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Enhancing Germination With Liquid Smoke©

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INTRODUCTION

Exposure to smoke has been shown to improve germination of species previously thought to be difficult or impossible to germinate (Dixon et al., 1995). Kings Park and Botanic Gardens in Western Australia have used exposure to smoke to increase the germination of at least 23 native species that do not germinate easily. These include species that had been described as being fire-responsive, suggesting that germination would only occur after exposure to heat from a fire. However, there is evidence that the products of fire rather than the effects of heat may be an important germination stimulatory factor. Keeley and Bond (1997) observed that of 57 species of South African natives from fire-prone areas 44% had increased germination in response to being treated with the products of fire while heat treatments increased germination of only 16% of these species. Only one species, *Heliophila pinnata*, responded positively to both stimuli.

The search for the causal agent has been elusive (Minorsky, 2002; Van Staden et al., 2004). Flematti et al. (2004) reported the discovery of the causal agent, butenolide 3-methyl-2*H*-furo[2,3-*c*]pyran-2-one, as a by-product of combustion. Using the species *Syncarpha vestita* L. (cape everlasting), *Emmenanthe penduliflora* Benth. (whispering bells), and *Lactuca sativa* L. 'Grand Rapids' (Grand Rapids lettuce) each responded with demonstrated activity at very low concentrations [<1 ppb (10^{-9})] of the butenolide compound. Research has confirmed the activity and presence of the butenolide compound in liquid smoke formulations (Goubitz et al., 2003; Perez-Fernandez and Rodriguez-Echeverria, 2003; Kulkarni et al., 2007; Sparg et al., 2006).

Since many of our herbaceous perennial species are native plants and may have been subjected to occasional exposure to wild fire during evolutionary development, perhaps these species would also respond to treatment with liquid smoke. Producing many perennials from seed can be difficult and techniques that may enhance or improve erratic germination of some herbaceous species would be useful to the grower. This is a summary of work to evaluate the use of liquid smoke on the germination of a herbaceous perennial species having erratic germination. Two experiments were conducted in which *Echinacea,* an herbaceous flowering perennial genus exhibiting erratic germination characteristics (7 to more than 21 days) was chosen as the model plant.

Experiment 1. A liquid smoke product was applied using a hand sprayer at the following rates 0 (control), 50, 100, 200, or 400 $ml \cdot m^{-2}$ to *Echinacea purpurea* seeds sown into 128-cell plug trays. After treatment application, the four replicates were placed under mist. Germination was recorded 7, 9, 12, 16, 19, and 21 days after treatment.