Washington Organic Recycling Council Research Needs

The Washington Organic Recycling Council (WORC) is a 501(c)6 trade organization that represents entities in Washington State who are concerned and involved with recycling organic materials. Our members are composters, farmers, engineering consultants, laboratories, state, local and regional governments, landscapers, log yards, anaerobic digestion and biodiesel producers, students and others.

A major concern for our members is the lack of published, peer-reviewed research in many areas that directly concern our industry. WORC is proposing to use its position as representative of the industry interests to act as liaison between our members who have an interest in getting the research performed and the research institutions who can perform the research. We would like to partner with research institutions and others, or to assist in other ways such as helping to connect research institutions, interested parties, and/or potential funding sources in order to facilitate finding answers to the questions needed by the Organics Recycling industry.

To this end we surveyed our members and other interested parties to generate a list of topics and questions of value to our members. We have prioritized these topics based on the Committee's subjective assessment of relative 'High', 'Medium', and 'Lower' impact or value for the industry as a whole, recognizing that ALL of these topics are considered to be "of interest" to our members. A summary and brief discussion of these topics is presented below.

Please consider these questions and topics for use with your students' research projects and for use in obtaining funds to work in these areas. Please feel free to contact any of the Research Initiative Subcommittee of WORC for assistance and discussion of either topics or partnering opportunities. Thank you for your interest.

Tamara Thomas
Research Initiative Committee Chair
November 2007

Topics with "High" Priority for the Organics Recycling Industry

Green House Gas Sequestration

The immediacy of the impact of green house gas emissions combined with the high political and monetary cost of petroleum fuels has brought the question of how we manage carbon resources to our immediate attention. Activities that contribute to utilization of waste materials such as recycling paper and composting are important from a landfill optimization and cost standpoint. Compost has the additional environmental benefit of improving soils, and reducing the need of additional water and nutrients for plant growth. Many questions remain, however, concerning all of the impacts and emissions produced during composting as well as what specific operational methods can be used to reduce the climate impact and improve the carbon sequestration and plant growth qualities of compost.

WORC's members need legitimate data on all of those topics. They also want to know "Is composting environmentally beneficial with respect to green house gas emissions and climate change?" If so, are there ways to quantify that benefit and allow expansion of the practice through funding by carbon credits or offsets? Are there other technologies that can produce a soil amendment for agriculture similar to compost that can provide additional benefits with respect to climate change?

Compost Leachate

Washington Department of Ecology has defined "leachate" as any water that has touched any material involved in the compost process up until the compost is "finished" and determined to be "not a solid waste".

WORC members are interested in research on the content and qualities of compost leachate. Is it a consistent material or does it vary widely in quality and characteristics? Does it deserve the label "leachate" in terms of potential environmental degradation? What are the qualities of leachate? Is there a potential use / market for compost leachate? What management practices impact the qualities of the leachate and how?

Specific questions include: What are the microbial characteristics of compost leachate (beneficial versus pathogenic)? Are there nutrients in leachate that could be utilized as a fertilizer? What are the effects of different feedstocks on the qualities of the leachate?

Odor Generation Sampling Technology and Methodology

Odor associated with composting is the leading cause of facility closures and failures. Good management techniques are key, but the ability to objectively measure odors generated and odor movement is generally not available. Because of the subjective and transient nature of odors, it becomes one of the hardest parameters to control and to defend against. The industry as well as neighbor groups would benefit from reliable, understandable, and affordable instrumentation for measuring and identifying odors.

Soil Quality and Organics

The impact of compost on soil quality use is essential to WORC's members in that you must produce a good quality soil amendment that makes positive changes to the soil. Documenting what these changes are and what they are not is essential to the proper production and use of organic amendments.

Compost makes profound changes on soil quality. Research on the soil quality changes from applications of compost has been studied mainly in agricultural soils. Limited research is available on changes in urban soils. A broad perspective needs to be undertaken to better understand the specific relationships between compost qualities, initial feed stocks and finished compost's effect on soil. This needs to include soil chemical, microbiological, and physical aspects of urban and agricultural soils.

Additional specific questions raised include: What is the impact of temperature on the release of organic nitrogen from compost? From raw manures? From green manures?

Pathogen Control via Composting

The composting process has been shown to destroy human pathogens such as e.coli and salmonella. Much of the research performed on those pathogens was generated from the perspective of the processing of biosolids and development of the 503 CFRs. A combination of heat, moisture, and consumption of easily accessible carbon have been linked to this destruction.

More recently, research into plant pathogens such as pythium sp., phytopthoras such as p. ramorum, and rhyzoctonia has shown suppression of these diseases during composting of specific agricultural debris. More needs to be known.

As our ability to dispose of agricultural mortalities becomes more and more costly, the potential for expanding the use of composting for animal mortalities raises the question of how effective composting is for destruction of animal diseases. This question is very large as it encompasses traditional bacterial pathogens, viruses, and pathological proteins. Are these diseases permanently destroyed or only reduced awaiting appropriate environmental conditions for regrowth? Composters, users of compost, state and local health departments, federal and state environmental protection agencies, and the Center for Disease Control are only a few of the entities with vested interest in the answers to these questions. More information needs to be found on what mechanism is responsible for the destruction of specific health risks so that operators can optimize their process to produce a healthy, environmentally beneficial product that will protect human health and the environment.

Pathogen Control via Use of Compost

(Related to work described under Agricultural Trials)

Dr. Hoitink of Ohio State University has done a great deal of research into the pathogen suppressive capabilities of compost use in agricultural and horticultural practices. Questions remain related to the suppression of additional plant diseases. Use of compost as bedding for dairy cows has been shown to reduce the incidence of mastitis, but the mechanism is not well understood. Other potential uses of compost may provide similar health benefits for crops and animals. Research into these areas and other creative beneficial uses is needed.

Topics with "Medium" Priority for the Organics Recycling Industry

Agricultural Trials

WORC members are interested in information about compost use in agriculture both for marketing purposes and for use in their own agricultural endeavors. Use of compost has been shown to improve several soil parameters that benefit plants and plant health. Specifically, addition of compost increases soil organic matter which increases moisture holding capacity of the soil, increases cation exchange capacity, increases microbial diversity which can reduce pathogen impact, improved plant growth has been shown to reduce erosion, increase infiltration and improve water quality of run off. WORC's agricultural members need specific information on compost use on specific crops, for specific plant parameters, and for which organic and conventional practices. Research is needed on all of those topics while specifically requested areas of investigation included:

- Compost use with alfalfa and other feed crops,
- Use of green manures,
- Disease suppression from compost or other organics applications,
- Impact of compost on potato diseases,
- Use of compost for the wine industry

Anaerobic Digestion Residual Uses

Anaerobic digestion is a technique of processing organic wastes that is becoming increasingly viable because of the generation and utilization of methane (a greenhouse gas) for power and mitigation of climate impact. The process produces a solid residual that is a needed to produce an income generating product to assist the economics of the system. This residual solid material varies dramatically from system to system in qualities that determine its potential use in the marketplace such as pH, electrical conductivity, nutrient content, moisture content, and pathogen content. Research is needed into the range of these and other qualities and the process factors that determine the qualities a residual will possess in order to design viable, consistent and marketable products from this material. Additionally, research is needed to investigate pathogen reduction needs of the residual, and processing and marketing needed to produce innovative value-added products from this material.

Low Impact Development Use of Organics

WORC has worked with local governments through its Soils for Salmon program to develop Best Management Practices that conserve native soils and improve disturbed soils. It has been shown that:

- Soil degradation and water pollution are widely recognized as major environmental problems;
- Healthy soils directly contribute to healthier water resources and thus indirectly support salmon;
- Steps taken to improve soils lead to improved water quality and quantity that will result in healthier fish habitat;
- Increased use for compost helps close the recycling loop through beneficial use of organic materials.

Healthy soil provides a number of vital functions including the ability to store water and nutrients, reduce erosion, regulate the flow of water, and immobilize and degrade pollutants. Compost has the ability to bring back many critical functions to urban soils, which have lost their ability to hold and retain water, and bind pollutants. Just as the retention of forest cover has been recognized as a land use tool for managing water quality and water volume, it is critical that soil structure retention be considered as a tool in the regulatory and land use tool box. Because salmon and other fish species rely on clean, fresh water to survive, they equally need healthy soil in the watershed above them.

Washington State is growing quickly with associated impacts from both residential and commercial development both in the traditional urbanized Puget Sound area as well as in agricultural areas such as the Great Basin areas east of the Cascades and the Olympic Peninsula. Research is needed into techniques for utilizing organics to mitigate impacts of development on water quality, air and soil quality, and climate change. Some potential areas include: green roofs, rain gardens, storm water filtering, erosion control, and many others.

Biodegradable Products in Composting

As foodwaste composting expands issues surrounding contaminants, reduction of wash water, and separation/collection become more important. Biodegradable utensils, plates, cups, and bio-plastic bags are being produced to address that demand. There are many different formulations of biodegradable products and the definition of "biodegradable" is very broad. The US EPA's Terms of Environment: Glossary, Abbreviations and Acronyms, defines biodegradable as: **"** Capable of decomposing under natural conditions." Without a time frame for degradability, or discussion of "natural conditions", nearly anything can be defined as 'biodegradable'.

In reality, a composter needs a material that will break down to unrecognizable particles, without adverse chemical impact on the resulting compost, in less than 28 days. Different composting systems will require biodegradable materials that decompose at different rates and with different temperature requirements. Process specific information is needed for technologies such as windrow composting, aerated static pile composting, anaerobic digestion, Earth Tub composting, and home composting conditions among others. New materials need to be created from benign manufacturing processes that do not utilize large quantities of fossil fuels or energy. Life cycle analyses are needed on the production and degradation of such materials to determine the impact on the environment of using these products in a composting process. The chemical impact on the compost from these biodegradable materials is also needed.

Topics with "Lower" Priority for the Organics Recycling Industry

Compost Tea

Organic farming and turf management is becoming increasingly important to the viability of many segments of agriculture, to protection of environmental water and soil quality, and to the health of many consumers. Barriers to implementation of organic options include availability of proven, economical insect and other pathogen control, nutrient sources, and weed control. Compost tea is being used by organic farmers, golf courses, and home gardeners. Anecdotal evidence exists linking uses and recipes for compost tea with remedies to all of those barriers, however, published peer-reviewed research is lacking in most areas regarding production and use of the various types of compost tea. Providing publications on such research would be of great interest to organic and conventional agriculture, horticulture industry, and turf managers.

Noxious Weeds

There are currently 111 noxious weeds listed by the Noxious Weed Board for the State of Washington. Of those 32 are considered class "A" and their eradication is required by law. It is currently being recommended to prevent seeds from noxious weeds to enter the compost pile.

Proper composting destroys the viability of seeds thus helping to eradicate noxious weeds, while improper composting could increase the problem. Research into this subject would provide members of WORC, as well as the general public, sound information as to more exacting time, temperature, and moisture levels that destroy specific noxious weed seeds. The information derived would give certainty to proper composting procedures and their affects on noxious weeds.

Vermicomposting

Utilization of worms (vermicomposting) to break down organic waste material into an agriculturally valuable product is a viable technology that exists in addition to microbial facilitated breakdown typically known as thermophilic composting. Vermicomposting has traditionally been used only at small scale such as for individual homes and schools or used on animal manures on specific farms. This boutique industry is thought to have greater potential than its current applications. Research is needed into the qualities of vermicompost for use in marketing programs and into a technique or technology to determine if vermicomposting can be used at larger scale to augment the tools available to agriculture, communities, and industry to more effectively process more types of solid waste.

Research Initiative Subcommittee
Andy Bary / Washington State University – Puyallup
253-445-4588

Richard Finch / Washington State University – Pullman
509-335-3288

Thad Schutt / Royal Organic Products LLC
509-554-3885

Tamara Thomas / Terre-Source LLC
360-336-3536