Miscanthus Straw Compost as Growth Medium for Pot Plants

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INTRODUCTION

Peat is the dominant growth medium used in ornamental potted plant production. However, in many areas of the world, including Denmark (Aaby, 1996), exploitation of peat bogs is restricted. Composts made from household or garden wastes may be attractive alternatives to peat. Such composts are, however, not uniform from time to time and may contain undesirable levels of salts, nutrients, and heavy metals (Grantzau, 1997). Therefore, commercial growers of pot plants are reluctant to use compost based on municipal waste or biowaste as growth medium.

In order to obtain a uniform, stable, and well defined final compost, *Miscanthus* straw was used as raw material in combination with different nitrogen sources. The purpose of this composting was to obtain defined products. These products were subsequently compared to peat-based growth media for potted plant production.

COMPOSTING OF *MISCANTHUS* STRAW

Shredded straw of *Miscanthus* x*ogiformis* Honda 'Giganteus' was composted with ammonium sulphate, urea, or pig slurry as nitrogen source or tap water as control. The ratio between carbon and nitrogen, C/N (w/w) was 27 with ammonium sulphate, 27 with urea, 19 with pig slurry, and 96 with tap water. The C/N ratios range of 19 to 27 used in this experiment were close to the optimum, 30, for poplar wood plus urea (Rao et al., 1995) and 22 for urban refuse plus urea (Nakasaki et al., 1992).

Within 2 days of composting peak temperatures rose to 65°C for pig slurry and within 3 days to 59°C for ammonium sulphate, 41°C for urea, and 59°C for tap water. These heat developments are similar to results obtained in a pile of cattle manure (Cáceres et al., 1998). The higher temperature increase and faster heat development in compost based on pig slurry compared to other N sources are probably due to the higher content of both nutrients and microorganisms in pig slurry.

At the end of the composting period volumetric water content, at a suction of 10-cm water, was 60% and 32% for composts with pig slurry and ammonium sulphate, respectively, compared to 80% for the fully fertilized peat. Pig slurry resulted in high electrical conductivity and high concentrations of K, P, Mn, Na, Cl, Cu, and Zn. In composted *Miscanthus,* Grantzau (1999) found high pH values and high nutrient contents, especially of potassium. This corresponds well with results of the present experiment.

PLANT GROWTH EXPERIMENTS

After 5 months the four *Miscanthus* composts were compared with unfertilized or fertilized peat as growth media for *Hedera helix* 'Mein Hertz' and *Fatsia japonica*. Unrooted cuttings of *Hedera* and seedlings of *Fatsia* were grown in 9-cm pots according to a standard growing program using ebb-and-flood fertigation under greenhouse conditions.

After 12 weeks, shoot lengths of *Hedera* were similar in fully fertilized peat and *Miscanthus* composts with urea or pig slurry (13.5 to 16.0 cm). Shoots were shorter from unfertilized peat and *Miscanthus* compost with water (8.3 to 8.5 cm) and from *Miscanthus* compost with ammonium sulphate (5.5 cm). Plant dry weight of *Hedera* was highest for fully fertilized peat (1.4 g), lower for composts with urea or pig slurry (0.9 to 1.0 g), and still lower for unfertilized peat and composts with ammonium sulphate or water (0.5 to 0.6 g). In *Fatsia* the dry weight was highest for fertilized peat (1.8 g). Unfertilized peat and ammonium sulphate or urea composts gave similar results (1.2 g), while pig slurry and water composts resulted in the lowest dry weights (0.8 g and 0.5 g).

The two plant species responded differently with respect to plant growth in different composts. *Hedera* dry matter production was higher in composts with urea or pig slurry than with ammonium sulphate or water-based composts. *Fatsia* dry matter production was higher in ammonium sulphate or urea-based composts than in composts based on pig slurry or water. The different response of the two plant species may be due to a greater susceptibility of *Fatsia* to excess levels of nutrients especially in compost based on pig slurry. The fact that *Fatsia* had roots at transplanting enabling a quicker root establishment in the growth medium than the unrooted cuttings of *Hedera* might also have influenced plant growth. This may have been advantageous for *Fatsia*, especially in ammonium-sulphate compost with low volumetric water retention.

CONCLUSION

Our results demonstrate that shredded straw of *Miscanthus* plus a N source giving a C/N ratio of 20 to 30 comprises a well defined starting material for composting. By testing the growth of *H. helix* and *F. japonica* it was shown that *Miscanthus* compost is a suitable substitute for peat as growth medium for pot plants. Pig slurry as the N source may be better than the other N sources tested due to a better water retention in the 5-months-old compost. Problems caused by supraoptimal concentrations of nutrients when using pig slurry, as in this experiment, are easily solved by dilution with water. Future experiments will define the degree of dilution giving the best results with respect to plant growth.

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Addition of Beneficial Microorganisms to Growth Media: An Overview

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Addition of beneficial microbiological products, also called "biopesticides", and other beneficials to growth media has become increasingly explored during the last 10 to 15 years. This is due, in part, to increasing pest and pathogen resistance to chemical products and due to banning of many environmentally harmful pesticides.

INTRODUCTION

Until 1995 there were no legal prohibitions in European Union (EU) against adding microbiological products against pests and pathogens to growth media. In 1995 registration rules for microbiological products where established in EU. Products that had been sold prior to 1993 where allowed to continue if they could pass national registration rules but new microbiological products introduced after 1993 have to pass new tough EU rules. This meant that many "new" products used between 1993 and 1995, especially against pests, suddenly had to be taken off the market in Denmark.

The microbiological product Supresivit (*Trichoderma harzianum*) is one of the products that was in use before 1993. Borregaard BioPlant registered this product nationally in 1995 and in accordance with the new rules (new products with similar active organisms do not need to be registered) this has opened up the market for many other *Trichoderma*-based products on the Danish market.

The tendency in plant production for many years has been to develop as sterile a growth medium as possible. A negative consequence of this has been the difficulty controlling pest and pathogen outbreaks. The natural microbiological balance that exists in nonsterile media almost always helps to suppress such outbreaks to a certain degree. So because of these factors it is highly relevant to consider active incorporation of beneficial organisms in to growth media. For this purpose there are products consisting of: (A) beneficial arthropods, nematodes, etc.; (B) beneficial bacteria; and (C) beneficial fungi. Against pathogens there are commercial products available from the two last groups and against insect pests there exists products from all three groups.