Scaling Up Through Participatory Trial Designs

Researchers, community activists, field workers and farm advisors are charged to work with many stakeholders and develop technologies that have widespread relevance. There are a number of successful approaches to this, from participatory breeding programs to farmer field schools. Many of these approaches involve experimentation, either through fostering learning and testing of technologies by farmers, or more formal trials for large-scale testing.

Participatory methods can be linked with trial designs to involve farmers and rural stakeholders in defining experimentation objectives and assessment of technology performance. Conducting surveys in conjunction with trials is one important tool that helps document farmer preferences and evaluation of the process, and of the technologies or varieties being tested. Detailed guides are available presenting information on how to carry out on-farm trials and complementary surveys (see for example, Mutsaers, *et al.*, 1997).

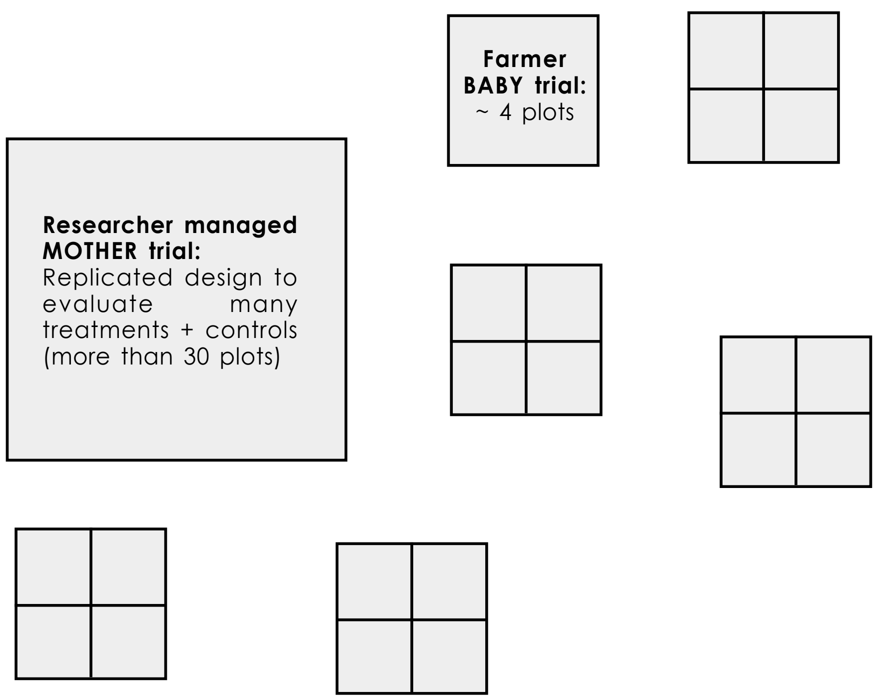
Trial Designs

Large-scale trial programs, with hundreds of on-farm sites, are often advocated for testing new varieties or soil enhancing technologies across an entire region. At each site a farmer compares a selected number of 'best bet' technologies (or varieties) to a local control. There is no replication at that site, but through the use of multiple sites the comparison is replicated many times over the landscape. This approach takes advantage of variation in environment and management from farm to farm. Statistical approaches such as adaptability analysis rely on this variation to test technology or variety adaptation to different levels of stress and environmental conditions (Hildebrand and Russell, 1996).

Another approach is to work at a fewer number of sites and involve large groups visiting these selected sites, to help in the evaluation process. The selected sites can be located on farmers' fields or at research stations. This intensive type of 'replicated within a site' approach frequently involves expert farmer panels (Sperling, *et al.*, 1993). Certain types of research on biological soil processes or participatory plant breeding selection from a large number of genotypes may require some degree of within site replication and the intensive, uniform management possible at a limited number of sites.

A third approach links the two trial designs together. The 'mother-baby' trial design methodically links 'replicated within a site' researcher-led mother trials with 'one site, one replica' farmer-led trials (Figure 1). A mother trial is centrally located in a village or at a nearby research station, and replicated at the site. Baby trials are located on farmer fields, where each site is a replicate, comparing a sub-set of technologies or varieties.

Figure 1. Mother - Baby Trial Design Layout



The 'within site replicated' mother trials are conducted at central locations (on research stations, near schools or community centers) and compare a large number of technologies, such as different varieties grown at low and high fertility levels. On-farm baby trials compare a sub-set of the technologies, frequently those chosen by the farmer implementing the baby trial (Snapp, *et al.,* 2002). Participatory plant breeders have implemented mother and baby trials in a systematic manner using an incomplete block design to make sure all varieties are represented in an equal manner across the landscape (Witcombe, *et al.,* 2002).

For all types of trials, whether replicated within or across sites, there can be a continuum of participation. Trials can be led by farmers, conducted jointly by farmers and researchers or led by researchers with farmers acting as advisors. The extent of local involvement in trial design and implementation depends on the objectives of the endeavor. Experience and outcomes vary, depending on the level of engagement by farmers and other stakeholders. These experiences and outcomes are summarized as follows:

- Where farmers lead, greater local empowerment results (Snapp, *et al.*, 2003). Researchers can learn a great deal about farmer decision-making by documenting what is locally chosen as experimental priorities, where trials are located, and farmer perceptions of lessons learned. Observing farmer practice and changes in practice over the experimentation period is one of the most valuable (and often overlooked) opportunities for researchers to learn.

- Joint planning and carrying out trials is a valuable learning process, which can meet joint objectives of local learning and scientific findings. It requires considerable communication investment in building the trust necessary to negotiate mutual objectives.

- Researcher-led trials are particularly useful if a primary objective is to derive knowledge about biological processes and extrapolate from local findings. Participatory plant breeding and selection processes usually depend on researcher-led trials (Witcombe, *et al.,* 2002).

Participatory Trial Design as a Process

Investment of education, time and commitment to a joint process is essential on the part of all parties, in order to successfully carry out participatory trials. Whether farmers or researchers are the lead actors in the experimentation processes, attention to developing an iterative process is vital, to 'build-in' feedback and communication at each step. An example in presented in Table 1, from experiences in Malawi conducting mother and baby trials in partnerships with farmers to develop improved soil fertility technologies (Snapp, *et al.,* 2002). Note that frequent meetings were held with countrywide partners, and with local communities.

Surveys are important tools that have to be integrated throughout the process. Semi-formal interviews are also valuable, where diverse stakeholders and trial participants are asked open-ended questions. Responses to open-ended questions often provide new insights. This type of qualitative data can be statistically evaluated by determining the major categories represented by the answers, then calculating the percentage of responses per category.

Table 1. Sequence of Events to Initiate and Carry Out Trials Through a Participatory Iterative Process

	Months 1-3	Month 4-6	Months 7-9	Months 10-12
Year 1	❑ Literature review and stakeholder analysis	❑ First meeting with government and NGO stakeholders, ❑ Survey sites	❑ Choose representative sites and characterize sites ❑ Introduction to communities	❑ Visioning exercises with communities; ❑ Evaluate opportunities and constraints, ❑ Negotiate trial objectives
Year 2	❑ Intial, large-scale survey carried out across all sites: people, soils, agro-ecosystems	❑ Communities and local institutions review technology options with researchers, design trials	❑ Second meeting with government and NGO stakeholders ❑ Review trial objectives ❑ Initiate trials	❑ Conduct evaluation with farmers (surveys) ❑ Farmer to farmer field days and farm visits with stakeholders ❑ Researchers evaluate data across sites
Year 3	❑ Researchers report to communities initial trial finding ❑ Document farmer evaluation	❑ Third meeting with government and NGO stakeholders ❑ Review findings ❑ Plan ongoing activities	❑ Trials continue, new ones may be initiated based on farmer interest	❑ Conduct evaluation with farmers (short surveys) ❑ Farmer to farmer field days and farm visits with stakeholders ❑ Researchers evaluate data across sites
Year 4	❑ Researchers report to local and larger	❑ Second large-scale survey conducted on adoption, farmer perceptions, soils	❑ Researchers summarize results, in terms of farmer perceptions and biological performance, soils	❑ Fourth meeting with countrywide stakeholders, policymakers, farmer representatives ❑ Planning new directions

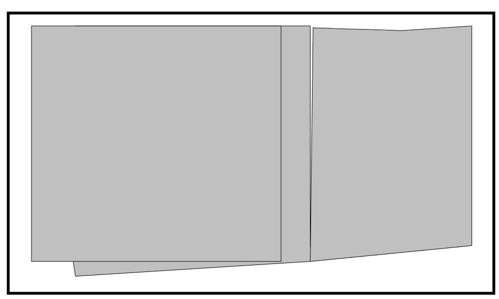
In Malawi, short surveys were conducted to document farmer preferences, and detailed baseline characterization. Information about the farm wealth status and reliance on crop sales for income, and other demographic characteristics of the farmer was gathered. Farmer preference data could thus be put in a socio-economic perspective. It is important to be able to make inferences about how labor availability, income sources and farm market goals influence assessment of technologies. There are guides now available that provide statistical advice for preference ranking of technologies (Bellon and Reeves, 2002).

Choosing representative sites, and conducting in-depth characterization, are crucial to the scaling up process (Snapp and Heong, 2003). Then, analyses can be conducted across trial sites to determine the potential for wider-scale adoption of a technology. As shown in Table 1, the Malawi experience involved agroecosystem characterization of case study sites where mother and baby trials were carried out with farmers. Local data was collected on rainfall patterns and soil types, along with consulting government databases. Socio-economic characteristics were documented, such as infrastructure, market access and demographics. Conducting stakeholder analysis and local visioning exercises provided insights into history and goals of different groups in each area where we worked intensively.

In working with different organizations across Malawi, we found that the same trial design could be implemented in different ways, depending on local partners. All the partners were interested in increasing farmer participation, but levels of farmer involvement varied from site to site (Snapp, *et al.,* 2003). The institutional organization and goals of partners at each site made a difference. We worked with a wide range of non-governmental organizations (NGOs), private industry, university and government partners. At some sites, particularly at sites where NGOs took the lead, farmers were lead actors. Farmers designed the comparisons, selected the types of technologies and varieties to compare and lay out the trials. Researchers and crop advisors (from NGOs and from government extension) acted as catalysts and information sources. Farmers were the lead.

In Figure 2 where farmer-led trial plots are represented, note that comparisons of technologies tend to be simple (1 or 2 technologies compared to a current system), involve large portions of a field and may be irregular in shape. The larger area involved allows farmers to fully judge the labor involved and scope of the potential benefits of a technology, as a realistic portion of the farm is represented.

Figure 2. Farmer-Led Trials
This frequently involves NGO or other farm advisors, large plots laid out informally and frequently simple, paired comparisons of a new option and current farmer practice.



At other sites, a joint effort was achieved by farmers and researchers working together. In Figure 3, cooperative trials are shown, which tended to involve slightly more complex comparisons, and necessarily, smaller plots. Finally, Figure 4 shows researcher-led comparisons which tended to involve a larger number of comparisons, with more rigidly controlled characteristics at each site (for example, weeding inputs might be more consistent from plot to plot in a researcher-led on-farm trial) and smaller, more regular sized plots. Scientific findings regarding biological processes such as levels of nutrient recycling were documented in greater detail at researcher-led sites.

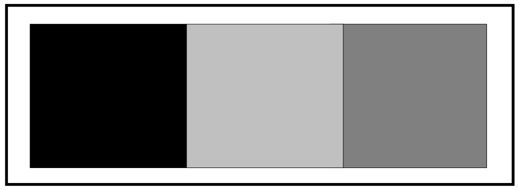


Figure 3. Cooperative Effort
Farmers choose among the best bet options presented by researchers and extension. A comparison is conducted between these options and the farmer-designed controls – the farmer's best bet. Plots are laid out by farmers with researcher input.

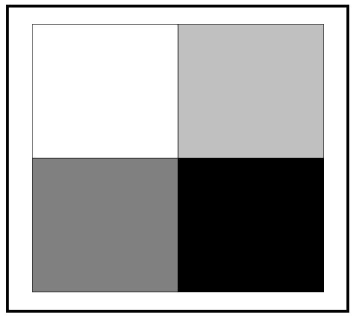


Figure 4. Researcher-Led
Generally, researchers choose four or more best bet technology options to compare. These are a sub-set of all the options compared in the mother trial. Farmers manage the trial; researchers monitor farmer practice.

Statistical and Economic Analysis

Adaptability analysis is a useful regression approach that allows performance of technologies to be compared across a range of environments, where average yield or edaphic factors are used as an environmental index (Hildebrand and Russell, 1996). It is possible to evaluate trials conducted with replication at a site (mother trials), or replicated across sites (baby trials) and any combination using adaptability analysis. A useful aspect of this approach is the ability to test variety and technology performance under stressed conditions. This provides insight into the risks associated with different technologies. Farmers are frequently interested in technologies which are low risk and perform across a wide range of environments. Regression type models such as adaptability analysis are also straightforward to understand, and lend themselves to presentations to a wide range of stakeholders.

Other statistical approaches to analyzing participatory trial designs are described in Bellons and Reeves (2002). These include mixed models, such as factor-analytic models for modeling variance and co-variance from multi-environment trial data. An incomplete lattice design for mother and baby trials has been used to systematically evaluate stress-tolerant varieties of maize, and farmer-preferred rice varieties.

Economic analysis of net benefits is another valuable approach to evaluating technology performance. A detailed description of how to estimate net benefits associated with a technology is presented in a booklet by CIMMYT (1988).

Learning

Overall, this experience points out valuable lessons:

- Communication is the foundation of any successful participatory research endeavors.

- A through review of the literature and stakeholder analysis should be conducted initially as it will broaden the range of partners, technology options and participatory approaches considered.

- Facilitated discussions or role-playing and brainstorming are useful exercises in thinking through and defining the goals of the participatory research. This investment in partnership building will improve the design of the trials, and levels of engagement with different stakeholders.

- Choosing the most appropriate trial design will depend on the goals of the participatory research project. If generation of knowledge about biological processes is a primary goal, then researcher-led trials may be most appropriate. Frequently, this involves replicated 'mother trials'. Replicated across the landscape researcher-led 'baby trials' may be an overlooked opportunity for research on biological processes across different scales.

- Leadership of trials by farmers should be considered if empowerment of farmers to conduct experimentation and understanding of farmer decision making are major goals of the project.

- For either mother or baby trials, it is important to use trial designs and statistical analysis that document variability across sites. Variability is an opportunity to understand processes involved and to identify technologies that perform well across different environments.

- Across all trial designs, it is important to 'build in' a voice for farmers and other stakeholders in the research process. This can be through joint discussions of outputs, investing time and resources in forging farmer-researcher partnerships and through conducting surveys. Farmers provide unique insights into analysis and results. Identification of trade-offs and reasons for variation in performance can be the basis for new hypotheses.

- Documenting farmer assessment is critical to identifying promising new technologies and varieties.

References

Bellons, M.R. and J. Reeves (eds). 2002. Quantitative Analysis of Data from Participatory Methods in Plant Breeding: URL http://www.cimmyt.org/Research/Economics /map/ research_tools/manual/ Quantitative/Contents.htm

CIMMYT. 1988. From Agronomic Data to Farmer Recommendations: An Economic Training Manual. Completely Revised Edition. Mexico, pp. 78: CIMMYT.

Hildebrand, P.E. and J.T. Russell. 1996. Adaptability Analysis: A Method for the Design, Analysis and Interpretation of On-Farm Research and Extension. Iowa State University, Ames, Ia.189 pp.

Mutsaers, H.J.W., G.K. Weber, P. Walker and N.M. Fisher. 1997. A Field Guide for On-Farm Experimentation. IITA/CTA/ISNAR, Ibadan, Nigeria. 235 pp.

Snapp, S.S., M.J. Blackie and C. Donovan. 2003. Realigning Research and Extension Services: Experiences from Southern Africa. Food Policy in Press.

Snapp, S.S. and K.L. Heong. 2003. Scaling Up: Participatory Research and Extension to Reach More Farmers. Pp. 67-87. *In:* Pound, B. S. S. Snapp, C. Mcdougal and A. Braun (eds.). Uniting Science and Participation: Managing Natural Resources for Sustainable Livelihoods. Earthscan, U.K. and IRDC, Canada.

Snapp, S.S., G. Kanyama-Phiri, B. Kamanga, R. Gilbert and K. Wellard. 2002. Farmer and Researcher Partnerships in Malawi: Developing Soil Fertility Technologies for the Near-Term and Far-Term Experimental Agriculture 38:411-431.

Sperling, L., M. E. Loevinsohn and B. Ntabomvura. 1993. Rethinking the Farmer's Role in Plant Breeding: Local Bean Experts and On-Station Selection in Rwanda. Experimental Agriculture 29:509-519.

Witcombe, JR, L.B. Parr and G.N. Atkin (eds). 2002. Breeding Rainfed Rice for Drought-Prone Environments: Integrating Conventional and Participatory Plant Breeding in South and SE Asia. IRRI and DFID. URL: http://www.dfid-psp.org/publications/IRRI-2002/ IRRI_Proceedings.pdf

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