Case Study No. 1

Good practice in well-linked studies using several methodologies

Crop Protection Programme funded project titled *The epidemiology and management of rice tungro virus disease in relation to the ecology of the leafhopper vectors,* led by Dr Tim Chancellor, Natural Resources Institute.

1. Background

The purpose of the project was to increase and stabilise rice yields in intensive cropping systems in India and the Philippines, by developing and promoting sustainable strategies to manage rice tungro virus disease (RTVD), a disease occurring in major epidemics and causing severe yield losses.

The specific expected outputs were: (i) RTVD management recommendations developed and adapted for differing agroecological and socio-economic conditions in accordance with disease risk for two target countries, i.e. India and the Philippines; (ii) Rice varieties and advanced breeding lines evaluated for resistance to leafhopper vectors and to tungro viruses at two locations in each of three countries (India, Indonesia and Philippines); (iii) Extension methodologies developed to enable farmers to identify RTVD symptoms and leafhopper vectors, to gain a basic understanding of the operation of the disease cycle and to utilise appropriate control measures such as resistant varieties.

To achieve the research objectives, the following methodologies were used within the project activities.

(a) Survey Methods:

Surveys were used to characterise proposed sites in which RTVD strategies were to be developed, adapted and evaluated. Survey instruments included rapid rural appraisals as well as structured questionnaires to identify farmers' perceptions of RTVD, their existing cropping and pest management practices and potential constraints to the introduction of recommended disease control methods.

(b) Mathematical Modelling:

A mathematical model was developed of the dynamics of the disease within a spatially referenced lattice of fields of a host crop e.g. rice. The aim was to develop an understanding of the potential impact of changes in cropping synchrony on RTVD.

(c) On-farm trials:

On-farm tungro management trials were conducted in the Philippines and in India to (a) evaluate the performance of promising tungro-resistant advanced breeding lines under farmer field conditions and (b) as part of a training programme to promote the use of resistant varieties as one component of a tungro management strategy.

(d) Controlled experiments:

Greenhouse experiments, where test entry lines were inoculated by the test tube inoculation method, led to the selection of a number of promising lines. Field evaluation of these lines was conducted in a tungro "hot spot" in an area in the Philippines. The most promising lines from the crosses in these trials were selected for further evaluation in replicated field trials on experimental farms in areas with reported high tungro disease incidence in the Philippines, Indonesia and India.

2. Good biometric/computing practices

2.1 Integration of approaches

A positive aspect of the project was the selection of a wide variety of approaches to fulfil the research objectives. This had been done with considerable care, with due thought being given to the way in which results from the different studies could be linked. For example, the use of formal survey work and participatory activities were useful in decisions concerning the modelling process. The controlled studies on the experimental farms in the Philippines, India and Indonesia, identified promising lines that could then be further tested under farmer field conditions, as well as be used in demonstration plots to show neighbouring farmers the beneficial effects of resistant varieties. The modelling work was complementary to the field trials and showed the influence of variability in planting dates on disease endemicity.

Point No. 1: Ensure multiple studies activities link appropriately to achieve project outcomes.

2.2 Survey methods and analysis

The aims of the survey component within this project are outlined in section 1.2(a) above. Two areas were under study, one each in India and the Philippines. Each consisted of 20-30 villages. Focus group and semi-structured interviews had been held in a sample of 6 villages in Chengalpattu District, Tamil Nadu, India and 9 villages in Midsayap, North Cotabato, Mindanao, in the Philippines.

A series of structured questionnaire surveys had been conducted with 90 farmers selected randomly from 2 villages in Tamil Nadu and 226 farmers selected from 9 villages in Mindanao. The first of these surveys was a baseline study to determine farming practices, pest and disease problems, knowledge and management of tungro disease. There were then follow-up surveys to record farming practices for several seasons after the baseline survey. The number of farmers included in these surveys is adequate, particularly in the Philippines, to give generalisable conclusions in the project areas. The method of sampling farmers within villages has been random. In hindsight, the project leader felt that management of irrigation systems more effectively was an important issue and that a stratification of farmers with respect to different types of irrigation systems may have led to further useful results.

Point No. 2: Ensure sampling is adequate to generalise survey results to the target population.

Point No. 3: It is possible to post-stratifying the data according to factors seen later as important.

The manuscript reporting the survey results was well written. The data analysis work presented was largely in the form of summary tables. These were well presented. Where percentages were reported, the denominator used had been specified. Where relevant, the table indicated that multiple responses were possible. As with many research studies, more information could have been extracted from the data. However, the simple analysis in the form of tabular presentations, was sufficient here to meet the survey objectives. One small improvement would have been to give 95% confidence limits for reported estimates of percentage figures.

Point No. 4: When tabulating survey data, ensure denominator is made clear for all percentage values present. Give a measure of precision, such as 95% confidence limits, for key estimates.

2.3 Mathematical Modelling

The appropriate use of a modelling approach is particularly useful for tasks where the objectives are difficult to realise by other means. In this project use of asynchronous planting with rice always in the vicinity, was thought to pose a problem for tungro management. Investigating the benefits of synchronous planting via field trials is clearly very time consuming and has resource implications, so the project adopted a modelling approach to investigate this aspect. This is clearly a useful approach with the research being published in *Plant Pathology*. The modelling work was a key component of the project activities and appears to have been used appropriately and effectively.

Point No. 5: Consider modelling techniques particularly for objectives that are difficult to achieve by other means.

2.4 Project Data Management

The data management aspects of the project were impressive. The raw data had been entered on Excel workbooks for immediate access and use by the researchers, manual checks done to ensure data had been accurately entered and copies of all data files left with the collaborators in India and the Philippines. We were also impressed at the use of the system developed at IRRI for archiving all information concerning project activities. This included not just the raw numerical data, but also the meta-data, i.e. information relating to project objectives, trial design, etc. We note that IRRI's archiving system, while most important, is purely for data archiving, rather than serving also as a data management system.

Point No. 6: Have a data management strategy before project activities commence. Ensure all data, including meta data are archived and hence accessible to other users.

3. Lessons to be learnt

On-farm trials were conducted on 3 farms in North Cotabato and three in Tamil Nadu. These trials were repeated over a number of seasons. Two promising varieties were grown in each farm, together with a variety chosen by the farmer, in a randomised complete block design with three replicates. The project leader realised in hindsight that the selection of plots and farms for the trial could have been improved and raised the question of whether there should be more blocks (replications) or more farmers. Some relevant biometric points arose as a result.

To satisfy the objective that the trials were used "as part of a training programme to promote use of resistant varieties" the use of results from 3 farmers is reasonable. Other farmers in the area can be brought in to view the trials and observe the beneficial effects of the resistant varieties in the different seasons. Plots within each farm are *demonstration* plots. More replicates in different parts of the farm would only serve to provide evidence of the superiority of new varieties over the farmers' own variety. Additional replicates within each farm would also allow statistical analyses to be conducted to demonstrate that observed differences are real *within that farm* and not a chance occurrence.

In terms of the second objective, i.e. evaluating the performance of promising resistant breeding lines under farmer field conditions, the number of participating farmers is considerably less than adequate. If the aim is to provide evidence that would allow promising lines to be recommended across farms in the study area, then an adequate representation of farmers is needed. One main benefit is that this would allow a study of the variety × farmer interaction, i.e. whether variety differences vary in their magnitude across different farms. If they do, then factors influencing such differences need to be identified. Farms stratified by these factors will then give rise to different recommendation domains. This type of investigation is not possible without a much larger number of farmers participating in the trial.

Difficulties arose here because of conflicting objectives within a single study. To promote adoption of promising varieties, a couple of farmers growing the promising varieties alongside their own variety in *demonstration* plots is sufficient within each locality. However, to evaluate the promising varieties compared to farmers' varieties within the target area requires more farmers.

Point No. 7: Check that a single study does not have conflicting objectives. If this is the case, then consider using two or more studies.

4. Concluding remarks

We were very impressed by the efforts of the Project leader and collaborators associated with Project R6519. They are to be praised for their conduct of a complex series of studies, well linked together, to produce outputs that fulfil the stated research objectives. The approaches to data collection activities and analysis methodologies were sensible. Some suggestions for minor improvements have been provided within this review.

A noteworthy aspect of the project was the strategy used for computering the data and for archiving all meta data associated with the project. This has been possible through involvement with a reputed CGIAR Institute, i.e. IRRI, whose Biometrics and Data Processing Unit is well-established.

Our impression was that a component of the overall success of the project can also be attributed to a TC Team Leader being based full-time at IRRI and a full time researcher being employed by the project at Tamil Nadu Agricultural University, as well as close collaboration between staff working on the project.

5. Acknowledgement

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