COMPOSTED SEWAGE SLUDGE: AN AID IN PROPAGATION[1]

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Nutrient rich compost is becoming more available as an increasing number of municipalities adopt environmentally sound methods of composting to recycle sewage sludge, yard waste, and garbage. The use of quality compost in plant propagation can provide many benefits, although the quality of compost will vary according to: raw materials used, age of compost, and management of the composting facilities.

MANUFACTURING COMPOST

Composting is as old as the "Garden of Eden"; however, technology in the science of composting is as "New as Tomorrow". Composting is more than simply placing organic materials in piles and providing sufficient time for decomposition. With current technology, composting can be completed in as little as 30 days depending on raw materials, composting systems, and desired quality of finished product.

Composting is an aerobic process requiring in excess of 5% free oxygen for optimum macro-microorganism activity. Organic materials with a carbon/nitrogen ratio between 35:1 and 25:1, approximately 50% water, and in sufficient mass to maintain temperatures near 150°F (50°C) will compost with maximum efficiency. Although pathogens and weed seeds are killed within 5 days under ideal conditions, composting is not complete. An additional 25 days is generally necessary for greater reduction of carbonatious materials to a C:N ratio near 10:1 and for N stabilization.

Quality compost is near sterile and can be handled without fear of pathogen and weed seed contamination. However, most of the nitrogen in fresh compost is in the ammonia form. For ammonia-sensitive crops it is necessary for the compost to "cure" for an additional 60 to 90 days to convert ammonia to nitrates.

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To ensure that the compost is safe to use, EPA requires that temperature records of compost made from sewage sludge be maintained and available for inspection. Any deviation from minimum composting standards of 50 °C (120 °F) for 5 consecutive days (off-spec compost) requires that the composting pile be broken down and rebuilt or discarded in a safe manner. In nearly all instances composting temperatures of 55 °C or greater are achieved and composting is allowed to continue for 20 days or more for maximum volume reduction. Composted sewage sludge to be sold to home gardeners and farmers for producing food for human or animal feed use must be limed to a pH of 6.5 or above. However, nurserymen and landscape contractors can purchase unlimed compost because of the diversity of non-food crops they grow. They may also purchase off-spec compost for field production use only.

STORING COMPOST

Since the physical and chemical properties of compost improves with age, it is often recommended that compost be stored. Storage improves the uniformity of particles and increases the availability of plant nutrients. However, it is important that the compost be stored in windrows no greater than 2 meters (6.5 ft) high, 4 meters (13 ft) wide at the base, in a well drained area. To maintain quality, the compost should never be allowed to go anaerobic and the pile should be covered to protect from wind-blown weed seeds and/or rains.

COMPOST QUALITY

The most common fear in using sewage sludge compost is the presence of heavy metals. EPA maintains strict guidelines regarding acceptable metal levels for sewage sludges and it tests regularly to assure that standards are maintained. However, it is important to understand that most of the heavy metals contained in compost are essential to the growth and development of plants. The only exceptions to these are cadmium (Cd) and lead (Pb). Organic chemicals such as PCB's (polychlorinated biphenyls) are decomposed during the composting process.

Compost quality is highly dependent on good management of the composting system and on the kind of organics being composted. One should never use compost from a newly-opened composting unit for formulating potting mixes or for propagating, but it can be used safely for improving soils. It generally takes from 6 months to a year for a new composting unit to stabilize and continually produce quality compost suitable for use in formulating potting mixes and for propagation. Also, any alteration to composting

procedures or raw materials influences compost quality and consistency.

The quality of the compost will determine its uses. For propagation and for use in formulating potting media, compost particle size should not exceed 1.25 cm (1/2 in.). Large particles of undecomposed organic matter will cause competition between plant roots and microorganisms for available nitrogen.

Screening is the only effective means of removing large particles from finished compost. Finished compost should never be hammermilled to reduce particle size. Milling will expose cellulose fibers which will re-activate the composting process.

Depending on the raw materials and age of compost, most compost made from yard waste and sewage sludge will have a nitrogen level from 0.7 to 2%, a P_2O_5 level of 1 to 3%, and a K_2O level of 0.2 to 1.8%. The mineralization rate of nitrogen from most compost will be between 8% and 10%, depending on age. The mineralization rate determines the amount of nitrogen available at any time soil temperatures are near 21 °C (72 °F). Compost in cool soils will have a slower mineralization rate than compost in warm soils.

COMPOST IN SEEDLING PRODUCTION

Compost made from woodchips and sewage sludge has been demonstrated to be an effective soil amendment in seedbed preparation for the production of deciduous trees and shrubs. When applied at the rate of 112 dry T/ha (50 T/A) and incorporated just prior to fall seeding, it produced taller seedlings of: dogwood (*Cornus florida*), tulip tree (*Liriodendron tulipifera*), black walnut (*Juglans nigra*), red oak (*Quercus rubra*), black locust (*Robinia pseudoacacia*), and autumn olive (*Elaeagnus umbellata*) than similar plants grown with and without the use of chemical fertilizers. In the production of dogwood seedlings from freshly harvested uncleaned seeds, more seedlings were harvested from compost amended soil than from soils without compost. Also, tulip trees grown in compost-amended soils suffered little to no winter injury while 50% or more of top growth of seedlings grown in soils without compost died-back. Levels of compost in excess of 112 T/ha generally resulted in reduced seedling population without any substantial increase in top growth. None of the seedbeds amended with compost were fertilized.

A single application of composted sewage sludge at 112 dry T/ha is capable of supplying all of the nutrient needs for the production of 1-0 seedlings. Although residual nutrients remain in the soil after having grown one crop of seedlings, there was not sufficient N and K in the original amended seedbeds to produce an acceptable crop

of red maple (*Acer rubrum*) seedlings without supplemental applications of chemical fertilizers.

The use of composted sewage sludge at 112 T/ha in the fall preparation of seedbeds for white pine (*Pinus strobus*) and Norway spruce (*Picea abies*) resulted in reduced seedling population. However, applying the same amount of compost as a winter mulch over 1-0 seedlings resulted in an increase in top growth similar to applying chemical fertilizer and milled pine bark mulch at the same time (unpublished data).

COMPOST IN THE ROOTING OF CUTTINGS

Compost in combination with 75% perlite and 15% peat moss (v/v/v) has been used in the rooting of poinsettia (*Euphorbia pulcherrima*), evergreen euonymus (*Euonymus kiautschovica*), Japanese holly (*Ilex crenata* 'Helleri'), French hydrangea (*Hydrangea macrophylla*), and glossy abelia (*Abelia* × *grandiflora*) (unpublished data). The addition of compost to the rooting medium resulted in the development of larger rootballs and greater top growth, especially if transplanting of rooted cuttings was delayed a month or more after cuttings had rooted. Cuttings propagated in perlite or perlite and peat moss generally appeared chlorotic and initiation of top growth was delayed when rooted cuttings were neglected for the same period of time.

CONCLUSION

Not all composts are alike and each must be tested under production conditions in each nursery before it can become an accepted medium in the propagation of seedlings or the rooting of cuttings. The use of compost offers many benefits and it is a renewable resource. In addition to providing organic matter, compost can supply nearly all of the essential trace elements as well as a large percentage of the major elements needed by plants in a slowly available form. Therefore, it can reduce dependency on chemical fertilizers and imported organic amendments such as peat moss and pine bark. It makes economically good sense to use compost in the production of environmental plants and for improving our environment by recycling organic solid waste and reducing our dependency on landfills and the problems they create.

ADDITIONAL READING

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DOUG CHAPMAN: Did root development change with the sludge application?

FRANCIS GOUIN: When we counted roots, we found that the number did not change but branching did. There was a larger mass of roots.