

PROJECT COMPLETION SUMMARY SHEET (PCSS)

NOTE: PLEASE REFER TO THE GUIDELINES APPENDED WHICH COVER SUBMISSION REQUIREMENTS FOR BOTH THE PCSS AND THE FINAL TECHNICAL REPORT (FTR).

PROJECT COMPLETION SUMMARY SHEET

DATE Sheet Completed: 28 June 2002

Project Title:	Minimising the economic and sociological impact of <i>Phalaris minor</i> in rice/wheat ecosystems	
DFID Project Reference No:	ZA0284 [R7331]	
Programme:	Crop Protection Programme	
Programme Manager (Institution):	Dr Simon Eden-Green (NRIL)	
Sub-Contractor (<u>project leader's institution</u>):	Scottish Agricultural College [SAC]	
Production System:	High Potential Production System	
Programme Purpose:	Yields improved and sustainability enhanced in high potential cropping systems by cost effective reduction in losses due to pests	
Commodity Base:	Wheat/rice	
Beneficiaries:	Indian Farmers, Academics and Extension Workers	
Target Institutions:	Haryana Agricultural University, Hisar, India	
Geographic Focus:	Indo-Gangetic Plains	
Total Cost:	£233,795	
	Planned	Actual
Start Date:	1 January 1999	1 February 1999
Finish Date:	30 June 2002	30 June 2002

1. Project Purpose:

Ecosystem Audits

- To describe the influence of environmental, vegetation and management factors upon weed population biology and control, using a range of statistical techniques including multivariate analysis.
- To assess the contribution that socio-economic farm factors have upon the development of weed populations and farmers' ability to adopt innovative production techniques reducing *P. minor* pressure.

Weed Life Cycle Studies

- To describe the demography and germination periodicity of *P. minor* as influenced by temperature and moisture and farmer cropping practices, using field data as well as quantitative and analytical models
- To predict the economic impact of *P. minor* in wheat/rice ecosystems, using the outputs of models.

Education and Technology Transfer

To implement a programme of education and technology transfer for researchers and advisors with respect to:

- [a] undertaking the ecosystem audit;
- [b] utilising plant population models;

[c] identifying the key factors which can be used to minimise the economic and sociological impact of *P. minor*.

Weed Genetics

To assess the genetic variability within and between *P. minor* biotypes and its ecological/agronomic impact.

The weed genetics work was an additional [supplementary] section added to the project in 2000.

2. Outputs:

In the project, education and technology transfer was an integral part of generating the outputs from the research activities. The Ecosystem Audit identified a range of economic constraints to farm profitability. Survey data permitted a socio-economic characterisation of farmers in Hisar. In addition, these studies identified farmers in the 'information poverty gap', thus informing future research, extension and technology transfer needs. There is a risk that polarisation of the farming community may occur if farmers with strong socio-economic positions continue to gain most of the benefits from current R&D and extension activities.

The weed life cycle studies provided new information of seed longevity, which informed crop rotation/weed management practices *in situ* and via modelling. Weed seed management research described the influence of seed burial, tillage and straw treatment on seed survival. The data were used to inform analytical modelling, thus guiding best cropping practices designed to minimise losses from *P. minor*. Beyond the seedbank, plant population flux assessments were studied examining the impact of tillage, herbicides and reproduction of the weed on crop competition. Again, in-field experiments were integrated to inform a simulation model for *P. minor*. The model combines temporal, biological and agronomic factors to allow the prediction of the impact of a range of *P. minor* control strategies.

A supplementary field and laboratory study described the nature of the reproduction of *P. minor* in genetical and evolutionary terms. This molecular ecology research informs sustainable crop management programmes and instructs on the avoidance of herbicide resistance biotypes of *P. minor*.

3. Contribution of Outputs to Project Goal:

The target of the project was to minimise the economic and sociological impact of *P. minor* in rice/wheat cropping systems. The goal has been accomplished using a combination of socio-economic, laboratory and field-based technical research, with an overlying education/training programme. Thus the project has clarified the following:

- The socio-economic characterisation of farmers in Hisar illustrates technological and management practices which can minimise losses from *P. minor*.
- Socio-economically disadvantaged farmer groups require a differentiated approach to extension and technology transfer, beyond the socio-economically successful groups.
- Crop yield losses have been characterised in economic, and empirical terms and simulation modelling approaches devised.
- Weed life cycle management is at the hub of minimising losses by *P. minor*.
- Integrative life cycle models can be used as practical tools to predict the longer term impact of single and multiple inputs e.g. tillage/herbicide use/rotations.
- Adoption of best practice to reduce *P. minor* populations.

4. Publications:

4.1 Conference Papers

Franke, A. C., McRoberts, N., Marshall, G., Malik, R. K., Singh, S., Nehra, A. S. [2002]. Seed longevity and emergence of *Phalaris minor* as affected by tillage regime and herbicide resistance. *Paper for International Conference on Herbicide Resistance Management and Zero Tillage in Rice-Wheat Cropping System, 4-6 March 2002, CCS Haryana Agricultural University, Hisar, India*, pp. 35-40.

Franke, A. C., McRoberts, N., Marshall, G., Malik, R. K., Singh, S., Nehra, A. S. and Gill, G. S. [2001]. The contribution of zero tillage for the management of *Phalaris minor* in the Indian rice-wheat system. *Brighton Crop Protection Conference 2001 – Weeds*. pp. 901-906.

4.2 Conference Abstracts

Marshall, G., Sinclair, W., McRoberts, N., Franke, A. C. Singh, S., Saharan, R. P. and Malik, R. K. [2001]. Characterising populations of *Phalaris minor* Retz. via molecular techniques. *2001 Meeting of the Weed Science Society of America, North Carolina, February 2001*, abstract 120.

Malik, R. K. [2000]. Success of zero-till and *Phalaris* management in Haryana. *Third International Weed Science Congress. Brazil, 6-11 June 2000*, abstract 501, pp. 241-242.

Franke, A. C., McRoberts, N., and Marshall, G. [2000]. A population model for *Phalaris minor* Retz., applied for Indian rice-wheat rotations. *WSSA Abstract, 2000 Meeting of the Weed Science Society of America*, vol. 40, p.50-51.

4.3 Conference Posters

Franke, A. C., McRoberts, N and Marshall, G. [2002]. Relation between annual rainfall and demography of isoproturon-resistant *Phalaris minor* in Haryana. *To be presented at International Workshop: Herbicide resistance management & zero tillage in rice-wheat cropping system, Hisar, 4-6 March 2002*.

Franke, A. C., McRoberts, N. and Marshall, G. [2000]. A farmers' survey to assess *Phalaris minor* in the Indian rice-wheat system. *SAC Research Conference 7-8 September 2000, Aberdeen*.

4.4 Newspaper Articles

Franke, A. C. and Franke, B. [2002]. Canarygrass epidemic threatens wheat cultivation in northern India [In Dutch]. *Natuur & Techniek* 70 [1]: 54-59.

McRoberts, N. [2001]. Having a bubaly time. *SAC News*, 11 [3]: 6.

Franke, A. C. [2001]. Small weeds, big issues. *SAC News*, 11 [4]: 10.

Franke, A.C. [1999]. *Phalaris minor* major mission. *SAC News* 9 [5]: 7.

Marshall, G. [1999]. Rice, wheat and that weed. *SAC News* 9 [2]: 11.

5. Internal Reports:

McPherson, A., Sinclair, B. [2000]. DNA extraction and PCR amplifications of *Phalaris minor*. *Initial Progress Report, Plant & Crop Science Division, Scottish Agricultural College, Auchincruive.*

6. Other Dissemination of Results:

Workshop Manuals

Franke, A. C., McRoberts, N., Marshall, G. [2002]. Utility of DFID-funded research for control of *Phalaris minor*. Workshop manual for Review Workshop on the utility of socio-economic and lifecycle research for the control of *Phalaris minor*, Haryana Agricultural University, Hisar, India, 18-20 March 2002.

Franke, A. C., McRoberts, N., Marshall, G. [2000]. Simulation of ecological processes. *Workshop manual for Workshop on mathematical modelling, Haryana Agricultural University, Hisar, India, 11-14 December 2000.*

Franke, A. C., McRoberts, N., Marshall, G. [1999]. Multivariate data analysis in weed science. *Workshop manual for Workshop on multivariate data analysis, Haryana Agricultural University, Hisar, India, 13-15 December 1999.*

7. Listing and reference to key datasets generated:

Survey data sets for 2000/01

Demography data

Seed longevity data

Simulation model

These datasets are available on request.

8. Follow-up indicated/planned:

Regional Issues

Essentially, in this project the outputs were produced by the SAC/HAU team and shared with participating farmers, extension scientists and research scientists in Hisar. In addition, specific workshops gained involvement from participants in Punjab, Uttar Pradesh, Uttaranchal and Tamil Nadu. The process of promoting the research themes was made throughout the 3 years rather than simply at the end. This evolutionary approach was beneficial since the project work gained exposure to the various end users over a 3 year period. The lessons learned in 'good practice' in terms of crop agronomy, weed management, scientific training, surveying and participative farm-based research are frequently adopted by the HAU staff.

In Hisar, the research and extension programme on *Phalaris* control in the rice/wheat ecosystem is continuing. Funding is still available from National, Australian Government and World Bank sources to progress refinements in cultivation practice, herbicide selection and management advice. The emphasis of the research programme at HAU will probably move towards the rice crop in future.

On the basis of our project, we would suggest that there would be value in undertaking research to further assist the sector of Indian farmers we described as being in the 'information poverty gap'. Essentially, these are the farmers who, for various reasons, become excluded from technological progress via new practices such as zero-till farming. This significant minority are vulnerable to being excluded from successful cropping if a range of alternate, low-tech solutions cannot be found to assist them.

Reaching those in the information poverty gap would require a special understanding of their needs and perceptions. It could be instructive to assess a range of extension techniques to

understand how best to communicate and inform these more introvert groups. We would anticipate that such a programme of work could usefully be pursued in a collaborative manner with other potentially 'technologically excluded' groups.

National Issues

There is a continuing benefit from the programme of work, certainly in Hisar and Punjab. We would anticipate that some of the refereed publications would engender further interest in the programme in India beyond Hisar. In particular, we consider that there is a need to identify a mechanism whereby other Indian agronomists/weed scientists could more readily interact with the HAU programme. At present our perception is that International funding programmes could work more effectively with Indian R&D programmes if Indian research was more collaborative in its domestic strategy. Similarly, International programmes could benefit greatly if domestic research priorities were clearly articulated. Thus in our experience with an Indian/Australian/DFID funded programme, scaling up of such collaborative ventures could be beneficial in reaching a greater number of end users.

An advantage of scaling up is that universities situated in the poorer parts of India [on the Indo-Gangetic plains these are: eastern Uttar Pradesh, Madhya Pradesh and Bihar] could benefit from the experience and knowledge collected by universities in States such as Haryana and Punjab, where agriculture is better developed.

- 9. Name of author of this report:** Professor George Marshall
Date: 28 June 2002