GK=Gold Kist, CKR=Coker, P-B=Pioneer Brand, ASG=Asgrow.