



C O N T E N T S

The Making Of Compost Teas —
The Next Generation 55

Biogas Operations And Wind Turbines
Show Power In Renewables 57

Planning The Waste Management Future
For Orkney And Shetland Islands 59

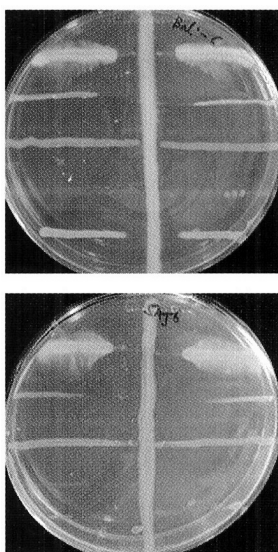
Australia

The Making Of Compost Teas — The Next Generation?

Laboratory tests using nonsterile fish waste/wood waste compost isolate bacteria that “possibly tip balance to improved biocontrol options.”

Martin Line and Yan Ramona

THE PREPARATION, use and efficacy of compost teas has been regularly featured in the pages of *BioCycle*, with a comprehensive report on the variables and management appearing in the February 2003 issue. (i.e. “Understanding How Compost Tea Can Control Disease”). Compost teas are known to be effective against a wide range of plant pathogens, if appropriately prepared and applied, with most interest



Researchers in Australia found that fish waste compost provided antagonism of *Lysobacter antibioticus* (vertical streak top photo) and *Pseudomonas corrugata* (vertical streak bottom photo) against some aerobic bacterial isolates (horizontal streaks).

being focused on the leaf surface. We now have quite a good understanding of the limitations of compost tea formulations, including, that they can still sometimes fail with resultant loss of credibility of the products and of their manufacturers.

As noted in the February article, there is little scientific information on important factors including fermentation temperature, degree of aeration, pH and dilution potential. A major difficulty is that such

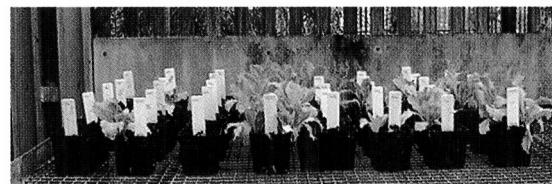
studies are restricted in relevance to the specific substrates used to make the compost, their relative proportions used, the conditions of composting, and

the holding time before the compost is utilized. Added to this, the methods used for quality are varied and we have no basis for assuming that such assessments are applicable to field conditions.

The alternative, traditional approach to biological control of plant pathogens has been to use known selected strains suited to the purpose, with for example the U.S. Environmental Protection Agency listing six microorganisms (bacteria and fungi) effective against powdery mildew of apple leaves alone. Combining composting with microbial cultures has been particularly examined by Harry Hoitink of Ohio State University and coworkers, who have demonstrated the controlled inoculation of mature compost-amended substrates for control of a variety of plant pathogens.

Unfortunately, the utilization of compost as a culturing medium for biological control agents has generally been hampered by the perceived need to sterilize the compost substrate, although in 1998 Nakasaki *et al.* reported successfully culturing a biocontrol (*Bacillus subtilis*) in freshly cut nonsterile grass, with the spores surviving the thermophilic phase to effectively rejuvenate following application.

Work in our laboratory at the University of Tasmania developed this lead, reporting the growth of *Trichoderma spp.* antagonistic to *Sclerotinia minor* and *Sclerotium cepivorum* to high populations



The relative protection of lettuce plants is shown in this trial of bacterial-amended fish waste compost (5 percent w/w) at seven weeks after planting. Pots in rows from left to right are amended with different microorganisms.



**SMALL TROMMEL, SMALL PRICE
ANY QUESTIONS?**

SCREEN USA, INC 770-433-2440

Manufacturing Portable Shaker Screens, Trommel Screens & Star Screens



Food Waste Composting

Use your mixer as a collection vehicle!

**Kuhn Knight offers batch mixers
with capacities of 5 to 35 cubic yards**

Call for information on the Kuhn Knight line of mixing and land application equipment for compost, biosolids, food waste and other organic material.



Kuhn Knight, Inc.
Brodhead, WI • 608-897-2131
www.kuhnknight.com

in sterile or nonsterile nutrient-amended raw wood fiber waste or mature compost made from this material. Subsequently, we have managed to manipulate a nonsterile commercial fish waste-wood waste compost to cultivate several nonsporing biocontrol bacteria by combining selective strategies favoring the inoculated bacteria as follows:

- The biocontrol bacteria were originally isolated from low-temperature mature compost at high dilution;
- Terminal hot phase compost was used as culture substrate, after being rapidly cooled to ambient temperatures;
- The compost was enriched with a nutrient not previously present (waste milk whey was used, with additional supplements of N and P fertilizers) and known to be utilized by the biocontrol bacteria; and
- The compost was heavily inoculated with active cultures of the biocontrol bacteria previously cultivated on these nutrients.

By combining these strategies, we have managed to achieve very high cell numbers of the inoculated bacteria in compost ($>10^8$ cells/g dry weight), with two nonsporing isolates achieving near-monoculture status after 10 to 14 days ambient incubation. The compost substrate was originally at 56°C, the microbiota being dominated by thermophiles. Cooling to 25°C provided a new milieu for mesophilic inocula. The very high numbers of desired bacteria found in compost would inevitably translate to equivalent numbers in compost tea extracts.

The approach used shows that the selective cultivation of both spore forming and nonspore forming bacterial biological control agents in bulk compost is possible without the need for prior sterilization. The effectiveness of these composts in protecting lettuce plants from attack by *Sclerotinia minor* was demonstrated in a glasshouse trial, but a follow-up field trial was inconclusive due to low pathogen attack. Regardless of this, the potential for directing the growth of bacteria in compost matrices is demonstrated — possibly tipping the balance towards improved, standardized biocontrol options.

Martin Line is a Senior Lecturer in Agricultural Microbiology at the University of Tasmania, Hobart, Australia. Yan Ramona was involved in this study as a Ph.D. student and is now at Udayana University in Bali, Indonesia.