
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

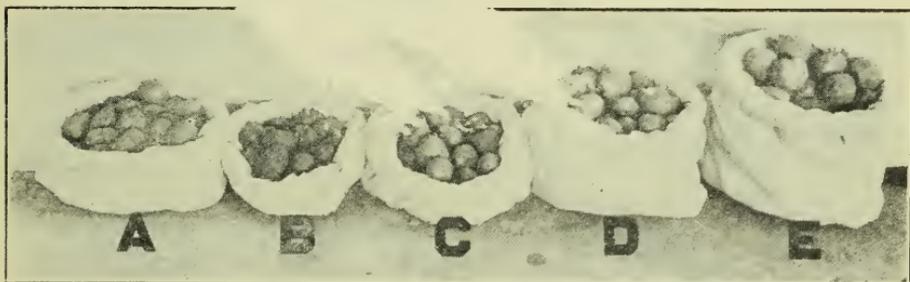
Agricultural College, Mississippi

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DEGENERATION DISEASES OF THE IRISH POTATO IN MISSISSIPPI

By

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State Plant Board



Comparison of yields of potatoes in 1927. A, Spindle-tuber; B, leaf-roll; C, rugose mosaic; D, mild mosaic; E, healthy.

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The degeneration diseases constitute one of the most important groups of infectious diseases affecting the Irish potato in Mississippi. These diseases occur in practically all of the Irish potato growing sections of the United States as well as in many foreign countries. The most important diseases of this group in Mississippi are commonly known as mosaic, leaf-roll, and spindle-tuber. The exact origin of these diseases is not known. They have undoubtedly been present in this country for many years and have probably been the chief cause of the "running out" of potatoes, a condition which has generally been attributed to various causes, such as climate, soil, continuous production by seed cuttings, etc.

DESCRIPTION OF DISEASES

Mosaic. There are apparently several types of mosaic affecting the Irish potato. Two of these types are very common



Fig. 1. Plants infected with mosaic showing the typical crinkling or puckering of the lower leaves.

in Mississippi, namely mild mosaic and rugose mosaic. The leaves of plants which are affected with mild mosaic are mottled with yellowish-green or light green spots which usually shade off gradually into the adjacent normal, green tissues. These spots vary greatly in size, shape, location, and abundance. They are seldom more than one-fourth of an inch across although they may follow a vein in the leaf for a much longer distance. They may be circular in outline but are usually more irregular and more or less elongated. At high temperatures, these symptoms tend to disappear and it is then difficult or impossible to dis-



Fig. 2. A, Healthy plant; B, plant infected with rugose mosaic.

tinguish diseased from healthy plants. A period of from four to six days of high temperature is sufficient to mask the symptoms of this type of mosaic. This does not mean however, that plants upon which the symptoms tend to disappear have recovered from the disease because they produce infected tubers and may serve as a source of infection for healthy plants. This type of mosaic does not ruffle or pucker the leaves as badly as the rugose type nor does it dwarf the plants and reduce the yield rate as much.

The rugose type of mosaic is the one most commonly recognized because it causes the leaves to become crinkled or puckered between the veins (Fig. 1), dwarfs the plants (Fig. 2), and greatly

reduces the yield rate. This type of mosaic also causes a mottling of the leaves but this symptom is not nearly as distinct as in the case of mild mosaic. The leaves of infected plants have a tendency to be curled downward and the plants have a sickly yellow color. The tubers produced on plants infected with both types of mosaic appear normal except for size, making tuber selection impossible.

Leaf-roll. Plants infected with this disease are usually badly dwarfed and show a very severe upward rolling of the leaflets (Fig. 3). The leaves are stiffer and thicker to the touch than normal ones which give the plants a very rigid appearance. They



Fig. 3. Potato plant infected with leaf-roll.

may become yellowish, reddish, or purplish in color and finally small, dead areas may be produced near the tips. The symptoms of leaf-roll on plants which are produced from diseased tubers are more pronounced on the lower leaves while in the case of plants which become infected during the growing season, the rolling is first noticeable on the upper leaves.

On the underground part of the plants, the stolons on which the potatoes are produced are greatly shortened, resulting in the potatoes being produced very close to the tap roots. Aside from this character, there are no other constant symptoms on the underground parts. In many cases, however, the tubers have a net-like darkening of the tissues which may be seen as spots or

streaks when the tuber is cut in sections. Infected tubers show a marked crispness and often produce very weak, spindling sprouts. This disease reduces the size and number of tubers very much, but does not affect the shape.

The rolling of potato leaves due to wilt diseases, *Rhizoctonia*, black-leg, excessive moisture in the soil, etc., should not be confused with leaf-roll. The rigidity or stiffness of plants infected with leaf-roll distinguishes them from plants with limp, wilted leaves which are characteristic of wilt diseases, black-leg, and the



Fig. 4. Potato plant infected with spindle-tuber. (After Goss)

early stages of tip-burn. In the case of *Rhizoctonia*, the leaves are usually smaller, the nodes of the plants are rather enlarged, and there is the characteristic browning of the underground part of the plants. The rolling of the leaves due to excessive moisture is usually confined to areas in the field where the soil is too wet.

Spindle-tuber. Plants infected with spindle-tuber usually have fewer stalks per hill which are dwarfed, somewhat spindling, and very erect (Fig. 4). In the early part of the season, the leaves

are smaller, somewhat darker green in color, have slightly ruffled edges, and tend to point upward. Later in the season, the leaves become more dwarfed, are usually not distinctly ruffled, and show a slight rolling along the margins.

The effect of spindle-tuber on the vines is not nearly as conspicuous as that produced by mosaic and leaf-roll. It differs from these diseases in that it affects the tubers as well as the tops. In severe cases, the disease causes the tubers to become long, cylindrical, and spindling with tapering ends (Fig. 5). In the Triumph variety, the color of diseased tubers is much paler than that of normal tubers and they appear somewhat blotchy. The eyes are more numerous, shallower, and sometimes bulged out and the skin is usually smoother and tenderer, making the tubers more easily



Fig. 5. Potato tubers showing the spindling effect of spindle-tuber as compared with a healthy tuber (center).

bruised or cut. When infection takes place late in the season, there may be no noticeable effect on the vines or tubers. The tubers from such plants are infected, however, and when used for seed produce diseased plants.

CAUSES OF DEGENERATION DISEASES

Although the causes of mosaic, leaf-roll, and spindle-tuber are unknown, many points regarding the nature and methods of transmission of these diseases have been determined and are practically the same in each case. It has been found that the juices from diseased plants contain the infectious principles known as viruses which cause these diseases; that is, the juice taken from a diseased plant and introduced into a healthy one will cause it to become infected with one of the diseases in question.

The healthy plants will usually show evidence of disease in from two to four weeks after they have become infected. Aphids or plant lice are responsible for the greater part of the spread of these diseases in the field in that they carry the juices from diseased plants to healthy ones. The fact that plant lice are so numerous on the potato in the South probably accounts for the consensus of opinion that potatoes "run out" very quickly in this section of the country. As has been pointed out previously, the diseases are carried from one season to the other in the tubers. They may also be carried from one season to the other in plants which are closely related to the potato. It is probable that these diseases can be transmitted from one tuber to another by the knife used in cutting the seed pieces, but this has been demonstrated only in the case of spindle-tuber. This method of transmitting the disease is relatively unimportant if abnormally-shaped tubers are discarded before cutting and the cutting knife is kept clean.

EFFECT OF SOME DEGENERATION DISEASES ON THE YIELD OF IRISH POTATOES

The effect of these diseases on the yields of Irish potatoes was carefully studied during 1927 and 1928. Irish potato seed of the Green Mountain variety, which were infected with mild mosaic, rugose mosaic, leaf-roll, and spindle-tuber, were courteously furnished each season by Dr. E. S. Schultz of the United States Department of Agriculture for this work. The experiments were conducted on well drained, sandy loam soils which were quite uniform in texture. All lots of seed received the same fertilization, cultural care, etc. The results from these experiments are given in table 1.

Results Showing the Effect of Degeneration Diseases on the Yields of Irish Potatoes During 1927 and 1928

Disease	1927*		1928**	
	Bushels per acre	Per cent of check	Bushels per acre	Per cent of check
Healthy (check)	89.2	100.0	180.2	100.0
Mild mosaic	63.6	71.3	131.2	72.8
Rugose mosaic	27.0	30.3	71.3	39.6
Spindle-tuber	40.4	45.3	79.2	44.0
Leaf-roll	18.7	21.0	68.9	38.2

*Average of 2 plats.

**Average of 4 plats.

The results obtained during the two seasons were very similar. In 1928, the symptoms of leaf-roll and rugose mosaic were not nearly as pronounced as in 1927 which may account for some of the variation in the yields during the two seasons. These results indicate that leaf-roll reduces the yield to a greater extent than any one of the other diseases under Mississippi conditions. Due to the fact, however, that mosaic is more prevalent in the State, it causes by far the greatest total loss of this crop. These figures indicate that the degeneration diseases are probably more severe under Mississippi conditions than under those of some of the western and northern states.

CONTROL OF DEGENERATION DISEASES

Due to the fact that the infectious principles causing these diseases are in the inside of the potato plants and tubers, it is obvious that spraying the plants, treating the seed, or any other surface treatment would be worthless. Since tubers infected with mosaic, leaf-roll, and mild forms of spindle-tuber cannot be detected, the question of tuber selection is impossible. The same is true for hill selection after the tops of the plants have died down. Since plants infected with the degeneration diseases can be detected in the field, it is possible to eliminate or reduce these diseases to a great extent. If potatoes are being grown for seed purposes, it is necessary to go through the field or seed plats and dig out all diseased plants and tubers at frequent intervals starting in the early part of the season and continuing until harvest. To aid in detecting diseased plants, the potatoes should be planted in tuber units; that is, all of the seed pieces from a given tuber should be planted in adjacent hills of the same row. By having the seed pieces from a given potato together which may prove to be diseased, the affected plants will be much easier to detect and eliminate; whereas, by planting the seed pieces at random, some of the diseased plants may be overlooked.

Under Mississippi conditions where the population of aphids in potato fields is very great, it is necessary to have a seed plat of potatoes well isolated from all other potato fields. It is also necessary to start the seed plat with disease-free seed stock and to rogue out all off-type plants including diseased ones at frequent intervals. Some of the difficulties of producing seed potatoes in Mississippi on a commercial scale are:

1. With the large number of aphids in this section, the degeneration diseases are spread so very rapidly.