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EC1802 Reduce Black Stem Rust of Wheat, Oats, Barley, Rye

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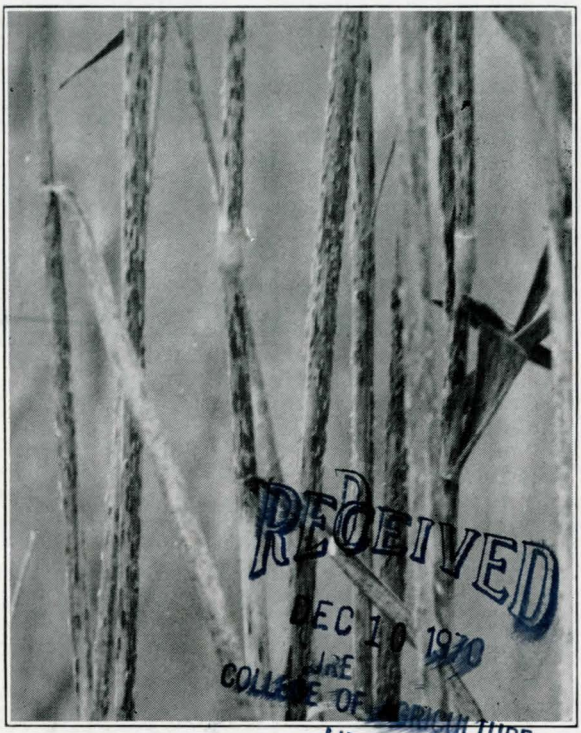

Extension Circular 1802

The University of Nebraska Agricultural College Extension Service and United States Department of Agriculture Cooperating
W. H. Brokaw, Director, Lincoln, Nebraska

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Two Important Sources of Stem Rust

1. From Barberry

In the spring, tiny stem rust spores become detached from old straw and grasses and are blown about by the air currents. Those falling on barberry leaves, under favorable conditions, germinate and grow into the leaf tissues. Soon orange-colored rust spots appear on the barberry leaves. Each of those spots in turn produces millions of spores.

During the late spring and early summer the rust spores, shed from the barberry leaves, drift in the air currents like particles of dust and are deposited on grains and many of the wild and cultivated grasses. There the fungus is capable of growing into the stem tissues, producing brick-red rust spots. Once established on the growing stems, the rust fungus produces millions of rust spores every few days. These, in turn, drift with the air currents to neighboring grain plants and fields, and serve as new centers of infection.

As the grain matures the red rust spores are replaced by black spores which remain dormant through the winter. It is only those stem rust spores which reach the black stage that are able to survive the Nebraska winter. Once the stem rust fungus has entered the black or winter stage it is incapable of again infecting the grains and grasses until it first passes through a period of growth on its alternate host, barberry. Therefore, the object in destroying the rust-susceptible barberry bushes in the northern states is to eliminate the method by which the stem rust organism is spread from the old straw, stubble and grasses of the past year to the green, growing grain of the next year.

Stem rust on barberry leaves.

Both Sources are Important

Rust development over large areas may result from spores being blown in from other crop-producing regions. Barberry bushes serve to carry over stem rust infection from the previous year, serve as centers of early infection, and as centers for the development of new strains of the rust organism. Accumulation of evidence during past years shows that barberry serves as the earliest source of infection for Nebraska.

Does more than one kind of rust attack grains?

There are several different kinds of rust that attack grain plants, the most common of which are leaf rust on wheat, leaf rust on oats, and stem rust on wheat, oats, barley and rye. It is only the stem rust of cereals that develops on the barberry.

Does weather cause stem rust?

Stem rust increases rapidly during warm, damp weather, but the disease does not occur unless spores of the rust fungus are present to cause infection.

Is only barberry known to spread stem rust?

Yes. However, not all species of barberry disseminate stem rust.

Will burning infected straw and grasses help?

It is not a practical method of stem rust control.

Will premature harvesting reduce losses?

Studies made at the Nebraska Experiment Station relative to harvesting winter wheat at different stages of maturity show that premature harvesting may lower the yield as much or more than stem rust infection. Harvesting winter wheat (free of stem rust) in early dough stage reduces the yield approximately 29 per cent, and in the late dough stage about 10 per cent, as compared with grain harvested in the ripe stage.

What can the individual do to reduce losses?

Small grain producers can reduce stem rust losses to a minimum by planting only approved resistant varieties of small grain where they are available and by eradicating all rust-susceptible barberries growing on their properties.

The value of cooperation

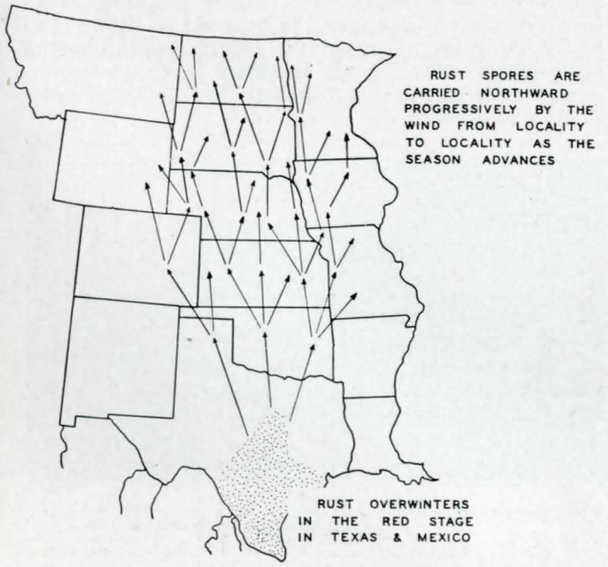
The effectiveness of stem rust control work is dependent on the extent to which growers practice recommended control measures. The more people who make sure that rust-spreading species of barberry are not permitted to grow, the more rapidly the barberry eradication project can be drawn to a successful close.

2. Blown in From Other Areas

Under certain conditions rusted grain in Texas and northern Mexico may serve as another source of stem rust infection for grain crops in the Missouri Valley. When severe stem rust occurs in the southern area the tiny rust spores are blown into the air above the fields and drift with the air currents. These spores settle very slowly, and thus may be carried long distances. Generally speaking, this northward spread of rust is by progressive stages and the first infection of grain in Nebraska from this source usually occurs later than infection from local barberries.

Stem rust blown in from other areas is important in Nebraska when: (1) viable stem rust spores are carried into the state in large quantities by winds, (2) the strains of rust are capable of seriously injuring the varieties of grain grown in the state, (3) Nebraska's grain crop matures later than normal, and (4) the above conditions are accompanied by weather favorable for the rapid development of stem rust.

Only recently it has been recognized that the high temperatures and light intensities of the southern grain-producing areas are sufficient to prevent stem rust from normally surviving the summer season in that region. Actually, this southern area is reinfected each fall by stem rust spores from northern areas drifting back into the region with the northerly winds. In Texas and northern Mexico the stem rust organism is capable of surviving the mild winter in the red, or repeating stage. From this source, rust is able to develop to an epidemic proportion in the southern area if later growing conditions are favorable.



Stem Rust Control Problems and Practices

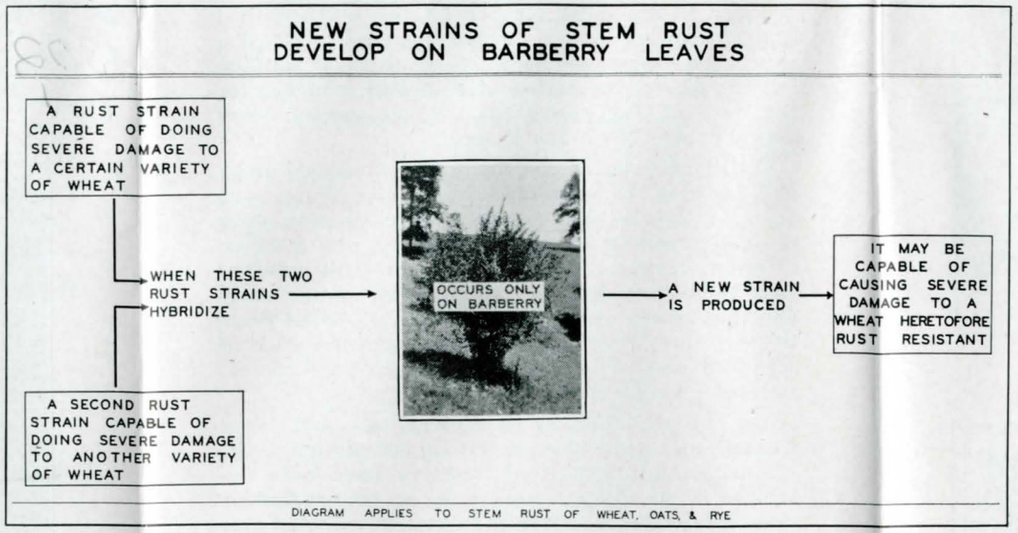
New Strains of Stem Rust Produced on Barberry

The problem of producing stem rust-resistant varieties of grain is complicated by the existence of many different strains of rust which differ in their ability to attack varieties of wheat and other grains. In addition, new strains of stem rust may be developed and old strains perpetuated through hybridization of existing strains as the rust fungus passes through the stage of growth on barberry. These new strains are not only a hazard to the grain growers of the immediate vicinity, but they also complicate the problem of the plant breeder in producing varieties of grain resistant to the commonly occurring strains of stem rust.

The reader can more easily appreciate the complexity of the task of producing varieties more resistant to stem rust when it is realized that there are at least 200 different strains of the stem rust fungus which attack wheat, 12 which attack oats, and 14 which attack rye.

The existence of these strains within the varieties of stem rust explains, to a great extent, why a given variety of grain may appear resistant to stem rust in some years and in some localities, and be severely attacked by stem rust in other years.

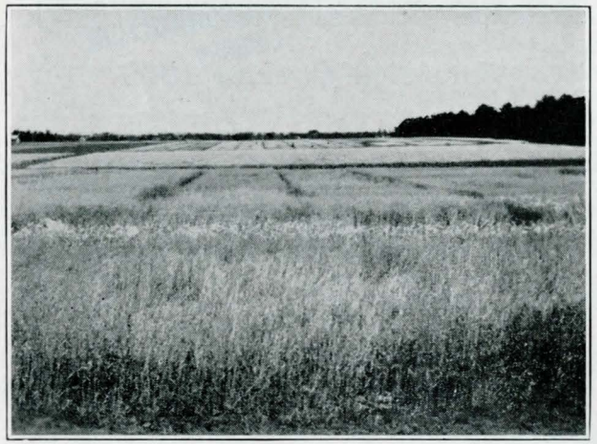
An investigation of the distribution of stem rust strains on wheat in Nebraska was inaugurated in 1924, and by 1941 a total of 29 different strains had been found. Only eight were present over any considerable period. The study also revealed that different strains of stem rust of wheat are present in Nebraska in different years. For example, many were common in the late 'twenties and have not appeared since, while other strains have become temporarily established.



Real progress has been made, however, in the development of rust-resistant varieties of grain. Still more will be made in the future as better parent varieties are made available. New and better varieties are being produced and will be distributed from time to time. Not only is this true for wheat, but also for oats. Several varieties of oats are now available with considerable resistance to stem rust. Progress is being made in the development of resistant varieties of wheat for Nebraska. Yet even in localities where they are available it will still be advisable to continue the removal of all barberries in order to eliminate the source of new strains of stem rust. After the barberries have all been eradicated, the other methods of rust prevention will have a great deal more chance of success.

Grow variety of grain best adapted

A grower is interested primarily in a low unit cost of production and the selection of the better-adapted varieties is an essential step in achieving that goal. The Nebraska Experiment Station, in cooperation with county agents of the Nebraska Extension Service, and the Nebraska Grain Improvement Association, has compared many small grain varieties in different locations throughout the state. The results of these studies, showing the most desirable varieties for a given locality, are available at the office of the County Agricultural Agent.



Testing varieties of small grain.
College of Agriculture, Lincoln, Nebraska.

Reduce Stem Rust Losses by the Following Farm Practices

Stem rust must be prevented, as it cannot be controlled successfully once it becomes prevalent in a field of grain. The following constitute essential measures in the efforts to reduce losses from stem rust:

1. Destroy all rust-susceptible barberry bushes in Nebraska. As long as one of these harmful shrubs remains in a community it serves not only as a source of stem rust, but produces seed from which additional bushes may develop, and is a point from which new strains of the stem rust organism may originate.
2. Sow the more rust-resistant varieties of grain recommended by the State Agricultural College, as such become available.
3. Generally speaking, the earlier a grain field matures the greater are its chances of escaping damage from stem rust. Seed fall grain as nearly as possible in accord with the recommended seeding dates—too early or too late may increase losses from hessian fly, root rot, or winter injury. Sow spring grains just as early as the soil can be properly prepared, and on well-prepared land. In fact, every good cultural practice should be used which will help produce a healthy, strong, early-maturing crop.

Progress in controlling stem rust varies directly with the advancement of each of the above control measures. Neglect of any one may result in seriously retarding progress of the control program.

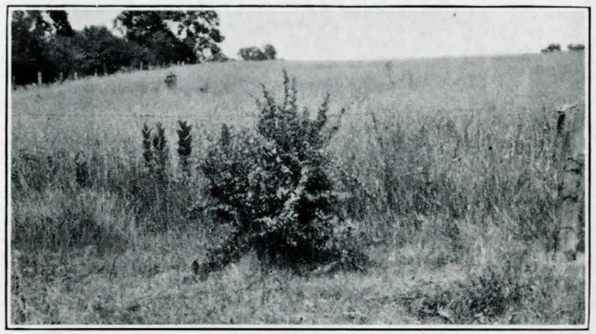
Destroy barberries by applying salt around the crown of the bush.

A DANGEROUS NEIGHBOR

The phrase "A Dangerous Neighbor" seems very appropriate when it is realized that as long as a rust-spreading species of barberry remains in a community it serves to perpetuate stem rust from year to year whenever favorable weather conditions prevail, and it may be responsible for the production of new and virulent rust strains which may attack varieties of grain that were previously considered resistant to stem rust. In addition, the shrubs produce seed from which more bushes will become established in the community.

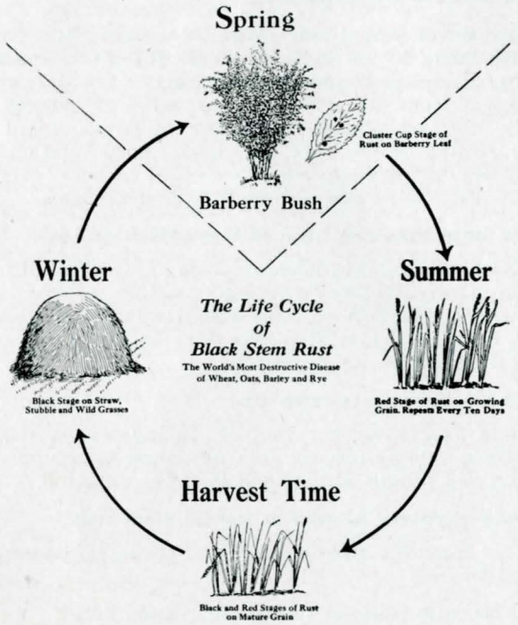
The shrub was introduced into America from Europe by colonists and was brought into Nebraska by the early settlers for garden, hedge and ornamental use beginning about 1870. From these and plantings made as late as 1918, the bushes became generally scattered by birds and other agencies to windbreaks, orchards, wooded areas, pastures, and along ravines, streams and fence lines, where wild bushes developed and continued to spread. The barberry has been found growing wild on approximately 474 properties scattered over the state. Bushes, planted or wild or both, have been found in 87 of Nebraska's 93 counties.

The task of eliminating the pest from the state has not been easy. First of all, locating the scattered shrubs requires a systematic inspection of all uncultivated territory where brush and trees may be growing. Second, the smaller bushes are found only by very careful observation. Third, the seed produced by the bushes may lie dormant in the soil for a period of eight to twelve years before germinating and giving rise to new bushes. This makes necessary a re-inspection, after an interval of from six to eight years, of all localities in which the larger seed-producing shrubs have been found. In many instances even a second re-inspection is necessary to prevent re-establishment of the pest.



Barberry bush along fence line which may spread rust to adjacent grain.

Remove the Barberry and Break the Rust Cycle



What the individual can do

There are two methods by which the inspection work can be carried out, either by a governmental agency hiring workers to perform the inspection work, or by each individual carefully inspecting his own premises. If each individual would locate and destroy these stem rust-susceptible shrubs, the task of completely eliminating the pest from the state could be accomplished within a comparatively short time.

Why now?

The campaign to destroy harmful rust-spreading barberry has greatly reduced the number of these bushes within the state. To allow the bushes to re-seed will increase the stem rust hazard.

Can the individual destroy his own barberry?

Yes. Many Nebraskans already have taken the responsibility of destroying the bushes found on their own properties. It is the most economical method if the following precautions are observed: Be sure that identification of the shrub is correct and that the eradication method will assure complete destruction, otherwise the pest will become re-established.

How to Destroy Barberry

The two most common methods are digging and salting. If the digging method is used, it is necessary to dig out all of the roots down to a size smaller than a lead pencil, if re-establishment of the shrub is to be prevented. If the salting method is used, the cheaper grades of stock salt should be applied at the rate of approximately ten pounds per square foot of ground area from which the canes arise. Do not chop off the bush at the time of treatment, merely push the canes apart and pour the salt on the ground at the cane base. It is important to cover the salt with a layer of dirt or trash in order to prevent livestock or poultry from disturbing it.

Why report location of barberry bushes?

One of the most important reasons is that a careful inspection of neighboring properties often reveals additional bushes that have grown from seed scattered by birds or other agencies. A report of a location of barberry assures the eventual inspection of all neighboring properties.

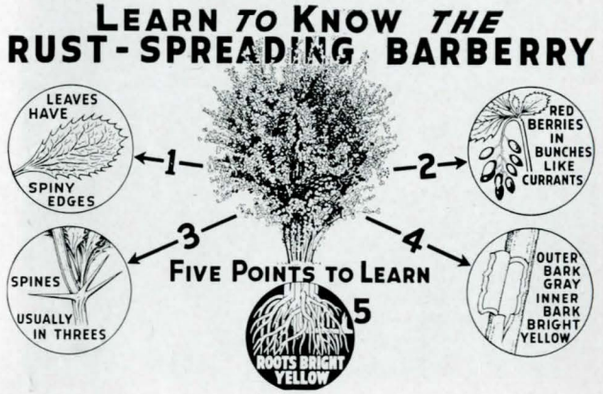
Where to report locations of barberry

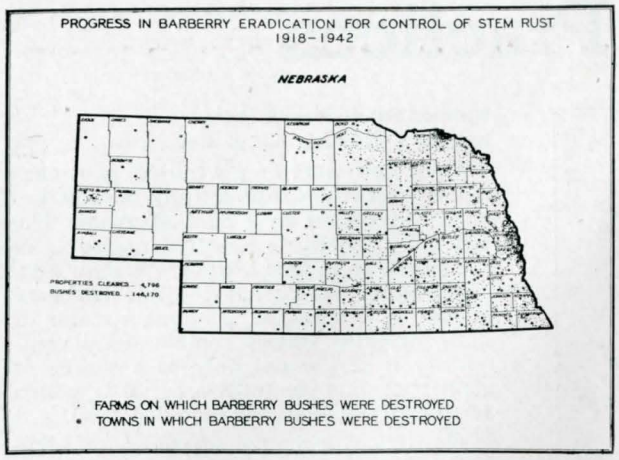
Reports may be made directly to the County Agricultural Extension Agent or, if more convenient, directly to the College of Agriculture, Lincoln, Nebraska. Kindly enclose a small twig with your letter.

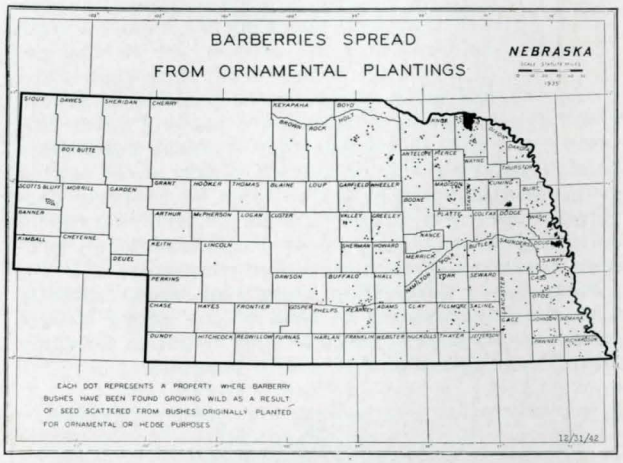
General comment

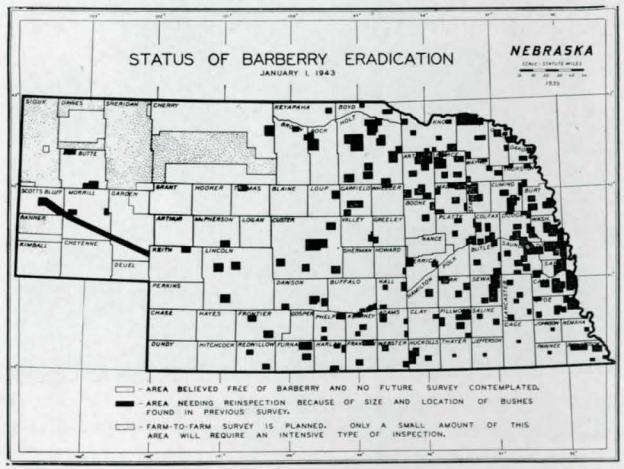
Each stem rust control measure put into practice helps to stabilize the grain yields and maintain quality of grains after the major costs of production have been incurred.

While it is not a crime to have a crop pest, to shelter it knowingly is a costly farm practice that may affect the entire community.









Progress in Controlling Stem Rust

Losses from stem rust have been reduced to approximately half of the damage formerly caused by the disease. In the area comprising the north-central grain-producing states, which includes Nebraska, stem rust losses averaged more than 55 million bushels during the period of 1916-1927, whereas for the next 12-year period the average annual losses approximated 27 million bushels.

The marked decrease in losses from stem rust probably has been the result of the application of approved control measures, including the destruction of millions of rust-spreading species of barberry; the growing of grain varieties that are either more rust resistant than those formerly available, or that mature early and thus escape serious damage; and improved practices on the part of the individual growers, such as seed bed preparation and observance of the recommended planting date.

The Federal Bureau of Entomology and Plant Quarantine reports that more than 300 million of the rust-susceptible species of barberry have been destroyed in the 17 states that make up the eradication area. More than 146,000 of the shrubs distributed over approximately 4,800 Nebraska farm and city properties are included in this figure.

Numerous state experiment stations, and the Federal Bureau of Plant Industry, Soils and Agricultural Engineering, are cooperatively engaged in the development of improved varieties of grain. Much progress has been made.

The nature of the stem rust control problem is such that the eradication of barberry, the production of improved rust-resistant varieties of grain, and better farming practices on the part of the growers tend to complement each other.

It is important that the problem of stem rust control be attacked from every possible angle. No one method of control is sufficient. All must be used, as they are inter-dependent, and together will contribute to the success of the control program.

Profit .... or Loss