Description and Use of Municipal Solid Waste Composts in New Mexico

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The average American generates approximately 4.5 pounds of garbage per day, for a total of 196 million tons of trash per year, most of which ends up in landfills (Shortridge, 1993). Various government and private programs have been organized to divert part of this garbage (metals, plastics, paper and cardboard, and yard and food wastes) from landfills by recycling. Yard and food wastes often are recycled as compost.

A 1991-1992 landfill survey showed that yard waste made up 33.8 percent of the City of Albuquerque's residential solid waste stream (Romo, Cave, and Watkins, 1992). During the same period, the city's wastewater treatment facility was treating more than 50 million gallons of mixed residential and industrial wastewater daily, producing about 22 dry tons of stabilized biosolids (sludge) per day.

To address these solid waste problems, the City of Albuquerque dedicated a state-of-the-art municipal compost facility in early 1992. Since then, portions of the source-separated landscape wastes (2,500 ton/year of yard trimmings) have been combined with biosolids (9,700 ton/year) and horse track manure (3,600 ton/year) at the facility to create an EPA-certified (Class A) biosolid compost (Glass, 1997). In 1996, the same facility began making a green waste compost using urea (fertilizer) instead of biosolids as a nitrogen source. Other municipal composting operations in New Mexico are located at Artesia, Los Alamos, Alamogordo, Carlsbad, and Tucumcari (Baker, 1998). A number of private companies compost yard wastes, and permits are pending for other municipal composting programs.

COMPOSTING VERSUS LANDFILLING

Yard wastes and biosolids not only occupy valuable space in landfills, but they also decompose, which can result in the production of methane gas and leachates that pollute the environment. Also, collection of yard waste is expensive. Recycling these organic wastes as composts benefits the environment, and financial returns from the sale of municipal composts can help offset the costs of collection and processing. Recycling the composts back on city parks, in local gardens, on farms, or for revegetation of disturbed lands, also can make such entities more sustainable.

THE COMPOSTING PROCESS

Composting is the aerobic, biological degradation and oxidation of organic wastes such as manures, biosolids, food scraps, and yard trimmings by various naturally occurring microorganisms under controlled conditions which results in a stabilized, humus-like material.[1]

Municipal solid waste composting is composting on a community-wide scale. Most municipal solid waste composting facilities in New Mexico are source-separated operations where yard wastes are separated from other wastes such as cans and plastic. Biosolid composts are co-composted products where biosolids are combined with yard wastes. Green waste composts generally only involve yard wastes and the possible addition of a nitrogen fertilizer.

Optimum composting conditions involve a balance of six factors: (1) the carbon:nitrogen ratios of feedstocks, (2) particle size, (3) oxygen, (4) moisture, (5) temperature, and (6) time. The composting process involves the generation of heat, production of carbon dioxide, loss of water vapor, loss of mass (waste), and production of a relatively stable humus that is free of offensive odors.

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[1] The criteria for "stabilized" compost vary somewhat, but in general, a compost is considered stable when the temperature in a static pile remains at or near ambient air temperatures for several days; moisture content is about 50 percent; and oxygen content is more than 5 percent.

All organic wastes (feedstocks) are made of carbon and nitrogen. When combining various organic wastes in a composting operation, the ideal ratio of carbon to nitrogen is 30:1 for optimum growth of bacteria, which dominate the initial composting process. Microorganisms like bacteria require carbon for energy and nitrogen for the production of amino acids and proteins in their bodies. Higher carbon:nitrogen ratios slow the composting process, while lower carbon:nitrogen ratios produce too much ammonia. Raw materials high in carbon (such as sawdust, leaves, and paper) should be combined with raw materials high in nitrogen (such as manure, grass clippings, and food waste) to obtain the appropriate 30:1 ratio for optimum composting conditions.

Feedstocks used in composting often are shredded or ground to increase the surface area of these materials. The particle size of these materials after processing affects the porosity of the compost, which in turn affects the flow of air in the compost. The smaller the particle, the greater the surface area and the faster the compost will decompose. If the particle is too small, however, airflow is inhibited. If the particles are too large, the compost dries out. Best results are obtained when the particle ranges from 1/8 inch to 2 inches in diameter.

Compost should contain at least 5 percent or more oxygen for optimum aerobic composting. Aeration in most New Mexico municipal composting operations is passive, such that oxygen enters the compost by natural convection. Turning of a compost pile or windrow provides only limited aeration. Good porosity is important for natural convection and diffusion of oxygen into the compost. Insufficient oxygen results in anaerobic conditions and the production of objectionable odors (from chemicals such as hydrogen sulfide, methane, and organic acids).

Compost should contain 40 to 60 percent moisture to support the growth of microorganisms involved in the composting process. Microbial activity is severely inhibited below this range. Moisture levels above 60 percent result in anaerobic conditions.

The breakdown of wastes by bacteria in the composting process generates heat. Mesophilic organisms generally are active at temperatures of 70° to 105°F. Thermophilic bacteria take over at higher temperatures (110° to 150°F). At temperatures above 160°F, microorganism activity begins to shut down. Turning piles mechanically at this stage helps bring the temperature down. Compost on the outside of a pile or windrow should be turned to the middle of the pile so it can undergo the composting process. Temperatures are considered ideal between 131° and 150°F, which kill most weed seed and pathogens (both plant and animal). The compost should be kept at these temperatures for as long as possible.

As the organic food supply is depleted, the compost begins to cool. Heat, water vapor, and carbon dioxide released during the composting process reduce the overall size of the compost pile or windrow by as much as 50 percent. When the compost temperature drops to 100°F or less and fails to reheat after turning, the compost is allowed to cure for one to six months or more under natural aerobic conditions. During the curing process, various fungi and actinomycetes form. Actinomycetes form filaments like fungi but are much smaller, so they are classified as higher forms of bacteria. Both fungi and actinomycetes tend to feed on more resistant materials, such as cellulose and lignins, that are left over after the composting process. Actinomycetes also convert volatile organic acids into longer chained organic acid complexes (5 carbon ringed humic acids), which make up humus. This tends to stabilize the nutrients in the compost. Curing is considered complete when the pile remains at or near ambient air temperatures and the respiration rate (rate of oxygen consumed) is less than 200 mg O_2 per kg of compost per hour. The compost can then be screened for various agronomic and horticultural uses.

Biosolid Composting Process

Composting of biosolids or sludge is regulated by the Environmental Protection Agency (USEPA, 1993). Heavy metals in biosolid composts must be in compliance with the Clean Water Act of 1987, 40CFR, Part 503, for "exceptional quality" (table 1). To date, the City of Albuquerque's Municipal Compost Facility has met these requirements as well as EPA's requirements for polychlorinated biphenyl (PCB) content (Glass, 1997). To control pathogens in the compost, windrows of

Table 1. EPA criteria for heavy metal content in higher quality biosolids applied to land (USEPA, 1993).

Heavy metal	Maximum level for high quality biosolids (mg/kg)	Albuquerque biosolid compost,[1] 4/18/98 (mg/kg)
Arsenic	41	5.1
Cadmium	39	1.6
Chromium	1,200	28.0
Copper	1,500	165.0
Lead	300	66.0
Mercury	17	0.9
Molybdenum	18	9.9
Nickel	420	LT[2]
Selenium	36	1.0
Zinc	2,800	275.0

[1]Soil, Water, and Air Testing Laboratory, NMSU.

[2]LT = Less Than 1 mg/kg

composted biosolids and yard waste are kept at 55°C (131°F) for 15 days and turned 5 times (every 3 days) during the maximum heating phase. The finished compost (Class A) should have less than 1000 organisms (most probable number) per gram of total dry solids for the benign indicator bacteria, fecal coliform (USEPA, 1993).

The production of green waste compost (from yard trimmings) is somewhat less expensive than that of biosolid compost because fewer state and federal regulations apply. Urea is often added as a supplemental nitrogen source for this type of composting.

CHARACTERISTICS OF COMPOST

The specific characteristics of various composts depend on the organic wastes being composted and the composting process. The ultimate use and value of any compost depends not only on its physical and chemical properties, but also on its biological activity.

Physical Characteristics

Compost particle size depends on how the feedstocks were processed (chipped, shredded, or ground), the thoroughness of the composting process, and whether the compost is screened after curing. Particle size affects the ultimate bulk density (lb/yd^3) of the finished compost (average is between 800 lb/yd^3 and 1000 lb/yd^3), which in turn affects the structure of the soil it's applied to. Smaller particles increase the surface area of a compost, thus increasing the water-holding capacity of a soil (particularly important in sandy soils) and its ability to retain nutrients (cation exchange capacity). Composts with larger particles have lower bulk densities and are used as mulches or in heavy soils to increase aeration and improve water infiltration (by enhancing soil aggregation). Composts vary in organic matter content from 30 to 70 percent, but the ideal is more than 50 percent.

Moisture content of finished composts should range from 45 to 50 percent. Composts with less moisture tend to blow in the wind, while those with more moisture are heavier and tend to clump.

Composts should be free of metal, glass, plastic, cement, asphalt, and other debris (no greater than 1 percent). Most debris can be controlled with a good source-separation program.

Chemical Characteristics

The nutrient content of most composts is relatively low compared to most commercial fertilizers. Composts containing manures or biosolids tend to contain more nutrients than pure green waste composts. Although composts are relatively low in macronutrients (nitrogen, phosphorous, and potassium), they generally are an excellent source of micronutrients (such as iron, zinc, and magnesium), especially composts made from biosolids. As most nutrients in compost are in organic forms, they are slowly made available for plant uptake, thus they are considered more environmentally friendly. Biosolid composts, however, often contain low levels of undesirable heavy metals like lead, mercury, arsenic, and cadmium.

Soluble salts in a compost include many of the above nutrients as well as salts like sodium. Soluble salt content is generally expressed as the electrical conductivity (measurement of the readiness of a medium to transmit electricity) of the compost or soil. Electrical conductivity is generally expressed in millimhos per centimeter (mmho/cm) at 25°C. Some crops, like green beans, are very sensitive to salts, while others, like asparagus, are more tolerant. The ideal compost should have an electrical conductivity no higher than 3.5 mmho/cm.

The pH of a compost can affect how soluble the nutrients will be in a plant's root zone. Some greenhouse plants and strawberries prefer acidic soils, while many turfgrasses tolerant more alkaline soils. Most composts have a pH of 6.8 to 7.5 (Naylor, 1993).

The carbon:nitrogen ratio of a compost is important because it is a general indicator of whether a compost will rob plant roots of nitrogen. The ideal finished compost should have a carbon:nitrogen ratio between 15:1 and 25:1 (Naylor, 1993). Higher carbon:nitrogen ratio composts can be used in crop production, but they may need to be supplemented with nitrogen fertilizer.

Compost maturity relates to the stability of the organic mass. Immature composts can contain organic acids, ammonia, and other phytotoxic chemicals that can damage plant roots. For the compost to mature and stabilize, sufficient time must be allotted for proper curing of compost under aerobic conditions.

Compost also should be free of objectionable odors and have a pleasant appearance. Ideal composts have an earthy smell and a dark, crumbly, humus-like appearance.

Biological Characteristics

Unlike most peat mosses, compost is biologically active. Microorganisms in compost continue to break down the various complex carbonous materials in the compost, slowly making nutrients available for plant uptake.

Many microorganisms that recolonize the compost during the curing phase can behave like biological fungicides by controlling various soil-borne plant diseases. Composts, particularly those made from tree bark, have been used for many years in the nursery industry as a substitute for peat moss. Tree bark composts have been found to suppress soil-borne diseases caused by *Fusarium* spp., *Phytophthora* spp., *Pythium* spp., *Rhizoctonia solani*, and other pathogens (Hoitink and Grebus, 1995). The mechanisms for biological control are thought to be based on competition, antibiosis, hyperparasitism, and induced systemic resistance in plants (Hoitink, 1993). Under- and overmature composts, and those high in soluble salts have less fungicidal effect (Rynk, 1992).

USES OF COMPOST

Municipalities often find composting an environmentally preferred alternative to landfilling yard wastes and biosolids. Composting not only avoids methane and leachate production in the landfill, it also saves valuable landfill space. Compost production also can generate funds that can be returned to municipal governments through the direct sale of compost to the public or by reducing the purchase of fertilizers and soil amendments used on city parks, golf courses, cemeteries, and other properties.

The major benefit of compost is to improve the structure of a soil. It is also a source of plant nutrients, can be used as a mulch, and, in some cases, can be used as a natural fungicide. The application rates of compost depend on its characteristics and intended use.

Agricultural Cropland

Agricultural cropland is the largest potential market for compost use, but it is one of the least profitable. Municipal compost is applied to cropland primarily to improve the structure of a soil (such as to increase its water-holding capacity, cation-exchange capacity, and, in heavy soils, water infiltration and aeration). Municipal compost also is used as a source of nutrients, particularly minor elements, because most commercial fertilizers rarely contain minor elements. The organic matter in compost also acts as a relatively long-term reserve for major nutrients like nitrogen, phosphorous, and potassium. It is estimated that 10 to 15 percent of nitrogen in this organic matter may be released during the first growing season through mineralization, with residual nitrogen released over the next 2 to 3 years (Naylor, 1993).

The particle size of compost applied to cropland can be 1/2 to 3/4 inch in diameter. It is important that the carbon:nitrogen ratio be no greater than 30:1 so that the compost does not rob plants of nitrogen (although extra nitrogen fertilizer can be applied to overcome this tendency). The compost also must be mature to prevent damage to plant roots from excess ammonia, organic acids, and other phytotoxic chemicals. Immature composts can be applied directly to cropland if it's done well in advance of planting to give the compost a chance to stabilize in the soil. For example, for spring-planted crops, apply the compost to the soil the fall before planting.

The application rate of municipal compost basically depends on its nutrient content, soluble salt concentration, soil reserves of nutrients as determined by soil testing, and the crop to be planted. The application rate for most food crops should not exceed 50 dry tons per acre (Rynk, 1992). Generally, optimum rates are 10 to 20 tons per acre, but rates depend on soil test results and crop requirements.

A municipal compost's application rate, soluble salt concentration, and ability to suppress disease in combination with irrigation technique can affect yields. In 1995, 5 rates (3 replications) of a biosolid compost (EC = 14.5 mmho/cm) from the City of Albuquerque, were applied to a chile field in Garfield, New Mexico; disked; listed; pre-irrigated; and planted to 'Sandia' chile. After removing the soil cap (a layer of soil over the seed to prevent soil crusting) from the bed after the seed germinated, seedling counts were made at various times during the season beginning on 5/17/95 (table 2).

There was a 27.2 percent mortality rate in seedlings in the check plot compared with the 50 ton/acre plot (5/17). These losses were attributed to "damping off" (*Rhizoctonia solani*) due to cool temperatures early in the growing season. These results, however, were reversed by the end of the season (10/2), with the greatest losses occurring in the 50 ton/acre plot. These losses were attributed to salt and damping off. Losses to chile wilt (*Phytophthora capsici*) also were heaviest in the 30 ton/acre and 50 ton/acre plots. The 20 ton/acre plots resulted in the lowest losses from either damping off or chile wilt and produced the greatest yields.

Although the compost suppressed both diseases, the high content of soluble salt in the biosolid compost at 30 ton/acre and 50 ton/acre resulted in greater plant losses from both diseases. The salt concentration was aggravated by the fact that the plants were in the middle of the bed, where salts tend to accumulate. Higher compost

Table 2. Effects of biosolid compost on plant mortality (from Rhizoctonia solani and salt), plants with chile wilt, and chile yields, Garfield, New Mexico, 1995.

Compost (Ton/ acre)	# chile seedlings/acre 5/17	6/9	10/2	% Plants w/chile wilt (10/2)	Yield (lb/A) (10/25)
0	42,643	24,073	10,730	14.1	4471
10	44,019	32,464	14,031	12.7	5227
20	55,298	39,892	15,269	9.0	5420
30	55,436	41,955	13,618	27.3	4484
50	58,600	30,263	10,179	27.0	1761

rates may be tolerated when plants are established on the outside edge of a flat vegetable bed (because salts tend to move to the middle of the bed by capillary action), are sprinkle-irrigated (so salts leach through soil profile), or are placed under drip irrigation next to plants so that salts are moved away from the plants.

There is some concern that heavy metals can accumulate in the soil from heavy applications of biosolid compost. This was not the case in the chile experiment (table 3). Analyses of soil samples (from an 8-inch depth) taken at the end of the growing season from each plot showed only random differences in metal contents at all rates. The high iron figures may have been due to lab error or a fertilizer application. Where food crops are grown in fields treated with biosolid composts, the heavy metal content of fields should be monitored yearly.

Table 3. Effects of biosolid compost on soil nutrients and other parameters after one growing season (chile), 11/95.

	Biosolid compost (ton/acre)				
Parameter	0	10	20	30	50
pH	7.94	7.46	7.63	7.67	7.78
EC (mmho/cm)	1.93	2.85	1.81	2.35	1.61
Organic matter (%)	1.18	1.57	1.54	1.71	1.48
Nitrate nitrogen (ppm)	18.6	62.6	20.2	34.5	22.5
Sodium (meq/l)	9.26	10.72	8.09	10.03	7.19
Calcium (meq/l)	8.66	14.27	8.50	12.01	7.3
Magnesium (meq/l)	2.36	4.08	2.43	3.26	2.03
Phosphorous (ppm)	28.4	52.8	46.8	15.9	52.8
Potassium (ppm)	40.0	61.0	52.0	64.0	54.0
Lead (mg/kg)	17.0	17.0	17.0	14.0	17.0
Cadmium (mg/kg)	LT	LT	LT	LT	LT
Nickel (mg/kg)	7.2	6.9	7.2	6.5	7.1
Arsenic (mg/kg)	1.1	1.18	1.2	1.1	1.1
Chromium (mg/kg)	10.8	11.3	10.0	9.2	11.2
Copper (mg/kg)	12.0	13.0	14.0	13.0	14.0
Iron (mg/kg)	15,510	14,590	15,020	11,980	15,220
Mercury (mg/kg)	LT	LT	LT	LT	LT
Molybdenum (mg/kg)	LT	LT	LT	LT	LT
Selenium (mg/kg)	LT	LT	LT	LT	LT
Silver (mg/kg)	LT	LT	1.6	LT	LT
Zinc (mg/kg)	53	58.0	56.0	46.0	53

[1]LT = Less Than 1.0 mg/kg

Nursery Crops

The "green industry" (greenhouses, nurseries, garden centers, landscape contractors) makes up the second largest agricultural industry by income in the United States. Given that about 80 percent of all marketed containerized ornamental plants are grown in media made of 75 to 80 percent organic matter, this industry could be a huge potential market for compost. The use of compost in creating new topsoil also is important. It is estimated that harvesting 1 acre of balled and burlapped trees and shrubs removes more than 200 tons of soil. Compost often is used to create new topsoil to keep such operations sustainable (Gouin, 1995).

While the quality of compost applied to cropland can vary widely, compost used in the green industry must be consistent in its quality. Two of the most important considerations in quality are compost maturity and soluble salt content.

Composted tree bark has been evaluated for many years as a substitute for peat moss in potting soil media. Although properly stabilized or mature compost helps suppress soil-borne pathogens in potting media, overly stabilized or immature composts are not as effective. Composts high in soluble salts (particularly biosolid composts) also can reduce the effectiveness of the compost in suppressing soil-borne diseases (Hoitink, 1993).

In the spring of 1996, four potting soil mixes were evaluated for their ability to suppress damping off (*Pythium ultimum*) in a greenhouse (Edgewood, New Mexico). The check (grower treatment) consisted of 25 percent vermiculite, 25 percent perlite, and 50 percent peat moss. The other three treatments also consisted of 25 percent vermiculite and 25 percent perlite. A sifted biosolid compost (EC=14.5 mmho/cm), however, was used to replace some of the peat moss in three treatments. The treatments were 12.5 percent compost with 37.5 percent peat moss; 25 percent compost with 25 percent peat moss; and 50 percent compost with no peat moss. The treatments were then seeded with snapdragons.

Higher salt concentrations from the heavier compost rates increased the number of days to emergence for the snapdragons and decreased the emergence rating (table 4). Heavier compost rates also decreased plant height.

On 4/3/96, healthy snapdragon plants were transplanted to new trays containing the same media treatments. The 25-percent compost treatment resulted in the greatest suppression of damping off (*Pythium ultimum*), followed by the 12.5-percent rate (table 4). The check, with no compost and 50 percent peat moss, resulted in the lowest suppression rating. Although the 50 percent compost treatment showed some signs of disease suppression, the high salt content of the compost reversed benefits of disease suppression.

Most potting soil mixes range from 20 to 33 percent compost. The best mixture depends on the plant species and the soil's soluble salt content (Rynk, 1992). The pH of the media can be regulated, to some extent, by the

Table 4. Effects of a biosolid compost on seedling emergence, height, and disease suppression (Pythium ultimum) of snapdragons under greenhouse conditions, Edgewood, New Mexico, 1996.

Media treatment (% compost)	Days to emergence (3/15/96)	Emergence rating[1] (3/27/96)	Height of seedlings (cm) (4/23/96)	Disease suppression[3]
0.0 (check)	8.0	3.67	2.3a[2]	2.62
12.5	9.0	3.83	2.8ab	4.31
25.0	9.7	2.27	2.0bc	4.65
50.0	11.0	1.17	1.3c	3.18

[1]Emergence rating: 1 = poor, 2 = fair, 3 = good, 4 = excellent.

[2]Means followed by the same letter in a column are not significantly different ($P \leq .01$, Duncan's Multiple Range Test).

[3]Disease suppression (*Pythium ultimum*): 1 = dead, 2 = poor, 3 = fair, 4 = good, 5 = excellent.

feedstocks used in creating the composts and amendments like sulfur (which makes soil more acidic).

Given the nutrients in most composts (especially biosolid composts), liquid fertilizers generally are not required by most potting plants for the first couple of weeks of growth. Slow-release fertilizers may be blended with the potting soil mixture if required.

Landscaping and Turfgrass

Municipal composts can be applied to new landscapes at a rate of up to 50 dry ton/acre (2,296 lb/1000 ft^2). Rates will vary depending on the soluble salt content of the compost. After rough grading, the compost should be incorporated into the existing soil to a depth of 6 to 10 inches. After removing rocks and other debris, the site can be raked smooth and planted to sod or other ornamentals (Gouin, 1995).

When planting shrubs and trees, some landscapers backfill individual planting holes with a mixture of 25 to 50 percent compost and native soil. Composts with higher soluble salt contents should be applied at lower rates. Lower rates also should be used for native plants.

Municipal composts can be applied to flower beds and vegetable gardens at a rate of 1000 lb/1000 ft^2 to 2000 lb/1000 ft^2. Lower rates should be used if the soluble salt content is high. Rates also will vary with the initial soluble salt content of the soil, type of crop planted, and watering technique.

Peat moss has been a common component of top-dressing mixes used to treat golf course greens, fairways, football fields, and parks throughout the United States. Mixtures often include various grades of sands, zeolites (volcanic mineral amendment), and peat moss. The peat moss may range from 15 to 20 percent by volume in such mixes.

Given the finite quantities of peat moss and its transportation cost, peat moss can be quite expensive ($7.44/3.8 cubic feet, 1998, an Albuquerque retail outlet). Many New Mexico turfgrass managers have replaced the peat moss in top-dressing mixes with greater amounts of zeolites. An alternative is to use local municipal compost to replace the peat moss. Per cubic yard, peat moss is three times more expensive than municipal compost in Albuquerque.

Besides being less expensive than peat moss, municipal compost has an advantage over peat moss and zeolites because it provides a wide range of nutrients for plant growth. Because these nutrients are in organic form, they are released slowly during the growing season with less nutrient loss to leaching. Compost also contains humic acid, which makes other nutrients in the soil more available for plant uptake.

As in the nursery industry, municipal compost also has been found to be more biologically active than peat moss or zeolites when used on turf. Many composts have been found to be effective in suppressing diseases like brown patch, dollar spot, Pythium blight, and Pythium root rot (Tyler, 1996).

The particle size for municipal compost in top-dressing mixes should be no larger than 1/8 to 1/4 inch in diameter, particularly on golf course greens. Top-dressing is combined with aeration operations in the spring and fall. Spreaders should be calibrated to apply a 1/4-inch layer of mix that may or may not be mixed in with plugs using a drag or keystone mat. Excess material may have to be blown off the greens if the compost particle is larger than 1/8 of an inch. Typical topdressing mixes include 15 percent compost, 20 percent zeolites, and 65 percent sand; or 10 to 30 percent compost and the rest, sand. Municipal compost mixes also are very popular in repairing divots on golf courses and tees.

Municipal composts also can be used to rebuild or repair poor soil in rough areas, parks, and other non-USDA-specified turf areas. Compost with a larger particle (1/2 inch) can be used in such cases because it's incorporated into the soil.

Compost quality is important when considering its use in top-dressing mixes or soil mixes. Parameters to be considered include particle size, pH, soluble salts, nutrient content, stability of heavy metals, stability, weed seed, phytotoxic compounds, and foreign objects. Quality also should be relatively consistent from batch to batch to insure a consistent response from the turf.

Compost also has been used to stabilize slopes. Compost with a larger particle (1/2 inch) is often combined with soil stabilization mats or netting, then overseeded with native grasses to control erosion, especially along highway right-of-ways.

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