

## YIELD LOSS TO DISEASES IN ALFALFA AND THE POTENTIAL FOR CONTROL THROUGH GENETIC RESISTANCE

D. G. Gilchrist  
Department of Plant Pathology  
University of California, Davis

One key feature of the Integrated Pest Management program on alfalfa in California has been the coordinated effort on the part of investigators working with weeds, insects, vertebrates, nematodes, and diseases to develop current information on the identification of and yield impact due to various pests of alfalfa. Efficient development of long-term management strategies for all pests or pest complexes depends on up-to-date data relating to the biological basis of pest stress, the seasonal behavior of the pests, and the potential, as well as the real, economic impacts involved. Acceptance of pest management procedures will occur only when the tactics suggested are economically sound and practical to use. Thus, the ultimate goal of any integrated pest management program is to provide long-term strategies for minimizing economic losses caused by pests with as little cost to the grower and environmental disruption as possible.

In theory, as a perennial plant, alfalfa should provide a productive stand for many years, yet the average term of a stand in California is about three to four years after establishment. The gradual decrease in productivity, usually beginning in about the second production year, is known as "stand decline" and has been presumed to be due to a number of factors, including diseases, but no quantitative data on the contribution of diseases to stand decline are available. However, it is true that because alfalfa is a perennial crop it provides a favorable environment for many disease organisms over a long period of time. This factor along with the dense canopy of alfalfa permits the development of several diseases that would not have sufficient time to cause damage on an annual crop.

In relation to stand persistence, the most serious alfalfa diseases are those which affect the perennial parts of the plant: the crown and roots. Many root and crown diseases also have leaf symptoms that appear only in the spring and fall; however the absence of foliar symptoms at other times does not mean the plants are free of the disease but, in fact, the pathogens may often be found colonizing the perennial parts of the plants as long as the plant is alive.

Results to be reported from field studies on the incidence and impact of crown and root diseases indicate a significant role of crown and root colonizing fungi in seasonal yield loss and stand persistence. Through the use of chemical "tools" to protect field plantings of alfalfa from infection by such fungi, total yield losses of 35% have been recorded over a four-year period of data collection. These yield losses are associated with a decline in both individual plant integrity and plant population. Similar studies with foliar pathogens, evaluated before significant stand loss occurs, also reveal significant economic loss potential due to diseases which affect the leaf tissue during the spring period of growth and indicate that the yield impact persists through subsequent regrowth cycles even though the disease symptoms are no longer present.

Diseases determined to be part of the complexes present under these experimental conditions, which also were identified in field surveys throughout the Central Valley of California, have been integrated into a breeding program to develop germplasm resistant to the key pathogens. Selection procedures have been developed using information obtained from field and greenhouse studies concerned with limiting conditions for disease development and methods for assessing disease severity. Progress in selecting for disease resistance to *Stagonospora* crown rot (*Stagonospora meliloti*) and *Stemphylium* leafspot (*Stemphylium botryosum*), as well as the methodology employed, will be discussed.