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The Barberry

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The Barberry

Is the Spring Host for;

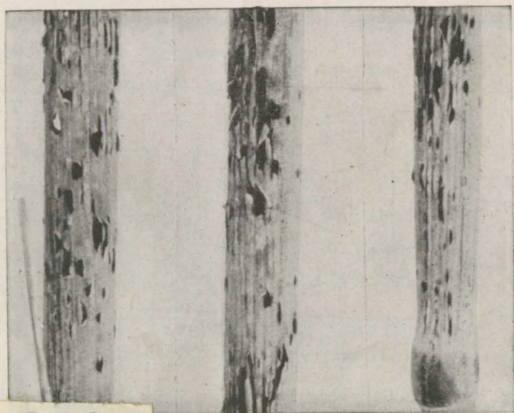
Is the Base for Early Spread of;

AND

Is the Place of Origin of Races for

Stem Rust

of small grains and grasses



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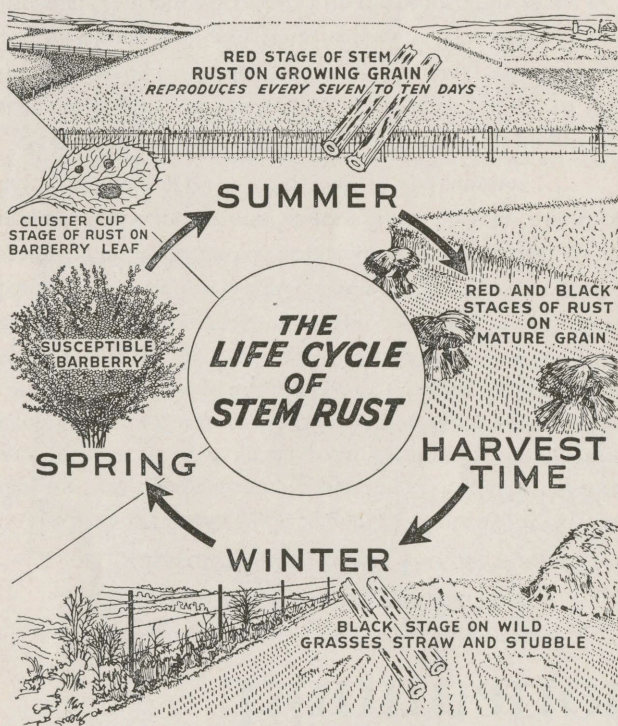
Extension Service
South Dakota State College---Brookings
Department of Agriculture Cooperating

Barberry Serves As Spring Host For Stem Rust

In the upper Mississippi Valley, stem rust overwinters only in the black stage on wild grasses, grain straw and stubble. Spores formed from the black stage cannot infect growing small grains and grasses, but can infect barberry. The rust spots on barberry leaves in turn develop spores which can infect small grain. *Rust-susceptible barberry bushes, therefore, are the only means by which the overwintered black stage of stem rust can become established on the green growing grain crop in South Dakota.*

In the spring, tiny spores become detached from old straw and dead grasses and are blown about by air currents. Those that fall on barberry leaves germinate and grow into the leaf to form orange-colored rust spots. Each spot produces millions of orange spores which in late May and early June are shed from the barberry leaves and drift in the air currents like particles of dust. Many fall on the stems and leaves of small grains and grasses. These grow into the stem and leaf tissues and produce tiny brick-red spots. Many thousands of rust spores are produced every few days in these spots.

As grain reaches maturity, the black stage is formed on the ripened straw and grasses. In this stage the fungus lives over the winter and is ready to infect barberry bushes again the following spring. Stem rust infection on barberry has been observed in 46 South Dakota counties.

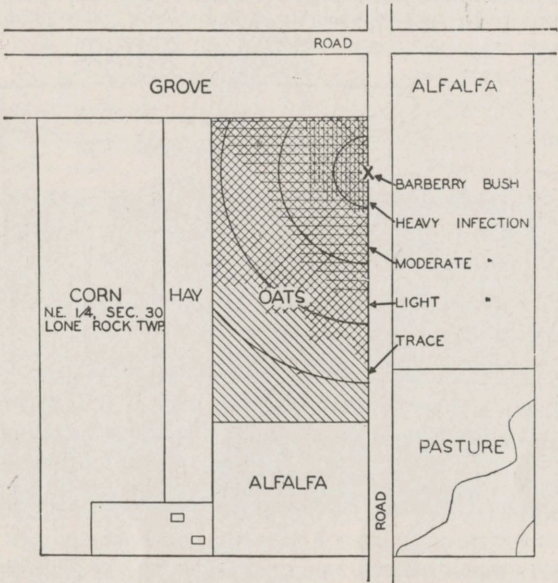


Stem Rust Spreads From Infected Barberries

Infection of barberry leaves usually takes place during warm wet weather in the spring. Young tender barberry leaves are very susceptible. Within two weeks, rust spots on barberry leaves are shedding spores. Therefore small grain and grass plants growing near rusted barberries become infected early, and finally are damaged severely, by stem rust.

Once on small grain, stem rust may spread from grain plant to grain plant across an entire field or even be carried by winds to other fields and other areas, sometimes several miles distant.

There are detailed records of 44 such spreads of stem rust from barberry bushes in South Dakota.



A spread of stem rust from a barberry bush in Moody County. When this situation was discovered there was a heavy infection of stem rust on oats growing near the bush. The severity of infection dwindled to a trace about 80 rods away, and other oat fields in the locality were nearly free of stem rust. This spread occurred in 1926.



This small barberry bush along the fence was the center of spread of stem rust to the adjacent oat field outlined in the above diagram.

Races of Stem Rust Originate and First Maintained on the Barberry

It has long been known that races of stem rust differ in their ability to infect varieties of small grains. Only recently has it become increasingly evident that the origin of these races is almost exclusively on the barberry. Races are produced by hybridization of the rust on barberry leaves, before any spores are shed from the spots. There are usually a greater number of races on grain and grasses close to barberry bushes than in areas where no barberries occur. In areas where barberries are infected, races are often found which do not exist elsewhere. There have been identified 189 races of stem rust that can infect wheat, 13 that can infect oats and 14 that can infect rye. Some of the races that can infect wheat and rye also infect barley.

The existence of races, and their rise and fall in prevalence, accounts in part for the variation in stem rust resistance of small grain varieties from season to season.

This possibility is well illustrated by the rise to prominence of race 56 of wheat stem rust and the consequent failure of Ceres wheat in the eastern spring wheat area in 1935.

Race 56 was first identified from wheat stem rust collected near barberries in Nebraska and Iowa in 1928. It apparently was perpetuated in the northern states (where stem rust develops in the spring only on barberries) for at least five years before it appeared in Texas and become established in northern Mexico. It was not until 1934 that race 56 became generally prevalent. In 1935 it was the predominant race and was largely responsible for reducing the wheat crop of South Dakota by an estimated 29% and the Minnesota and North Dakota crops by more than 50%. In 1935 Ceres wheat was a failure in eastern South Dakota because of stem rust; prior to 1935 it had been stem rust resistant. Except for 1941, race 56 has continued to be the most prevalent race of stem rust.

THERE ARE MORE THAN 200 KNOWN RACES OF STEM RUST

THESE ARE DESIGNATED BY NUMBER AND DIFFER IN THEIR ABILITY TO ATTACK VARIETIES OF SMALL GRAIN

When Races Hybridize on the Rust Spreading Barberry Bush



Races Can Be Produced That May Attack Varieties of Grain Now Considered Resistant

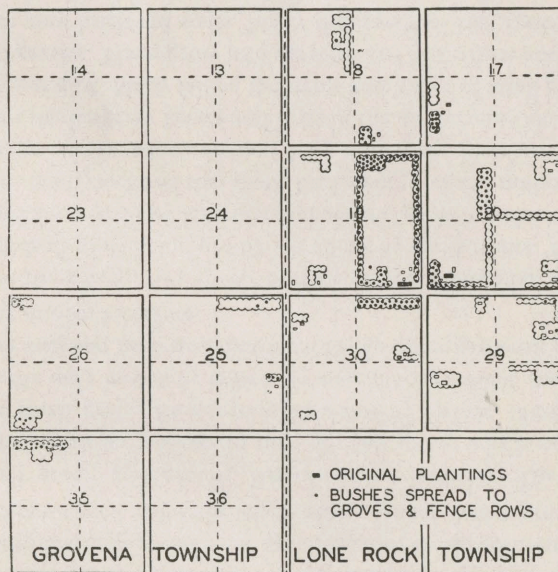
HYBRIDIZATION OCCURS ONLY ON THE BARBERRY

Elimination of Stem-Rust-Susceptible Barberries

History of the Barberry and Barberry Eradication in South Dakota

The barberry was brought to South Dakota by the early settlers for hedge and ornamental plantings. Originally the shrub was introduced to America from Europe by the colonists. From the early plantings made in South Dakota, and those that continued to be made until as late as 1917, the seed of the barberry was spread by birds and other agencies to windbreaks, orchards, wooded areas, tree claims, pastures, along stream banks and fence lines, where bushes grew and continued to spread. The barberry has been found growing wild on 395 properties distributed over eastern South Dakota. The shrub has been found in 59 of South Dakota's 69 counties.

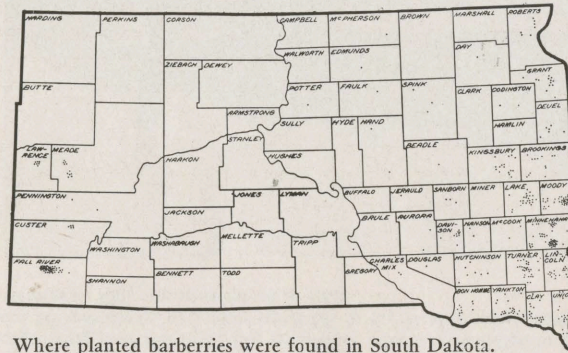
South Dakota, in 1917, was the first of 20 grain-growing states to require the eradication of barberry bushes. In 1918, the 13 states of Colorado, Wyoming, Montana, North Dakota, South Dakota, Nebraska, Iowa, Minnesota, Wisconsin, Illinois, Indiana, Ohio and Michigan, with the cooperation of the U. S. Department of Agriculture, undertook the elimination of rust-susceptible barberries from within their borders. The states of Missouri, Pennsylvania, Virginia, Washington, and West Virginia have more recently undertaken such a program.



Map showing where barberry bushes had grown from seeds scattered by birds from a hedge of planted bushes in Moody County, S. D.

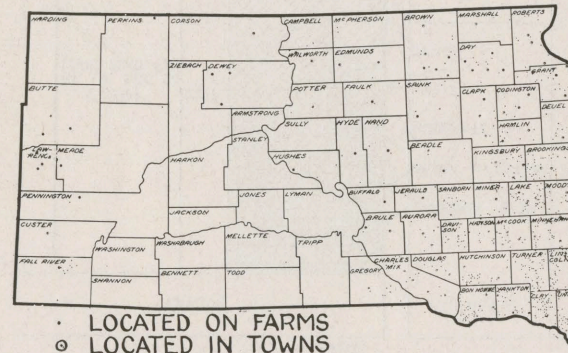
Where Barberries Have Been Found in South Dakota

Ornamental and hedge plantings of barberries were most numerous in eastern South Dakota. That section has long contained the most people and is the area where such plantings were likely to be successful and somewhat permanent.



Where planted barberries were found in South Dakota.

Many barberries have been found in places where they obviously had not been planted. Older bushes produce berries and seed in abundance. The fruit is eaten by birds; as a consequence the seeds become widely scattered. In areas favorable to seedling growth, seedlings may become established as much as two miles from seed-bearing bushes. Such "escapes" have been numerous in eastern South Dakota where the most bushes were originally planted and where rainfall is most abundant.



Where "escape" barberries have been found in South Dakota. Each dot represents a farm or town property on which barberries were found growing wild from seed apparently scattered by birds.

Where Remaining Bushes Are Likely to be Found

All of the known rust-susceptible barberry bushes originally planted in South Dakota have been destroyed. All of the "escapes" thus far found have likewise been destroyed. However, the seed may lie dormant in the soil for ten or more years and young seedlings sometimes go unnoticed. Therefore there are likely to be a few remaining "escape" bushes, particularly in the area where reproduction has been common, and an occasional planted bush that may have been overlooked. (Several small "escapes" were found in Turner county in 1943.)

How Barberries Can Be Destroyed



Crushed rock salt, 10 pounds per square foot of crown area, effectively destroys the entire barberry plant.

The stem-rust-susceptible barberry develops an extensive root system and an abundance of underground stems that arise from the roots and from the crown. These underground stems may develop into new bushes. This characteristic makes it necessary to kill all the underground parts of a barberry bush to assure its destruction.

Crushed rock salt at the rate of 10 pounds for each square foot of crown area will kill barberry bushes. In yards or pastures where the use of salt constitutes a hazard to livestock or poultry, kerosene is equally effective. The kerosene is applied at the rate of one gallon for each square foot of crown area.

Salt and kerosene will likewise kill or injure shade trees, shrubs, and grass. To kill barberries in lawns or gardens, digging is effective if all underground parts of the plant are removed.

Progress in Destruction of Stem-Rust-Susceptible Barberries

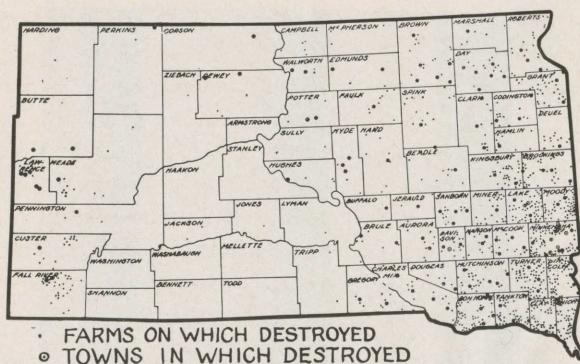
About 87 percent of South Dakota's total area is believed to be free of barberries. Since the eradication program began in 1917, 136,001 barberry bushes located on 1,494 properties have been destroyed.

First to go were bushes in large ornamental and hedge plantings, which obviously were serving as stem rust dissemination centers and producing quantities of seed.

Wherever a planting has been destroyed, the immediately surrounding area has been carefully inspected for the presence of "escape" bushes. Each locality in which barberry bushes have been destroyed is reinspected to be certain the bushes have been killed and to find bushes that may have grown from seed.

In many sections of the state there has been a close inspection of virtually every square rod of uncultivated territory where brush and trees were growing. Many of the barberries found as the result of this intensive type of inspection have been isolated and widely scattered along fence rows, streams, ravines, river islands, timber claims, canyons, and in other uncultivated places.

In some parts of Fall River, Custer, Lawrence and Meade counties rust-susceptible barberries are known to occur, but eradication activities have thus far not been adequate to assure their elimination. There are likewise about 1,200 square miles of farm area in the eastern and southeastern parts of the state which need careful reinspection for the presence of recently developed "escapes." In some cases, not enough time has elapsed since the destruction of bushes for seed to germinate and bushes to grow to a recognizable size.



Where barberries have been destroyed in South Dakota since 1918.

Losses from Stem Rust Decline

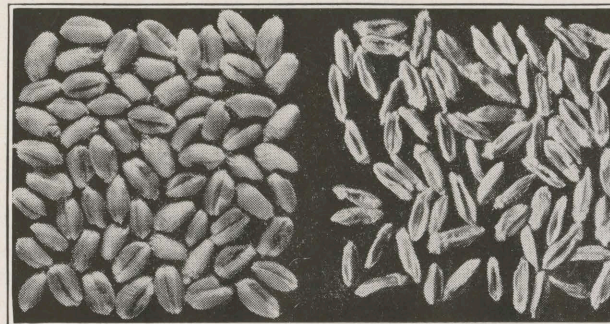
Annual stem rust damage to South Dakota small grains during the period, 1916 to 1929, has been estimated at an average of 8,358,000 bushels, whereas for the next 14 year period the average annual loss has been estimated to be 1,398,000 bushels.

This stem rust control is the result of:
Elimination of rust-susceptible barberries.

The barberry serves as a spring host for stem rust. In so doing it serves as a base for early spread of the disease and functions in the formation of races.

Development and adoption of resistant varieties.

The South Dakota Agricultural Experiment Station and the U. S. Department of Agriculture, and experiment stations in adjacent states are constantly testing and developing varieties of small grain resistant to stem rust and other diseases. In parts of South Dakota, particularly the eastern half, where



From healthy plants From rusted plants
 Heavily rusted small grain plants produce unfilled shrivelled kernels.

stem rust is a major problem, such varieties are likely to be superior. The county agent has reliable local information.
Insuring early development and maturity of small grains.

Generally, the earlier a grain field matures the greater are its chances of escaping damage from stem rust. Seeding spring grains just as early as the soil can be properly prepared and seeding fall grain as nearly as possible in accord with the recommended seeding dates, aids in assuring an early maturing crop.

In the 13 Upper Mississippi Valley states where these control programs and practices have been under way for 25 years, average yearly losses from stem rust have been cut about in half. In South Dakota, the average yearly loss has been reduced about 75 percent.

This leaflet was prepared by Dr. W. F. Buchholtz, plant pathologist of the South Dakota Agricultural Experiment Station, at the request of the Agricultural Extension Service. Detailed factual material and illustrations assembled and made available by the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Eradication of the rust-susceptible barberry from all of South Dakota is a cooperative enterprise involving the State of South Dakota and the U. S. Department of Agriculture. The individual may assume his share of responsibility in this program by reporting the suspected presence of barberry bushes to the County Extension Agent or to the Barberry Eradication Office, South Dakota State College, Brookings, South Dakota.

Other Areas Serve As Stem Rust Source

Sometimes rusted grain in Texas and northern Mexico is the source of rust which eventually reaches small grain in South Dakota. In the southern United States, grain crops mature early and rust development and ripening is progressively later as the season advances northward. Occasionally when moisture, temperature and crop conditions are favorable, rust spores are carried into the air above the fields and drift northward with the wind. These spores settle very slowly, and thus may be carried long distances. Usually this northward spread of rust is by progressive stages and the first infection of grain in South Dakota by stem rust from states to the south occurs later than infection by spores from local barberry bushes.

Stem rust spores blown in from states to the south are the cause of serious rust outbreaks in South Dakota when: (1) viable stem rust spores are carried into the state in large quantities by winds, (2) the races of rust blown in are capable of seriously injuring the varieties of grain grown in South Dakota, (3) the state's grain crop matures later than normal, and (4) the above conditions are accompanied by weather favorable for the rapid development of stem rust. It is not very often that all these conditions prevail in the same year. There have been only two really bad "stem rust years" in South Dakota during the last 15 years.

There Are Other Cereal Rusts

Stem rust is not the only rust of small grains. In South Dakota each small grain is afflicted also with its own particular leaf rust, each of which does considerable damage. Stem rust pustules are long, brick red, and occur primarily on the stems and leaf sheaths. The leaf rust pustules are short, orange red, and occur primarily on the leaves and leaf sheaths. All small grain rusts are first red and later black, and do their damage in the red stage. When they become black the straw is ripening and the damage has been done.

Only stem rust infects the barberry.

Barberry the Only Shrub That Spreads Stem Rust

Only the rust-susceptible barberry can be infected by the stem rust fungus. No other shrub in South Dakota, native or planted, is susceptible to stem rust.

TWO KINDS OF BARBERRY

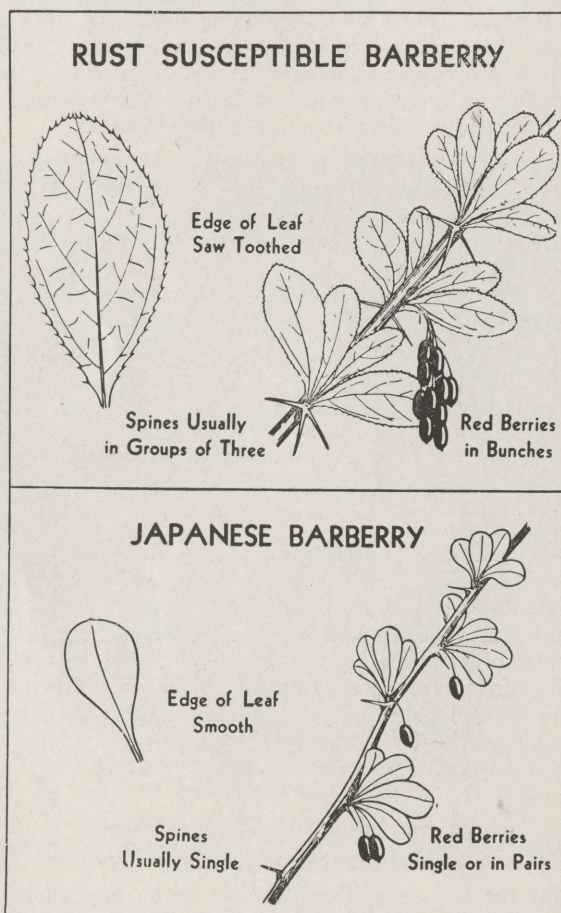
Common In South Dakota

- (1) The stem-rust-susceptible barberry (*Berberis vulgaris*).
- (2) The Japanese barberry (*Berberis thunbergii*).

Of these two, the stem-rust-susceptible was commonly planted until 1917, when because of its susceptibility to stem rust, further planting of it was prohibited by law.

The Japanese barberry is not susceptible to stem rust and has more recently been planted extensively.

Characteristics of Rust-Susceptible and Japanese Barberry



Certain other barberry species are certified rust-resistant by the U. S. Department of Agriculture and offered for sale by nurserymen.

What Is Barberry's Place in *Stem Rust Outbreaks?*

You know that stem rust periodically damages small grain crops severely in South Dakota. That happened in 1916, '19, '20, '21, '23, '27, '35 and '37.

Perhaps you wonder, "What is the role of the barberry in these rust outbreaks and to what extent has its destruction and eradication progressed in South Dakota?"

This leaflet, sent you by your County Extension Agent of the South Dakota Agricultural Extension Service, answers these questions about the barberry and stem rust in South Dakota.

UNITED STATES DEPARTMENT OF AGRICULTURE
EXTENSION SERVICE
WASHINGTON, D. C.

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