PROJECT COMPLETION SUMMARY SHEET DATE 25/07/2001

TITLE OF PROJECT:		The development and application of transformation systems in rice
R NUMBER:		R6948
PROGRAMME:		Plant Sciences Research Programme
PROGRAMME MANAGER (INSTITUTION):		John Innes Centre
PROGRAMME PURPOSE:		Methods to genetically modify crops to overcome biotic or abiotic constraints developed, tested, piloted and promoted in High Potential Production System and Forest Agriculture Interface Production System.
PRODUCTION SYSTEM:		High Potential and Forest Agriculture.
BENEFICIARIES:		DFID programmes focusing on rice and banana improvement who need access to tranformation technology. Ultimately rice farmers in West/East Africa and South-East Asia
TARGET INSTITUTIONS:		WARDA (Ivory coast), KARI (Uganda) and IRRI (Philippines)
GEOGRAPHIC FOCUS:		West and East Africa (Ivory Coast, Uganda) and Asia (India, Bengladesh)
	Planned	Actual
START DATE:	1st September 1997	1st September 1997
FINISH DATE:	30th June 2001	30th June 2001

1. Project purpose

The purpose of this project is to provide enabling technology for rice genetic engineering to related DFID programmes which concentrate on either improving rice resistance to nematodes (R6453 and R7294) and viruses (R6394, R6355 and R7415) or on studying transgene behaviour in rice (R6343). In 1999 the reseach programme on tungro virus resistance was progressively phased out with the retirement of collaborator Dr. R. Hull and replaced by a programme on the development of banana transformation technology to provide enabling technology to related DFID programmes (R6743 and R7478-CPP).

2. Outputs

Banana transformation

- Shoot tip cultures were used for the production of AAA east African banana plants and immature inflorescences at JIC.
- Embryogenic calli and embryogenic cell suspensions (ECS) were successfully produced from immature flowers. Banana plants have been regenerated from the ECS at very high frequency.
- **Transformed banana plants** expressing reporter genes are currently regenerated.

Rice transformation

- 124 independently transformed clones containing anti-nematode, anti-tungro, MARs and targgetting constructs have been produced from elite rice varieties by particle bombardment .
- 617 transgenic rice plants have been produced from these clones and analysed at the structural and expression levels.
- Transgenic rice seeds were disseminated to collaborators for biochemical analysis and bioassay.
- In collaboration with the University of Leeds (R7294) high levels of **nematode resistance (80% egg reduction**) were identified by bioassays.
- An efficient rice transformation system has been established using embryogenic calli derived from mature embryos of the Nipponbare genotype.
- **High throughput transformation system** based on herbicide or antibiotic resistance have been used for the production of ~500 independently transformed rice plant clones.
- Segregation analyses have been performed on transformed plant lines.

3. Contribution of outputs to Project Goal

Project R6948 has sucessfully provided enabling technology for rice genetic engineering to DFID programmes which concentrate on improving rice resistance to nematodes (R6453 and R7294) and viruses (R6394, R6355 and R7415) or which concentrate on transgene study in rice plants (R6343). Hundreds of transgenic lines and

thousands of transgenic plants containing anti-nematode and anti-viruses constructs were produced and distributed to DFID collaborative programmes and IRRI. In addition R6948 contributed to an understanding of the factors controlling transgene expression and stability in rice. Banana transformation technology was also sucessfully developed during project R6948.

4. Publications

James V *et al*. (*in press*) ***Theor. Appl. Genet***.
Vain P *et al*. (*in press*) *In* ***Rice Genetics IV***, GS Kush Ed.
James V *et al*. (*in press*) *In* ***Rice Genetics IV***, GS Kush Ed.
Vain P *et al*. (1999) ***The Plant Journal*** 18:233-242
Kohli A *et al*. (1999) ***The Plant Journal*** 17 (6): 591-602
Kohli A *et al*. (1999) ***Planta*** 208 (1): 88-97
Vain P *et al*. (1998) ***Theor. Appl. Genet***.96:164-169
Arencibia A *et al*. (1998) ***Molecular Breeding*** 4:99-109
Vain P *et al*. (1998) ***Theor. Appl. Genet***. 96:266-271
Kohli A *et al*. (1998) ***Proc. Natl. Acad. Sci. USA.*** 95:7203-7208

5. Internal Reports

Vain P *et al*. (2001) DFID Annual Report.
Vain P *et al*. (2000) John Innes Centre Annual Report. p11
Vain P *et al*. (2000) DFID Annual Report.
Vain P *et al*. (1999) DFID Annual Report.
Vain P *et al*. (1998) DFID Annual Report.
Vain P *et al*. (1997) John Innes Centre Annual Report. p20
Vain P *et al*. (1997) DFID Annual Report.

6. Other dissemination of results

Meeting participations

Vain P *et al*. (2000) 4th International Rice Genetics Symposium, IRRI, Philippines, p363
James V *et al*. (2000) 4th International Rice Genetics Symposium, IRRI, Philippines, p145
James V *et al*. (2000) 6th International Congress of Plant Molecular Biology, Quebec, Canada. pS3-57
Vain P *et al*. (1999) RF International Rice Biotechnology Meeting. Phuket, Thailand. p326
Vain P *et al*. (1999) EU-Balkan Cereal Biotechnology Workshop. Sofia, Bulgaria
Vain P *et al*. (1998) IX Intern. Congress on Plant Tissue and Cell Culture. Jerusalem, Israel. p183
Vain P *et al*. (1998) IITA-JIC-NRI Gatsby-funded biotechnology projects. John Innes Centre, UK.
Kohli A *et al*. (1998) EC COST Action 824 meeting. John Innes Centre, UK.
Vain P *et al*. (1998) Joint RWTH-JIC meeting. John Innes Centre, UK
Richard GJD *et al*. (1997) 5th Int. Congress of Plant Molecular Biology, poster #1300, Singapore.
Christou P *et al*. (1997) RF International Rice Biotechnology Meeting, Malacca, Malaysia p164.

Lectures

R6948 research activities have been presented in 14 seminars at National and International meetings (see R6948 technical report for details)

Others

Transgenic rice seeds containing anti-nematode and anti-tungro transgenes were distributed to the Univ. of Leeds and IRRI. Many visiting workers were trained to rice transformation technologies.

7. Follow-up indicated / planned

The transgenic technologies developed in R6948 allowed DFID collaborative programmes (R6453, R7294, R6394, R6355 and R7415) to test genes for their potential to confer resistance to rice nematodes and viruses. During this 3 year 9 month period, levels of resistance against nematodes and Yellow Mottle Virus were identified in transgenic rice plants by DFID programmes R7294 and R7415 respectively. Upon confirmation of resistance under controlled conditions, transformed seeds will be made available to downstream users for testing at WARDA and IRRI. Germplasm would then be made available to NARS by the CGIAR centres, for the testing and release. In addition, the banana transformation technologies developed in R6948 will allow collaborative programme R8031 to develop strategies for nematode-resistance in cooking banana. The ultimate beneficiaries would be farmers in Africa and Asia

8. Name and signature of author of this report

Philippe Vain