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Composting of Rhododendron and Bilberry Wastes To Contain Spread of Exotic Plant Pathogens *Phytophthora kernoviae* and *Phytophthora ramorum*

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Plant material infected with the exotic pathogens *Phytophthora kernoviae* and *Phytophthora ramorum*, particularly of the invasive and highly susceptible *Rhododendron ponticum*, can pose a risk to indigenous host flora in Britain. Areas of infected bilberry (*Vaccinium myrtillus*) can also threaten surrounding non-infected heathland. Composting was examined as a more environmentally acceptable method of disposal of infected plant material than burning. Three types of low cost composting systems were developed and tested on shredded rhododendron and chopped bilberry wastes: permanent and mobile insulated bays, and insulated cargo containers, located at six different sites. In addition to temperature-time profiles of the composting wastes, the discoloration of the waxy leaves of *R. ponticum* and Portugal laurel (*Prunus lusitanica*) was developed as a potential indicator of the sanitising effect of the composting process. The relationship between the mean compost temperature and the percentage of green area of leaves positioned in the compost enabled the sanitising effect of a composting process to be immediately assessed. Mean compost temperatures and exposure times achieved in shredded rhododendron or chopped bilberry wastes in the majority of the compost in the insulated composting systems were above those needed to reduce *P. ramorum* and *P. kernoviae* to below detectable limits, and to eliminate any green colour in the indicator leaves. The exception was in the corners of the systems that contained >4 m^3 waste, and in the outer surfaces at one site where the volume of waste was only 2.9 m^3. Temperature-time profiles of the composts and positioned indicator leaves demonstrated that the main pathogen survival risk was in the corners of the insulated composting systems; pathogen survival risk could be minimised by positioning the corner material into the centre of the composting system during sequential refilling.

Introduction

Rhododendron ponticum is an introduced and invasive evergreen plant in Britain and can spread rapidly by seeds and vegetative means. Bilberry (*Vaccinium myrtillus*) is a British native deciduous species of heaths and moorlands. Both woody species are highly susceptible hosts to the introduced exotic pathogens *Phytophthora kernoviae* and *P. ramorum*, but attacked plants, particularly of less susceptible species, can survive for several years (Sansford & Woodhall 2007; Sansford 2008; Fichtner *et al.* 2009; Beales *et al.* 2009; Anon 2010). During this time, large amounts of inoculum of these pathogens can be produced which then threatens non-infected areas of bilberry and other indigenous susceptible host flora. Attempts to eradicate *R. ponticum* using herbicide applications have not been very successful (Anonymous 2010) and clearance usually involves cutting the plants to ground level followed by burning of the waste. However, the high moisture content of the waste means that fuel needs to be added to enable burning and significant amounts of smoke are produced, which is environmentally unacceptable.

Composting has been shown to be an effective method for reducing inoculum of *P. ramorum* from infected plant wastes to below a detectable level (Swain *et al.* 2006; Noble *et al.* 2011a). Both *P. kernoviae* and *P. ramorum* have been shown to be susceptible to compost temperatures and exposure times which are achieved in well managed composting systems (Noble *et al.* 2009).

Temperature and exposure time are usually the most important and easily verified factors in eradicating pathogens during composting, but other factors such as moisture and gaseous conditions in the compost may also have an influence (Noble and Roberts 2004; Noble *et al.* 2009). The viability of indicator organisms in the compost has therefore been used to provide additional information on sanitisation (Noble *et*