Section I

Compost Production Methods, Chemical and Biological Processes, and Quality

CHAPTER 1

The Composting Industry in the United States: Past, Present, and Future

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CONTENTS

I. INTRODUCTION

The horticulture industry is one of the primary consumers of organic amendments for use as its growing media. Consider these statistics for just nurseries and greenhouses (Gouin, 1995):

- Nearly 80% of all ornamental plants are marketed in containers and 75 to 80% of the ingredients in potting media consist of organic materials.

- When nurseries harvest balled and burlapped trees and shrubs, they also remove between 448 and 560 $Mg \cdot ha^{-1}$ (200 and 250 tons per acre) of topsoil with every crop.

The horticulture industry has used compost for many years, but not in the same quantities as other products such as peat. More recently, however, several factors have combined to make compost a competitive alternative in the horticulture industry. These include:

- Increased pressure on harvesting peat
- Proven benefits from compost use, including plant disease suppression, better moisture retention, and building soil organic matter
- Wider availability of quality compost products
- Creation of composting enterprises by the horticulture industry, in response to its own need for the end product; rising disposal fees for green waste; and consumer demand for compost at retail centers

Although landscapers, nurseries, and other entities in the horticulture industry can produce some of the compost to meet their own needs, demand exceeds what they can supply. Furthermore, certain composts that can better meet the needs of some crops may not be produced by the horticulture industry in adequate quantities.

Because of these factors, there is an excellent synergy between the horticulture industry and the composting industry. Currently, the largest dollar and volume markets for high quality compost producers are in the horticulture industry. This chapter provides an overview of where the composting industry in the U.S. is today, how it evolved, and where it is going.

II. COMPOSTING INDUSTRY OVERVIEW

Composting in the U.S. has come a long way in the past 30 years. A full range of organic residuals — from municipal wastewater biosolids and yard trimmings to manures and brewery sludges — are composted. Technologies and methods have grown in sophistication. The knowledge about what it takes to operate a facility without creating a nuisance and to generate a high-quality product has also expanded.

About 67% of the municipal waste stream in the U.S. (excluding biosolids) consists of organic materials. However, a considerable portion of the newspaper, office paper, and corrugated fiberboard is already recovered for recycling and thus is unavailable for composting. This leaves about 68 million Mg (75 million tons), or 36%, of the waste stream available for composting, including items such as yard trimmings, food residuals, and soiled or unrecyclable paper (U.S. EPA, 1999). However, in the general scheme of waste management alternatives, only a small percentage of residuals from the municipal, agricultural, commercial, industrial, and institutional sectors are composted at this time. Yet the significant level of composting experience in all those sectors lays the groundwork for growth in the future.

Although there is nothing new about the practice of composting, especially in agriculture, its application in the U.S. on a municipal or commercial scale did not occur until the middle of the 20th century. At that time, composting was viewed as a business opportunity — a way to turn garbage into a commercial product. However, before the industry had a chance to get off the ground, landfills came into the picture, making it nearly impossible for composting to be cost-competitive.

It was not until the 1970s that the current composting industry began to develop. The Clean Water Act was passed early in the decade, making millions of dollars available to invest in municipal wastewater treatment plants. One consequence of improved wastewater treatment was a greater amount of solids coming out of the wastewater treatment process. The U.S. Department of Agriculture (USDA) launched a project at its Beltsville, MD research laboratory to test composting of municipal sewage sludge (referred to in this chapter as biosolids). The research resulted in what was known as the Beltsville method of aerated static pile composting — essentially pulling air through a trapezoidal shaped pile to stimulate and manage the composting process (Singley et al., 1982).

At about the same time, European companies were developing technologies to compost municipal solid waste (MSW). These countries did not have the luxury of abundant land available for garbage dumps. As a result, many of the MSW composting technologies eventually marketed in the U.S. in the 1980s originated in Europe. These systems used enclosed, mechanical technologies, such as silos with forced air.

American companies also developed some in-vessel technologies during this time. These included rotating drums and vessels or bays with mechanical turning devices.

Although a handful of municipalities started to implement composting in the 1970s to manage biosolids or leaves, it was not until the 1980s that public officials and private developers paid any significant attention to this methodology. The drivers contributing to these developments differed somewhat for the different waste streams, but the net result is a significant base of knowledge and technological advancements that made composting a competitive management option for residuals from all sectors — municipal to agricultural.

This chapter will look at several different residual streams — biosolids, yard trimmings, MSW, and food residuals — and analyze composting developments in terms of the number and types of projects, technologies, end markets, commercial developments, public policies, and regulations. Much of the data will be provided from surveys conducted by *BioCycle*, a journal of composting and recycling.

III. BIOSOLIDS COMPOSTING

The first survey of biosolids composting appeared in *BioCycle* in 1983 (Willson and Dalmat, 1983). The survey was conducted by USDA staff in Beltsville, MD. At that time, a total of 90 projects were identified. These included 61 in operation and 29 in development. *BioCycle* began conducting the nationwide survey of biosolids composting in 1985. A survey was completed for every year from 1985 to 1998.

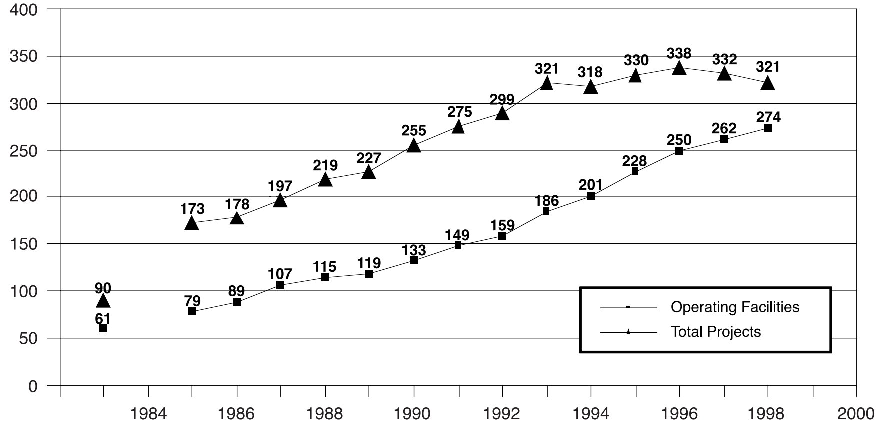

Figure 1.1 Biosolids composting project history in the U.S. (From *BioCycle* Annual Biosolids Composting Surveys: 1983–1998. With permission.)

Figure 1.1 provides a summary of the results of those surveys. Each year's report provides a state-by-state breakdown of biosolids composting projects, including the project's location, project status, composting methodology, and quantity composted. Projects that fall into the "in development" category include those in construction, permitting, planning, design, or active consideration.

A variety of configurations are used to compost biosolids. These include static piles, aerated static piles, actively and passively aerated windrows, enclosed versions of these methods, and in-vessel. The method chosen is dependent on a variety of factors, including climate, site location and proximity to neighbors, degree of process control desired (including the rate at which composting needs to proceed), and regulations. For example, a fairly isolated site in the Southwest can compost effectively in open air windrows. A facility in New England, with neighbors within view, might opt for an enclosed system — to better deal with the weather and with possible nuisance factors.

Biosolids are mixed with a bulking agent prior to composting. The bulking agent provides both a carbon source and pile structure. *BioCycle* survey data finds that the most common amendments for aerated static pile composting are wood chips, followed by leaves, grass, and brush. In-vessel systems without built-in agitation typically use sawdust and wood chips for amendments, while the agitated bay systems may utilize those materials and/or ground yard trimmings. The most common amendment at windrow facilities is yard trimmings, followed by wood chips. Other amendments utilized in biosolids composting include wood ash (which also helps with controlling odors), newsprint, manure, and peanut (*Arachis hypogaea* L.) and rice (*Oryza sativa* L.) hulls. Many facilities also use recycled compost.

Most biosolids composting facilities are fairly small to medium in size. According to *BioCycle*'s 1998 biosolids composting survey (Goldstein and Gray, 1999), three of the four largest sites are windrow operations composting between 82 and 91 dry Mg (90 and 100 dry tons) per day of biosolids (two in California and one in Kentucky); the fourth, in West Virginia, is an aerated static pile operation. Other larger scale facilities include a 54 dry Mg (60 dry ton) per day in-vessel plant in Ohio and a 36 dry Mg (40 dry ton) per day aerated static pile operation in Pennsylvania.

Overall, biosolids composting is fairly well represented across the country. The only states currently without any projects are Minnesota, Mississippi, North and South Dakota, Wisconsin, and Wyoming. In terms of the actual number of projects, New York State leads with 35, followed by Washington (19), California (18), Massachusetts (18), and 15 each in Colorado, Maine, and Utah.

Biosolids composting facilities typically are successful in marketing or distributing the compost produced. The top paying markets for biosolids compost are nurseries, landscapers, and soil blenders. Other end uses include public works projects (e.g., roadway stabilization, landfill cover), application on park land and athletic fields, and agriculture. Many composting plants distribute compost directly to homeowners.

A. Biosolids Composting Drivers

A number of “drivers” have contributed to the development of biosolids composting projects in the U.S. They revolve around potential difficulties in continuing current practices — such as landfilling, incineration, or in some cases, land application — to a confidence level to undertake the effort because of the success of other projects.

Although smaller plants may use composting as their primary management option, a number of facilities start a composting project in conjunction with a land application program. Composting provides a backup when fields are not accessible. For treatment plants in areas where agricultural land within a reasonable hauling distance is being developed, composting is a backup and is likely to become the primary management method in the future. In other areas, treatment plants that dispose of biosolids in landfills may start a composting facility because of the uncertainty of continuing landfill disposal in the future.

In the 1980s, landfill bans on yard trimmings forced many local governments to initiate composting projects to process leaves, brush, and grass clippings. In some cases, public works officials joined forces with wastewater treatment plant operators in their towns to create co-composting projects — using the yard trimmings as a bulking agent for the biosolids. This contributed to the growth of biosolids composting in the late 1980s and early 1990s.

Two other drivers — not just for biosolids composting but for other residuals — have been the evolution of the knowledge base and technologies to handle these materials and demand for compost products. In some municipalities, there is a higher comfort level with composting in a contained vessel or a bay-type system that is in a completely enclosed structure. The availability of these technologies, and the accompanying refinement in controlling odors from these types of systems, helped to fuel the growth in projects.

Research on compost utilization helped stimulate markets for biosolids compost, especially in the horticultural and landscaping fields. It is anticipated that demand for these kinds of products will grow in the future. For example, research in Massachusetts with utilization of biosolids compost in a manufactured topsoil showed significant potential for application in landscape architecture projects, an end use that can require vast amounts of finished product (Craul and Switzenbaum, 1996). In another case, landscape architects specified that biosolids compost be used in the soil mix for a recently completed riverside park in Pittsburgh, PA (Block, 1999).

A nursery in Ohio has used composted municipal biosolids for bed and container production for over 10 years (Farrell, 1998). It uses about 765 m^3 (1000 yd^3) per year of the compost, which it obtains from two sources. The nursery owner notes that the composted biosolids contributed to increased plant growth and plant disease suppression, and are a good source of mycorrhizal inoculum, organic material, and plant mineral nutrients. He adds that the compost made a tremendous difference in the quality and vigor of boxwoods (*Buxus* spp.) and reduced the cycle of growth so that more can be grown.

In the future, growth in the number of biosolids composting projects is expected to continue. At least four factors contribute to the increase. First, a high quality biosolids compost can meet the U.S. Environmental Protection Agency's Class A standards, which give a wastewater treatment plant more flexibility in product distribution and regulatory compliance. Second, increasing pressure on land application programs due to land development and public acceptance issues is forcing wastewater treatment plants to seek alternatives such as composting. Third, there is a growing demand for high-quality composts. Finally, continual technology and operational improvements result in more project successes, thus building confidence in composting as a viable management option.

There are some caveats that hamper the development of biosolids composting projects. The economics are such that composting can be more costly than other management alternatives, such as land application and landfilling. Also, there is adequate landfill capacity available in many regions, and some treatment plants are taking advantage of that option at this time. As a result, there is likely to be continued steady but not rapid growth in the number of biosolids composting projects in the U.S.

IV. YARD TRIMMINGS COMPOSTING

BioCycle began tracking the number of yard trimmings composting sites in the U.S. in 1989, as part of its annual "State of Garbage in America" survey. That first year, the survey found 650 projects. In the 1999 State of Garbage survey (which provides data for 1998), there were 3807 yard trimmings composting sites (Glenn, 1999).

A majority of the 3800-plus sites are fairly low technology, smaller operations that are municipally owned and operated. Typically, yard trimmings are composted in windrows. Some of these smaller sites utilize compost turning equipment. Most, however, turn piles with front-end loaders. Many operators simply build windrows, turn them occasionally in the beginning, and then let the piles sit for a number of months, moving material out only when there is a need for more space at the site.

There are some sizable municipal operations that utilize up-front grinding equipment, turners, and screens. These sites tend to be managed more intensively because of the higher throughput and thus the need to move finished compost off the site more quickly. There also is a healthy private sector that owns and operates yard trimmings composting facilities. These sites also tend to be managed more aggressively because the owners rely on income from tipping fees and from product sales. Although most of the larger sites also compost in windrows, some experienced odor problems (particularly from grass clippings) and started using aerated static piles in order to treat process air and not disturb the piles during active composting (Croteau et al., 1996).

Markets for yard trimmings compost include landscapers and nurseries (both wholesale and retail), soil blenders, other retail outlets, highway reclamation and erosion control projects, and agriculture. Many municipal projects provide free finished compost and mulch to residents.

A. Yard Trimmings Composting Drivers

State bans on the disposal of yard trimmings at landfills and incinerators were the primary driver in the development of yard trimmings composting projects. Currently, there are 23 states with disposal bans; several bans only apply to leaves, or leaves and brush. No state has passed a landfill ban on yard trimmings in recent years, but New York State was expected to consider such legislation in 2000. Growth of yard trimmings composting projects in the future will be driven primarily by localities trying to divert more green materials from landfills in order to save capacity or meet a state or locally mandated diversion goal (such as California's mandated 50% goal by 2000), or by market demand for composted soil products (and thus the need for more feedstocks).

Other possible drivers are the fact that yard trimmings are easy to source separate and thus are accessible for diversion; they are a good fit with biosolids composting; and most states' regulations make it fairly simple to compost yard trimmings, thus there are few entry barriers.

In the future, there likely will be some consolidation of yard trimmings projects. Smaller municipalities may opt to close their sites and send material to a private facility or a larger municipal site in their region. Private sector processors also offer mobile grinding, composting, and screening services, which eliminate the need to haul unprocessed feedstocks (a significant expense).

Municipal and privately owned yard trimmings sites also are starting to accept other source separated feedstocks, such as preconsumer vegetative food residuals (such as produce trimmings), manure, and papermill sludge. In some states, as long as the site is equipped to handle these other materials, getting a permit to take additional feedstocks is fairly straightforward. For example, a municipal yard trimmings composting site in Cedar Rapids, IA, takes papermill sludge and a pharmaceutical residual. A large-scale private site in Seattle, WA services commercial generators in its region.

V. MSW COMPOSTING

Historically, MSW generation grew steadily from 80 million Mg (88 million tons) in 1960 to a peak of 194 million Mg (214 million tons) in 1994. Since then, there has been a slight decline in MSW generation. Recovery of materials for recycling also increased steadily during this period. In 1996, about 56% of the MSW in the U.S. was landfilled; 17% was combusted, primarily in trash-to-energy plants; and 27% was recycled. Within the 27% of MSW that was recycled, about 10.2 million Mg (11.3 million tons) was composted, representing 5.4% of the total weight of MSW generated in 1996 (U.S. EPA, 1998).

MSW composting has been around in the U.S. for decades. Projects were started around 40 years ago, but closed with the advent of inexpensive landfill space. There was a resurgence in MSW composting in the 1980s due to a number of factors, including closure of substandard landfills in rural areas; rising tipping fees in some regions as well as perceived decreases in landfill capacity; minimal development of waste to energy facilities (due to cost and performance issues); a perceived natural "fit" with the growing interest in recycling; the existence of technologies, primarily European, so that projects did not have to start from scratch; flow control restrictions that could enable projects to direct MSW to their facilities; and a potential revenue stream from tip fees and product sales.

Solid waste composting in the U.S. emerged on two tracks during the 1980s. The first, the mixed waste approach, involves bringing unsegregated loads of trash (in some cases this includes the recyclables) and doing all separation at the facility, both through upfront processing and/or back end product finishing. The second track, the source separated approach, relies on residents and other generators to separate out recyclables, compostables, and trash.

BioCycle also conducts annual surveys of solid waste composting projects. Interest in MSW composting grew rapidly in the late 1980s and early 1990s, but the number of operating projects never grew very much (Table 1.1). At the peak in 1992, there were 21 operating MSW composting projects. As of November 1999, there were 19 operating facilities in 12 states, and 6 projects in various stages of development (Glenn and Block, 1999). The two most recent facilities to open are in Massachusetts. Operating projects range in size from 4.5 to 272 Mg (5 to 300 tons) per day of MSW.

Of the current operating projects, seven use rotating drums and either windrows, aerated windrows or aerated static piles for active composting and curing. Seven projects use windrows, two use aerated static piles (one contained in a tube-shaped plastic bag), two compost in vessels, and one uses aerated windrows. Fifteen projects receive a mixed waste stream; four take in source separated MSW. Currently, there are very few vendors in the U.S. selling solid waste composting systems.

Not all of the operating MSW composting facilities have paying markets for the finished compost. Some use the material as landfill cover, while others donate it to farmers. A few facilities market compost to the horticulture industry. These include Pinetop–Lakeside, AZ; Fillmore County, MN; and Sevierville, TN (Glenn and Block, 1999).

Table 1.1 Solid Waste Composting Project History in the U.S.

Year	Operational	Total
1985	1	1
1986	1	6
1987	3	18
1988	6	42
1989	7	75
1990	9	89
1991	18	—
1992	21	82
1993	17	—
1994	17	51
1995	17	44
1996	15	41
1997	14	39
1998	18	33
1999	19	25

From *BioCycle* Annual MSW Composting Surveys: 1985–1999. With permission.

A. MSW Composting Drivers

In the late 1980s, many in the solid waste field felt there would be a landfill crisis in some regions of the country, prompting a surge of interest in alternative management options. In addition, the federal regulations under Subtitle D of the Resource Conservation and Recovery Act (U.S. EPA, 1997) — which went into effect in 1994 — were expected to force the closure of many substandard landfills, again putting pressure on existing disposal capacity.

The expected landfill crisis never really materialized, at least on a national basis. Landfills definitely closed — from almost 8000 in 1988 to about 2300 in 1999 (Glenn, 1999). At the same time, however, new state of the art mega-landfills opened, serving disposal needs on a regional (vs. a local) basis. When landfills closed in small towns, instead of building small composting facilities, many communities opted to build solid waste transfer stations and to haul waste long distances for disposal. Today, there are more transfer stations than landfills in the U.S.

Tipping fees, which did start to rise in many places, never stayed high in most regions. In fact, tipping fees have dropped in the U.S., and it is not anticipated they will go up significantly any time in the near future.

Solid waste composting projects also were negatively impacted by a 1994 U.S. Supreme Court decision that struck down flow control laws that gave government agencies the ability to direct the waste stream to specific facilities (Goldstein and Steuteville, 1994). MSW flow into some composting plants dropped considerably as haulers opted to transport garbage further distances to landfills with lower tipping fees.

Other factors that have stymied the development of MSW composting in the U.S. include generation of odors at some of the larger, higher visibility projects, leading to their failures; inadequate capitalization to fix problems that caused odors and/or to install odor control systems; production of a marginal compost product; and significant skepticism about the technology due to the project failures.

In the future, there will be some development of MSW composting projects, perhaps in areas where it is difficult to implement recycling programs (e.g., major tourist areas). The application of the technology, however, will be very site specific. For example, there may be a few communities that decide to increase diversion by getting households to separate other organics beyond yard trimmings. Many towns, however, have opted to push backyard composting of household organics instead of getting involved in centralized collection.

Experience has shown that composting solid waste on a larger scale requires a significant amount of capital, as well as deep financial pockets to address problems that arise once the facility starts operating. Projects also need to be able to set tipping fees that are competitive with landfills, which can be difficult when a project needs to make a sizable capital investment in processing (upfront and product finishing) equipment.

VI. FOOD RESIDUALS COMPOSTING

Perhaps the fastest growing segment of the U.S. composting industry is diversion of institutional/commercial/industrial (ICI) organics, primarily food and food processing residuals, including seafood. *BioCycle* began tracking data on this sector in 1995, when there was a total of 58 projects (Kunzler and Roe, 1995). In 1998, the last time *BioCycle* surveyed projects in all ICI sectors individually, there were 250 total projects, with 187 in operation, 37 pilots, and 26 in development (Goldstein et al., 1998). The 1999 *BioCycle* survey excluded institutional projects (which in 1998 numbered 116) that only handle residuals generated at that institution (Glenn and Goldstein, 1999). Instead, the survey focused on projects that handle food residuals from a combination of ICI sources — or commercial only — and those handling food processing residuals from only industrial generators. A significant difference between the projects traced in 1999 and the on-site institutional ones is scale. Typically, the on-site projects have throughputs of 4.5 to 91 Mg (5 to 100 tons) per year. Those tallied in the 1999 food residuals composting survey can easily reach upwards of 90,720 Mg (100,000 tons) per year (though not all do).

The 1999 survey found a total of 118 projects in the U.S. Of those, 95 are full-scale facilities, and 9 are pilot projects, primarily at existing composting sites (including nurseries). Another 14 projects are in various stages of development. Geographically, there is a very sharp division in the distribution of food residuals composting projects, with the Northeast and West Coast containing the majority of the facilities. Most of the sites compost feedstocks in windrows; many use yard trimmings as a bulking agent. Feedstocks include pre- and post-consumer food residuals (e.g., vegetative trimmings, kitchen preparation wastes, plate scrapings, baked goods, meats), out-of-date or off-specification food products, and industrial organics such as crab and mussel residuals and brewery sludge. The economics of food residuals composting projects have to be competitive with disposal options because the generators typically deal with private haulers (and thus know current disposal costs) (Glenn and Goldstein, 1999).

As with biosolids compost, nurseries, landscapers, and soil blenders represent the highest volume and dollar markets. Agricultural markets also were cited by survey respondents (Glenn and Goldstein, 1999).

A. Food Residuals Composting Drivers

Several different factors combined to promote the initial diversion of food residuals to composting. On the institutional side, it was a combination of cost savings, legislated recycling goals, regulatory exemption, and a finished compost that could be used on site for landscaping or gardens. In most cases, these institutions had yard trimmings available to compost with the food residuals (or started composting yard trimmings and recognized that food residuals — generated in a fairly clean stream — could be co-composted with the yard trimmings).

On the commercial and industrial sides, which have been slower to develop, cost savings are a significant factor — again the ability to divert an already segregated stream to composting instead of disposal. Another benefit is that most food residuals composting sites also accept wet or recyclable waxed corrugated fiberboard, which otherwise would have to be disposed. This was and still remains a significant benefit to generators.

In terms of the composting process, food residuals provide additional moisture and nitrogen to the composting process, especially when the yard trimmings being composted are fairly high in woody materials (a carbon source). In addition, some states' regulations are designed to encourage diversion of source separated, preconsumer feedstocks such as vegetative food residuals. This made entry into food residuals composting more realistic on a permitting level.

With landfill prices holding fairly steady in the \$33 per Mg (\$30 per ton) range on a national basis, it is difficult for haulers and processors to convince generators to divert feedstocks to composting. Nonetheless, a growing number of commercial and municipal sites are finding the right combination of tools to encourage generators to sign on to a composting program.

VII. REGULATIONS

No discussion of composting is complete without a look at regulations. Because composting falls in the waste management spectrum, it is typically regulated under solid waste rules. Biosolids composting is an exception, as many states regulate it under their water divisions.

The federal government does not have specific regulations for composting, except for EPA's Part 503 rules for biosolids (U.S. EPA, 1994), which include stipulations for biosolids composting, particularly regarding pathogens and vectors. The Part 503 rules also set pollutant limits, which each state has to use as a minimum. These limits apply to biosolids compost.

Aside from applicability of the Part 503 rule at the state level, state composting regulations vary significantly. Some states, like California, Ohio, New York, Maine, and Oregon, have very specific composting regulations. In most of these cases, the regulations are "tiered," meaning the degree of permit restrictions changes with the feedstocks being composted. Typically, facilities composting yard trimmings have fairly minimal requirements (primarily addressing setback distances from ground and surface water and quantities processed). Wood processing operations also tend to have few regulatory requirements, as do those projects handling manure.

Regulatory requirements increase with source-separated food residuals (preconsumer) and then get more stringent with regard to postconsumer food residuals, biosolids, and MSW. Some states, like Maine, have few restrictions for sites which compost less than a certain quantity of feedstocks per year (e.g., 382 m^3 [500 yd^3] per year of preconsumer food residuals).

VIII. CONCLUSIONS

Composting serves as both a waste management method and a product manufacturer. As such, a project can generate revenue streams on both the front end (tipping fees) and the back end (product sales). Many companies got into composting mostly based on the upfront revenue from tipping fees, and did not focus a lot of attention on producing a high-quality product to maximize sales. But with steady or dropping tipping fees, projects are having to become more market driven and not tip fee driven. Successful companies and operations are those with excellent marketing programs. They have invested in equipment to service their markets, e.g., screens with various sizes to meet different end uses. In short, they know their markets and know how to service them.

There also are exciting developments on the end use side. Composts are used increasingly for their nutrient value and ability to build soil organic matter and also because of their ability to suppress plant diseases. There is an increase in agricultural utilization of compost, and many states are developing procurement programs for compost use on highways and for erosion control. Interesting projects also are developing in the use of compost for bioremediation. In short, although composting will always be available as a waste management option, it is becoming equally (and in some cases more) valuable as a producer of organic soil amendments.

For the most part, major solid waste initiatives that might have a positive impact on the development of composting projects are not expected. There may be some indirect impacts, e.g., from increasing regulation of manure management, which may lead to more composting on farms. But for the foreseeable future, growth in composting may be primarily due to market demand for compost.

In the final analysis, the composting industry knows how to make compost products that meet the needs of the horticulture industry. The combination of research and practical experience demonstrates the benefits, cost savings, and sustainability of compost use in horticulture. Furthermore, composting is an economically viable management tool for nurseries and other sectors of the horticulture industry that generate organic residuals.

If compost is going to play a more significant role in horticulture, it is critical that the composting industry has the capability to reliably (1) produce compost that is of a consistent quality, and (2) produce the volume of quality compost needed to match the demands of the horticulture industry.

Today's composting industry has the knowledge and technical ability to produce a compost product that consistently meets the needs of the end user. Adequate volumes are and can be produced. However, composters face a dilemma in that they need to secure long-term market contracts so that they can secure long-term sources of feedstocks and have adequate financing available for site expansion. A number of composters have found that balance; in fact, some actually pay for feedstocks in order to guarantee an adequate supply and to have the quality input desired.

In summary, the U.S. has a healthy and growing composting infrastructure. Around the country, private sector composters are running successful businesses, serving as models for other entrepreneurs and investors. Some individuals start composting companies from "scratch," while others add composting on to an existing business — such as a mining or excavation company, nursery, wood grinder, soil blender, or farmer. Many municipal projects are thriving as well, giving generators an excellent outlet for their residuals and providing end users with a steady supply of quality compost.

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