PHYSICAL AND CHEMICAL CHARACTERISTICS OF SPENT COMPOST

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Abstract. Physical and chemical characteristics of spent compost were studied to ascertain how it compares with commercial greenhouse growing preparations, and with top soil. Water holding capacity, drainage, aeration, and other characteristics of compost compare favorably with other mixes. Soluble salts, nitrate nitrogen, magnesium, calcium, and certain trace elements were significantly higher in spent compost. The pH of compost from most samples was above 7.5, and its ion exchange capacity was within desirable limits to facilitate satisfactory growth and development.

REVIEW OF LITERATURE

Previous work has addressed the feasibility of using spent compost as a horticultural growing mix (2,3,4,6,7,8) for greenhouse and nursery crops. Data support the viability of spent compost as a growing medium or medium additive for ornamentals that have been evaluated to date.

Indications are that spent compost has definite potential as a horticultural growing mix, particularly when amended with additives such as peat moss, Gro-Lite mixes, and certain organic materials like wood chips, bark, and ground corn cobs. Easter lilies, poinsettias, chrysanthemums, and several types of bedding plants have been successfully grown in compost alone and in combination with certain additives (2,3,4,6,7,8).

The high salt level seems to be the greatest limiting factor in using spent compost as a growing mix. Other attributes, such as water holding capacity, drainage, and aeration compare favorably with commercial mixes. However, certain nutrient elements are sometimes present at toxic levels. Nitrate nitrogen, magnesium, calcium, and potassium are often excessively high among the major elements. Iron, boron, manganese, and molybdenum are highest among the trace elements. Comparisons are listed in Table 1.

The salt content is naturally reduced to tolerable levels by leaching, when exposed to the elements for two to three years. The high nitrogen and magnesium content, governed in part by the amounts of certain additives in preparation of the compost, are also lowered through leaching.

This study compares physical and chemical characteristics of spent compost with Pro-mix Bx, peat moss, and top soil because of their wide use in the industry. Thus, favorable comparisons with these media would strengthen the potential for compatibility of compost with numerous commercial crops.

Table 1. Nutrient analysis of spent compost after aging for 2 to 3 years.

Element	Concentration (ppm)
Nitrate nitrogen	462.00
Ammonium nitrogen	6.58
Phosphorus	7.76
Potassium	236.00
Calcium	940.00
Magnesium	147.00
Boron	0.590
Copper	0.117
Manganese	0.147
Molybdenum	0.104
Iron	0.246
Zinc	0.056
pH	7.80
Soluble salts (mmhos)	5.04

MATERIALS AND METHODS

Samples of spent compost were obtained from Pennsylvania mushroom growers. Typical materials, although not an industry standard, used to prepare compost for mushroom production are illustrated in Table 2. The samples were prepared for determining water holding capacity, aeration, and drainage according to the methods described by Cheng and Evett (1). Ion-exchange capacity, pH, soluble salts, organic matter, nutrient, and ash content were determined by a commercial soils testing laboratory.

Specifications for physical and chemical characteristics of commercial mixes were obtained from the manufacturers of the products. Samples were then sent to the same commercial laboratory for confirmation. These data are listed in Table 3.

Table 2. Ingredients used in the preparation of compost for mushroom production.

Material	Quantity (lb)
Straw-bedded horse manure	39,375
Hay	25,000
Cottonseed hulls	6,500
Gypsum	4,000
Chicken manure	3,600
Urea	240

RESULTS AND DISCUSSION

The standards of good water holding capacity, drainage, and aeration are apparent in spent compost. In addition, the proportion of organic matter is sufficient to provide satisfactory ion exchange, particularly for greenhouse-grown crops. However, decreased water availability resulting from the high salt content increases osmotic forces and, thereby, can result in injury to certain plants.

Spent compost differs most from other commonly used greenhouse mixes in its soluble salt, pH, and nitrate nitrogen levels, as illustrated in Table 3. Compost also has higher levels of magnesium and calcium, and the trace elements boron, magnesium, and molybdenum. Available water and free space of spent compost, measured at 52.8% and 6.3%, respectively, compare favorably with sandy loam soils, which were measured at 33% and 11%, respectively. Minimum desirable free air space after drainage is 8%, according to Mastalerz (5). Drainage in compost alone is noticeably slower than in commercial mixes, however, when two parts of peat (by volume) is added it drains comparably to all mixes with which it was compared.

Table 3. Comparisons of chemical characteristics among spent compost, peat, top soil, and Pro-mix Bx. (All nutrient values are in parts per million).

	Compost	Peat	Soil	Pro-Mix	Normal Range
pH	7.8	3.9	6.6	7.00	5.2 – 6.5
Nitrate nitrogen	462.0	Trace	55.0	22.9	35.0 –180.0
Ammonium nitrogen	6.6	Trace	4.0	8.8	0.0 – 20.0
Phosphorus	7.8	55.0	15.0	11.9	5.0 – 50.0
Potassium	236.0	275.0	45.0	12.8	35.0 –300.0
Soluble Salts[1]	5.0	0.7	1.3	0.5	0.75– 3.5

[1]Salt concentration is measured in millimoles.

Conductivity of compost samples measured between 3.45 and 5.04 mmhos. The acceptable range is 0.74 to 3.5, with most crops having desirable growth responses at or near 1.25 mmhos.

The variations in soluble salts, pH, and nutrients in spent compost obtained from different sources are high because of both content and methods of preparation. Similar differences are common in different batches of compost obtained from the same source. Horse manure, along with added gypsum, hay, and urea have the greatest effects on subsequent nutrient quality of the compost.

In previous growing comparisons with greenhouse crops there were no deleterious effects on Easter lilies, poinsettias, petunias, and chrysanthemums, although there was a growth retarding effect in lilies and chrysanthemums. Thus, the salt effects are apparently a species/cultivar specific effect.

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RESPONSE OF WOODY PLANT MICROCUTTINGS TO IN VITRO AND EX VITRO ROOTING METHODS

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Abstract. Direct, side by side, comparison of *ex vitro* and *in vitro* produced roots on woody plant microcuttings reveals several important differences likely to influence the qualities that control survival of micropropagated nursery stock. In preliminary observations, *ex vitro* root systems are well-branched with normal root hair development, whereas roots initiated *in vitro* lack secondary roots and have a comparatively sparse development of root hairs. The *in vitro* roots tend to have extremely enlarged cortical cells (a false secondary thickening) and poor vascular connections. *Ex vitro* produced roots are more slender and have greater tensile strength. This research project will follow the fate of roots initiated *in* or *ex vitro* through acclimation, greenhouse growth, and in field environments, to determine if the root differences established by either root initiation method early in production continue to influence the root morphology and growth of the ultimate landscape plant.

INTRODUCTION

Micropropagation has recently become an important technique for insuring rapid, uniform delivery of new plant selections to the nursery industry. The speed by which plants can be multiplied and the reliability of the clonal nature of the plants produced is unsurpassed when compared to conventional propagation methods (3). The usual time, space, and materials restrictions on production are eliminated, and very quick release of new clonal propagules is now possible. Many woody plants are responsive to microculture propagation, although they may be recalcitrant to other clonal propagation methods (5).

Even though micropropagation is an accepted technique, there are surprisingly few standards within the industry on production methods. For example, the formulation of propagation media is determined empirically on a producer by producer basis. A wide