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Establishing oak woodland on cutaway peatlands: Effects of soil preparation and fertilization

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Abstract

This research was part of a large-scale project investigating various species and silvicultural techniques in order to improve afforestation success on cutaway peatlands in Ireland. Successful establishment, in terms of fast growth and good quality may be hampered on most cutaway peatlands by harsh environmental conditions. The effects of various soil preparation techniques and fertilization rates and methods on the survival, growth and quality of pedunculate oak (*Quercus robur* L.) were studied in two cutaway peatland sites. Survival of oak was excellent regardless of experimental treatments applied. Phosphatic fertilization had little effect on the early growth of oak but higher fertilizer rates increased foliar P concentrations and improved stem quality. Results from cultivation trials would suggest that mounding should be avoided while deep ploughing would benefit oak performance. Protection from exposure that leads to shoot die-back was found to be critical for oak development. Overall, the hypothesis that oak requires specific silvicultural management techniques adapted to various site conditions of the cutaway peatlands was confirmed.

Keywords: Afforestation; Cutaway peatland; *Quercus robur*; Site preparation; Fertilization; Exposure

1. Introduction

Until the early 1990s, the level of broadleaf afforestation in Ireland was very low and mostly confined to the private sector (Neeson, 1991). This level subsequently increased; thanks to European and governmental financial incentives. In 1995, 20% of the afforested land was planted with broadleaf species, while the current target is to plant at least 30% of new forests with broadleaf species (Forest Service, 1996). Of the current broadleaf species, oak (*Quercus* spp.) is now the most commonly planted in this country (Forest Service, 2003). Broadleaves are generally more expensive and more difficult to establish than conifers (Joyce et al., 1998) and there are still major gaps in our knowledge of how to establish and manage many species. An increased research effort is now needed in broadleaf silviculture if we are to confidently manage the large areas of broadleaf crops over the coming years.

Industrial cutaway peatlands are those on which peat harvesting for fuel or horticulture has ceased; they form a substantial landmass in Ireland, part of which has been earmarked for future afforestation (McNally, 1997; Renou and Farrell, 2005; Renou et al., 2006). Pedunculate oak (*Quercus robur* L.) is a potential native species for afforestation on cutaway peatlands as it has a high timber value as well as a high biodiversity, heritage and landscape value but little is known about its silvicultural requirements on such sites.

The success of oak woodlands depends primarily on seedling persistence through the establishment period (i.e. 1–5 years following planting) (Kelly, 2002; Jacobs et al., 2005); survival can be very poor due to many stresses. Nursery stock quality and vegetation control have been cited as important for successful establishment (Frochot et al., 1986; Dey and Parker, 1997; McKay et al., 1999) and improvements in both areas are ongoing. The planting shock that oak seedlings undergo has also been related to moisture and nutrient stress (Jacobs et al., 2005). On cutaway peatlands, successful establishment of oak can also be hampered by severe nutrient imbalance, exposure, late spring frost and hare browsing (Renou and Farrell, 2005). It is widely acknowledged that phosphorus (P) is the most

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