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River waste as a potentially amendment for a low quality *Sphagnum* peat

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Summary

The objective of this research was to determine the suitability of river waste as an amendment for low quality peat in container growth media. Physical and chemical properties of the river waste and Argentinean peat were determined, and the ability of the media to support *Gypsophila muralis* plant growth was evaluated. Once river waste was added to the Argentinean peat, total porosity and dry weight increased. The best combination of different amounts of the components was also determined.

Key words. bedding plant – *Gypsophila muralis* – peat – river waste.

Introduction

In a previous report, Di Benedetto et al. (2006) have indicated that Argentinean peat doesn't seem to be an acceptable substitute for *Sphagnum* Canadian peat, because the lower dry matter production of the plant which could reduce bedding grower productivity. By the other hand, the increasing cost of high quality peat for horticultural use (Meerow 1994) and the declining availability of high quality peat in the near future due to environmental constraints (Robertson 1993; Frolking et al. 2001; Schilstra 2001) need a solution; the presence of wetland ecosystems in the south of Argentina (15,3 x 10^5 t of *Carex* and *Sphagnum* peat) offer an opportunity if an adequate management for this material is achieved.

River waste or 'temperate peat' is the result of the accumulation of plants residues under an anaerobic environment which is dredged from river or lake banks. The sedimentary organic matter is derived from the delta plain vegetation and is highly dominated by phytoplasts (plant debris). This large input of leaves and petioles into subaquatic sediments originated from soft-plant tissues are preserved chemically and structurally under an environment where the organic matter is in excess concentration compared with the oxidants utilized by microorganisms. The result is a fine-grained, black, oozy sediment deposited in the bottom of the coasts. For some time, it was used as a locally available material for preparing soilless growing media for containerised crop production. Only during the past few years has this material become commercially popular, and it is now being successfully sound Canadian peat substitute for perennial pot plants (Di Benedetto et al. 2004), but availability as a low quality peat media amendment was not yet investigated.

Materials and Methods

Gypsophila muralis 'Garden Bride' was chosen for this study based on its sensibility to different growing media (unpublished data). Seeds were germinated and grown in 288 plastic plug trays. A Fafard Growing Mix® (Canadian *Sphagnum* peat moss-perlite-vermiculite 70:20:10 v/v) as a growing media was used. When the fourth true leaf was developed, 20 plants were transplanted into 1,000 cm^3 pots containing the ten different substrates performed with an inverse proportion of river waste and Argentinean *Sphagnum* peat tested.

A weekly fertilization of 100 ppm N (1 N:0.5 P:1 K:0.5 Ca v/v) from transplant to sale stages were used. All nitrogen was as nitrates and a fertilization volume of 100 ml pot^{-1} was applied. Plants were irrigated with a high quality tap water (pH: 6.64 and electrical conductivity of 0.486 dS m^{-1}).

Samples of each medium were collected at transplant stage and at the end of the experiments, and porosity was determined according to the methodology and equations suggested by Fonteno (1996) and previously described (Di Benedetto and Klasman 2004).

River waste was collected from the coasts of the Paraná river (Argentine)(Organic Matter: 69.92 %; pH: 5.15; Electric Conductivity: 2.02 dS m^{-1}; Total Porosity: 95.64 %; Air-filled Porosity: 32.81 %; Bulk Density: 0.55 g cm^{-3}) while a *Sphagnum* peat from an Argentinean peatland (Organic Matter: 94.24 %; pH: 4.81; Electric Conductivity: 0.21 dS m^{-1}; Total Porosity: 55.23 %; Air-filled Porosity: 20.05 %; Bulk Density: 0.18 g cm^{-3}) was used.

The experiment was developed at greenhouse facilities from Buenos Aires University campus, Argentina (34 °28 'S) and it was repeated twice. Data were subjected to a one way ANOVA for a completely randomised de-

Table 1. Porosity changes from growing media tested between the beginning and the end of the experiments. Data are ten replicates mean.

River waste (%)	Initial porosity (%)	End porosity (%)
0	55.23 Ac	36.25 Bc
10	57.34 Ac	37.88 Bc
20	49.38 Ac	35.19 Bc
30	50.01 Ac	39.76 Bc
40	53.67 Ac	42.00 Bc
50	59.86 Ac	54.26 Bb
60	65.61 Ab	57.76 Bb
70	73.35 Ab	59.75 Bb
80	90.65 Aa	61.01 Bb
90	92.72 Aa	65.05 Ba
100	95.64 Aa	72.00 Ba

Substrates were performed with an inverse proportion of river waste and Argentinean *Sphagnum* peat. Different capital letters indicate statistically differences (P≤0.05) between initial and end sample harvest while different lower case letters indicate statistically differences (P≤0.05) between river waste percentages in the media.

sign analysis and means were separated by the Tukey test (P≤0.05).

Results and Discussion

There were significant total porosity changes related to the percentages of river waste and Argentinean peat in the mix and a decrease between the beginning and the end of the experiments (Table 1). When materials of different particle size are mixed, fine particles fill the pores between the large particles, resulting in reduction of the final volume of the mixture in relation to the original volume of the separate materials (shrinkage). Thus, the total porosity of the medium is decreased (Bures et al. 1993). However, the use of river waste increased total porosity and enhanced stability of Argentinean peat when it participles up the 60 % of the mix (Table 1). Although an increasing proportion of river waste in the substrate also would be able to change its chemical properties, this is not the case for river waste and Argentinean peat mixed media (data not shown).

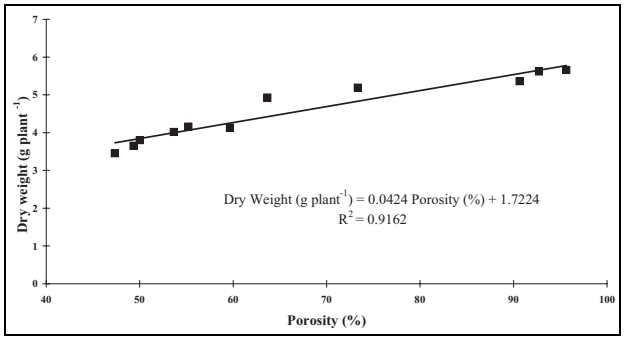


Fig. 1. Total dry weight related to total porosity for substrates performed with an inverse proportion of river waste and Argentinean *Sphagnum* peat. Each point is the mean of twenty replicates.

Developing peat alternative substrates is necessary because the pressure for using locally available alternatives increases rapidly and the economic necessity of reducing costs. The biostability of these materials varies and has consequences on the physical and chemical properties of substrates, their management and the growth of ornamental plants.

The marketability of potted plants is greatly influenced by the quality of the plant produced. *Gypsophila muralis* dry weight as related to initial porosity showed a high correlation coefficient (R^2 = 0.916); higher values were achieved when high percentages of river waste was included in the growing media (Fig. 1). The materials tested here showed that it is possible to grow high quality plants with a good stability in physical and chemical properties during cultivation through an adequate balance between biostability and culture period.

As peat cost has risen in response to increased demand as the nursery trade has grown, it represents a considerable portion of Argentinean nurseries costs which included locally available peat. The possibility to combining its low-quality peat (Di Benedetto et al. 2006) with another natural resource such as river waste let to obtain a high quality growing media for ornamental plant growth and with high export perspectives, too.

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