From Forest Nursery Notes, Summer 2009

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New Forests (2009) 37:295–311
DOI 10.1007/s11056-008-9125-4

Quality of maritime pine (*Pinus pinaster* Ait.) seedlings using waste materials as nursery growing media

Pilar Mañas · Elena Castro · Jorge de las Heras

Received: 21 August 2007 / Accepted: 18 November 2008 / Published online: 12 December 2008

Abstract The use of peat as a growing media in forestry nurseries is decreasing due to high costs and environmental considerations. Furthermore, diverse waste products are being used as organic amendments in certain soils before afforestation. In this study, combinations of both of these resources are considered and seven different materials were used to make mixtures of growing media used for maritime pine tree production in a forestry nursery. Pine bark, *Sphagnum* peat and paper mill sludge were mixed with sewage sludge, sewage activated sludge, municipal solid waste with activated composted sludge and inorganic fertilizer to fill containers where pine seeds were sown. Germination was monitored 30–50 days after sowing. Needle samples from each treatment were taken and physical parameters (height, stem diameter, aerial dry weight, main root dry weight, total dry weight) were measured along with several morphological attributes. Foliar nutrient content was also determined (N, P, K, Ca, Mg, Fe, Cu, Mn and Zn). The highest values for germination percentage were obtained for 75% pine bark + fertilizer and for sewage sludge treatments. Seedlings grown in paper mill sludge + activated sewage sludge + peat and in paper mill sludge + activated sewage sludge + pine bark mixtures presented the best physical parameter values. Municipal solid waste and composted sludge were the most useful amendments for morphological attributes. After linking morphological indexes and foliar nutrient content, the best Dickson Quality Index values correspond with higher values of N, Ca, Mg, Cu and Zn and lower values of P, K, Fe and Mn.

Resumen El uso de turba en viveros forestales como sustrato de cultivo está decreciendo debido a su elevado coste y consideraciones medioambientales. Por otro lado, distintos residuos están siendo utilizados como enmiendas orgánicas sobre ciertos suelos previa reforestación. En este estudio, se considera una combinación de ambos factores y siete diferentes materiales fueron usados para hacer mezclas de sustrato de cultivo para la producción de pino marítimo en un vivero forestal. Corteza de pino, turba de esfagno y

P. Mañas · E. Castro · J. de las Heras (✉)
Escuela Técnica Superior de Ingenieros Agrónomos, Universidad de Castilla-La Mancha, Campus Universitario s/n, 02071 Albacete, Spain
e-mail: Jorge.heras@uclm.es