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BEHAVIOUR OF YOUNG TREES CULTIVATED ON PEATS WITH DIFFERENT DEGREES OF DECOMPOSITION

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SUMMARY

In Italy, the production of tree seedlings from cuttings is achieved by rooting into media that may contain mixtures of peats and other substrates. Often water of high salinity status may be used to irrigate rooted cuttings during the early growth phase prior to potting on.

The aim of this experiment was to investigate the effects of peats of different degrees of decomposition, on growth of two tree species: *Fraxinus ornus* (ash) and *Ulmus pumila* (elm), irrigated with water containing different amounts of salts.

Trials were carried out using two peats: a less decomposed peat of Northern European origin (H2-H3) in comparison with a more decomposed peat originating from the Republic of Ireland (H4-H5). These media, were used pure or in mixture (25/75, 50/50 and 75/25 v/v). Species and substrates were irrigated with tap water (0,3 mS/m) and tap water with NaCl (3 mS/m). Data on most important morphological and quality parameters of plant growth were collected at the end of the experiments.

Differences in plant quality became evident during the trial period of six months. As the proportion of humified peat increased in mixtures, plant quality improved with both species, particularly in terms of leaf colour. This difference was evident in both low salinity and high salinity irrigation regimes.

KEYWORDS: buffering capacity, salts, electrical conductivity, sapling growth, peat quality

INTRODUCTION

Climate and saline conditions of irrigation water in Mediterranean countries can pose problems for growers of container, pot, bedding plants and particularly of seedlings. Growing media must be sufficiently robust to enable good germination and early plant growth.

The advantageous properties of strongly humified (H4-H5) peats for growth of container plants have been described by several authors (Aendekerk 1997, 2001; Niemenen and Reinikainen, 2011). The degree of decomposition/humification of peat has a great influence on the physical and chemical properties of substrates such as total porosity, air and water ratio, bulk density, shrinkage, electrical conductivity, buffering capacity and humic acids. The merits of moderately decomposed peats have been outlined by Prasad and Maher (2008) in their studies on the use of these peats with younger, less decomposed peats.

This study looks at the growth of young rooted saplings or 'whips' of two tree species characterised by different speeds of growth, *Fraxinus ornus* (ash) and *Ulmus pumila*, (elm), in mixtures of strongly humified and less humified peats irrigated with water containing different amounts of salts. Experimental studies were undertaken in the north east of Italy from April 2009 until March 2010.

MATERIALS AND METHODS

2.1. Peats

Two peats were used in the studies: a lightly decomposed peat defined as H2-H3 (Von Post and Granlund, 1926) from Scandinavia (20-40mm fraction: bulk density 96.1 g.L) and a more humified H4-H5 (10-25mm fraction: bulk density 244.5 g.L) peat from the Republic of Ireland.

Peats were brought to the same humidity and blended in proportions of 25:75; 50:50; 75:25 (vol:vol) as well as 100% for both peats: a total of five treatments. Mixtures were prepared after the determination of laboratory bulk density carried out following the EN 13040 method. Each mixture was limed (4 kg/m^3), fertilised with PG Mix (14-16-18 + t.e.) at 2 kg/m^3 plus a coated slow release fertiliser ('Actiwin') at 3 kg/m^3 with wetting agent (Fiba-Zorb Plus) added at 70 ml/m^3. A sixth treatment, a standard nursery substrate, was used in addition to the experimental mixes.

2.2 Experimental design

Thirty pots ('Issapotts® of 11cm diameter and 1L capacity) were used for each of the six treatments in four blocks, where treatments were fully randomised. Two salinity values were used: substrates were irrigated direct from the water supply on the nursery (EC 0,3 mS/m) and the same water supplemented with NaCl to reach an EC of 3 mS/m. Four replicates of each salinity/growing medium combination were established in each block. Blocks were surrounded by a double layer of pots with tree 'whips' in the standard substrate. The experimental treatments including the standard substrate contained in total 1440 pots.

2.3 Experimental maintenance and recording

The experiment was established outdoors at the Forestry research nursery at the end of April 2009, monitored and evaluated at monthly intervals, and terminated at the beginning of March of 2010. During 2009 from June to November, ten applications of nursery water/saline water were made to appropriate pots.

After 40 weeks measurements of height and stem base diameter were carried out, as were fresh and dry weights of stems, and root fresh weight after washing and separation. Statistical analyses were carried out using the Student-Newman-Keuls test (p=0.05). A photographic record of plant appearance was made prior to determination of fresh and dry weight.

RESULTS

In terms of numerical data, few significant differences between treatments were observed in this extensive trial. Tables 1 and 2 give summary details of results for the two species. With few exceptions, both tree species grew to almost the same extent irrespective of salt concentration, peat type or combinations of peat types. With ash, (Table 1) a highly significant difference was seen in the 75% H4-H5 + 25% H2-H3 mixture where basal stem diameter, plant height and stem fresh weights were much greater than in all other treatments. In the case of elm (Table 2), some significant differences in stem diameter were evident, with plants raised in 75% H4/H5 + 25% H2-H3 and 50% H4-H5 + 50% H2-H3 having greater basal diameters, and pure H2-H3 peat giving significantly thinner stems compared to other treatments.

During removal of plants from the experimental area and grouping prior to measurement and determination of stem and root data, it became clear that plants raised in H4-H5 peat and higher concentrations of this peat were much greener in colour than those raised in higher concentrations of H2-H3 peat. These differences were evident for both species. Time and dry weight determinations precluded leaf collection for chlorophyll analysis but plants were photographed and the colouration is evident in Plates 1 and 2.

DISCUSSION

Clearly in these studies, irrigation with water of relatively high conductivity (3 mS/m) scarcely affected plant growth. The semi-hardwood nature of the tree ‘whips’ may render them less sensitive than for example, seedlings, to effects of saline water: however, another recent study (Carlile and Cattivello, 2012) showed that growth of a range of seedlings in both H2-H3 and H4-H5 peats and mixtures of these was little affected by irrigation with water of 3 mS/m.

These earlier studies also showed that faster germination and better seedling growth was observed in mixtures rich in H4-H5 peat, with seedlings having a much greener appearance in these peats. The physiological mechanisms that contribute to the ‘greening’ of plants in substrates rich in H4-H5 rather than H2-H3 peats are not clear, and may be worthy of further investigation.

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Table 1. Summary data for basal diameters, stem heights, stem fresh and dry weights of ash (*Fraxinus ornus*) raised in H4-H5 and H2-H3 peats alone and in mixture.

Peats	Basal diameter		Height stem		Stem fresh		Root fresh	
	cm		cm		weight (g)		weight (g)	
H4/H5 Peat 100% v/v	0.56	b	25.2	b	12.1	b	26.4	a
H4/H5 Peat 75% v/v	0.65	a	30.6	a	18.3	a	40.5	a
H4/H5 Peat 50% v/v	0.56	b	23.3	b	12.5	b	30.6	a
H4/H5 Peat 25% v/v	0.59	ab	25.2	b	13.8	b	32.2	a
H2/H3 Peat 100% v/v	0.6	ab	25.6	b	14.7	b	35.4	a
LSD 0,05	0.06		2.84		5.3		13.5	
CV %	9.13		10.68		35.9		40	
Main factors								
Peats		*		***		ns		ns
Salts		ns		ns		ns		ns
Interactions								
Peats x salts		ns		ns		ns		ns

Table 2. Summary data for basal diameters, stem heights, stem fresh and dry weights of elm (*Ulmus pumila*) raised in H4-H5 and H2-H3 peats alone and in mixture.

Peats	Basal diameter		Height stem		Stem fresh		Root fresh	
	cm		cm		weight (g)		weight (g)	
H4/H5 Peat 100% v/v	0.71	ab	67	a	49.7	a	56.8	a
H4/H5 Peat 75% v/v	0.73	a	69.3	a	52.2	a	61	a
H4/H5 Peat 50% v/v	0.73	a	69.8	a	49.4	a	58.6	a
H4/H5 Peat 25% v/v	0.71	ab	68.9	a	49.2	a	57.8	a
H2/H3 Peat 100% v/v	0.69	b	68.1	a	45.9	a	53.7	a
LSD 0,05	0.028		2.14		6.03		7.6	
CV %	3.79		3.04		11.93		12.8	
Main factors								
Peats		*		ns		ns		ns
Salts		ns		ns		*		ns
Interactions								
Peats x salts		ns		ns		ns		ns

Figure 1. Morphology of elm (*Ulmus pumila*) raised in H2-H3 and H4-H5 peats, alone and in mixture. Plants were irrigated with nursery (non-saline) water (EC 0,3 mS/m)

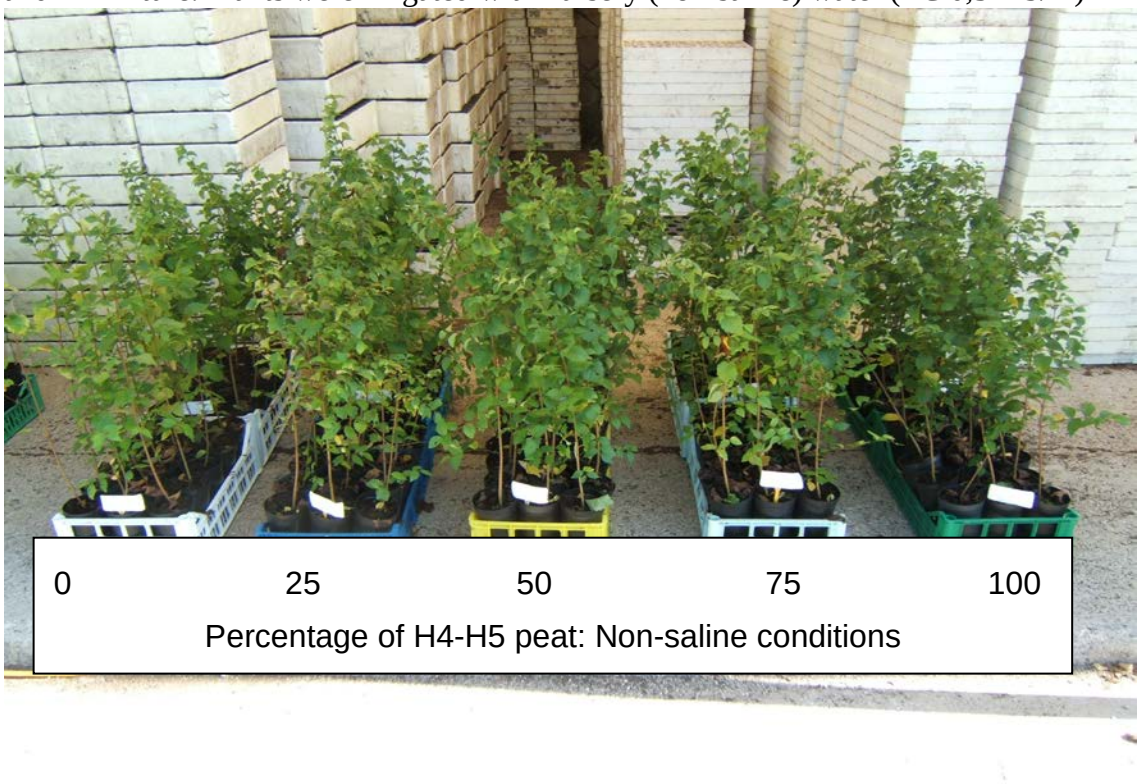

Figure 2. Morphology of elm (*Ulmus pumila*) raised in H2-H3 and H4-H5 peats, alone and in mixture. Plants were irrigated with nursery (non-saline) water (EC 3.0 mS/m)