MYCORRHIZAL FUNGI AS PATHOGENS CONTROLLED BY SOIL FUMIGATION

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Control of a previously undefined disease of burley tobacco by soil fumigants containing methyl bromide led to identification of the mycorrhizal fungus Glomus macrocarpum as the cause. This summary is provided to those who see unexplained productivity benefits of MB in other crops.

Symptoms.--Transplants fail to grow normally, the disease being apparent as soon as plants in fumigated soil start growing rapidly. Root length density is greatly reduced before shoot growth differences are measurable; otherwise, roots appear normal. Maturity (flowering) is delayed several weeks; severely affected plants may be killed by frost without flowering. Yield may be halved, and quality is reduced.

Association:--G. macrocarpum was present in high levels only in land with a stunt history. Sievings only from stunt fields stunted greenhouse plants, and degree of stunting was correlated with sporulation by G. macrocarpum. Only plants with stunt had high mycorrhizal colonization. Height of plants at harvest time was negatively correlated only with populations of spores of G. macrocarpum of the fungi present in all stunt fields. Of about twenty species found in a tobacco soil, only G. macrocarpum appears to be pathogenic.

Isolation and reisolation, and symptom reproduction.--Single-spore isolates of G. macrocarpum from stunt fields, and single-spore isolates of these isolates, stunted greenhouse plants. Degrees of colonization and stunting were related. Inoculation caused root-length reduction as high as 15-fold.

Other evidence.--Benomyl, a fungicide consistently found to inhibit mycorrhizal fungi, prevented colonization, sporulation, root-length reduction, and stunting.

Cropping system effects.--Other crops planted on land harboring populations of G. macrocarpum which severely stunted tobacco were not affected. However, other crops greatly affect populations of G. macrocarpum which stunt tobacco. Growing tall fescue, particularly fescue heavily colonized by the Acremonium endophyte, for two years controls stunt nearly as well as MB. Rotating with sorghum-sudangrass hybrid and corn favored tobacco stunt as much or more than continuous tobacco; soybean was intermediate.

Populations of G. macrocarpum usually were consistent with these crop effects on tobacco stunt. In one instance, an

extremely high G. macrocarpum population resulting from growing sorghum-sudangrass hybrid did not produce a proportionate degree of tobacco stunt; however, populations of G. macrocarpum after producing a crop of tobacco were consistent with effects of prior crops on stunt disease. These relationships suggest that biotypes of G. macrocarpum for capacity to cause tobacco stunt occur and that tobacco selects for these biotypes. Crop effects on species and biotypes of mycorrhizal fungi are not due simply to host specificity, for a single crop species was used as a bioassay host to determine populations of the fungi.

Other diseases possibly caused by mycorrhizal fungi.--Most diseases controlled by MB can be thought of as a consequence of lack of crop rotation. There is some evidence that strawberry and grape are adversely affected. Yields of most annual crops decline with continuous production, and replant disorders of perennial crops can be considered rotation problems. Crop rotation drastically affects mycorrhizal fungal communities and creates greater diversity. Continuous production of tobacco reduced species richness and diversity and brought about mycorrhizal communities dominated by the pathogenic G. macrocarpum. It is possible that mycorrhizal fungi are generally related to yield suppression associated with lack of crop rotation.

Because mycorrhizal fungi do not cause conspicuous symptoms, diseases caused by them are insidious. One must be wary of attributing yield depression to the presence of a necrogenic pathogen, for an insidious pathogen may be primarily responsible.

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