

Fusarium wilt **OF SPINACH**

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DURING THE LAST FEW YEARS *Fusarium* wilt of spinach, a disease new to Monterey County and California, has been observed. This disease was first suspected as the cause of severe losses in a 50-acre field adjoining the Salinas River, 4 miles south of Salinas, in 1967. In 1969 it was positively identified on a ranch in the Moss Landing area, where it caused almost complete loss of a summer spinach crop in a 10-acre field. The organism which incites the disease is *Fusarium oxysporum* f. sp. *spinaciae*.

In the summer of 1971 the disease was found to be causing severe crop losses on five additional sites (approximately 100 acres). All of these sites are located within one-half mile of the Salinas River in an area approximately eight miles long starting near the town of Spreckels and proceeding to the northwest. This area includes the original suspected site found in 1967.

There is an association between the location of the infested lands and the infrequent occurrence of flooding by the Salinas River. The last major flooding of these lands occurred in 1969 and included four out of the five properties found infested in 1971. A relatively warm period in the latter part of the 1971 summer may have favored wilt symptom expression.

Although this particular disease appears to be relatively new to California, it was first described in 1923 by Hungerford in Idaho. Since then serious disease outbreaks have been reported from Virginia, Texas, and Arkansas.

The above-ground symptoms are yellowing of the lower leaves, wilting, stunting and finally death of the plant. The vascular system is discolored. The *Fusarium* moves up in the plant xylem vessels and often can be isolated from vascular tissue in the crown, the petioles and the leaf blades.

Often blackening of the root tips due to water molds occurs with *Fusarium* wilt, but these pathogens do not move up the plant in the vascular system. However, when they infect plants in the absence of *Fusarium* wilt, the stele of the root may be darkened up to several inches above the infected blackened root tip.

Vascular discoloration which occurs when the plants are infected with *Verticillium albo-atrum* proceeds high up into the plant, and for this reason the symptoms may be confused with those of *Fusarium* wilt. However, *Verticillium* wilt has not been as devastating as the *Fusarium* wilt in the fields where it does occur. *Fusarium* wilt can kill all plants in large areas of a field.

Like most pathogenic *Fusaria*, *F. oxysporum* f. sp. *spinaciae* is host specific. Spinach is the only host known for this pathogen. The fungus must be introduced into a soil in order to be present because it is not part of the natural flora of virgin soils. However, once the pathogen is present, it remains in a soil for many years, existing as resistant spores. Populations of as high as 1000 such resting propagules per gram of field soil have been found in the field in the Moss Landing area, and 200 per gram in some of the other fields. Longevity of the resting propagules plus a certain amount of saprophytic ability of *Fusarium* wilt pathogens mean that crop rotations are



Symptoms of *Fusarium* wilt on a spinach plant taken from the field. Note discoloration of foliage and on the internal tissues of the cut stem and root.

not generally successful control measures once the pathogen has become established in a particular field.

Fumigation with methyl bromide and chloropicrin under polyethylene tarps has been used successfully on a limited basis on a ranch in the Moss Landing area, but the expense of this control measure severely limits its use.

No economic control method is known for the larger spinach grower on contaminated land and no *fusarium* wilt-resistant spinach varieties are available. Farmers wishing to grow spinach in the warmer parts of the year must move to land uncontaminated with the pathogen in order to grow a good spinach crop.

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