

Chemical Control of *Phytophthora ramorum* Causing Foliar Disease in Hardy Nursery Stock in the UK

Judith Turner, Philip Jennings, Sam McDonough, Debbie Liddell & Jackie Stonehouse
Environmental Biology Group, Central Science Laboratory, York, UK. YO41 1LZ; +44 (0) 1904
462200; j.turner@csl.gov.uk

A range of fungicides have been tested for activity against *P. ramorum* using both *in vitro* and *in vivo* tests. All fungicides had proven activity against *Phytophthora* species and either had full approval for use on hardy ornamental nursery stock in the UK, or could be used under the Revised Long Term Arrangements for Extension of Use (2002). Fungicides were initially tested for *in vitro* activity against mycelial growth and spore germination of two isolates of *P. ramorum* from the UK. Agar plate tests showed that metalaxyl-M (SL 567A), dimethomorph/mancozeb (Invader), etridiazole (Standon Etridiazole 35) and fenamidone/mancozeb (Sonata) were the most effective fungicides against mycelial growth. Tests on activity of the fungicides against spore germination showed that metalaxyl-M, SL 567A, etridiazole, fenamidone/mancozeb, azoxystrobin (Amistar) and famoxadone/cymoxanil (Tanos) were most effective. In both tests metalaxyl-M was by far the most effective of all the fungicides tested. Seven fungicides: metalaxyl-M, dimethomorph/mancozeb, cymoxanil/mancozeb (Curzate M68), fenamidone/mancozeb, etridiazole, azoxystrobin and famoxadone/cymoxanil were tested for protectant and eradicant activity on containerised rhododendron and viburnum. All fungicides were applied as foliar sprays at the manufacturer's recommended rate. On rhododendron, metalaxyl-M, azoxystrobin and fenamidone/mancozeb completely inhibited symptom development when applied as protectant treatments either 4 or 7 days prior to inoculation. However, on viburnum only metalaxyl-M was completely effective at all protectant timings. Fenamidone/mancozeb was effective when applied 4 days prior to inoculation but efficacy was greatly reduced when the treatment was applied 3 days earlier. Fungicides were generally less effective when applied as eradicants. The most effective was metalaxyl-M, completely inhibiting disease development when applied 4 days after inoculation. None of the fungicides completely controlled disease development on viburnum when applied after the same time period. Despite the fact that metalaxyl-M was the most effective fungicide for control of *P. ramorum*, use of this fungicide has not been recommended due to the significant risk of the rapid development of fungicide resistance in the pathogen. Co-formulations and mixtures of metalaxyl-M with other active ingredients, including those shown to be effective in this study (e.g. azoxystrobin and fenamidone/mancozeb), need to be investigated to develop a protocol for durable fungicidal control of *P. ramorum*.

Overall, the project has demonstrated that, subject to further investigation, chemical treatments could play a major role in future control and containment strategies for *P. ramorum*. However, before growers in the UK could adopt the results of the work there would need to be changes in the current eradication policy for *P. ramorum* and further experimental work carried out on rates and methodologies for fungicide application and on the development of sound anti-resistance strategies.