EFFECTS OF COMPOSTS ON SUPPRESSION OF SOIL-BORNE PLANT DISEASES

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Compost produced from animal manures (poultry, dairy cattle, beeflot, or smaller mammal operations), leaves and yard trimmings, cafeteria residues, biosolids, municipal solid wastes, and other bio-organic residues is an increasingly available soil conditioning agent and renewable source of organic matter for soil. On-farm composting fits with other farm operations and can potentially supplement farm income (Dreyfus, 1990). Compost from bio-organic residues is more easily stored, handled, land applied, or used, in preparation of horticultural mixes for containerized plants, than noncomposted feedstock materials. However, because the value of the immediately available nutrients in compost is rarely competitive with cheap inorganic fertilizers, much of the value of compost is associated with its soil and crop conditioning effects. Aerobic composting of organic residues for 21 days (with temperatures above 45 C for 10-14 days) assists with plant disease control in two ways: 1) it eliminates plant pathogens from colonized plant residues; and 2) it stimulates microbially-mediated suppression of root diseases, either directly or indirectly. In addition, several reports have documented significant suppression of soilborne plant pathogens by water extracts of compost, e.g., control of foliar diseases of downy mildew on grape leaves, possibly due to induced resistance, and control of *Botrytis cinerea* grey mould, and *Phytophthora infestans*. Composted biosolids added to soil reduces the incidence of *Pythium* and *Rhizoctonia* infection on beans and *Pythium* damping-off on peasand cotton, and leaf drop of lettuce caused by *Sclerotinia minor*. Bark compost controls fusarium wilt in carnation.

Compost produced from a variety of organic materials also is beneficial as a horticultural medium because it provides a suitably porous rooting matrix, various levels of plant nutrients, protection against plant pathogens, and humic-type plant growth factor. Roots become colonized with beneficial microbes important in biocontrol of soil-borne root pathogens. Hence, compost, when carefully produced so as to achieve time-temperature standards, is not only free of phytopathogens, it is also an aid in control of seedling and root diseases, including those caused by various nematodes and pests, such as the Colorado potato beetle, *Leptinotarsa decemlineata*, and various weeds by suppressing seed germination.

Identification of rhizosphere bacteria isolated from plants grown in compost-amended potting mixes conducive and suppressive to Pythium damping-off disease reveal that suppressive mixeshave higher levels of pseudomonads, whereas *Arthrobacter* and *Bacillus* species predominate in the conducive mixes. In contrast, composts suppressive to phytopathogens can also have strains of *Bacillus subtilis* that produce an antifungal compound. Isolation and characterization of microbes from composting materials continues to show the pasteurization effects on pathogens and the recolonization of self-heated materials by complex plant disease suppressive microbial populations.

Despite the numerous reports of disease suppression by composts produced from bark, biosolids, grape marc, yard trimmings, and food residues, only one study with compost-amended potting mix and two mini-field plot studies have reported on the effects of animal manure composts on plant disease suppression. Gorodecki and Hadar (1990) showed that *R. solani* and *Sclerotium rolfsii* diseases were reduced in container media with either composted cattle manure or composted grape marc; germination of *S. rolfsii* sclerotia was also suppressed (Hadar and Gorodecki, 1991). In greenhouse assays, there was less disease by *Rhizoctonia* on radish in fresh and composted dairy manure mixed with soil than in urea mixed with soil (Voland and Epstein, 1994). Nelson and Craft (1992) assessed use of six animal manure composts for suppression of dollar spot disease by topdressing putting greens. Turkey litter, chicken-cow manure, and cow manure composts reduced dollar spot disease more than the horse manure compost did in fall onset disease development on a putting green at Ithaca, NY. We recently tested 1) the effects of the type of animal manure used in a compost, 2) the effects of age of a compost, and 3) the relation of some chemical properties of a compost on disease suppression.

Broiler litter, dairy manure, and steer/horse manure were separately co-composted with other organic residues, and incorporated at 30% (vol), as a partical substitute for peat, into a potting mix. The effect of compost age (42 to 202 days) on Pythium damping-off of cucumber and Rhizoctonia damping-off of radish was evaluated. Composts and potting mixes containing the composts were analyzed for NO_2^--/NO_3^- - and NH_4^+-nitrogen content, electrical conductivity, pH, and effects on plant growth. All three types of composted manure-amended potting mixes were suppressive to disease caused by *Pythium* and *Rhizoctonia* relative to disease conducive controls. There was no statistically significant association between disease suppression and compost age. The type of manure in the compost significantly influenced damping-off by *Pythium* but not by *Rhizoctonia.* Composts differed in the relative amounts of suppression of Pythium damping-off as follows: dairy manure $\geq$ steer manure $\geq$ poultry litter. Comparisons between disease losses in nonautoclaved and autoclaved potting mixes provided evidence that disease suppression was microbially mediated. There was also some evidence that low levels of NO_2^-- or NO_3^--nitrogen were associated with suppression of Pythium damping-off.

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