FINAL TECHNICAL REPORT FORMAT

R6355

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Executive Summary
The purpose of the project was to develop RYMV resistant rice suitable for cultivation in West Africa. In the first phase, susceptible cultivated rice varieties were transformed with cDNA constructs based on fragments from the RYMV genome. The aim was to produce an RNA-based resistance called homology dependant resistance. Transgenic cultivated rice varieties have successfully been produced which resist RYMV through a mechanism of homology dependant resistance. In addition a strain survey has been initiated and those isolates which have been tested on the transgenic plants are resisted through the same mechanism. Since the mechanism of resistance does not rely on the production of functional viral proteins the resistance would be likely to have fewer risks for the environment. Since the resistance trait has been found to be stable over several generations they may be suitable for introduction into field agriculture over a 3-10 year time frame (Starting from 1995). These cultivated varieties will then improve the efficiency of sustainable rice production in West Africa through the production of rice lines that are resistant to rice yellow mottle virus.

Background
RYMV is a very serious disease of West and East Africa. Surveys have confirmed RYMV in Tanzania and Madagascar. Potential yield gaps estimate by researchers at WARDA for the West African region alone are as high as 325000 tonnes of rice per year, which could be reduced with the use of resistant varieties. No other disease was rated as highly in terms of importance as RYMV in the lowlands and irrigated ecosystems. These environments have also been targeted as the regions for greatest future rice expansion.

Trials to identify tolerance and resistance to RYMV in West Africa have been ongoing. Interspecific crosses between *O. sativa* and *O. glaberrima* were initiated to produce introgressed resistant material. However, the time frame for this last activity was estimated at 5 years before material would be available.

Two strains for RYMV have now been cloned as cDNA from which infectious RNA may be produced Ivory Coast (Brugidou et al 1995) and Nigeria (Pinto and Baulcombe, In preparation). The sequence data provided the opportunity to produce constructs for transformation and to identify regions which could be used for primer design for survey of strains.

It is well established that plants may be genetically engineered to resist a virus by transgenic expression of part of the virus genome. Recent work in the Sainsbury Lab. Showed that resistance to PVX produced was due to an RNA mediated mechanism in which the target viral RNA was specifically degraded. Similar parameters were used for RYMV resistance were used from the example produced in the Sainsbury Lab for PVX.

The demand for RYMV resistant rice varieties was identified through literature reviews of WARDA and IITA Annual Reports, international journal articles and direct dialogue between staff at WARDA and IITA.

Project Purpose
The project purpose was to assist the West African Rice Development Association to develop cultivated rice varieties with resistance to RYMV.

Research Activities
The research activities can be found in the attached publication. The descriptions are very detailed and an indication of the contribution of these activities to the overall aims of the project are indicated. Much additional support was provided by DFID and the Gatsby Charitable Foundation. This support was made available through three main activities: Firstly the Gatsby Foundation committed funds to the planning and building of a containment screenhouse at WARDA for the testing of the transgenic material produced. This would allow technology to be transferred directly to WARDA and allowed the construction of adequate facilities to house the material. Secondly, the Gatsby Charitable Foundation and the DFID committed funds to allow scientists from the Ivory Coast and Ghana and Nigeria respectively to visit the South African biosafety committed and learn how the facility was set up and how its running objectives are attained. And finally, DFID commissioned a socio-economic study in East and West Africa which identified the best pathways for technology transfer and how these could be achieved. The last activity identified activities one and two that were then implemented as a result.

Whilst the initial project also attempted to produce a clone of the virus driving a reporter as a tool to illustrate virus multiplication in susceptible hosts, this component has not been achieved due to recurring difficulties with recombination of the cDNA clones and resulting in non-functional viral clones. The precise reason for this lack of success is not well understood.

Outputs
Pleae refer to the publications for the details of the outputs and all the presentation of the data, graphically and through illustrated photographs.

Contribution of Outputs
The first transgenic lines (Bouake 1890) are currently ready for testing under African conditions in a controlled screenhouse at WARDA. Subsequent testing is likely to take 3 years before the earliest possible use of the transgenic plants in Agriculture. These lines will also be evaluated for their agronomic performance and if suitable, will be crossed to transfer the resistance to other desirable cultivars (with RYMV susceptible varieties Africawide).

A continuation of the project R7415 has outlines the importance of combining the resistance from interspecific introgression lines with the transgenic resistance and this component to exploit any nematode resistance in these interspecifics is also part of the new project.

The market studies for outputs will be the responsibility of WARDA - who have a technology transfer mandate for the region. The Cote d'Ivoire Biosafety Working Group will be involved in grating any permission for contained tests of transgenics to be undertaken and have as a component of their remit, provision to address public perception of transgenic technology and public awareness campaigns.

By making the material produced available to WARDA, this material will be included in varietal development programmes and advanced varietal testing programmes for varietal release. WARDA is the primary organization ensuring that the outputs of the project are successfully transferred to

beneficiaries. WARDA has excellent links with international CGIAR centres, research institutions as well as NARS and NGOs and excellent support for member countries.

In the future WARDAs link with NARS will be essential in transferring locally adapted transgenic RYMV resistant varieties to farmers. WARDA currently has programmes aimed at strengthening West African NARs and NGOs through training, policy advice, and communication activities. Their focus will be the participatory schemes such as participatory varietal selection. There will also be specific project components covering women and the uptake of rice technology. Farmers will be able to examine the benefits of the technology themselves through these participatory schemes.

The cost of further stages including those for varietal development will be WARDAs responsibility.