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Compost made of organic wastes suppresses fusariosis

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Fungal plant diseases cause dramatic yield losses worldwide. Usually, pesticides are used for soil sanitation, and it results in practically pest-free soils, although pesticides cause a biological vacuum, which present many horticultural disadvantages. Suppressive composts, which possess both fertilizing properties for plants and inhibiting properties for plant pathogens, represent an effective and environmentally friendly alternative to conventional pesticides.

In this study, composts obtained from agricultural organic wastes were applied to suppress Fusarium oxysporum of tomato plants in model experiments. Composts were made of mixtures of the widespread organic wastes sampled in Tatarstan (Russia): straw (SW), corn wastes (CW), chicken manure (ChM), cattle manure (CM) and swine manure (SM). 11 two- and three-component mixtures were prepared to obtain the optimal carbon-nitrogen, moisture and pH balances, and composted for 210 days. It was found that the thermophilic phase of composting in all the mixtures lasted from 2 to 35 days, and was characterized by significant fluctuations in temperature, i.e. from 27° to 59°. In the initial mixtures, the dissolved organic carbon (DOC) content was between 10 and 62 mg kg-1; it fell significantly on day 13, and then continuously decreased up to day 102, and subsequently remained low. For all the mixtures, maximal respiration activity was observed in the beginning of composting (231.9 mg 2- g-1 day-1). After 23 days, this parameter decreased significantly, and fluctuations subsided. The phytotoxicity of the initial compost mixtures varied from 18% (SW+SM) to 100% (CW+ChM+SM, CW+ChM); however, the trends in the dynamics were similar. After 120 days of composting, 5 of 11 samples were not phytotoxic.

After 120 days of composting, each mixture was divided into two parts; one was inoculated with a biopreparation consisting of four microbial strains (Trichoderma asperellum, Pseudomonas putida, Pseudomonas fluorescens and Streptomyces spp.), and the other part was not inoculated. Both parts were composted under equivalent conditions. Inoculation led to a slightly shorter period of increasing DOC and respiration activity. It did not influence the temperature profile and phytotoxicity of the mixtures. In contrast, the suppressiveness of the composts towards Fusarium oxysporum increased by 1.2-fold after 60 days, although the inoculated compost mixtures became suppressive 30-58 days earlier. The compost mixture prepared from CM, ChM and CW was the most suppressive one, both in its inoculated and non-inoculated variants. It was therefore used in further experiments.

Further, we were searching for the optimal doses of CM+ChM+CW compost's amendments. Amoung several does checked (1%, 5%, 10%, 15%, 20% and 25%), a dose of 20% was demonstrated to be the most effective and resulted in disease suppression of 84% after 21 day of plant incubation. From the three amendment schemes investigated (1 – once before vegetation season, 2 – twice before vegetation season with one month break between amendments, half of the dose each time, 3 – twice, once before winter frost simulation, once before vegetation season, half of the dose each time), the first scheme was the most efficient one. After a single amendment with 20% of compost, soils were suppressive during two consecutive vegetation periods.