Case Study No. 3

Good practice in on-farm studies

We report here on good biometric practices and lessons learnt from two projects working in close collaboration, i.e. the Natural Resources Systems Programme Project R6382 led by Barry Pound, NRI, titled *Sustainable Agriculture in Forest Margins* and the Crop Protection Programme funded project R6008 led by Morag Webb, NRI, titled *Weed Management for Sustainable Agriculture in Forest Margins.*

1. Background

The combined central aim of the two projects was to generate and validate cropping systems which maintain or enhance soil fertility, suppress weeds and diversify farm incomes.

There were three principal research objectives:
(a) to evaluate the performance of novel crops and systems under local conditions;
(b) to monitor their adoption and to study how farmers manage and modify the systems according to their own conditions, needs and experiences; and
(c) to adopt and adapt farmer participatory research methodologies within the local research environment.

To achieve these objectives, the projects used (i) on-farm validation plots; (ii) researcher-managed trials; and (iii) complementary studies. Here we report on good biometric/computing practices and lessons learnt from the first two of these.

The on-farm trials included over 180 validation plots established in more than 70 communities. The trials were very simple comparisons of farmer practice with one or more modified 'agro-ecological systems'. Thus each farm included one, two or three sub-plots, allowing farmers and technicians to assess the advantages and disadvantages of the novel components, and the way in which they interacted biologically and economically within the farming system.

The on-farmer-managed farm trials were supplemented by five researcher-managed on-farm trials. These attempted to generate technologies that could then feed back into the validation process. The researcher-managed trials were mostly conducted on farmers fields and evaluated by conventional data collection procedures and methods of analysis. The results were supplemented in some cases by visiting panels of "expert" farmers, whose comments were recorded and incorporated into the evaluation. The trials yielded both quantitative and qualitative information.

The following methodologies were used included within these activities.

(a) Participatory workshops, in which farmers evaluated the component technologies and systems using qualitative and subjective assessments.

(b) Field days, in which farmers presented their trials to neighbours and technicians.

(c) A survey of farmers during the growing season to elicit farmers' spontaneous comments and their answers to direct questions.

(d) A final survey of the majority of collaborating farmers to identify changes in management of the plots and reasons for such changes. A second objective was to determine the extent to which farmers had adopted or expressed willingness to adopt the technologies and systems under evaluation.

(e) Case studies of collaborating farming families to determine how relevant the research had been to the livelihood priorities of these families.

2. Good biometric practices

2.1 Objectives achieved using on-farm validation plots

The use of the term “validation plots” is likely to have stemmed from traditional experience of validating, technologies found promising in on-station trials, on farmers’ fields. In this study, it was not the ideal descriptor of the purpose behind establishing these plots. Each farmer volunteered to have a small area where new cropping systems (technologies) were to be tried out. These were researcher recommended options but the farmer was allowed to modify the technologies once they were established in his/her field. This amounted to a small experiment without replications run by each farmer.

These types of experiments appropriate, not only for rapidly screening a great many options, but also for monitoring the evolution process that results from adapting the technology to local conditions. The best options in this process of selection are likely to be adopted by the farmer-experimenter and by those farmers who witness the success of the technology. On a local scale the project can be regarded as very successful in its rapid screening of a large number of novel cropping systems, in monitoring and evaluating farmer adaptation and adoption and in promoting dissemination.

The research team recognised that the design of the “validation plots” study was inappropriate for obtaining information which could be used to assess the replicability of the findings or their transferability to other locations. Generalisability of results requires replication of defined technologies across an adequate number of farmers and also the estimation of the precision of some indicator of success for the technologies across different farming environments. This led to some researcher-managed on-farm trials for some of the technologies selected by the farmers for further experimentation (see section 2.2).

Given the conditions under which the research was carried out, replicability of the findings from the on-farm validation plots was recognised as having to take lower priority. The more important objective of trying out technologies and studying farmers’ adaptation of these was achieved with great success. Over 80 communities participated and benefited from project activities at a local level. Furthermore, the integration of results and experiences at validation plot level was possible when the team looked at the patterns of preference for crops, combinations of crops, types of changes and adaptations made to the cropping systems and the intention of adoption of technology. The information came from semi-structured interviews and spontaneous comments expressed by farmers. Through a system of synthesis and coding of responses, the results were processed using the statistics package SPSS.

Point No. 1 When several objectives are present, recognise that some may be conflicting and that a single study may not be able to achieve all objectives with the same degree of success.

Point No. 2 If a large number of technologies are being investigated, with farmers given full freedom to try out one or two of their own selections for adoptation and adaptation, recognise that this will be very beneficial at a local level but will not enable replicability or transferability of findings to other locations unless several farmers with similar farming environments and practices test out overlapping subsets (2 or more) of the same set of technologies.

2.2 Complementarity between conventional research and participatory methods

The research team managed to encapsulate the complimentarity between conventional research and participatory methods in their Final Technical Report:

"Once the validation trials were in progress, it became evident that some topics could be studied more efficiently in formal trials. For example, testing by farmers of the rice-*Calopogonium* intercrop indicated that simultaneous sowing was not successful. To rapidly establish the best sowing date and density of *Calopogonium* in different rice varieties, controlled conditions were required and this could best be achieved in researcher managed trials. The suggestions of farmers who had tested the intercrop were incorporated into a formal trial, and the farmers continued to play a part in the evaluation of the results.

There is pressure, particularly from donor agencies, for researchers working with resource poor farmers to adopt a participatory approach. One of the valuable lessons learned by this project was that the research method must be tailored to the research objectives; farmer participatory research is not always the most appropriate and not always sufficient on its own. The project also demonstrated how formal research and farmer participatory research can be successfully married in a single programme."

This is a good example of the integration of methodologies within the research project and reflects the ability of the research team to adapt and choose methods on the basis of the research objectives.

Point No. 3: Tailor the research methods to the research objectives. For example, integrating participatory research activities with researcher-designed and managed on-farm trials can usefully enhance fulfilment of research objectives.

2.3 Need for biometric support

The researcher designed and managed on-farm trials generated data that were expected to lead to standard methods of analysis since most were established, effectively and efficiently, by the research team, as randomised complete block designs. However, missing data and the need to integrate a variety of quantitative and qualitative pieces of information required assistance from professional biometricians.

Point No. 4: The project's ability to include biometrics support was due to the inclusion, in the project proposal, of a budget item to pay for such services. The message for those writing project proposals is that in the absence statistical expertise within the project team, statistical support should be seen as another type of specialised services that may be required to give the necessary support at the study design and data analysis phases. Ideally this support should be provided locally.

3. Lessons learnt

As with many research projects, the follow up and systematisation of information from over 180 validation plots made data management a task for which the research team was initially unprepared. This was partly because of:

- Lack of experience with the implementation of the adopted methodology. The final joint report points out that "at the planning stage, few relevant guidelines on the implementation of on-farm experimentation were available".

- Conflicting objectives set up for the validation plots (see section 2.1 above); and

- Lack of initial awareness of how the information was to be computerised, analysed and presented to the different audiences. This is again a common occurrence within many research projects.

We describe here the attempts made by the research team to organise the data. Some of the difficulties that arose and lessons that can be learnt from their experiences are highlighted below.

⇒ First, a local consultant was contracted. He set up a collection of Excel files to record economic and agronomic data from each plot with the inevitable result of hundreds of files that were not linked. This did little to mitigate the problem but it must be noted that the responsibility for this data management strategy was shared by both the local team and the UK advisers. Lack of clarity about the intended uses of the information and lack of experience with data management hindered the researchers ability to define the type of data management strategy to be developed by the external consultant.

⇒ The problems concerning the data were sufficiently severe that the research team were finally compelled to re-enter the agronomic data in a different format that allowed integration of results across validation plots and subsequent statistical analysis. A clearer definition of the intended use of the information allowed the UK statisticians who were involved to organise the data in an efficient and appropriate manner. This enabled much of the agronomic information to be analysed. The statistics package Genstat was used.

Difficulties were also encountered in the use of the economic data (mainly labour and input costs) because of the inaccuracy with which it was collected. The final project report points out that:

"The information generated did not prove appropriate for this type of analysis (economic analyses to provide gross margins) due to a combination of factors. This included the difficulty experienced by farmers in providing accurate estimates of labour inputs, the inaccuracy of extrapolating labour data from very small plots and the long term nature of the perennial systems".

Unreliability of the data and limitations in the storage strategy were seen only after the project was well advanced. It is a common practice among researchers to collect data for long periods and only when the "data collection phase" has finished, to move on to an "analysis phase". An important lesson to be learnt from this experience is that even if the researcher is unaware of methodological and data management problems during data collection, these will arise during the analysis phase. Keeping in mind the points highlighted below will enable these problems to be detected early in the life cycle of the project.

Point No. 5: Run pilot tests of the methodology that include not only testing the questionnaire or research instruments but proceeding further into data management, storage and analysis.

Point No. 6: Do not leave the data to be analysed until "all the data" have been collected.

Point No. 7: A noteworthy aspect of this project is the recognition, by the research team, that they did not have the experience required to deal with the complex task of data management and analysis. This was particularly true for the local research team. Input from two biometricians allowed the research team to make best use of the information collected.

4. Concluding remarks

The project started when there was little debate about the value if integrating participatory activities and formal research methods. As a consequence the project evolved and learnt with the debate and was able, with different levels of success, to adapt methodologies to achieve their objectives.

Probably the main two difficulties encountered were

- conflicting objectives defined for the validation plots; and
- the complexity of the information management task.

In both areas sensible compromises were eventually achieved, though with some loss in the efficiency of the use of resources. A planned strategy for data management and data analysis work at the commencement of project activities would have avoided these problems.

An excellent discussion, by the research team, of the methodology and lessons learnt in the execution of this project is in the "Final Joint Technical Report" of the two projects published by NRI.

5. Acknowledgements

We are very grateful to the two project leaders who have given us permission to use the experiences from their combined projects to highlight a number of valuable points in relation to biometric and computing issues. Their comments on the initial draft of this document are also much appreciated.