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Trivial and Political Reasons for the Failure of Classical Biological Control of Weeds: a Personal View

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Abstract

Analyses of worldwide databases on weed biocontrol programs reveal success rates of agents of only 8–29%, and of programs of 17–39%. In contrast, more recent analyses for particular countries, where substantial commitment to biocontrol programs have been made, show rates of full or partial success of weed biocontrol programs of 50–80%. Problems with defining and monitoring success are well known, and may explain some of the poor apparent success rates for global efforts in weed biocontrol. In addition, the original analyses of the global databases pointed out that programs varied considerably in quality of financial support and management. A retrospective assessment of the 8 biocontrol of weeds programs that I was involved with from 1988–1998 suggests that 5 (63%) suffered from a serious lack of resources, or were hampered by a lack of political will on the part of the appropriate authorities. Although these constraints have understandable causes, they are likely to seriously reduce the chance of success in these recent biocontrol programs. If this pattern is common, then global trends in success rates are unlikely to show any increase. Assuming weed biocontrol programs are adequately funded, and involve a long-term commitment from researchers and authorities, then we can probably be justified in predicting success rates against target weeds of 50–80%.

Keywords: success rates, weed biocontrol, global databases, under-resourcing

An accepted belief over the past 10–15 years has been that attempts to control weeds, using deliberate introductions of herbivorous insects or plant pathogens, have a high probability of failure. Typical examples of this include a press article in 1998 in New Zealand during a visit by Professor Mick Crawley (Imperial College, University of London) with the title "Biocontrol Not Panacea" (Anon. 1998) and including a quote that "biocontrol was the answer to only about one in six (weed) problems" (Anon. 1998). These statements were based on an analysis of databases of all weed biocontrol attempts worldwide (Crawley 1989, analysing data from Moran 1986 and Julien 1987) introduced with the comment that "the history of biological weed control is marked by a small number of spectacular successes and a large number of disappointments" (Crawley 1989). Another analysis suggested that 39% (68 out of 174) of biological control programs prior to 1980 led to some level of control of the target weeds (Julien *et al.* 1984). Although these reviews may acknowledge the high cost-effectiveness and overall good safety record of weed biocontrol (Crawley 1989), the rather low probability of success can make it hard to convince potential sponsors to invest in new programs.

More recently, problems with the use of these global databases have been highlighted, in particular the subjective nature of the assessments of success, and the need to give long-term programs sufficient time to become effective (McFadyen 1998). McFadyen

(1998) also points out the possible confusion between different types of rates of success, such as those for agent establishment or for the effectiveness of individual biocontrol agent species. Rates of success for individual agents exerting marked control over a weed target vary in global analyses from only 8% (post-1980, from Crawley 1989) to 29% (pre-1980, from Julien 1989). Potential sponsors are likely to be most interested in the rate of success of weed biocontrol programs, i.e. what the probability of success is against a particular target weed, so this is my focus here. In the next section, the relatively high reported rates of success in weed biocontrol programs for several individual countries or regions are reviewed. Then another possible reason for the discrepancy between these higher rates and the lower rates in the global databases is suggested, based on personal experience of programs over a 10-year period.

Rates of Success for Weed Biocontrol Programs for Countries/States

Success rates for biological control programs for individual countries or states are shown in Table 1. What is striking about these success rates is how high they are: of weeds targeted for biological control, anywhere from 50–80% are fully or substantially suppressed by the introduced agents. Typically, these analyses use definitions and criteria for assessing success of biological weed control similar to those proposed by Hoffmann (1995), e.g.:

1/ Complete success: the weed is suppressed by the introduced biocontrol agents and no other control methods are required.

2/ Substantial success: other management methods are needed but at reduced levels because of the suppression achieved by the biocontrol agents.

3/ Failures: the introduced agents have a negligible effect, and fail to reduce the dependence on other control methods for managing the target weed.

Importantly, Hoffmann (1995) excluded weed control programs where insufficient time had passed since agents were introduced for full or partial control to become apparent.

It is important to note that the countries/regions in Table 1 have all made substantial commitment to weed biocontrol programs over long periods of time. In Mauritius, for example, there was a total of 5 programs from 1914–1981 involving the release of 10 agents, at times preceded by very substantial studies of the ecology of the target weed and the potential biocontrol agents, and mostly featuring reasonable levels of post-release monitoring (Greathead 1971, Fowler *et al.* 2000a).

How can the differences between the low rates of success of biological control programs in the analyses of global databases be reconciled with the much higher success rates from the countries/states in Table 1? McFadyen (1998) points out that the global analyses

Table 1.
Reported rates for complete or substantial success in biological control of weeds in Hawai'i, Mauritius, New Zealand and South Africa

Country or state	Percentage of programs successful	Reference
Hawai'i	50%	Markin *et al.* (1992)
Mauritius	80%	Fowler *et al.* (2000a)
New Zealand	83%	Fowler *et al.* (2000b)
South Africa	83%	Hoffmann (1995)

often fail to exclude programs where there has been insufficient time to allow a fair assessment of success, and also that the claiming of degrees of success has been very subjective. The variable quality of the biological control programs providing data for the global databases has also been mentioned: Julien *et al.* (1984) pointed out that "techniques, expertise and financial support varied with nearly every release and possibly affected the outcome", and Crawley (1989) noted that "a great many failures are caused by pure bad luck, bad timing or bad management". It might be hoped that programs that are inherently flawed, due to under-resourcing or poor management, were things of the past, and that recent additions to the global databases would include only the types of weed biocontrol program usually operated by countries/states such as those in Table 1. However, looking back on weed biocontrol programs that I had been personally involved in from 1988–1998, I realised that some of these recent programs had been severely constrained by a lack of funding, or by a lack of interest or long-term commitment by the relevant authorities. In the next section, I carry out a simple retrospective assessment of the proportion of these projects that I felt were seriously compromised by funding constraints or other problems.

Assessing Constraints in Weed Biocontrol Programs with my Involvement, 1988–1998

I considered only those programs for which had been personally involved in the selection, host range testing, shipment or release of biological control agents. In particular, I was interested in whether I regarded these programs as adequately resourced and backed-up with political will, or long-term commitment, from the relevant authorities in the country where the agents were intended to be released.

Examples of problems with programs included:

1/ Only enough resources for a small number of releases of a small number of agent species (often only 1 species). Often using an agent with no existing track record of success.

2/ Insufficient political will to provide funding for further releases, or for investigating the potential of other species of biological control agents.

3/ No systematic monitoring of the success of the release(s) carried out, and no political will to obtain funding for such monitoring.

I considered 5 of the 8 weed biocontrol programs I had personally been involved with from 1988 to 1998 to have suffered from serious shortcomings because of insufficient funding or political will. Thus 63% of the weed biocontrol programs considered were, in my judgement, seriously compromised and therefore unlikely to succeed. Even if several of these programs have now succeeded, the planned monitoring has not been carried out, so their fates are unknown. Indeed, the only programs that were adequately resourced and carried out with a clear will to succeed, were those operated for New Zealand: one of the countries with a high recorded rate of success in biological control of weeds (Table 1). If this is a general trend, then the global statistics for success in classical biological control of weeds are unlikely to show much improvement over the next 10–20 years. It should be made clear that in all these cases there were good reasons behind the problems. Often programs were driven by a feeling that there was a need to solve the weed problem, even if the funding was inadequate. There was also great pressure to obtain external funding, even if this at times was adequate for only a rather token biocontrol effort. The authorities providing funding, or with responsibilities for monitoring the programs after releases were

made, often had budgets that were stretched or had other funding priorities that were entirely understandable.

Conclusion

It is possible that the global databases of weed biocontrol contain many programs where resources were severely lacking and/or political will was poor. In theory it might be possible to exclude such programs from analyses of success rates, but in practice applying non-biased criteria in hindsight is probably very difficult. In most cases the necessary records probably don't exist. Provided that a new program can be adequately resourced and managed, then it is probably justifiable to predict likely success rates of 50–80%, using the examples from Table 1, rather than those from the global analyses. There may still be good reasons for trying weed biocontrol programs in other less favourable circumstances, but it should be recognized that the probability of achieving, or being able to monitor, success in weed suppression is probably greatly reduced.

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