

# Current Knowledge on Disease Suppressive Properties of Composts

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## Disease Control with Composts

### 1) Plant Diseases

- **Potted Crops:** practiced effectively since the 1970's for root diseases. Biocontrol agent inoculants improve efficacy for some root diseases and may provide systemic control of foliar diseases.
- **Field Agriculture:** Broad spectrum disease control is feasible but many factors must be considered. Introduced biocontrol agents have been less effective, so far.

## Disease Control with Composts

### 1) Animal Diseases

- **Poultry:** Practiced since 1959 for broilers by composting sawdust-bedded manure between flocks. Reduces death rates over time through 4-5 cycles.
- **Dairy Cows:** Recycled bedding sand and deep sawdust systems suppress mastitis by reducing coliform populations in bedding and on teats. Practiced widely since 1998.

## Bedding Options

- Mattress covered by sawdust results in high incidence of mastitis.
- Coliforms utilize glucose released from cellulose!!



## Composting Bedded Pack

- New (experimental) technology
- Requires specific barn design
  - Feed alley
  - Bedded pack
  - Wall



## Composting Bedded Pack

- Wood shavings or sawdust added at 3-4 week intervals
- Stirred at least twice daily
- Compost under cows reaches high temperatures (130°F)



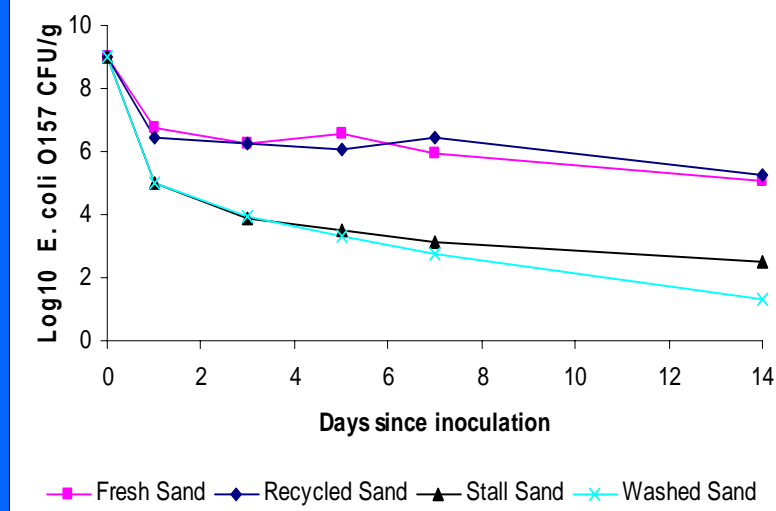
## Sand Bedding: Benefits

- Comfort ?
- Health
  - Fewer swollen hocks/Fewer knee injuries
  - No differences in SCC
  - Mastitis reduction
- Environmental Hygiene
  - Food Safety
    - Less *E. coli* O157



Disadvantage: high bulk density

Survival of *E. coli* O157 in sand bedding



LeJeune et al., 2004, unpublished info.

## Environmental mastitis / bedding pathogen inoculum interactions

- Mastitis incidence relates directly to pathogen population on the teat end
- Rate of clinical mastitis relates directly to number of mastitis-causing organisms in bedding
- Population of Coliforms in bedding should be  $< 10^6$ CFU/g

## Mechanisms of Biological Control

- **Microbiostasis** (competition & antibiosis): effective for suppression of pathogens with propagules  $< 200$   $\mu$  diam. (coliforms, *Phytophthora*, *Pythium*, etc.).
- **Parasitism**: required for suppression of pathogens with propagules  $> 200$   $\mu$  diam. (*Rhizoctonia*, *Sclerotium*, etc.).
- **Systemic Induced Resistance**: induced by ISR-active rhizosphere microorganisms against root and foliar diseases.

## Microbiostasis

- Most composts provide this effect naturally after biocontrol agents colonize the substrate (*Phytophthora*, Coliforms, etc.).
- Organic matter decomposition level critically affects efficacy.
- Compost salinity impacts efficacy.

Stone et al., 2004; Franz et al., 2008 *Env. Microbiol.* 10:313-327

## Parasitism

- Few composts provide this effect naturally (< 20%).
- Controlled inoculants (e.g. *Trichoderma*) improve efficacy for *Botrytis*, *Rhizoctonia*, *Sclerotium*, etc.
- Organic matter decomposition level critically affects efficacy (glucose and other soluble nutrients repress lytic enzymes).

## Systemic Induced Resistance (ISR)

- Effective for suppression of foliar diseases (Botrytis, powdery mildews), stress canker, bacterial, some viral and vascular wilt diseases
- Rarely provided naturally by composts (< 2%).
- ISR inoculants can significantly improve efficacy.
- Substrate chemistry matters!



## ISR Mechanism

- Differs from SAR pathway.
- Jasmonic acid/ethylene pathways are involved (Pieterse et al., 2003; Soresh et al., 2005).
- Extensin proteins and PR 5 seem to play a role in ISR mechanism induced by *Trichoderma* (Alfano et al., 2007).



Do cows have an equivalent ISR mechanism?

