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Comparison of Farmer-Participatory Research Methodologies: Case Studies in Malawi and Zimbabwe

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Abstract

Farmer-participatory research (FPR) can help improve the effectiveness of technology development, raise adoption rates, and increase the payoff to agricultural research. However, there is wide diversity of opinion about the scope and nature of farmer participation in the implementation of FPR. This study compared different FPR approaches being used by various organizations at six on-farm sites in Malawi and Zimbabwe, with a view to developing guidelines for future work, particularly in developing technologies targeted at women farmers. The study found differences between the various approaches in diagnostic activities, planning of experiments, assessment of results, and strengthening of farmers' capacity to conduct their own experiments. Overall, however, the various methods were not completely distinct, but represented a continuum from traditional research-led, to researcher-led with farmer input, to farmer-led with research input. The results indicated that when there are no clear procedures to directly target women farmers they tend to be under-represented, and gender issues are not sufficiently integrated into the research process. PRA techniques were also found to be useful in planning experiments, but require considerable investment of time by researchers and extension staff.

Researchers therefore need to formulate clear objectives for conducting different types of on-farm experiments, ensure that farmers understand their roles in each case, and finally integrate different types of research to develop technologies that are practical and profitable.

Résumé

Comparaison des méthodologies de recherche menée avec la participation des paysans : Etudes de cas au Malawi et au Zimbabwe. Les recherches menées avec la participation des paysans (FPR) peuvent améliorer la mise au point des technologies, augmenter le taux d'adoption et accroître les retombées positives de la recherche agricole. Il existe cependant, une large diversité d'opinions sur la portée et la nature de la participation des paysans à la mise en œuvre de la recherche participative. La présente étude a comparé les différentes approches en matière de recherche participative adoptées par différentes organisations dans six sites en milieu paysan au Malawi et au Zimbabwe, en vue d'élaborer des directives pour les travaux futurs, en particulier pour la mise au point de technologies destinées aux femmes en milieu rural. L'étude a trouvé qu'il y a des différences entre les diverses approches adoptées dans les activités de diagnostic, de planification des expériences, d'évaluation des résultats et de renforcement de la capacité des paysans à réaliser leurs propres expériences. En général, ces différentes méthodes ne se distinguaient pas totalement les unes des autres, mais formaient un continuum qui va des méthodes de recherche sans participation des paysans, ensuite les recherches faites par les chercheurs avec la participation des paysans et à la fin la recherche faite par les paysans en collaboration avec les chercheurs. Les résultats de l'étude indiquent que lorsqu'il n'y a pas de procédures claires permettant de cibler directement les femmes productrices, ces dernières ont tendance à être sous-représentées et les questions de genre ne sont pas suffisamment prises en compte dans le processus de recherche. L'étude a également trouvé que les techniques de FPR sont utiles pour la planification des expériences, mais exigent un important investissement de temps de la part des chercheurs et du personnel de vulgarisation. Les chercheurs doivent donc définir des objectifs clairs pour la conduite de différents types d'expériences en milieu paysan; s'assurer que les paysans comprennent leur rôle dans chaque cas et combiner différents types de recherche pour mettre au point des technologies pratiques et rentables.

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Contents

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Acronyms

AGRITEX	Department of Agricultural, Technical and Extension Services (Zimbabwe)
CIMMYT	Centro Internacional de Mejoramiento de Maïz y del Trigo
DFID	Department for International Development (UK)
DR&SS	Department of Research and Specialist Services (Zimbabwe)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
NGO	Nongovernmental organization
PRA	Participatory Rapid Appraisal
SADC	Southern African Development Community
SMIP	Sorghum and Millet Improvement Program
TSBF	Tropical Soil Biology and Fertility Program

Introduction

Farmer-participatory research (FPR) describes a process for developing and testing agricultural technologies. This approach encompasses diverse research and research-related activities that range from informal surveys with a few farmers, to conducting research with farmer involvement, to community empowerment, to technology development and dissemination by extension services and other development institutions. In principle, however, FPR describes a process that is based on dialog between farmers and researchers in order to develop improved technologies that are practical, effective, profitable, and will solve identified agricultural production constraints.

Few would question the need for farmer participation in the research process. It is widely viewed that incorporating farmers' priorities and assessment can improve the effectiveness of technology development, raise adoption rates, and increase the payoff to agricultural research. However, in practice there is wide diversity of opinion about the scope and nature of farmer participation in the implementation of FPR.

The DFID-supported project implemented by ICRISAT, *Will women farmers invest in improving their soil fertility management? Participatory experimentation in a risky environment,* seeks to develop research methods and practical soil fertility management options for smallholder farmers, particularly women farmers who are heads of households (Snapp 1999). A key component of this research is to provide guidelines on FPR methods that will facilitate the integration of farmers' assessment of technology options into the development, testing, and dissemination of practical soil management options[1]. To accomplish this the project tested one FPR method at each of six case study sites, three each in Malawi and Zimbabwe. The various methods were all FPR, but involved varying degrees of farmer participation: traditional research-led, research-led with farmer input, and farmer-led with research input. The goal was to compare the effectiveness of different methodologies in developing and testing soil management technologies for resource-poor farmers, particularly women. The objective of this study is to assess researchers' characterization of various alternative FPR methods, identify the main differences between them, and thus compare the different approaches. It is expected that the study will provide guidelines for FPR, particularly as it relates to developing technologies targeted at women.

Methodology

A case study approach was used. Informal interviews were conducted with site leaders (scientists or staff of collaborating national research programs or NGOs) as well as the technicians and enumerators who supervised and monitored the trials at the case study sites. These informal interviews were supplemented with information from project records and two workshops organized by the project. Interviews were conducted with individual farmers and groups of farmers during April and May 2000 at five villages in Malawi and six villages in Zimbabwe (Fig.1, Annex 1). A checklist was used in the interviews to ensure that all major topics were covered (Annex 2).

1. The FPR research at two sites in Zimbabwe was undertaken under the regional SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP).

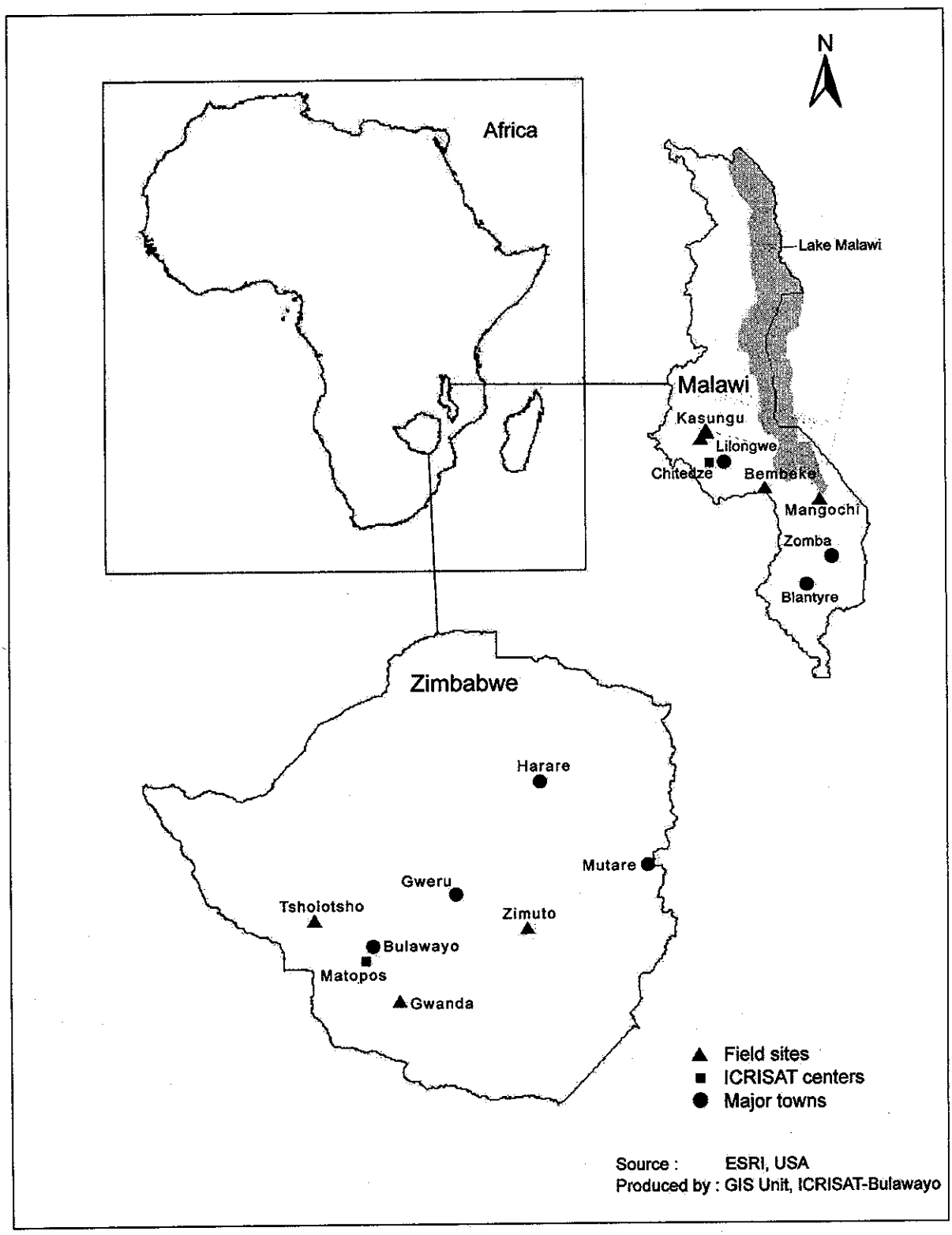

Figure 1. Location of field sites in Malawi and Zimbabwe.

FPR Methods

The primary aim of this study is to compare different FPR methods. The research implemented at the case study sites provides an opportunity to evaluate whether the various methods were indeed significantly different, and the implications for technology development and testing, particularly as it relates to women farmers. The study therefore focuses on technology adoption and adaptation rather than the technologies per se. The framework for comparison uses the stages in the research process and the level of farmer/researcher participation in decision making. As is commonly done in the FPR literature (eg Lilja and Ashby 2000, Okali et al. 1994), we divided the research process into three stages: diagnostic; planning of experimentation; testing and adapting. In the diagnostic stage the research problem is diagnosed, opportunities for research identified, priorities set, and potential solutions identified. In the experiment-planning stage the potential options selected for experimentation are evaluated, and decisions made about who conducts the experiment, where and how, and with what inputs. The testing and adapting stage involves implementation and monitoring of trials, data collection, and assessment of results.

Selecting Farmers for Participation in On-Farm Trials

Farming communities in southern Africa are not homogeneous. Farmers differ in social status, wealth, access to and control over resources, and proclivity to conduct research. Research activities therefore focused on the needs of low-resource farmers, particularly women farmers (Snapp 1999). Gender was identified as a key variable in the participatory testing and dissemination of technologies. The case studies, however, suggest that in practice there were few attempts to directly target and select women farmers for on-farm trials in any of the FPR approaches. This was due partly to the lack of procedures for selecting women farmers. Because the project did not set standard procedures for integrating gender concerns into the participatory testing of technologies, each research team developed its own strategy for selecting participants for experimentation.

There were four main strategies for selecting farmers to participate in on-farm trials. In part, each strategy reflected the research team's perception of farmer participation. First, a strategy that was frequently used in the mother-baby trials was to select village headmen to host the mother trials, with other farmers volunteering to participate in the baby trials. The rationale was that farmers frequently meet at the headman's compound for various community and development initiatives. Thus, locating the trials in the headman's field offered easy access to the mother trial, facilitating farmers' observation and comparison of the mother trial with their own baby trials. However, all the village headmen at the case study sites were influential and relatively wealthy male farmers, not representative of resource-poor farmers or women farmers. Because they were selected solely for being local leaders they did not bring any specific expertise into the experimentation process.

The second strategy was ask for volunteers during village meetings, and from them select farmers to participate in on-farm trials. This strategy was used by the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP) and the Tropical Soil Biology and Fertility (TSBF) project in Zimbabwe, and in ICRISAT's baby trials in Malawi and Zimbabwe. The strength of this approach was that farmers were selected based on their willingness and ability to host the trials. But it is also plausible that male and/or resource-rich farmers who could afford the resources were most likely to volunteer and be selected. This perception was confirmed during field work. Many participants in the baby trials and the farmer-led trials were relatively better-off males. However, at the SMIP project sites the majority of farmers attending meetings and volunteering to host trials were women (G Heinrich, personal communication). In some cases researchers considered socioeconomic differences

– including gender – among farmers volunteering to host the trials, but it was not clear whether systematic consideration was given to the selection of women. Thus, the selected farmers may or may not be representative of women farmers.

A third strategy used by the Centro Internacional de Mejoramiento de Maïz y del Trigo (CIMMYT) in Zimbabwe and in baby trials in Malawi, was to let farmers select participants within their communities. These farmers were selected because of the perception that they were knowledgeable about farming, willing to share knowledge and experiences, and hence best placed to represent their communities. An implicit assumption in several cases was that these farmers would automatically share their knowledge with researchers and other farmers in their community. In at least one case the issue of selected farmers sharing their knowledge and experience with others was raised during the selection process. In this case, after the farmers had been selected the make up of the group was compared with a community wealth ranking exercise conducted earlier, and the group composition was adjusted accordingly.

In the fourth strategy, used by CIMMYT in Malawi, farmers were selected by extension staff and enumerators. Here also there was high probability that selection would be biased against women because extension staff and enumerators were inclined to select better endowed farmers or those perceived to be more innovative or research minded. In several cases these criteria tended to favor male farmers. One notable exception was in Malawi, where CIMMYT researchers used information from a diagnostic baseline survey to select women farmers for the baby trials.

Farmer Participation in Technology Development and Testing: Evidence from the Case Studies

Case study sites were located in and around villages where on-farm trials were being implemented as part of another research program. A full comparison involved a control village where there were no interventions, a village where interventions were limited to demonstration plots, a researcher-led trial village, and a farmer-led trial village. Researchers characterized the approach used at each site as traditional research-led, research-led with farmer input, and farmer-led with or without research input. It was hypothesized that the largest degree of researcher control would be in a traditional trial approach, with control diminishing in favor of farmer control as the research evolved towards a farmer empowerment approach.

Traditional research-led approach

Traditional research-led approaches were implemented in Malawi and Zimbabwe. These trials are meant to demonstrate 'best bet' technology options defined by researchers. The trials are designed and managed by researchers with inputs from extension, using a standard trial design and approach. Field days are held and researchers may organize farmer exchange visits to other demonstration trials.

Diagnosis stage

No baseline diagnostic survey or participatory problem analysis was conducted at the case study sites to help identify major constraints and their causes and effects, before trials were implemented. However, researchers had access to an earlier baseline diagnostic survey which provided information on local socioeconomic conditions. Researchers had developed a menu of best-bet soil fertility technology options for Malawi and Zimbabwe based on their potential acceptability to smallholder farmers. The specific options tested in the on-farm trials were selected by researchers and presented to

farmers as potential solutions for addressing the perceived productivity problem. Research and extension staff organized village meetings to consult with farmers. At these meetings researchers discussed trial plans and their implementation with farmers and selected farmers for the trials. Researchers initiated and led the discussions. Farmers responded to enquiries but it was apparent that their views and opinions were not actively sought in identifying technology options for experimentation.

Planning and implementation of trials

The trials were formal experiments designed and implemented by researchers on farmers' fields, using a traditional experimental design with randomized experiments and replicates. Farmers provided the land and, in some cases, labor for plowing and weeding as laid out in the trial plan. Researchers provided all other inputs, and made all decisions regarding quantity, timing, and method of application of inputs. All activities were carried out either by research staff or by labor hired by researchers.

The level of interaction between scientists and farmers was low. Scientists were present at the initial consultative village meeting. They also visited the trials to observe the performance of the experiments. Technicians were also present at the village meeting, and managed and supervised trial activities. Enumerators who resided in the area monitored the trials on farmers' fields. Data were collected on traditional biophysical parameters such as method and date of planting, crop stand, weed coverage, dates of weeding, and rainfall. The data were passed on to researchers for analysis and dissemination.

The high level of researcher control in these trials was expected to lead to the collection of high quality biophysical data. However, logistics problems in managing and supervising the trials made this difficult. Enumerators monitored the trials but there was little contact with scientists and technicians who had authority to make and change decisions. For example, in Zimbabwe, research officers are based in Harare, approximately 300 km from the trials in Zimuto. Visits to research-led trials and discussions with farmers hosting these trials in both Malawi and Zimbabwe suggested significant variation in the level of supervision and management of trial activities, which affected the quality of the trials and the data collected.

Assessing results from on-farm trials

Farmer assessment of the technologies was limited to field days organized by research and extension staff[2]. These field days were meant to demonstrate the potential of the technology options to farmers in the area. Researchers led discussions and answered farmers' questions. Ideally, farmers attending the field days would assess the trials and provide ideas for experimentation. But many farmers, including those hosting the trials, felt it was difficult for them to realistically assess the trials because of their limited involvement. However, some farmers who hosted trials expressed a desire to try out, on their own, some of the treatments that looked promising.

Training farmers, disseminating information

Technicians and enumerators were responsible for collecting data and monitoring the trials. Results were analyzed by researchers and disseminated to typical research audiences. Thus, the experiments did not strengthen farmers' capacity to conduct their own experiments.

2. Project staff reported visiting trial sites and communicating the results back to farmers after this survey was conducted.

Research-led with farmer input

This method was research-led but with greater farmer involvement in testing and assessing technologies. Activities included both research-managed and farmer-managed trials and were implemented jointly by ICRISAT, CIMMYT, TSBF, and national research and training organizations in Malawi and Zimbabwe. Because different organizations and locations were involved, the exact approach varied, but in general they could all be characterized as research-led with farmer input.

One method used was the mother-baby trial design (Snapp 1999). This approach seeks to facilitate communication between researchers and farmers by incorporating farmers' input early in the research process. The mother trials are researcher designed and managed, fully replicated on-farm trials involving a range of technology options. The baby trials are a subset of the technologies tested in the mother trial, with which the host farmers experiment. The baby trial can be equivalent to one full replicate of the mother trial, or only a partial subset. For statistical purposes each host farmer is considered as a replicate. This design attempts to meet researchers' objectives to generate reliable biophysical data and simultaneously allow farmers to compare a subset of technologies in the baby trials with the wider range in the mother trial. Both ICRISAT and CIMMYT implemented mother-baby trials in Malawi and Zimbabwe, but there were differences in the level of farmer participation at different stages in the research process. These differences mainly reflected researchers' diverse views of how FPR should be implemented.

SMIP and TSBF used a different approach to research-led experimentation with farmer input in Zimbabwe. Researcher-managed and farmer-managed trials were conducted simultaneously on farmers' fields. The researcher-managed trials served as focal points for field days and provided farmers with opportunities to observe and compare different technologies. In the SMIP trials farmers selected the technology options they wished to test, after discussions with researchers. Consequently, researchers and farmers developed the trial design together. In both cases farmers conducted their own experimentation using their desired input levels and management practices.

Diagnosis stage

The institutions involved in the research used different approaches to define the research problems and their causes.

Mother-baby approach. The DR&SS/ICRISAT/CIMMYT mother-baby trials in Zimbabwe did not conduct reconnaissance or diagnostic baseline surveys to help guide the research, but used socioeconomic data from earlier surveys in the case study villages (personal communication, K Vaughan). In Malawi researchers used information from an earlier participatory problem analysis, informal farmer consultations in village meetings, and data from a crop management reconnaissance survey to help identify the major productivity constraints and plan research activities (personal communication, S Snapp). In addition, baseline surveys were conducted at the Malawi sites to obtain detailed information on farmers' socioeconomic characteristics, crop management practices, and productivity constraints. However, the results were not readily available when the first year's research activities were being planned. Notwithstanding this, farmer participation in problem diagnosis was limited to providing answers to questions determined by researchers. To this extent, there was only one-way communication between farmers and researchers.

SMIP/TSBF approach. In order to identify opportunities for experimentation, information on productivity constraints at the trial sites was obtained from two sources: baseline diagnostic surveys and village meetings. The baseline surveys were carried out by SMIP specifically to diagnose

productivity constraints and identify opportunities for experimentation. The village meetings were organized by researchers and extension staff, with the same objectives. Farmers identified several constraints during these meetings. SMIP and TSBF conducted separate trials at different locations. One TSBF location had been earlier surveyed by SMIP, so TSBF was able to use the survey data to plan the experiments.

Selecting and prioritizing technology options for experimentation

Mother-baby approach. At the village meetings in Malawi and Zimbabwe, research and extension staff informed farmers about what technology options were likely to resolve the perceived productivity problems. Researchers explained the trials that were planned and the potential impact of the technology options selected for experimentation. All treatments in the mother-baby trial designs were researcher-designed best-bet options that were developed to address specific production constraints hypothesized by researchers. Although farmers participated in village meetings it was apparent from the set experiments conducted that they did not have specific inputs in choosing what technologies to test.

SMIP/TSBF approach. In the SMIP trials in Zimbabwe, priorities for experimentation were determined based on farmers' assessment of constraints, i.e. information from baseline surveys and village meetings. At these meetings farmers suggested options for experimentation based on their experience and prior knowledge from an NGO-sponsored exchange visit to other experimental sites. Researchers also suggested technology options that had worked well in other areas. Through negotiation, researchers and farmers eventually agreed on what options would be tested.

The TSBF trials in Zimbabwe also used village meetings to set priorities for experimentation. Farmers raised concerns about some of the technology options that researchers suggested. These concerns were discussed, and this led to a set of research issues which provided a basis for selecting technology options for testing. Final selection, for both researcher-managed and farmer-managed experiments, was done by researchers. The researcher-managed trials were a combination of experiments that had performed well under research management in other areas, and a limited set of experiments to address research issues identified jointly at the village meeting. The farmer-managed trials were a combination of technologies suggested by researchers, and those which farmers were interested in trying on their own in the light of research issues identified at the village meetings.

Planning stage

Mother-baby approach. Researchers provided information on the mother/baby trial design and the technology options at the village meetings. The mother trials were designed and managed by researchers using traditional experimental approaches. Farmers provided the land and in some cases, labor. Researchers provided all other inputs, and made all decisions on inputs (quantity, time and method of application) without consulting with farmers. In contrast the baby trials were designed by researchers but managed by farmers. From the full complement of treatments in the mother trial, farmers hosting baby trials selected the technology options they wanted to experiment with. In nearly all instances researchers provided seed and fertilizer, as well as advice on inputs to be applied. Farmers were free to implement their own management practices but most of them followed the advice of researchers. Thus, all the baby trials that were monitored followed a prescribed set of technologies and management practices.

SMIP/TSBF approach. In the SMIP trials, farmers decided whether to host a research-managed or a farmer-managed trial or both, and which treatments they wanted to experiment with. Researchers designed the researcher-managed trials and made all decisions on quantities, when, and how to apply inputs. In the farmer-managed trials, researchers provided seed and facilitated access to fertilizer, but farmers made the decisions on input application. Researchers gave advice on trial management but farmers were free to manage their trials as they wanted. Farmers who implemented farmer-managed trials were aware of what inputs were being used in the researcher-managed trials (this was discussed at the village meetings), but many changed the level, timing, and method of applying inputs to suit their circumstances.

In the TSBF trials farmers similarly decided whether they wanted to host a researcher-led trial or a farmer-led trial, and what treatments they wanted to test. Researchers designed the researcher-managed trials and made all decisions on inputs, while TSBF technicians and enumerators supervised and managed the trials. Farmers provided land and labor at cost. TSBF provided all other inputs. In the farmer-managed trials, TSBF provided inputs including seed and fertilizer, and advice on crop and manure management. Technicians assisted farmers with plot lay-out. Farmers decided on methods and timing of input application and overall management of their trials.

Implementation of experiments

Mother-baby approach. The treatments were best-bet technology options designed by researchers. Enumerators collected data and monitored the trials while research technicians supervised the trials. The mother trials, run by research technicians, contained the full set of technology options, while farmers planted subsets of these technologies in their baby trials. In some cases enumerators helped farmers lay out their trial plots.

SMIP/TSBF approach. Treatments in the SMIP research-managed trials were best-bet options designed by researchers using information from the diagnostic baseline survey, a cropping systems simulation model, and researchers' and farmers' prior experience in other areas. In the farmer-led trials, farmers tested either the full set or a subset of technology options that they selected from the researcher-managed trials, but were free to modify the treatments based on their prior experience.

In the TSBF experiments, treatments in the researcher-managed and farmer-managed trials were different. The former were based on researchers' experiences in other areas. The latter were a combination of treatments based on researchers' experience and modifications arising from the issues farmers raised at the village meetings.

Assessing results from on-farm trials

Mother-baby approach. Enumerators hired by the different organizations monitored trial plots and collected data on both the mother and baby trials, although the mother trial was more closely monitored. All the institutions implementing on-farm trials collected agronomic data (crop emergence, weed cover, crop stand, weeding dates) and farmers' perceptions of the treatments. In addition, CIMMYT researchers at the Zimbabwe and Malawi sites collected data on labor use for the entire trial rather than individual treatments. In the ICRISAT-led trials in Malawi and Zimbabwe and the CIMMYT-led trials in Malawi, enumerators collected data on both the mother and baby trials. In contrast, the CIMMYT-led trials in Zimbabwe encouraged farmers to collect data on their baby trials. While this helped build farmers' capacity to monitor their experiments, farmers often recorded only the dates of key activities such as planting, weeding, germination, and fertilizer application. Most

farmers reported that the biophysical data sought by researchers were too complex to monitor. Most farmers found data collection useful because they could compare crop performance on trial and non-trial plots. For the most part, the same type of data was collected from mother and baby trials. The data were passed on to researchers for analysis, but many farmers did not know what the researchers did with the data.

At each case study site researchers and extension staff organized field days to demonstrate the performance of the new technologies in the mother trials and in selected baby trials – selected primarily by technicians and enumerators. The field days involved trial farmers as well as others from surrounding villages. Research and extension staff described the on-farm experiments, led the subsequent discussion, and answered farmers' questions. These field days provided an opportunity for farmers hosting baby trials to compare the performance of researcher-managed mother trials with their own experiments. In addition to field days, CIMMYT researchers in Zimbabwe organized mid-season evaluation meetings with farmers hosting the baby trials, to discuss trial performance. These meetings provided an opportunity for farmers to make an early assessment of the technologies, and discuss possible adaptations they might want to make in subsequent trials. In the CIMMYT-led trials at one site in Zimbabwe, researchers encouraged farmer-led field days in conjunction with local extension staff, with farmers selecting sites and leading the discussions. In Malawi, ICRISAT researchers used quantitative evaluation techniques such as matrix and pairwise ranking to obtain farmers' assessment of the relative strengths and weaknesses of technologies in the baby trials.

SMIP/TSBF approach. In the SMIP trials, enumerators collected agronomic data (including input application) and feedback from farmers' observation of the trials. Similar data were collected in the researcher-managed and farmer-managed trials. Where possible, farmers were encouraged to collect the data themselves, using trial books provided by the project. TSBF also used enumerators to collect similar data from both researcher-managed and farmer-managed trials. Researcher-managed trials were monitored more closely than farmer-managed trials. Data collected by farmers were often passed on to researchers.

Both SMIP and TSBF used field days to involve farmers in the research process. SMIP organized field days, jointly with national extension staff and farmers' organizations, to demonstrate the performance of the technologies to other farmers and allow farmers to compare the different options being tested. Field days were held at both researcher-managed and farmer-managed sites. In the researcher-managed trials the farmer hosting the trial explained the experiments to other farmers, and responded to questions with assistance from researchers. In the farmer-managed trials a group of farmers in the community visited all the farmer-managed trials and selected sites for the field days. The farmer hosting the farmer-managed trial explained the trial to other farmers and researchers and led the discussions. TSBF held field days at researcher-managed sites only. Researchers explained the trials and led the discussions. Farmers hosting the researcher-managed trial explained their level of involvement, their observations, and the problems they faced. Farmers who hosted farmer-managed trials also explained their experiments and shared their experiences.

SMIP organized end-of-season evaluations at which farmers evaluated researcher-managed and farmer-managed trials and technology options using matrix scoring and ranking. Farmers developed their own evaluation criteria and scored all treatments within trial types according to these criteria. They then ranked treatments overall (within the experiment) and made recommendations for other farmers.

TSBF also organized a farmer feedback meeting after the trials were harvested and the data analyzed. At these meetings farmer and researchers discussed results from researcher-managed trials; farmers who hosted trials presented their results to other farmers with the assistance of researchers.

There was significant variability in the results from farmer-managed trials. Such variability highlights the need for researchers to provide farmers with more information on the analysis of trial results.

Training farmers, disseminating information

At all sites where researcher-managed and farmer-managed trials were conducted simultaneously, farmers were encouraged to collect data, monitor, and report on their experiments. This helped strengthen their capacity to conduct their own experiments.

Farmer-led with research input

This approach aims to empower farmers to develop their own solutions to agricultural problems. The goal is to encourage the development of farmer leadership within the community, for example through specific training exercises such as Training for Transformation. Three types of farmer-led experimentation were implemented. ICRISAT and national extension staff in Malawi implemented trials that were linked to the mother-baby trials; the NGO Concern Universal and ICRISAT implemented farmer empowerment trials in Malawi; and CIMMYT in collaboration with national research (DR&SS) and extension (AGRITEX) facilitated farmer experimentation in Zimbabwe.

Diagnosis stage

Participatory problem analysis was used as a diagnostic tool in the CIMMYT/DR&SS/AGRITEX trials in Zimbabwe and the Concern Universal/ICRISAT trials in Malawi. CIMMYT/DR&SS/AGRITEX used resource maps drawn jointly by farmers and enumerators to depict resource availability and use, resource flows, product flows, and market relationships. These maps were used as tools to identify problems and discuss technology options with farmers. Concern Universal/ICRISAT used PRA tools including social mapping, transect walks, and semi-structured interviews to assess farmers' resources and opportunities for resolving identified production constraints and enhancing income generation. There was no participatory problem diagnosis at the ICRISAT/national extension initiative in Malawi. Rather, researchers relied on earlier diagnostic work on crop production constraints in the area. The trials were, however, directly linked to the mother-baby trial design in which researchers had formulated hypotheses on priority constraints in the area.

Selecting and prioritizing technology options for experimentation

One objective of the CIMMYT/DR&SS/AGRITEX work was to support farmers to identify technology options and conduct their own experiments. Technologies were chosen for experimentation after discussion between farmers, researchers, and extension in a series of village meetings. During these meetings farmers and researchers suggested technology options they had prior experience with, or which had performed well elsewhere. The final selection of treatments was done through negotiation between farmers, researchers, and extension staff.

The PRA implemented by Concern Universal used problem and objective tree analysis for participatory problem diagnosis and identification of technology options to address key problems. Farmers participated in problem diagnosis, but their views were not adequately represented in the selection of technology options for experimentation – the experiments conducted on-farm did not include several technology options identified in the PRA. Rather, they focused on best-bet options identified by researchers as well as options that reflected Concern Universal's wider development

objectives in the area. Discussions with farmers suggested they were interested in testing some technology options that were not included in the trials.

In the ICRISAT/national extension work in Malawi, farmers were encouraged to conduct their own experiments based on their observation of the performance of best-bet options in the mother trials. Farmers selected the treatments they wanted to try on their own; ICRISAT facilitated farmer experimentation by providing seed and technical information, and monitoring the experiments.

Planning stage

In all the farmer-led experimentation, farmers managed the trials and made decisions on the quantity, timing, and method of application of inputs. Research and extension staff provided technical advice on technology options, ICRISAT and CIMMYT supplied seed for the experiments, and farmers provided all other inputs. In Zimbabwe, CIMMYT suggested a split plot design, which they felt made it easier to compare farmer practice with the technologies being tested. In both the ICRISAT initiatives in Malawi, farmers decided how they wanted to plant the experiments. Some farmers closely followed the design of the baby trials while others modified their experiments to suit their circumstances.

Implementation of experiments

In the CIMMYT/DR&SS/AGRITEX trials, farmers planted the treatments they had negotiated with researchers. Farmers did not change the trial plan or treatments but were free to decide what management practice to use. At the Concern Universal/ICRISAT sites in Malawi farmers planted the best-bet options suggested by researchers. Most followed the advice offered by researchers and did not modify their experiments. In the ICRISAT/national extension trials in Malawi, some farmers planted the treatments as they observed them in the baby trials but others modified the treatments to suit their circumstances.

Enumerators employed by CIMMYT and ICRISAT monitored the farmer-led experiments at all sites. Farmers collected data on dates of operations such as planting and weeding. This data was given to the enumerators but most farmers had no idea what the researchers did with it. Some farmers reported that they have not had an opportunity to discuss the data with researchers. ICRISAT researchers did not collect data on their farmer-led experimentation.

Assessing results from on-farm trials

At all sites, farmer-led experimentation was monitored and supervised less intensively than researcher-managed trials. Researchers made informal visits to the trials to interact with farmers, discuss trial performance, and get insights into farmers' observations.

Training farmers, disseminating information

The emphasis in all farmer-led research was to facilitate farmer experimentation. Farmers in the CIMMYT/DR&SS/AGRITEX initiative in Zimbabwe were encouraged to collect data and monitor their experiments. In contrast farmers in both ICRISAT initiatives in Malawi did not collect data although they were encouraged to informally observe their experiments and note their observations. Concern Universal conducted Training for Transformation for farmers who hosted trials. The objective of the training was to build capacity and empower farmers to make and manage decisions in their communities. However, the training was conducted after farmers had planted their experiments,

so it is unclear how and to what extent it influenced their decision making processes or communication with researchers.

Guidelines for FPR: Key Issues

The primary objective of this study was to determine whether there were sufficient differences in FPR methods across the case study sites to allow a comparison of the approaches and draw guidelines for planning and designing future projects, particularly as they relate to developing technologies relevant to women farmers.

Characterizing FPR methods

Researchers were requested to characterize the participatory research method they were implementing at each case study site. The findings from this study suggest that researchers correctly characterized the research methods they were using into the three broad categories: traditional research-led, research-led with farmer input, and farmer-led with research input. Nonetheless, the study suggests that when these methods are characterized in the context of farmer participation, they could best be depicted not as distinct methods, but rather as a continuum from less farmer participation toward farmer empowerment, with the largest degree of farmer participation in farmer-led experimentation and the least in traditional research-led approaches. To make the comparison manageable, we summarized the FPR methods used in terms of the extent of farmer participation or farmer/researcher interaction at different stages in the research process.

Differences in FPR methods across sites

The study suggests that differences in FPR methods across sites were sufficient to allow comparison of the different methods. Defining FPR in the context of farmer participation, the study identified important differences in the ways farmers interacted with researchers at different stages in the research process. All the research programs made efforts to involve farmers in diagnostic activities. Some programs, such as the traditional research-led approaches and the mother-baby trials in Zimbabwe, did not conduct specific participatory problem diagnosis. Baseline surveys, in which farmers responded to questions designed by researchers, were used to diagnose problems at some sites in Malawi and Zimbabwe. While some of these surveys were useful in characterizing farmers' production practices and diagnosing key productivity constraints, there were concerns, especially at the Malawi sites, that the survey results were not produced in a timely manner for use in planning future research activities. PRA techniques and tools were used for participatory problem diagnosis at the Concern Universal site in Malawi and the CIMMYT site in Zimbabwe. These techniques resulted in timely reports that were useful in planning subsequent research, but there is a possibility that the experiments eventually conducted do not fully reflect the PRA results. PRA type activities also require greater investment of time by researchers and extension staff. Thus, important decisions must be made in determining what proportion of total resources to allocate to such activities, and the cost effectiveness of these resource allocation decisions.

All the research programs used village meetings to elicit farmer participation in diagnostic activities. However, these meetings were used for different purposes, which also had different implications for the ways in which farmers participated. In the traditional research-led and mother-baby trial approaches it appeared that researchers used village meetings to inform farmers about the hypothesized productivity constraint, the experiments that were planned to address key problems, the

roles of farmers and researchers, and the manner in which the research program was to be managed and organized. Farmer participation in these meetings can be described as passive – they asked questions or sought clarifications, but it was not clear how and to what extent their ideas influenced the research process. In contrast SMIP and TSBF used village meetings to gain a better understanding of farmers' constraints and priorities, and identify issues that influenced research planning. In these cases farmers participated as active decision makers, and technology options were selected for on-farm testing through a process of negotiation between farmers and researchers.

In the planning stage researchers had the greatest control in the traditional researcher-managed approaches, typically making all decisions about how experiments were to be conducted and with what inputs. Farmers were more involved in decisions about where the experiments were planted because they provided land and decided which farmers would conduct the experiments. This situation was similar in researcher-led mother trials. In the baby trials, farmers were expected to make planning decisions. However, the manner of implementation suggested that researchers had great control over how the trials were planted, presumably because the baby trials were meant to be subsets of the mother trials where researchers had complete control. In addition, researchers largely determined what inputs farmers used in the baby trials because farmers were advised to use the same plot size as in the mother trials, and because researchers provided all other inputs besides land and labor. The researcher-led trials with farmer input, implemented by SMIP and TSBF, used similar planning arrangements as the traditional research-led approaches, but farmers were more involved in making decision on how, where, and with what inputs, especially in cases where researchers did not provide the inputs.

In the farmer-led approaches, researchers had the greatest influence in planning the experiments in the CIMMYT/DR&SS/AGRITEX trials in Zimbabwe because of the close interaction between researchers and farmers in designing the experiments during the diagnostic stage. However, across all sites farmers seemed to have the largest control over the "how, where, and who" decisions in planning experiments. Farmers had control over the "with what" decisions in cases where they provided the inputs. In contrast, researchers had control over these decisions in cases where they provided farmers with inputs to conduct experiments.

Field days were used to assess results from the on-farm trials at all research sites, but there were important differences in how farmers participated in field days. In general there were two broad types of field day. In one type, researchers and extension staff used field days to demonstrate to farmers the potential benefits of the technologies being tested. Researchers explained the trials, led the discussions, and answered farmers' questions. This was done in the traditional research-led approach in Zimbabwe and the mother-baby trials in Malawi and Zimbabwe. In the other type of field day farmers hosting experiments (both researcher-managed and farmer-managed) explained the trials, led the discussions, and responded to questions, sometimes with assistance from researchers. This type of field day was found in the SMIP and TSBF researcher-led trials and the CIMMYT/DR&SS/ AGRITEX farmer-led trials in Zimbabwe. In addition to field days, CIMMYT mother-baby trials in Zimbabwe used mid-season evaluation meetings with farmers to discuss trial performance, while SMIP and TSBF used end-of-season evaluations to discuss trial results and set priorities for future experimentation. Besides these organized meetings with farmers, researchers in mother-baby trials at all sites in Malawi and Zimbabwe, the SMIP trials in Zimbabwe, and the CIMMYT/DR&SS/ AGRITEX farmer-led trials in Zimbabwe, provided opportunities for farmers to note their comments on trial performance in trial books. Researchers also interacted informally with farmers during field visits. Besides the SMIP project, other forms of farmer participation in assessing research results – tours or exchange visits to research areas outside the community and other experiment stations or trial demonstration sites – were not emphasized in any of the research approaches.

Building the capacity of farmers to conduct their own experiments appeared to be limited to efforts to encourage farmers to monitor their trials and collect data. Farmers were collecting data themselves in CIMMYT's mother-baby trials and farmer-led trials, and the SMIP farmer-managed trial in Zimbabwe. In most cases both enumerators and farmers were collecting the same data. Involving farmers in monitoring trials and recording results might enhance farmers' capacity to conduct their own experiments. But there are concerns whether this could be achieved with the current emphasis on agronomic data rather than on meaningful variables which farmers use in making decisions on technology options; for example intensity of resource use (labor, land, capital) and relative returns to the resources they invest. Across all sites there was also less emphasis on enhancing farmers' ability to design their own trials or set up trial plots on their own. Similarly, researchers across all sites did not collect data or consistently monitor farmers' own experiments. This suggests lost opportunities for stimulating farmer experimentation or broadening the research agenda to work on solutions that farmers have taken the lead on.

Targeting women farmers

A primary focus was to develop technologies relevant to women farmers. Yet none of the trials specifically targeted women or explicitly incorporated gender issues in the research process. Several criteria were used to select farmers for participation in on-farm trials, but almost none targeted women. In part, this omission reflected the lack of procedures for targeting women in stratification of farmers or as targets for empowerment. Thus, in practice the participation of women farmers in experimentation was largely ad-hoc and turned out to be the most difficult aspect of participatory research.

Objectives for different types of trials

Comparison of FPR methods was made difficult because the project did not formulate clear objectives, across locations, for the different trials. The project document stated one main objective: to compare the effectiveness of farmer-led versus researcher-led FPR methods in the development and dissemination of technology options. Nonetheless, considering the potential for variability in biophysical and socioeconomic parameters within and across sites as well as the effects of farmer management on performance/assessment of technology options, it is doubtful whether one general objective can be applied to different types of on-farm trials. The potential for variability in on-farm trial results implies the need to formulate clear justifications and objectives for conducting different types of research, and spell out the expected role of farmers in achieving the stated objectives. The challenge for researchers is to effectively integrate different types of research to develop technologies that are practical and profitable.

Conclusions

This study used a case study approach to compare different types of farmer-participatory research being implemented in Malawi and Zimbabwe. The study used a framework for comparing different FPR methods based on stages in the research process and the level of farmer/researcher participation in decision making. The research process was divided into three stages: diagnostic; planning of experimentation; testing and adapting. On-farm trials were implemented at case study sites organized around trial villages. Researchers characterized their work at each site as traditional research-led, research-led with farmer input, and farmer-led with or without research input. It was hypothesized that

the largest degree of researcher control would be in a traditional trial approach, with control diminishing in favor of farmer control as the research evolved towards a farmer empowerment approach.

The study found that researchers correctly characterized their research method in broad terms. However, the practice of FPR at different sites in the context of farmers' participation suggested that, rather then being distinct or separate approaches, these methods represent a continuum from less farmer participation toward farmer empowerment; with the largest degree of farmer participation in farmer experimentation and the least in traditional research-led approaches. The study found differences in diagnostic activities, planning of experiments, assessment of trial results, and strengthening of farmers' capacity to conduct their own experiments. These differences would permit a comparison of the different approaches. The study also suggests that researchers need to pay greater attention to procedures for targeting women farmers, integrating gender issues into the research process, and formulating clear justifications and objectives for different types of on-farm experiments.

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Annex 1. Case study sites, FPR methodology, and lead organization(s)

Location	Village	FPR method	Lead organization(s)
Malawi			
Dedza	Kanti	Research led, farmer input	ICRISAT/Concern Universal
Dedza	Kulumeka	Farmer led, research input	Concern Universal
Chisepo	Mbinga	Research led, farmer input	CIMMYT/ICRISAT
Chisepo	Santhe	Farmer led, research input	CIMMYT/ICRISAT
Chisepo	Kampenga	Research led, farmer input	CIMMYT
Zimbabwe			
Zimuto	Mahoto	Research led, traditional	DR&SS
Zimuto	Mahoto	Research led, farmer input	DR&SS/ICRISAT
Zimuto	Maraire	Research led, farmer input	CIMMYT
Zimuto	Chikato	Farmer led, research input	CIMMYT
Tsholotsho	Nembe	Research led, farmer input	DR&SS/ICRISAT
Tsholotsho	Nhalangano	Research led, farmer input	SMIP and TSBF
Tsholotsho	Nhalangano	Farmer led, research input	SMIP and TSBF
Tsholotsho	Manzimahle	Research led, farmer input	SMIP
Tsholotsho	Manzimahle	Farmer led, research input	SMIP

Annex 2. Checklist for discussion with farmers

Level of historical intervention

- Who
- Since when
- What issues

Selection of trial farmers

- Who selects
- Why selected

Modes of participation

- Identification of constraints and opportunities
  - Who identifies subject matter for investigation
  - How were these identified – instruments used
- Identification of ideas/options
- Trial design
  - Who identifies technology options to be tested
  - How are priorities set
  - Who determines type of trial and choice of treatments
  - Who designs trials

... *continued*

Annex 2. *Continued.*

Testing/adapting options

Trial management

- Who decides on level of inputs (quantity applied, when, how)
- Can farmer change decisions on inputs (consult? who?)
- Who supplies inputs

Data collection and analysis

- Who collects data
- Types of data collected, variables monitored
- Who analyzes data
- How are results evaluated
- How are data interpreted
- How are results disseminated
- How is information shared, with whom

Intensity of interaction

- Mode of interaction – researchers, technicians, extension, farmer
- Frequency of interaction
- Involvement with on-station and on-farm experimentation

Farmer knowledge and perceptions

- Knowledge about objectives of trials
- Perception of treatments
- Establish trials on their own (understanding the research process)

Farmer experimentation

- What experiments conducted
- Motivation for conducting experiments
- Monitor farmer experimentation
- Mechanism for feedback
- Influence research agenda (how and to what extent)

Annex 3. Types of trial implemented at case study sites

TYPE OF TRIAL: Traditional research-led

Research process	Researcher only, no farmer involvement	Researcher with passive farmer involvement	Researcher and farmer jointly (negotiated process)	Farmer with researcher involvement	Farmer without researcher involvement
Diagnose problem	√				
Identify opportunities		√			
Set priorities		√			
Identify options		√			
Planning experiments How Where Who With what	√ √	 √ √			
Conducting experimentation	√				
Assessing results		√			
Training Plot layout Replication Monitoring, data collection	√				

TYPE OF TRIAL: Researcher-led – mother-baby trial design

Research process	Researcher only, no farmer involvement	Researcher with passive farmer involvement	Researcher and farmer jointly (negotiated process)	Farmer with researcher involvement	Farmer without researcher involvement
Diagnose problem	√				
Identify opportunities		√			
Set priorities		√			
Identify options		√			
Planning experiments How Where Who With what	 √ √	 √ √		 √ √	
Conducting experimentation	√			√	
Assessing results	√	√		√	
Training Plot layout Replication Monitoring, data collection	 √	 √			

TYPE OF TRIAL: Researcher-led – simultaneous research-managed and farmer-managed research

Research process	Researcher only, no farmer involvement	Researcher with passive farmer involvement	Researcher and farmer jointly (negotiated process)	Farmer with researcher involvement	Farmer without researcher involvement
Diagnose problem			√		
Identify opportunities			√		
Set priorities			√		
Identify options			√		
Planning experiments How Where Who With what	√	 √ √		√ √ √	√
Conducting experimentation		√		√	
Assessing results			√	√	
Training Plot layout Replication Monitoring, data collection				 √	

TYPE OF TRIAL: Farmer-led research – farmer experimentation linked to mother-baby trials

Research process	Researcher only, no farmer involvement	Researcher with passive farmer involvement	Researcher and farmer jointly (negotiated process)	Farmer with researcher involvement	Farmer without researcher involvement
Diagnose problem	√				
Identify opportunities		√			
Set priorities		√			
Identify options				√	
Planning experiments How Where Who With what			 √	 √ √ √	
Conducting experimentation				√	√
Assessing results				√	√
Training Plot layout Replication Monitoring, data collection					

TYPE OF TRIAL: Farmer-led research – facilitating farmer experimentation

Research process	Researcher only, no farmer involvement	Researcher with passive farmer involvement	Researcher and farmer jointly (negotiated process)	Farmer with researcher involvement	Farmer without researcher involvement
Diagnose problem			√		
Identify opportunities			√		
Set priorities			√		
Identify options			√		
Planning experiments How Where Who With what			√	√ √ √	
Conducting experimentation				√	
Assessing results			√	√	
Training Plot layout Replication Monitoring, data collection		√	√ √	√	

TYPE OF TRIAL: Farmer-led research – farmer empowerment

Research process	Researcher only, no farmer involvement	Researcher with passive farmer involvement	Researcher and farmer jointly (negotiated process)	Farmer with researcher involvement	Farmer without researcher involvement
Diagnose problem				√	
Identify opportunities				√	
Set priorities				√	
Identify options		√			
Planning experiments How Where Who With what			√	 √ √ √	
Conducting experimentation				√	
Assessing results		√	√		
Training Plot layout Replication Monitoring, data collection			√		

About ICRISAT

The semi-arid tropics (SAT) encompasses parts of 48 developing countries including most of India, parts of southeast Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and parts of Latin America. Many of these countries are among the poorest in the world. Approximately one-sixth of the world's population lives in the SAT, which is typified by unpredictable weather, limited and erratic rainfall, and nutrient-poor soils.

ICRISAT's mandate crops are sorghum, pearl millet, finger millet, chickpea, pigeonpea, and groundnut; these six crops are vital to life for the ever-increasing populations of the semi-arid tropics. ICRISAT's mission is to conduct research which can lead to enhanced sustainable production of these crops and to improved management of the limited natural resources of the SAT. ICRISAT communicates information on technologies as they are developed through workshops, networks, training, library services, and publishing.

ICRISAT was established in 1972. It is one of 16 nonprofit, research and training centers funded through the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is an informal association of approximately 50 public and private sector donors; it is co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the World Bank.