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RESEARCH REPORT 1983

WHEAT

ALABAMA AGRICULTURAL EXPERIMENT STATION AUBURN UNIVERSITY
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FOREWORD

Acreage of wheat planted in Alabama has increased almost eight times during the past 14 years. The value of that portion of our wheat acreage harvested for grain has increased from about $5 million in 1978 to over $80 million in 1981 and 1982.

This research report communicates some of our recent research findings regarding production of wheat. Included in this report are results from experiments involving studies on fertilization, control of disease, response of various varieties, management, and production systems as well as costs and returns from the crop.

Because of the historically modest acreages of wheat in the past, we had allocated limited resources to wheat research. However, in view of the recent expanded acreage, the need for additional research is very real. We are making every effort to address that need within the framework of our available resources.

The team that prepared this publication included researchers of the Alabama Agricultural Experiment Station (AAES) and a staff member of the Alabama Cooperative Extension Service (ACES). The contributors are:

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We hope these research findings will be useful to you and enable you to be more effective in your wheat production program.

Gale A. Buchanan
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Information contained in this report is available to all persons without regard to race, color, sex, or national origin.

INTRODUCTION

J.L. Stallings

Planted and harvested acres of wheat have dramatically increased since 1978 after many years of being a relatively minor crop in Alabama, table 1 and figure 1. From a low of 44,000 planted and 35,000 harvested acres in 1962, acreage reached a high of 970,000 planted and 825,000 harvested acres in 1982. The rapid increase after 1978, and the presumed increased interest in wheat as a crop, have prompted the Alabama Agricultural Experiment Station to summarize, in this publication, what is currently available in terms of research results concerning wheat.

Location of wheat acreage in Alabama at two points in time, which dramatically illustrates the recent increases in production, can be seen in figure 2. A 5-year interval was chosen represented by a "normal" year before the recent increase, 1977, and the peak year of 1982. These concentrations of wheat production in Alabama can be seen generally as the "Limestone Valley," the "Black Belt," and the southern tier of counties from Baldwin to Houston, figure 2 and figure 3.

The increase in wheat acreage in Alabama in recent years is probably due to a variety of reasons. It can be seen that yields have generally increased in recent years along with general increases in prices per bushel, table 1. Thus, value of production has risen dramatically. Another reason for increased acreage of wheat in recent years has been an increasing use of wheat with soybeans and other crops in "double cropping." The Alabama Crop and Livestock Reporting Service made a survey of the extent of double cropping for 1982[1] and found that "nearly one-half of Alabama's soybean acreage was planted after another crop" and that "wheat accounted for over nine-tenths of the first crop acreage." The survey indicated that "wheat was also the first crop for about three-fourths of all the grain sorghum planted in this State."

TABLE 1. ALABAMA WINTER WHEAT: ACREAGE, YIELD, PRODUCTION, PRICE, AND VALUE, 1957-82

Year	Planted	Harvested	Yield/ harv. acre	Prod.	Sea. av. price/bu.	Value of prod.
	Acres	*Acres*	*Bu.*	*Thou. bu.*	*Dol.*	*Thou. dol.*
1957	162,000	130,000	18.0	2,340	1.82	4,259
1958	133,000	100,000	23.0	2,300	1.80	4,140
1959	73,000	55,000	23.0	1,265	1.76	2,429
1960	64,000	48,000	25.0	1,200	1.73	2,249
1961	68,000	56,000	26.0	1,456	1.73	2,519
1962	44,000	35,000	24.0	840	1.89	1,588
1963	69,000	42,000	23.5	987	1.85	1,695
1964	75,000	64,000	25.0	1,600	1.43	2,288
1965	68,000	55,000	24.5	1,348	1.42	1,914
1966	71,000	59,000	28.0	1,652	1.63	2,693
1967	130,000	112,000	24.0	2,688	1.49	4,005
1968	144,000	111,000	25.0	2,775	1.20	3,330
1969	123,000	87,000	29.0	2,523	1.20	3,028
1970	120,000	85,000	28.0	2,380	1.26	2,999
1971	164,000	120,000	29.0	3,480	1.48	5,150
1972	161,000	110,000	20.0	2,200	1.36	2,992
1973	127,000	80,000	23.0	1,840	2.72	5,005
1974	135,000	95,000	23.5	2,233	3.66	8,173
1975	146,000	105,000	24.0	2,520	2.98	7,510
1976	140,000	85,000	27.0	2,295	3.20	7,344
1977	135,000	90,000	28.0	2,520	2.05	5,166
1978	130,000	65,000	26.0	1,690	3.00	5,070
1979	220,000	145,000	26.0	3,770	3.95	14,891
1980	325,000	260,000	25.5	6,630	3.80	25,194
1981	650,000	565,000	44.0	24,860	3.35	83,281
1982	970,000	825,000	32.0	26,400	3.05	80,205
1983*	600,000	470,000	34.0	15,980	--	--

Sources: USDA, SRS, Crop Production and Alabama Crop and Livestock Reporting Service, *Agricultural Statistics*.
*Forecast as of August 1983.

[1]Alabama Crop and Livestock Reporting Service, *Alabama Farm Facts*, October 14, 1982.

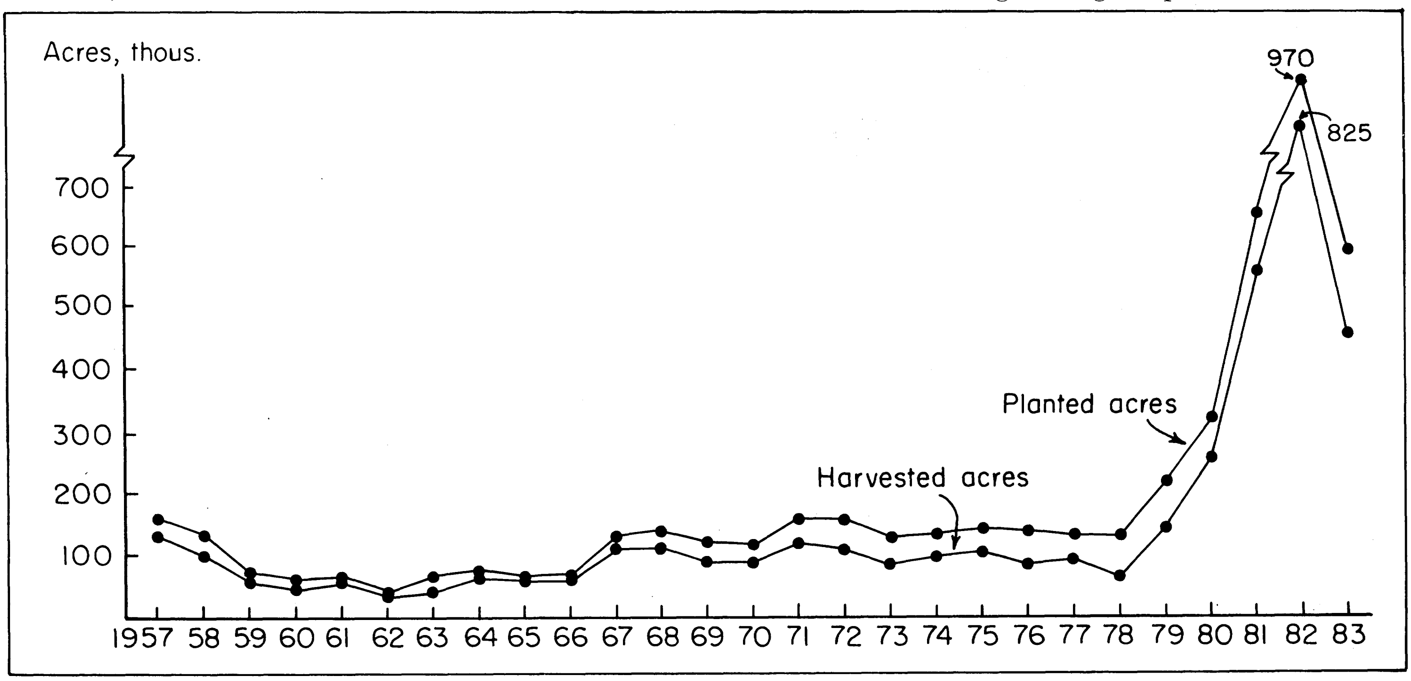


FIG. 1. Planted and harvested acres of wheat, Alabama, 1957-1983.

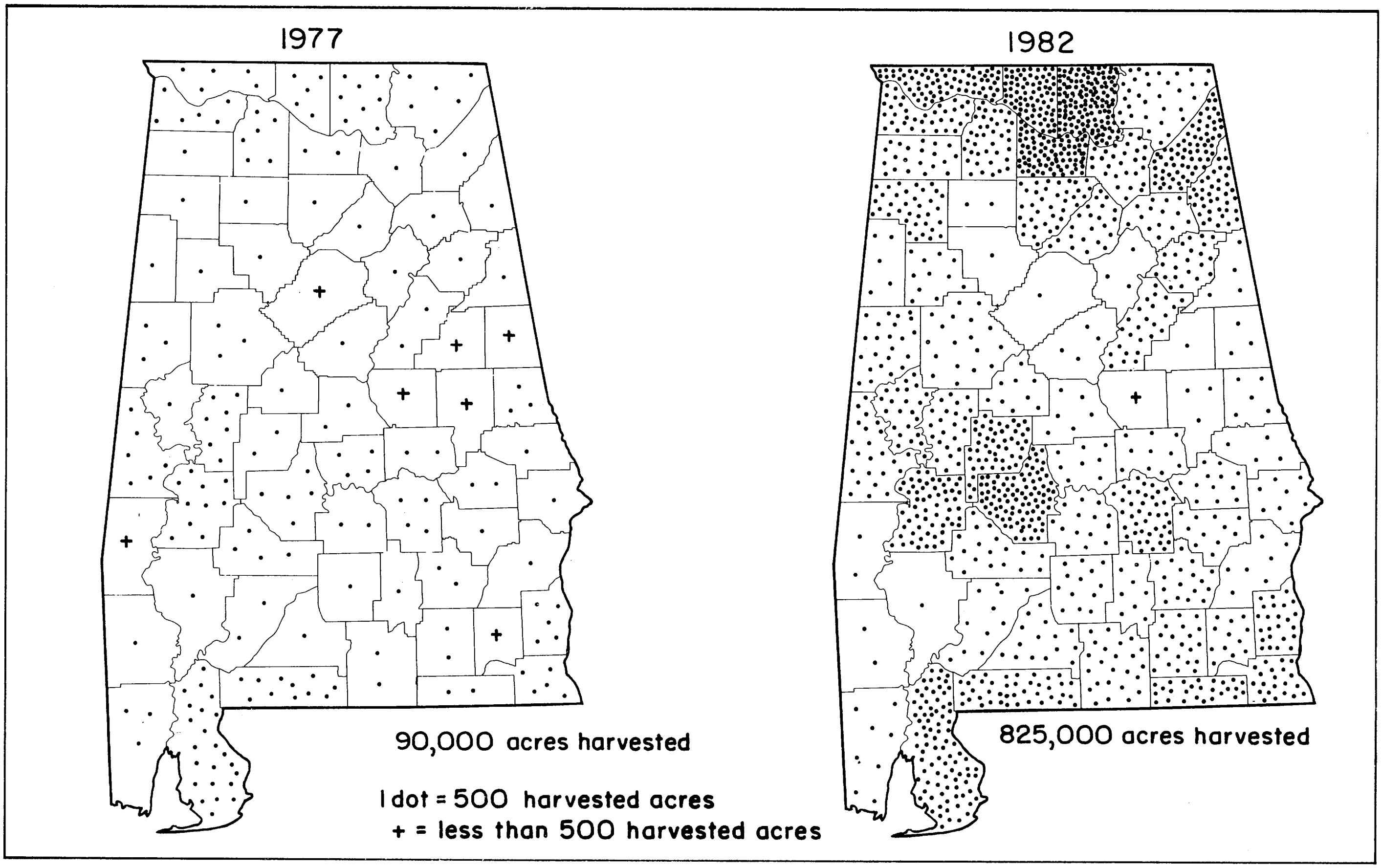


FIG. 2. Harvested acres of wheat, Alabama, 1977 and 1982.

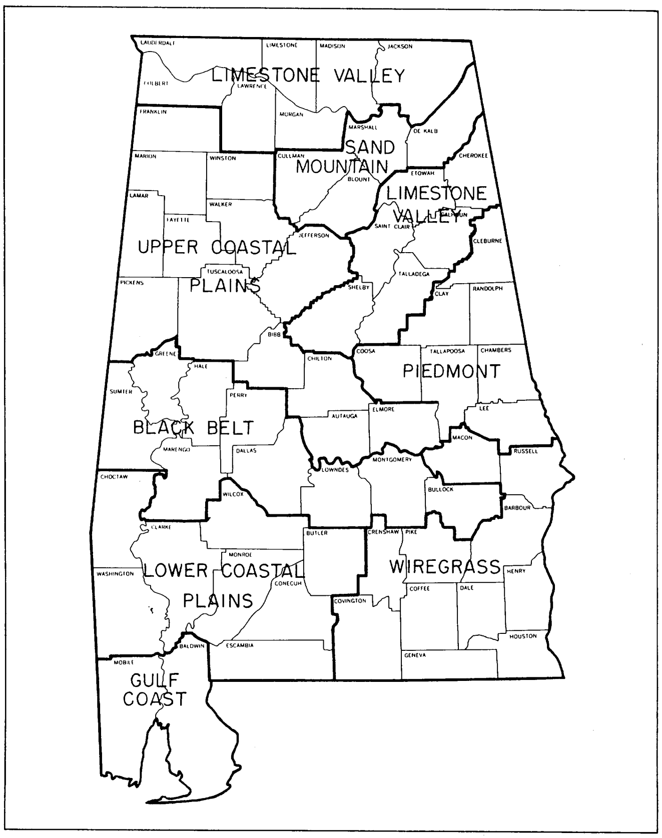


FIG. 3. Alabama counties and regions.

COSTS AND RETURNS

J.L. Stallings

The Alabama Cooperative Extension Service, in cooperation with personnel of the USDA and the Alabama Agricultural Experiment Station, prepares budgets of costs and returns annually. These budgets serve many purposes, including that of inputs into further research on various economic problems.

The latest of these costs and returns budgets (1983) are summarized in table 2 for different State areas, figure 3. This is done because it has been found that yields, prices, and costs vary from area to area resulting in differences in profitability. Budget data are presented for wheat grown alone and double-cropped with soybeans.

TABLE 2. COSTS AND RETURNS PER ACRE FOR WHEAT BY REGIONS OF ALABAMA, RECOMMENDED MANAGEMENT PRACTICES, 1983

Item	Limestone Valley	Sand Mountain	Upper Coastal Plains	Piedmont	Lower Coastal Plains	Black Belt	Wiregrass	Gulf Coast
				Wheat for grain (alone)				
Yield per acre, bu.	40.00	40.00	37.00	33.00	37.00	38.00	34.00	34.00
Price per bu., dol.	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
Value, dol.	172.00	172.00	159.10	141.90	159.10	163.40	146.20	146.20
Variable costs except labor, dol.	84.79	85.84	86.23	85.96	88.98	87.00	89.77	89.67
Fixed costs, dol.	32.78	32.78	32.19	32.19	32.78	32.78	32.19	32.78
Labor costs, dol.	4.51	4.51	4.78	4.78	4.51	4.24	4.78	4.51
Total costs, dol.	122.08	123.13	123.20	122.93	126.27	124.02	126.74	126.95
Return above variable costs, dol.	87.21	86.16	72.87	55.94	70.12	76.40	56.43	56.53
Return to land and mgt., dol.	49.92	48.87	35.90	18.97	32.83	39.38	19.46	19.25
				Wheat-soybeans (double-cropped)				
Soybeans:								
Yield per acre, bu.	25.00	25.00	25.00	23.00	27.00	25.00	25.00	30.00
Price per bu. dol.	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Value, dol.	150.00	150.00	150.00	138.00	162.00	150.00	150.00	180.00
Wheat:								
Yield per acre, bu.	40.00	40.00	37.00	33.00	37.00	38.00	34.00	34.00
Price per bu. dol.	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
Value, dol.	172.00	172.00	159.10	141.90	159.10	163.40	146.20	146.20
Total value, dol.	322.00	322.00	309.10	279.90	321.10	313.40	296.20	326.20
Total variable costs, except labor, dol.	142.90	138.34	140.36	138.79	156.10	159.43	157.74	159.57
Total fixed costs, dol.	76.30	76.30	81.40	81.40	78.95	77.30	83.91	78.30
Total labor cost, dol.	11.80	11.80	13.97	13.97	12.69	11.11	15.07	11.80
Total costs, dol.	231.01	226.44	235.73	234.16	147.74	247.90	256.72	249.67
Return above total variable costs, dol.	179.10	183.66	168.74	141.11	165.00	153.92	138.45	166.63
Return to land and mgt., dol.	90.99	95.56	73.37	45.74	73.36	65.50	39.48	76.53

Source: Budgets compiled by the Alabama Cooperative Extension Service in cooperation with the USDA and the Alabama Agricultural Experiment Station.

WHEAT VARIETIES AND MANAGEMENT SCHEMES

Cliff G. Currier

Wheat is a versatile crop. It can be planted alone or in combination with other forages for winter grazing. It can be grazed until the plants begin reproductive growth and then be allowed to produce a grain crop. It can also be grown for a grain crop only.

Field research studies have been conducted to test the yield potential of wheat and other small grain varieties when grown under various management practices. In general, results have shown that among the many wheat varieties currently available to Alabama farmers, some varieties have better yield potential for a given management practice than others. Some of these varieties appear to be adapted over the whole State, while others have a more specific area of adaptation. Many varieties have been tested, but only the results for those varieties recommended in the Experiment Station's Small Grain Variety Report, 1981-82 (Department of Agronomy and Soils, Departmental Series No. 77) are given here.

WHEAT AS A FORAGE CROP

Wheat to be used for forage, planted alone, or in combination with other grasses and or legumes is generally planted in early September or October. Lime, phosphorus, and potassium are applied prior to planting on a prepared seedbed. One hundred pounds of nitrogen are also applied prior to planting. Grazing can commence as soon as the plants attain a height of 6 to 10 inches. Another 60 pounds of nitrogen is applied in mid- to late February. The nitrogen rate can be reduced or omitted if a good stand of legumes is present in the pasture. Oven-dry forage yields of wheat grown alone ranged from 2,847 to 4,488 pounds per acre, depending on the variety and the location involved, table 3.

TABLE 3. THREE-YEAR AVERAGE OVEN-DRY FORAGE YIELD OF WHEAT VARIETIES RECOMMENDED FOR FORAGE PRODUCTION ONLY IN NORTHERN, CENTRAL, AND SOUTHERN ALABAMA, 1980-82

Variety	3-yr. av. oven-dry forage yield per acre
	Lb.
Northern Alabama	
Coker 68-15	3,770
Coker 747	4,240
N.K.-McNair 1003	3,962
Southern Belle	3,740
Central Alabama	
Coker 68-15	4,155
Coker 747	4,488
N.K.-McNair 1003	4,284
N.K.-McNair 1813	4,011
Southern Alabama	
Coker 68-15	3,378
Coker 747	3,207
Coker 762	2,847
Holley	2,982
Southern Belle	3,074
Wakeland	3,092

WHEAT AS A COMBINATION FORAGE AND GRAIN CROP

Wheat used in this way is planted in early September or October, limed, fertilized, and nitrated as described earlier. Wheat must be planted alone because of interference by other species with grain harvest. Animals are removed from the pasture at the February nitrating. Timing is critical in the removal of animals from pastures in this scheme. Animals need to be removed just before wheat plants begin head initiation (jointing). If a primordial head is broken or bitten off, that tiller will not produce a seed head.

Wheat herbage produced during fall and winter is extremely palatable and high in available energy. From a nutritional standpoint it is not unreasonable to equate a pound of wheat herbage dry matter to a pound of grain dry matter and sum the two to arrive at a figure for total feed. Wheat varieties differ greatly in total feed production and in the relative amount of forage and grain they produce. One must decide if the forage or the grain is the most important component needed from the variety. The forage to total feed ratio is given to show the proportion of total feed that is forage. Forage yields range from 690 to 2,325 pounds of dry forage with the subsequent grain yields varying from 1,414 to 3,059 pounds of grain. Total feed production by varieties ranges from 2,983 to 4,705 pounds of feed per acre with the proportion of forage making up the total feed production ranging from 22 to 62 percent forage, table 4.

TABLE 4. THREE-YEAR AVERAGE COMBINATION FORAGE AND GRAIN YIELD OF WHEAT VARIETIES RECOMMENDED FOR NORTHERN, CENTRAL, AND SOUTHERN ALABAMA, 1980-82

Variety	3-yr. av. oven-dry forage yield per acre	3 yr. av. grain yield per acre	3-yr. av. total feed production per acre	Forage to total feed ratio
	Lb.	*Lb.*	*Lb.*	
Northern Alabama				
Coker 68-15	1,169	2,237	3,406	34
Coker 747	706	2,495	3,201	22
Coker 762	1,163	2,331	3,494	33
Coker 916	902	2,637	3,539	26
Ga. 1123	1,264	1,871	3,135	40
N.K.-McNair 1003	997	2,292	3,289	30
N.K.-McNair 1813	1,175	1,808	2,983	39
Roy	1,119	2,332	3,451	32
Southern Belle	954	2,359	3,313	29
Wakeland	1,408	1,715	3,123	45
Central Alabama				
Abe	1,260	2,131	3,391	37
Arthur	1,514	2,197	3,711	41
Arthur 71	1,485	2,035	3,520	42
Coker 68-15	2,040	1,696	3,736	55
Coker 747	1,622	2,217	3,839	42
Coker 762	2,193	1,865	4,058	54
N.K.-McNair 1003	2,216	2,207	4,423	50
N.K.-McNair 1813	2,289	2,150	4,439	52
Roy	2,194	2,090	4,284	51
Southern Belle	1,868	2,155	4,023	46
Wakeland	2,325	1,414	3,739	62
Southern Alabama				
Coker 68-15	1,681	2,155	3,836	44
Coker 747	1,359	2,491	3,850	35
Coker 762	1,910	2,577	4,487	43
Coker 916	1,646	3,059	4,705	35
Holley	1,791	2,332	4,123	43
N.K.-McNair 1003	1,804	2,007	3,811	47
Roy	2,106	2,049	4,155	51
Southern Belle	1,564	2,357	3,921	40
Wakeland	2,115	1,831	3,946	54

TABLE 5. THREE-YEAR AVERAGE GRAIN YIELD OF WHEAT VARIETIES RECOMMENDED FOR GRAIN PRODUCTION ONLY IN NORTHERN, CENTRAL, AND SOUTHERN ALABAMA, 1980-82

Variety	3-yr. av. grain yield per acre
	Bu.
Northern Alabama	
Coker 68-15	42
Coker 747	42
Coker 762	46
Coker 916	45
N.K.-McNair 1003	40
N.K.-McNair 1813	37
Roy	45
Southern Belle	41
Central Alabama	
Arthur	40
Coker 68-15	40
Coker 747	42
Coker 762	48
N.K.-McNair 1003	48
N.K.-McNair 1813	44
Roy	43
Southern Belle	45
Southern Alabama	
Coker 68-15	40
Coker 747	45
Coker 762	52
Coker 916	56
Holley	40
N.K.-McNair 1003	40
Roy	42
Southern Belle	48

WHEAT FOR GRAIN PRODUCTION ONLY

Wheat planted for grain production only is normally planted in mid-October in northern Alabama to as late as December 1 in southern Alabama. Wheat for grain is most often used in a double-cropping scheme with soybeans. This crop can be broadcast seeded over a senescing stand of soybeans or broadcast or drilled into a prepared seedbed. Higher seeding rates are needed with broadcast seedings. Twenty pounds of nitrogen are normally applied with other fertilizers at planting, followed by an application of 60 pounds of nitrogen in mid- to late February.

Wheat varieties currently recommended have produced from 37 to 56 bushels of grain per acre (60 pounds per bushel), table 5. Another important factor to farmers double-cropping with wheat is the rate of maturity of the wheat variety. At present, there is little information available concerning harvest-ready dates for these varieties. There appears to be a 7- to 10-day difference among heading dates in the varieties currently recommended. This difference may not be large enough to warrant selection for maturity alone. However, yield should be the major consideration, in variety selection.

FERTILITY REQUIREMENTS OF WHEAT

J.T. Cope, D.L. Thurlow, E.M. Evans, and J.T. Touchton

The primary consideration in fertilizing wheat is to apply adequate nitrogen in the fall and late winter, with phosphorus, potassium, and lime applied according to reliable soil tests. Nitrogen needs do not vary much on Alabama soils because all are low in organic matter and supply only small amounts of nitrogen to growing plants, especially during cool seasons when decomposition of the organic matter is slow. Amounts of phosphorus, potassium, and lime needed vary among soils and with past fertilization and cropping practices.

NITROGEN

Research conducted on small grains many years ago showed that nitrogen applied at planting had little effect on grain yield. The primary purpose of fall applied nitrogen on wheat grown for grain is to ensure adequate plant growth prior to severe freezes, which will sometimes kill plants. Excessive nitrogen applied in the fall may cause rapid vegetative growth during the fall and winter, which may result in excessive lodging in the spring. Depending on fall application to supply all of the nitrogen needed by wheat will usually result in an exhausted supply before grain production is initiated in the spring.

Data from an experiment at the Sand Mountain and Wiregrass substations in 1980-81 show that the nitrogen requirement is affected by the preceding summer crop, table 6. Need for fall applied nitrogen was greater following sorghum than when wheat followed soybeans. The data from these studies support data from other studies, and currently

TABLE 6. RATES OF N FOR WHEAT FOLLOWING SOYBEANS AND SORGHUM, 1980-81

Location		Wheat yield/acre, by fall/spring N lb./acre															
	Fall	0				12				24				36			
	Spring	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Wiregrass Substation	Soybeans	41	50	54	49	42	55	55	51	54	49	52	51	52	52	55	51
	Sorghum	35	37	49	53	40	42	56	55	38	48	54	59	45	54	55	54
Sand Mountain Substation	Soybeans	31	42	38	43	38	42	47	46	38	45	51	45	34	46	45	45
	Sorghum	14	27	38	40	21	31	40	44	24	37	42	47	28	39	46	53
Average	Soybeans	36	46	46	46	40	48	51	49	46	47	52	48	43	49	50	49
	Sorghum	24	32	43	46	30	36	48	49	31	42	53	53	36	46	50	54

it appears that the best rates for wheat following soybeans are 0 to 20 pounds per acre in the fall and 40 to 60 pounds per acre in late February. Wheat following non-legumes needs 30 pounds per acre in the fall and 60 to 80 pounds per acre in late February.

In an experiment at the E.V. Smith Research Center in Macon County in 1980-81, the best time to apply spring nitrogen for wheat was January or February, table 7. Rates of

TABLE 7. TIME OF APPLICATION OF SPRING N FOR WHEAT, E.V. SMITH RESEARCH CENTER, 1980-81

N. rate, lb./acre	Yield/acre, by date of application			
	Jan. 22	Feb. 24	Mar. 24	Apr. 23
	Bu.	*Bu.*	*Bu.*	*Bu.*
50	45(3)[1]	43(3)	36	25
75[2]	52(69)	45(5)	28	24
100[2]	40(77)	50(27)	37	26
No N check = 18 bu. per acre				

[1]Number in parenthesis are percent lodged.
[2]For 75 and 100 pounds per acre January application, wheat had to be picked up by hand and thrown in combine.

75 pounds nitrogen applied in late January or 100 pounds in January or February caused extensive lodging. These data support the current recommendation of 60 pounds in February. Delaying nitrogen application until March 24 reduced yield at this location. The optimum time for spring nitrogen application will vary from year to year and among locations within the State. Research on timing of spring nitrogen application is limited. Currently, it appears the optimum time for spring application is between February 15 and 20 for south Alabama and between March 1 and 15 for north Alabama.

When grown for grazing, wheat planted on fallowed fields in early September can utilize up to 100 pounds of nitrogen per acre in the fall and winter in producing vegetative growth. For late planted fields, only 60 pounds is needed. The spring application is necessary for grain production or for late spring grazing.

PHOSPHORUS, POTASSIUM, AND LIME

The need for phosphorus and potassium varies with kind of soil and past cropping and fertilization history. The 1981 soil test summary showed that of all soil samples received for temporary winter grasses, which were mostly for wheat, 40 percent were *High* in phosphorus and 56 percent were *High* in potassium. These were about the same percentages as for all field crop samples. The *High* levels indicate these soils contained adequate amounts of phosphorus or potassium to produce maximum yields without application of the nutrient tested. This also means that 60 percent of samples received recommendations for applying phosphorus and 44 percent for applying potassium.

These soil test recommendations are based on data such as that from experiments at six locations on a rotation of corn-wheat-soybeans during 1968-78, table 8. The standard treatment in these experiments was 20-100-100 pounds of N-P_2O_5-K_2O in the fall and 60 pounds nitrogen in the spring to wheat. Corn in the rotation received 120-100-100 and soybeans were not fertilized. Soil test values presented are from plots that had received no phosphorus since 1957 and no potassium or lime since 1929. The data show that even though soil test levels of phosphorus and potassium were *Low* in most cases, there was little response to either nutrient by wheat. Only at the Sand Mountain Substation and Brewton Experiment Field, which were *Low* in soil test phosphorus and potassium, were responses produced by either element. These data indicate that present recom-

TABLE 8. SOIL TEST LEVELS AND RESPONSE OF WHEAT TO P, K, AND LIME AT 6 LOCATIONS, 1968-78

Item	Result, by location and soil type, best 7 of 11 years							
	Brewton Field, Benndale sl	Monroeville Field, Lucedale fsl	Wiregrass Substation, Dothan fsl	Prattville Field, Lucedale scl	Sand Mountain Substation, Hartsells fsl	Tenn. Valley Substation, Decatur cl	Average all locations: Best 7 of 11 years	Average all locations: All 11 years
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Response to phosphorus								
Soil test P index, 1972[1]	L60	VL50	M100	M80	L60	L70		
Soil test P index, 1978[1]	VL50	VL60	M80	M80	L60	L70		
Yield no P, bu.	18	24	38	40	35	50	33	28
Yield 60 P_2O_5, bu.	24	26	39	41	45	45	37	32
Increase from 60 P_2O_5, bu.	6	2	1	1	10	-5		
Response to potassium								
Soil test K index, 1972[1]	L60	M70	M80	M70	M80	M90		
Soil test K index, 1978[1]	L60	L60	M70	M70	L60	M80		
Yield no K_2O, bu.	22	26	41	39	41	46	36	31
30 K_2O, bu.	24	28	39	40	44	43	36	32
60 K_2O, bu.	24	26	41	39	45	45	37	32
120 K_2O, bu.	23	26	38	39	43	44	36	31
Increase from 120 K_2O, bu.	1	0	0	0	2	-2		
Response to lime and micronutrients								
Soil pH, 1972[2]	5.0	4.8	5.2	4.9	4.8	5.4		
Soil pH, 1978[2]	5.0	4.7	5.1	4.6	4.7	5.1		
Yield, no lime, bu.	17	23	38	31	26	43	30	26
Yield, lime, bu.	24	26	41	39	45	45	37	32
Yield, lime + micronutrients[3], bu.	23	26	38	40	44	47		
Increase from lime, bu.	7	3	3	8	19	2		
Increase from micronutrients, bu.	-1	0	-3	1	-1	2		

[1]Soil test ratings - Very Low, Low, Medium, and percent sufficiency index of plots receiving no P or no K.
[2]Soil pH of unlimed plots. Other plots limed to pH 6.0 to 6.5.
[3]Micronutrient mixture containing boron, zinc, manganese, copper, and iron.

mendations from the soil testing laboratory are more than adequate for this crop. Responses to lime show the importance of maintaining pH by liming when indicated by soil tests. No response was found from the use of micronutrients on wheat.

The Cullars Rotation Experiment is a 3-year rotation on Dothan loamy sand at Auburn which has been in progress since 1911 with numerous revisions. The rotation from 1968 to 1972 was cotton-winter legume-corn-wheat-soybeans. Data show large response to phosphorus by oats and wheat on this soil, which was *Very Low* in soil test P, table 9. Wheat produced only 11 bushels per acre compared to 24 bushels where 60 pounds P_2O_5 from concentrated superphosphate was applied. Rock phosphate does not appear to be a satisfactory source of phosphorus for wheat even if applied at 120 pounds P_2O_5 per acre.

Wheat produced a 6-bushel response to 120 pounds of K_2O but has been less responsive to potassium than have the other crops in the rotation. This agrees with data which showed that wheat did not respond to K at six other locations, table 8.

Lime increased wheat yield from 13 up to 24 bushels at pH 4.9. An experiment on an Allen loam soil at pH 5.2 in Morgan County in 1981 found that lime increased wheat yield from 27 up to 37 bushels per acre.[2] These data support those in table 8 emphasizing the importance of keeping pH at satisfactory levels for this crop.

Plots that received no sulfur, and the ones that received a micronutrient mixture containing boron, zinc, manganese, copper, and molybdenum produced about the same yield of oats and 4 bushels less wheat than the standard plots. This indicates a small decrease from lack of sulfur and a possible toxicity from one of the micronutrients on wheat on this very sandy soil.

[2]Reported by Charles Burmester.

Soil test values for pH, phosphorus, and potassium on check plots are presented to show the relationship between soil test levels and response, tables 8 and 9. These data are from long-term experiments where fertility levels of the plots have become quite stable as indicated by similar values for 1972 and 1978, table 8. Comparison of these soil test values for phosphorus and potassium, with present recommendations from the soil testing laboratory, shows that rate recommendations are more than would be justified by data from these long-term experiments. The data show that wheat is less responsive to phosphorus and potassium than most other crops which have been grown in rotation with wheat.

TABLE 9. YIELDS OF OATS AND WHEAT IN CULLARS ROTATION EXPERIMENT, AUBURN, 1956-71

Rate, lb./acre				Yield/acre		Soil test 1971[1]
N	P_2O_5	K_2O		Oats, 1956-67	Wheat 1968-71	
				Bu.	*Bu.*	
Response to phosphorus						
60	0	90		14	11	VL 30
60	60	90		39	24	H 120
60	120	90	Rock phosphate	45	20	EH 970
Response to potassium						
60	60	0		29	20	L40
60	60	30		--	21	M70
60	60	60		39	23	M80
60	60	90		--	24	H90
60	60	120		--	26	H90
Response to lime, sulfur, and micronutrients						
60	60	90	No lime	32	13	pH 4.9
60	60	90	No sulfur	41	20	pH 6.1
60	60	90	Micro-nutrients	40	20	pH 6.1

[1]Soil test ratings and percent sufficiency index.

DISEASES AND THEIR CONTROL

Robert T. Gudauskas, Cliff G. Currier, and Austin K. Hagan

Wheat plants in all stages of growth are subject to numerous diseases. Many of the important diseases of wheat are caused by microorganisms such as fungi, bacteria, viruses, and nematodes which parasitize the plants. Diseases may also be caused by adverse factors in the environment, such as nutrient deficiencies, unfavorable soil pH, drought, and pesticide injury. It has been estimated that about 20 percent of the world wheat crop is lost annually to diseases. Of the nearly 200 diseases of wheat that have been described, about 50 are routinely important economically.

CURRENT RESEARCH

As with any crop, sound agronomic practices, such as planting adapted varieties and following soil test recommendations, can be important in reducing the impact of diseases on wheat. However, effective control of many of these diseases requires additional measures like use of disease-free seed, planting resistant or tolerant varieties, crop rotation, field sanitation, and spraying with pesticides. Historically, research by the Alabama Agricultural Experiment Station has focused primarily on evaluating wheat varieties for resistance to diseases that commonly occur in Alabama. Recently, the work has been expanded to include testing fungicides for control of some of these diseases.

DISEASE RATINGS

Some varieties of wheat are resistant to attack by disease agents or tolerate a disease to the extent that yields are relatively unaffected. Some of the wheat varieties recommended for planting in Alabama contain specific factors for disease resistance whereas others do not. Even the "resistant varieties" often vary in susceptibility from area to area because of difference in type and prevalence of the disease agent, environment, and condition of the wheat plants. Entries in small grain variety tests planted at various locations throughout the State are evaluated annually for reactions to diseases. These disease ratings are included in the Small Grain Variety Report published each year by the

Alabama Agricultural Experiment Station to aid farmers in selecting a wheat variety for areas where the diseases occur.

Ratings for three major diseases on wheat entries in the 1982 and 1983 variety tests are summarized in tables 10-12.

FUNGICIDE TESTS

Several fungicides, fungicide combinations, and times of application have been tested for effectiveness in controlling wheat diseases, primarily Septoria blotch. Most of the tests were conducted at the Gulf Coast (Fairhope), Lower Coastal Plain (Camden), and Tennessee Valley (Belle Mina) substations on small plots (8 x 15 to 15 x 20 feet) of Arthur 71, Coker 68-15, Coker 747, and Coker 762 wheat. Fungicides were applied with hand sprayers in 18-25 gallons of water per acre, and all treatments were replicated at least five times. Plots were rated periodically for disease severity and harvested at crop maturity for grain yields. Fungicides tested to date include anilazine (Dyrene 4F), benomyl (Benlate 50WP, DPX-3866 75DF), captafol (Difolatan 4F), chlorothalonil (Bravo 500), DPX-965 75WP, DPX H-6573, DS-57654, HWG-1608 250 EC, mancozeb (Dithane M-45, DPX-7331 4F, Manzate 200), maneb (Manex 4F), propiconazol (proposed) (Tilt 3.6 E), RH-3866 1E, RH-5781F 1.5 EC), SLJ-0312 50 WP, copper-sulfur [Top Cop with sulfur (50 percent S, 4.4 percent Cu)], and triadimefon (Bayleton 2 EC, 50 WP).

In additional tests in 1982, mancozeb was applied by airplane in 3 gallons of water per acre to plots (60 x 400 feet) of N.K.-McNair 1003 wheat in fields near Dothan. Treatments were replicated four times. Plots were rated for

TABLE 10. SEPTORIA BLOTCH RATINGS FOR WHEAT VARIETIES GROWN IN ALABAMA DURING 1982-83[1]

Variety	Ratings for north Alabama					
	Belle Mina		Crossville		Winfield	
	1982	1983	1982	1983	1982	1983
Arthur	7	3	5	3	8	5
Arthur 71	5	5	6	3	7	7
Auburn	-	1	-	3	-	6
Caldwell	-	3	-	5	-	4
Coker 68-15	7	4	6	7	6	5
Coker 916	6	4	6	4	8	7
Coker 747	6	4	6	4	6	4
Coker 762	7	4	4	5	6	8
Delta Queen	4	-	4	-	7	-
Fillmore	-	2	-	4	-	3
Georgia 1123	5	4	5	5	7	4
Hart	6	-	4	4	7	3
HW 3006	-	5	-	5	-	3
HW 3007	-	3	-	6	-	2
N.K.-McNair 1003	3	4	4	6	8	8
N.K.-McNair 1813	7	6	5	6	9	8
N.K. 79810	6	-	4	-	8	4
Pioneer 2550	6	3	4	3	6	4
Roy	5	4	5	4	7	4
Southern Belle	7	4	6	4	9	7
Stacy	7	4	4	3	7	7
Wakeland	4	5	5	3	7	5

Variety	Ratings for central Alabama							
	Marion Junction		Camp Hill		Prattville		Tallassee	
	1982	1983	1982	1983	1982	1983	1982	1983
Abe	6	4	5	3	5	2	5	4
Arthur	5	3	3	2	5	2	6	6
Arthur 71	4	4	5	3	6	3	5	5
Auburn	-	3	-	2	-	2	-	5
Caldwell	-	3	-	3	-	3	-	5
Coker 68-15	6	5	4	4	5	3	6	6
Coker 916	5	3	2	3	6.5	3	6.5	6
Coker 747	4	3	5	3	5	2	5	5
Coker 762	4	3	2	3	4	3	6	7
Doublecrop	5	3	5	3	6	3	7	5
Fillmore	-	3	-	3	-	5	-	6
Florida 301	6	4	3	8	5	2	5.5	8
Hunter	6	4	2	6	6	3	6	7
HW 3006	-	3	-	5	-	4	-	6
HW 3007	-	3	-	3	-	3	-	6
N.K.-McNair 1003	6	4	2	5	4	3	6	7
N.K.-McNair 1813	7	3	6	3	7	4	7	8
N.K. 79810	4	-	4	-	4	-	7	-
Omega 78	5.5	5	4	2	6	4	5	7
Pioneer 2550	3	3	3	3	5	4	5	5
Roy	4	2	4	4	4	2	5	6
Southern Belle	7	2	6	3	7	3	6.5	6
Stacy	5	5	5	3	5	3	5	5
Terral 81-12	-	3	-	3	-	3	-	4
Terral 800-22	6	3	3	2	5	3	-	-
Wakeland	3	4	3	3	5	2	6	6

(Continued)

	Ratings for south Alabama									
	Fairhope		Brewton		Monroeville		Headland		Camden	
	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983
Arthur 71	-	4	3	4	3	3	2	3	4	3
Auburn	-	5	-	4	-	3	-	3	-	2
Caldwell	-	5	-	4	-	2	-	4	-	1
Coker 68-15	5	6	5	4	5	5	4	3	3	5
Coker 916	2	5	4	3	2	2	2	2	2	2
Coker 747	-	4	4	4	3	2	3	3	3	2
Coker 762	5	8	4	2	3	3	6	2	2	2
Coker 797	8	-	7	-	7	-	8	-	5	-
Doublecrop	3	6	4	3	2	2	3	4	3	3
Fillmore	-	6	-	4	-	4	-	1	-	4
Florida 301	6	9	8	6	6	4	6	4	4	4
Holley	4	7	6	4	4	1	5	4	3	2
Hunter	7	4	7	3	5	4	5	3	4	1
HW 3006	-	5	-	5	-	4	-	1	-	3
HW 3007	-	5	-	4	-	2	-	3	-	4
N.K.-McNair 1003	3	8	6	5	4	3	6	1	4	3
N.K.-McNair 1813	4	8	8	4	5	2	7	4	3	4
Pioneer 2550	-	6	4	3	3	4	2	5	0	4
Roy	3	5	5	5	3	3	3	2	2	1
Southern Belle	4	6	5	3	5	3	3	2	2	2
Terral 81-12	-	6	-	3	-	3	-	3	-	3
Terral 800-22	5	-	-	-	3	5	4	3	2	5
Wakeland	4	3	4	3	3	2	6	3	2	2

[1]0-9 scale: 0 = no disease, 9 = severe disease.

disease severity when the crop was in the milk stage, and a swath (14 x 200 feet) was harvested from each plot for grain yields at crop maturity.

SEEDLING BLIGHTS

These diseases are caused primarily by fungi that live in the soil. Death of wheat seedlings before or after emergence is the result of early attack by the fungi.

Use of clean or fungicide-treated seed will reduce seedling blights. Fungicides available for treatment of wheat seed include captan (Captan 25, Isotox Seed Treater, Orthocide 4F, Orthocide 75-3, Soil Treater X), captan-carboxin (Orthocide-Vitavax 20-20), carboxin-thiram (Vitavax T, Vitavax 200), captan-PCNB (Ortho Soil Treater 3X), mancozeb/maneb (Dithane M-22, Dithane M-45, Granox NM, Grainolum, Manzate 200), PCNB (Terra-Coat LT-2, Terra Coat SD 205), and thiram (Arasan 50-Red). Delaying planting to lessen exposure of seedlings to warm soil temperatures may also help.

TAKE-ALL

Take-all is caused by *Gaeumannomyces graminis*, a soil-borne fungus that attacks the roots, crowns, and lower stems of wheat plants. The disease is so named because of the devastating effects it has been known to have on wheat crops. Take-all has long been recognized as a serious problem on wheat in temperate climates; however, it was not discovered in Alabama until the spring of 1983. Occurrence of take-all has now been confirmed in Cullman, Jackson,

TABLE 11. POWDERY MILDEW RATINGS FOR WHEAT VARIETIES GROWN IN ALABAMA DURING 1982-83[1]

	Ratings for north Alabama					
Variety	Belle Mina		Crossville		Winfield	
	1982	1983	1982	1983	1982	1983
Arthur	5	4	7	7	0	-
Arthur 71	4	4	9	8	0	-
Auburn	-	0	-	5	-	-
Caldwell	-	2	-	7	-	0
Coker 68-15	0	5	7	8	0	0
Coker 916	0	5	4	3	0	-
Coker 747	0	4	6	7	0	0
Coker 762	0	5	0	5	0	-
Delta Queen	0	-	3	-	0	-
Fillmore	-	0	-	5	-	-
Georgia 1123	0	3	4	7	0	0
Hart	0	-	8	7	0	-
HW 3006	-	7	-	8	-	-
HW 3007	-	3	-	6	-	-
N.K.-McNair 1003	0	0	5	5	0	-
N.K.-McNair 1813	0	7	0	6	0	-
N.K. 79810	0	-	4	-	0	-
Pioneer 2550	0	3	6	8	0	-
Roy	0	-	8	8	0	-
Southern Belle	0	6	6	5	0	-
Stacy	0	0	0	3	0	-
Wakeland	0	5	0	3	0	-

(Continued)

(*Continued*) TABLE 11. POWDERY MILDEW RATINGS FOR WHEAT VARIETIES GROWN IN ALABAMA DURING 1982-83[1]

	Ratings for central Alabama							
	Marion Junction		Camp Hill		Prattville		Tallassee	
	1982	1983	1982	1983	1982	1983	1982	1983
Abe	3	0	6	3	7	5	7	6
Arthur	6	0	7	3	7.5	4	8	7
Arthur 71	6	0	6	3	7	5	6	7
Auburn	-	0	-	2	-	3	-	6
Caldwell	-	0	-	0	-	3	-	4
Coker 68-15	7	0	7	4	8	6	8.5	7
Coker 916	0	0	4	0	5	3	5	5
Coker 747	7	0	6	4	6.5	3	8	5
Coker 762	6	0	0	0	5	1	5.5	6
Doublecrop	5	3	7	2	8.5	5	9	7
Fillmore	-	0	-	0	-	0	-	3
Florida 301	3	0	0	0	2	2	0	-
Hunter	0	0	4	3	5.5	1	5	6
HW 3006	-	4	-	6	-	6	-	8
HW 3007	-	0	-	3	-	4	-	6
N.K.-McNair 1003	4	1	6	0	6	3	5	-
N.K.-McNair 1813	6	0	0	0	4	4	6	-
N.K. 79810	5	-	6	-	7	-	7	-
Omega 78	0	1	0	0	5.5	0	6	-
Pioneer 2550	6	0	7	4	7	4	8	7
Roy	6	1	8	7	8.5	4	7.5	5
Southern Belle	6	0	7	4	8	6	7	8
Stacy	3	0	4	2	3	5	6	1
Terral 81-12	-	0	-	0	-	3	-	4
Terral 800-22	0	0	0	0	0	1	-	-
Wakeland	5	4	7	2	6.5	3	6	8

	Ratings for south Alabama									
	Fairhope		Brewton		Monroeville		Headland		Camden	
	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983
Arthur 71	-	-	7	2	0	0	-	1	7	2
Auburn	-	0	-	2	-	0	-	2	-	0
Caldwell	-	-	-	0	-	3	-	1	-	0
Coker 68-15	0	0	8	3	7	3	7.5	7	7	0
Coker 916	4	0	4	0	3	0	2	0	2	0
Coker 747	-	0	7	3	-	3	4	3	6	0
Coker 762	0	-	4	0	0	0	0	2	0	2
Coker 797	-	-	4	-	0	-	6	-	0	-
Doublecrop	7	0	8	5	6	0	7	4	6.5	0
Fillmore	-	-	-	0	-	0	-	1	-	0
Florida 301	0	-	0	0	0	0	0	0	3	0
Holley	0	0	3	0	0	0	0	0	0	0
Hunter	0	-	0	0	0	0	0	0	0	1
HW 3006	-	4	-	5	-	4	-	6	-	4
HW 3007	-	-	-	0	-	2	-	0	-	0
N.K.-McNair 1003	-	-	-	4	-	3	0	0	4	0
N.K.-McNair 1813	0	-	-	0	4	0	-	0	3	0
Pioneer 2550	-	0	7	0	5	0	3	4	4	3
Roy	6	-	9	5	6	4	7	6	6	3
Southern Belle	5	-	7	4	5	2	6	3	5	0
Terral 81-12	-	0	-	0	-	0	-	0	-	0
Terral 800-22	0	-	-	-	0	0	-	2	0	0
Wakeland	0	0	6	0	4	0	7	3	5	0

[1]0-9 scale: 0 = no disease, 9 = severe disease.

Lauderdale, Limestone, Madison, Marshall, and Morgan counties. This apparent wide-spread occurrence, plus observations by county agents and farmers, indicates that take-all was present in previous years.

Generally, incidence and severity of take-all were low in most fields examined in 1983. However, there were a few fields in which losses to the disease were estimated at 50 percent or higher. Damage was heaviest in fields that had been planted to wheat for 5 or 6 successive years. Little damage was noted in fields where wheat had not been grown for more than 2 successive years. The cool, wet spring probably contributed to the severity of take-all; however, successive cropping of wheat appeared to be the chief factor in the pronounced outbreak of the disease in Alabama in 1983.

Plants infected with the take-all fungus are stunted and chlorotic,and often have few tillers. Stems and heads of diseased plants turn tan-colored to white at the time of grain filling in green, healthy plants. Diseased plants occur in scattered patches ranging in size from a few, figure 4, to several feet to sometimes acres in diameter, figure 5. Severely diseased plants are easily pulled from the soil because rotted roots break off, leaving plants with short, brittle, and dark-colored roots, figure 6. The black-brown dry rot also extends into the crown and lower stem, and a superficial, dark-colored mass of fungus growth (mycelium) develops on the lower stem beneath the leaf sheath, figure 7. Black, flask-shaped reproductive bodies (perithecia) of the fungus may be found embedded in the leaf sheath.

The fungus persists as mycelium or perithecia primarily in crop debris in the soil, and is most active in the soil at temperatures of 54-68°F (12-20°C) and high soil moisture levels. Infection generally takes place as mycelia growing through the soil come in contact with wheat roots. Spores are considered a minor source of inoculum. Movement of infested soil or crop debris by farm machinery, wind, or water is the primary means by which the fungus is dispersed from field to field.

Rotation is the best control for take-all. Land should not be planted to wheat for more than 3 successive seasons, and fields with a severe take-all problem should be kept out of wheat for at least 2 years. Cotton, full season soybeans, corn, and sorghum are suitable for rotation. Other small grains or pasture grasses should not be substituted as winter cover crops; however, leguminous cover crops are acceptable substitutes for wheat. Maintenance of fertility at soil test recommendation levels will promote root growth and differentiation, and thereby aid in reducing effects of take-all. Excessive liming and application of nitrate nitrogen reportedly favor the disease.

STEM RUST

This disease is caused by the fungus *Puccinia graminis* f. sp. *tritici*. It is similar to leaf rust except that the pustules are reddish-brown and the epidermis of diseased tissues is ruptured, figure 8. There are several races of this fungus. In 1974, stem rust caused extensive damage and yield losses in

TABLE 12. LEAF RUST RATINGS FOR WHEAT VARIETIES GROWN IN ALABAMA DURING 1982-83[1]

Variety	Ratings for north Alabama					
	Belle Mina		Crossville		Winfield	
	1982	1983	1982	1983	1982	1983
Arthur	3	3	0	0	6	0
Arthur 71	4	3	0	0	9	0
Auburn	-	0	-	0	-	0
Caldwell	-	2	-	0	-	0
Coker 68-15	1	3	0	0	6	0
Coker 916	0	0	0	0	0	2
Coker 747	0	4	0	0	9	0
Coker 762	0	0	0	0	0	-
Delta Queen	0	-	0	-	0	-
Fillmore	-	0	-	0	-	-
Georgia 1123	2	2	0	0	7	0
Hart	6	8	0	0	9	-
HW 3006	-	0	-	0	-	-
HW 3007	-	3	-	0	-	-
N.K.-McNair 1003	7	6	0	0	9	-
N.K.-McNair 1813	0	5	0	0	8	-
N.K. 79810	4	-	0	-	9	-
Pioneer 2550	0	2	0	0	8	-
Roy	2	5	0	0	8	-
Southern Belle	0	0	0	0	7	-
Stacy	4	4	0	0	9	-
Wakeland	2	2	0	0	9	-

	Ratings for central Alabama							
	Marion Junction		Camp Hill		Prattville		Tallassee	
	1982	1983	1982	1983	1982	1983	1982	1983
Abe	8	7	0	0	6	3	9	7
Arthur	8	1	0	0	5.5	3	7	7
Arthur 71	8	7	3	0	6	3	5	7
Auburn	-	1	-	0	-	0	-	0
Caldwell	-	0	-	0	-	1	-	3
Coker 68-15	2	1	0	0	0	3	0	7
Coker 916	0	0	0	0	3	0	0	1
Coker 747	6	2	2	0	6	0	6.5	6
Coker 762	0	0	0	0	0	0	0	0
Doublecrop	0	2	0	0	0	0	0	0
Fillmore	-	0	-	0	-	0	-	0
Florida 301	0	0	0	0	0	0	0	-
Hunter	2	1	0	0	0	1	0	1
HW 3006	-	1	-	0	-	0	-	1
HW 3007	-	2	-	0	-	0	-	7
N.K.-McNair 1003	8	1	0	0	7	2	8.5	7
N.K.-McNair 1813	5	0	0	0	0	0	8.5	-
N.K. 79810	3	-	2	-	4	-	7.5	-
Omega 78	0	1	0	0	4.5	0	4	7
Pioneer 2550	2	3	0	0	0	2	0	5
Roy	2	1	0	0	4	2	6	6
Southern Belle	7	0	0	0	5	0	4	6
Stacy	7	1	0	0	5	0	8.5	5
Terral 81-12	-	0	-	0	-	0	-	4
Terral 800-22	3	6	3	0	7.5	1	9	-
Wakeland	0	3	3	0	0	0	7	6

(Continued)

(*Continued*) TABLE 12. LEAF RUST RATINGS FOR WHEAT VARIETIES GROWN IN ALABAMA DURING 1982-83

	Ratings for south Alabama									
	Fairhope		Brewton		Monroeville		Headland		Camden	
	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983
Arthur	9	7	8	3	6	4	9	1	7	1
Auburn	-	3	-	0	-	0	-	1	-	0
Caldwell	-	4	-	0	-	0	-	3	-	0
Coker 68-15	4	5	0	3	4	2	0	0	3	1
Coker 916	3	0	5	0	3	0	3	0	0	0
Coker 747	8	6	5	3	7	0	4	3	5	0
Coker 762	0	-	0	0	0	0	0	0	0	0
Coker 797	0	-	7	-	4	-	0	-	0	-
Doublecrop	3	4	4	3	0	0	3	3	0	0
Fillmore	-	3	-	0	-	0	-	1	-	0
Florida 301	0	-	0	0	0	0	0	0	0	0
Holley	3	0	0	0	0	1	4	0	2	0
Hunter	0	4	0	2	0	0	0	0	0	-
HW 3006	-	2	-	0	-	2	-	0	-	0
HW 3007	-	8	-	5	-	3	-	5	-	3
N.K.-McNair 1003	9	7	8	2	8	3	9	1	6	0
N.K.-McNair 1813	6	3	4	2	4	2	7	4	0	0
Pioneer 2550	8	6	0	4	0	0	3	3	0	0
Roy	4	5	6	3	4	2	3	0	0	0
Southern Belle	6	8	6	3	5	3	5	1	3	2
Terral 81-12	-	0	-	0	-	0	-	0	-	0
Terral 800-12	4	8	9	8	0	7	8.5	1	2	0
Wakeland	6	4	6	2	5	0	6	0	4	0

[1]0-9 scale: 0 = no disease, 9 = severe disease.

a couple of varieties in some areas, but in recent years has been of little importance on varieties commonly grown in the State. Use of resistant varieties is the control method for stem rust.

LEAF RUST

Leaf rust is caused by the fungus, *Puccinia recondita* f. sp. *tritici*. The disease usually is widespread in Alabama and can be very damaging to susceptible varieties. In many areas of the State in 1982, leaf rust occurred early and continued throughout the growing season, and yields of susceptible varieties often were greatly reduced.

Leaf rust is characterized by small, yellow-orange pustules or masses of spores on leaves and leaf sheaths, figure 9. These are disseminated to other plants. Heavily infected leaves turn yellow and die. In later stages of the life cycle of the fungus, black masses of spores may become apparent.

Although leaf rust can be reduced by spraying with fungicides, tables 13, 15, 16, 18, use of resistant varieties, table 12, currently is considered the most economical means of controlling this disease. Control is complicated by the existence of races of the causal fungus which have differing capabilities to infect different varieties of wheat. Statewide collections of leaf rust are made annually and sent to the USDA Cereal Rust Laboratory at the University of Minnesota to determine number and kinds of races present in Alabama.

POWDERY MILDEW

Powdery mildew is caused by the fungus, *Erysiphe graminis* f. sp. *tritici*. The disease occurs commonly on wheat and can be a serious problem under favorable conditions. Powdery mildew reached epidemic proportions in many plantings throughout the State in 1982.

Powdery mildew usually becomes prevalent during cool, cloudy days of early spring and first appears as dirty-white powdery patches on leaves and leaf sheaths, figure 10. The powder consists of mycelia and spores of the fungus. The fungus is usually most prevalent on the upper surface of lower leaves but can infect all aerial portions of the plant. Flag leaves were heavily infected in many wheat fields in 1982 and occurrence of powdery mildew on heads was not uncommon. As the season progresses, the white powdery growth turns dull gray-brown with small black bodies scattered throughout. These are reproductive bodies that are able to survive dry periods and winter months.

Wheat plants are most susceptible to powdery mildew when they are rapidly growing. Disease development is favored by heavy nitrogen fertilization, dense stands of susceptible varieties, high humidity, and cool temperatures.

Use of resistant varieties is perhaps the best means of control for powdery mildew, table 11. The disease can be reduced with fungicides, tables 15 and 16; however, occurrence of powdery mildew in experimental plots has been too sporadic to determine possible yield response to fungicide treatments.

SEPTORIA LEAF AND GLUME BLOTCH

Septoria leaf and glume blotch is one of the most widespread and damaging diseases of wheat in Alabama. It is caused by the fungus *Septoria nodorum* that attacks the leaves, leaf sheaths, upper stem, and head of wheat plants. Septoria blotch can cause losses by reducing seed size and weight.

On leaves, symptoms of Septoria blotch begin as small, dark spots that later enlarge to boat-shaped lesions that are tan to brown or black and measure ¼ inch or more in length, figure 11. Tiny, round black structures may be seen in the lesions. These are the spore-producing bodies, or pycnidia, of the fungus.

The disease appears on wheat heads as a gray to brown discoloration of the glumes or outer coverings of the kernels, figure 12. Pycnidia are formed in abundance on the diseased glumes, figure 13.

The fungus survives between crops on seed and in wheat debris in the soil. Spore production, spread, and infection are favored by warm wet weather. Generally, such conditions occur in the spring months in most parts of the State; however, weather conditions conducive for Septoria blotch can also develop in the fall and winter.

Use of resistant varieties is an effective control for some diseases of wheat. However, most of the varieties commonly grown in Alabama are susceptible to Septoria blotch, table 10. Other control measures include use of disease-free or fungicide-treated seed, rotation with a non-cereal, and spraying with fungicide.

Control of Septoria blotch and significant yield increases reportedly have been obtained with aerial applications of mancozeb. Results with this and other fungicides tested in recent years at the Alabama Agricultural Experiment Station are presented in tables 13-17. Several fungicides reduced the severity of Septoria blotch, and, in general, when the disease developed to significant levels, yield increases were associated with treatments that gave maximum disease control.

Greatest general yield increases obtained to date occurred in 1982 at the Gulf Coast Substation where yields from plots of Coker 68-15 wheat sprayed with fungicides were 20-100 percent higher than those of the unsprayed control plots, table 16. Leaf rust was prevalent in the test and several treatments gave good control of this disease. However, maximum yield increases were usually associated with

TABLE 13. DISEASE SEVERITIES AND GRAIN YIELDS FOR PLOTS OF ARTHUR 71 WHEAT SPRAYED WITH FUNGICIDES, LOWER COASTAL PLAIN SUBSTATION, CAMDEN

Fungicide, grams a.i./acre[1]	Application stage[2]	Disease severity[3]			Yield/acre
		Septoria blotch		Leaf rust	
		Leaf	Glume		
					Bu.
1978					
Benomyl (227)	10.3,10.5,11.1	3.4	2.4	-*	37.7
(113.5) + mancozeb (363.2)	10.3,10.5,11.1	2.6	2.6	-	34.7
Captafol (454)	10.3,10.5,11.1	1.0	1.4	-	37.4
Chlorothalonil (473.1)	10.3,10.5,11.1	1.0	1.9	-	35.4
(473.1)	10.3,10.5	1.8	2.3	-	37.6
(709.6)	10.3,10.5,11.1	1.0	1.8	-	37.7
(709.6)	10.3,10.5	1.0	2.5	-	36.2
Mancozeb (726.4)	10.3,10.5,11.1	2.8	2.1	-	37.0
None (check)		4.2	2.7	-	36.7
1979					
Benomyl (56.7) + mancozeb (544.8)	9, 10, 10.5	.8	.7	-*	33.9
(56.7) (726.4)	9, 10, 10.5	1.0	1.0	-	34.4
(113.5) (544.8)	9, 10, 10.5	1.0	.8	-	34.9
(113.5) (726.4)	9, 10, 10.5	.4	1.0	-	38.4
Captafol (454)	9, 10, 10.5	.8	.7	-	34.0
Chlorothalonil (354.8)	9, 10, 10.5	1.0	1.3	-	33.9
(473.1)	10, 10.5	1.6	.8	-	31.1
(709.6)	10, 10.5	.8	.7	-	33.6
(946.2)	9	1.8	2.1	-	33.7
Mancozeb (726.4)	9, 10, 10.5	1.0	1.0	-	34.9
None (check)		2.8	1.8	-	31.1
1980					
Benomyl (56.7) + DPX 7331F (733.2)	9, 10.5	-*	.8	2.2	37.7
(113.5) (560.7)	7, 9, 10.5	-	1.4	1.4	36.7
(56.7) + propiconazol (51.1)	7, 9, 10.5	-	1.4	0	39.0
(56.7) + triadimefon (56.7)	7, 9, 10.5	-	1.4	0	37.3
Chlorothalonil (354.8)	7, 9, 10.5	-	1.0	1.4	35.9
(473.1)	9, 10.5	-	1.6	2.4	36.3
(946.2)	10	-	2.8	3.0	34.7
Mancozeb (726.4)	7, 9, 10.5	-	1.2	1.2	39.8
Maneb (544.8)	7, 9, 10.5	-	2.0	2.4	36.8
(726.4)	9, 10.5	-	2.0	3.0	37.0
Propiconazol (102.1)	9, 10.5	-	1.0	0	38.6
None (check)		-	2.0	2.4	36.8
1982					
Benomyl (113.5)	8, 10.1	-*	-*	4.0	29.2
(56.7) + propiconazol (50)	8, 10.1	-	-	1.0	32.3
(56.7) + triadimefon (56.7)	8, 10.1	-	-	1.2	31.0
Chlorothalonil (473.1)	7, 9	-	-	3.6	31.7
(473.1)	8, 10	-	-	4.0	28.8
(473.1)	9, 10.1	-	-	3.2	29.8
Mancozeb (726.4)	8, 10.1	-	-	3.2	28.5
Propiconazol (50)	8, 10.1	-	-	.8	34.2
(75)	8	-	-	2.4	35.2
(75)	10	-	-	2.4	33.6
Triadimefon (56.7)	8, 10.1	-	-	2.2	32.0
(56.7) + SLJ 0312 (340.5)	8, 10.1	-	-	3.0	30.1
None (check)		-	-	4.8	27.6

[1]Grams of active ingredient per acre.
[2]Feekes' scale: 7 = jointing, 8 = flag leaf just visible, 9 = flag leaf emerged, 10 = late boot, 10.1 = head emerging, 10.3 = head half emerged, 10.5 = head fully emerged, 11.1 = milk stage.
[3]0-5 scale: 0 = disease free, 5 = severely diseased.
*Disease did not develop.

treatments that gave the highest levels of control of Septoria blotch, particularly on the glumes. At the Lower Coastal Plain Substation in 1982, several treatments controlled Septoria blotch on flag leaves of Coker 68-15; however, the disease did not develop to any appreciable level on glumes, and yields showed little response to fungicide treatments, table 14. Incidence of Septoria blotch was also insignificant on glumes of Coker 747 wheat in test plots on the Tennessee Valley Substation in 1982, the first year of testing at that location. However, yield increases up to 28 percent were

TABLE 14. DISEASE SEVERITIES AND GRAIN YIELDS FOR PLOTS OF COKER 68-15 WHEAT SPRAYED WITH FUNGICIDES, LOWER COASTAL PLAIN SUBSTATION, CAMDEN

Fungicide, grams a.i./acre[1]	Application stage[2]	Septoria blotch severity[3]		Yield/acre
		Leaf	Glume	
				Bu.
1978				
Benomyl (227)	10.3,10.5,11.1	4.0	2.3	32.1
(113.5) + mancozeb (363.2)	10.3,10.5,11.1	4.0	2.6	30.9
Captafol (454)	10.3,10.5,11.1	1.8	1.6	33.6
Chlorothalonil (473.1)	10.3,10.5,11.1	1.4	1.9	32.3
(473.1)	10.3, 10.5	3.0	2.9	30.1
(709.6)	10.3,10.5,11.1	1.6	2.2	30.2
(709.6)	10.3, 10.5	2.6	2.6	32.9
Mancozeb (726.4)	10.3,10.5,11.1	3.6	2.5	28.7
None (check)		4.1	2.9	30.0
1979				
Benomyl (56.7) + mancozeb (544.8)	9, 10, 10.5	1.0	1.2	38.0
(56.7) (726.4)	9, 10, 10.5	.2	.9	38.6
(113.5) (544.8)	9, 10, 10.5	.8	1.1	37.4
(113.5) (726.4)	9, 10, 10.5	.2	.8	42.0
Captafol (454)	9, 10, 10.5	.8	.9	37.3
Chlorothalonil (354.8)	9, 10, 10.5	.6	1.0	37.0
(473.1)	10, 10.5	1.4	.9	36.9
(709.6)	10, 10.5	.6	1.0	35.2
(946.2)	9	3.0	1.9	37.3
Mancozeb (726.4)	9, 10, 10.5	1.2	1.1	34.5
None (check)		3.6	2.6	31.8
1980				
Benomyl (56.7) + DPX 7331F (733.2)	9, 10.5	-*	2.7	31.1
(113.5) (560.7)	7, 9, 10.5	-	3.0	31.4
(56.7) + propiconazol (51.1)	7, 9, 10.5	-	.4	35.6
(56.7) + triadimefon (56.7)	7, 9, 10.5	-	4.6	28.2
Chlorothalonil (354.8)	7, 9, 10.5	-	2.4	31.9
(473.1)	9, 10.5	-	2.4	31.6
(946.2)	10	-	3.6	30.4
Mancozeb (726.4)	7, 9, 10.5	-	2.6	32.6
Maneb (726.4)	9, 10.5	-	3.4	30.5
(544.8)	7, 9, 10.5	-	3.6	28.3
Propiconazol (102.1)	9, 10.5	-	.7	36.0
None (check)		-	5.0	27.9
1981				
Benomyl (113.5) + mancozeb (544.8)	7, 9	.9	.7	66.0
(113.5) (544.8)	7, 9, 10.5	1.0	.3	61.4
(113.5) + propiconazol (51.1)	7, 9	0	.8	70.8
(113.5) + triadimefon (56.7)	7, 9	1.4	1.0	60.7
DPX 3866 (112.9) + mancozeb (544.8)	7, 9	1.2	.4	64.2
Mancozeb (726.4)	7, 9, 10.5	.9	.4	65.5
Maneb (726.4)	7, 9	.8	.7	65.8
(726.4)	7, 9, 10.5	1.3	.8	64.9
Propiconazol (102.1)	7	.3	.4	67.8
(51.1)	7, 9	.2	.9	68.6
Sulfur (1316.6) + copper (113.5)	7, 9	1.3	.9	61.8
Triadimefon (113.5)	7, 9	1.5	.8	66.9
(56.7)	7, 9, 10.5	2.3	1.2	62.1
None (check)		2.2	1.2	62.0
1982				
Benomyl (113.5)	8, 10.1	3.2	-*	28.2
(56.7) + propiconazol (50)	8, 10.1	.4	-	25.3
(56.7) + triadimefon (56.7)	8, 10.1	3.8	-	24.4
Chlorothalonil (473.1)	7, 9	1.2	-	26.6
(473.1)	8, 10	1.8	-	25.0
(473.1)	9, 10.1	.2	-	30.4
Mancozeb (726.4)	8, 10.1	1.2	-	26.3
Propiconazol (50)	8, 10.1	.4	-	25.4
(75)	8	1.8	-	27.9
(75)	10	2.0	-	25.3
Triadimefon (56.7)	8, 10.1	2.8	-	28.3
(56.7) + SLJ 0312 (340.5)	8, 10.1	1.2	-	29.5
None (check)		3.8	-	27.3

[1]Grams of active ingredient per acre.
[2]Feekes' scale: 7 = jointing, 8 = flag leaf just visible, 9 = flag leaf emerged, 10 = late boot, 10.1 = head emerging, 10.3 = head half emerged, 10.5 = head fully emerged, 11.1 = milk stage.
[3]0-5 scale: 0 = disease free, 5 = severely diseased.
*Disease did not develop.

associated with treatments that controlled Septoria blotch on flag leaves, table 17. Fungicide tests were conducted again in 1983 at the Gulf Coast, Lower Coastal Plain, and Tennessee Valley substations. Disease incidence and severity were uniformly low throughout the tests at all three locations, hence disease and yield data are not included in this report.

Results to date indicate that two applications of fungicide are required for effective control of Septoria blotch, one at flag leaf emergence to protect the flag leaf and a second at head emergence to protect the head. An additional application prior to flag leaf emergence may be necessary in years of early disease occurrence or in areas of anticipated severe disease development.

Presently, mancozeb is the only fungicide labeled for Septoria blotch control on wheat. Results obtained in Alabama and other states have indentified several fungicides and combinations that show good potential for control. Additional research on rates and time of application is needed to determine their practical effectiveness.

LOOSE SMUT

Loose smut, caused by the fungus *Ustilago tritici*, is common in wheat fields in Alabama but rarely has caused serious or widespread losses. However, this disease can become a serious problem if control measures are ignored. The heads of smut-affected wheat plants are destroyed and become masses of dark brown to black spores. The spores are dispersed to healthy flowers and the subsequently developing seed become infected. When infected seed is planted the following season, the fungus develops with the plant and the characteristic smutted head eventually results, figure 14.

Since this fungus occurs within the tissues of seed, surface-active chemical seed treatments are of no value. Smut can be controlled by treatment of seed with systemic chemicals like carboxin (Vitavax, Vitavax 25 DB, Vitavax 200, Vitavax T, Orthocide-Vitavax 20-20) which eradicate the fungus. Use of certified, disease-free seed and growing resistant varieties are also valuable control measures.

HEAD BLIGHT OR SCAB

Scab is caused by fungi in the genus *Fusarium* and occurs sporadically on wheat throughout the State. The most obvious symptom is premature death or blighting of one or more spikelets, producing a bleached or whitened appearance in the infected part of the head, figure 15. The entire head may be killed. The bleached or yellowed spikelet(s) of a scab-affected head is quite obvious against healthy green heads. At normal maturity of wheat, pink spore masses are usually apparent at the base of infected spikelets.

Scabbed heads produce less grain and the grain is poorly filled. Also, the grain may be less palatable to livestock and sometimes contains mycotoxins that affect man and some animals.

To date, the disease has not been a problem on wheat varieties commonly grown in Alabama. Chemical seed treatment (see page 13), crop rotation, and plowing to bury crop debris help in controlling scab.

BARLEY YELLOW DWARF

Barley yellow dwarf is a virus disease which was not recognized in the United States until the early 1950's. The name is derived from initial discovery of the disease in

TABLE 15. DISEASE SEVERITIES AND GRAIN YIELDS FOR PLOTS OF ARTHUR 71 WHEAT SPRAYED WITH FUNGICIDES, GULF COAST SUBSTATION, FAIRHOPE

Fungicide, grams a.i./acre[1]	Application stage[2]	Disease severity[3] Septoria blotch Leaf	Septoria blotch Glume	Leaf rust	Powdery mildew	Yield/ acre
						Bu.
1979						
Benomyl (56.7) + mancozeb (544.8)	9, 10, 10.5	0.6	1.8	-*	2.5	23.2
(56.7) (726.4)	9, 10, 10.5	.8	2.2	-	2.5	20.6
(113.5) (544.8)	9, 10, 10.5	.4	1.6	-	2.1	22.6
(113.5) (726.4)	9, 10, 10.5	.4	1.5	-	1.5	26.4
Captafol (454)	9, 10, 10.5	1.2	1.7	-	4.4	24.2
Chlorothalonil (354.8)	9, 10, 10.5	1.0	2.3	-	4.6	20.6
(473.1)	10, 10.5	1.2	2.6	-	4.8	19.7
(709.6)	10, 10.5	1.0	1.6	-	4.2	25.2
(946.2)	9	2.6	2.5	-	4.2	25.1
Mancozeb (726.4)	9, 10, 10.5	.6	1.8	-	3.1	23.2
None (check)		3.6	2.4	-	4.3	21.9
1981						
Benomyl (113.5) + mancozeb (544.8)	7, 9	-*	-*	1.7	-*	61.8
(113.5) (544.8)	7, 9, 10.5	-	-	.8	-	69.3
(113.5) + propiconazol (51.1)	7, 9	-	-	.7	-	66.3
(113.5) + triadimefon (56.7)	7, 9	-	-	.6	-	68.9
Mancozeb (726.4)	7, 9, 10.5	-	-	1.1	-	67.8
(544.8) + DPX 3866 (112.9)	7, 9	-	-	.9	-	62.1
Maneb (726.4)	7, 9	-	-	1.3	-	66.2
(726.4)	7, 9, 10.5	-	-	1.2	-	69.5
Propiconazol (51.1)	7, 9	-	-	0	-	67.2
(102.1)	7	-	-	1.2	-	63.9
Sulfur (1316.6) + copper (113.5)	7, 9	-	-	3.1	-	63.4
Triadimefon (56.7)	7, 9, 10.5	-	-	.1	-	64.6
(113.5)	7, 9	-	-	.1	-	60.0
None (check)		-	-	2.9	-	64.1

[1]Grams of active ingredient per acre.
[2]Feekes' scale: 7 = jointing, 9 = flag leaf emerged, 10 = late boot, 10.5 = head fully emerged.
[3]0-5 scale: 0 = disease free, 5 = severely diseased.
*Disease did not develop.

FIG. 4. Wheat field showing small patch killed by the take-all fungus. FIG. 5. Wheat field showing large areas killed by the take-all fungus. FIG. 6. Degenerate roots and darkened stem bases indicative of take-all. FIG. 7. Dark, superficial mycelium of take-all fungus on stem base of wheat plant (right); healthy plant (left). FIG. 8. Wheat stem with pustules of stem rust. FIG. 9. Wheat leaves with pustules of leaf rust.

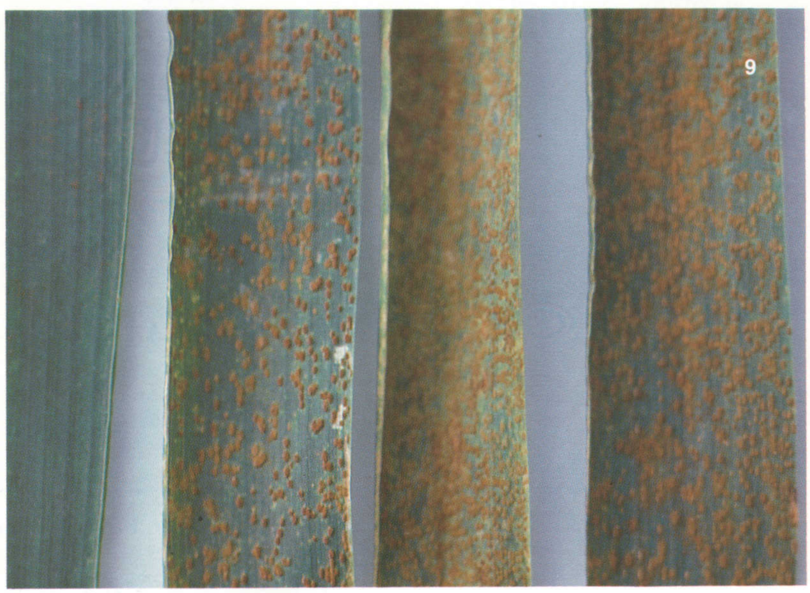
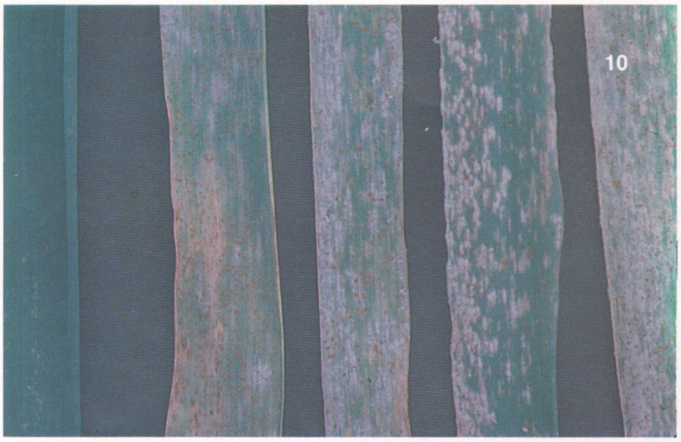
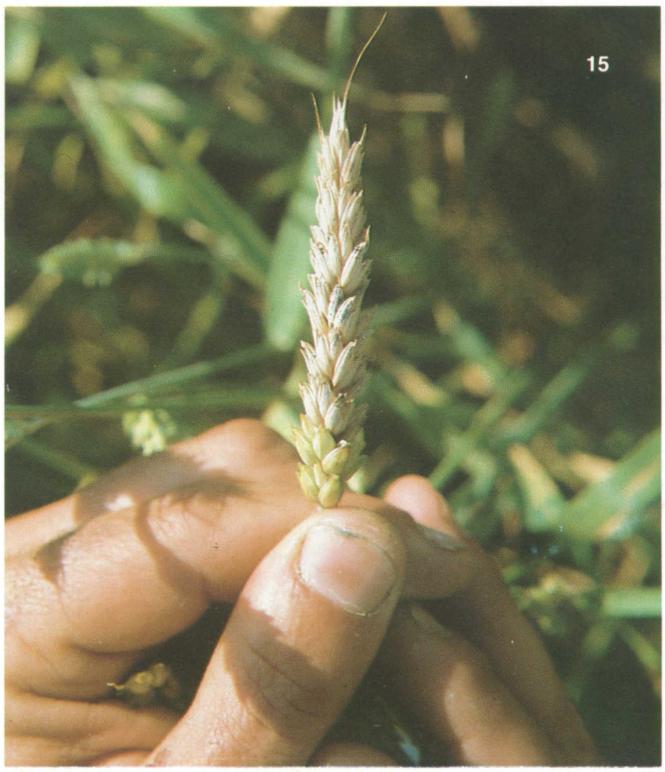


FIG. 10. Powdery mildew on wheat leaves. FIG. 11. Symptoms of Septoria blotch on wheat leaves. FIG. 12. Symptoms of Septoria glume blotch on wheat heads. FIG. 13. Closeup of Septoria glume blotch lesions with pycnidia (speckles). FIG. 14. Wheat head with loose smut. FIG. 15. Wheat head with scab.





barley. Occurrence of barley yellow dwarf in Alabama had been suspected for many years but was not confirmed until 1975 when the causal virus was experimentally transmitted from diseased wheat and oat plants.

Symptoms of barley yellow dwarf are variable among the various hosts and within genotypes of the same host. In the cereals commonly grown in Alabama, symptoms are usually most severe in oats, somewhat less in barley, and least severe in wheat. Some stunting occurs in most diseased plants. Leaf discoloration begins at the tips of leaves, and can range from a light chlorosis to a brilliant yellow in barley. Oat leaves may become red or purple, hence the disease is often called red leaf in this crop. Depending on susceptibility of the host and the stage at which infection occurs, curling, serration of margins, and other leaf distortions may develop. Similarity of barley yellow dwarf symptoms to those of other, often nonparasitic, disorders frequently makes diagnosis difficult.

The barley yellow dwarf virus is spread by the feeding activities of aphids, of which about 14 different species are known to transmit the virus.

The incidence and importance of barley yellow dwarf in wheat in Alabama are not known.

TABLE 16. DISEASE SEVERITIES AND GRAIN YIELDS FOR PLOTS OF COKER 68-15 WHEAT SPRAYED WITH FUNGICIDES, GULF COAST SUBSTATION, FAIRHOPE

Fungicide, grams a.i./acre[1]	Application stage[2]	Disease severity[3]				Yield/ acre
		Septoria blotch		Leaf rust	Powdery mildew	
		Leaf	Glume			
						Bu.
	1979					
Benomyl (56.7) + mancozeb (544.8)	9, 10, 10.5	1.6	1.8	-*	2.5	30.0
(56.7) (726.4)	9, 10, 10.5	1.0	1.6	-	3.2	27.4
(113.5) (544.8)	9, 10, 10.5	2.0	1.8	-	2.3	26.6
(113.5) (726.4)	9, 10, 10.5	1.2	1.3	-	3.0	29.0
Captafol (454)	9, 10, 10.5	1.6	1.7	-	4.4	24.8
Chlorothalonil (354.8)	9, 10, 10.5	2.5	2.1	-	4.3	24.2
(473.1)	10, 10.5	1.6	1.8	-	4.5	25.2
(709.6)	10, 10.5	1.2	1.7	-	4.1	25.5
(946.2)	9	3.2	1.8	-	4.8	27.8
Mancozeb (726.4)	9, 10, 10.5	1.6	1.7	-	3.5	27.4
None (check)		4.8	2.7	-	4.3	23.2
	1981					
Benomyl (113.5) + mancozeb (544.8)	7, 9	-*	.4	-*	-*	74.2
(113.5) (544.8)	7, 9, 10.5	-	1.0	-	-	75.9
(113.5) + propiconazol (51.1)	7, 9	-	0	-	-	76.0
(113.5) + triadimefon (56.7)	7, 9	-	2.7	-	-	76.2
Mancozeb (726.4)	7, 9, 10.5	-	1.0	-	-	77.4
(544.8) + DPX 3866 (112.9)	7, 9	-	1.0	-	-	75.3
Maneb (726.4)	7, 9	-	.8	-	-	73.9
(726.4)	7, 9, 10.5	-	1.0	-	-	80.7
Propiconazol (51.1)	7, 9	-	0	-	-	77.6
(102.2)	7	-	.7	-	-	77.3
Sulfur (1316.6) + copper (113.5)	7, 9	-	2.1	-	-	80.2
Triadimefon (56.7)	7, 9, 10.5	-	2.6	-	-	86.9
(113.5)	7, 9	-	3.1	-	-	73.1
None (check)		-	3.0	-	-	71.4
	1982					
Benomyl (113.5)	8, 10.1	1.6	2.2	3.0	-*	24.7
(56.7) + propiconazol (50)	8, 10.1	.8	.6	.8	-	37.6
(56.7) + triadimefon (56.7)	8, 10.1	1.8	1.6	1.8	-	26.0
Chlorothalonil (473.1)	7, 10.1	1.4	1.8	2.2	-	27.1
(473.1)	8, 10.1	1.2	1.4	1.8	-	26.2
(473.1)	10.1	1.6	2.0	2.2	-	21.5
DPX 965 (127.8)	8, 10.1	2.0	2.2	2.6	-	22.8
Mancozeb (726.4)	7,10.1,10.5	1.2	1.2	2.4	-	28.4
Propiconazol (50)	8	1.8	1.4	1.8	-	30.7
(50)	8, 10.1	1.0	1.0	1.2	-	35.5
(50)	10.1	1.0	.6	.8	-	33.1
(75)	8	1.6	2.0	2.4	-	30.1
(75)	10.1	1.2	1.2	1.2	-	30.1
Triadimefon (56.7)	8, 10.1	1.8	2.0	1.8	-	26.0
(56.7) + SLJ 0312 (340.5)	8, 10.1	1.2	1.2	1.6	-	29.0
None (check)		2.0	3.4	2.8	-	18.0

[1]Grams of active ingredient per acre.
[2]Feekes' scale: 7 = jointing, 8 = flag leaf just visible, 9 = flag leaf emerged, 10 = late boot, 10.1 = head emerging, 10.5 = head fully emerged.
[3]0-5 scale: 0 = disease free, 5 = severely diseased.
*Disease did not develop.

Table 17. Severity of Septoria Blotch on Flag Leaves and Grain Yields for Plots of Coker 747 Wheat Sprayed with Fungicides, Tennessee Valley Substation, Belle Mina, 1982

Fungicide, grams a.i./acre[1]	Application stage[2]	Septoria blotch[3]	Yield/ acre
			Bu.
Benomyl (113.5)	8, 10.1	1.4	43.3
(113.5) + mancozeb (544.8)	8, 10.1	.8	46.4
(56.7) + propiconazol (50)	8, 10.1	.1	42.7
(56.7) + triadimefon (56.7)	8, 10.1	.9	41.4
Chlorothalonil (473.1)	7, 9	.9	45.4
(473.1)	8, 10	.5	47.3
(473.1)	9, 10.1	2.9	39.7
DPX 965 (127.8)	8, 10.1	1.8	39.6
Mancozeb (726.4)*	8, 10.5	1.3	47.5
(726.4)	7,9,10.5	3.2	36.6
Propiconazol (50)	8	.3	42.7
(50)	8,10.1	0	45.4
(50)	10	2.6	36.9
(75)	8	.1	43.8
(75)	10	2.1	40.2
RH-5781F (90.8)**	8, 10.1	.6	42.3
(181.6)**	8, 10.1	.5	45.7
Triadimefon (56.7)	8, 10.1	1.1	46.1
(56.7) + SLJ0312(340.5)	8, 10.1	.2	46.9
None (check)		2.2	37.0

[1]Grams of active ingredient per acre.
[2]Feekes' scale: 7 = jointing stage, 8 = flag leaf just visible, 9 = flag leaf emerged, 10 = late boot, 10.1 = head emerging, 10.5 = head fully emerged.
[3]0-5 scale: 0 = disease free, 5 = severely diseased.
*Plus Agridex® at 1 pint per 100 gallons.
**Plus Agridex® at 1 quart per acre.

Table 18. Severity of Leaf Rust and Grain Yields from Plots of N.K.-McNair 1003 Wheat Sprayed with Aerial Applications of Mancozeb[1]

Application stage[2]	Leaf rust[3]	Yield/acre
		Bu.
9, 10.5, 11.1	1.2	50.5
9, 10.5	1.2	51.3
10.5, 11.1	1.9	49.9
None (check)	2.3	43.1

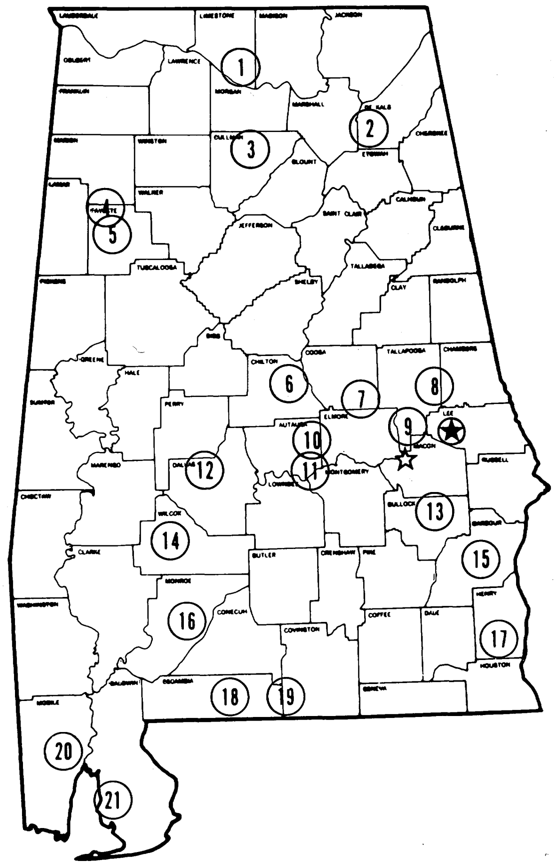
[1]At rate of 726.4 grams of active ingredient per acre, plus Triton CS-7 at 2 pints per acre.
[2]Feekes' scale: 9 = flag leaf emerged, 10.5 = head fully emerged, 11.1 = milk stage.
[3]0-5 scale: 0 = disease free, 5 = severely diseased.

NEMATODES

Nematodes are microscopic worms and a number of them, including the lesion, stubby root, sting, lance, peanut root-knot, and southern root-knot nematodes, have been reported to parasitize wheat. There is evidence suggesting that some of these nematodes can reproduce slowly on wheat through the winter. To date, no instances of nematode damage on wheat have been confirmed in Alabama. Evidently, nematodes either fail to invade wheat roots in the fall or populations of nematodes rarely build up to the point that damage becomes evident. However, wheat and other small grains may serve as important overwintering sites for some nematode parasites of other crops like cotton, soybeans, or peanuts.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

⊛ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.