UPGRADING MARGINAL SOILS

USING COMPOST

Compost
Research & Education Foundation

Description:

This work consists of incorporating compost within the root zone to improve soil quality and plant growth. This specification is intended to upgrade compacted, disturbed, un-irrigated, low-maintenance sites, or marginal soils.

Key Benefits/Return on Investment:

- May reclaim previously unusable land, potentially even salt damaged soil,
- Enhances the rate of vegetation establishment and overall appearance,
- Nutrient savings – 50% or more of starter fertilizer (possibly feeding native plants for multiple years),
- Water savings – 25 - 50% annually,
- May reduce or eliminate lime/gypsum application,
- Improves storm water infiltration and capture, and
- Can bind specific heavy metals.

Extensive research and practical experience illustrate great success using compost in reclaiming marginal soils.

Construction Requirements:

- Compost should be uniformly applied over the planting area at an average depth of 1 to 3 inches.
  - Lower compost application rates may be necessary where salt-sensitive species are being established, where compost possessing higher salt or nutrient levels are used, where moderate amounts of organic matter exist on the site to be treated, or where native plant species are to be established.
- Higher application rates (3-inch layer) may be required in sandy soils and where reduced water usage is desired. In these cases, a lower nutrient content compost may be necessary (e.g., yard trimmings-based). Higher rates of compost may also be used if deeper soil incorporation (12-inch depth) is possible or desired.
- Compost may be applied with a mechanical spreader (e.g., manure spreader, large broadcast spreader, etc.) or blower truck depending on the precision required.
- Incorporate uniformly to a minimum depth of 6 inches using a chisel plow or similar equipment. A rotary tiller or other small tillage equipment may be necessary for smaller sites.
  - Avoid incorporation when soils are excessively wet or dry.
  - On compacted sites and/or where more improved storm water infiltration is desired, deep ripping of the soil to a depth of 12 inches in a crisscross pattern with a chisel plow (or the similar) is desired.
- If fertilizer or pH adjusting agents (e.g., lime and sulfur) are necessary, apply pre-plant or in conjunction with compost incorporation. Reduced nitrogen and phosphate application is suggested.
- Prepare the soil surface to allow for seeding.
  - The soil surface should be reasonably free of large clods, roots, stones greater than 2 inches, and other material which will interfere with planting and subsequent site maintenance.
  - Depending on the seed mix used, a small size native seed planter may be required.
- Water thoroughly after seeding.

General:

Compost Analysis: All compost products have different characteristics. Before selecting a compost product, a compost analysis should be completed by a reputable laboratory* to determine the characteristics of the material, so that the right material can be used for the appropriate purpose. Once determined, the soil should be appropriately amended to a range suitable for the plant species to be established and results desired.

Soil Analysis: Before any soil preparation procedures ensue, a soil analysis should be completed by a reputable laboratory to determine any nutritional requirements, pH and organic matter adjustments necessary. Once determined, the soil should be appropriately amended to a range suitable for the turf species to be established.

Compost inclusion rates depend upon soil conditions and quality, plant tolerances, and manufacturer's recommendations. The use of stable, nutrient-rich compost will reduce (or eliminate) initial fertilizer requirements by the amount of available nutrients in the compost.

Compost Research & Education Foundation

UPGRADING MARGINAL SOILS Using Compost

Compost Parameters:

Parameters[1,5]	Reported as (units of measure)	General Range
pH[2]	pH units	6.0 - 8.5
Soluble Salt Concentration[2] (electrical conductivity)	dS/m (mmhos/cm)	Maximum 10
Moisture Content	%, wet weight basis	30 – 60%
Organic Matter Content	%, dry weight basis	30 – 65%
Particle Size	% passing a selected mesh size, dry weight basis	95% pass through 3/8" screen or smaller
Stability Carbon Dioxide Evolution Rate	mg CO2-C per g OM per day	< 4
Maturity (Bioassay) Seed Emergence and Seedling Vigor	 %, relative to positive control %, relative to positive control	 Minimum 80% Minimum 80%
Physical Contaminants (man-made inerts)	%, dry weight basis	< 1.0%
Chemical Contaminants[3]	mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels
Biological Contaminants[4] Indicator Organisms Fecal Coliform Bacteria, and /or Salmonella	 MPN per gram dry weight MPN per 4 grams dry weight	 Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

References:

Alexander, R.A., The Field Guide to Compost Use. The US Composting Council, 1996.

Alexander, R.A., The Use of Compost in Reclamation Activities. Funded by the City of Edmonton, March 2005.

Cogger, C.G., Potential Compost Benefits for Restoration of Soils Disturbed by Urban Development. Washington State University, Compost Science & Utilization, (2005), Vol. 13, No.4, 243-251.

Coker, C. and Schwartz, S., Site Restoration with Compost and Subsoiling. BioCycle, March/April 2017.

Schwartz, M., Bassuk, N., Bonhotal,, J., and Harrison, E., Highly Compoacted Soils Improved by Compost Use. BioCycle, July 2007.

***The Seal of Testing Assurance (STA) Certified Compost Program provides a comprehensive history of compost analysis results from proficiency-tested laboratories, list of ingredients, and suggested directions for using that unique product.** **www.compostingcouncil.org/participants**

[1] Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The Compost Research & Education Foundation).

[2] It should be noted that the pH and soluble salt content of the final amended soil is more relevant to the establishment and growth of a particular plant, than is the pH or soluble salt content of the specific compost used to amend the soil. The pH and soluble salt content of the compost is diluted when mixed with the native soil, so testing for these parameters in the amended soil is suggested. Each specific plant species requires a specific pH range. Each plant also has a salinity tolerance rating, and maximum tolerable quantities are known. Most ornamental plants and turf species can tolerate a soil/media soluble salt level of 2.5 dS/m and 4 dS/m, respectively. Seeds, young seedlings and salt sensitive species often prefer soluble salt levels at half the afore mentioned levels. When specifying the establishment of any plant or turf species, it is important to understand their pH and soluble salt requirements, and how they relate to existing soil conditions.

[3] US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels = Arsenic 41ppm, Cadmium 39ppm, Copper 1,500ppm, Lead 300ppm, Mercury 17ppm, Molybdenum 75ppm, Nickel 420ppm, Selenium 100ppm, Zinc 2,800ppm.

[4] US EPA Class A standard, 40 CFR § 503.32(a) levels = Salmonella <3 MPN/4grams of total solids or Fecal Coliform <1000 MPN/gram of total solids.

[5] Landscape architects and project (field) engineers may modify the allowable compost specification ranges based on specific field conditions and plant requirements.

Developed for the CREF by R. Alexander Associates, Inc.