

Small Grain, Flax and Potato Diseases in 1944

By

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IN GENERAL crops were good all over the State. The yields and quality were the best produced in several years. Considered as a whole the returns were very favorable but in some sections excessive rains and continued wet weather favored the development of diseases and caused considerable disappointment. The grain crops, the potato crop, and some gardens were affected. Cereal blights were severe in the wetter sections of the Red River Valley.

Wheat.

Black chaff was destructive in southeastern North Dakota. False black chaff was sometimes confused with the true black chaff disease. Laboratory studies showed that the discolored straws and heads associated with false black chaff were sterile, that is, not associated with any disease organism. Much of the blighting of the leaves and discoloration of the stems and heads was directly associated with excessive moisture.

Scab developed in cereal crops over wide areas. The severity of this disease in parts of the Red River Valley perhaps was never greater in the last 20 years. All varieties of wheat, including the durumms and barley, rye, and emmer were affected. This disease developed not only on the standing grains but later in the windrows and in shocks where harvest was delayed. Scab caused reduced yield, poor quality, and discounted prices. In feed grains, particularly those which were harvested late, another loss may be expected. Scabby grain is poisonous to certain types of livestock, especially hogs. Also this disease will present a considerable seed problem. Any grain which carries the scab fungus will, when sown, develop seedling blight. The seed problem may be partially eliminated by properly grading and treating the seed with an organic mercury disinfectant, such as Ceresan.

Wheat was affected by a number of diseases usually considered

of minor importance. These included various leaf infections, joint infection, and chlorotic conditions associated with excessive moisture. Often a major disease developed uncommon symptoms which were confused with those of a minor disease. The fungus causing scab has seldom been observed on the necks of grain but this year, probably because of very favorable conditions, it was frequently found producing spores and discoloring the necks of wheat.

Severe root diseases of cereals developed in restricted sections of the State. Root troubles caused by *Pythium* sp. and *Helminthosporium* sp. were common. Wet weather seemed to favor these troubles.

The rusts of wheat occurred over a larger part of the State but the damage was light. Stem rust caused no appreciable damage in the bread wheats, except in a few rust susceptible varieties grown in small sections of the State. In Rival wheat, traces of stem rust could be found in most fields but the damage was slight. Rust-resistant varieties such as Thatcher, Regent, and Pilot were not injured. The rust susceptible varieties, Ceres and Marquis, suffered considerable damage. Durum wheats were damaged somewhat in late sowings. Leaf rust developed all over the State and caused more damage than stem rust. Newthatch, a variety considered somewhat resistant to leaf rust, was affected by that disease.

Oats

Diseases have been very destructive in oats the past few years. Crown rust and the smuts caused some damage this year. Many growers changed to the new disease resistant varieties of oats. Vicland, Tama, and Boone were grown in seed plots, or larger sowings. In general it seems that these varieties have met with considerable favor. In most cases they matured with a good yield. All of these varieties are resistant to the rusts and smuts. We have no reports of crown rust or any other diseases causing damage in these varieties this year. Crown rust was widely distributed and destructive in the susceptible varieties, particularly where seeding was late.

Barley

The condition of barley was similar to that of wheat. This crop was poor in the southern part of the Red River Valley and considerably better in the northern part. The rootrot disease, together with leaf and head blights, caused considerable damage. Scab was widely distributed in barley fields, especially in the southeastern part of the state. At present we have no variety of barley which possesses much resistance to these diseases. Plump heavy seed, free from fungi, frequently will escape damage from the rootrot diseases unless sown in infested soil. The leaf and head blights may develop in any field, regardless of farm practice, since the germs are airborne. Barley grown after oats perhaps suffered less damage from scab than barley grown after corn, but often there was scab damage under all conditions, regardless of the crop rotation in operation.

Flax

Flax rust was found widely distributed over the State but generally was not very destructive. Pasmó again became quite important, causing considerable damage in the susceptible varieties such as Viking and Victory.

Potatoes

Both the acreage and the production of potatoes have increased enormously in recent years. Beginning in a small way, about 25

years ago, production has gradually and steadily increased. This year we have an estimated yield of more than 20 million bushels, which is exceeded in only three other states. The practice of mass production has not been reached without encountering many hazards. Earlier our soils were relatively free from contamination of the common potato diseases and there was not very much interstate movement of seed stocks. The few diseases which developed in this territory were not very troublesome and we were not bothered by many of the more serious types common to those regions in which there was more intensive potato culture. Extending acreage and importation of seed stocks have resulted in the establishment of practically all types of diseases which can exist under our conditions. In recent years we have had to deal with many troublesome disease problems. The virus diseases have long been held under fair control by the practice of growing seed plots. For a number of years only the more common virus diseases were troublesome but more recently we have had the other types to deal with. In addition to practically all of the virus diseases the very infectious ring rot disease has been troublesome. During the past two years a relatively new disease, purple top wilt, has occurred over wide areas. Then, last but not least, along with the wetter seasons, late blight has taken its toll. Late blight was very seldom encountered in the earlier years of potato production in North Dakota. It was thought, and it still seems probable, that our climate generally is adverse to the development of this disease. The last two years, which have been more humid, are exceptions. Leaf roll, a virus disease, appears to be increasing. As the name indicates the leaves are rolled, are abnormally thick, and the plants are dwarfed with a rigid appearance. The tubers are reduced in size and few in number. The disease is readily spread by aphids. Mild infections cause considerable trouble in certified seed. There is no information available to indicate that the disease has been very destructive this past year. The common control meas-

ures for leaf roll are tuber indexing, the practice of growing well managed seed plots, and the use of insecticides.

The potato scab disease has been a problem for many years. Generally scab has caused little trouble in this State, but in a few restricted sections it has been increasing and causing considerable damage. This disease appears to be more troublesome on the alkaline soils, although it definitely is able to develop under a wide range of soil alkalinity. Some of our least alkaline soils are developing scab. This disease is transmitted with the seed but more often it appears to be harbored in the soil. By selecting and treating seed it is possible to eliminate the disease from the seed source but infested soils are very difficult to clean up. In some cases it seems advisable to discontinue the production of potatoes on soils which are known to be infested with scab.

The ring rot disease has been very troublesome since 1938. The infectious bacteria which cause this disease are distributed by the seed. The very infectious nature of the bacteria makes control difficult. It is necessary to follow most rigid sanitary measures. This year the disease occurred in practically all parts of the State and is now a major problem in seed stocks. Growers who think they do not have this disease often find, to their disappointment, that at least a few plants in their fields are affected. Only a few infected plants are needed to contaminate the entire crop, and only with the most rigid care is it possible to hold this infectious disease in control. There apparently has been little diminishing intensity of the bacteria ring rot disease during the last three years.

Purple top wilt was severe in 1937 but of minor importance in the five years following 1937. In 1943 and again this year the disease, for some unexplained reason, seems to have gotten out of control. Almost all fields in the State had a trace or more. Some fields had as much as 15 per cent of the plants infected. All common varieties may be classed as susceptible. This wilt disease is easily

identified in the field by the purple color of the young growth at the top of the plants, by the roughness of the leaves, by the dwarfing of the plants, and often by the formation of tubers on the stems above the ground. Below the ground extensive root development immediately above the seed piece often is found, the tubers are small and few and sometimes the stolons are "beaded" with small tubers.

The purple top wilt disease not only reduced the yield of potatoes under the infected plants, but also reduced their value for seed purposes. Potatoes harvested from infected plants have many deformed eyes which develop thin, weak sprouts, commonly known as "hair sprouts." The nature of this virus-like disease as yet is not fully understood. There is no evidence to indicate that it is easily transmitted to healthy plants. Some experts, it appears, have induced transmission by exposing the plants to insects, particularly to certain species of leaf hoppers. They have obtained some evidence that the virus, or causal agent, is the same as that which causes yellows of asters. This virus affects not only asters but many garden crops and weeds. During the past season aster yellows was common and there were symptoms of yellows found on a number of other plants such as fleabane, rag weed, carrots, lettuce, salsify, and many other kinds of plants. In some cases the vegetables commonly considered susceptible were not affected, although they were growing within a few feet of infected potatoes. It is probable that the disease, common in this region, may not be identical with the aster yellows disease which has been described as occurring in some of the western and eastern states. Up to this time we have no definite evidence that our purple top wilt is identical with the aster yellow disease.

Late Blight

Late blight failed to develop in the early part of the season. The earliest date of which we have record was August 3rd, in Walsh county. A few days later scattered light infections were found in Traill, Cavalier, and Cass counties.

Blight appeared considerably earlier in several other states, south and east of North Dakota, according to reports from pathologists in these regions. The earliness of the initial infection, the conditions of the foliage, and weather are important factors in the development of this destructive disease. Cool wet weather and heavy green foliage are favorable. These conditions prevailed over most of the State but since the disease made a slow beginning its destruction was light except in later plantings and in later maturing, leafy varieties. In most fields the foliage was more or less destroyed by leaf hoppers and flea beetles, and in some sections hail or dry weather prevented normal foliage development. The destruction by leaf hoppers increased progressively as the season advanced and this seemed to check the development of blight, although in much of the State weather conditions were favorable. Near the end of the growing season excessive rain fell over much of the growing area and this greatly increased blight development. In those fields, in which blight was present even in small amounts, deterioration was rapid.

The nature of this disease is such that it may spread very rapidly, almost completely destroying the foliage in a few days. This happened in scattered fields where there was an abundance of green foliage remaining when the blight appeared.

In several instances discard piles of unwanted potatoes appeared to initiate blight infections in nearby fields. Not all discarded potatoes developed blight but there is much evidence available showing that discarded potatoes are dangerous to the growing crop. As an important sanitary measure such potatoes should be destroyed in some manner which will prevent them from growing. No doubt the general practice of applying fungicidal dusts and sprays on the growing potato foliage was in a measure responsible for holding blight development in check.

The heavy rains in August over much of the Red River Valley continued for a period of several days. It is very probable that some of

the fungicidal dust was washed from the foliage. Because of the wet soil conditions it was impossible to keep the foliage properly protected with the fungicides during the wet period. This, together with the abundance of moisture, not only induced blight development but also permitted spores to be washed from the foliage into the ground. Tuber infection and excessive decay developed in some fields. Fortunately for the succeeding crop the blight spores which were washed into the soil will soon die out. It is believed that blight may survive the winter, not in the soil but in the infected potatoes in storage.

Potato Tuber Decays

Tuber rots resulting from late blights caused some damage in the Red River Valley and may yet affect potatoes in storage to some extent. While blight destroyed potatoes in some fields there were serious decays which developed as a direct result of wet soil. The condition known as "leak", caused by the fungus *Pythium* and by other fungi, was wide-spread. Considerable bacterial soft rot developed. The bacterial decay often was associated with "leaky" rots, as well as with late blight decays. The emergency brought on by heavy rains at the harvest period tested the ingenuity of potato growers. The questions when to dig and what to do with potatoes were answered in various ways. All agreed that if potatoes must decay they should decay in the ground rather than in storage or transit. In all probabilities the best procedure was to wait until the ground became dry enough for digging. It is true that waiting permitted the decays to develop in the ground but it is well known that "leaky" types of decay develop freely in storage. Potatoes slightly infected by decay organisms and placed in storage continue to deteriorate. When dug in wet conditions slight defects and traces of decay escape the pickers, although these tubers should be left in the field to decay.

Common dry rots are developing in some storage bins. These types of decay often are caused by the fungus *Fusarium*. In some fields,

altho. the "leaky" types of decay were absent, the common dry rots have developed, often originating from cuts and bruises. Rough handling should always be avoided as much as possible.

Further precautions in the handling of potatoes in a manner to prevent development of storage decays are necessary. Some growers are ventilating the bins. Many are closing the ventilators in the day time and keeping them open at night. In all cases it is wise to prevent sweating. This, of course, occurs when cool potatoes are subjected to warm air. A uniform temperature should be maintained.

In the first month or six weeks this need not be below 60°F. but in the later storage period it should be held as near 35°F. as possible. Most of the decay and shrinkage occurs in the early part of the storage period. It appears to be good practice to provide some sort of temporary storage for the first month or six weeks, which would permit sorting and discarding decayed and partially decayed tubers before the winter storage period begins. The practice of sorting and regrading after a pre-storage period is not always necessary but with conditions such as prevailed over wide areas this year this practice will often be required.

ERGOT on Spring Rye

Ergot continues to be a disease of grains and grasses for which control measures are being sought. W. E. Brentzel, Plant Pathologist, reports that the seed treatments used so far have had little effect upon the vitality of the sclerotia (ergotized kernels or bodies). In studies conducted with spring rye in 1944 Mr. Brentzel found that spring rye plots became naturally infected from grass plots about 20 rods away. An artificial inoculation by spraying a portion of the field with a suspension of spores nearly doubled the number of heads affected by the ergot disease. Ergot infection seems to reduce yields. Infected heads set fewer seeds than non-infected heads, exclusive of sclerotia, and the mean weight per seed was slightly less.

FLAXSEED Treatments

In a series of experiments conducted cooperatively by this Station, other stations, the U. S. Department of Agriculture, and Experimental Stations in Canada, tests have been carried out on four seed disinfectants, two containing organic mercury, namely New Improved Ceresan and Semesan Jr., and two containing no organic mercury; namely, Arasan and Spergon. Two lots of Royal flax were used in the trials, one which had been subjected to serious threshing injury and one not so handled. In all rows of flax counted, whether treated or untreated, significantly fewer plants emerged from the injured seed than from the uninjured seed. Chemical treatment did not appear to injure either lot of seed and in some cases there was considerable improvement. The experiments at this Station were conducted by W. E. Brentzel, Plant Pathologist.