National Organic Standards Board

Compost Tea Task Force Report

April 6, 2004

Introduction

In 2003, the National Organic Standards Board convened a Compost Tea Task Force to review the relevant scientific data and report their recommendations on 'What constitutes a reasonable use of compost tea?' The Task Force was composed of 13 individuals (Appendix B) with knowledge and expertise in organic farming practices, organic certification, EPA pathogen regulations, compost, compost tea production and analysis, plant pathology, food safety and environmental microbiology. Throughout their discussions, members consistently acknowledged the growing interest among certified organic and conventional growers to use compost teas, and the need to develop effective biologically-based tools to manage plant fertility, pests, and diseases. A major focus of the Task Force was concern about the potential for compost tea to contaminate edible plants with human pathogens as regulated in Section

205.203 of the USDA National Organic Program Final Rule. Addressing potential contamination by human pathogens required an examination of compost tea production and use practices, along with the underlying science relative to human pathogen contamination of crop plants.

Use of the terms compost and vermicompost in this report refer to the definitions set forth in the NOSB Compost Task Force report of April, 2002 (NOSB, 2002). These definitions are printed in the glossary below, along with additional terminology and definitions used in this report. Hereafter in this report, 'compost' shall refer to both compost and vermicompost. Likewise, 'compost tea' shall refer to both compost tea and vermicompost tea.

Background

Compost tea practitioners are largely responsible for developing the wide array of compost tea production practices and uses of compost tea in plant pest, disease, and fertility management programs (reviewed in Brinton, 1995; Brinton et al, 1996; Diver, 1998 and 2001; Ingham, 2003; Quarles, 2001; Scheuerell and Mahaffee, 2002; Touart, 2000). In comparison to the extensive experiences reported by practitioners, relatively few peer-reviewed reports describe scientific studies on the production and use of compost teas; most research reports relate to the efficacy of compost teas for plant disease control (reviewed in Weltzien, 1991; Scheuerell and Mahaffee, 2002). Because much of the available information on compost tea practices and effects has not been rigorously or scientifically documented, this report attempts to distinguish between existing practitioner-based knowledge [practice] and scientific knowledge that is supported by controlled, replicated experiments [science].

A primary reason for producing compost tea is to transfer microbial biomass, fine particulate organic matter, and soluble chemical components of compost into an aqueous phase that can be applied to plant surfaces and soils in ways not possible or economically feasible with solid compost. While compost tea is made in a variety of ways, all methods are similar in having water as the first, and compost as the second, most abundant starting materials. Compost tea production methods diverge based on several properties, particularly the intent to maintain a minimum level of dissolved oxygen. Other distinguishing factors are the ratio of compost to water, addition of supplemental nutrients designed to increase microbial biomass (in this report termed ‘compost tea additives’), and the duration of the production process. At the time this committee gathered information to review (2003-2004), the predominant compost tea production method practiced in the United States is commonly termed actively aerated compost tea, which is the product of the following general process. Usually compost is filled into a porous container, which is then suspended in a water-containing vessel, typically 1 part compost to 10-50 parts water. Constant mechanical energy input is used to provide aeration either by air injection directly into the water or by re-circulation of the water, typically for 12-24 hours. Compost tea additives, such as molasses, yeast extract, algal powders, when included, substantially increase microbial biomass in the aqueous phase from microorganisms extracted from the compost. Often actively aerated compost teas are made using one of many commercially produced “brewers”, however, many home-made brewers are also in use.

A second form of compost tea is termed either non-aerated compost tea or passively aerated compost tea, and is the product of the following general process. Typically 1 part compost is mixed with 3-10 parts water in an open container, where it remains with or without daily stirring, for at least several days, often for 1 to 3 weeks. Compost tea additives are infrequently added to non-aerated compost tea.

For the purposes of distinguishing compost tea production practices that have the potential to support growth of bacterial pathogens, this report considers any mixture of compost and water that is held for longer than one [1] hour before initiating application to be a form of compost tea. Any mixture of compost and water that is held for less than one hour before initiating application is considered a compost extract (see Glossary herein for a definition of compost extract; see Scheuerell and Mahaffee, 2002, for a discussion).

Before use, compost teas are typically filtered to a degree necessary to avoid plugging the sprayer or irrigation system used for application. Spray adjuvants are sometimes added immediately prior to application.

Background issues associated with human pathogen contamination

The National Organic Program (NOP) specified composting standards for manure and mandated a 90/120 day pre-harvest interval for land application of

non-composted manure. These requirements were established to reduce the potential for transfer of human pathogens to food crops from raw manure. Time-temperature criteria for thermophilic composting provides a basis for this disinfection process that further reduces pathogens (PFRP), however, meeting the criteria does not guarantee the complete destruction of all pathogens in every particle of compost. The number of human pathogens surviving may be so low that they are undetectable by standard laboratory procedures used in quality assurance testing. This does not mean that the process was deficient, but simply indicates that the test cannot guarantee a pathogen-free result for the entire mass, and that the test has limits of sensitivity. It does show that the pathogen content of the organic mass is substantially less than it was prior to composting. With both the time-temperature exposure data and before/after composting test results, compost producers can document that their process meets the standards for pathogen limits established for use and general distribution of composted fecal-matter as a soil amendment (US EPA, 1993; FDA, 1998).

For compost tea, the use of compost tea additives to encourage growth of beneficial, nonpathogenic microbial populations from compost can have nontarget effects, i.e., the additives can likewise support growth of bacterial human
pathogens from undetectable to easily detectable numbers, in liquid microbial cultures, as preliminary investigations have demonstrated (discussed further below). This is the basis for concern about compost tea production practices that use compost tea additives to increase microbial populations; thereby potentially posing a risk of contaminating crop plants with human pathogens due to introduction of pathogenic bacteria (Patricia Millner, personal communication). The concern is similar to that of EPA’s Solid Waste bureau and other State regulating bodies which restrict re-introduction of fresh decomposable substrates into composts that have previously met heat standards, owing to risk of pathogen regrowth. These concerns led the NOP to state that compost tea does not satisfy .205.203 Soil fertility and crop nutrient management practice standard (c) The producer must manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances (NOSB Compost Task Force Recommendation, 2002; as amended by the NOP). However, there is not unanimous agreement on these and other data, which the Task Force was aware

of, suggesting that the evidence of dangers from pathogens is inconsistent.

Although concern exists, there have been no reported cases of food borne illness from the use of compost tea, but there have been no epidemiological health/microbial studies done to evaluate this effect. Because gastrointestinal disease cases in the US are notoriously underreported and of unknown cause (Mead et al., 1999), lack of evidence cannot be used to support evidence of no problem. The committee acknowledges that proactive protective measures should be considered when the contamination of fresh produce with human pathogens is an issue. For compost tea, averting the theoretical possibility of contaminating crops with human pathogens can be approached by implementing measures that reduce the potential for pathogens to enter compost tea

production systems, and perform quality assurance testing to demonstrate that a specific compost tea production system produces compost tea that meets microbiological quality guidelines.

Glossary and definitions

A brief list of relevant terms used in this report is provided below.

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Composting. A managed process in which organic materials, including animal manure and other residuals, are decomposed aerobically by microbial action. “Thermophilic” composting refers to the time-limited, self-heating process in which heat generated by microbial respiration is retained in the mass of a pile or windrow such that vulnerable pathogenic microorganisms are destroyed. Compost is defined by the NOSB Compost Task Force (NOSB, 2002) as “Compost, in addition to that described in section 205.203 (c) (2), is acceptable if (i) made only from allowed feedstock materials, except for incidental residues that will not lead to contamination, (ii) the compost undergoes an increase in temperature to at least 131 degrees F (55 degrees C) and remains there for a minimum of 3 days, and (iii) the compost pile is managed to ensure that all of the feedstock heats to the minimum temperature.”
See also Vermicompost below.

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CFU. Colony-forming unit; a term used in microbiology to express the number of microbes in a sample that produced colonies on nutrient agar in petri plates.

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Compost extract. Any mixture of compost and water, additives, and adjuvants that is not held for more than one hour before use. Compost extracts lack sufficient holding time for microorganisms to multiply and grow significantly.

- Compost leachate. Liquid that has leached through a compost pile and collects on the ground, compost pad, or collection ditches, puddles, and ponds.
- Compost tea additives. Materials separate from compost and water that are added in the process of making compost tea that are presumed to sustain and enrich microbial growth. These are distinct from spray adjuvants that are tank mixed immediately prior to application of compost tea. Examples include but at not limited to the following: molasses, yeast extract, fish-based products, kelp, and green plant tissue.
- Disease vector. Animals including rodents, flies, and birds that are capable of transferring human pathogens to other materials.
- Manure extract. Water suspension containing raw, non-disinfected manure; when the suspension is maintained for several hours or more it is sometimes referred to as manure tea.
- Microorganism. Bacteria, fungi (molds, yeasts), protozoans, helminths, and viruses. The terms microbe and microbial are also used to refer to microorganisms.
- Pathogen. A microorganism capable of causing disease or injury; used to refer to "plant" or to "human" pathogens. Parasite and parasitic refer to infectious protozoans and helminths. Helminth and helminth ova refer to parasitic worms, e.g., roundworms, tapeworms, Ascaris, Necator, Taenia, and Trichuris, and ova (eggs) of these worms. (See Appendix A for a list of pathogens of concern).
- Indicator organism. A microorganism that is used for monitoring whether a certain set of pathogens might be present.
- Potable water. Water suitable for human consumption.
- Sanitize. To treat equipment and surfaces by a process that is effective in destroying or substantially reducing the numbers of microorganisms of public health concern, as well as other undesirable microorganisms. Sanitizing agents are described and defined in 21 CFR 178.1010.
- Spray adjuvants. Any material added to compost tea immediately prior to application of compost tea. These may include materials that are

designed for wetting & sticking agents, plant nutrients, and those materials that sustain and enrich microbial growth, but because of the short time frame between addition and application, there is a very low probability of multiplying undesirable microorganisms in the spray tank.

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Vermicomposting. Process of worms digesting organic matter to transform the material into a beneficial soil amendment. Vermicompost is defined by the NOSB Compost Task Force (NOSB, 2002) as:
“Vermicompost is acceptable if (i) made from only allowed feedstock materials, except for incidental residues that will not lead to contamination, (ii) aerobicity is maintained by regular additions of thin layers of organic matter at 1-3 day intervals, (iii) moisture is maintained at 70-90%, and (iv) duration vermicomposting is at least 12 months for outdoor windrows, 4 months for indoor container systems, 4 months for angled wedge systems, or 60 days for continuous flow reactors. “
See also Compost above.

Compost tea applications

Compost tea practitioners have developed a range of compost tea uses and applications methods. A brief description of the most common uses and application methods for compost tea follows. This information was used to develop an understanding of compost tea applications that could pose an increased potential of contaminating food crops with human pathogens.

Applications to above ground plant parts.

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Foliar spray. Applied through irrigation system or sprayer to above-ground plant parts.

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Stubble digester/green manure inoculant. Applied to crop residues or cover crops, usually after mowing and before incorporation into the soil

Applications to soil and soil-less potting media.

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Soil. Application to unplanted or planted fields. For unplanted fields, applied through irrigation system (drip, micro sprinklers, sprinkler line, gun, wheel line, center pivot) or tractor mounted/pulled sprayer. For planted fields, applied as a directed spray to areas of bare soil or through drip irrigation systems.

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Soil-less media. Use to moisten media before planting or as a post-

plant drench.
Seed treatment. Soak seeds or propagation material (e.g., potato) before planting.

Odor suppressant. Applied to manure collection/handling areas or to ground surrounding compost piles to reduce production of odors.

Plant responses to compost tea

Grower testimonials constitute the majority of evidence that supports the use of compost tea as a beneficial agricultural production tool. Most testimonials have described impacts on plant growth or disease suppression. Relatively few rigorous scientific studies have examined the use of compost tea for plant disease suppression. The following information summarizes plant responses to compost tea and was used by the Task Force to identify areas of study that should receive greater scientific attention.

Positively impact plant vigor and growth. A growing number of organic and conventional growers are using compost tea because they have observed yield

and/or production efficiency gains (Schmitz, 2002; Diver, Ingham, Scheuerell, personal communication).

- Postulated direct mechanisms include plant response to nutrients or phytohormone/growth promoting chemicals in the compost tea.
- Postulated indirect mechanisms include altering composition and/or populations of plant associated microorganisms that cause a direct effect, or over time, moderation of the chemical, physical or biological properties of the rhizosphere/phyllosphere. Examples would be soil structure, pH, or reducing the effect of deleterious (nonpathogenic) microorganisms.

Plant disease management

- Practitioner-based knowledge [Practice]

There have been a large number of grower testimonials in recent years suggesting that compost tea has improved their ability to manage plant diseases (Diver, Ingham, Scheuerell, personal communication).
Grower experiences have indicated that both non-aerated and aerated compost tea can suppress the incidence and/or severity of foliar and root rot diseases.

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Science-based knowledge [Science]
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Some replicated scientific studies have indicated that both non-aerated and aerated compost tea can suppress the incidence and/or severity of foliar and root rot diseases, while others have observed no significant effect (reviewed in Scheuerell and Mahaffee, 2002; Weltzien, 1991).
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Lack of consistency of disease suppression by compost tea is postulated to be caused by variability in raw materials, the production process, nutrients and other materials tank mixed before application, application method and timing, pathogen pressure, and environmental conditions. The committee had limited data available to review (see Scheuerell, 2002; Scheuerell and Mahaffee, 2002; Weltzien, 1991).

Potential Microbial Hazards Associated with Compost Tea

There are many variables in the production and application of compost tea that could affect the probability of contaminating crops with human pathogens. In addition, plant properties and environmental conditions greatly affect survival of human pathogens. This section of the report discusses factors associated with compost tea production, plant properties, and environmental conditions that could affect the contamination of crops with human pathogens. This information was used by the Task Force to identify data gaps and guide the development of recommendations.

Transfer or multiplication of pathogenic organisms

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Compost tea production factors. In general, pathogens that go into the process might come out at the same, lower, or higher levels. Processes or materials that have a high probability of increasing human pathogens during compost tea production are of greatest concern.
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Compost feedstocks and composting process used [Science]

Feedstocks such as manure have a high probability of containing pathogenic organisms. These types of materials can be processed to reduce populations of indicator microbes and pathogens to acceptable levels by using approved PFRP’s. For example, Lung et al. (2001) recently reported that after composting cow manure E. coli and Salmonella were not detected after 72 hours at 45 degrees C. All data brought to the Task Force support the notion that compost tea made from compost and vermicompost, as defined by the NOSB Compost Task Force (NOSB, 2002), does not represent a risk if compost tea additives are not used.

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Compost stability. [Science]
Compost stability is the reactivity of composting materials, most commonly measured as the rate of oxygen consumption and/or rate of carbon dioxide respiration. Stability is known to affect the potential for Salmonella re-growth in composting biosolids (Soares et al , 1995; Soares, 1996; Skanavis and Yanko, 1994; Yanko, 1987; Yanko et al., 1995). Stability affects the relative quantity of nutrients originating from the compost that support the growth of a wide range of microorganisms, including some human pathogenic bacteria. Data is lacking on the relationship between human pathogen growth potential in compost tea and compost stability.

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Water quality [Science]

Potable water quality is necessary to prevent the introduction of pathogens.

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Sanitation [Practice]
Cleaning procedures for production and application equipment. No standards exist, but sanitizing agents should be used to maintain equipment free of microbial biofilms between uses, and accidental contamination from wind-borne dust should be avoided.

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Disease vector access [Science]
Rodents, flies, and birds need to be excluded from the materials used to produce compost tea.

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Brew time and temperature. [Practice]
Affects the theoretical maximum number of bacterial divisions that can occur during compost tea production.

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Compost tea additives. [Practice and Science]
Materials other than water and compost added at the start of the compost tea making process to increase microbial biomass/populations. It should be noted that as of March 30, 2004, only one of the studies (Duffy et al, 2004) discussed below has been published in a peer-reviewed scientific journal.
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Duffy (et al 2004) related the growth of E. coli O157:H7 and Salmonella Thompson to concentration of molasses added to 2 types of compost with water in sealed flasks that were rotary shaken for 72 hours (Duffy et al, 2002). Re-growth of either pathogen was not detected when 0, 0.05, or 0.2% vol/vol molasses was added. Re-growth of E. coli and Salmonella was observed when 0.5 or 1.0% molasses was added, with 0.5% molasses supporting greater re-growth of Salmonella than E. coli. For Salmonella, composted chicken manure supported 100 times more re-growth than composted dairy manure when 0.5 or 1.0% molasses was added; potentially due to the greater concentrations of inorganic nutrients in the composted chicken manure. This indicates that pathogen re-growth can be dependent on the concentration of compost tea additive used. In addition, the significant interaction between compost source and additives on the re-growth potential of human pathogens in this study indicates the need to test individual batches of compost with defined concentrations of compost tea additives

for compost tea quality assurance testing. The nature of the production method used in the Duffy et al paper has been challenged as not relating to any compost tea production practice (Elaine Ingham, personal communication).

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Data presented by Bess (et al, 2002) at the 2002 International Symposium Composting and Compost Utilization, May 6-8, Columbus, Ohio, addressed the issue of increasing populations of bacterial pathogens through the addition of compost tea additives. The report indicated that E. coli increased to various degrees with different microbial culture nutrients when incompletely composted material that contained detectable populations of E. coli was used in an aerated compost tea brewer (Bess et al, 2002).
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Initial experiments presented to the Task Force by Pat Millner

and Will Brinton and duplicated in two microbiological labs simultaneously, indicated pathogen growth could occur in compost teas when very low concentrations of molasses were used in combination with a compost substrate seeded with very low numbers of human pathogens (‘trace’ concentration, also referred to as ‘undetectable’ by common laboratory analysis). This resulted in growth of the pathogens in the compost tea to a quantity detectable by common laboratory procedures (Millner and Brinton, Manuscript Report to Task Force).

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Other experiments were discussed that showed vermicompost with relatively high populations of E. coli resulted in variable amounts of E. coli growth depending on the concentration of molasses used as a compost tea additive (Elaine Ingham, personal communication). Related experiments using a mined humus material (no detectable E. coli) in place of compost resulted in no growth of E. coli over a range of molasses concentrations used as a compost tea additive (Elaine Ingham, personal communication). Other tests that utilized compost sold as part of an aerated compost tea production system or compost that had had below detectable levels of E. coli did not show an increase in E. coli even when compost tea additives were used (Scheuerell and Millner, personal communication; Brinton, personal communication).

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Crop/environmental factors [Practices available, no Science available that directly addresses compost tea use under agronomic conditions]

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Pre-harvest interval

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Climate – temperature, humidity, precipitation

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Crop architecture – UV protected sites, moisture availability, plant exudates

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Crop cleaning, processing, cooking. Crops that are dried and then cooked before consumption, such as grain crops, are not considered to be a significant source of human pathogens.

Factors Associated with Human Pathogens

The following are factors associated with human pathogens that the Task Force considered while developing recommendations.

- Actual pathogens present. The presence or growth potential of many pathogens has not been thoroughly evaluated for different compost teas.
- Contamination level of compost teas. Available research has used non-stable compost with readily detectable populations of human pathogens or compost artificially inoculated with human pathogens. For artificially inoculated compost, research has demonstrated a high degree of variability in final pathogen populations across replications of the same compost tea production treatment (Scheuerell and Millner, personal communication). Data currently relate to pathogens suspended in the tea, rather than the number that survive on the surface of edible fresh produce after tea is directly applied to plant surfaces.
- Pathogen survival. In the environment pathogen populations typically decline over time, unless deposited in a site with all conditions conducive for survival or growth. For example, Liao (2003) demonstrated that human pathogens present in dairy manure were not detectable 70 days after application to potato production fields. In a review of published data on the survival of human pathogens on plant surfaces, Epstein (1997) indicated that most studies found bacterial pathogens to survive for <1 day to a maximum of 35 days on plants, and the longest cited survival time of any pathogen was 68 days.
- Crop architecture and exudate profile. Potential for the crop to enable pathogen survival or growth. Lettuce and apples are the best known examples for harboring bacterial pathogens in sites protected from environmental stress and likely releasing sufficient nutrients to support pathogen metabolic activity.
- Environment. Particularly important for above ground portions of plants. Ultraviolet radiation and dessication are the two most important environmental factors causing pathogen destruction.

  Little is known about interactions with other microorganisms on plant surfaces under field conditions.

- Pre-harvest interval. If the decimal reduction time is known for a crop and general environment, then the interval between the last compost tea application and harvest can be used to compute the amount of pathogen reduction expected during that pre-harvest interval.

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Post-harvest treatments. Removing part of the plant, sanitizing, and processing activities can leave unaffected, spread or kill individual pathogen cells. This depends on a number of factors including plant type, washing system, sanitizing system, cutting of plant tissue, and most importantly thermal processing.

Data Gaps [Science needed]

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Cost-benefit analysis. Developing a cost-benefit analysis of compost tea use will require confirming compost tea production and application methodologies that consistently provide a positive, measurable crop response. If benefits were quite certain, then the cost of incorporating the compost tea program compared to other production choices could be quantified.

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Ecology of human pathogens

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We lack an understanding of the population dynamics of human pathogens when occurring in diverse microbial mixtures with active predation by higher trophic levels. The microbial diversity and competition found during compost tea production could inhibit or destroy human pathogenic bacteria.

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Influence of water temperature and production duration on pathogen growth. For compost tea production, combining relatively low water temperatures with short production durations may provide conditions not suitable to significantly increase human pathogenic bacteria that have evolved optimal growth rates associated with warm-bodied animals.

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Survival of human pathogens on crop plants, under field conditions, when inoculated at realistic levels. In addition, diverse microbial competition for resources and/or antagonism and predation by other organisms on crop plants could affect duration of survival in crop environments.

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Internalization of pathogens into plants. Laboratory and greenhouse studies have shown incorporation of E. coli into plant tissue is possible when inoculated with very high populations of pathogenic bacteria. Whether this occurs on crop plants, under field conditions, or in relation

to compost teas containing a realistic level of contamination has not been researched. If internalization of pathogens is an issue, on what plants and under what conditions needs to be determined.

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Pre-harvest application interval. The aforementioned data gaps preclude a meaningful assessment of appropriate pre-harvest interval recommendations.
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Compost Stability. Role of compost stability in the potential for compost to support the growth of pathogenic bacteria during compost tea production.
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Feedstocks. Role of different feedstocks used to make compost in the potential for compost to support the growth of pathogenic bacteria during compost tea production.
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Phytotoxic reaction [Practice]. Potential for compost tea to cause phytotoxic reactions, particularly in relation to the compost tea production practice used. There are few reports of adverse effects (Diver and Ingham, personal communication). Theoretical concerns of phytotoxicity are based on soluble salt levels or potential accumulation of phytotoxic microbial metabolites during compost tea production. Potential for phytotoxic reactions could be affected by tea concentration, dose, crop, and environmental conditions. If a concern exists, like any agricultural material, the tea should be tested on a small portion of the crop and observed.
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Dissolved oxygen content. The relevancy of measuring oxygen content of compost teas as a stand-alone indicator of potential pathogen growth is uncertain given than E. coli and other potential pathogens are facultative organisms (capable of growth in presence of oxygen).
Recommendations

1. Potable water must be used to make compost tea and for any dilution before application.
2. Equipment used to prepare compost tea must be sanitized before use with a sanitizing agent as defined by 21 CFR 178.1010.
3. Compost tea should be made with compliant compost or vermicompost, using the NOSB Compost Task Force Guidelines set forth on April 18, 2002, for thermal compost and vermicompost, or compost as defined in section 205.203 (c) (2) of the NOP rule. For compost tea, this applies to 100% plant feedstock materials in addition to manure feedstocks because non-manure compost feedstocks may harbor high levels of fecal bacteria (Epstein, 1997).

4. Compost tea made without compost tea additives can be applied without restriction.
5. Compost tea made with compost tea additives can be applied without

restriction if the compost tea production system (same compost batch, additives, and equipment) has been pre-tested to produce compost tea that meets the EPA recommended recreational water quality guidelines for a bacterial indicator of fecal contamination (US EPA, 2000). These indicators and the passing criteria are Escherichia coli (126 CFU/100ml) or enterococci (33 CFU/100ml). At least two compost tea batches must be tested using accepted methodology (APHA-AWWA-WEF, 1999; US EPA, 2000), with the average population of indicator bacteria across compost tea batches used as the measurement of passing. Each new batch of compost would require that the system quality assurance pre-test be conducted again as indicated. After it passes again, compost tea from the system can be used without restriction. If compost tea made with compost tea additives has not been pre-tested for indicator bacteria, its use on food crops is restricted to the 90/120 day pre-harvest interval. Crops not intended for human consumption, ornamental plants, and grain crops intended for human consumption are exempt from bacterial testing and 90/120 day pre-harvest interval restrictions. In the view of the Task Force, educating producers about the potential for contamination and its impacts on public health and marketing, as well as how this recommended quality assurance testing system would avoid potential contamination will provide compelling incentives for producers to follow the rules.

6. Compost extracts - any mixture of compost, water, additives, and adjuvants that is not held for more than one hour before use - may be applied without restriction.
7. Raw manure extracts or teas may be applied to the soil with a 90/120 day pre-harvest restriction, foliar applications are prohibited.
8. Compost leachate may be applied to the soil with a 90/120 day pre-harvest restriction, foliar applications are prohibited.
9. Compost tea is not allowed for the production of edible seed sprouts.
10. The emerging national acceptance of compost tea as a biologically-based crop production tool by organic as well as conventional growers clearly indicates the need for further scientific investigation to validate the benefits and concerns of compost tea use. The Task Force unanimously urges USDA and its agencies to strongly support additional research on the potential for crop contamination and plant disease/pest control by compost tea. There is an urgent national need to address critical data gaps, uncertainties, and variability in existing data that limited the evaluation of potential crop contamination by the current task force. Data are urgently needed to provide science-based recommendations on how compost tea production and application practices impact potential crop contamination, while at the same time preserve the means for improving plant health and vigor. Critical issues requiring further data include compost quality, compost tea additives, temperature and duration of compost tea production, and the population

dynamics of human pathogens in microbially diverse agro-ecosystems relative to pre-harvest intervals for application of compost tea.

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Appendix A

Public Health (Food and Waterborne) Pathogens of Concern in
Animal Manure

Major Concern Minor Concern Intermediate

E. coli 0157:H7 Bacillus cereus Helicobacter
Listeria monocytogenes Brucella Aeromonas
Salmonella Citrobacter spp. Burkholderia
enterpathogenic E. coli Clostridium perfringens Legionella pneumophilia
Yersinia enterocolitica Coxiella burnetii Toxoplasma gondii
Campylobacter jejuni Enterobacter spp. Endotoxins
Leptospira Erysipelotrix rhusiopathiae Enterotoxins
Cryptosporidium parvum Francisella tularensis Antibiotic resistance
Giardia lamblia Klebsiella spp. Paramyxovirus (Newcastle)
Ascaris lumbricoides Mycobacterium tuberculosis Parapox (Orf)
Ascaris suum Mycobacterium avium spp.
Hymenolepis nana Proteus spp.
Necator americanus Pseudomonas aeruginosa
Taenia saginata Serratia spp.
Toxocara canis Staphylococcus
Trichuris trichiura Streptococcus spp.

Enteroviruses
Rotaviruses
Orthomyxovirus (Influenza A)

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Not all pathogens are necessarily present in all manures, all the time.
In terms of emerging diseases, Taylor et al. (2001) reported that there are 1415 infectious agents that affects human, including 217 viruses and prions, 538 bacteria and rickettsia, 307 fungi, 66 protozoa, 287 helminths. Of these 868 (61%), are zoonotic, i.e. transmissible between humans and animals, 175 pathogenic spp. are associated with diseases considered to be ‘emerging’ Taylor et al. (2001) show that zootic pathogens are more likely to be emerging than existing and that protozoa and viruses are most likely to emerge and helminths are least likely. They found no association between the disease transmission route and emergence.

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Appendix B

Compost Tea Task Force Members

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Maine Organic Farmers and Gardeners Association

Dennis Holbrook, Co-Chair until he resigned from the NOSB
National Organic Standards Board, Farmer

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Dr. Clive Edwards
The Ohio State University

Dr. Elaine Ingham
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Dr. Rosalie Koenig
National Organic Standard Board, Chair of Material Committee and Co-Chair of Task force replacing Dennis Holbrook

Dr. Frederick Magdoff
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