One or more of the leaf spots of cotton occur in practically every cotton-field when the crop is growing. Some have to do with maturity of the plant and have no great effect on its growth or yield. Others develop on seedlings or young plants and damage the normal growth and fruiting processes. The leaf spot organisms commonly cause shedding of the affected leaves, but some may injure the branches and bolls.

This article deals mostly with the effect of some of the leaf-spotting organisms on the foliage of the plant. The leaf spot caused by *Alternaria tenuis* probably is one of the most common. We have known about it since 1918, when investigators learned that it was often linked with angular leaf spot, or bacterial blight, and that it was found on leaves throughout the growing season. Often it was found overgrowing old angular leaf spot lesions or in places where spider mites were doing harm. We have learned that it can infect undamaged leaves and may be considered as a weak parasite. Sometimes *Alternaria* may cause severe shedding of leaves.

In the early stages, the spots on the leaves have a pale-green area with an indefinite and irregular margin. As the area enlarges, the color of the older part becomes straw yellow and then rusty brown. By then the spot contains a number of irregular concentric zones in the roughly circular lesions and the fungal spores may be found on the surface of the lesions.

We do not know exactly which environmental conditions favor the development of this leaf spot, but it has been reported on plants suffering from low vigor because of drought or deficiency of potash. Experiments indicate that plants can be inoculated most easily if humidity is high. Although the alternaria leaf spot is common, it is considered of less importance than other leaf-spotting organisms. Little therefore has been done on control measures.

*Ascochyta leaf spot*, canker or blight, wet-weather canker, and wet-weather blight are names commonly given to the disease caused by the fungus *Ascochyta gossypii*. As the names indicate, the disease may manifest itself as a seedling blight, a leaf spot, a stem or petiole canker, and as a boll spot. Ordinarily several phases of the disease may be seen on a plant.

The first symptoms are small, round, white, purple-ringed spots on the cotyledons and lower leaves. The spots become somewhat elongated and raised on the upper surface. Later they change to a light brown, the purple ring around the outside disappears, and the diseased tissue often falls out. If infections are numerous, irregular diseased areas result and are followed by drying and shedding of infected cotyledons and lower leaves. Pycnidia—fruiting bodies—of the fungus are produced irregularly or in concentric rings and are visible on the upper surface of the lesion. Growth of the plant is stunted. The upper small leaves, petioles, and buds are often infected, and the plant dies. The almost bare stems, with a few small leaves at the tip, are characteristic of the disease in the later stages.

Outbreaks have been associated with long periods of rain and cool weather. Ascochyta may be seedborne, but the carry-over of diseased stalks and branches from the preceding year's crop may be of greater impor-
tance in setting up new infections. The disease can be spread in infected plant debris; local spread appears to be mainly by the flow of surface water from contaminated fields to lower places.

Rotation with other crops helps control it by eliminating the carryover of the fungus from one season to another. If rotation is not practicable, old cotton stalks should be plowed as soon as possible after harvest to obtain maximum decay or deep-plowed in the spring to reduce the amount of infected plant material on the surface at time of planting. Seed treatment reduces the amount of carry-over on the seed and improves the initial stand but does not give protection beyond the early seedling stage.

The bacterial blight disease, caused by *Xanthomonas malvacearum*, can affect all above-ground parts of the cotton plant. It occurs in all cotton areas. In the United States it is particularly severe in the Southwest. It shows up on the leaves as angular, water-soaked lesions, which turn brown or black when dry. On the bolls, it appears as round water-soaked lesions, which are sunken and black when dry. On the stems and fruiting branches, it produces black, elongated lesions. Therefore the disease is commonly known as angular leaf spot, boll blight, and black arm.

On upland varieties it may cause a blight of seedlings, defoliation of plants, or shedding and rotting of the bolls. Upland varieties in the Cotton Belt are affected by the black arm phase, but it is more common on the American, Egyptian, and the sea-island varieties, which often show almost complete destruction of bolls and branches. Severe leaf infection in all varieties means extreme defoliation; slight to severe losses in yield of seed cotton may follow.

The bacteria that cause the disease may overwinter on the surface of the seed, within the seed coat, and on diseased cotton stalks and bolls from the previous crop. Volunteer seedlings from infected bolls can be responsible for early appearance and spread of the disease, particularly when splashing rain or irrigation water aid in the movement of the bacteria.

The first evidence of the disease is seen on the under surface of the cotyledons as water-soaked spots, circular or irregular but without the marked angular appearance noted on the true leaves. Such lesions are first evident along the margins of the cotyledons and then spread inwardly. Later the part near the original site of infection becomes brown and dry, frequently distorting the shape of the cotyledon. The bacteria may move along the petiole of the cotyledon and into the stem of the young seedling, producing the typical water-soaked appearance of the tissues. Continued movement of the bacteria into the terminal bud region results in tissue collapse and death of the young plant.

On the true leaves the external symptoms appear as water-soaked lesions, first on the under surface and later on the upper surface. The lesions are bounded by small veinlets of the leaf—hence their characteristic angular appearance. If the young leaves are held toward the light, the spots appear translucent. As the lesions become older, large amounts of bacterial slime are exuded and form a dry film on the discolored lesions, usually on the under side of the leaf. The infected area of the leaves finally becomes dry and sunken and turns reddish brown or black; often the nearby healthy areas become yellowish. At times the blight lesions along the veins of the leaf produce a symptom known as vein blight.

The bacteria are spread from older to newly formed leaves and eventually to the bolls by wind-driven and splashing rain. Dry, hot weather checks the progress of the disease.

Control measures have centered around the use of disease-free seed, attained through acid-delinting and the application of a chemical disinfectant. That practice has been successful.
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particularly in the rain-belt part of the production area. In drier parts of the Southwest, however, there may be more overwintering of the organism in undecomposed, infected plant material, and the use of acid-delinted and dust-treated seed has not been uniformly successful. In order to reduce the carry-over of the blight organism in plant debris, we recommend rotation with other crops or the early and complete turning under of infected material, followed by irrigation to promote decomposition.

But the use of resistant varieties is the only adequate control throughout the entire period of plant development. D. M. Simpson, at the Cotton Field Station, Knoxville, Tenn., found a high degree of resistance in one of his breeding strains of cotton. It was released to other breeders as Stoneville 20 and has been used widely as the resistant parent in crosses with a number of desirable, but susceptible, commercial varieties. The qualities of the commercial parent are then regained through a series of back-crosses to this parent, accompanied by selection for the resistance and for good fiber properties and high yield. Field tests in 1950, 1951, and 1952 in Texas and New Mexico confirmed the practicability of combining blight resistance with the desired fiber and yield properties of the recurrent commercial varieties.

Leaf spot due to the attack of the Cercospora fungus (Cercospora gossypina) is common in almost every cotton field toward the end of the season. The spots it causes are rarely more than one-fourth of an inch in diameter and are roundish or irregular. The lesions have purple borders and white centers, which finally fall out and leave a riddled appearance. The fungus may attack uninjured tissues, but it seldom causes much defoliation and is of minor economic importance.

Ramularia leaf spot, also called arcolate mildew and frosty blight, was first discovered in 1889 on leaves collected near Auburn, Ala. It has been found since in many Southeastern States and abroad. The disease usually occurs toward the end of the growing season. It may cause some leaf shedding, but it is not of great economic importance.

A typical symptom is the whitish growth of the fungus on the under side of leaves, which produces a frosty or mildew appearance. The spots are angular and bordered by the veinlets of the leaf. Viewed from above, the lesions are bright green to yellowish green, and only occasionally show the white coating so typical on the under surface of the infected leaves. Similar lesions may form on the bracts surrounding the bolls.

The fungus that causes sore shin and damping-off of cotton seedlings, Rhizoctonia solani, has been reported also as a leaf-spotting fungus in Louisiana.

In the early stage, light-brown, irregular spots of varying size appear between the veins and are bordered by dark, purplish rings. As the fungus advances, it causes the tissue immediately surrounding the spots to become chlorotic and the dead tissue in the center of the old spot cracks or falls out. On the lower surface of the leaves the smaller spots may be covered by light- to yellowish-brown growth of the fungus. It might affect considerable leaf area, but it is not of serious economic importance as a leaf-spotting organism.

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