Bioherbicide development for cereals in integrated weed management (CP/1998/018)

Bruce Auld

Project number	CP/1998/018
Project name	Bioherbicide development for cereals in integrated weed management
Collaborating institutions	▪ Australia: NSW Agriculture ▪ Vietnam: National Institute of Plant Protection, Hanoi; Cuu Long Rice Research Institute, Omon, Cantho
Project leaders	▪ Professor Bruce Auld ▪ Professor Dr Ha Minh Trung
Duration of project	1 July 1999 –30 June 2002; extension 1 July 2002 – 30 June 2004
Funding	$462,163
Countries involved	Vietnam and Australia
Commodities involved	Rice and wheat
Related projects	CS2/1994/002 – Biological control of grassy weeds with fungi as bioherbicides

Motivation for the project and what it aimed to achieve

Although a range of selective herbicides is available for wheat and rice, their continued use is leading to the development of herbicide resistance and pollution of the environment. The use of naturally occurring fungal pathogens as bioherbicides is an attractive alternative to chemical control for specific weeds. Research and development of bioherbicides involves weed science, plant pathology, microbiology and formulation chemistry. It is thus an excellent tool for developing a range of technical skills and collaboration among researchers.

The project arose from project CS2/1994/002 – Biological control of grassy weeds with fungi as bioherbicides, implemented in Vietnam and Australia. This project identified the major grass weeds in rice in the Mekong Delta in the south and the Red River Delta in northern Vietnam. Subsequently, extensive field surveys of diseases of these weeds were made. Fungi isolated from infected plants were assessed as potential bioherbicides. Fungi specific for the two major grass weeds in Vietnam were found. In Australia, a pathogen was found for wild oats, the worst weed in wheat.

Weed scientist Ms Nguyen Thi Tan (left) and technician Ms Tran Thi Thu working with the weed collection in the herbarium at the National Institute of Plant Protection, Hanoi. Ms Tan coordinated the first systematic survey of weeds of rice in the Red River Delta as part of the project.

Dr Duong Van Chin, Cuu Long Rice Research Institute, examines plants treated with a bioherbicide formulated from an indigenous fungus. Junior researchers Tran Thi Kieu (left) and Duong Pham Minh Chau (middle) look on. Dr Chin was the project leader in South Vietnam.

What the research project produced

Greenhouse experiments confirmed the potential for the fungus *Exserohilum monoceras* to control barnyard grass, *Echinochloa crus-galli*, but large-scale field experiments in the Red River Delta demonstrated that the fungus was not sufficiently virulent to control the weed. In southern Vietnam, the fungus *Setosphaeria rostrata* was effective in greenhouse and small-scale field experiments in controlling red sprangletop, *Leptochloa chinensis*. However, mass production of the fungus was not developed beyond laboratory scale and formulation improvement would be required for application to large areas.

In Australia, glasshouse experiments showed that the fungus *Drechslera avenacea*, although producing lesions, could not kill wild-oat plants, *Avena fatua*. An extensive survey for potential bioherbicides of the other major grass weed of wheat, annual rye grass (*Lolium rigidum*), failed to discover any suitable candidate organisms.

Dr Nguyen Hong Son, weed scientist at the National Institute of Plant Protection, Hanoi, at a field site in the Red River Delta. Dr Son completed his PhD while working on the project.

Adoption—how the project outputs are being used

In Australia, the project has demonstrated that there are no potential bioherbicides for the two main grass weeds of wheat. This finding is adopted in the sense that researchers are thus guided to other avenues for management of these weeds.

In Vietnam, while research on formulation of *Setosphaeria rostrata* to control red sprangletop continues at the Cuu Long Rice Research Institute its ultimate practical development appears unlikely. This is because of lack of large-scale, mass-production technology and the existence of competing chemical herbicides. Although the fungus found in the Red River Delta for barnyard grass control was not successful, a bioherbicide product for this weed has been under development in Japan and may become a commercial product.

Impact—the difference the project has made or is expected to make

The project introduced biological control of weeds into Vietnam and enhanced the capacity of two scientific institutions to undertake major weed-research projects and plant-disease surveys. Skill development among the researchers in this project has probably been the major impact of the project. Most of the Vietnamese scientists involved in the project visited Australia at least once during the period of this and the earlier project. As the research in Australia was on a grass weed in a grass crop and the fungi were similar, the Australian work provided a model for the visiting scientists at a hands-on level.

The magnitude of carryover impacts of this project is dependent on the extent to which the cooperating researchers have benefited from the work. As several of the original cooperating scientists have been promoted into research management, it is likely that their influence will be significant.