EFFECT OF TILL AND NO-TILL SOYBEAN CULTIVATION ON DYNAMICS OF ENTOMOPATHOGENIC FUNGI IN THE SOIL

D. R. SOSA-GOMEZ AND F. MOSCARDI
EMBRAPA - Centro Nacional de Pesquisa de Soja, Cx P 1061.
Londrina, PR - 86001-970. Brazil.

Several species of phytophagous insects are attacked by entomopathogenic fungi of the Moniliacea family. In soybean agroecosystems, the most prevalent fungi are *Nomuraea rileyi* (Farlow) Samson which infect caterpillars, and *Beauveria bassiana* (Balsamo) Vuill. which attacks chrysomelids such as *Diabrotica speciosa* (Germar), *Cerotoma arcuata* (Olivier), *Colaspis* spp. and curculionids, such as *Aracanthus* spp. Other fungal species of lesser prevalence associated with soybean insects include *Metarhizium anisopliae* (Metsch.) Sorok., which is found on *Phyllophaga cuyabana* (Moser) and other Scarabaeidae; *Paecilomyces fumosoroseus* (Wize) Brown & Smith which cause epizootics in populations of *Lagria villosa* Fabr. (Coleoptera: Lagriidae); and another species of *Paecilomyces*, probably *tenuipes*, which occurs at low levels in the wet season on *Anticarsia gemmatalis* Hubner, *Chrysodeixis includens* (Walker)

and *Rachiplusia nu* (Guenée) (D. Sosa-Gómez unpublished). The prevalence of these entomopathogenic fungi are affected by various abiotic and biotic factors including cultural practices (Gaugler et al. 1989; Sosa-Gómez & Moscardi 1992). The objective of this paper was to study the effect of till and no-till cultivation practices on density dynamics of entomopathogenic fungi in the soil.

The experiment was carried out in two contiguous areas of 22 x 312 m each, in Londrina, state of Parana, Brazil, one under no-till cultivation and another under conventional tillage. In the area under no-till, the soil was not cultivated during the entire year. Double-croppings of soybean and wheat had been planted on these areas since 1985. The soil type was classified as oxisols (soil taxonomy of Brazil = latossolo roxo distrófico epieutrófico). Along the length of the two areas, nine paired plots (50 m^2) were delimited in the 1989/90 season and eight paired plots (50 m^2) in the 1990/91 season. In each paired plot, eight soil core subsamples, 2 cm diam and about 2 cm deep, were taken every two weeks from the soil surface from randomly selected sites (1 m^2). The majority of fungus inocula usually concentrate in this soil layer (Ignoffo et al. 1977; Storey et al. 1989). The subsamples from each plot were combined and mixed thoroughly in the laboratory. One-gram aliquots were taken per sample and processed for colony forming units (CFUs) growing on selective medium (Chase et al. 1986). The number of CFUs per gram of dry soil was analyzed by the t-test procedure of the Statistical Analysis System (SAS Institute 1985), so as to compare mean responses between CFUs from tilled and untilled paired plots.

Significant differences ($P < 0.05$) in the number of CFUs recovered from the two areas occurred at practically all sampling dates (Fig. 1). The predominant species among the observed entomopathogenic fungi was *B. bassiana* reaching about 1.9 x 10^5 CFUs per g of soil on February 2, 1990 (Fig. 1a) and 3.3 x 10^4 CFUs per g of soil on January 17, 1991 (Fig. 1b). The prevalence of *B. bassiana* explains the frequent incidence of this fungus on populations of chrysomelids and pentatomids as reported by Moscardi et al. (1985) and Daoust & Pereira (1986). *M. anisopliae* reached the maximum level on January 19, 1990 with 1.2 x 10^4 CFUs per g of soil (Fig. 1c), and 1.1 x 10^4 CFUs/g soil in 1991 (Fig. 1d). *Paecilomyces* spp. reached a peak incidence of 1.9 x 10^4 on December 14, 1989 (Fig. 1). Thus, in both years, the three fungus species occurred at higher levels in soils cultivated under the no-till system. The differences can be attributed to biotic and abiotic differences between the cultivation systems. Wierenga et al. (1982) mentioned that the surface temperature amplitudes are considerably larger in tilled soil than in non-tilled soil. Other factors, such as the soil capacity to retain water, higher organic matter, and lower temperature of soils under minimum tillage (Vieira 1981) may have contributed to the differential prevalence of fungi under the two cultivation systems studied.

Gaugler et al. (1989) observed that application of *B. bassiana* followed by tillage was very important in achieving enhanced fungal persistence in the soil. This was attributed to the incorporation of conidia into the soil. In the same way, no-tillage practices can enhance persistence of entomopathogenic fungi in the surface layer of the soil, as found in the present work. More research is needed to evaluate the effect of the greater persistence and prevalence of fungi in no-till systems on natural populations of soybean pests as compared to conventional tillage systems. This information will be important for devising cultural practices aimed at augmenting the natural occurrence of entomopathogenic fungi on soybean insects and, consequently, increasing the contribution of natural pest mortality in soybean agroecosystems.

We thank Ivanilda Soldorio and Jairo da Silva for technical assistance.

SUMMARY

Cultural practices influence propagule densities of entomopathogenic fungi in agroecosystems. An experiment was conducted in Brazil to evaluate the prevalence of

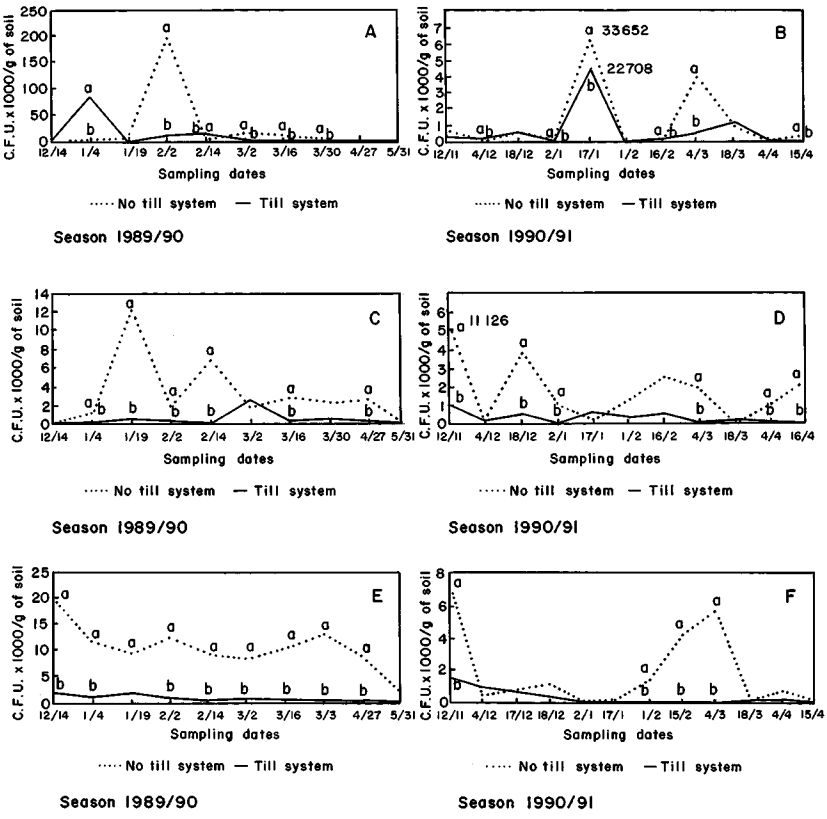

Fig. 1. Effect of till and no-till farming on density of colony forming units (CFUs) of *Beauveria bassiana* (A, B), *Metarhizium anisopliae* (C, D) and *Paecilomyces* spp. (E, F) in two seasons. Means within each sample date with different letters are significantly different. (P > 0.05; t-test).

Beauveria bassiana, Metarhizium anisopliae and *Paecilomyces* spp. in soil under no-till and conventional tillage systems. The no-till cultivation favored the prevalence of the three fungus species when compared with the conventional tillage system.

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