PLANT DISEASE CONTROL NOTES
EXTENSION DIVISION ● VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

July 1978 PMG 19

TOBACCO RINGSPOT VIRUS IN SOYBEAN

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Tobacco ringspot virus (TRSV) causes a disease known as budblight of soybean. TRSV infects many different plant species such as tobacco, cucumber, grape, fruit trees, spinach, and several ornamental crops, such as geranium, in which it causes diseases known by other names.

Though TRSV occurs less frequently than other viruses in soybean, it causes greater damage when it does occur. Reductions in yield are due to a decrease in the number of pods reaching maturity, the number of seeds per pod, and the quality of the seed. Severe widespread infections have occurred in the Midwest, but only isolated infections have been reported in Virginia. A 90% reduction in yield has been observed in diseased experimental soybeans in Virginia. TRSV causes a major disease of soybean in the Midwest.

SYMPTOMS

The severity and type of symptoms of bud-blight depend on the age of the soybean when it becomes infected, the strain of the virus, the variety of the soybean, and the weather conditions during the growing season. If a plant becomes infected before it blossoms, the terminal bud may turn brown and become dry and brittle, hence the name bud-blight (Figure 1). Stunting may occur if the plant is less than five weeks old at the time of infection. Other symptoms include vein-clearing (a loss of green color around the veins on the leaves), leaf-rolling, bronzed and/or yellowed leaves, small brown spots on the leaves, and the death of blossoms (Figures 2 and 3). Early infections result in small, undeveloped pods or no pods at all. Soybeans infected after blooming produce poorly filled pods, which may drop before maturity. Infected plants remain unusually dark green until they are killed by frost. Seeds from infected plants may show a dark symmetrical streaking or "mottle" (Figure 4).

Figure 1.

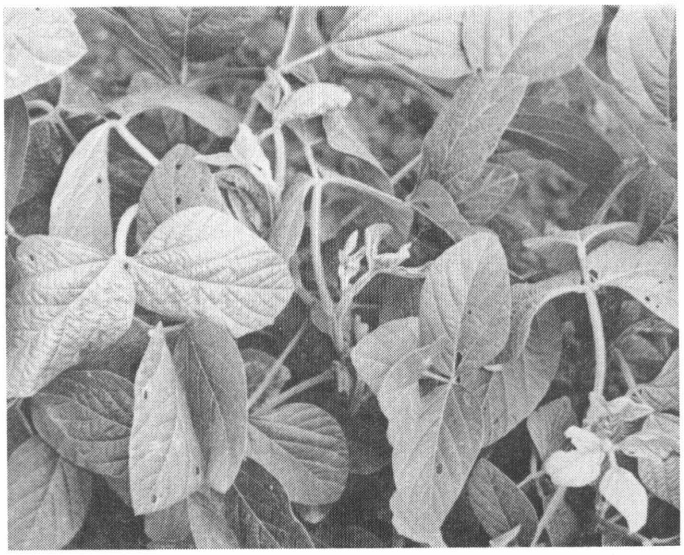

Figure 2.

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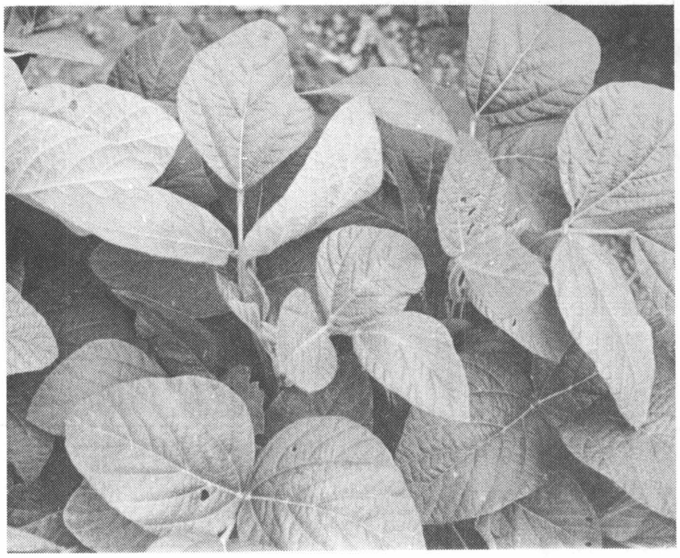

Figure 3.

Figure 4.

DISEASE CYCLE

The disease cycle of TRSV is not well understood. TRSV is introduced into soybean fields mainly by infected seeds, which sprout and produce infected soybean plants. However, this virus infects many common wild plants which can be found around soybean fields. The perennial and biennial wild plant hosts such as dandelion, common ragweed, wild carrot, and sheep sorrel can be sources of infection for soybeans. Also, TRSV infections are frequent when soybean fields are located next to fields of mixed legumes, such as clover and alfalfa, plants which are susceptible to the virus. TRSV overwinters in the roots of infected wild plants and legumes which sprout into infected plants in the spring. Certain insects and worms, by feeding on different plants, spread TRSV from the wild plants and legumes to the soybean plants. TRSV can be spread between plants by nematodes which feed on plant roots, and by immature thrips which feed on plant leaves. A flying insect is suspected of spreading TRSV through soybean fields, since it moves through a field so rapidly. However, none of the insects tested to date can spread the virus at a high enough rate to account for the field observations.

When a plant becomes infected, the virus particles increase in number and spread to other parts of the plant. Many of the seeds produced by TRSV-infected soybean plants contain the virus and when planted will produce infected plants.

CONTROL

No effective control measures are known for bud-blight. Infection might be reduced by controlling the wild plants in and around soybean fields to limit a source of the virus. Clean culture methods may also reduce the source of infection. Soybeans should not be planted next to pastures and fields of legumes.

TECHNICAL DESCRIPTION

Tobacco ringspot virus is a member of the Nepovirus group. The virus is transmitted by several organisms including *Thrips tabaci* (thrips) and *Xiphinema americanum* (dagger nematodes). A more efficient aerial vector is suspected, but as yet has not been found. TRSV is seed-borne in soybean at varying rates.

Recently, another virus, tomato ringspot virus, has been found in naturally infected soybeans in Virginia. It is closely related to TRSV and causes similar symptoms in soybean.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. W. R. Van Dresser, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

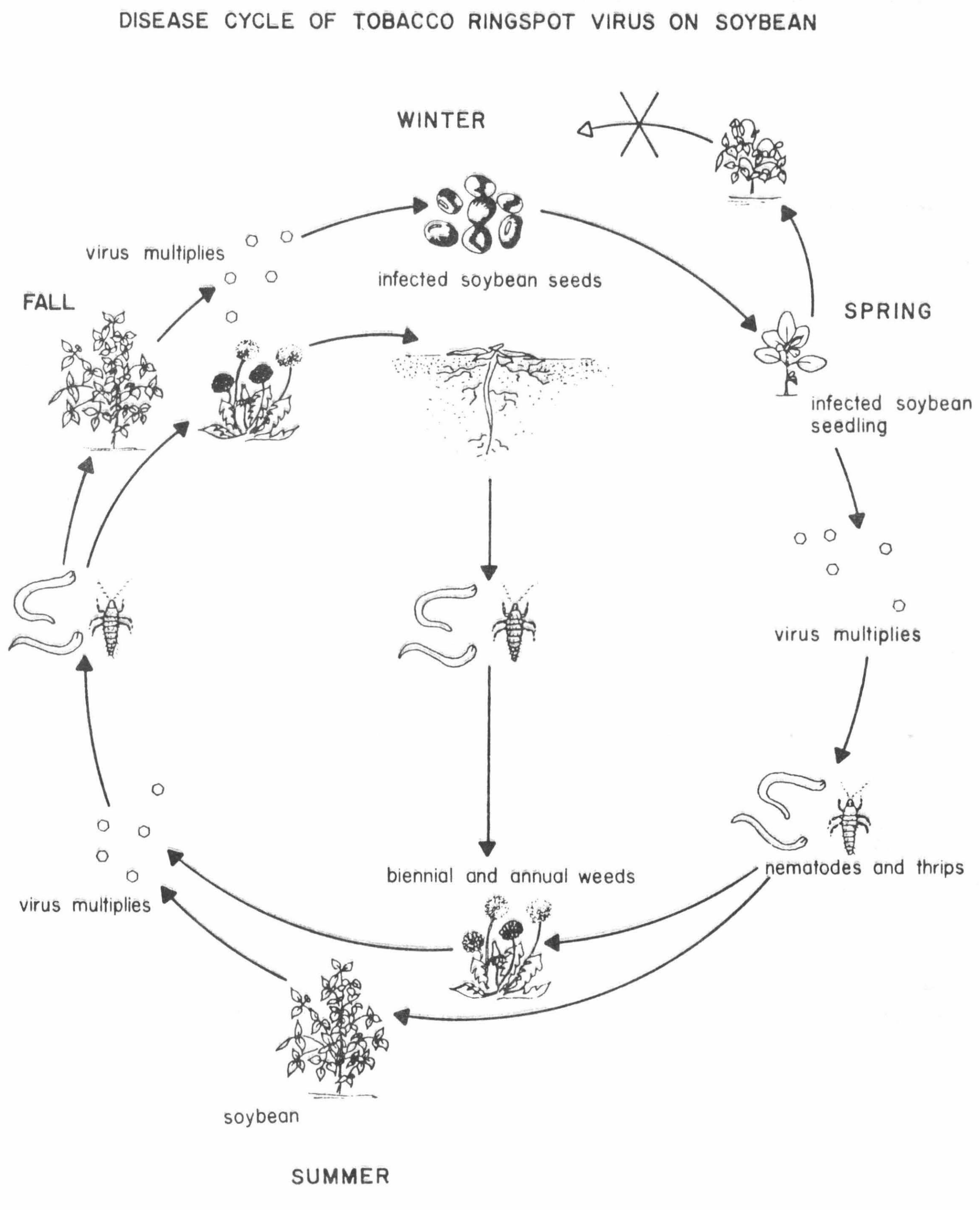
DISEASE CYCLE OF TOBACCO RINGSPOT VIRUS ON SOYBEAN
WINTER
infected soybean seeds
SPRING
infected soybean seedling
virus multiplies
nematodes and thrips
biennial and annual weeds
soybean
SUMMER
virus multiplies
FALL
virus multiplies

Figure 5.