Research Application Summary

Translating integrated soil fertility management empirical knowledge into action through participatory learning and marketing agricultural produce in Zimbabwe

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Abstract

The study sought to identify suitable mechanisms for transferring the available knowledge on concepts and principles of integrated soil fertility management (ISFM) technologies to smallholder farmers and agricultural service providers in Zimbabwe. The study was carried out in two distinct smallholder farming communities of Makoni and Wedza in eastern Zimbabwe aiming at with an aim of promoting adoption of innovations for sustainably increasing yields and incomes. a The national extension agency, Agritex, was identified as the major conduit for agricultural information dissemination by 80% of farmers in Makoni and 95% in Wedza. PAR approaches enabled mobilisation of farmers differing in resource-endowments to participate knowledge-sharing alliances resulting in significant farm-level increases in maize and legume yields. Attendance to local meetings and other agriculture-related fora also increased from <5% representation to ~50% for the more vulnerable members, notably women-headed households, the elderly and the more resource-constrained community members. Benefits of ISFM for farmers participating in learning alliances included improved household food security through increased yields and marketing of produce (income).

Key words: Crop yields, learning alliances, learning centre, participatory action research, SOFECSA

Résumé

L'étude a cherché à identifier les mécanismes appropriés pour transférer les connaissances disponibles sur les concepts et les principes des technologies de gestion intégrée de la fertilité des

sols (GIFS) aux petits exploitants et aux fournisseurs de services agricoles au Zimbabwe. L'étude a été réalisée au sein de deux communautés distinctes de petits exploitants agricoles de Makoni et Wedza dans l'est du Zimbabwe visant un but de promouvoir l'adoption des innovations pour les rendements et les revenus croissants de manière durable. L'agence de vulgarisation nationale, Agritex, a été identifiée comme l'axe majeur pour la diffusion de l'information agricole par 80% des agriculteurs à Makoni et 95% à Wedza. Les approches PAR ont permis la mobilisation des agriculteurs se différenciant dans les dotations en ressources pour participer aux alliances de partage des connaissances résultant dans l'augmentation importante du niveau des exploitations en ce qui concerne les rendements de maïs et de légumineuses. La participation aux réunions locales et autres instances en rapport avec l'agriculture a également augmenté de représentation <5% à environ 50% pour les membres les plus vulnérables, notamment les ménages où le chef de famille est une femme, les membres âgés et ceux des communautés dont les ressources sont plus limitées. Les avantages de la GIFS pour les agriculteurs participant à des alliances d'apprentissage ont inclus l'amélioration de la sécurité alimentaire des ménages grâce à une augmentation des rendements et de la commercialisation des produits (revenus).

Mots clés: Rendements des cultures, alliances d'apprentissage, centre d'apprentissage, recherche d'action participative, SOFECSA

Background

Agriculture remains the primary source of livelihoods for many rural and peri-urban communities of sub-Saharan Africa (SSA). However, the current lag in per capita food production among these communities does not reflect the massive investments by many national and international economies towards agricultural research. Poor soils continue to drive poverty in much SSA, and this is exacerbated by intricate linkages among inappropriate methods of crop production (primarily driven by low adoption of proven technologies), poverty and food insecurity. In addition, increased impacts of climate change and variability in recent years has led to a declining natural resource base and loss of biodiversity in smallholder farming. Indications therefore point to the need utilise empirical knowledge that has been generated through decades of research to better sustain livelihoods of farming communities through improved adoption.

Identification of appropriate mechanisms for transferring available knowledge on 'best-fit' agricultural technologies among them, principles and concepts of ISFM, to farmers, extension agencies and other agricultural service providers could provide the much needed milestones to sustainable adoption. Recent large scale initiatives in southern Africa by the Soil Fertility Consortium for Southern Africa (SOFECSA) have demonstrated the potential for field-based learning platforms and innovation systems approaches improving adoption of ISFM and climate change adaptation measures under diverse agro-ecosystems and socio-economic circumstances. The focus of this study was therefore, to co-learn with smallholder farmers and develop capacity to apply principles and concepts of diverse ISFM options with different categories of smallholder farming households seeking to increase staple food production and generate marketable surpluses in the wake of increased climate variability and change.

Literature Summary

According to SOFECSA (www.sofecsa.org) ISFM refers to a combination of a proven set of concepts, principles and practices on the efficient use of available organic and inorganic resources, soil water and appropriate plant genotypes, according to farmer circumstances, in maintaining or improving soil fertility leading to sustainable crop production for household food and income security and enhanced livelihoods (Mapfumo, 2009). ISFM seeks to (i) encourage use and optimal combinations of locally available and externally added nutrient resources into cropping systems; (ii) promote appropriate choices of crop types and cultivars for given biophysical and socio-economic environments; (iii) employ mechanisms that minimise nutrient losses from the cropping system to enhance sustainability, and (iv) promote recycling of nutrients within cropping systems. The definition does not differ much from that by Sanginga and Woomer (2009).

Several methods have been proposed and/or tested for dissemination of agricultural technology information. These include traditional extension methods and farmer participatory research methodologies (Farrington and Martin, 1988), including participatory action research (PAR) (German *et al*., 2008). PAR, based on the understanding that reality is socially-constructed and viewed in different ways by different actors in a system, points to the need for external researchers to be engaged in joint learning processes with those directly affected. FAO (2001) highlighted the importance of active engagement among farmers and agricultural service providers including

extension, in improving the farmers' knowledge base on new and improved technologies, thus enhancing capacity to adopt.

Study Description

The study was carried out in two distinct smallholder farming communities of Wedza and Makoni districts in eastern Zimbabwe taking advantage of SOFECSA groundwork on ISFM and climate change awareness in the districts. SOFECSA uses the Learning centre approach in its research and development initiatives with smallholder farmers. The Learning centre not only acts as a field-based activity to showcase ISFM innovations, but also a rallying point to share knowledge and exchange information (Mapfumo, 2009). Dendenyore and Goto wards in Wedza district lie in Zimbabwe's natural region (NR) II and receive an average annual rainfall of >750 mm between November and March. Wedza has >80 yrs of smallholder farming and average landholding of < 3 ha household^{-1}. The agriculture extension workers (AEWs):farmer ratio in each of the two wards is ~1: 500 households and at least 80% of the households derive their livelihoods from crop-based farming. The soils in Wedza range from coarse sands (Arenosols) to sandy clay loams (Lixisols) with <10% clay, low in nitrogen and phosphorus, and organic carbon contents of <0.65%.

With the help of local national agricultural extension, at least 200 farmers were classified into resource groups using criteria developed by Mtambanengwe and Mapfumo (2005) namely Resource-endowed [RG1] farmers (owning basic farming implements including draught and relatively high capacity to secure inputs); Intermediate [RG2] farmers (a diverse group of varying but limited resource-ownership) and Resource-constrained [RG3] farmers with low resource base and often face difficulties in conducting farming activities. RG3 households were significantly constituted by female or child-heads and old people (> 60 years). A formal questionnaire survey focussing on farmers' understanding of ISFM, sources and use of ISFM was administered before farmers were mobilised into knowledge-sharing platforms using PAR methodologies. The resultant three groups differing in leadership then set-up their own Learning centres where best-fit ISFM technologies were tested, and yield quantified.

Nyahava ward 9 in Makoni, is in NR III and receives between 450-650 mm annum^{-1}. Formerly a large scale commercial farming area, Nyahava, is a resettlement area with <30 years of smallholder farming having been opened up by the

Government of Zimbabwe during the first phase of decongestion of communal areas between 1982 and 1983. Households have an average landholding of 6 ha, with maize (*Zea mays* L.) being the major crop, although there is a strong crop-livestock interaction with average cattle ownership of at least 5 cattle household^{-1}. Grain legumes; groundnuts (*Arachis hypogaea* L.), cowpea (*Vigna unguiculata* [L.] Walp), Bambaranuts (*Vigna subterranea* (L.) Verdc) and soyabean (*Glycine max* L.) are produced at a comparatively low scale. Key farmer participatory research tools including structured questionnaire surveys, focus group discussions, key informant interviews and grey literature were used to assess the differential benefits of ISFM. Using PAR, farmers in Nyahava were mobilised into co-learning alliances by three resource categories (RG1-RG3) to determine factors influencing uptake of ISFM technologies around field-based SOFECSA Learning Centres (LCs). Visioning, participatory action planning and reflection formed the major PAR steps at this site.

Research Application

The results indicated that the introduction of ISFM-based field learning centres by SOFECSA, and PAR approaches increased farmer participation in learning alliances. At least 70% of the farmers in Makoni and 85% in Wedza participating in these alliances were using components of ISFM in their own fields. For example, individual farmers were seen to be using combinations of organic and inorganic nutrient resources, practicing legume-cereal intercrops and rotations, demonstrating knowledge of appropriate crop varieties, and/or reflecting knowledge of both soil and water conservation among other practices. The interactions among their peers or with other agricultural service providers raised farmers' awareness in the benefits of becoming members of commodity associations and natural resource management.

Prior to PAR initiatives, farmers in both communities rarely met to exchange information and knowledge on ISFM and climate issues on their own initiative. Some of the reasons forwarded included preference given to individual visits; lack of transparency during identification of rallying points, often blaming local extension for favouritism; or absence of groups with farming agenda in their midst. Access to ISFM information was poor in Makoni only being limited to national extension, Agritex, primarily due to low infrastructural development in the area. However, different categories of farmers in both Makoni and Wedza had their own preferred sources of

Table 1. Sources of integrated soil fertility management and weather information by smallholder farmers differing in resource endowment in two communities of Makoni and Wedza in eastern Zimbabwe.

Site	Farmer prioritized sources of ISFM and weather information		
	Resource-endowed (RG1)	Intermediate (RG2)	Resource-constrained (RG3)
Makoni	1. National extension (Agritex) 2. Research 3. Electronic/print media 4. Learning institutions 5. Fellow farmers 6. NGOs	1. Agritex 2. Fellow farmers 3. Research 4. NGOs 5. Electronic/print media 6. Learning institutions	1. Agritex 2. NGOs 3. Fellow farmers
Wedza	1. Agritex 2. Research 3. Private extension 4. Electronic/print media 5. Fellow farmers	1. Agritex 2. NGOs 3. Research 4. Fellow farmers 5. Electronic/print media	1. Fellow farmers 2. Agritex 3. NGOs 4. Research 5. Learning institutions

agricultural information. In resettlement area of Makoni, Agritex, was seen to play a key role in information flow across all resource groups (Table 1). This was in contrast with Wedza, an old communal setting, where the more resource-constrained (RG3) farmers, most of whom were women, trusted their peers as major sources of agricultural information.

Electronic and print media was ranked highly only by RG1 farmers who often can afford it, implying that research needs to identify alternative sources of information dissemination to reach out to all groups. The importance of innovation approaches which often involves other relevant stakeholders may be key in disseminating empirical data derived from research, given the low rank of research by mostly RG3 farmers in Wedza. Complete absence of research as an important source of ISFM and climate information in Makoni (Table 1) may imply that current approaches used in agricultural research do not enable effective communication to different farmer categories. Previous findings have reported that vulnerable members of communities, particularly if they lack resources to perform basic farming activities, usually 'shy away' from meetings and gatherings related to learning and knowledge sharing (Mtambanengwe and Mapfumo, 2005; Mapfumo *et al*., 2010).

Attendance of RG3 farmers to learning-based farmer meetings prior to 2008 was often <5% in the two communities. Preference

was given to NGOs, where there was always anticipation of receiving some donations and food handouts as opposed to research. However, the field-based Learning centre approach, introduced by SOFECSA and adopted under the reported study, encouraged adaptive testing of ISFM innovations by all resource groups, as well as increased participation of men cropping activities. Farmers in co-learning alliances realised increased yields and were able to organise themselves to collectively market any surpluses for income generation. The study revealed the effectiveness of PAR in facilitating interaction through co-learning alliances and knowledge sharing platforms resulting in sustained yields and soil productivity by different farmer resource categories.

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References

FAO. 2001. The Economics of Conservation Agriculture. Food and Agriculture organisation of the United Nations, Rome, Italy.

Farrington, J. and Martin, A. 1988. Farmer participation in Agricultural Research: A review of concepts and practices. Occasional Paper No. 9, ODI, London, UK.. 17pp.

German, L.A., Tiani, A., Mutimukuru, T., Chuma, E., Jum, C., Nemarundwe, N., Daoudi, A., Ontita, E., Yitamben, G., Orindi, V. and Beaulieu, N. 2008. The Application of Participatory Action Research to Climate Change Adaptation: A Reference Guide. 102 pp.

Mapfumo, P. 2009. Integrating sustainable soil fertility management innovations in staple cereal systems and other value chains to enhance livelihoods and environmental systems in Southern Africa. SOFECSA Annual Report for SSA-CP FARA. SOFECSA- CIMMYT, Harare, Zimbabwe.

Mapfumo P., Chikowo R. and Mtambanengwe, F. 2010. Lack of resilience in African smallholder farming: Exploring measures to enhance the adaptive capacity of local communities to climate change. Final Technical Report to

the IDRC-DfID Climate Change Adaptation in Africa (CCAA) program. University of Zimbabwe, Harare, Zimbabwe. 99 pp.

Mtambanengwe, F. and Mapfumo, P. 2005. Organic matter management as an underlying cause for soil fertility gradients on smallholder farms in Zimbabwe. *Nutrient Cycling in Agroecosystems* 73: 227-243.

Sanginga, N. and Woomer, P.L. (Eds). 2009. Integrated soil fertility management in Africa: Principles, practices and developmental process. Tropical Soil Biology and Fertility Institute of the International Centre for Tropical agriculture. Nairobi, Kenya. 263 pp.