

UNIVERSITY OF MISSOURI

COLLEGE OF AGRICULTURE

AGRICULTURAL EXPERIMENT STATION

RESEARCH BULLETIN 111

Varietal Resistance and Susceptibility to Wheat Scab

(Publication Authorized November 11, 1927)



COLUMBIA, MISSOURI

NOVEMBER, 1927

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Varietal Resistance and Susceptibility to Wheat Scab*

I. T. SCOTT

ABSTRACT.—The comparative resistance of 189 varieties and strains of winter wheat to wheat scab or head blight caused by *Gibberella saubinetii* (Mont.) Sacc. was determined by field tests at Columbia, Missouri. Artificial inoculation was made. The data presented represent the tests for four years. The entire group of selections was not used in all trials, but many were used in at least two tests. Several well known local varieties showed relatively low resistance to scab, notably strains of Fulcaster, Michigan Wonder, and Red May. Artificial inoculation gave relatively low infection in most cases but this is attributed to the weather conditions prevailing during May and June of the years in which the trials were conducted.

Wheat scab caused by *Gibberella saubinetii* (Mont.) Sacc. results in appreciable losses to wheat growers in Missouri nearly every year. Two serious epidemics have occurred within the last ten years, in 1919 and 1927, respectively. The percentage of infection during these epidemics averaged from 4 to 8 per cent. Losses are incurred by actual decrease in yield due to scabby heads, by the low weight of scabby grain lowering its market grade, and by low percentage of germination and seedling blight with subsequent decrease in stand and yield which result from planting scabby grain.

Scab is difficult to control inasmuch as the disease is widespread and the causal organism is soil-borne and occurs on other hosts, particularly corn. Certain recommendations are made which markedly cut down loss from the disease, such as sanitary practices, proper rotations, and clean seed. However, it would be of considerable advantage to use well adapted varieties of wheat relatively resistant to attack by the scab organism. A varietal test of the resistance of wheat to scab was initiated at the Missouri Agricultural Experiment Station after the epidemic of 1919. Since that time the relative resistance of a number of varieties and selected strains of wheat to scab under local conditions in field tests has been determined in 1921, 1922, 1924, and 1925. Weather conditions at the time of planting prevented tests in 1926 and 1927.

VARIETAL TESTS†

The tests were all conducted on a plat of land located at the southwest corner of the horticultural experimental grounds in Columbia, Missouri. The soil is Putnam silt loam of fair fertility, relatively flat and

*Due credit is hereby given to Dr. E. F. Hopkins, formerly plant pathologist at the Missouri Agricultural Experiment Station, who planned and directed the first two varietal tests given in this paper. The writer conducted the remaining tests and has compiled the experimental data. We desire to acknowledge the assistance of Dr. C. E. Leighty, Office of Cereal Investigations, Bur. Plant Ind., U. S. Dept. of Agriculture, and of the Field Crops Department, Missouri College of Agriculture, who kindly furnished the seed used in our tests.

†Progress notes concerning the varietal tests have appeared in the following annual reports of the director of the Missouri Agricultural Experiment Station: Missouri Agr. Expt. Sta. Bulletins 197, 1922; 210, 1924; 236, 1926; 244, 1926.

tending to be somewhat slow in drying out during rainy seasons. The experimental plot consisted of three plots 133 feet long and 12 feet wide separated by lanes 1 foot wide. Three border rows were planted at the ends and along each side. The varieties to be tested were seeded in rows 12 feet long and 1 foot apart, the entire plot furnishing space for 300 12-foot rows. The soil was thoroughly plowed and a good seed bed prepared in all cases. Seeding and harvesting was done by hand. Each row was cut when ripe with a hand sickle, the grain tied into small bundles and stored in a dry room. As soon as possible after harvesting counts were made in order to determine the number of scabby heads in each row. The grain was then threshed in a small motor-driven thresher and stored for subsequent planting.

The seed for the 1920-1921 test was obtained from C. E. Leighty, Office of Cereal Investigations, United States Department of Agriculture, Washington, D. C., and from the Field Crops Department of the Missouri College of Agriculture. From the varieties and strains obtained 98 different lots were selected for the first experiment. This permitted four replications of each selection except in a few cases where there was an insufficient quantity of seed. All seedings were made as soon as the soil was in condition after the fly-free date for this section, *i. e.*, October 7.

In the fall of 1921 there were used 73 varieties and strains, which, with three exceptions, were different from those used in the first experiment. This permitted four replications of each variety, the remaining rows being planted with Fulcaster. Due to unavoidable circumstances the trials were not continued in the season 1922-1923, but were resumed in the fall of 1923. For the next two seasons, 1923-1924, and 1924-1925, the number of varieties and strains was decreased to 29, several of which were identical with those used in previous trials. The plots were shortened to 100 feet in length for these two trials. From 9 to 12 replications were used for the 29 selections. Many of those used in these tests were varieties and selections grown in Missouri. No spring wheats were employed in any of the tests.

Inoculations were made at the time of flowering and filling by spraying the heads with a heavy spore suspension of *Gibberella saubinetii* by means of a knapsack sprayer. Two sprayings were given about one week apart beginning in the last week of May in 1921. A similar inoculation was given in the spring of 1922. A proven culture of *Gibberella saubinetii* was used as the source of inoculum. In the third and fourth trials three sprayings were made each spring, the first being applied near the first of June, and the other two following at intervals of five or six days. All applications were made late in the afternoon just before sundown during clear weather. On one or two instances when the weather was

cloudy the applications were made earlier in the afternoon. For these two latter experiments four isolations of *Gibberella saubinetii* were utilized as sources of inoculum. Three of these were monosporic strains isolated in our own laboratories, and one was a strain obtained from Miss Helen Johann of the Wisconsin Agricultural Experiment Station. All of these strains sporulated readily on acidified potato dextrose agar plates from which spores and mycelium were scraped and washed for making up the suspension of inoculum. The term "strain" refers to isolations of the fungus showing different cultural characteristics.

Table 1 gives the name of each variety or strain of wheat used, the percentage of infection for each year of harvest, and the average percentage of infection for all trials of each lot.

TABLE 1.—PERCENTAGE OF INFECTION OF VARIETIES AND STRAINS OF WINTER WHEAT BY *Gibberella saubinetii*

Variety or Strain	Percentage of infection				Average of all trials
	1921	1922	1924	1925	
Alabama C. I. 5785	---	0.96	---	---	0.96
American Bronze C. I. 5638	0.35	---	---	---	0.35
Barletta C. I. 3297	1.50	---	---	---	1.50
Beechwood Hybrid #8	---	0.75	---	---	0.75
Beechwood Hybrid #85	---	0.73	---	---	0.73
Beechwood Hybrid #87	0.77	---	---	---	0.77
Beechwood Hybrid #202	---	0.17	---	---	0.17
Beechwood Hybrid #207	1.46	---	---	---	1.46
Beloglina C. I. 5964	0.59	---	---	---	0.59
Black Hybrid #8	---	0.12	---	---	0.12
Black Rudy	1.47	---	---	---	1.47
Blue Ridge W194	---	---	3.51	1.86	2.68
Budapest C. I. 5789	4.17	---	---	---	4.17
Buffon #17, C. I. 3330	0.00	---	3.40	1.63	1.68
Chirka Winter C. I. 1438	0.00	---	---	---	0.00
C. I. 3808	---	0.61	---	---	0.61
C. I. 3846	---	0.57	---	---	0.57
C. I. 3972	---	0.08	---	---	0.08
C. I. 3980	---	0.30	---	---	0.30
C. I. 3988	---	0.94	---	---	0.94
C. I. 4004	1.75	---	---	---	1.75
Cladden C. I. 5644	1.20	---	---	---	1.20
Club "Rodrow 307"	3.05	---	---	---	3.05
Crémian C. I. 5831	1.43	---	---	---	1.43
Currell C. I. 2906	0.00	---	---	---	0.00
Dawson's Golden Chaff C. I. 6161	0.33	---	3.27	4.89	2.83
Dawson's Golden Chaff (no No.)	1.63	---	---	---	1.63
Defiance	---	0.29	---	---	0.29
Dietz	2.72	---	---	---	2.72
Early Harvest C. I. 4852	0.25	---	2.14	1.11	1.17
Early Red Clawson	---	0.67	---	---	0.67
Early Reper #26	---	0.30	---	---	0.30
Early Ripe	---	0.58	---	---	0.58
Early Ripe C. I. 5319	0.75	---	---	---	0.75
Early Ripe W213	---	---	1.75	1.51	1.63

TABLE 1.—PERCENTAGE OF INFECTION OF VARIETIES AND STRAINS OF WINTER WHEAT
BY *Gibberella saubinetii* (CONTINUED)

Variety or Strain	Percentage of infection				Average of all trials
	1921	1922	1924	1925	
Farmers' Friend.....	----	0.59	----	----	0.59
Fulcaster.....	----	0.47	----	----	0.47
Fulcaster #2.....	0.00	----	----	----	0.00
Fulcaster #12.....	----	0.79	----	----	0.79
Fulcaster C. I. 4864.....	1.75	----	----	----	1.75
Fulcaster W18.....	----	----	1.46	0.78	1.12
Fulcaster W195.....	----	----	3.18	3.33	3.25
Fultz Archias.....	----	0.70	----	----	0.70
Fultz C. I. 3349.....	2.20	----	----	----	2.20
Fultz (Co-op).....	4.30	0.26	----	----	2.28
Fultzo-Mediterranean C. I. 3421.....	0.45	----	----	----	0.45
Fultzo-Mediterranean C. I. 4811.....	1.33	----	----	----	1.33
Genesee Giant C. I. 1744.....	2.58	----	----	----	2.58
Gold Coin.....	----	1.80	----	----	1.80
Gold Coin C. I. 5355.....	0.26	----	----	----	0.26
Golden Wave.....	0.55	----	----	----	0.55
Greene County.....	----	0.30	----	----	0.30
Gypsy C. I. 3439.....	----	0.10	----	----	0.10
Harvest King #7.....	2.04	----	----	----	2.04
Harvest King C. I. 5647.....	----	0.27	----	----	0.27
Harvest Queen.....	1.20	----	----	----	1.20
Harvest Queen C. I. 4882.....	----	0.90	----	----	0.90
Harvest Queen W23.....	----	----	1.05	0.58	0.81
Hickman.....	----	0.43	----	----	0.43
Illini Chief.....	0.38	----	----	----	0.38
Illini Chief C. I. 5406.....	----	1.00	1.06	0.87	0.96
Iowa #404, C. I. 5580.....	2.22	----	----	----	2.22
Jersey Fultz.....	----	0.80	----	----	0.80
Jones Climax.....	----	1.08	----	----	1.08
Jones Longberry.....	----	0.79	----	----	0.79
Jones Paris Prize C. I. 3568.....	1.15	----	----	----	1.15
Jones Winter Fife C. I. 5608.....	----	0.72	----	----	0.72
Junior #6.....	0.33	----	----	----	0.33
Kanred C. I. 5146.....	4.97	----	----	----	4.97
Kanred (Co-op).....	4.70	----	----	----	4.70
Kanred W104.....	----	----	2.61	4.05	3.33
Kessinger.....	----	0.24	----	----	0.24
Kharkof.....	2.40	----	----	----	2.40
Kharkof C. I. 5661.....	0.88	----	----	----	0.88
Leap Prolific.....	----	1.18	----	----	1.18
Leap Prolific C. I. 5618.....	----	1.94	----	----	1.94
Malakof C. I. 5663.....	0.62	----	----	----	0.62
Mammoth Red.....	----	0.37	----	----	0.37
Mammoth Red W189.....	----	----	2.10	1.74	1.92
Marquis.....	----	1.50	----	----	1.50
Marten Amber C. I. 4636.....	4.50	----	----	----	4.50
Marvelous C. I. 5961.....	1.90	----	----	----	1.90
Mealy.....	----	0.00	----	----	0.00
Mealy C. I. 3563.....	1.73	----	----	----	1.73
Mediterranean #8.....	1.65	----	----	----	1.65
Mediterranean #17.....	9.30	----	----	----	9.30
Mediterranean #31, W87.....	8.00	6.36	10.09	7.15	7.90
Michigan Amber.....	----	1.80	----	----	1.80
Michigan Amber #7.....	4.60	----	----	----	4.60

TABLE 1.—PERCENTAGE OF INFECTION OF VARIETIES AND STRAINS OF WINTER WHEAT BY *Gibberella saubinetii* (CONTINUED)

Variety or Strain	Percentage of infection				Average of all trials
	1921	1922	1924	1925	
Michigan Amber #12	---	0.37	---	---	0.37
Michigan Amber C. I. 4864	---	1.23	---	---	1.23
Michigan Amber Indiana	---	0.09	---	---	0.09
Michigan Wonder	---	0.34	---	---	0.34
Michigan Wonder #4	---	1.21	---	---	1.21
Michigan Wonder #8	---	0.17	---	---	0.17
Michigan Wonder #21	4.90	0.70	---	---	2.80
Michigan Wonder #55	---	0.47	---	---	0.47
Michigan Wonder #56	---	1.56	---	---	1.56
Michigan Wonder #83	---	0.34	---	---	0.34
Michigan Wonder #103	---	0.51	---	---	0.51
Michigan Wonder #116	1.20	---	---	---	1.20
Michigan Wonder #130	5.50	---	---	---	5.50
Michigan Wonder #140	2.28	---	---	---	2.28
Michigan Wonder #141	---	0.89	---	---	0.89
Michigan Wonder #155	3.00	---	---	---	3.00
Michigan Wonder #209	---	0.64	---	---	0.64
Michigan Wonder #211	4.80	---	---	---	4.80
Michigan Wonder #221	---	0.65	---	---	0.65
Michigan Wonder W29	---	---	2.11	1.23	1.67
Michigan Wonder W207	---	---	0.88	0.70	0.79
Missouri Blue Stem C. I. 3332	0.27	---	---	---	0.27
New Amber Longberry C. I. 3361	0.00	---	---	---	0.00
New Yorker 123-32	4.50	---	---	---	4.50
Niagara	5.60	---	---	---	5.60
Nigger	---	0.56	---	---	0.56
Nigger C. I. 5652	5.53	---	---	---	5.53
Nigger C. I. 5689	---	---	3.67	1.68	2.67
Odessa C. I. 6151	0.60	---	---	---	0.60
Old Iron Clad	---	0.34	---	---	0.34
Ontario Wonder C. I. 3483	0.94	---	---	---	0.94
Pennsylvania Blue Stem C. I. 5342	0.12	---	---	---	0.12
Poole #3	1.55	---	---	---	1.55
Poole B-3	---	0.19	---	---	0.19
Poole (Co-op)	---	0.58	---	---	0.58
Portage	5.70	---	---	---	5.70
Portage C. I. 5370	0.29	---	---	---	0.29
Power Fife C. I. 3697	0.08	---	---	---	0.08
Price's Wonder W192	---	---	2.10	1.27	1.68
Pride of Genesee	---	2.16	---	---	2.16
Pride of Indiana	---	0.98	---	---	0.98
Pride of Indiana W212	---	---	0.87	0.56	0.71
Purple Stem C. I. 1915	4.90	---	---	---	4.90
Red Cross W206	---	---	0.46	0.24	0.36
Red Cross	1.10	---	---	---	1.10
Red Hussar	---	0.09	---	---	0.09
Red May	2.30	---	---	---	2.30
Red May C. I. 5339	---	---	1.80	1.20	1.50
Red May C. I. 5596	0.00	---	---	---	0.00
Red May C. I. 5635	---	---	2.27	0.67	1.47
Red May W203	---	---	0.55	0.28	0.41
Red May W210	---	---	0.77	0.37	0.57
Red May W214	---	---	0.79	0.18	0.48
Red Rock C. I. 5597	0.77	---	1.80	0.91	1.74

TABLE 1.—PERCENTAGE OF INFECTION OF VARIETIES AND STRAINS OF WINTER WHEAT BY *Gibberella saubinetii* (CONTINUED)

Variety or Strain	Percentage of infection				Average of all trials
	1921	1922	1924	1925	
Red Rock Indiana.....	-----	0.00	----	----	0.00
Red Rock Michigan.....	0.85	----	----	----	0.85
Red Wave.....	12.10	----	----	----	12.10
Red Wave C. I. 5624.....	2.65	----	----	----	2.65
Red Wave W305.....	----	----	4.60	1.49	3.04
Red Wonder W198.....	----	----	1.94	1.00	1.47
Reliable.....	----	0.12	----	----	0.12
Reliable C. I. 3508.....	----	0.33	----	----	0.33
Rochester Red.....	6.30	----	----	----	6.30
Rudy C. I. 5625.....	4.30	----	----	----	4.30
Rural New Yorker.....	0.97	----	----	----	0.97
St. Louis Grand Prize C. I. 5627.....	0.76	----	----	----	0.76
SPI # 11616.....	----	0.29	----	----	0.29
SPI # 25984.....	3.87	----	----	----	3.87
SPI # 26012.....	----	0.85	----	----	0.85
SPI # 26013.....	----	0.16	----	----	0.16
SPI # 26014.....	1.71	----	----	----	1.71
SPI # 26015.....	----	0.80	----	----	0.80
SPI # 26017.....	----	0.63	----	----	0.63
SPI # 26018.....	----	0.00	----	----	0.00
SPI # 26019.....	----	0.19	----	----	0.19
SPI # 26022.....	----	0.37	----	----	0.37
SPI # 26023.....	13.70	----	----	----	13.70
SPI # 26025.....	4.90	----	----	----	4.90
SPI # 26029.....	0.70	----	----	----	0.70
SPI # 26085.....	15.00	----	----	----	15.00
Super C. I. 5544.....	2.27	----	----	----	2.27
Thesis C. I. 1561.....	----	0.87	----	----	0.87
Treadwell.....	2.00	----	----	----	2.00
Treadwell C. I. 3527.....	1.34	----	----	----	1.34
Trumbull C. I. 5657.....	0.00	----	----	----	0.00
Tule C. I. 4140.....	1.32	----	----	----	1.32
Turkey.....	4.30	----	----	----	4.30
Turkey # 24.....	2.60	----	----	----	2.60
Turkey C. I. 6152.....	3.23	----	----	----	3.23
Turkey C. I. 6613.....	----	3.80	3.46	4.74	3.58
Turkey C. I. 7005.....	----	----	2.61	1.67	2.14
Turkey Kansas.....	----	0.62	----	----	0.62
Valley.....	5.80	----	----	----	5.80
Velvet Chaff # 2.....	6.40	----	----	----	6.40
Velvet Chaff # 8.....	5.00	----	----	----	5.00
Velvet Chaff (Penquite).....	0.16	----	----	----	0.16
Wheedling C. I. 4846.....	----	0.60	----	----	0.60
37 A-4.....	0.86	----	----	----	0.86
34 B-2a.....	1.21	----	----	----	1.21
13 D-4a.....	0.66	----	----	----	0.66

DISCUSSION

The percentage of infection in any case is surprisingly low when compared with natural infection occurring in the field during years of scab epidemic. For the four years the average percentage of infection was 2.55% for 1921, less than 1.00% for 1922, 4.18% for 1924, and 1.64% for 1925. The maximum percentage of infection observed for any variety during the four years was 15% for 1921 (SPI # 26085), 3.36% for 1922 (Mediterranean #31, W87), 10.09% for 1924 (Mediterranean #31, W87), and 7.15% for 1925 (Med. #31, W87). The heavy spore suspensions used for inoculation should have insured higher infection on susceptible varieties under favorable weather conditions. As high as 50% natural infection has occurred at Columbia during a year favorable for scab. It is interesting to note, however, that the four years during which these trials were conducted showed relatively low percentages of natural scab infection in this section of the country. This is unquestionably largely due to the weather conditions prevailing at the time of flowering and filling. There seems to be but little doubt that moderately high temperature and heavy rainfall, accompanied by considerable cloudy weather at the time of infection, result in epidemics of scab. The following records of temperature and rainfall for May and June reported at the Columbia station of the United States Weather Bureau may be interesting in respect to the four years during which the varietal resistance experiments were conducted:

TABLE 2.—RECORDS OF TEMPERATURE AND RAINFALL AT TIME AND PLACE OF RESISTANCE TESTS

	1921		1922		1924		1925	
	May	June	May	June	May	June	May	June
Mean temperature F°....	65.80	75.70	66.30	75.60	57.40	71.80	60.60	75.80
Departure from normal F°.....	+1.3	+1.2	+1.7	+1.1	-6.9	-1.0	-3.7	+3.0
Total rainfall, inches....	4.01	3.18	4.34	2.01	5.11	7.72	3.56	7.07
Departure from normal, inches.....	-0.8	-1.2	-0.5	-2.4	+0.2	+3.3	-1.3	+2.7

The rainfall for both May and June in 1921 and 1922 was less than normal, the departure from normal being especially marked in June of both years. In 1924 the rainfall was about normal for May but considerably above normal for June. However, the temperature for both months was decidedly below normal showing a departure of 6.9°F for May. This probably was an important factor in preventing a heavy scab infection in 1924. In 1925 there was a deficit in precipitation of 1.3 inches

and a departure of 3.7°F below normal in temperature for May, while conditions were rather favorable for infection in June with relatively high temperature and excess precipitation. It is quite probable that here the weather conditions of May were the controlling factors in scab infection. The cloudiness which accompanies excessively moist spring weather is also a contributing factor in scab infection providing temperatures are favorable. The season of 1927 was the most severe in recent years in Missouri from the standpoint of the prevalence of scab. The months of May and June for this year were marked by excessive precipitation with the temperature 1.1°F below normal in May, and 3.3°F below normal in June. The rainfall averaged nearly 2 inches above normal in both May and June, with 25 cloudy and partially cloudy days in May, and only 13 clear days in June. It is quite probable that with artificial inoculation the percentage of infection for 1927 would have been much greater than during any of the seasons in which the varietal tests were conducted. It is also interesting to note that during the epidemic of 1919 the rainfall for May was 1.4 inches above normal with a departure of 3.0°F below normal in temperature, while the rainfall and temperature in June were about normal.

The relation of wheat scab to weather conditions was noted by a number of early workers. Since the establishment of the Federal Plant Disease Survey more definite information has become available regarding the distribution of scab each year and its severity in relation to prevailing weather conditions ^{4 5 6 7 8}. Atanasoff¹ discusses the weather conditions in Wisconsin in relation to head infection by *Gibberella saubinetii* and particularly notes that where rainy weather closely followed artificial inoculation the percentage of infection was considerably increased. In the trials at the Missouri Station there was an absence of rainfall and cloudy weather following the artificial inoculation in nearly all cases. It was not possible to wait for periods when rainy weather was forecasted inasmuch as the inoculations had to be made at the time the host was in a favorable stage of development for infection. The severity of scab depends upon the weather conditions prevailing throughout the entire period of flowering and filling of the wheat rather than upon conditions at and immediately following inoculation.

Certain varieties and selections show rather promising results in the limited number of trials in which they were tested. The 29 strains selected for the trials of 1924 and 1925 have been subjected to more thorough testing in many respects than the larger number used in the previous trials due to the greater number of replications possible. Mediterranean #31, W87 is the only selection used in all four experiments and consistently showed relatively high percentage of infection throughout.

Six strains were used in three trials as follows: Dawson's Golden Chaff C. I. 6161, Buffum #17, C. I. 3330, Early Harvest C. I. 4852, Illini Chief C. I. 5406, Red Rock C. I. 5597, and Turkey C. I. 6613.

Those strains showing an average infection of 4 per cent or greater are as follows: Budapest C. I. 5789 (4.17%), Kanred C. I. 5146 (4.97%), Kanred Co-op (4.70%), Marten Amber C. I. 4636 (4.50%), Mediterranean #17 (9.30%), Mediterranean #31, W87 (7.90%), Michigan Amber #7 (4.60%), Michigan Wonder #130 (5.50%), Michigan Wonder #211 (4.80%) New Yorker 123-32 (4.50%), Niagara (5.60%), Nigger C. I. 5652 (5.53%), Portage (5.70%), Purple Stem C. I. 1915 (4.90%), Red Wave (12.10%), Rochester Red (6.30%), SPI # 26023 (13.70%), SPI # 26025 (4.90%), SPI # 26085 (15.00%), Turkey (4.30%), Valley (5.80%), Velvet Chaff #2 (6.40%), and Velvet Chaff #8 (5.00%).

Those strains showing an average infection of 0.20% or less are as follows: Black Hybrid #8 (0.12%), Chirka Winter C. I. 1438 (0.00%), C. I. 3972 (0.08%), Currell C. I. 2906 (0.00%), Fulcaster #2 (0.00%), Gypsy C. I. 3439 (0.10%), Mealy (0.00%), Michigan Amber Indiana (0.09%), Michigan Wonder #8(0.17%), New Amber Longberry C. I. 3361 (0.00%), Pennsylvania Blue Stem C. I. 5342 (0.12%), Poole B-3 (0.19%), Power Fife C. I. 3697 (0.08%), Red Hussar (0.09%), Red May C. I. 5596 (0.00%), Red Rock Indiana (0.00%), Reliable (0.12%), SPI #26013 (0.16%), SPI #26018 (0.00%), SPI #26019 (0.19%), Trumbull C. I. 5657 (0.00%), and Velvet Chaff (Penquite) (0.16%).

Several varieties used in these trials are not generally grown in Missouri, nor are they recommended for this section of the country. However, there is always a possibility that varieties not acclimated to a particular section of the country might be made adaptable and thus be generally used by growers should they prove resistant to a serious disease.

The outstanding varieties and strains in the 1924 and 1925 tests with respect to low scab infection and general adaptability to Missouri conditions are as follows:

TABLE 3.—VARIETIES SHOWING LOWEST SCAB INFECTION

Variety	Average Percentage of Infection
Fulcaster W18.....	1.12
Michigan Wonder #207.....	0.79
Red May W203.....	0.41
Red May W210.....	0.57
Red May W214.....	0.48
Red Cross W206.....	0.36

No attempt is made by the writer to pass upon any other desirable agronomic characteristics of these strains.

There are several rather interesting features to be noted with reference to the reaction of a number of varieties to scab infection. One is the variation in relative resistance in selections within certain established varieties. Five selections of Beechwood Hybrid were tested none of which showed high susceptibility, varying from 0.17% infection for selection #202 to 1.46% for selection #207. Fulcaster showed greater variation where selection #2 in one year's trial showed no infection whereas selection W195 gave an average infection of 3.25% in two years' trials. Kanred and Turkey showed relatively high percentage of infection with but one exception; Turkey Kansas selection, tested but once (1922) gave only 0.62% infection. This is rather surprising due to the fact that these strains are generally supposed to be somewhat resistant to scab. It is quite probable that they are less resistant under our climatic conditions as these strains have given relatively higher infection farther east than Missouri as noted below. Eighteen selections of Michigan Wonder were used at some time during the trials with considerable variation among the various strains ranging from 5.5% infection for selection #130 to only 0.17% infection for selection #8. The Mediterranean selections were invariably highly susceptible to scab infection. Selection #31, W87 was used in all trials and varied from 6.36% to 10.09% infection. Seven strains of Red May were used, five of them in the last two trials, 1924 and 1925. Some variations occurred among them but, in general, this variety seems to be rather resistant to scab in Missouri, especially selections obtained from the Missouri Station—W203, W210, and W214.

It is realized that the somewhat limited trials reported in this paper cannot give as definite information relative to the comparative resistance of the strains and varieties used as would be possible if the tests were conducted over a longer period of time under a greater variety of weather conditions. However, it is believed that the data so far presented give considerable information which should be of some value to those conducting similar tests or contemplating experiments of such nature.

There has been but little experimental work presented by other workers relating to the relative resistance of wheat to scab, particularly winter wheat. Atanasoff¹ recorded observations made at the Wisconsin station in 1918 which showed considerable variation among a number of varieties of spring wheat in their susceptibility to scab. A Preston × Kubanka cross showed the greatest infection. Observations of the relative resistance of winter wheats were rendered difficult because of severe winter injury.

MacInnes and Fogelman³ reported the results of observations and experiments at the Minnesota station regarding the comparative resistance of spring wheat varieties to scab. They note that Marquis has

shown marked susceptibility to scab. Previous to its introduction scab was largely restricted to the durum wheats in Minnesota. Preston 924, Haynes Blue Stem 169, Glyndon Fife 163, and Kitchener C. I. 2153 showed greatest resistance.

In the supplements of the Federal Plant Disease Survey various observations are reported. Thus Valteau⁵ noted that later varieties show less scab than early ones in Kentucky. Tehon⁵ found that the affected varieties in Illinois for 1923 were Red Wave, Fultz, New Columbia, Fulcaster, Turkey 10-110, Turkey Red, Marquis and Red Cross, whereas there was no infection on Illinois No. 1. Weniger⁵ observed that early maturing varieties in North Dakota like Prelude were more commonly affected with scab than later ones, while Evans⁵ in South Dakota reported scab to be most severe on Durum. In 1924, Young⁶ observed Marquis to be unusually heavily infected in Illinois.

Christensen and Stakman² have recently published a note regarding the susceptibility of wheat varieties and hybrids to scab in Minnesota in which they present a summary of six years varietal tests of 250 varieties of *Triticum* spp., and a number of selections of crosses in relation to artificial inoculation with the scab organism. They suggest that there are probably different parasitic strains of the causal organism. The varieties cited in their abstract are all spring wheats.

In general, more experimental work is needed to determine the relative resistance and susceptibility of winter wheat to scab infection, especially experiments extending over a long period of time under different seasonal conditions. The possibility of the existence of a number of different strains of the causal organism should be further investigated inasmuch as varieties of wheat resistant to one parasitic strain may not be resistant to another. The relative importance of *Gibberella saubinetii* (Mont.) Sacc. and species of *Fusarium* as the causes of scab in this section of the country should be thoroughly investigated.

No attempt is made to recommend certain varieties or strains of wheat as resistant to scab. This is the function of the agronomist after disease resistant varieties have been definitely established. A number of the selections employed during the 1924 and 1925 tests give promising results and special emphasis is to be made regarding the experiments of these two years because of the greater number of replications of the various selections.

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