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THE EARLIEST KNOWN EPIPHYTOTIC OF RUST
IN IOWA¹

MARIE A. CORKLE AND I. E. MELHUS

It is the purpose of this paper to call attention to a rust epiphytotic in 1858, which apparently has been overlooked in the study of plant disease prevalence in Iowa. Early Iowa agricultural records and newspapers contain numerous reports of the calamitous wheat and oat failures caused by rust in 1858, yet this rust year has not been reported in any scientific publication from Iowa. Miss Hamilton², who summarized material regarding a rust epiphytotic that occurred in 1878 in southern Minnesota, northern Iowa and Wisconsin, likewise makes no mention of the epiphytotic of 1858.

The wheat and oat crops of 1858 were generally reported as failures throughout the state. The secretary of the Iowa State Agricultural Society³ reported in 1858 as follows: "The past has been a year of great discouragement to the Agriculturist. One of our staple productions, wheat, has been cut off—thousands of fields of the greatest luxuriance and promise, afforded only disappointment when entered by the sickle of the reaper, and consequently thousands of plans for adding some additional comfort or convenience to the homestead, or of enlarging the area of his broad acres, has been abandoned till another season shall bless the farmer with a more abundant harvest. These disappointments have not been confined to the agriculturist, but have been, and are now being felt in every pursuit and department of life, and whatever may be the plans of pseudo political economists for affording relief in the present monetary embarrassment, they can only end in disappointment if not based on the productions of the earth. If a kind Providence had favored us with abundant crops the past year, it is probably not going too far to say Iowa would have been in a more prosperous and independent position today than she has ever been."

The following statement is made concerning the census taken in 1859⁴: "The great current of immigration, which had poured

¹ Journal Paper No. J-883 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 450.

² Hamilton, Laura M. Stem rust destructive to spring wheat in 1878. U. S. D. A., Bur. of Ent. and Pl. Quar., Div. of Pl. Dis. Control. (Unnumb. Pub.) 11 pp., May 1939. (Mimeographed).

³ Iowa State Agricultural Society Annual Report. 1858.

⁴ Census of Iowa, 1836-1880.

such myriads of population into the state, has been entirely checked. Indeed, to some extent, people were actually leaving Iowa, seeking new homes in the South, which was not so seriously affected by the prevalent monetary stringency. The figures showing the agricultural productions for 1858 give a reason for this movement. These figures bear evidence of the calamitous extent of the crop failure of 1858, the most extensive and disastrous that has ever visited Iowa. The seasons of 1855 and 1856 had been very fruitful, and prices ruled exceptionally high because the Crimean war had cut off Russia from the markets of western Europe. The great yield and the high prices combined to cause a vastly increased acreage in 1857. But the crop of wheat was a comparative failure that year, owing to protracted rains about harvest time; while the close of the Russian war materially lowered the price of what was produced. The financial panic of the fall of 1857, with the exception of that of 1837 was the most widespread and disastrous the country has ever experienced, coming between the partial crop failure of 1857 and the complete one in 1858 in Iowa, all conspired to retard the growth of the state."

The wheat and oat yields for 1858 and also those available for several preceding and subsequent years are presented in Table 1. The wheat yield was conspicuously lower in 1858 than during

Table 1. The yield of wheat and oats in Iowa in certain years from 1855 to 1868a.

	1855 b	1858	1859	1862 c	1864 d	1866	1868
All wheat—acres	388,080	779,909		1,149,836	944,452	1,057,330	1,804,504
Spring wheat—acres	346,966	750,719		1,098,998	827,487	980,905	1,730,590
Fall wheat—acres	41,114	29,190		50,838	116,965	73,425	73,914
All wheat—bushels	5,469,516	3,293,253	8,449,403	8,795,321	8,285,565	14,635,520	17,963,555
Spring wheat—bushels	4,972,639	3,090,049		8,052,684	7,175,784	13,912,368	16,823,520
Fall wheat—bushels	496,877	203,204		742,638	1,108,781	723,152	1,140,035
All wheat—bu. per A.	14.09	4.2		7.7	8.8	13.8	10.0
Spring wheat—bu. per A.	14.33	4.1		7.4	8.7	14.1	9.7
Fall wheat—bu. per A.	12.86	7.0		14.6	9.5	9.8	15.4
Oats—acres	190,922	315,573		336,137	577,540	504,361	657,007
Oats—bushels	6,127,329	1,703,760	5,887,645	7,582,062	15,928,777	15,861,494	18,596,625
Oats—bu. per acre	32.09	5.4		22.6	27.6	31.4	28.3

a Data taken from the Census of Iowa, 1836-1880.

b For want of returns, the yields in Sac, Warren and Woodbury Counties are not included.

c For the above reasons, Buena Vista, Clay, Emmet, Ida, O'Brien and Sioux Counties are not included.

d For the above reasons Buena Vista, Clay, Ida, O'Brien and Sioux Counties are not included.

any of the other years. While the acreage in 1858 was approximately twice that planted in 1855, the number of bushels produced was slightly greater than half the number harvested in 1855. In 1858 the yield per acre was only 30 to 54 percent of that of the other years presented.

Of the many county agricultural societies that reported on the wheat yield, all reported either total failures or poor yields ranging from one-third to one-fourth of the usual crop, with the exception of Van Buren and Woodbury Counties, which referred to "medium" and "fair" yields respectively. Oats were frequently recorded as a total failure or seriously injured. Many fields of wheat and oats throughout the state were left uncut, not being worth the expense involved in harvesting.

The following reports by the various county agricultural societies were taken from the Annual Report of the Iowa State Agricultural Society for 1858:

Henry County. "Wheat—The yield this year will fall short of the usual average; almost an entire failure upon prairie soils, four bushels per acre is full measure; timber land, eight. John Shafer, of Marion Township, on timber land, raised eighteen bushels per acre of Mediterranean. Some of his nearest neighbors did not harvest a bushel. Hundreds of acres, on prairie land, would not pay for cutting. Oats is a total failure."

Mahaska County. "We have nothing to report on grain crops this year, as they have proved to be almost an entire failure; perhaps we have about half of an average crop of corn. Our wheat and oat crop was, with but few exceptions, left standing in the field without cropping."

Marion County. "Our crops this season are very light, especially wheat and oats, which were almost an entire failure; corn on the rolling lands is perhaps an average crop; but on the flat lands, it is very poor, owing to the very wet season. Oats have been an entire failure this season, in our county."

Monroe County. "Wheat—The crop of 1858 was almost an entire failure. The only variety that did tolerably well was the 'Black Sea'; some fields of this variety yielded fifteen to twenty bushels per acre. Oats—With the exception of a few very early sown pieces, were an entire failure."

Scott County. "The wheat crop this year is almost a total failure. I say failure, for a large portion of it little more than pays for harvesting and threshing, while much of it falls short of that. From one-fourth to one-third of the number of acres

sown, were not harvested. Several pieces that were harvested and threshed, (which came under my observation), fell short of two bushels per acre, while but very few produced more than eight or ten bushels; so that I am confident, of the whole amount sown, the average yield cannot exceed five bushels per acre, and will probably fall short of that; and that little of very inferior quality."

Union County. "Wheat and oats generally were failures here this season. Some pieces of 'May' and 'Black Sea' wheat were half crops."

Wheat and oat losses were most frequently attributed to rust and weather conditions, with occasional mention of blight and scab. The following reports were taken from the Annual Report of the Iowa State Agricultural Society:

Appanoose County. "Wheat this season was almost a total failure, owing to the rust."

Black Hawk County. "The crop of small grain was almost a total failure. The average yield (of wheat) is not more than seven or eight bushels per acre, while some will not yield more than four or five. Scarcely one field of oats in fifty was cut. Much of the crop was blighted by rust, and the general effects of the exceedingly wet season we have had."

Dallas County. "Wheat has been nearly a failure because of the rust, attributed to the incessant spring rains. Oats, a failure, caused by the rust. Not an acre harvested to my knowledge."

Davis County. "Here, as elsewhere throughout the state, our small grains, except in occasional instances, were a total failure. We had an unusual breadth of these grains sown, throughout the county, and the early prospect of much of it was very fine. But unfortunately, the rust was general and effective, so that perhaps three-fourths of our crop was not harvested."

Harrison County. "The wheat crop this year was small—probably one-third crop. Failure caused by rust."

Jasper County. "Wheat and Oats were almost a total failure this year, owing, I believe, principally to rust."

Jefferson County. "The crop of cereals in this region, may be put down as a grand failure. We have been over nearly every section of the county, and noticed vast fields of wheat and oats uncut. One field of fall wheat, estimated to bring twelve hundred bushels, or forty bushels per acre, when cut and threshed brought not quite three hundred bushels. In all our acquaintance, we hear of but one field of oats that was harvested; and that was sown

during the fine weather in April, long before the frost was out of the ground. Our wheat crop failed on account of the rust."

Johnson County. "The wheat crop raised in the county the past year will not exceed one-fourth the amount of former years. More wheat was put in the ground, but the failure was owing to rust."

Jones County. "Wheat—This crop proved almost a total failure; thousands of acres not being touched, save by the 'torch'. The cause of the failure is attributed to the rust. Oats—A perfect failure—doubtful whether enough was raised, at any rate saved, for seed—cause of failure, the rust."

Keokuk County. "The crop of wheat in the county this year, will average about five bushels to the acre. The cause of failure of the wheat crop is attributed to the extreme wet spring and summer, causing it to rust and blight. Our oats this year is nearly an entire failure, caused by rust, or blight."

Kossuth County. "In this county but very little wheat was raised this year, it being killed by wet weather and rust. The majority of fields were not cut, some have a small crop, while I have heard of but one full crop in the county; but our farmers are not discouraged, and will try again."

Louisa County. "The present year has presented many discouragements to the more liberal tastes and impulses of our farmers. While all the avenues of society have felt the extreme pressure of the universal 'hard times', the farmer, though usually beyond the reach of commercial crisis, in a great measure, has suffered the additional calamity of a serious failure of his crops. Wheat has been even a poorer crop than corn, yielding not more than four bushels to the acre, failing from the same general cause, developing itself in rust and scab, or spot. Oats, with us, may be put down a total failure, the principal apparent cause being rust."

Mills County. "Our wheat crop the past season was much effected by rust; indeed, many fields were not harvested at all; yet it is believed that our county contains enough for the bread of the present inhabitants, including what remains on hand of last year's crop. Oats has invariably been excellent, in this county, until the past season, when it was so much effected by rust that it was comparatively a failure."

Muscatine County. "Wm. Lundy, residing in the northern part of the County, says: "Our wheat crop is almost a failure. Cause, the wet weather." A. Cone, Esq., residing in the western part

of the county, says as the cause of the failure—"Black rust, and that one-fourth the wheat raised in this vicinity, is fall wheat." Oats, an entire failure. Cause wet weather and rust."

Poweshiek County. "The wheat crop is nearly an entire failure this year (1858), caused by the rust, and what is known here as the scab."

Wapello County. "Our wheat crop this year was almost a total failure. Probably more than half the crop in the county was not harvested at all, and much of that which was, I should think, did not pay the expense of harvesting. The cause of failure was rust. There was a fine growth of straw, and the crop promised an abundant yield, both of fall and spring varieties, until struck with rust."

Washington County. "Wheat crop failure. Cause, rust. Oat crop a failure this year. Cause, rust."

Wayne County. "Wheat was almost an entire failure, from the effects of the rust and scab. There were a few pieces of bearded wheat that was probably half a crop. The smooth wheat was an entire failure. Oats this year are an entire failure, from the rust."

Webster County. "Wheat was almost a total failure, there not being more than about six or eight hundred bushels raised in the county. The greater part sown was not harvested. There has not been any fall wheat raised in the county to any extent."

"Oats have generally yielded from thirty-five to fifty bushels per acre. This year almost a total failure, caused mostly by the wet and rust."

Newspapers published during this year of destruction were filled with reports stressing the severity of the rust epiphytotic. Some of these accounts follow:

The Democratic Clarion (Davis County), July 12, "The crops this spring are not so promising as we would like. The fall wheat is very much injured with rust, and some fields will not be cut. Oats are somewhat injured, also. We have a very good prospect for corn considering the wet season." Apparently the epiphytotic was not confined to Iowa, as the article also stated that "The complaint of rust, blight, and weevil extends throughout the wheat growing portions of the country, including Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri and Iowa. The appearance of great abundance, which was promised early in the season, was

followed by a lean harvest of half a crop; which has greatly discouraged farmers."

This same publication on July 28 warned farmers not to turn their stock into rusted oat fields even though they did not intend to harvest the crop, saying that, "We learn that a farmer in Union township in this county has lost three horses, said to have died from having been turned into a field of oats so badly rusted as not worth harvesting. It is supposed that oats which have suffered from this terrible blight is a powerful poison to all animals which feed upon them while on the straw." A note in the August 4 issue summarized the crop loss as follows: "From every part of the State, and indeed throughout the entire West, there is but one story in regard to the crops. The present season has been one of the worst that has occurred since the settlement of the country. Not more than half the usual crop of wheat has been harvested, and oats are almost an entire failure."

Iowa Democratic Enquirer (Muscatine County), July 15. "We hear the worst tidings about the wheat crop in this county. Many fields are entirely ruined with the rust. Thousands of acres will not pay for cutting. Oats, too, are in the same condition. We hope that these reports may in some cases prove groundless."

Hamilton Freeman (Hamilton County), July 22. "We are sorry to learn that a good deal of wheat in this portion of the state was struck with rust last week, and that quite serious damage will be done to the crops thereby. An intelligent farmer at our shoulder says that not more than half a crop will be harvested." July 29.—"It is not to be concealed that the wheat crop of this State is little better than an entire failure. In this County there are whole fields, which will not pay the expense of cutting. Oats are nearly destroyed by the rust. If we are to have short crops during the present season of business prostration, we shall see the hardest times next winter that we have yet dreamed of. Rust has seriously affected the wheat. Oats will not yield half a crop. Clouds, storms, and rain, came when dry, clear weather was confidently anticipated. Their stay was protracted beyond anything hitherto witnessed in Iowa. The emerald green of the grain stalk disappeared. It became black and shrivelled. The rust with its usual train of evil omens, destroyed in a few days, thousands of acres of beautiful grain. The disease has spread, like a pall, over neighborhoods, counties, and—we almost fear—whole States."

Many reports contained in the 1858 report of the Agricultural Society indicate that the season was one of excessive rainfall, which would create a favorable environment for the development of a rust epiphytotic.

Allamakee County. "The wheat crop this year was a complete failure, supposed to be caused by very warm weather and wet weather about the time of filling."

Boone County. "The crop of wheat raised this year was very limited; probably not more than one-fourth as much as last year. The late and unprecedented rains of spring very materially injured its growth, and the continued foul weather during the time of harvest, damaged it to an incalculable extent."

Bremer County. "Wheat.—The crop was almost a total failure. The yield did not exceed, on an average, seven bushels per acre, and inferior at that. The cause of the failure, were too numerous rains, causing rust, which destroyed the crop. Many fields looked fine in straw, but were unfilled."

Buchanan County. "Our wheat crop was very light this season, in consequence of wet weather."

Fayette County. "Wheat.—Of this there was not more than one-fourth of a crop. The principal cause of the failure was too much rain. Oats.—The crop was almost a total failure the present season."

Jackson County. "The wheat crop in this County, the present year, was very light; probably not more than one-third of a crop; generally considered almost a failure; caused, probably, by the large amount of rain that continued to fall through the season, till the grain was nearly matured, and the extreme heat while ripening. The average per acre of spring wheat, is about 8 bushels. Oats this year, a failure. Average crop, 12 bushels per acre; average weight per bushel, 20 lbs. Of not much value for feed; will vegetate readily, and are of not much value, except for seed."

Madison County. "This year the oat crop, like the wheat, is almost an entire failure, owing to wet weather."

Marshall County. "Wheat.—Our crop the past year was comparatively a failure. A few fields yielded fifteen bushels per acre, but the whole crop will not average five bushels per acre. The cause of the failure is generally attributed to the effect produced by the excessive amount of rain which fell during the season. Oats.—The common varieties are cultivated; the crop was a

failure this year, in many sections total. The yield per acre has generally been, heretofore, about fifty bushels."

Lee County. "Spring wheat (which is the principal kind sown) proved almost an entire failure; not a fourth of the ground sown in wheat being harvested. That harvested yielded from four to ten bushels per acre, of poor stuff. Fall wheat, though but little cultivated in this county, did better, yielding about half or two-thirds of a crop, of rather poor wheat. The excessive rains throughout May and June is supposed to be the cause of rust. On the first of July spring wheat looked unusually well, and promised a heavy yield. Oats.—An entire failure from rust."

Linn County. "Wheat failed on low land this season, owing to the unusual amount of rain last spring."

Polk County. "There has been a failure the past season of the wheat crop in our county, attributed to the great amount of rain and rust. The oat crop of this county for the past season, may be considered a failure. The same cause named as affecting wheat, has seriously affected the crop of oats."

Pottawattamie County. "Wheat, one-fourth crop; cause of failure, wet. Oats a failure; cause, wet."

Winneshiek County. "The crop of wheat this season is very light, probably not more than one-third of the ordinary yield; and I think will not average over eight bushels per acre. The cause of the failure is doubtless owing to the excessive rains."

Weather data for various parts of the the state during the late spring and summer months of 1858 are presented (table 2) which show that the season was very wet, particularly July. The reader should bear in mind, however, that even though most of the work was supervised by the Smithsonian Institute, the best methods for making observations had not yet been determined.

Table 2. *Precipitation and average temperatures at various stations in Iowa during May, June, July and August, 1858.*

Stations	Total precipitation in in.				Ave. monthly temp. in degrees C.			
	May	June	July	August	May	June	July	August
Bellevue	9.59	6.66	6.61	2.54	55.9	71.8	73.5	71.5
Fort Madison	8.10	6.36	5.90	1.59	57.9	74.2	76.2	—
Dubuque	8.23	4.86	8.69	1.37	56.2	72.9	73.5	72.3
Iowa City	8.17	4.55	8.74	2.52	56.3	72.0	74.4	72.9
Monticello	7.97	6.63	6.21	4.18	62.5	69.0	73.1	67.0
Muscatine	8.40	6.67	7.30	4.12	54.3	70.6	78.8	79.9
Pleasant Plain	9.70	8.20	8.60	2.97	57.5	74.1	74.5	72.8
Sioux City	3.30	4.72	7.42	6.07	54.1	70.6	72.6	70.4

Reports from Muscatine⁵ state that during May the rainfall was "2.87 inches greater than the average. A very wet month—

too wet for plowing, so that the farmers were very much put back with their work." In June the month was very wet, "1.25 inches more than the average," in July "rains almost uninterruptedly, 7.30 inches, the average being only 4.35 inches."

⁵ See footnote 3.

Very little fall wheat was planted in Iowa at this time because of the general opinion that spring wheat was more productive. Canada Club and Wild Goose were among the leading varieties of spring wheat that were cultivated. Other varieties less extensively planted were Rio Grande, Scotch Fyfe or Scotch Club, Tea, Black Sea, Golden Chaff, Big White, Goose, Club, Bald Red Chaff, Hedge Row, Red River, Fife, White Genesee, White Flint, Spring White, Red Chaff Bearded, Mediterranean, Chintz-proof Mammoth, Golden Drop, and May.

Apparently some thought was given to the introduction of new varieties that might prove to be more productive in this state. The following account was included in the report from Lee County⁶: "Under the impression that our wheat is running out, and needs renewing from a different soil and climate, considerable effort is being made just now to introduce new varieties. This fall, the writer has obtained some Canada Club from Northern Iowa, and Scotch spring wheat from Minnesota. The latter variety is said to have yielded well in Minnesota, the present year, being entirely free from rust and smut, while other varieties were destroyed by rust, as with us. Our present variety, the Wild Goose, was introduced into this neighborhood from Canada, about 1845 or 1846, a returning Canadian bringing about a quart of seed at that time. Up to 1851, it brought as high prices and made as good flour, as fall wheat. From that time it has been sensibly deteriorating, but was not known to rust until 1856."

⁶ See footnote 3.

SUMMARY

The wheat and oat crops failed throughout Iowa in 1858. The majority of reports attributed the loss to rust. That rust was the general cause of the great reduction throughout the state is evidenced by the fact that those counties attributing the loss to unfavorable weather, scab or blight were, in most instances, adjacent to counties that reported rust. The season was unusually wet, particularly July, which would certainly provide very favorable conditions for a rust epiphytotic. Spring wheat was grown exten-

sively in 1858, and it has long been known that spring wheat frequently suffers from rust in this state. There is no way of knowing definitely which rust or rusts were present, but the fact that rust occurred on wheat and oats would suggest stem rust rather than leaf rust.

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