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# The Compost Connection for Western Agriculture

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## CERWA Project Wrap Up

by Cinda Williams and David Granatstein

The bad news...the CERWA project is winding down. The good news...there IS 'compost' after CERWA. This may be the last of the official *Compost Connection* newsletters to come your way - but the fun is far from over.

In some ways, it is just beginning. We like to think CERWA may have helped. CERWA has forged some new partnerships and connections between educational institutions, agriculture and environmental agencies, the composting industry, private consultants, on-farm composters and producers. We brought more educational tools to those doing compost education. We connected people to the researchers, experienced compost makers and users. And we had fun and we aren't done yet!

David Granatstein will continue this newsletter in an electronic version. All you need to do is get on a list to be reminded when the next issue is ready. If you are interested in being notified about future issues of the *Compost Connection* newsletter, send an email to [compostconnection@tfrec.wsu.edu](mailto:compostconnection@tfrec.wsu.edu) if you have not already done so.

The CERWA web site will be transferred to the same location as the newsletters [[csanr.wsu.edu/compost/](http://csanr.wsu.edu/compost/)]. The current site will forward to the new address for a few months. In addition to new and past versions of the newsletter, the site will feature ordering information about CERWA products, resources and contacts from the CERWA project and will house a catalog of electronic images.

(go to CERWA, p. 6)

## Biodynamic Compost: Is it something special?

by David Granatstein

The Biodynamic system of farming was developed by Rudolf Steiner in Austria and Germany during the 1920s. This system shares many similarities with organic farming and puts special emphasis on the use of compost in maintaining the health of the soils, crops, and animals. One unique aspect of Biodynamics is the use of "Preparations" which are made from specific plants and other substances. Steiner and others have developed very detailed instructions for making the Preparations, which are then highly diluted and sprayed on crops or added to compost almost in a homeopathic manner.

Most of the interest and research on Biodynamic farming comes from northern Europe. But interest is spreading to other countries and large-scale Biodynamic farms can be found in New Zealand, Australia, Canada, and the U.S. To add to the scientific understanding of Biodynamics, two researchers conducted separate replicated studies on the subject at Washington State University in the past two decades.

(go to *Biodynamic*, p. 2)

### *Inside This Issue*

- Teaching Composting on the Web ...p.3
- Breakeven Hauling Distances ... p.5
- Pesticide Residues in Yard Compost ...p. 5
- Compost Resources ... p.7
- Compost Calendar ... p.7

(*Biodynamic, from p. 1*)

The more recent study was done by Lynne Carpenter-Boggs, currently with the USDA-ARS lab at Morris, Minnesota, along with Ann Kennedy and John Reganold. Carpenter-Boggs studied the effects of Biodynamic (BD) preparations on compost development. In her study in Pullman, Washington, a set of six different BD compost preparations (Nos. 502-507) were applied to 3.5 ton compost piles made of separated dairy manure and woodshaving bedding. Application of the BD preparations also required 6 liters of soil and 8 liters of water; therefore control piles received the same additions of soil and water as BD compost piles received, but no BD preparations.

Biodynamic-treated composts maintained an average 3.4°C higher temperature throughout the 8-week active composting period, suggesting more thermophilic microbial activity and/or faster development of compost with BD treatment. Biodynamic farmers have often noticed that their BD composts “stay hot longer” than other composts, and this study confirmed that.

Final samples were taken when active composting slowed and the piles entered a curing stage. The BD compost showed a tendency to reach maturity faster than the control compost. At the final sampling, BD-treated piles respired CO<sub>2</sub> at a 10% lower rate, and had a larger ratio of dehydrogenase enzyme activity to CO<sub>2</sub> production, than the control compost. Finished BD piles had an average of 65% more nitrate than the control piles.

Phospholipid fatty acids were extracted from the finished composts to compare the microbial communities, which were different between the two treatments. Biodynamic preparations thus led to discernible changes in compost chemical and microbial parameters.

The research is planned for publication in *Biological Agriculture and Horticulture* later this year. In subsequent 2-year field trials, Carpenter-Boggs found that the use of either BD or non-BD compost as fertilizer led to yields similar to a commercially fertilized grain crop, and it improved biological soil quality (more microbial biomass and activity, more

## The Compost Connection

earthworms). There were no consistent additional effects of BD compost or field spray preparations.

Walter Goldstein, currently with the Michael Fields Agricultural Institute in East Troy, Wisconsin, conducted an extensive series of field experiments in Pullman, Washington, to compare conventional grain production with more biologically based systems. In addition to crop rotation studies, Goldstein set up some comparisons among conventional, organic, and Biodynamic systems. All three had similar inputs of N on the wheat crop, but differed in the fertility source. The conventional system received commercial fertilizer, while the organic and Biodynamic received composted dairy manure from the university dairy farm. The Biodynamic system differed from organic only in the use of BD preparations added to the compost and sprayed on the fields.

There were no significant differences in total C, N, or P between the organic and BD compost in either year it was prepared. The BD compost did appear to be less humified than the organic, based on absorption ratios of compost extracts. But there were no differences in humic or fulvic acid content.

The two composts did vary in their impact on soil properties. Either compost led to higher soil C, soil respiration, and microbial biomass than the conventionally treated soils. Soils with BD compost had greater microbial biomass, lower respiration, and the same carbon level as soils with organic compost (Table 1). And the total root length of wheat plants was significantly greater with BD compost than with the other two treatments.

Various crops were grown in a number of rotations, with the focus on cereal production. Barley under conventional management grew better than under the other two treatments, and there were no differences between organic and BD. Wheat growth and yield was generally better with one of the compost treatments (Table 2). The wheat with BD compost did not consistently outperform the wheat with organic compost.

Goldstein is continuing this type of research in a set of long-term experiments in Wisconsin. Crops grown

### 3

with biodynamic composts are consistently outyielding both the conventional and organic treatments. The yield-enhancing effect of the BD treatment is strongest when crops face increased stress. Under ideal conditions, there may be no beneficial effect. Goldstein suspects that the effects of the biodynamic preparations are caused by

## The Compost Connection

hormonal changes in the growing crops. Part of the effect may have to do with root production; the biodynamic crops may produce more roots to greater depths, thus helping the crop to deal with moisture and nutrient stresses.

Table 1. Effects of fertility treatment on soil properties.

	<u>% soil C</u>	<u>Respiration (ug CO<sub>2</sub>-C/g soil/hr)</u>	<u>Microbial biomass (ug C/g soil)</u>
Conventional	1.42	0.33	485
Organic compost	1.57	0.46	564
BD compost	1.60	0.40	602
LSD (.05)	0.08	0.04	29

Table 2. Effects of fertility management on winter wheat.

	----- 1983 -----		----- 1985 -----	
	<u>Plant Biomass (T/ac)</u>	<u>Grain yield (bu/ac)</u>	<u>Tillers/ plant</u>	<u>Grain yield (bu/ac)</u>
Conventional	7.4	87.6	7.2	16.3
Organic compost	9.2	105.4	8.2	31.2
BD compost	10.0	123.2	9.4	25.2
LSD (.05)	0.88	29.4	1.2	12.6

The use of biodynamic compost and preparations also appears to increase the content of particulate organic matter (POM) in the soil. This POM fraction is the more biologically active portion of soil organic matter and plays a major role in N turnover. Goldstein is uncertain if this is caused by increases in root production by crops or by changes in the way organic matter or manure decomposes in the soil. The research presented above points to the complexity and subtlety of our attempts to enhance the living soil. Our knowledge of soil quality is increasing as we strive to understand how to maximize the benefits of compost and other management practices for sustaining the soil. \*

## Teaching composting on the Web - it's hard to smell the ammonia!

by Dave Bezdicek

As a result of a grant from the SARE-funded CERWA (Composting Education and Resources for Western Agriculture) project, I proposed to teach a one credit composting course via the World Wide Web. This course has been taught previously at Washington State University (WSU) on four occasions in a classroom lecture format. In the fall semester of 1999, the course was offered on the Web for the first time and included five Pullman-based

## 4

students and five students located outside of Pullman, Wash., in the Extended Degree Program (EDP).

Since we moved away from the traditional lecture based format, we required that all students participate in building a compost pile either at their home, community, or at the facility on the WSU campus. Students were encouraged to form teams, as not all students were able to build their own compost piles. This aspect allowed students to pick the feedstocks available in their area, and decide on the proportions based on moisture, desired C:N ratio, and the method of composting. Students calculated the proportion of feedstocks using published formulas and downloadable spreadsheets. Some students decided to build compost piles in their back yards, while others built theirs at the large scale WSU facility.

### Course Objectives

The objectives of the course were set up so students would understand the following:

- 1) Principles of biological decomposition of organic waste materials.
- 2) The processes and methods used in the composting industry.
- 3) Applications and beneficial uses of compost, and compost quality criteria.
- 4) Environmental, health, and regulatory concerns.

In brief, the following aspects were covered:

- Introduction, safety concerns for handling biological materials
- Compost process and biology
- Team compost feedstocks and action plan
- Feedstocks, types of composting and levels of technology
- Compost: the product; analysis, and quality
- Compost application, utilization, and loading rates
- Odor control, plant disease suppression, animal pathogens, on-site health effects
- Compost regulations, standards, loading limits; US and other country standards
- Site selection, management, social and environmental concerns
- CERWA case studies from the project videos

## The Compost Connection

### Course format

The course deviated drastically from the traditional lecture-based format as there were no lectures. Thus the emphasis was on a learner-based format rather than on taking notes and taking tests. The course was taught using the WSU Internet platform called *Speakeasy Café*, where the detailed outline, course assignments, and threaded discussions were centered. This site provided the Internet links to course resources that covered everything from safety issues, basic biology, journal articles, compost quality, pathogens, home work problems, and some streamed video by the instructors. We found that we did not need to provide hard copies and thus we avoided many of the copyright issues. Most of the materials, articles, and streamed video could be down loaded using free software from the Internet.

A major role of the *Speakeasy* format was to provide the format for the threaded discussions. The threaded discussions were intended to provide students with the following opportunities: present their compost plan and respond to the plans of other students; respond to specific case studies in the CERWA videos, answer questions posted for each event and respond to answers provided by other students; critically review articles and respond to the comments by other students; report on the progress of their compost and make suggestions as to frequency of turning, additions of moisture, maturity, etc. All students were provided with thermometers and compost maturity test kits. Students were required to post their data on temperature and to provide photos of their composts that were posted on the course Web site.

### Grading and evaluation

Approximately 50% of the grade was based on class participation and interaction in the threaded discussions in *Speakeasy*, and half was based on assignments and homework problems. As students develop skills on communicating ideas, they are aware that they will be graded on how well they think critically and communicate these ideas with each other. For those who wish to see the *Speakeasy* site, the URL is: <http://morrison.wsu.edu/studio/>. The textbook used for the course was *On-Farm Composting Handbook*, by Robert Rynk (ed.).

## 5

Copies were made available from the bookstore. CERWA composting videos (2) were available for a rental fee of \$20. An optional text was *The Rodale Book of Composting*, from Rodale Press.

### Concluding comments

The majority of off-campus students were more familiar with the Web format as they have taken courses by long distance before. Several of the Pullman-based students liked the format as well, but others would have preferred the traditional classroom lecture format. The course will be changed to 2 credits and will be offered in fall semester of 2000 on campus and in the EDP program. We are evaluating the option of offering the course as a certificate program through Conferences and Professional Programs at WSU. This would provide an opportunity for participants to be certified for achieving a certain level of knowledge of composting without having to take the course for credit.

The following individuals provided input and assistance for the course: Mary Fauci (WSU Crop and Soil Sciences) for her technical input; Dan Caldwell and Rick Finch (WSU compost facility) for their input into the videos and their cooperation in the on-site composting by the students. Others from the CERWA project team, the WSU EDP program, the WSU Center for Teaching and Learning and Educational Telecommunications Technology were instrumental in helping set up the course. Contact David Bezducek, [bezducek@wsu.edu](mailto:bezducek@wsu.edu) for more information.

*Dave Bezducek is a Professor of Soil Microbiology, Dept. of Crop and Soil Sciences, Washington State University, and member of the CERWA project team. \**

### Breakeven Hauling Distances for Beef Feedlot Manure in southern Alberta.

*B.S. Freeze and T.G. Sommerfeldt. 1985. Canadian Journal of Soil Science (65:687-693).*

A major portion of the cost of purchased compost to the grower is trucking and handling. In this economic study, a number of aspects of manure management

## The Compost Connection

are spelled out that could be useful in analyzing the economics of compost use on farms. The analysis modeled three different feedlot sizes. Based on the value of N and P, manure appeared to be an economical substitute for commercial fertilizer when hauled up to 15 km (9 miles) from the feedlot source. Breakeven hauling distances for the largest feedlots were nearly double those of the medium size, which were triple those of the smallest size.

When the value of crop yield increases from manure application are included, breakeven hauling distances increased. And this depended on the particular crop; for example, breakeven hauling distances for sugar beets were 10-15 times higher than for wheat. Generally, for grain crops, manure can be hauled an extra 2-5 km more than when nutrient value alone was considered.

*This research was conducted at the Agriculture Canada Research Station, Lethbridge, Alberta T1J 4B1, Canada. \**

## Pesticide Residues in Yard Debris Compost.

*by David Granatstein*

With the increasing scrutiny of compost quality, especially for organic farmers, the fate of various pesticides during the compost process has received more attention. This is especially true where urban yard debris recycling programs are diverting the product for agricultural use.

One study by Peter Strom of Rutgers University in New Jersey analyzed six different yard debris composts for a wide range of chemicals. One set of samples went to a state lab that tested for 27 pesticides plus PCBs. Another set went to a university lab that tested for 144 pesticides and metabolites. The state lab found no detectable levels for PCBs and 26 of 27 pesticides in all samples. Chlordane was found in every sample. The university lab found no pesticides at all, but upon retesting with a more sensitive method, found traces of chlordane. Since chlordane has been banned for farm and garden use since 1988, it is likely that soil mixed in with the yard debris is the source.

## 6

Chlordane is known to persist in soils, but is generally not taken up by plants. The researcher concludes that use of yard debris compost poses no pesticide risk, and in fact has lower risk than the residential soil itself. He concludes that the absence of detectable levels should preclude the need for routine pesticide testing of yard debris compost.

Researchers F.C. Michel and C.A. Reddy at Michigan State University studied the fate of three commonly used lawn chemicals during composting: diazinon, 2,4-D, and pendimethalin (Prowl). A laboratory scale compost system was used for leaves and grass (in a 2:1 ratio) amended with radiolabeled pesticides at levels typical for incoming feedstocks at a commercial compost operation. Evolution of labeled CO<sub>2</sub> was a primary indicator of pesticide breakdown.

About 50% of the 2,4-D was mineralized to CO<sub>2</sub>, compared to only 10-13% of the other two pesticides. Leaching and volatile losses were low. The researchers then searched for the fate of the remaining carbon. Much of the labeled carbon from all three pesticides was associated with the humic materials or was unextractable from the final composts. These pesticide residuals appeared chemically quite different from the parent compounds and less available to plants and animals. Thus, while complete mineralization did not occur, decomposition appeared to eliminate the pesticides as bio-active materials.

Researchers at the University of Guelph are studying the fate of 2,4-D, mecoprop and dicamba applied to turf and then composted. They measured a 78-87% loss of the herbicides over 10 weeks of composting. But the mass of compost declined by 92%, leading to an increase in the concentrations of the herbicides. (see <http://www.uoguelph.ca/GTI/94anrep/94r9.htm>)

More recently, there have been several instances of phytotoxicity from composts produced in Washington State. A relatively new lawn herbicide from Dow Chemical called 'Confront' (clopyralid) appears to be causing herbicide damage on plants grown with the compost from the Spokane, Wash., facility. Confront is intended to provide residual weed control in the soil. The product label specifically states "Do not

## The Compost Connection

use compost containing grass clippings from turf treated with Confront in the growing season of application."

The herbicide has a half-life of about 250 days. The 60-90 day composting process at Spokane did not break down the material. Clopyralid was present only in trace amounts in the compost and in the plants. The limit of detection is 0.03 ppm, and levels were below that. Even so, enough herbicide was present to kill tomato plants.

Recently, a two-part literature review of the fate of pesticides in composting was published in *Compost Science and Utilization* (Buyuksonmez et al.; Fall 1999, Winter 2000). While the recent problem with Confront was not included, the authors generally concluded that pesticide degradation in compost is similar to that in soil. Compost may have different microbial communities, higher temperatures, and more active organic matter. But those pesticides that are persistent in soil and cause residual phytotoxicity may exhibit the same problems in compost and should be candidates for more careful monitoring than pesticides that routinely degrade. \*

(from CERWA Wrap-Up, p. 1)

PHOTOS! Yes, that's right! David is preparing a set of compost and composting images to be available on the web. Pictures will be individually labeled and catalogued by category. They will be available for use by late fall 2000. Please feel free to use them in your composting/compost educational activities. To meet the demands of changing technologies, these web-based pictures will be available instead of the slide sets, as originally planned. If you have specific requests for types of slides that you could use in a program, please let David know.

Another VERY valuable resource on the web site is the on-line PDF version of "CERWA Answers Your Questions." This document is a compilation of all the Questions and Answers from the two CERWA satellite programs. It is arranged into 15 topics and each topic has 3-8 questions. Compost professionals from all over the country were asked to answer the various questions. It summarizes many things we

## 7

talked about on the program and delves into areas we didn't have time to discuss. Check it out. If for some reason you don't have access to the web, you can order copies of it from Cinda Williams, [cindaw@uidaho.edu](mailto:cindaw@uidaho.edu), 208-885-7499.

Don't miss the opportunity to be involved in an exciting on-line composting course. This course (another CERWA product) is discussed in detail in the article *'Teaching Composting on the Web - it's hard to smell the ammonia!'* by Dave Bezdicek (see p. 3-5, of this issue).

If you have any questions about the CERWA project - please contact David Granatstein or Cinda Williams (emails and numbers previously listed). If you have been involved with the CERWA project, please take a moment and provide any feedback, good or bad, to the Project Team through email to [cindaw@uidaho.edu](mailto:cindaw@uidaho.edu). With your feedback, we can continually improve the products and services provided by the Western SARE funding program that is here to enhance the sustainability of agriculture in our region.

Thank you so much for your interest! \*

## Compost Resources

**Field Guide to On-Farm Composting.** 1999. NRAES-114. \$14. 128 pages. This book was designed as a companion to *the On-Farm Composting Handbook* and is meant to assist in day-to-day compost system management.

**On-Farm Large-Scale Chicken Carcass Composting.** 1997. NRAES-110. \$15. This 10-minute video offer producers a working knowledge of composting for handling chicken mortalities using a windrow method.

Both resources are available from:  
NRAES, 152 Riley-Robb Hall, Cornell University,  
Ithaca, NY 14853-5701; 607-255-7654. \*

**Compost Utilization in Horticultural Cropping Systems.** This new book is edited by Pete Stoffella (Univ. Florida) and Brian Kahn (Oklahoma St.

## The Compost Connection

Univ.). Contact Pete Stoffella for more information (561-468-3922). \*

The Center for Urban Water Resources Management at the University of Washington has two publications on the use of compost in the urban environment, and potential impact on salmon recovery.

*"Guidelines for Landscaping with Compost Amended Soil"* and *"Soils for Salmon -- How Soil Amendments and Compost Can Aid in Salmon Recovery"* are both available on the Web at: <http://depts.washington.edu/cuwrn/> \*

**In-vessel Composting.** For those interested in in-vessel composting for a variety of feedstock applications and volumes, this website is an excellent resource. It contains results from various studies as well as many photos and streaming video. The research and demonstration work is being conducted by Dr. Don Cawthon, Texas A&M University – Commerce.

<http://www.tamu-commerce.edu/coas/agscience/dept-res.html> \*

## Compost Calendar

August 28-30, 2000. **BioCycle** is holding its Northeast Conference in Burlington, Vermont, with a focus on recycling food residuals. Call 610-967-4135 for information.

September 12, 2000. **Yard Debris as a Soil Amendment field day.** Bailand Farms, Snohomish, WA. 2:00-3:30 pm. Topics will include uses in crop production, factors affecting nitrogen availability, nutrient management using organic materials, and corn production using yard debris as a nutrient source. For more information and directions, contact Andy Bary, Washington State University, at 253-445-4588, or email: [bary@puyallup.wsu.edu](mailto:bary@puyallup.wsu.edu).

Sept. 16-22, 2000. The **Vermilleneium** (International Conference on Vermiculture), Kalamazoo, MI. Check [www.wormwoman.com/vermilleneium.html](http://www.wormwoman.com/vermilleneium.html)

September 27-30, 2000. **The Future Starts Here ... Compost!** The Composting Council of Canada's 10<sup>th</sup> Annual Conference, Shaw Conference Centre, Edmonton, Alberta. For information, contact Susan Antler at [ccc@compost.org](mailto:ccc@compost.org) , or 416-535-0240.

October 9-11, 2000. **Y2K Composting in the Southeast**, Charlottesville, VA. Information at [www.conted.vt.edu/y2kompost.htm](http://www.conted.vt.edu/y2kompost.htm).

October 18-20, 2000. International conference on "**Microbiology of Composting**", Innsbruck, Austria.

November 14-16, 2000. **Compost 2000 Down Under**, Melbourne, Australia. Information at [www.compost-australia.com](http://www.compost-australia.com)

March 5-7, 2001. **BioCycle West Coast conference**, Portland, OR. Call 610-967-4135 for information. \*

## The Compost Connection

**Comments and submissions for this newsletter are welcome ! Contact the Editor.**

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Past issues of this newsletter can be found on the CSANR web site at:

<http://csanr.wsu.edu/compost/>

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