Research Evaluation, 19(2), June 2010, pages 145–155
DOI: 10.3152/095820210X510106; http://www.ingentaconnect.com/content/beech/rev

An evaluation of the use of participatory processes in wide-scale dissemination of research in micro dosing and conservation agriculture in Zimbabwe

Tarisayi Pedzisa, Isaac Minde and Stephen Twomlow

Participatory technology development has been used for quite some time. However, little is known about how farmers perceive participatory methods and processes. Understanding farmers' concerns about the participatory process can be an important starting point and can further the ultimate aim of encouraging sustained technology adoption. An ex-post participatory technology development and transfer evaluation was carried out in Zimbabwe in 2006/07 involving 231 farmers. It was revealed that use of demonstration trials encouraged the greatest participation and subsequent adoption and adaptation of the technologies to suit specific needs. The participatory nature of the process encouraged greater knowledge-sharing among farmers and gave them more confidence in the technology. In order to increase the gains of the participatory process, feedback loops should be built in to allow improvements and modifications to be made to the techniques being promoted.

MOST OF THE GROWTH in global food production during the past three decades has resulted from the adoption of productivity-boosting technologies in areas of high agricultural potential — particularly those with relatively high and reliable rainfall or equipped with irrigation infrastructure (Greenland *et al*, 1998; Pretty and Hine, 2001; Kiers *et al*, 2008). A major challenge in the coming decades will be to increase agricultural production and make similar gains in livelihoods in areas of lower potential.

Although many promising technologies have been developed and made available, the real-world application and impact of these in areas of lower potential has been limited to date (Knox and Meinzen-Dick, 1999; Von Braun *et al*, 2008). Sub-Saharan Africa (SSA) is still struggling with the basic issue of just producing enough food at the household and national levels. To exacerbate this situation, rising populations are adding stress to these marginal fragile environments.

It is critical that productivity-enhancing agronomic techniques are adopted. However, technology adoption continues to remain a serious challenge in SSA. There is no one simple answer to the question of why many African farmers do not adopt or adapt seemingly superior technologies that are already available from the research pipelines. Economic factors including high labor and financial costs, lack of credit, low levels of information and skills, lumpiness (non-divisibility), technologies that are too generic and fail to fit in local circumstances, low output/input price ratios, learning effects, geographical proximity and the household characteristics of farmers are all related to the dynamics of technology

At the time of writing, Tarisayi Pedzisa (corresponding author), Isaac Minde and Stephen Twomlow were at the International Crops Research Institute for the Semi-Arid Tropics, PO Box 776, Bulawayo, Zimbabwe. Tarisayi Pedzisa is now at the Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria, 0002 South Africa; Email: tpedzisa@yahoo.com. Stephen Twomlow is now Senior Program Officer Biodiversity, Land Degradation and POPs Division of GEF Coordination, United Nations Environmental Program (UNEP), PO Box 30552 (00100) Nairobi, Kenya; Email: stephen.twomlow@unep.org.

 0958-2029/10/02145-11 US$12.00

adoption (Von Braun *et al*, 2008; Kiers *et al*, 2008; Rusike *et al*, 2006).

However, since finding solutions to such impediments as rudimentary infrastructure, missing credit markets and weak input markets may take time, it is crucial that, in the short term, low-cost development interventions that can increase household food production be found and promoted successfully. The question of great development and policy interest is: in the face of paucity of resources on the part of many smallholder farmers, are there dissemination mechanisms that can help stimulate adoption of appropriate techniques with only marginal increases in costs and other resource requirements?

It has become apparent that there is a greater need to consult with farmers not only about the questions that they wish resolved (Ashby, 1990; Campbell and Sayer, 2003), but also on the manner in which the issues preventing access to various solutions, including technologies, could be resolved (Ashby and Sperling, 1995; Röling and Wagemakers, 1998; Rusike *et al*, 2006; Twomlow *et al*, 2008a). The process must be farmer-centred, fully involving the intended beneficiaries from the early stages of problem identification through to technology development and adaptation (Pretty and Hine, 2001; Rusike *et al*, 2006; Ncube *et al*, 2007; Twomlow *et al*, 2008b).

This *article* is an evaluation of an ongoing and wide-scale agricultural intervention in SSA region, with focus on the program for the 2004−2006 seasons. The intervention uses participatory methods for technology development and adoption to increase agricultural production and improvements in the livelihoods of farmers. The intervention responds to a critical need area both in terms of target beneficiaries and in terms of the geographic region focused; it proposes and implements participatory research and development methods as an innovative solution. This *article* evaluates the extent to which the intervention suits the farmers' socio-economic circumstances.

Background

Participatory approaches in Zimbabwe

To address incomplete and slow adoption, a new paradigm that encouraged researchers to develop innovative methodologies emerged in the 1980s. These methodologies involved farmers in the testing and evaluation of alternative soil, water, and nutrient management options appropriate to the needs of rural households with different resource endowments in order to enhance research efficiency and impact (Bunch, 1985; Ashby *et al*, 1987; Chambers *et al*, 1989). This has led to a proliferation of tools and approaches that are now encompassed within the all-embracing title of farmer participatory research (FPR). FPR brings the experimentation to the farmers' fields through on-farm trials that enable farmers to evaluate and copy practices which work in their circumstances. Even though it is widely accepted among researchers and development that farmer-driven processes can spur rapid widespread adoption and adaptation, many researchers and development specialists still fail to understand or take full account of farmers' real priorities (Kanyama-Phiri *et al*, 2000; Douthwaite *et al*, 2003).

Since 1997, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has been conducting a program of FPR in Zimbabwe to identify practical and sustainable soil fertility and water management improvement options for smallholder farmers. The program has also evaluated various FPR approaches (Freeman, 2001; Rusike *et al*, 2006) including: the traditional on-farm research/extension and demonstration approaches as well as researcher-led approaches with farmer involvement. Table 1 summarizes the various research and extension approaches that have been developed, promoted, and evaluated in Zimbabwe since the 1980s.

Participatory action research

The basic principles which distinguish participatory approaches from conventional approaches were identified by Ashby (1990) as an efficient, client-driven methodology with a high level of decentralization and continuous interaction between scientists and farmers. Participatory approaches allow feedback from farmers to be integrated into the research program reviews, and major responsibilities for adaptive research are devolved to farmers, who also share costs of research so that they can demand accountability and transparency from the public research systems. If these principles were taken as an overlay on programs that claim to have adopted the FPR approach in order to assess the extent of farmer involvement, few would pass the test. Some have argued that while FPR increases participation among farmers, as a research methodology it has not brought about impact and output (Bentley, 1994), or may require more than short-term technology development efforts (Humphries *et al*, 2000).

Participatory approaches were developed to put right some of the problems of classical approaches to agricultural research which Salas *et al* (2003) described as the growing dependency of farmers upon external agro technologies and agro technicians, and the reduction in their confidence of their own skills and abilities to manage their resources. In addition, the top-down approaches have reduced farmers into passive end-users who are not consulted over the applicability of technologies to local conditions. Participatory approaches enhance the efficiency of agricultural research in delivering more suitable and easily adoptable technologies in smallholder agriculture to achieve sustainable rural development. The 'research' aspects of participatory action research also attempt to avoid the traditional 'extractive'

Table 1. Chronology of participatory technology development and dissemination approaches in southern Africa with reference to Zimbabwe

Period	Type	Key promoters	Main message	Remarks	References
1980s to date	Train and visit linked to Master Farmer certification	World Bank through AGRITEX	Encourages farmer−extension agent interaction. First year is training and second year involves farm visits to assess learning	Extension officers report that the Master Farmer training approach targets better resource-endowed households with livestock, implements and land, especially those who can read and write. It is dominated by well-resourced male-headed households	AGRITEX (1982, 1985, 1990); Drinkwater (1987); Rusike *et al* (2006); Eicher, 2007
1990s	Participatory agricultural extension (PAE)	AGRITEX, GTZ, ITDG	Involves the use of training for transformation and look-and-learn visits	PAE targets existing farmer groups and clubs that are mostly self-selected. Also, dominated by well-resourced male-headed households. High level of support required for extension	Hagmann *et al* (1997, 1998); AGRITEX (1998)
2000–2004	Farmer field school	UZ, AREX, NGOs	Use of groups to develop new interventions Involves evaluation and application of improved technology options within farmers' community	Farmer field schools evaluations show that they are costly and difficult to scale up because of high fixed costs associated with training staff to facilitate them and delivering time-intensive services	Von Braun *et al* (2008); Rusike *et al* (2006)
2003 to date	Relief recovery and ICRISAT's capacity-building program	DFID, ECHO, EU FAO Emergency Office for Zimbabwe, NGOs	Builds upon seed and fertilizer relief programs	The vulnerable groups have a chance to receive extension support and access to inputs	Rohrbach *et al* (2004, 2005); Mazvimavi and Twomlow (2009); Twomlow *et al* (2008b,c)

research carried out by universities and governments where 'experts' go to a community, study their subjects, and take away data without adequately giving back to local communities who participated in the research.

Participatory research or participatory action research (PAR) has been understood, implemented and introduced to local people (beneficiaries) in development work in many different ways. What PAR captures is more of a group reference rather than an individual one. However, in the end, each individual farmer has to act on his/her own in making investment decisions regarding the type of farming, investment of inputs and marketing of produce. PAR remains marred by the failure to deliver increased productivity, particularly in the short run. All too often participation is used manipulatively as a means to get local people to work to fulfill the goals and quotas of outside organizations at the expense of the community's time and energy. Also, the learning curve is long and patience is needed for one to register sustained positive change in productivity accruing from PAR. Incentive structures and review criteria inherent in academic research place a premium on production of peer-reviewed scholarly articles and graduate theses, leaving little room for follow-up and feedback on the practical value of such research.

Participatory development and scaling-out of conservation agriculture and micro-dosing

It is the work conducted by ICRISAT and partners that led to the participatory development (Ncube *et al*, 2007) and subsequent wide-scale promotion of micro-dosing (MD) (Twomlow *et al*, 2008b) as well as the adaptive work on conservation agriculture (CA) (Mazvimavi and Twomlow, 2009; Twomlow *et al*, 2008c). CA is a technique that requires the application of basic principles such as minimum soil disturbance, soil cover through mulching, crop rotation and integrated management. On the other hand, MD is a simple technique of applying fertilizer at a rate of one coke bottle cap per two plants at the five-to-six-leaf stage. Results from initial on-farm trials showed that smallholder farmers could increase their yields by 30–50% through the application of as little as 10 kg nitrogen ha^{-1} (Dimes *et al*, 2003). The question remained of whether these results could be replicated on a much broader scale.

Scaling-out of MD was initiated in 2003/2004 in the context of national drought relief programs. Donors were already distributing seed and fertilizer inputs to drought-affected farmers. This distribution was accompanied by a series of simple, paired-plot, participatory evaluation trials (PETs) with or without fertilizer, hosted by farmers selected by the community. The PETs differed from the traditional demonstration plots which are planned and managed by extension staff and only required farmers to simply observe and learn (Rusike *et al*, 2006). Initial results, based on 1,200 farmer-managed paired plots (Twomlow *et al*, 2008b) and subsequent survey work (Rohrbach *et al*, 2005) showed that MD (17 kg nitrogen ha^{-1}) increased grain yields by 30–50% across a broad spectrum of soil, farmer management and seasonal climate conditions.

The broad-scale testing encouraged DFID to launch a protracted relief program (PRP) for Zimbabwe <http://www.prpzim.info/> in 2004. The PRP provided a platform for the wide-scale promotion of improved soil fertility and water management options using the concepts of farmer-hosted, paired-plot PETs, training of change agents in adaptive evaluations, farmer field days, and various extension approaches. In 2005, more than 200,000 flyers written in the vernacular were distributed across all participating districts. Posters were also used at centrally located places such as the business centres, clinics, schools, extension offices (AREX, now known as AGRITEX), and even churches as ways of disseminating information.

Most donors believe that non-governmental organizations (NGOs) are intrinsically innovative, flexible, and responsive to the 'grassroots', and are therefore the best means of channeling effective aid to the poor. The number of NGOs operating at the grassroots level has been on the increase in Zimbabwe since 2000. According to newspaper reports, 450 new NGOs have registered since 2000 to bring the total to 1,400. In addition, as AGRITEX has been experiencing a decline in resources, NGOs have acquired an even more important role in development work and technical support in communities. While their attempts to fill this vacuum are appreciated, they have been criticized for lacking the scientific and technical expertise to effectively complement their dialogue with the poor (White and Eicher, 1999; Ryan and Spencer, 2001).

Focus of the study

The purpose of this study is to capture the effectiveness of participatory processes in agricultural technology promotion undertaken by ICRISAT and partners as it relates to soil fertility and water management technologies for the 2004/05 and 2005/06 seasons. It is important to note from the outset that the technologies in question are not new innovations but are those generated as a result of years of on-farm adaptive trials, testing and modification by both farmers and researchers. The PRP used a middleman approach whereby the technologies were promoted through various partner NGOs and AGRITEX.

In the first year of hosting paired plots, PETs farmers were encouraged to follow protocols as closely as possible. ICRISAT and partner NGOs closely monitored the trial plots to understand farmers' constraints in following the given protocols. Farmers' engagement in these PETs was to give them an advance opportunity to test ready-made solutions developed by ICRISAT and partners with room to refine, validate and adapt over time. Farmers were encouraged to try and see how the technology works. The technologies provided an easy-to-implement package for farmers who were resource-constrained with limited or no

Almost every farmer hosting the trial for the second year modified the trials to what in their view was an improvement of the protocol compared to what was implemented in the first year

access to draft power. However, almost every farmer hosting the trial for the second year modified the trials to what in their view was an improvement of the protocol compared to what was implemented in the first year. Those farmers who hosted trials were provided with fertilizer, seed and technical support as required.

Method

This survey was conducted in the 2006/07 season, in August 2006, using a survey questionnaire. Participant observation was not part of the implementation phase: 2004–2006, and hence the reason for this survey. The focus was on what was done and how it was done, simply and totally relying on the farmers' recall and perceptions. A total of 229 were interviewed from 10 districts in four provinces in the southern and western parts of Zimbabwe covering the activities of eight NGOs. A minimum of two wards were covered for each district, targeting those households which held trial plots for either CA or MD in the PRP. The farmers selected for the survey were chosen from a list of those who hosted trials in 2004−2006. These farmers had experimented with different versions of CA including digging basins, using a ripper tine, or digging furrows as well as MD.

The questionnaire went through modifications during its construction with improvements made after training as well as after the pretest. No adjustments were made on the questionnaire during the implementation of the survey. All questionnaires were post-coded in field using a code sheet which was adjusted each day. The data were entered and analyzed using SPSS. Descriptive statistics was used to analyse the data; this was mainly the means and cross tabs explaining simple relationships. Data were aggregated per district for most of the statistics.

Results and discussion

This section presents the results mostly in Tables 2–9 and describes the roles that farmers played in the process of technology dissemination. Farmers' perceptions and the problems they faced in the process and the way they circumvented them is outlined.

Table 2. Characteristics of respondents conducting on-farm trials and implementing NGOs working in partnership with local AGRITEX officers in southern Zimbabwe, 2004–2006

District	Participating NGO	Dominant paradigm used	Sample size	Proportion of female-headed households (%)	Farming experience (mean years)	Proportion of farmers implementing trials (%)		Proportion of farmers working in groups (%)	Persons available for farm work (mean)	
						CA	MD		Part time	Full time
Insiza	WV	Lead farmer	24	33.3	22.3	83.3	16.7	4.6	3.3	2.2
Mangwe	CADEC	Lead farmer	11	81.8	20.9	41.7	58.3	0	2.3	2.2
Matobo	CADEC	Lead farmer	10	38.2	24.4	100	0	0	2.4	2.1
	WV	ARG	11	44.8	25.3	85.7	14.3	30.8	2.3	2.4
Bulilima	CADEC	Lead farmer	10	70.0	14.4	100.0	0	0	2.1	3.1
Tsholotsho	ORAP	SFFS	11	100	20.5	100	0	0	2.5	2.7
	CTDT	SFFS	13	100	21.6	100	0	0	2.7	2.4
Gutu	RUDO	ARG	19	10.5	28.3	100.0	0	11.4	2.6	3.3
Chivi	ZWP	SFFS	34	23.5	23.9	88.6	11.4	8.3	2.8	2.7
Masvingo	CARE	ARG	19	77.4	23.9	100.0	0	73.2	2.6	2.8
	RUDO	ARG	12	100	20.4	100	0	36.9	2.2	2.4
Chirumhanzu	OXFAM	SFFS	26	23.1	19.9	69.2	30.8	0	2.2	2.9
Zvishavane	OXFAM	SFFS	29	20.7	22.5	72.4	27.6	9.5	2.5	2.7
Total			**229**	**42.8**	**22.6**	**84.0**	**16.0**	**10.8**	**2.6**	**2.7**

Source: Survey data (2006)
Note: ARG = action research group; SFFS = simplified farmer field school

Participants

Table 2 provides a description of the characteristics of the farmers surveyed who conducted on-farm trials promoted by ICRISAT through NGOs in partnership with AGRITEX. It also shows that each NGO had its own mode of interaction with farmer beneficiaries reflecting the dominant participation paradigm used. These included such approaches as facilitated action research groups, lead farmer approaches, and simplified farmer field schools. This has resulted in farmers working either in groups or as individuals as designated by the implementing NGO. More female farmers (13.3%) worked in groups compared to male farmers. Groups were more prevalent among farmers practicing CA compared to MD.

Participants roles and level of participation

The authors have defined passive participation in this study as 'minimal involvement of farmers to mere observers during trial implementation' whereas active participation describes 'any level of activity ranging from merely holding a tape measure up to the level of decision making needed to choose the plot site'. During the process of hosting trials, farmers indicated their level of participation at each stage of trial implementation (Table 3). Most farmers actively participated at all stages except during data collection where the greatest constraint was the use of a record book. It must be noted, however, that despite the definitions, some farmers, who were actively involved in measuring the plots, were actually only working as mere assistants who held the other end of the rope or put in a peg during the first year of implementation.

Farmers were generally happy with their level of participation during trial implementation; however, they made a number of suggestions to enhance their level of participation (Table 4). Most farmers who worked in groups (where a simplified farmer's field school approach was used) indicated that they would have preferred centrally located plots if they were given an opportunity to make the decision. These farmers would implement the PET plots at one common point for the purpose of learning and would in the next season try to host the trials in their own field. Teamwork was considered to be important during site selection, measurement, and management

Table 3. Proportion of farmer participation by type for different tasks during the implementation of experiential trials in southern Zimbabwe, 2004–2006

Task	Active participation (%) (n = 231)	Specific task	Farmers doing task Total (%)
Site selection	84.0	Advised on available land	72.2
Measuring plot	89.2	Putting pegs	50.2
Managing plot	93.1	Land allocation and providing all labor required	91.0
Data collection	86.1	Recorded all quantities used and dates	81.0

Source: Survey data (2006)

Table 4. Suggested changes by participating farmers to be made during trial implementation

Task	Changes to be made	Proportion of farmers (%)
Site selection	Select site central to group members	66
	Choose plot with poor soils to see impact	16
	Increase spacing for maize	13
	Encourage working as a group	5
Measuring plot	Use tape measure	12
	Increase spacing for maize	20
	Encourage working as a group	36
	Pacing is faster than tape measure	8
	Getting assistance from school children who are literate	24
Managing the plot	Encourage working as a group	94
	Select site central to group members	6
Data collection	Select site central to group members	37
	Modify record book to be in calendar format and in vernacular	30
	Getting assistance from school children who are literate	23
	Extension/NGO to visit frequently as an encouragement	9

Source: Survey data (2006)

of the trials. Notably, farmers hosting trials for the first time requested more supervision and guidance since they were still learning.

Problems emanating from farmer participation in technology adaptation

During the second and subsequent years of trial implementation, farmers made changes to the PET protocols they received and this freedom was important for the eventual uptake. Adaptation and innovation are essential components of the technology evaluation process and lead to empowerment. The modifications to PET protocols were necessary because they addressed specific problems or constraints encountered by farmers during the first year of implementation (Table 5). Farmers found different solutions to similar problems they encountered during trial implementation. Rodents became a problem in the second year of running the trials because, during the dry winter months, rodents move into the fields to eat dropped grain and to breed. Some farmers alluded to the problem of termites which fed on the maize stover. However, in reality this should not be a problem to farmers because it actually helped in the breaking-up of maize stover.

Another problem with mulching using crop residue was its destruction by stray animals especially during the dry season. Animals are allowed to graze freely in the winter and often end up feeding on the mulch. Grazing land is common property and one cannot exclude other people's animals from one's fields. Fencing may provide an effective control but the cost is prohibitive. The alternative is the use of

Table 5. Reasons for modifications and the related adjustments made by farmers

Reason for modification	Recommendations before adjustments	Adjustments made to the advice	Proportion of farmers (%) (n = 58)
Labour constraint	Weeding three times before harvest and once in winter	Reduced frequency of weeding to once/twice	21
	15cm x 15cm x 15cm basin	Reduced basin size	16
Easier application of fertilizer	Apply fertilizer using a bottle cap	Hand application	19
		Use a teaspoon	14
Could not afford recommended fertilizer amounts	One handful of manure	Applied manure only	16
	One bottle cap per basin	Reduced amount of fertilizer	12
Recommended fertilizer too little	One bottle cap for two plants	Increased the fertilizer applied to two caps	16
Capture more water	15 cm x 15 cm x 15 cm basin	Increased basin size	19
Too much rain	One bottle cap for two plants	Increased the fertilizer applied to two caps	12
Animals would feed on crop residue in the field	Leave maize stalks in field	Removed crop residue and applied during planting	7
Crops too crowded	90 cm inter-row x 60 cm in-row	Increased basin spacing to varying sizes	9

Source: Survey data (2006)

Table 6. Problems and solutions for the trials hosted by farmers (n = 229)

Problems encountered during trials	Proportion of farmers encountering problem (%)	Measures put in place	Proportion of farmers using the measure (%)
Problem of rodents/termites due to crop residue	20	Used traditional practices (sand, ashes, treated with certain plants)	38
Stray animals	17	Protected the plot by fencing or guarding	46
Labor constraints	16	Pooled labour by working in groups	26
Problem of invasion by worms/birds (seasonal)	13	Used traditional pesticides (special ashes, wild plants)	50
Lack of fertilizer	10	Used manure instead of fertilizer (farmers allowed to choose between manure and fertilizer)	38
Too much rain/wind	7	Replanted destroyed crop	59

Source: Survey data (2006)

live fences to protect the fields. A summary of the general nature of the problems encountered is shown in Table 6 and this is important feedback information to scientists as it sets the agenda for further research.

Changes incorporated into farmer practice

Farmers who hosted trials managed to learn a number of practices that they subsequently incorporated into their normal farm operations. According to Rusike *et al* (2006), information generated in the trials enables farmers to revise their subjective beliefs about the profitability of the new technology and to decide whether or not to continue using it and what resources to allocate to it. Most of the practices that were taken up by farmers were linked to the aims of the PETs. In the case of CA, 56% of the respondents indicated that they realized that the aim of the trial was to learn about the payoffs of using own labour when faced with a draft power constraint. Consequently, most of these farmers could now plant in time since they no longer had to wait to borrow draft animals. Winter weeding and the use of maize stover for mulching have not become common practices because of the implications on farmers' time and infringement on the free movement of cattle in winter.

Farmers adopted some changes to their old practices because they had learned better ways of managing soil fertility and water and because they anticipated better yields. A comparison of the old and new practices adopted highlighted the driving force behind the change (Table 7). Targeted application of nutrients and the use of bottle caps to apply fertilizer are the most popular techniques that have been adopted by those who practiced CA and MD. Different forms of minimum tillage, ranging from digging basins, furrows and using a ripper tine, were readily accepted by the farmers. Almost all farmers who hosted CA trials have acknowledged the incorporation of minimum tillage into their normal practice.

Participatory technology transfer process and feedback loops

The majority of farmers (80%) hosting PETs confirmed that in each season they had the opportunity of discussing their results through a range of different platforms as shown in Table 8. Field days, farmer meetings and shows (fairs) ensured that a larger audience was addressed. Field days and shows are paramount in ensuring that tangible evidence is available in the farmer's field. The same methods were also used as platforms for spreading information

Table 7. Reasons for moving away from the old practices

New practice	Old practice	Reasons for changing
Use of chemical fertilizer	Use of cattle manure, anthill soil, ashes and compost	Got access to fertilizer through programs
		Fertilizer makes crops grow fast and improves soil fertility
Targeted application of nutrients and micro-dosing	Broadcasting	Economical and efficient way of applying fertilizer
Minimum tillage (digging basins)	Summer ploughing	Enables maximum water use per plant
	Contours and storm drains	More effective in soil erosion control
Mulching	Winter ploughing	Improves water retention by soil
		Improves soil fertility

Source: Survey data (2006)

Table 8. Proportion of farmers who were reached by the various methods used to present results during 2005/06 season

	Method			
	One-on-one	Meetings	Shows	Field days
Male (%) (n = 102)	26	29	1	43
Female (%) (n = 73)	26	19	0	55

Source: Survey data (2006)

to other farmers. Farmer-to-farmer extension was the most popular transmission vehicle, used by more than 70% of the farmers.

Farmers felt free to communicate their skills and experience with all members of the community. Once this level of communication flow is reached in communities, farmer-to-farmer sharing becomes quite dynamic. Strategically located trial plots tend to attract the attention of all neighbours, silently transferring information.

One of the primary benefits of attending field days was interaction with other farmers through observation by neighbours. Field days are one-off events that leave a lasting impression, unlike farmer meetings, which have to be attended regularly. Field days proved to be an important platform for presenting results to the female household heads (Table 8). Farmer meetings were mainly used to reach male household heads because they are not faced with a time constraint like their female counterparts. Women normally have other commitments and are often unable to attend regular meetings. Given the sample size (231), the extent of contacts between farmers and extension through various methods is quite high by African standards (Table 8).

Farmers had suggestions on how the hosting of trials could be improved (Figure 1); this critical feedback is essential in a participatory process. If the information was incorporated in future programs, farmers would feel a sense of ownership, boosting their confidence and leading to wider adoption. Female-headed households indicated a greater preference for working in groups as they believed it incorporated more community members in the program. Getting more training and stricter supervision is fundamental to them as a way of boosting their confidence. By contrast, male-headed households demanded inputs on time and wanted a chance to experiment with different crop varieties. They even requested the trial plots to be increased in size. Male-headed households were primarily concerned with technical issues while their female counterparts raised issues more attuned to social aspects.

Farmers also had concerns relating to administrative issues of the implementing NGOs. The issue of delays in input distribution was pointed out as requiring corrective action and there were requests for an increase in the level of supervision which was deemed low or non-existent. Some farmers requested an increase in the size of demonstration plots as well as incorporating more farmers who were interested to ensure greater participation. For the continuity of the program, farmers requested more information on CA because it is a knowledge-intensive technology requiring a longer learning period. In addition, some farmers felt that fertilizer should be available at local shops to improve access. Developing input markets is a key issue in ensuring long-term sustainability.

Table 9 provides a summary of farmers' perceptions of the process of technology promotion and transfer with special emphasis on the approaches used, the behaviour towards farmers and farmer involvement during project implementation. The purpose of this inquiry was to take note of the strong points and areas that needed correction. Due to the

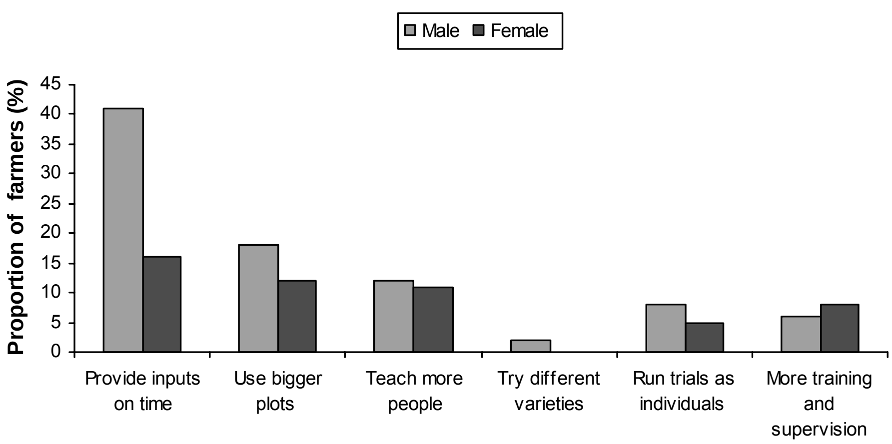

Figure 1. Farmer suggestions on how best to run trials

Table 9. Farmers' perception on the technology promotion and transfer process

Issue	Farmers' comment	Number of farmers	Proportion of farmers (%)
Approaches towards farmers	Consulted local leadership	127	55.0
	Accompanied by extension officer	79	34.2
	Explained objective at a meeting	17	7.4
	Farmers need more time before they get involved	2	0.9
Behavior towards farmers	Happy, friendly, respectful to farmers	151	65.4
	Used language that was understood by farmers	63	27.3
	Should speak in a language that villagers understand	8	3.5
	Should treat us with respect even if we do not know	5	2.2
	Treated everyone as a potential farmer	3	1.3
Involving farmers	Farmers given a chance to participate and ask questions	85	36.8
	Farmers were included in the planning	60	26.0
	Farmers should be involved in the actual planning of the program	43	18.6
	Treated everyone as a potential farmer	27	11.7
	Farmers not given a chance to participate	6	2.6
	They should explain why other farmers were excluded	6	2.6
	We volunteered to participate	5	2.2
Tools	Tools were user-friendly and appropriate	94	40.7
	Provide more tools to farmers	57	24.7
	Should bring appropriate tools for the job	36	15.6
	Should bring tape measures	32	13.9
	Improvise where tools are not available	12	5.2
Substance in what is being taught	Technology works	160	69.3
	Training workshop were good	52	22.5
	Practical lessons helped a lot	19	8.2
Methods used	Methods used were understandable	112	48.5
	Group discussions	52	22.5
	One-on-one	36	15.6
	Practical lessons helped a lot	16	6.9
	Training workshops were helpful	6	2.6
	Train farmers more frequently	5	2.2
	Record book should be in vernacular	5	2.2

Source: Survey data (2006)

diversity of farmers and NGOs involved, a homogenous view could only be captured while diversity of views was hidden in numbers. Generally, the comments were positive as would be expected because farmers were not so sure of the implication of any negative comment they give. Most farmers praised the technology even if the crops performed worse compared to their farmer practice because they shouldered the blame by attributing the poor performance to their failure to follow the recommendations exactly.

In terms of the approach towards farmers, most farmers acknowledged that local leadership was consulted and the purposes of the visits were always explained at a public forum. Local extension officers always accompanied the visitors and this was welcomed by farmers. A few individuals felt they were rushed into the program and it was necessary for them to be given adequate time before they got involved. The behaviour was commendable as more than 65% of the farmers testified that they were respected and treated well.

Conclusions

In this article we have evaluated the implementation process which uses a participatory approach together with wide-scale dissemination. In our evaluation of the process we have placed emphasis on farmer participation and lessons that can be fed back into this process and future relief-related programs in Zimbabwe. The study has verified that using a participatory approach in wide-scale dissemination of technologies allows farmers to adapt the recommendations and also provides a superior platform for the dissemination of technologies to a wider community.

The history of participatory technology development in Zimbabwe goes back to the early 1980s (about 30 years ago). Extremely useful lessons and feedback have been obtained from farmers ever since. However, it remains unclear the extent to which follow-up programs or initiatives have internalized these lessons. Extending farmer's recommendations should be done in tandem with on-farm trials, to encourage adaptation and modification. This leads to more permanent adoption, greater diffusion, and better engagement of farmers, increased input use and associated productivity increase.

Given the current harsh economic and social conditions in Zimbabwe, there is a strong temptation for farmers to be overly loyal to the advocates of PAR, particularly when the components are accompanied by provision of free goods and services such as agricultural inputs — seeds and fertilizer and even direct food handouts. Despite this, as shown by the results of the survey, PAR has the ability to provide feedback to researchers, providing room for mid-term corrections of the technology and making it more relevant to the farmers in the end. PAR provides the space for participating farmers to state what does not work and why, as well as providing alternatives (Table 5). It is imperative that scientists and promoters seriously heed the feedback, to achieve the real objectives of the participatory processes.

As a result of recent political developments, Zimbabwe will probably continue to have serious economic stress for the next 10 years even if the turnabout started immediately. Under these conditions, resource-poor farmers will need the most help. Fortunately, there are several NGOs that seem to be interested in assisting these farmers to cope with the situation (Table 2). Their presence and continued interest in supporting PAR in the next 10 years will be critical in alleviating the suffering of resource-poor farmers. The participatory approach which has been applied thus far has led to tighter collaboration among national and international researcher organizations, NGOs, and the government.

References

AGRITEX, 1982. *Master Farmer Trainee Record Book*. Harare, Zimbabwe:Agritex. Ministry of Agriculture, government printers.

AGRITEX, 1985. *A Systems Approach to Agricultural Extension*. Harare, Zimbabwe: Agritex Training Branch, Ministry of Agriculture.

AGRITEX, 1990. *Master Farmer Training Scheme 1990 Policy and Objectives.* Masvingo, Zimbabwe: AGRITEX.

AGRITEX, 1998. *Learning Together Through Participatory Extension: a Guide to an Approach Developed in Zimbabwe*. Harare, Zimbabwe: Department of Agricultural, Technical and Extension Services.

Ashby, J A 1990. Evaluating technologies with farmers: a handbook. CIAT Publication No. 187. Cali, Colomnia: Centro Internacional de Agricultural Tropical (CAIT).

Ashby, J A and L Sperling 1995. Institutionalizing participatory, client-driven research and technology development in agriculture. *Development and Change*, **26**:753–770.

Ashby, J, A Q Carlos and Y M Rivera 1987. Farmer participation in On-Farm Varietal trials. Agricultural Administration (Research and Extension) Network. Discussion Paper no. 22. London: Overseas Development Institute.

Bentley, J 1994. Facts, fantasies and failures of farmer participatory research. *Agriculture and Human Values*, **11**(243), 140–150.

Bunch, R 1985. Two Ears of Corn: a Guide to People Centered Agricultural Improvement. Oklahoma: World Neighbours.

Campbell, B M and J A Sayer eds 2003. Integrated natural resource management: linking productivity, the environment and development. CABI Publishing UK in association with CIFOR.

Chambers, R, A Pacey and L A Thrupp eds 1989. *Farmer First: Farmer Innovation and Agricultural Research*. London: Intermediate Technology Publications.

Dimes, J, S Twomlow and P Carberry 2003. Application of APSIM in smallholder farming systems in the Semi-Arid Tropics. In *A Practical Guide to Decision-Support Tools for Smallholder Agriculture in Sub-Saharan Africa*, eds Tjark Struif Bontkes and Marco C S Wopereis, pp. 85–99. Muscle Shoals, AL, USA: International Center for Soil Fertility and Agricultural Development (IFDC); and Wageningen, The Netherlands: Technical Centre for Agricultural and Rural Cooperation (CTA).

Douthwaite, B, R Delve, J Ekboir and S J Twomlow 2003. Contending with complexity: the role of evaluation in implementing sustainable natural resource management. *International Journal of Agricultural Sustainability*, 1, 51–68.

Drinkwater, M J 1987. *Exhausted Messages: Training and Groups: A Comparative Evaluation of Zimbabwe's Training and Visit System*. Working Paper AEE 2/87. Harare, Zimbabwe: Department of Agricultural Economics and Extension, University of Zimbabwe.

Eicher, C K 2007. Agricultural Extension in Africa and Asia. Staff Paper 2007-05. East Lansing, Michigan: Department of Agricultural Economics, Michigan State University.

Freeman, H A 2001. Comparison of Farmer-Participatory Research Methodologies: Case Studies in Malawi and Zimbabwe. Pantancheru 502 324. Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Greenland, D J, P J Gregorgy and P H Nye eds 1998. Land resources: on the edge of the Malthusian precipice. *Philosophical Transactions of the Royal Society*. Royal Society, London and CAB Int., Wallingford, Oxon, UK.

Hagmann, J, E Chuma, M Connolly and K Murwira 1997. Propelling change from the bottom up: institutional reform in Zimbabwe. Gatekeeper Series no. 71. London, UK: IIED.

Hagmann, J, E Chuma, M Connolly and K Murwira 1998. Client-driven change and institutional reform in agricultural extension: an action learning experience from Zimbabwe. ODI Agricultural Research and Extension Network, AgREN. Network Paper No. 78.

Humphries, S, J Gonzalez, J Jimenez and F Sierra 2000. Searching for Sustainable Land Use Practice in Honduras: Lessons from a Programme of Participatory Research with Hillside Farmers. Overseas Development Institute. Agricultural Research and Extension Network Paper No. 104. July.

Kanyama-Phiri, G, S Snapp, B Kamanga and K Wellard 2000. Towards integrated soil fertility management in Malawi: incorporating participatory approaches in agricultural research. Managing Africa's Soils No. 11. Edinburgh, UK: IIED-Drylands Programme.

Kiers, E T, R R B Leakey, A Izac, J A Heinemann, E Rosenthal, D Nathan and J Jiggins 2008. Agriculture at a crossroads. *Science*, **320**, 320–321, 18 April, <www.sciencemag.org>.

Knox, A and R Meinzen-Dick 1999. Property rights, collective action and technologies for natural resource management. CGIAR SP-CAPRi, Policy Brief no. 1. Washington DC.

Mazvimavi, K and S Twomlow 2009. Socioeconomic and institutional factors influencing adoption of conservation farming by vulnerable households in Zimbabwe. *Agricultural Systems*, 101, 20–29.

Ncube, B, J Dimes, S Twomlow, W Mupangwa and K Giller 2007. Raising The productivity of smallholder farms under semi-arid conditions by use of small doses of manure and nitrogen: a case of participatory research. *Nutrient Cycling in Agroecosystems*, **77**, 53–67.

Pretty, J and R Hine 2001. Reducing food poverty with sustainable agriculture: a summary of evidence. Final report from SAFE-World Research Project. Colchester, UK: University of Essex.

Rohrbach, D, R Charters and J Nyagweta 2004. Guidelines for Agricultural Relief Programs in Zimbabwe. ICRISAT Box 776, Bulawayo, Zimbabwe.

Rohrbach, D D, K Mazvimavi and M Mudhara 2005. The Distribution of Relief Seed and Fertilizer in Zimbabwe. Lessons Derived from the 2003/04 Season. ICRISAT, Box 776, Bulawayo, Zimbabwe and United Nations Food and Agricultural Organizations Emergency Office for Zimbabwe.

Röling, N and M Wagemakers eds 1998. *Facilitating Sustainable Agriculture*. Cambridge: Cambridge University Press.

Rusike, J, S J Twomlow, H A Freeman and G M Heinrich 2006. Does farmer participatory research matter for improved soil fertility technology development and dissemination in Southern Africa? *International Journal of Agricultural Sustainability*, **4**(3), 176–192.

Ryan, J G and D C Spencer 2001. Future challenges and opportunities for agricultural R&D in the semi-arid tropics. *Patancheru*, **502**, 324. India: ICRISAT.

Salas, M, J C Xu and T Tillmann 2003. *Participatory Technology Development: Linking Indigenous Knowledge and Biodiversity for Sustainable Development*. Kunming: Yunnan Science and Technology Press.

Twomlow, S, B Shiferaw, P Cooper and J D H Keatinge 2008a. Integrating genetics and natural resource management for technology targeting and greater impact of agricultural research in the semi-arid tropics. *Experimental Agriculture*, **44**, 235–256.

Twomlow, S, D Rohrbach, J Dimes, W Mupangwa, B Ncube, L Hove, M Moyo, N Mashingaidze and P Mahposa 2008b. Micro-dosing as a pathway to Africa's Green Revolution: evidence from broad-scale on-farm trials. *Nutrient Cycling in Agro-ecosystems*. DOI: 10.1007/s10705-008-9200-4.

Twomlow, S J, J C Urolov, B Oldrieve and M Jenrich 2008c. Lessons from the field – Zimbabwe's conservation agriculture task force. *Journal of SAT Agricultural Research*. In press.

Von Braun, J, S Fan, R Meinzen-Dick, M W Rosgrant and A N Pratt 2008. International Agricultural Research For Food Security, Poverty Reduction, and Environment: What to Expect from Scaling Up CGIAR Investments and 'Best Bet' Programs. IIFPRI Discussion Paper, advanced copy, 23 September 2008.

White, R and C K Eicher 1999. NGOs and the African farmer: A skeptical perspective. Staff Paper No. 99-01. East Lansing, Michigan, USA: Department of Agricultural Economics, Michigan State University.