Organic Wastes as Growing Media

Calvin Chong, R.A. Cline and **D.L. Rinker**
Ministry of Agriculture and Food, Horticultural Research Institute of Ontario, Vineland Station Ontario Canada L0R 2E0

The composting and reutilization of organic (biological) wastes have become a major part of the waste management cycle. In North America, this trend has accelerated in recent years as the cost of disposing of these waste by-products skyrocketed and suitable landfill sites became scarce.

The Ornamental Nursery Research Programme at the Horticultural Research Institute of Ontario (HRIO) has been evaluating the use of various organic waste by-products as growing medium ingredients or as substitutes for traditional organic products such as peat and bark. This paper highlights some of our recent investigations in this area of nursery culture.

MUSHROOM COMPOST

The mushroom industry generates large amounts of organic waste material The U.S. discards annually an estimated one billion tons of spent mushroom compost; Canada discards one quarter as much

The exploitation of this waste product as an amendment for large-scale crop production has been very limited. Researchers have suggested its potential for use in crop culture (Chong et al., 1987; Dallon, 1987; Wuest, 1991), but information on its use has been limited or not well defined, species response has been variable The high salt content of spent composts, which can be toxic to plants, appears to be largely responsible for concern about its use as a soil amendment or in potting mixes.

Studies at this institute showed that many ornamental shrub species grew well in containers amended with between 25 and 100% of spent mushroom compost (Chong et al., 1987, Chong et al, 1991, Chong et al., 1991). Species included cotoneaster, deutzia, dogwood, forsythia, juniper, ninebark, potentilla, rose, and weigela. The results also demonstrated little difference among media with freshly spent (high salt level), leached (low salt level), or aged (intermediate salt level) composts. Although growth of some species was moderately reduced or was not affected, most species grew more as the proportion of compost was increased in the media

Under our experimental conditions using trickle-irrigated containers, success in growing ornamental nursery crops with spent mushroom compost media was related to rapid and early leaching of high salts from the media (Fig. 1) Although our experiments included treatments with up to 100% compost, under normal cultural conditions no more than two thirds by volume is recommended due to shrinkage of the compost.

Use of mushroom compost should always be accompanied by appropriate soil tests for salts because of the potential for plant damage due to high salts In our experiments, high pH (up to 8.2, 1:2 soil: water extract), found initially in many of the compost formulations, had no detrimental effect on plant growth.

Recent research by Wuest (1991) has confirmed beneficial influence of spent mushroom compost with field crops

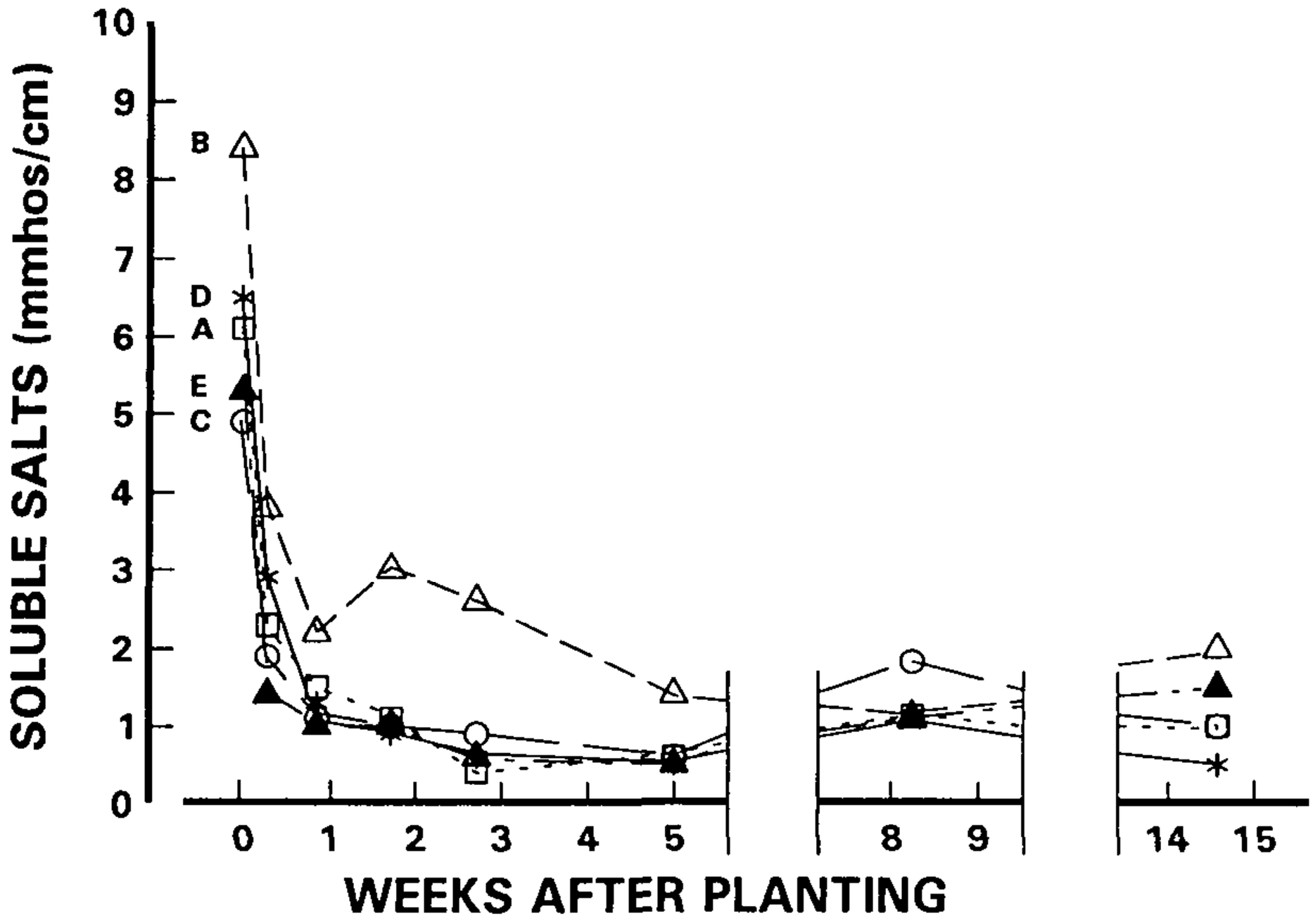

Figure 1. Initial elevated salt levels in spent mushroom compost (100%) media from five farms (A to E) are quickly leached from trickle-irrigated nursery containers

PAPERMILL SLUDGE

The paper manufacturing industry accumulates large quantities of organic wood waste products, often referred to as sludge There are three types of sludges. Primary sludge is derived directly from virgin wood and contains a great proportion of wood fibers. Secondary sludge is derived from primary sludge subjected to microbial decomposition with the addition of nitrogen and phosphorus. De-inked sludge is recycled from existing newsprint. Ontario produces annually about three quarter of a million tons of papermill sludge wastes.

Papermill sludge produced in Ontario is free of undesirable organic chemicals, and is low in heavy metals. The high fibrous matter makes it ideally suitable for improving the physical properties of growing mixes. Secondary sludge is a good source of plant nutrients such as nitrogen and phosphorus

Tests in conjunction with the Soil Management Research Program at this institute indicated that raw papermill sludge can be used as a soil conditioner and fertilizer for field-grown agricultural crops such as corn and grapes. Other studies indicated that papermill sludge mixed with soil can be effective for growing a variety of greenhouse crops, such as tomatoes, cucumbers and peppers (Cline and Chong, 1991). Growth of these crops was directly related to the amount of nitrogen present in the raw sludge. Related investigations in the Ornamental Nursery Research Program showed similar results when various nursery crops, including cotoneaster, dogwood, forsythia, spiraea, and weigela, were grown in container culture (Chong et al, 1987; Chong et al, 1988; Cline and Chong, 1991) As indicated

with spirea (Fig 2), media with more than one-third by volume of raw papermill sludge depressed growth. This result may be due to the combined influence of increasing unavailability of nitrogen and increasing compaction of the media as the proportion of sludge increases in the media.

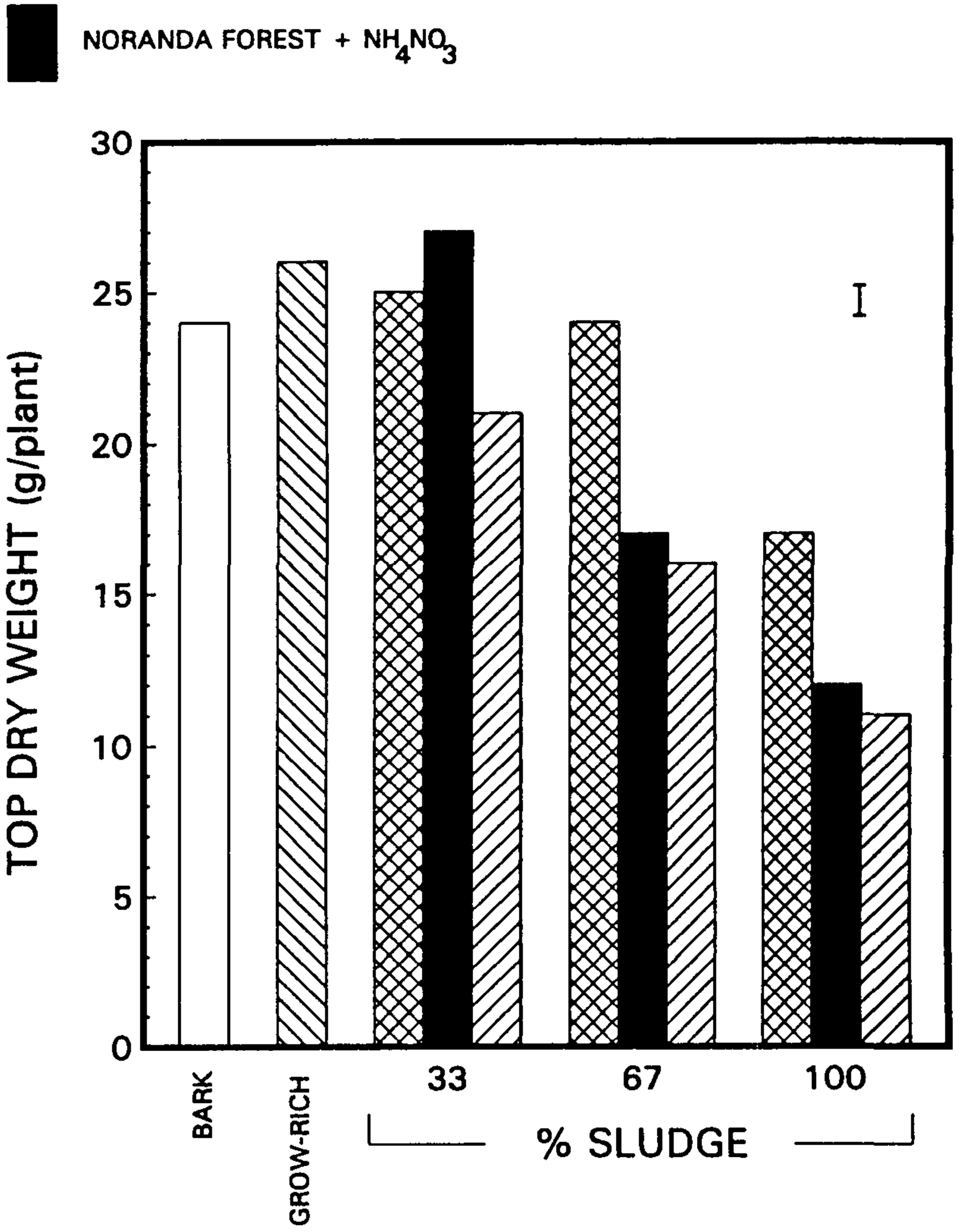

Figure 2. Top dry weight of spirea grown in #2 nursery containers with 100% bark (control medium), Grow-Rich, a brand-name medium made primarily from papermill sludge; and bark mixed with 33, 67 or 100% of two sources of raw papermill sludge, Quebec & Ontario and Noranda Forest (with or without 2 g ammonium nitrate per container) Vertical bar indicates LSD at 5% level of probability

The Grow-Rich medium (Fig 2) is produced by composting papermill sludge and other waste organic materials by Grow-Rich Inc., Niagara Falls, Ontario. At present, of over 270 large composting operations in the U.S., only four use papermill waste Grow-Rich is the only similar operation in Canada.

MUNICIPAL WASTE

Composted municipal residential waste offers another possibility for use in growing mixes. Several years ago, a demonstration project was initiated by the Ontario Ministry of the Environment (MOE), Ontario Centre for Resource Recovery, Downsview, to process and compost residential waste, with a view to marketing the end products as field or garden soil conditioners.

The recycling-composting process included multiple screenings, shredding, and separation by air and magnetic processes This resulted in a clean, easy-to-handle product. However, it contained small amounts of plastic and related synthetic materials, which made it visually unattractive.

A trial conducted at HRIO showed that when this composted waste was added to the container mix, growth of the ornamental species ninebark increased progressively with increasing amounts of the product (Table 1).

Regardless of medium, there were no apparent symptoms due to specific nutrient toxicity or deficiency. Leaf analysis from mid-July samples indicated small but significant increases in leaf nitrogen in plants grown with between 0 and 67% compost waste treatment (Table 1)

Relative compaction in each mix showed that only the 100% composted waste treatment subsided noticeably by the end of the season (Table 1).

Table 1. Effects of varying proportions of recycled composted municipal waste on top dry weight and leaf nitrogen content of ninebark and on medium compaction

	Composted municipal waste (%)				
	0	33	67	100	SE[z]
Top dry wt (g/plant)	97	116	127	133	7
Leaf nitrogen (%)	2 60	2 82	2 97	2 61	0 10
Medium compaction (cm)[y]	2 0	1 8	1 7	3 0	0.3

[z]Standard error of the mean

[y]Depth from container rim at the end of the growing season

CONCLUSION

Since the start of this research six years ago, there have been numerous enquiries as more and more nurseries consider organic wastes in their growing media. Various companies have been marketing or have been making preparations to produce more waste-amended growing media in commercial quantities for the nursery/landscape industry.

With increasing demand for container-grown ornamental plants, there will be an increased need for growing media Organic waste by-products such as the ones described in this paper will help meet this need and have positive environmental effects as well.

LITERATURE CITED

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PETER ORUM: A comment on the use of mushroom compost There is no doubt that we will be using these waste products in the future. We have used mushroom compost for 25 years in our mix. Before you use it, buy a good EC meter and test your mix. If you don't you may "burn" your plants up You must get your soluble salts down first or you could kill the roots on bare rooted plants before the level is leached down.

DAVE THOMPSON We use a wetting agent to aid leaching. We determined that it was not economical to use in our liner stage but larger sizes it was

SATURDAY AFTERNOON 7 DECEMBER 1991

The afternoon session was convened at 1.45 p.m. with Steven Verkade serving as Moderator.