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DISEASES of SMALL GRAINS in ALABAMA

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DISEASES of SMALL GRAINS in ALABAMA

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DISEASES are often the greatest single factor limiting forage and grain production of cereal crops.

Many diseases can be controlled by chemical seed treatment, use of resistant varieties, crop rotation, and field sanitation. However, identification of the disease involved is essential in selecting appropriate control measures.

Small grain diseases are most frequently caused by microscopic, non-green plants called fungi. The parasitic activity of these fungi on plants results in symptoms and/or signs characteristic of a particular disease. Fungi reproduce by tiny, seedlike bodies called spores. Being quite small, spores can be carried by wind currents sometimes hundreds of miles. Man, mechanical equipment, rain, insects, and animals aid in scattering spores. Other causes of small grain diseases include bacteria, nematodes, viruses, and unfavorable environmental conditions.

This report contains information obtained during the last decade from evaluations of disease incidence and varietal susceptibility of small grains planted in variety tests, field plots, and private farms throughout Alabama.

OATS

Crown Rust (causal fungus, *Puccinia coronata*). Crown rust or leaf rust occurs on oats throughout the State and has been particularly damaging in southern Alabama during recent years.

Crown rust is primarily found on leaves but also occurs on stems, leaf sheaths, and floral structures. The disease first appears as small, bright yellow to orange spore masses (pustules) that are round to oblong in shape, Figure 1. Spores are blown to susceptible plants. In later stages of the fungus life cycle, pustules of black spore masses

Fig. 1. Oat leaves infected with crown rust organism. New pustules are yellow to bright orange in color, on right, and later turn black, left.

may become apparent. Premature ripening, death of leaves, and lodging occur on heavily infected plants. The amount of functional tissue destroyed by rust varies from year to year.

Rust control is complicated because the causal fungus consists of races with capabilities to infect different oat varieties. Statewide collections of crown rust are made annually to determine number and kinds of races present in Alabama. Data given in Table 1 show that none of the commonly planted oat varieties are immune to attack from all races, but some have resistance to more races than others.

The observance of a race or races on a particular variety does not necessarily mean that the variety was severely rusted or that yields were reduced. Very little damage from rust has been observed in recent years on any of the listed varieties planted in variety tests throughout the State except at the Gulf Coast Substation, in southwestern Alabama, where all varieties planted were severely rusted in 1961 and 1962. The high disease incidence was correlated with reduced grain yields, although forage production was not affected. Similar rust infestations occurred during the 1949-1951 seasons.

Helminthosporium Leaf Blotch (causal fungus, *Helminthosporium avenae*). Leaf blotch, once regarded as a minor disease, is the most prevalent and perhaps most destructive disease of oats in Alabama.

The leaf blotch fungus causes seedling blight. On older plants, Figure 2, the disease appears as red-brown spots primarily on leaves and leaf sheaths but sometimes on stems and floral parts. These spots are small and round to oval with irregular margins and frequent sunken centers. Long linear blotches result from coalescing of

TABLE 1. OCCURRENCE OF PHYSIOLOGIC RACES OF CROWN RUST FUNGUS ON OATS GROWN IN VARIETY TESTS DURING 4-YEAR PERIOD, 1959-1962

Variety	Physiologic races											
	202	203	213	216	264	274	276	282	290	294[1]	295	326
A. B. 110				2								
Alamo				3								
Arkwin	2	1	3	6	1				2			
Arlington					1							
Carolee			1	5	2		2				1	
Coker 57-11				1								
Delta Red 88												1
Fulwood			1	4	1	1			1			
Fairfax					1						1	
Mid South			1	10	3	2			2		1	
Moregrain					2				1			
Radar I									1			
Radar II								1	1		1	1
Roanoke			1									
Suregrain				3	2							
Victorgrain 48-93			1	2								

[1] This race was found once on Variety C. I. 7255.

individual spots. Severely attacked leaves turn yellow and die.

Since the fungus can persist on seed and plant debris, chemical seed treatment and crop rotation aid in reducing the severity of the disease. Some oat varieties have been less affected by the disease in northern Alabama than in other areas of the State.

Covered Smut (causal fungus, *Ustilago kolleri*) and Loose Smut (causal fungus, *Ustilago avenae*). Farmers are generally familiar with smuts that occur on cereals and other grasses.

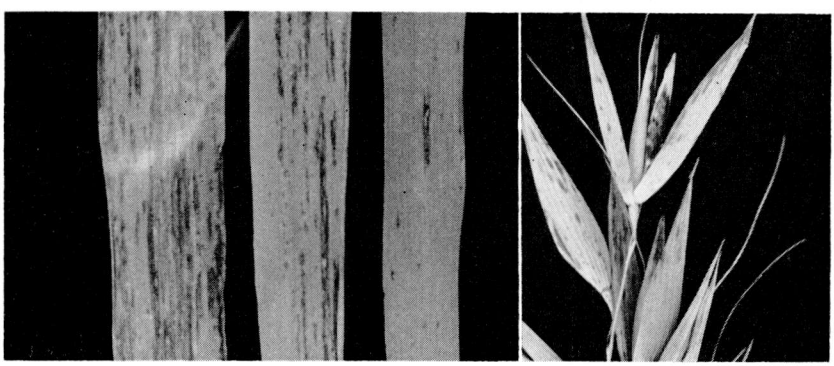

Fig. 2. This is an example of oat blotch disease. Note spots and blotches on leaves, left, and glumes, right. (Photos courtesy S. S. Ivanhoff, Mississippi State University.)

Fig. 3. Loose smut is shown on wheat at left, on oats, center, and on barley, right. (Photo at left courtesy E. A. Curl, Auburn University Agricultural Experiment Station.)

Smuts destroy the grain-producing portion or head of oat plants. Infected heads become masses of dark brown to black spores, Figure 3. In covered smut, these spores are covered by a thin, light-colored membrane, whereas the spores of loose smut are uncovered. The spores are carried by wind, rain, and harvesting machinery to healthy plants where they adhere to seed. When such seed are planted, the attached fungus infects young plants and eventually floral parts, resulting in a black smutty head seen at maturity.

These seed-borne smut fungi are effectively controlled by chemical seed treatment. However, smuts are of little importance on commonly grown varieties.

Victoria Blight (causal fungus, *Helminthosporium victoriae*). Victoria blight presents a serious problem when susceptible varieties especially those of Victoria parentage are planted.

The causal fungus is seed-borne and persists in crop residue. It infects the root system, crown, stems and foliage and may kill or seriously weaken plants at any age, Figure 4. Seed may rot in the

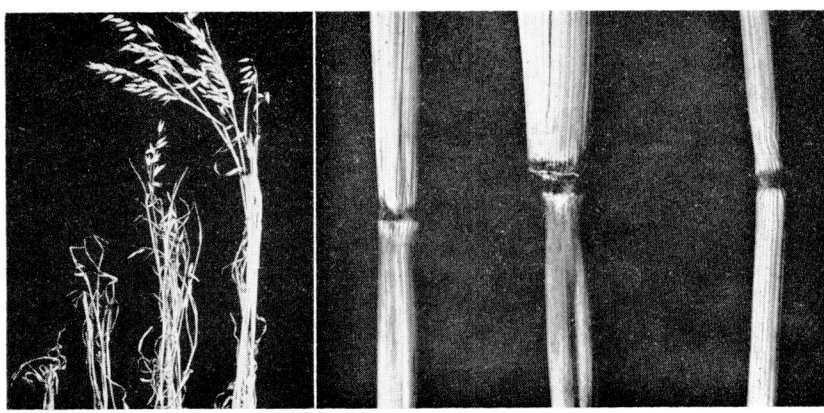

Fig. 4. Here is Victoria blight of oats. Note effect of disease on plants in left as compared to healthy plant on right. The picture at right is characteristic blackening of lower nodes. (Photos courtesy B. Koehler, University of Illinois.)

ground before germination or seedlings blighted after emergence. Leaves of affected seedlings become reddened and necrotic. A symptom in mature infected plants is a blackening of the lower joints. Plants tend to break just above these joints and lodging results. There may be deterioration of roots.

High temperatures and abundant moisture favor development of this disease. Under these conditions, a susceptible variety, seeded early, may suffer losses in stand, making reseeding necessary. Such losses occurred in Alabama on early-planted oats during the period 1946-1956.

Of the many varieties planted, only Victorgrain 48-93 is highly susceptible to Victoria blight. Chemical seed treatment and crop rotation must be practiced when a susceptible variety is grown.

Septoria Leaf Blotch (causal fungus, *Septoria avenae*). Septoria leaf blotch occurs frequently and causes damage to oats in Alabama.

This disease appears as brown, irregular-shaped blotches on leaves. The blotches may spread over the entire leaf blade and sheath, frequently extending into the stem causing it to become necrotic and blackened. Blotching of floral parts and subsequent kernel discoloration sometime occur.

Some oat varieties grown in Alabama are relatively unaffected by the disease.

Red Leaf (causal virus, Barley Yellow Dwarf Virus). Red leaf (yellow dwarf) of oats is caused by a virus transmitted by certain species of aphids. The disease occurs generally throughout the State on barley, rye, wheat, and other grasses.

Symptoms of this disease are sometimes difficult to distinguish from those of soil mineral imbalance, aphid damage, or some root and crown diseases. The most typical symptom is leaf discoloration. At first, there are yellowish-green blotches near the tips of leaves. The blotches, irregular in size and shape, become red, enlarge and fuse, making leaves entirely red. Frequently, symptoms appear after aphid infestation. Infected plants are often stunted. Reduction in forage quality and yield, grain yields, size, and test weight can result from infection by this virus.

Symptoms of red leaf or yellow dwarf on oats have been observed in Alabama since 1947. In the 1949-1950 season, a severe outbreak of the disease occurred in Alabama. The prevalence and severity of the disease varied from field to field and from year to year. Previous observations have indicated that, if an aphid infestation occurs early in the growing season and populations build up rapidly, many fields may be seriously affected.

No practical control measure is available. Aphid control has proved ineffective to date.

Miscellaneous Diseases of Oats. Other diseases occasionally found on oats in Alabama but not of economic importance during the past 10 years are:

Halo Blight	(causal bacterium, *Pseudomonas coronafacians*)
Bacterial Stripe	(causal bacterium, *Pseudomonas striafaciens*)
Downy Mildew	(causal fungus, *Sclerospora macrospora*)
Stem Rust	(causal fungus, *Puccinia graminis avenae*)
Blast	(adverse environmental conditions)
Powdery Mildew	(causal fungus, *Erysiphe graminis avenae*)
Mosaic	(soil-borne virus)
Gray Leaf Spot	(manganese deficiency)

WHEAT

Leaf Rust (causal fungus, *Puccinia rubigo-vera tritici*). Leaf rust is usually an important and widespread disease wherever wheat is grown in Alabama. Barley and a number of uncultivated grasses are also susceptible.

Like crown rust of oats, leaf rust is characterized by the small, yellow-orange pustules on the leaves, Figure 5. These masses of spores turn black as the wheat matures. Infected leaves turn yellow and die.

Damage from leaf rust is usually underestimated because there is seldom severe shriveling of grain. However, there may be a reduction in number of kernels. There is a severe loss in yield when infection occurs early and continues throughout the growing season. In general, grazed wheat has been observed to be less seriously affected by this disease than ungrazed wheat.

Physiologic races of leaf rust, like those of crown rust on oats, show selectivity to the wheat varieties they attack. In 1959, a total of 124 collections of wheat leaf rust was made throughout Alabama, Table 2. Race 15, and the similar race 2, comprised 67.7 per cent of all those isolated. Second in importance was the group composed of similar races 54, 77, and 122. These three comprised 21.0 per cent

of all isolated races. Race 5 was of minor importance, and the others were insignificant.

The use of resistant varieties is the only means of controlling this disease.

Fig. 5. This is wheat leaf rust. Pustules are orange in color. (Photo courtesy of B. Koehler, University of Illinois.)

Powdery Mildew (causal fungus, *Erysiphe graminis*). Powdery mildew occurs commonly on small grains and other grasses. It can be a serious problem on wheat under favorable conditions, especially when soil fertility is adequate for vigorous plant growth.

The disease becomes prevalent during cool and cloudy days of early spring and first appears as dirty-white, powdery patches on leaves and leaf sheaths, Figure 6. The powder consists of fungal threads (mycelia) and spores. The spores are carried by the wind to healthy plants. As the season progresses, the powder becomes dark grey with small black dots scattered throughout the growth. These dots are reproductive bodies that are able to survive dry periods and winter months. Forage quality and quantity and grain yields are reduced on severely infected plants.

Use of resistant varieties offers the best means of control; however, none of the presently recommended varieties is completely resistant.

Septoria Blotch (causal fungus, *Septoria nodorum*). Septoria blotch is a common disease on wheat that has done little damage in Alabama.

The disease appears on the leaves, heads, and nodal tissues as tan to brown spots or blotches that are frequently boat-shaped and elongated, Figure 7. The blotches appear speckled from the presence of many small, black fruiting bodies of the fungus. The disease can cause defoliation and yield reduction.

TABLE 2. OCCURRENCE OF PHYSIOLOGIC RACES OF LEAF RUST FUNGUS ON WHEAT GROWN IN VARIETY TESTS IN 1959

Variety	Physiologic Races										
	2	5	6	15	20	52	54	58	77	122	143
Anderson	2	2		3							
Atlas 66	2	1		6							
Axminster				1							
Carala	2										
Chancellor									3	1	
Chul	2								1		
C. I. 12185	1	1		2							
Coastal	3	1		3	1			1			
Coker 47-27	6			10					1		1
Coker 55-3	1	2		1			2		4	5	
Coker 57-6	3			1		1					
C. U. L. 6				4							
C. U. L. 22-1				6							
Hope	2			2							
Leap				1							
M. P. I. 242428				1							
Norka R. L. 1888	2										
Purplestraw	1							1			
Taylor	4		1	4	1				1	1	
Taylor 49				4							
T 1123-3-20							1			3	
Vermillion				4							

Crop rotation, plowing under volunteer wheat and wheat residue, and chemical seed treatment aid in reducing losses from this disease.

Loose Smut (causal fungus, *Ustilago tritici*). Loose smut is common in wheat fields, but has rarely caused serious or widespread losses in this State.

Symptoms of this disease are similar to those described for loose smut of oats. Spores of the fungus from smutted heads are wind and insect borne to healthy flowers. Seed thus infected are planted the following year and fungus develops with the plant, eventually resulting in the characteristic smutted head, Figure 3.

This fungus also has physiologic races, Table 3.

Since this fungus occurs within tissues of seed, chemical seed treatment *will not* control loose smut of wheat. Use of resistant varieties is the most practical control, Table 5. Certified seed, free from the disease, should be obtained.

Scab (causal fungus, *Gibberella zeae*). Scab occurs every year, usually to a minor degree, on wheat and other small grains throughout the State.

The disease causes a blight of seedlings and heads. Infected seedlings are stunted, yellowed, and frequently killed. The infected parts

Fig. 6. Here is powdery mildew on wheat. Fungus appears as white, powdery patches on leaf surfaces.

of heads are also killed. The most obvious symptom is premature ripening of one or more spikelets producing a bleached or whitened appearance in the infected part of the head. The entire head may be killed. The yellowed or whitened spikelet(s) of a scab affected head is quite obvious against healthy green heads in the dough stage. At normal maturity of wheat, pink spore masses are usually apparent at the base of infected spikelets.

TABLE 3. OCCURRENCE OF PHYSIOLOGIC RACES OF LOOSE SMUT FUNGUS ON WHEAT GROWN IN VARIETY TESTS DURING THE 3-YEAR PERIOD, 1950-1952

	Physiologic races											
Variety	7	9	10	12	13	14	15	16	17	18	19	20
Atlas 66		1					1					1
Coastal	1	2	1				1	1		1		
C. I. 12561							1					
Coker 47-23							1		2			
Coker 47-27				1		1	2	3	1			
Hardired		1		1	1		2				1	
Purplestraw							1					
Sanford		1				2	1	2		2		

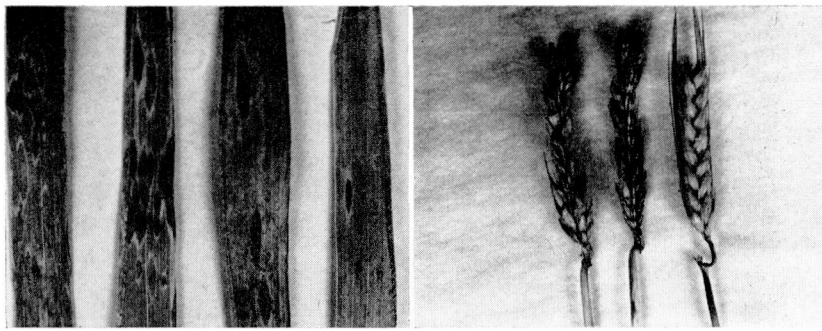

Fig. 7. Septoria blotch disease of wheat is shown on leaves at left, and on heads at right.

Poor stands often result from planting diseased seed that may not be viable. Other diseased seed may become established, but produce weak plants. If crown rot occurs in plants near maturity, premature ripening or dying results. Sometimes the fungus attacks plant joints and leaf sheaths. If the stem of a plant is girdled at joint, the portion above usually dies.

Grain infected with scab is usually light and chaffy. This condition reduces feed and market value. Scabby kernels contain substances that act as strong emetics in swine, other animals, and man. Grain containing 10 per cent or more scabby kernels fed to swine can cause vomiting. Hogs may refuse to eat the grain.

This disease has been unimportant on commonly grown varieties.

Miscellaneous Diseases of Wheat. Diseases that have occurred infrequently on wheat in Alabama include:

Anthracnose	(causal fungus, *Colletotrichum graminicolum*)
Basal Glume Rot	(causal bacterium, *Pseudomonas atrofaciens*)
Black Chaff	(causal bacterium, *Xanthomonas translucens*)
Downy Mildew	(causal fungus, *Sclerospora macrospora*)
Stem Rust	(causal fungus, *Puccinia graminis tritici*)

BARLEY

Scald (causal fungus, *Rhynchosporium secalis*). Scald occurs frequently on barley throughout Alabama.

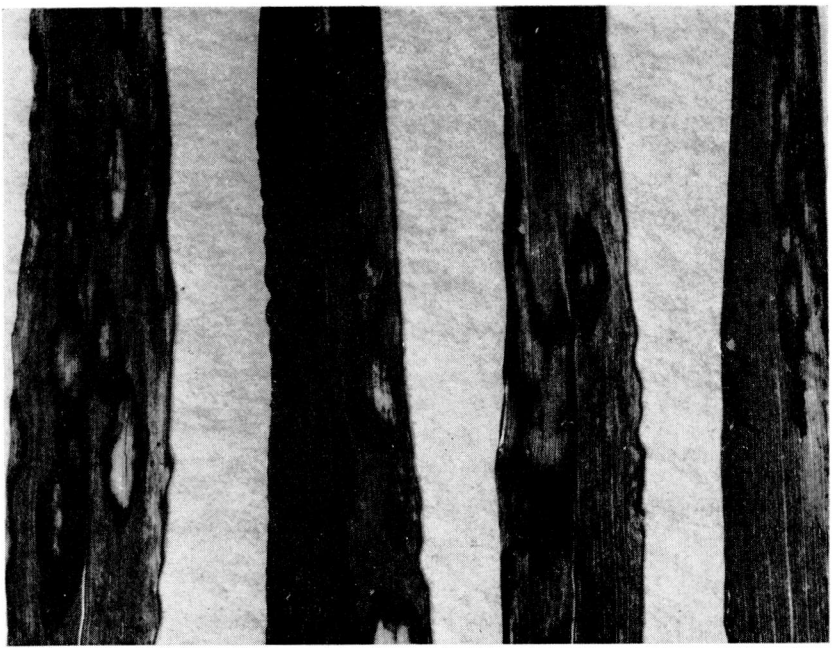

Fig. 8. This is barley scald. Note characteristic, light-colored spots with dark margins.

The symptom of this disease is a very conspicuous leaf spotting or blotching, Figure 8. Individual blotches that occur on leaves and leaf sheaths are regular in outline, oval, and light colored with a dark brown margin. The spots develop rapidly during cool weather and may result in defoliation and yield reduction.

Since the causal fungus lives over on infected dead leaves of the previous year's crop residue, crop rotation and field sanitation aid in reducing losses. Pace has appeared slightly more resistant to scald than other recommended varieties.

Spot Blotch and Net Blotch (causal fungi, *Helminthosporium sativum* and *Helminthosporium teres*, respectively). Spot and net blotch are two commonly occurring diseases of barley, with the former being more prevalent and destructive in Alabama.

Attack by the spot blotch fungus can cause pre-and-post-emergence kill of seedlings. Leaves of infected seedlings are dark green and have dark brown lesions extending from the soil line into the leaf blade. On older plants, the symptom consists of numerous oval, dark-brown spots, Figure 9. Mingled spots form blotches that may cover large areas of the leaf blade. Affected flower coverings and kernels have small black spots or brown to black discolorations.

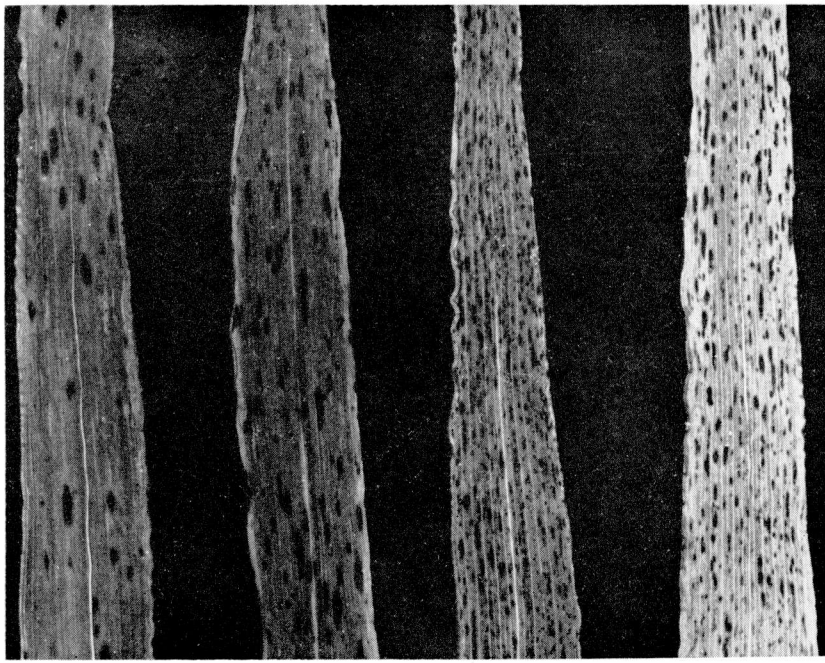

Fig. 9. This is spot blotch of barley. Note the dark, ovate, and somewhat elongate spots.

Net blotch on leaves is characterized by brown, netted blotches that are long and frequently rectangular in shape. The irregular distribution of darker dead tissue within the blotch gives the netted pattern. The blotches may unite lengthwise resulting in dark brown stripes.

Losses from these two diseases may be reduced by using clean, treated seed and by crop rotation and sanitation. Most barley varieties commonly used are susceptible.

Leaf Rust (causal fungus, *Puccinia hordei*). Leaf rust has not caused extensive damage on barley in the State.

The disease is similar in appearance to leaf rust of wheat. Greater rust resistance has been observed in Pace than other recommended varieties.

Powdery Mildew (causal fungus, *Erysiphe graminis*). Powdery mildew on barley resembles powdery mildew on wheat. The disease has not been particularly damaging on any of the recommended varieties, although none are completely resistant.

Miscellaneous Diseases of Barley. Diseases that sometime occur on barley in Alabama include:

Anthracnose	(causal fungus, *Colletotrichum graminicolum*)
Bacterial Blight	(causal bacterium, *Xanthomonas translucens*)
Covered and Loose Smuts (see Fig. 3)	(causal fungi, *Ustilago hordei* and *Ustilago nigra,* respectively)
Scab	(causal fungus, *Gibberella zeae*)
Septoria Leaf Blotch	(causal fungus, *Septoria passerinii*)
Stem Rust	(causal fungus, *Puccinia graminis secalis*)
Yellow Dwarf	(causal virus, *Barley Yellow Dwarf Virus*)

RYE

Anthracnose (causal fungus, *Colletotrichum graminicolum*). Anthracnose appears on leaves, leaf sheaths, and stems as long, narrow lesions that are light brown. Frequently, the small, black fruiting bodies of the fungus can be seen on the surface of the lesions. Stem discoloration is often strongly evident. Many affected rye plants are stunted and blighted, and the portion of the head above a lesion is often killed, resulting in shriveled grain in that part of the head. Reduction of vigor, premature ripening, and death of plants can result. Crop rotation, field sanitation, use of clean seed, and chemical seed treatment aid in minimizing losses from this disease. Explorer, Gator, and Wren's Abruzzi, the varieties recommended for planting, have not appeared to be susceptible.

Powdery Mildew (causal fungus, *Erysiphe graminis secalis*). Powdery mildew is commonly found on rye and occasionally causes severe damage. The disease is similar in appearance to that found on wheat. All varieties recommended for planting are susceptible.

Leaf Rust (causal fungus, *Puccinia rubigo-vera secalis*). Rust is found every year on rye but to date no appreciable damage has been observed in Alabama. Symptoms and control are similar to those of leaf rust of wheat.

None of the recommended varieties is resistant.

Miscellaneous Diseases of Rye. Some less important diseases occasionally found on rye in Alabama are:

Scab	(causal fungus, *Gibberella zeae*)
Scald	(causal fungus, *Rhynchosporium secalis*)
Septoria Leaf Blotch	(causal fungus, *Septoria secalis*)

CONTROL MEASURES

Resistant Varieties

The use of resistant varieties is the most practical method of controlling small grain diseases. Some of the small grain varieties recommended for planting in Alabama contain no specific factors for disease resistance and frequently vary in susceptibility to diseases. Such variation may result from differences in environment, type, race, and prevalence of the disease-causing agent, and the development and physiological condition of the host.

To determine varietal reactions to diseases as well as disease prevalence, yearly evaluations were made on entries in small grain variety tests planted at 15 locations in the State. Summaries of these evaluations for commonly grown varieties of oats, wheat, barley, and rye are given in Tables 4, 5, and 6. These reactions are *averages* of data obtained over a period of years, a minimum of 2 years for some of the newer varieties and up to 10 years for the older varieties.

TABLE 4. REACTIONS OF OAT VARIETIES TO SOME DISEASES IN ALABAMA

Variety	Crown Rust	Helmin-thosporium Leaf Blotch	Loose Smut	Victoria Blight	Septoria Leaf Blotch	Red Leaf
			NORTHERN ALABAMA			
Arkwin	S	S	R	R	R	S
Arlington	R	S	R	R	R	S
Carolee	R	R	R	R	S	S
Coker 57-11	R	S	R	R	S	S
Coker 58-7	R	R	R	R	R	R
Fairfax	R	R	R	R	R	R
Fulwood	R	S	R	R	S	S
Mid South	R	S	R	R	S	S
Moregrain	R	S	R	R	S	S
Roanoke	R	R	R	R	R	R
Victorgrain 48-93	R	S	R	S	R	S
			CENTRAL ALABAMA			
Arkwin	S	S	R	R	S	S
Carolee	S	S	R	R	S	S
Coker 57-11	R	S	R	R	S	S
Coker 58-7	R	S	R	R	R	R
Delta Red 88	R	S	R	R	S	S
Fairfax	R	R	R	R	R	R
Fulwood	S	S	R	S	S	S
Mid South	S	S	R	R	S	S
Moregrain	R	S	R	R	S	S
Roanoke	R	S	R	R	R	R
Suregrain	S	S	R	R	S	S
Victorgrain 48-93	R	S	R	S	R	S
			SOUTHERN ALABAMA			
Carolee	S	S	R	R	S	S
Coker 57-11	R	S	R	R	R	S
Coker 58-7	S	S	R	R	S	R
Delta Red 88	R	S	R	R	S	S
Fulwood	S	S	R	R	R	S
Mid South	S	S	R	R	S	S
Moregrain	S	S	R	R	S	S
Radar I	S	S	R	R	S	S
Radar II	S	S	R	R	S	S
Suregrain	R	S	R	R	R	S
Victorgrain 48-93	R	S	R	R	R	S

R—Resistant, never or only slightly affected.
S—Susceptible.

TABLE 5. REACTIONS OF WHEAT VARIETIES TO SOME DISEASES IN ALABAMA

Variety	Powdery Mildew	Scab	Leaf Rust	Septoria Blotch	Loose Smut
		NORTHERN ALABAMA			
Ace	S	R	R	S	R
Anderson	S	R	S	S	R
Atlas 66	S	R	S	S	R
Bledsoe	S	R	R	R	R
Coker 47-27	S	R	S	S	R
Ga. 1123	S	R	R	S	R
Knox	S	R	S	S	R
Wakeland	S	R	R	R	R
		CENTRAL ALABAMA			
Ace	S	R	R	S	R
Anderson	S	R	S	S	R
Atlas 66	S	R	S	S	R
Bledsoe	S	R	S	S	R
Coker 47-27	S	R	S	S	R
Coker 59-11	S	R	R	S	R
Coker 59-36	S	R	R	S	R
Ga. 1123	S	R	R	S	R
Wakeland	S	R	R	S	R
		SOUTHERN ALABAMA			
Ace	S	R	S	S	R
Anderson	S	R	S	S	R
Atlas 66	S	R	S	S	R
Bledsoe	S	R	S	S	R
Coastal	S	R	S	S	R
Coker 47-27	S	R	S	S	R
Coker 59-11	S	R	R	S	R
Coker 59-36	S	R	R	S	R
Ga. 1123	S	R	R	S	R
Wakeland	S	R	R	S	R

R—Resistant, never or only slightly affected.
S—Susceptible.

TABLE 6. REACTIONS OF BARLEY AND RYE VARIETIES TO SOME DISEASES IN ALABAMA

Variety	Powdery Mildew	Anthracnose	Spot Blotch	Net Blotch	Leaf Rust	Scald
			BARLEY			
Colonial 2	S		S	S	S	S*
Dayton	S		S	S	S	S**
Ga. Jet	S**		S	R***	S	S
Pace	S**		R***	R***	R	R***
			RYE			
Explorer	S	R			S	
Gator	S	R			S	
Wren's Abruzzi	S	R			S	

R—Resistant, never or only slightly affected.

S—Susceptible.

*—R in southern Alabama

**—R in central Alabama

***—S in central Alabama

Seed Treatment

Seed treatment is the practice of applying fungicides in the form of dusts, slurries, or liquids to seed before planting. Seed treatment protects the seed against certain disease-causing organisms and substantially improves the chances for survival for each seedling. Thus, there are fewer failures to obtain a good stand and fewer cases in which stands are irregular.

It is advisable to treat small grain seed either with chemicals or hot water before planting. The type of treatment will depend upon the disease or diseases to be controlled. Chemical treatments vary in their effect on surface seed-borne, internal seed-borne, and soil-borne organisms. Hot-water seed treatment is used to destroy disease organisms within the seed.

Various chemical seed protectants have been evaluated to determine their effect in disease control. In experiments conducted in 1954-1955 with Victorgrain 48-93 oat seed artificially inoculated with the Victoria blight fungus, *Helminthosporium victoriae*, the relative effectiveness of certain treatments was determined from average emergences in the greenhouse, Table 7, and from green forage and grain yields taken at six locations throughout the State, Tables 8 and 9. In general, the organic mercurials were more effective than the non-mercurials in control of Victoria blight.

TABLE 7. AVERAGE SEEDLING EMERGENCES IN THE OAT SEED PROTECTANT EXPERIMENT IN THE GREENHOUSE AT AUBURN, 1956

Treatment	Locations from which samples were taken					
	Main Station	Black Belt Sub-station	Piedmont Sub-station	Tennessee Valley Sub-station	Upper Coastal Plain Sub-station	Wiregrass Sub-station
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Agrox	98.80	99.75	95.60	96.00	99.2	99.75
Ceresan M	98.40	100.00	96.40	98.00	96.4	99.75
Ethyl B-856	98.40	98.00	91.60	94.40	96.4	98.00
Gy-Trete	94.80	92.00	86.40	84.40	90.0	96.00
Mercusol	98.80	98.80	94.40	96.40	90.4	95.20
Orthocide	96.00	97.60	90.00	92.80	97.2	97.60
Panogen	97.60	99.25	95.20	98.80	98.4	99.75
Inoculated Check	88.40	92.00	81.60	66.40	85.2	90.40
Uninoculated Check	91.20	89.25	84.00	83.20	93.2	94.00
L.S.D.–5% Level	4.29	3.53	5.60	6.09	3.45	3.47
L.S.D–1% Level	5.78	4.76	7.54	8.20	4.65	4.68

TABLE 8. AVERAGE YIELDS OF GREEN OAT FORAGE PER ACRE, SEED PROTECTANT EXPERIMENT AT SIX LOCATIONS, 1956[1]

Treatment	Main Station	Black Belt Sub-station	Piedmont Sub-station	Tennessee Valley Sub-station	Upper Coastal Plain Sub-station	Wire-grass Sub-station
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Agrox	3,748	17,548	11,969	9,924	5,001	18,233
Ceresan M	3,791	18,939	12,351	10,659	5,001	19,528
Ethyl B-856	2,549	14,429	9,138	7,592	4,856	14,940
Gy-Trete	3,364	19,328	9,855	8,061	4,356	15,614
Mercusol	1,906	14,766	8,757	6,886	5,404	14,429
Orthocide	3,271	14,940	9,502	7,998	4,449	14,799
Panogen	4,122	18,233	12,623	10,491	5,081	18,939
Inoculated Check	2,429	12,799	10,209	8,045	5,234	12,799
Uninoculated Check	3,194	14,540	12,069	8,669	5,375	17,548
L. S. D. — 5% Level, 1,008						
L. S. D. — 1% Level, 1,162						

[1] Two clippings made at the Black Belt, Piedmont, Tennessee Valley, and Upper Coastal Plain Substations; one clipping made at the Main Station (Auburn) and at the Wiregrass Substation.

TABLE 9. AVERAGE YIELDS OF GRAIN PER ACRE, SEED PROTECTANT EXPERIMENT AT SIX LOCATIONS, 1956

Treatment	Main Station	Black Belt Sub-station	Pied-mont Sub-station	Tennessee Valley Sub-station	Upper Coastal Plain Sub-station	Wire-grass Sub-station
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Agrox	85.94	70.71	84.74	103.02	95.41	43.66
Ceresan M	83.44	86.20	101.07	109.09	94.81	45.92
Ethyl B-856	71.18	64.59	84.71	84.64	88.76	36.88
Gy-Trete	79.05	61.95	81.53	92.36	94.68	36.90
Mercusol	53.14	56.65	77.59	91.69	91.81	30.18
Orthocide	72.65	68.06	87.80	92.38	80.07	43.66
Panogen	76.59	73.16	98.18	107.94	101.19	46.58
Inoculated Check	53.32	55.23	82.69	84.08	74.26	31.36
Uninoculated Check	73.64	58.69	82.46	101.05	94.59	36.08
L. S. D. — 5% Level, 6.6						
L. S. D. — 1% Ievel, 7.6						

Rotation and Sanitation

Losses from small grain diseases can be reduced by crop rotation and sanitation. In addition, crop rotation does much to control weeds and reduce destructive damage caused by insects.

Continuous cropping may result in establishing in the soil a high population of organisms infectious to that particular crop; the higher this population becomes, the greater is the potential loss. With rotation the continuity of susceptible hosts is broken and the population of destructive organisms is reduced. Some disease-causing organisms decrease in abundance as the host material disappears. A rotation system that allows decay of crop residue before the same crop is replanted in a field reduces materially the number of these organisms.

In sanitation the elimination or destruction of disease-carrying materials is necessary. Bacteria and fungi often inhabit crop residue, volunteer crop plants, weeds, or alternate hosts. Practicing sanitary measures, including plowing under and rotting diseased plant parts as completely as possible, burning, deep tillage, chemical control of weeds, use of clean seed, reduces or eliminates this inoculum before the new crop is planted.

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