Case Study No. 4

Good practice in researcher and farmer experimentation

Natural Resources Systems Programme funded project titled *Conservation Tillage Management for Marginal Smallholder Farm Systems in Zimbabwe*, led by Dr. S.J. Twomlow, Silsoe Research Institute.

1. Background

This project undertook participatory on-farm evaluation of conservation tillage, crop establishment and complimentary weed management systems that had previously been investigated through a series of researcher managed on-station trials.

The expected outputs were as follows:

(i) The technical and socio-economic potential for improved conservation tillage, crop establishment and weed management packages assessed;
(ii) Participatory evaluation of appropriate conservation tillage, crop establishment and weed control options developed and promoted in semi-arid savannah cropping systems;
(iii) Soil-water regimes that develop under the different management practices described and made available for use in a soil-water model;
(iv) Costed options for each tillage/crop establishment/week control technique promoted.

The project was planned in two phases. This case study refers just to Phase II with the Agronomy Institute of the Department of Research and Specialist Services and the Department of Agricultural, Technical and Extension Services (April 1995 – Sept. 1998). The objectives were as follows:

- To identify which conservation tillage and weeding systems were technically sound, sustainable, acceptable and adoptable by farmers in semi-arid regions of Zimbabwe.

- To develop farmer managed field trials to allow comparisons and farmer evaluation between farmer selected technologies and their existing practices.

2. Brief description of research methods used

2.1 Researcher-designed on-farm trials

Four tillage management practices and four weed management practices were investigated in experiments carried out with 16 farmers. Eight of these farmers came from Zimuto and eight from Mshagashe. All 16 treatment combinations were included in each of two blocks within each farm and a number of measurements taken on each plot. The experimental design was a split-plot design with the tillage treatment factor on the main plots (each main plot made up of 4 sub-plots) and the weeding treatment factor on split (sub) plots.

2.2 Farmer Experimentation and evaluation of crop establishment and weeding techniques

The farmer experimentation programme involved identifying 100 farmers to participate in the research, briefing farmers, encouraging and facilitating their involvement in the testing, implementing the participatory farmer research programme, provision of support to farmers during the season, co-ordinating farmer monitoring activities via participatory partial

budgeting, and obtaining farmers' evaluation of crop establishment and weeding technologies at the end of the season.

3. Good biometric/computing practices

3.1 In the researcher-designed on-farm trials, the use of a split-plot design rather than a full randomisation of all 16 factorial combinations (i.e. two factors, each at four levels) was useful in reducing the chance of an incorrect allocation by farmers of treatments to plots. Thus farmers applied the tillage treatment factor to strips of land (the main-plots) which included four sub-plots (the split-plots) for each of the different weeding techniques.

Point No. 1: When the research involves different crop management practices, use a design that may be implemented easily by the farmer, but ensuring that the results can still be subjected to a valid statistical analysis.

The data analysis took account of the two levels of variation involved, i.e. the variation between main-plots (within blocks in a farm) and variation between split-plots (within main-plot). Since the tillage treatment factor was applied at the main-plot level, the subsequent application of an analysis of variance procedure involved using the main-plot variation to test for significance of differences between the tillage treatments. Since the weeding techniques were applied at the split-plot level, comparisons between the weeding techniques were made relative to the split-plot variation.

Point No. 2: Recognise different levels of variation if one treatment factor is applied to sub-plots within larger plots containing a second treatment factor. The corresponding analysis (appropriate for a split-unit design), involving two residual (error) sources of variation, must be used and each treatment factor tested against the appropriate residual variation.

3.2 This project has been unusual in having more replication than is typical in on-farm experiments. There were results from 32 plots in each farm (2 blocks $\times$ 4 tillage methods $\times$ 4 weeding techniques). There were 16 farmers involved in the study. Hence results from each farm could be analysed individually (albeit with less precision on the tillage treatments). Conducting a full experiment in each farm enabled each farmer to observe and compare the effects of the tillage and weeding techniques in each of two replicates.

The results were also combined across the 16 farms to study the overall effect of the tillage and weeding techniques and the treatment by farmer interaction. The latter was particularly important in dividing the farmers into different recommendation domains.

Point No. 3: When crop management or other practices are being explored on-farm, they can serve as demonstration plots to other neighbouring farmers, as well as provide the means to carry out a combined analysis across all farms. The latter will enable the treatment by farm interaction to be explored, i.e. is the same practice the "best" over all farms or not? If there is no single "best" practice, then reasons for this must be explored, and recommendations made for different groups (recommendation domains) of farmers.

3.3 The farmer experimentation programme, carried out in the final year of the project, was aimed at targetting 100 farmers of all wealth categories in Zimuto and Mshagashe. Experimentation Guidelines for farmer use were discussed and clarified with farmer experimentation. These guidelines were well written and are reproduced in an appendix (with permission from the UK project leader) with only the very minor formatting modifications. This forms a good example of a protocol for use by literate farmers, or as a guidance document for use by Extension Officers. Not only does it describe the activities involved, it also presents the interview schedule to be used later to obtain farmers' evaluations.

Point No. 4: In a farmer experimentation programme, plan and document the activities involved in consultation with the farmers. This helps farmers to clarify what they are aiming at, and helps the researcher to clarify what information is to be subsequently collected and analysed.

4. Concluding remarks

In this project, the local cooperation has been substantial and excellent as seen from project documents. It was clear that every effort had been made by the project team to document the discussions held at various planning meetings, their plans for the implementation of each research activity, the findings from farmer group discussions and visit reports by UK collaborators. The project had considerable inputs from a statistician at Silsoe Research Institute, as well as a local biometrician in Zimbabwe.

5. Acknowledgements

We are grateful to the project leader for supplying us with a number of reports which have largely formed the basis for this case study. We are also grateful for his comments on an initial draft of this report.

Appendix

Guidelines for farmer experimentation

Aim: To give guidelines on experimentation for a farmer to see whether a new technique he/she tries out successfully in his/her farm is better or worse than his/her normal practice.

How to Compare?

An easy way to compare a new technique with the usual practice is putting the two side by side in the same field. If possible divide the field exactly in the middle along the contour so that both sides are approximately of an equal size, as in the diagram:

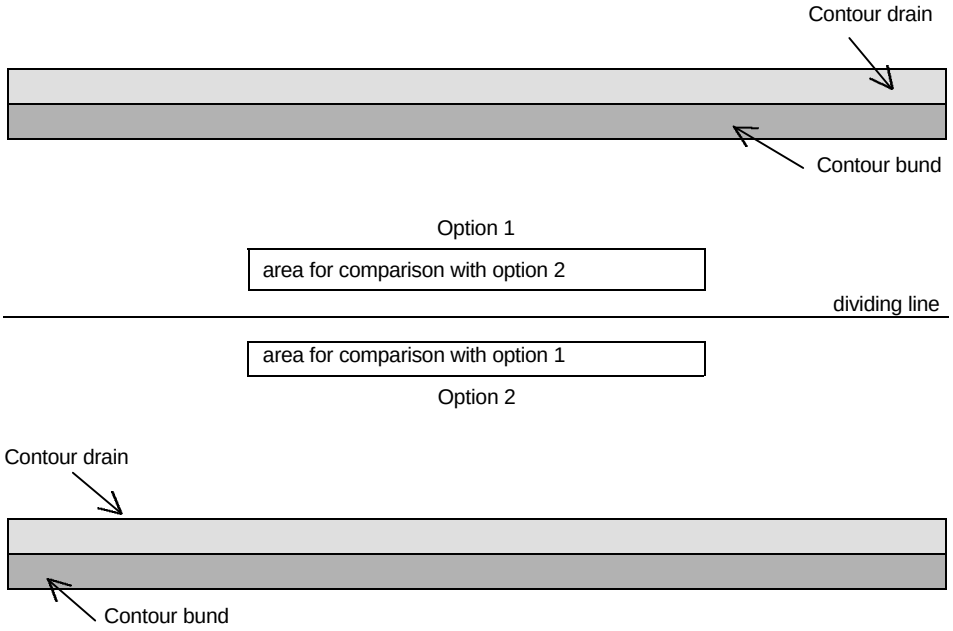

Figure 1. Possible field layout to compare two different crop husbandry practices

It is very important to put the two techniques in one single field because the soils and drainage in one field are more likely to be the same than in different fields. However, when selecting the field with farmer, take care that the two sides of the field are not too different. For example, if one side is a wetland and the upper slope is dry, you cannot compare two. The same rules apply if one side of the field is badly eroded.

To make good comparisons many other conditions have to be similar on both sides of the field, for example planting date, fertiliser rate, seed rate (unless you are comparing planting densities), weeding (unless you are comparing weeding techniques) etc. Treatment comparisons should only be made near the dividing strip where both treatments are close to each other.

What else to consider when experimenting with farmers?

- If you do not know how the technique will perform beforehand, try it out on a small piece of land, then there will be less risk in the case of failure. And, trying always can result in success but also in failure.

- Use the same seed and the same spacing on both sides (unless you want to compare varieties and spacings).

- Plant the experiment on the same day on both sides of the field to ensure that plants on both sides have the same rainfall.

- Put the same amount of fertiliser or manure on both sides, unless you want to see how plants grow with different amounts of fertiliser or manure.

- Do the same weeding on the same day on both sides unless you want to observe the effect of different types or times of weeding.

TRIAL RECORD SHEET/TECHNOLOGY SHEET
Name of Farmer: …….
Name of Trial: …….
Field No. ……..Soil Type: ……..

What did you do?	**New Practice**	**Usual Practice**
• What did you want to learn?		
• What did you try out		
• How did you lay out the field? (marking plots, plot size and shape, etc.)		
• When did you plant?		
• What spacing did you use for the crop?		
• Did you plant the same day?		
• Which variety?		
• When and how did you use fertiliser?		
• Did you use the same amount of fertiliser?		

What differences did you observe? (State whether new technology was better/worse, larger/smaller, less/more compared to own practice)

• Plant height?	
• Vegetative development?	
• Flowering (earlier/later)?	
• Weed growth?	
• Soil erosion (rills/sheet erosion)?	
• Earlier or later maturing?	
• Size of cobs?	
• Size of grains?	
• Total yields (provided the two sides of the field are uniform and have the same size)?	
• Labour: which side required more work and why?	
• Draught Power: which side needed more animal draught power?	
• What other things did you observe?	

What lessons do you draw from your results?

• What are the advantages of the new practice?	
• What are the disadvantages of the new practice?	
• What would you do differently next year?	