

Field tips

1. For initial establishment of *T. harzianum*, we suggest two applications of Bio-Trek 22G, four to six weeks apart during the first spring. These applications should be made as the soils warm in the spring, preferably after their temperature reaches 50°F.
2. Another application should also be made as the soils begin to cool in the autumn, again preferably while they are warm (above 60°F).
3. Single applications in spring and fall should suffice thereafter.
4. As an alternative to broadcast applications of Bio-Trek 22G, we anticipate that it will be effective if incorporated into new golf greens at the time of planting.
5. If possible, only compatible fungicides from the list on Table 1 should be used with Bio-Trek 22G; and they should be applied only one to two weeks after the application of Bio-Trek 22G (so that the fungicide is not applied directly to Bio-Trek 22G).
6. Holding pH values below neutral (7.0) is best for Trichoderma.

Gary E. Harman is a Professor in the Departments of Horticultural Sciences and Plant Pathology at Cornell University's New York State Agricultural Experiment Station, Geneva, NY. He has a B.S. from Colorado State University and a Ph.D. from Oregon State University. Dr. Harman has devoted much of his career to the development of biological alternatives to chemical pesticides for a variety of applications, including perennial, row, and greenhouse crops, as well as turf. He has focused recently on identifying genes and gene products that may be useful in agriculture, and developing biocontrol systems based on beneficial fungi. This is his first contribution to TurfGrass TRENDS .

Dr. Harman is a cofounder of TGT Inc., the company that produces Bio-Trek 22G.

Chaur-Tsuen Lo is an Associate Plant Pathologist in the Department of Plant Pathology at the Taiwan Agricultural Research Institute, Taichung, Taiwan, Republic of China. His major responsibilities are in bio-control of plant diseases. He is currently completing his Ph.D. degree at Cornell University under the direction of Dr. Harman and Dr. Eric Nelson in the area of the biological control of turf diseases. This is his first contribution to TurfGrass TRENDS .

Ask the Expert: Questions regarding Bio-Trek 22G *T. harzianum*

By G. E. Harman
Cornell University

Question: How does *T. harzianum* control disease?

Answer: This biocontrol fungus probably has several modes of action. Physically, it coils around fungi and digests their cell walls. In addition, pathogenic fungi attack plants when nutrients from the plants leak into soil, stimulating fungal growth. *T. harzianum* appear to limit this nutrient leakage, thereby reducing fungal infection. Other mechanisms also may be operating, including simply colonizing roots sufficiently that other fungi have difficulty becoming established on or in roots.

Question: If I have questions about Bio-Trek 22G, who can I ask? Also, if I wonder whether it has become established in my turf, how can I test this?

Answer: TGT Inc. is strongly interested in your experiences with Bio-Trek 22G in 1996. Questions on its use can be addressed to Dr. Christopher Hayes, Director of Research and Product Development, TGT Inc., Geneva,

NY, 14456, telephone 315-789-7573. In addition, TGT will be willing to test for the establishment of *T. harzianum* in your turf system on a limited basis. For information on this service, contact Dr. Hayes.

Question: How can I obtain Bio-Trek 22G?

Answer: To find the name of the nearest dealer, contact Mike Cline, Wilbur-Ellis Co., 2903 South Cedar Avenue, Fresno, CA, 93726, telephone 209-442-1220.

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Note to Readers:

The research reported in this article was conducted at Cornell University in conjunction with Dr. Eric Nelson. Dr. Harman has been developing biological control systems at Cornell for use in commercial agriculture for the past two decades. A primary goal has been not only to discover strains, delivery systems, and other aspects of biocontrol, but also to ensure that the results translate into useful products and processes for use in commercial agriculture and horticulture. He has found that the most difficult aspect of development of biocontrol systems is not solving technical problems but rather developing methods or vehicles

to implement and provide biocontrol products. This is an important goal; otherwise biocontrol will remain only in the lab, and will never become available to growers, managers, and the public.

Implementation of biocontrol research requires a for-profit company to register, develop, produce, and market the organisms and processes developed in University laboratories. Dr. Harman has investigated and tested various methods of accomplishing this, and has decided that the best method was to co-found a company to bring biocontrol products to the marketplace. Therefore, he and two colleagues, a scientist-lawyer and a businessman, formed TGT Inc. 2½ years ago. TGT operates under license from Cornell University and has developed methods for large-scale manufacture of biocontrol products. It is beginning to sell substantial quantities of EPA-registered biological fungicides as alternatives to existing purely chemical pest-control methods for several different purposes. Dr. Harman remains a full-time professor at Cornell University, and continues to develop new biocontrol strategies in the University setting. He provides advice and guidance to his colleagues at TGT who use his findings to implement new biocontrol products and strategies.



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