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Compost suppressiveness against *Fusarium oxysporum* was not reduced after one-year storage under various moisture and temperature conditions

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ABSTRACT

The effect of storage conditions on compost suppressiveness against fusarium wilt of melon, caused by *Fusarium oxysporum* f. sp. *melonis* (FOM) was studied in relation to the dynamics of compost microbial activity and biodegradability. For this purpose, mature suppressive compost, prepared from tomato plants and separated cow manure, was divided into four portions and stored for one year under cool/warm (12 or 28 °C) or dry/wet (15–35 or 55–65% moisture content) conditions, in four different combinations: cool-dry, warm-dry, cool-wet and warm-wet. All composts retained and even enhanced their suppressive capacity during storage, with no significant differences among them by the end of the storage period. However, significant differences were found in the dynamics of some of the measured chemical and microbial properties. The microbial activity of composts stored under wet conditions was higher than that of those stored under dry condition, which resulted in a substantial decrease in dissolved organic matter content (expressed as dissolved organic carbon; DOC) and increase in its recalcitrance to biological degradation, decrease in basal heat emission, slower response to added glucose or citric acid, and higher NO_3 concentration, indicating increased nitrification under wet conditions. The DOC significantly correlated with several microbial properties as well as with compost suppressiveness of fusarium wilt of melon seedlings, and may be regarded as a most suitable general index for compost maturity. A best-subset multiple linear regression analysis revealed that the three best predictors, namely dissolved organic carbon (DOC), basal heat, and mesophilic bacterial counts, could explain as much as 83% of the total variance in compost suppressiveness. The generally agreed association between compost maturity and suppressiveness was verified in this case. It appears that compost microbial populations might compete and interfere with the saprophytic stage of FOM conidia, between germination and host invasion. In conclusion, it was demonstrated that compost suppressiveness against fusarium wilt of melon can be maintained for at least one year under a wide range of storage conditions, without any loss of suppressive capacity. This fact has positive logistical implications for the use of suppressive composts against FOM.

1. Introduction

Root diseases cause significant economic damage to many plant species. In the past, fumigation with methyl bromide (MeBr) was used for soil sterilization, and it resulted in practically pest-free soils. Although MeBr caused a biological vacuum which presented many horticultural disadvantages, it was only the finding that MeBr contributed to depletion of the stratospheric ozone layer that resulted in an international agreement for complete phase-out of MeBr (with the exception of quarantine and other critical use exemptions) from 1 January 2005 under the Montreal Protocol.

The use of disease suppressive composts has been proposed as an environmentally-friendly substitute for soil fumigation. During the composting process, organic matter undergoes fundamental biological, chemical and physical changes; and conspicuous among these is the development of suppressiveness against several soil-borne fungal diseases (Hoitink et al., 1977; Nelson and Hoitink, 1982). Various types of composts have been shown to provide some level of pathogen and disease suppression (Bulluck et al., 2002; Benitez et al., 2007; Wu et al., 2007) in several production systems, including growing media (Hoitink and Fahy, 1986) and soil (Perez-Piqueres et al., 2006). The term “pathogen suppression” refers to the ability of the soil (or other media) to limit the inzoculum

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