

Systematic Review No. 6.

Do commonly used management interventions effectively control *Rhododendron ponticum*?

Review Report

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SUMMARY

Background

Rhododendron ponticum is an invasive plant of woodland, heathland, bogs and sand dunes. Suppression of native flora occurs as *R. ponticum* grows in dense impenetrable stands. Little light can penetrate its canopy; with the addition of leaf litter a near-sterile environment is created that cannot support a diverse flora and fauna. Control methods have been attempted, but many fail. This review collates accessible information and critically appraises the evidence for effective control using current management interventions.

Objectives

The primary objective is to address the question “Do commonly used management interventions effectively control *Rhododendron ponticum*?”

The question originated from UK-based organisations where *R. ponticum* control is a common problem. Therefore, although this review has not excluded information from elsewhere, it has a UK focus.

Secondary objectives

To address the following questions:

- Does habitat type modify the effectiveness of an intervention?
- Is effectiveness of control altered by the disposal of cut material?
- Can use of a follow-up treatment change the effectiveness of initial treatment?
- Are there other environmental or experimental factors that influence success of interventions?

Search strategy

Relevant studies were located through the computerised searches of English Nature’s ‘Wildlink database’, JSTOR, ISI Web of Knowledge (comprising BIOSIS previews: 1969 to 2004, CAB abstracts: 1973 to 2004, ISI current contents: 1997 to 2004, ISI proceedings: 1990 to 2004, ISI Web of Science: 1975 to 2004), ScienceDirect, Index to Theses online (1973 to 2004), Agricola, Scopus (1966 to 2004), Digital Dissertations, www.alltheweb.com (PDF, and word doc. search), and www.google.co.uk.

A secondary search was made of bibliographies of all articles accepted at full text.

Selection criteria

1) Subject

Rhododendron ponticum populations or subpopulations.

2) *Intervention*

Any intervention with the objective of controlling *R. ponticum* was considered appropriate for inclusion in this review. Studies over all time scales and habitats were included.

3) *Comparator*

Any articles that did not include a control site/comparator were rejected.

4) *Outcome*

Any study reporting on the outcome of an intervention with the objective of controlling *R. ponticum* was included. Specifically, studies examining any change in the population of *R. ponticum* including cover, stand density, frequency or biomass were deemed relevant.

Data collection and analysis

Article inclusion/exclusion assessments were performed by the primary reviewer with a subset assessed by a second reviewer for verification of repeatability within the methodology; any disagreements were resolved by discussion. Data extraction and study quality were performed by the primary reviewer with the use of pre-designed assessment forms, and then entered into a spreadsheet. Meta-analyses generated the effect size of different interventions, with univariate and multivariate meta-regression used to investigate possible reasons for heterogeneity.

Main results

Application of the herbicides Imazapyr or Metsulfuron-methyl to *R. ponticum* stands, and post-cut the application of Glyphosate, significantly reduce *R. ponticum* abundance ($p= 0.02$, 0.0005 , and 0.001 respectively) as demonstrated by the negative effect sizes generated ($d= -2.83$, -1.92 , and -1.14 respectively). No other interventions produce significant reductions.

Potential reasons for heterogeneity were identified as pot-grown vs. field trials, length of experiment, herbicide dosage, method of application, and month of treatment. These were assessed individually in a univariate meta-regression, and then in a multivariate meta-regression for Imazapyr; no factor was significant in the univariate meta-regression, but the multivariate meta-regression demonstrated that there was a significant difference between *R. ponticum* treated in the field and *R. ponticum* treated in pots ($R=19.26$, $p=0.034$), where the effect of treatment in pots was greater. Multivariate meta-regression for Metsulfuron-methyl yielded no significant results. Length of experiment was significant for Glyphosate application post cut ($R=-0.13$, $p=0.039$), where longer follow-up monitoring produced a greater reduction in *R. ponticum* however; in further analyses of independent data this factor was no longer significant.

Secondary objectives could not be directly addressed in the review due to lack of information in included articles.

Reviewers' conclusions

The weight of evidence suggests Metsulfuron-methyl application, and post-cut application of Glyphosate will produce short-term reduction of an *R. ponticum* stand. Only five studies provided data for analysis of Metsulfuron-methyl and are either performed in an unspecified habitat or in pots in glasshouses. The applicability of these results to field conditions with a diverse range of interacting variables is therefore uncertain. In particular, it is unclear whether short-term reduction means long-term effectiveness. Meta-analysis on post-cut glyphosate application used 11 data points; however, these data points came from only five studies, creating significant publication bias in the meta-analysis. Without further research producing more articles this problem cannot be overcome.

Imazapyr application also resulted in significant reduction in abundance but its use is now illegal in some countries (including UK). Since the majority of experimental work on the control of *R. ponticum* has been on the effect of Imazapyr, there is now a requirement for further research into the effect of replacement herbicides and other control methodologies.

The significantly greater effect of Imazapyr on pot-grown plants compared with field plants demonstrates that, whilst efficacy can be demonstrated with pot-grown trials they do not take into account ecological factors that can reduce the effectiveness of the intervention in the field. This should be considered when planning future trials.