

BIOLOGICAL CONTROL OF WILT PATHOGENS WITH BACTERIAL ANTAGONISTS

**P. M. Brannen
Gustafson, Inc.
McKinney, TX**

Abstract

Cotton (*Gossypium* spp.) is often attacked by wilt pathogens. The fungal pathogens *Fusarium oxysporum* f.sp. *vasinfectum* and *Verticillium dahliae*, causal agents of Fusarium and Verticillium wilts, are the predominant wilt pathogens associated with cotton. More recently, *Agrobacterium radiobacter* strains have also been associated with a wilt complex of cotton. In the past, neither use of chemical seed treatments nor in-furrow fungicides were efficient as control methods, largely due to the fact that the chemicals utilized were not efficacious against wilt pathogens. In addition, it is generally accepted that the wilt pathogens can infect plants after chemical activity has dissipated. In some cases, chemical fungicides may have exacerbated the problem, through selection of wilt pathogens as primary colonists of the cotton rhizosphere. Though biological control agents (BCAs) can colonize the rhizosphere and persist season-long, the use of BCAs to suppress or control wilt pathogens has only recently been pursued. In 1993, Kodiak® was registered for use as a cotton seed-treatment fungicide. Kodiak contains spores of a *Bacillus subtilis* biocontrol strain, GB03. In greenhouse and field trials, Kodiak has shown significant suppression of Fusarium wilt -- a good example of the use of a bacterial BCA for suppression of a wilt disease. The mode of activity has been presumed to be antibiosis, but this has not been proven conclusively. The use of Kodiak, when combined with other management practices such as resistant cultivars, is also a good example of how BCAs can be utilized as a component of integrated pest management systems. However, Kodiak has only suppressed Fusarium wilt, and there is room for improvement; additional disease control is warranted. New BCAs are being pursued, and there are numerous modes of action that either alone or in combination may provide better management of wilt pathogens of cotton. Some bacterial strains produce chitinases and B-1,3-glucanases, enzymes which are active against the structural components of fungal cell walls. Numerous bacterial strains may promote induced systemic resistance (ISR) in plants, and it is likely that such strains will be active in a cotton system as well. If so, the induction of the cotton defense system may be very effective against wilt pathogens. Endophytes, bacteria that colonize the internal plant tissues, may be more effective against wilt pathogens, since wilt pathogens also generally colonize the vascular system of the plant. Once inside the plant, endophytes may act through antibiosis, antagonism, or ISR.

A less-direct approach to use of bacterial BCAs would be the transfer of bacterial antifungal genes into the cotton plant genome. Another possible indirect approach is the use of crop rotations with plant species that enhance the natural level of BCAs in the soil. Any or all of these uses of bacterial BCAs may be utilized in the future to contribute to increased lint production through wilt management. It is not likely that wilt disease problems can be addressed through any single control method, but the use of BCAs will continue to add an additional management tool for the producer.