

or if soils remain cool and wet into the normal planting season. Wounding from cultivation, nematodes and herbicides enhance the development of this disease. Resistance exists, but the extent of use of this resistance by plant breeders is not known.

Fusarium wilts of beans and chickpeas

Fusarium wilts of beans and chickpeas have probably occurred in Florida based upon symptoms (Figs. 11 & 12) but official documentation is not available.

Fusarium root and lower stem rots

Fusaria are commonly associated with roots and lower stems of unthrifty plants. As indicated earlier, the presence of *Fusarium* spp. in roots or lower stems does not indicate that the Fusaria are the cause of the problem. However, primary or secondary invasion of plant tissue by Fusaria can cause root debilitation which is usually followed by stunting, loss of green color in leaves, wilting, and other decline symptoms. Some crops that are commonly infected with *Fusarium* spp. in Florida include celery (red root, Fig. 13), parsley (Fig. 14), carrots, corn (particularly field corn), sorghum, millet, peanuts (Fig. 15), soybeans, snow peas (possibly a wilt type of Fusarium), beans, southern peas, forage legumes, onions, and some herbs. Probably, most plants sustain some damage from Fusaria. Infection by Fusaria often begins during the seedling stage of the plant for direct-seeded crops (Fig. 16). Fusarium-induced diseases of potatoes (Fig. 17) would be more of a problem in Florida if certified seed pieces were not used.

Cultural and chemical control practices presented for Fusarium wilt diseases will reduce Fusarium root rots. Also, recontamination of fumigated soil should be avoided because fumigated soil has less natural biological diversity. Soils with less microbiological diversity may allow for a rapid increase of a plant pathogen (Fig. 14). Fertility adjustments may not be as effective for Fusarium root rots as they are for Fusarium wilts. Additional controls include fungicide seed treatments, destruction of all green ma-

nure 30 days or more prior to planting, preparation of soil into a loose tilth for planting, avoidance of deep setting of seeds or transplanting, use of healthy, undamaged transplants, and care not to deposit soil on stems when cultivating.

Fusarium fruit and flower rots

Infection of flower or fruit parts by Fusaria has not been common in Florida but both occur. Peanuts and corn are the crops that are most likely to incur infection of fruit by Fusaria (Figs. 18 & 19). Infection of peanut pods can be associated with damage from soil insects and nematodes. Fruit (ears) of field corn are commonly infected with Fusaria, particularly if damage to the husk or silks occurs from hail, insects, etc. Some Fusaria that infect grain crops such as corn and wheat produce toxins that can poison livestock.

Occasionally, fruit of vegetables may be infected with Fusaria (Fig. 20). Control for such fruit rots include avoidance of damage to fruit from insects or other factors, trellising crops or use of plastic mulch so fruit are not produced in direct contact with the soil. The infection of flowers by Fusaria is not a common problem but has been noted in tomato flowers infested with thrips, a small insect.

Summary

It is not possible to adequately generalize about the complex range of symptoms, environmental factors, and controls associated with Fusarium-induced diseases for the many susceptible crops. The reader is advised to make every effort to seek professional advice on the importance of the Fusaria found in association with a given situation. However, numerous cultural and chemical controls can be routinely incorporated during the production of a crop so that the impact from Fusaria will be minimized. As noted throughout this publication, successful control of Fusarium-induced diseases begins with healthy seed, healthy seed pieces, healthy transplants, and properly prepared and rotated land. Changes of soil fertility, use of resistant varieties, avoidance of plant stresses (biological and physical), and cultural manipulations can be used successfully in some situations.