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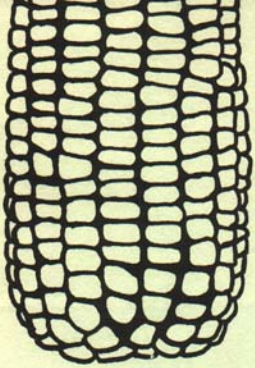

Michigan Corn Production

DISEASE CONTROL

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

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Disease takes a steady toll in Michigan corn each year. The average annual disease loss in potential production of corn is 12%. In 1963, this was equivalent to about 14 million bushels or about 15 million dollars. Naturally, losses vary from field to field. Also, the loss might not be apparent, as when a seed does not germinate. Again, disease may enter the young seedling and not show up until you find ear rot in storage.

Chemical fungicide control, except for seed treatment, is not effective or practical for controlling diseases in Michigan corn. Many diseases must be left to the plant breeder to attempt to reduce in new varieties of corn. However, Michigan farmers must be ever on the alert to follow practices which will lead to greater yield and return. Some of these practices which lead to disease reduction require many years of effort, such as improved soil structure, improved soil fertility, weed control, adequate drainage and reduced fungus carry-over.

Corn Dwarf Mosaic or Maize Dwarf Mosaic

In 1962, a new virus disease of field, sweet and pop corn appeared in the Ohio River Valley. It is virus in nature. The infectious "organism" has been transferred from plant to plant. It is clearly distinct from the effects of inadequate nutrition which cannot be transferred from plant to plant.

Since 1962, this disease has been reported throughout the eastern United States from the Michigan border to the Gulf of Mexico, as well as in California. Infection in a field may vary from a trace to almost 100%. Losses in yield up to 100% have been reported. This virus disease has not been confirmed in Michigan (January, 1965). It may have escaped detection. In November, 1964, scientists decided to call this virus disease of corn as Maize Dwarf Mosaic or Corn Dwarf Mosaic.

When this disease first appeared in Ohio, it was thought to be a form of Corn Stunt Virus, which is prevalent in southern United States and Mexico. The only known vectors or carriers of corn stunt virus are two species of leafhoppers. Neither of these species has ever been reported in Michigan or its bordering states. Also, corn stunt virus cannot be transmitted by grinding infected corn tissue and rubbing this juice into healthy corn leaf tissue (mechanical transmission).

Corn Dwarf Mosaic bears a remarkable resemblance to sugarcane mosaic, which was investigated about 1920. At that time, it was demonstrated that sugarcane mosaic could be transmitted by corn leaf aphids from sorghum to sweet corn and from infected sweet corn to healthy corn seedlings. Corn Dwarf Mosaic has been transmitted from infected to healthy sweet corn by the common corn leaf aphid. It has been mechanically transmitted from infected corn plants to teosinte, sorghum, Johnson grass, Sudan grass, sorghum × Sudan grass hybrids, sugarcane, large crabgrass, foxtail (yellow, green and giant) and barnyard grass.

After a plant is inoculated, its first visible symptom is a chlorotic (yellowish) striping in the newest leaves, particularly at the base of the leaf. This striping is interrupted, as compared to the uniform streaking associated with deficiencies of manganese, magnesium, zinc or iron. Soon a mosaic-type pattern appears of light and darker green areas. At this stage in the field, the corn in one spot will look off-colored. The striping and mosaicing may disappear, particularly later in the season, being replaced by bright splotches of red-purple coloration. This reddening occurs in the top leaves. Zinc deficiency has a reddening in the lowest leaves. Along with the very conspicuous reddening occurs a dwarfing or telescoping of the corn plant above the ear. There may be a mass of extra roots at nodes higher on the stalk. If the husk of the ear is peeled back, there is little seed set. In a hill, one plant

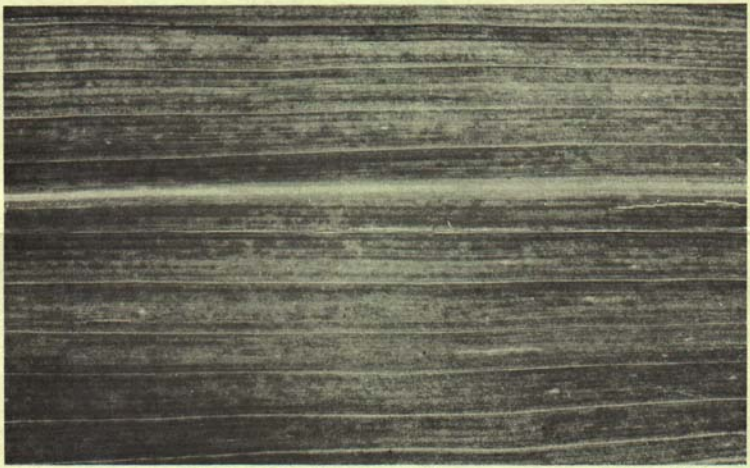
Uniform streaking of leaves, above, which is a symptom of manganese deficiency, should not be confused with Corn Dwarf Mosaic.

Photo courtesy R. E. Lucas

may have considerable red and be dwarfed, while an adjacent plant may be normal in color and height. One or more of these symptoms or similar symptoms can be reproduced by other conditions, such as black bundle fungus disease, bacterial diseases, mechanical injury, insect damage, drought, nutrient deficiency, hormone, weed killer, soil compaction, physiological disorders and probably other causes.

Suspicious plants and particularly odd-looking spots in a corn field should be reported to the local county agricultural extension agent. He can make a further check and, if necessary, refer specimens to the laboratory set up for confirming this virus disease of corn. Confirmation in the laboratory will be attempted by mechanical transfer of plant juice to healthy corn seedings under controlled greenhouse conditions.

It is believed that this virus is neither normally seedborne nor strictly soil-borne. While experimentally at least four species of aphid insects have transmitted this virus to corn, it still is not known just how this virus is transmitted in the field. Virus particles have been isolated and photographed by an electron microscope. There is some range in length of these particles, but this variation is believed to be due to different strains of this virus. This disease is not due to inadequate nutrition, although the level of nutri-



The discontinuous striping of Corn Dwarf Mosaic disease soon leads to the mosaic pattern of light and dark green areas. See page 4 for symptoms of the disease in other crops.

Photo courtesy J. L. Dale

ents may alter the appearance of the disease symptoms as well as produce symptoms of its own which may resemble this virus disease.

Plant scientists are intensively studying this disease. Also, existing corn hybirds are being evaluated for susceptibility. It is expected that new tolerant varieties will be developed.

Seedling Diseases

From planting time on is a critical period for young, germinating corn. Cold, wet soils expose the germinating corn kernel to many soil-inhabiting fungi which can cause seed decay and kill the new seedling. Soil temperatures, particularly below 55° F., are favorable for disease development and unfavorable to early corn growth. Before planting, seed should be covered with a protective coating of captan, thiram or other suitable fungicide. Plant hybrids which show greater seedling vigor, particularly under unfavorable weather conditions. Seed should be of high quality, free from cracks. Prompt germination in a warm, firm moist soil avoids many seedling difficulties.

Stunting is another conspicuous symptom of Corn Dwarf Mosaic. The dwarfing may occur along with a red coloration which replaces the striping and mosaicing.

Photo courtesy A. J. Ullstrup

Leaf Diseases

Northern corn leaf blight, caused by the fungus *Helminthosporium turcicum*, is the leading leaf disease of corn in Michigan. During recent years, only in 1961 was this disease severe in Michigan. The entrance of the fungus into the corn leaf is favored during late summer by moderate temperatures and extended periods of very high humidity. Small spots appear on the leaves. These may enlarge to several inches. Several lesions may join and brown the entire leaf. The browning and firing of plants may be due to other causes, and hence it is a mistake to call all firing Northern corn leaf blight. The local county agricultural agent can aid in verifying this disease. Since 1961, more breeding for resistance to Northern corn leaf blight has been done.

Common Smut

In 1963, corn smut was more common than in other years. Some corn smut can be found in almost any planting every year. Losses vary from a trace to 6% or more. The white, gray or black galls of this disease are easily recognized, whether they appear in place of the ear, on the stalk or scattered over the tassel. The galls later contain the black spores of the fungus which causes this disease.

This fungus can enter and grow in any part of the corn plant. On the leaf, the growth may resemble a wart or just a swelling. The fungus overwinters as black spores in plant residue. The following year, these infect the young corn plants.

When corn smut is more severe, attempts are made to associate it with one or more environmental and other conditions, such as variety, moisture, temperature, date of planting, tissue injury as from hail, and plant density. Varietal differences exist and provide the best opportunity for breeding greater resistance. However, at present infection with corn smut cannot be blamed entirely on recommended commercial hybrids. In 1963 and 1964, mid-May plantings appeared to have more smut than later or earlier plantings. This observation is not confirmed by research across the country. Possibly dry weather during infection is more common than any other single environmental factor. Chemical seed control is not effective. Thorough plowing under of corn residue is helpful.

Stalk Rots

Rots of the cornstalk and roots generally cause more losses than any other group of diseases. The losses vary. During 1961 they averaged about 11%.

Several fungi and a few bacteria cause decay of the corn plant either at the ground, in the three-nodal area above the ground or anywhere below the ground. The most common fungi are *Fusarium moniliforme* and *Gibberella zeae*.

Corn Dwarf Mosaic in (top to bottom) Johnson grass, Sudan grass, sorghum, and corn.

Photo courtesy J. L. Dale

One of the early symptoms of stalk rots is the discoloration of the inside of the lower tip of the stalk. This is most readily seen if the plant is pulled and split lengthwise all the way to the lower tip. The lower nodes become darkened. Dark nodes have been associated with selective absorption of nutrients. Later, the pith of the stalk disintegrates, leaving only the vascular bundles. The stem softens and falls over. The causal fungi overwinter in the plant residue. In addition, it appears that *Fusarium moniliforme* can be inside the seed, from where it can spread systemically throughout the growing plant.

Stalk rot cannot be eliminated, but losses can be reduced through good management. Use those hybrids which show the least stalk rot in field tests. The fertility of the soil should be such that there is always an adequate supply of nutrients and that these nutrients are in balance. Dead plant tissue, coupled with high moisture, permits rapid breakdown due to fungi; therefore, corn should be harvested just as soon as mature, with artificial drying to reduce kernel moisture, if necessary. Plant residue should be thoroughly covered in plowing.

Ear Rot

Most of the fungi which cause stalk rot also cause ear rot. In addition, there are a number of other fungi which cause rot in storage. The kernel is invaded by the fungus, thereby largely destroying its usefulness as food to man and animal.

Wet weather, particularly during August and September, frequently is associated with high ear decay. Early frosts speed growth of rot fungi. Insects, birds and other wildlife open ears and expose these to fungus infection. Hybrids vary in their resistance. Sometimes this resistance may be in the form of a tighter husk about the ear. All of the management practices which reduce stalk rot also aid in reducing ear rot. Harvest and storage practices can be important in reducing ear rots.

Purple Sheath Spot

Purple spots in the sheath around the stem sometimes cause alarm because they are so prominent. The purpling results in less chlorophyl but the loss of green surface must be small.

Purple sheath spot is not due to any organism—either bacterium, fungus or virus. Thus, it is said to be a physiological disorder. As the cells die, various fungi and bacteria enter and multiply. Certain inbred lines show more of this discoloration than others. The grower need not be concerned by this particular purple coloration of the sheath. However, it should be distinguished from the purpling due to virus, nutrient deficiency and other causes.

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