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Innovative Uses of Compost
Disease Control for Plants and Animals

Compost technology is a valuable tool already being used to increase yields by farmers interested in sustainable agriculture. Now, professional growers are discovering that compost-enriched soil can also help suppress diseases and ward off pests. These beneficial uses of compost can help growers save money, reduce their use of pesticides, and conserve natural resources. In the poultry industry, composting has also become a cost-effective method of mortality management. It destroys disease organisms and creates a nutrient-rich product that can be used or sold.

Plant Disease Control

Each year, more than 10 percent of the vegetables planted in the United States are lost to root rot alone, according to researchers at the University of Florida's Tropical Research and Education Center. Additional crop losses are caused by other soilborne plant pathogens, such as the micro-organisms that cause ashy stem blight and chili pepper wilt. Compost can help control plant disease and reduce crop losses. Disease control with compost has been attributed to four possible mechanisms: (1) successful competition for nutrients by beneficial micro-organisms; (2) antibiotic production by beneficial micro-organisms; (3) successful predation against pathogens by beneficial micro-organisms; and (4) activation of disease-resistant genes in plants by composts.

Scientists have enhanced the natural ability of compost to suppress diseases by enriching it with specific disease-fighting micro-organisms or other amendments. This amended or "tailored" compost can then be applied to crops infected by known diseases. Research has shown that tailored compost significantly reduced or replaced the application of pesticides, fungicides, and nematicides—which could adversely affect water resources, food safety, and worker safety.

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The use of tailored compost can also be more cost-effective than chemical soil treatments, such as methyl bromide. Soil treated with compost retains irrigation water better, which lowers water costs. Chemicals also must be applied more often than compost. In addition, some chemicals have re-entry requirements that prohibit workers from entering a field immediately after chemicals have been applied, reducing worker productivity.

Compost Impedes *Pythium* Root Rot

Dr. Harry Hoitink of The Ohio State University, has conducted compelling research on compost's effects on plants afflicted with *Pythium* root rot. As the photo below illustrates, the application of tailored compost had a dramatically positive effect on plant growth and impeded the spread of the disease.

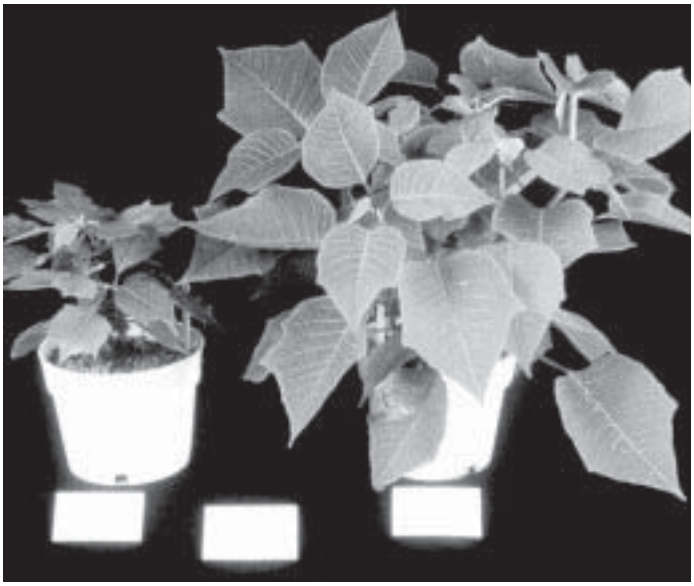

Photo courtesy of Dr. Harry Hoitink, University of Ohio

The plant on the right was treated with compost. The plant on the left was not and suffered the effects of Pythium *root rot.*

Dr. Hoitink views the disease-suppressive characteristics of compost as a reason to consider widening compost applications, "Those who believe composting is not practical for large acreages would find Brazil interesting. I visited a sugar cane farm of some 150,000 acres where the bagasse [stalks left after harvest] was composted and applied back on the land. Every acre got a treatment once every 5 years with 15 percent increases in yield. Some of that increase is apparently due to a suppression of disease organisms."

Compost Combats Chili Wilt

Researchers from New Mexico State University applied a compost made from municipal wastewater sludge and yard trimmings to chili crops in a field known to be infested with *Phytophthora* root rot, or chili wilt. Four different quantities of compost were applied: 10, 20, 30, and 50 tons per acre. Another section of the field, where no compost was applied, was used as a control area. Data collected included damping off disease effects, plant height, chili wilt infection, and yields.

The study showed that salt content in compost plays an integral role in suppressing diseases and increasing crop yields. The 10-ton and 20-ton compost applications provided the greatest suppression of chili wilt and the highest yields. The 50-ton treatment resulted in the poorest yields. The control acreage and the 30-ton application also produced poor yields. The losses in the 30- and 50-ton acreages were attributed to high salt concentrations in the compost, which weakened the plants and made them more susceptible to chili wilt. For optimal results, therefore, salt concentrations in compost should be measured and application rates adjusted accordingly. Plant salt sensitivity requires a tailored compost controlled for salt concentration.

Compost Abates Ashy Stem Blight and Root Rot

University of Florida researchers tested the effects of Agrisoil (compost made of mixed municipal solid waste) and Daorganite (a heat-treated biosolids mix), on test plots in a field in Homestead, Florida. The Agrisoil compost was applied at rates of 36 tons per acre and 72 tons per acre, and the Daorganite sludge was applied at rates of 0.67 tons per acre and 1.33 tons per acre. Sections of the field also were left

untreated as a control. Six weeks after the materials were incorporated into the soil, researchers planted bush beans throughout the field. A second crop, black-eyed peas, was planted following the bean harvest, and Agrisoil compost and Daorganite were applied at the same rates as in the bush bean project. The field was also fertilized according to accepted local agricultural practices.

The health and yields of the bush bean crops were significantly improved by compost. Beans grown in the Agrisoil compost were larger and healthier. Yields from the 36 and 72 tons per acre application areas were both 25 percent higher than control area yields. Beans grown in the Daorganite mix showed low yields similar to those grown in the control areas. In addition, ashy stem blight severely affected beans grown in both the control and Daorganite-treated areas, but not the plots with Agrisoil compost.

The health and yields of the black-eyed pea crops grown in compost were also significantly improved. These crops had greener foliage and were larger than those grown in the control or Daorganite-treated plots. Yields from the compost-enriched areas were more than double the control yields in the 72 tons per acre application sections and also significantly higher in the 36 tons per acre sections. By comparison, yields in the Daorganite-treated areas were only slightly higher or comparable to those in the control sections. *Rhizoctonia* root rot severely affected plants in the Daorganite-treated and control areas, but the disease was considerably less prevalent in the compost-enriched areas.

In this particular study, yields and disease infection proved to be directly related in both the bean and pea crops. Mature Agrisoil compost was more effective at disease suppression than the Daorganite heat-treated biosolids mix. Thus, yields were uniformly higher in the Agrisoil-treated areas than in the Daorganite-treated and control areas.

Mortality Composting

More than 7.3 billion chickens, ducks, and turkeys are raised for commercial sale in the United States each year, according to U.S. Department of Agriculture's National Agricultural Statistics Service. About 37 million birds (18-25 percent) die from disease or other natural causes before they are marketable. As more poultry is consumed, these numbers are expected to climb.

Composting is a viable and cost-effective option for disposing of poultry mortalities as compared to incineration or burial. Pathogens in poultry carcasses are destroyed during composting by the high temperatures (130-155 degrees Fahrenheit) inherent in the process.

During composting, various odor control techniques can be used. As a result, this type of compost is not only safe for crop application, but it also can be safely sold by farmers. In fact, selling excess compost could even be a source of additional income for farmers. Markets for high-quality compost include professional growers (such as horticultural greenhouses and nurseries), homeowners, turf growers, and crop farmers (such as corn and wheat farmers). Professional growers alone purchase $250 million per year in compost products.

Pest Control

Compost also can eradicate some types of pests, such as parasitic nematode (worm) infections, in addition to its use in controlling disease. Specially formulated (tailored) compost can include chemicals that actually kill nematodes or prevent their eggs from hatching. Most types of compost help control parasitic nematodes by providing nutrients to the soil, which encourage the growth of fungi and other organisms, which, in turn, compete with or destroy nematodes. Compost also contributes to plants' basic health, making them less susceptible to pests.

Compost's ability to halt soil nematode invasion was identified by the staff of Dr. Herbert Bryan of the University of Florida. While studying plant response to different compost applications and irrigation rates, the staff, who had a background in nematology, noted the unexpected results while conducting routine observations. "Where compost was used, even without a fumigant, there was a significant reduction in rootknot nematodes," said Dr. Bryan.

Later research by Dr. Tom Obreza, a soil and water scientist at Southwest Florida Research and Education Center, turned up similar results. Dr. Obreza's experiment consisted of growing tomatoes in composts from several different sources and comparing them to control plots treated with the usual fertilizers. Dr. Obreza found no disease problems in any of the plots except one. Dr. Obreza noted, "We had a little invasion of rootknot nematode in one corner of the field. The infection was evident in the plants right up to the compost treated plots and stopped right there. The difference was as plain as night and day."

Biopesticides (Tailored Compost)

Biopesticides are becoming effective alternatives to chemical pesticides. Biopesticides are made by adding controlled amounts of pest-fighting microorganisms to compost, which results in "tailored" compost with a specific pesticidal capability. Biopesticides must be registered with the U.S. Environmental Protection Agency (EPA) and undergo the same level of testing as chemical pesticides to determine their effectiveness and their safety for public health and the environment. Although one type of tailored compost that is inoculated by a patented process is already registered as a biopesticide with EPA, many more are expected to follow suit.

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