HOW'S IT GROWING?

VALUING THE U.S. COMPOSTING INDUSTRY

A 2002 research report estimated that for each one percent increase in organic carbon in the top foot of soil (e.g., from compost application), 16,500 gallons of plant-available water can be stored.

Aside from current investment in infrastructure and contracts to process organics, the primary metric available to assess the composting industry's worth is assigning a dollar value to compost use benefits.

Ron Alexander

BEGINNING in the late 1970s, the biosolids composting industry started in earnest with the ban on ocean dumping of sewage sludge on a nationwide basis. Through the late 1980s and early 1990s, landfill bans on yard trimmings were adopted by an increasing number of states and the volume of composted materials grew to an all time high. While this was happening, mixed waste composting expanded, then contracted, because of the cost of operation and product quality issues. On-farm composting of manure also expanded, although the actual number of facilities is difficult to track.

Even with all of this expansion, there is still significant room for growth. In the U.S., annual generation of manure is 66 million dry tons, biosolids is 7 million dry tons and MSW organics (food waste and yard trimmings) is 55 million tons (wet weight). Certainly, composting of food residuals has also expanded, but not to the level that many of us would have expected by now.

It has been estimated that 4,500 to 5,000 composting facilities exist in the U.S. But how many of these facilities are commercial scale, and how much material is really composted? On the end use side of the picture, compost markets have expanded greatly, with a minimum of 50 million cubic yards distributed annually in the U.S., and new applications being invented all the time.

Ultimately, the value of the U.S. composting industry needs to be determined based on financial metrics, such as annual earnings, capital expenditures and number of employees. (Of course, this does not mean that we should forego better defining the environmental benefits of organics recycling.) The North American Industry Classification System (NAICS) classifies business establishments for the purpose of collecting, tabulating and analyzing statistical data describing the U.S. economy. Data generated by these analyses (under the auspices of the U.S. Census Bureau) are widely used by the financial and investment industry.

NAICS divides U.S. industries first by economic sector, and then by a series of much more specific classifications. There is no NAICS code established for the composting industry. In absence of a code, members of the composting industry have struggled with the next best tool to quantify its economic value. To date, the best available tool is attempting to estimate the dollar value on the end use side of the equation, especially related to measurable environmental and agricultural benefits.

Public policy decisions can quickly put a dollar value on an environmental benefit. When states started banning landfill disposal of yard trimmings 20 years ago, the waste industry giants at the time — Browning Ferris Industries and Waste Management, for example — invested in the composting industry. If Congress enacts a cap and trade program for CO_2 emissions, investment dollars could start flowing to composting and anaerobic digestion projects — on the front end for landfill methane avoidance and on the back end for carbon sequestration.

This article lays out the range of known and well-proven environmental and agricultural benefits derived from compost utilization. The goal is to advance the thinking and dialogue of the metrics that factor into the composting industry's bottom line.

DOLLAR VALUE OF COMPOST BENEFITS

Surface water contamination and soil conservation are becoming more heavily regulated, and therefore, more focus is being placed on erosion control and storm water management. In 1992, soil loss in the U.S. was estimated at 5 billion tons/year. In 2003, the Natural Resources Conservation Service estimated that on a global scale, 75 billion tons of soil is lost annually. It was further estimated that 40 percent of agricultural soils are considered seriously degraded, and degradation has lowered the productivity of 16 percent of worldwide farmland.

With an ever growing population, how will we continue to feed ourselves? Why aren't we fixing declining soils with compost, instead of trying to invent new plant species that will grow in inferior soils? Let's not forget that the Kyoto Protocol allows for the creation of carbon dioxide sinks in the soil, which is eligible for carbon offsets (which have a market value). ATTRA (the National Sustainable Agriculture Informa-

Valuing the plant nutrients in compost, for example, $0.50/lb of N and $0.75/lb of P, is another way to quantify potential revenue related to compost sales.

tion Service) estimated that for each one percent increase in organic carbon in the soil (top foot), 132 tons/hectare of CO_2 can be sequestered. But how much is productive and CO_2 sequestering soil worth? How do we encourage a carbon credit trading system for compost (organic matter) addition to the soil to be created at a faster pace?

We know that climate change will also impact moisture distribution, and cause more severe storms, which in turn will increase flooding and infrastructure costs for storm water management. Of course, this also will lead to a greater need for irrigation, as more droughts are also expected. Water conservation in many areas of the country has already created hardship and political concern. A 2002 ATTRA research report on Drought Resistant Soils also estimated that for each one percent increase in organic carbon in the soil (top foot) 16,500 gallons of plant-available water can be stored. University of Illinois research found that the cost of adding 1-acre inch of water/acre in Illinois cost $160 to $347 in energy alone (see "Using Compost To Reduce Irrigation Costs," December 2004). Today, in certain areas of southern California, farmers are paying over $500/acre foot of water from public water districts. But how do we determine how much water is worth on a more national scale? How do we get farmers and water districts to encourage the improvement of soil quality to reduce water usage?

Interestingly, we know that the addition of compost to soil can assist in absorbing excess water, as well as increase its water holding capacity. Table 1 illustrates that as the rate of compost inclusion increased, the soil's bulk density decreased, while its water holding capacity and saturated hydraulic conductivity increased. The saturated hydraulic conductivity is used in the lab to measure a soil's ability to percolate excess (gravitational) water. This illustrates that the addition of compost can aid in increasing the moisture holding capacity of soil, while also improving its ability to absorb, then shed excess water (by creating improved soil porosity).

There are great trends in the construction of green buildings (e.g., LEED credits), and with it more compost will be used. The same can be said about using compost on commercial construction projects in bioengineering (e.g., erosion control, rooftop garden mixes, bioretention ponds, wetland mitigation). Gardening trends also favor expanded use of compost, as more gardeners are purchasing "green" products and more organically certified products are being requested every day. Home gardening itself is a huge market. Nursery Retailer estimated that in 2009, approximately $56 billion will be spent at Big Box stores and over $52 billion at independent garden centers on gardening products. Obviously, only a fraction of these monies will be spent on soil products… but how much?

There are even modeling tools (e.g., EPA's WARM, Carnegie Mellon's EIOLCA, and Jeffrey Morris' Environmental Benefits Calculator (see "Best Bang For MSW Management Buck," October 2008) available to help estimate the environmental benefits (value in pollution reduction) that composting can achieve. But what is this value on a statewide and national basis? How do we get policy makers to listen?

THE NEED TO QUANTIFY

Even though the organics recycling industry has greatly expanded over the past several decades, and we understand so much about the composting process, there is much more that we need to study and understand if our industry is to reach its full potential. We will need to invest in order to gain this knowledge, and this investment will have to come from within our industry, as well as from other sources. Aside from reestablishing funding sources for compost utilization research and market development, we also need to develop easy-to-use formulas that assign a dollar value to known benefits. For example, is there a formula to quantify compost's value in improving the availability of water and healthy soils?

What about a way to calculate the value of compost addition in slowing climate change (e.g., carbon sequestration, NOx reduction, etc.)? A worldwide system to sell carbon credits based on carbon addition to the soil needs to be established in order to assign a dollar value.

The end goal in these mathematical exercises is to develop a metric that can be used to measure the total financial worth — on an annual production/output basis — of

Table 1. Compost amendment rate and impact on soil, water holding capacity

% Biosolids Compost Added To A Sandy Loam Soil (by volume)	*Organic Matter* (%)	*Saturated Hydraulic Conductivity* (in/hr)	*Moisture At Field Capacity* (weight %)	*Moisture At Field Capacity* (in/ft)	*Bulk Density* (g/cm^3)
0	4.4	2.1	33.1	3.3	1.01
10	4.4	3.2	40.7	4.1	0.92
20	5.6	3.2	50.7	5.1	0.90
30	6.4	4.3	64.2	6.4	0.89

R. Alexander Associates, Inc. for Washington Organic Recycling Council, 2009 compost that can provide the environmental and agricultural benefits (e.g., compost that meets specific end use and product parameters). Having this data will allow composting facility owners and operators to better sell the industry to investors, as well as political decision makers who can assist (or devastate) it through policy making.

Running the numbers should not be that difficult to do, providing there is data relative to:

Volume and type of feedstock managed annually: Data may be used to help secure investment into the industry from private investors and quantify the environmental impact of managing organic by-products through composting, including the positive impact in reducing climate changing gases.

Organics recycling method (composting or anaerobic digestion): Data also may be used to secure investments for developing new technologies or constructing new facilities, or be used to estimate the positive impact in reducing climate changing gases.

Volume of product marketed (and average price): Data can help quantify the economic impact of compost products to associated industries (e.g., landscaping) and to both the local and overall economy. Also, if a specific volume of compost was identified or assumed to have been incorporated into the soil, the CO_2 reduction could be estimated as carbon credit systems are established.

Number of employees: Data could illustrate to policy makers that the composting industry can have an impact on job creation and retention.

Content of major plant nutrients in product: Data may be used to estimate the volume of beneficial major and minor plant nutrients manufactured through composting, then potentially estimate how compost offsets chemical fertilizer additions, thereby determining its economic and environmental impact and benefits (e.g., reduction in fossil fuel-based fertilizers).

Here is an example of how this last metric would work: Let's assume that there are 50 million cubic yards of compost produced annually in the U.S. This equals approximately 25 million tons (wet weight). If the content of total nitrogen and phosphorous (P_2O_5) in the compost is one percent each, then 250,000 tons of total nitrogen and P_2O_5 are generated for use in agriculture and horticulture through composting. At $0.50 and $0.75 per pound for N and P (or $1,000 and $1,500 per ton) respectively, that would equate to an economic value of $250 million (N) and $375 million (P) for the plant nutrients found in the compost alone. Theoretically, the environmental impact of producing and using these compost nutrients versus chemically generated nutrients could be factored into this equation to quantify environmental and economic impacts. By collecting simple data like this, the composting industry would be able to more precisely quantify its overall benefits to the economy and society.

THE CHALLENGE

For all the benefits that the organics recycling industry provides to our society at a fairly low cost, our "middle aged" industry still struggles to gain public acceptance and private investment (and overall respect). Composting is the Rodney Dangerfield of the environmental sector. Further, national support for organics recycling from the federal government, as well as most state governments, is woefully lacking. This is likely the case because most politicians don't see what we do as 'sexy' (garnering enough votes to support), and most of the electorate doesn't understand that composting is in fact recycling — in its most basic form — and doesn't see compost use as an environmental practice.

For the composting industry to grow and public policy to support it, those involved need to buckle down and work together to gather the data needed to prove that the industry is valuable to society — both environmentally and economically. The scientific data is there to support the benefits, which can be quantified; the challenge is to assign dollar values to them. ■

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