Innovation through action
An action research journey with smallholder farmers in Limpopo Province, South Africa: experiences of soil fertility management

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3. Innovation through action

An action research journey with smallholder farmers in Limpopo Province, South Africa: experiences of soil fertility management

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3.1 Background

This chapter documents the learning processes within the framework of innovation of soil fertility management practices that emerged from the implementation of Participatory Extension Approach (PEA) as part of service delivery reorientation within the Limpopo Department of Agriculture in South Africa. Other major innovation processes were developed around the same time and they include soil and water conservation, small-scale seed production and livestock management. All these innovations were developed by teams of researchers, extension officers and contributions from the farmers following the guiding principles of the PEA process. The author chose to use a soil fertility management case to illustrate the learning curves that researchers underwent together with farmers primarily because he was part of the learning team. Although reference is made to other villages in the later years of implementation of soil fertility management, the description of the learning process is rooted more in the first two seasons and in particular in three villages of the Capricorn districts, namely GaThaba, GaMogano and Spitzkop. In short, the chapter gives a narrative description of what transpired during the interaction between researchers, extension officers and farmers, the processes involved, the lessons and conclusion.

The processes took place in the context of the attempt to increase the efficiency of service provision to rural farmers by Limpopo Department of Agriculture (LDA). Limpopo Province is one of the nine provinces in South Africa with most of its people living in the rural areas. With 85% of the people involved in farming, agriculture is one of the pillars contributing to the economy (Anonymous, 1995; Schuh, 1999). After the establishment of the new government in 1994, it was realised that the majority of smallholder farmers in rural areas could not access adequate services from the government because existing mechanisms were largely modelled on commercial farming – the notion of 'one size fits all'. This prompted the South African government to develop policy statements[2] (Shao *et al.*, 2004) aimed at addressing poverty among the majority of rural people. In Limpopo this led to the establishment of a programme in 1998 called Broadening Agricultural Services

[2] Mission statement of the National Department of Agriculture is to "Ensure equitable access to agriculture and promote the contribution of agriculture to the development of all communities, society at large and the national economy, in order to enhance income, food security, employment and quality of life in a sustainable manner" (Anonymous, 1995).

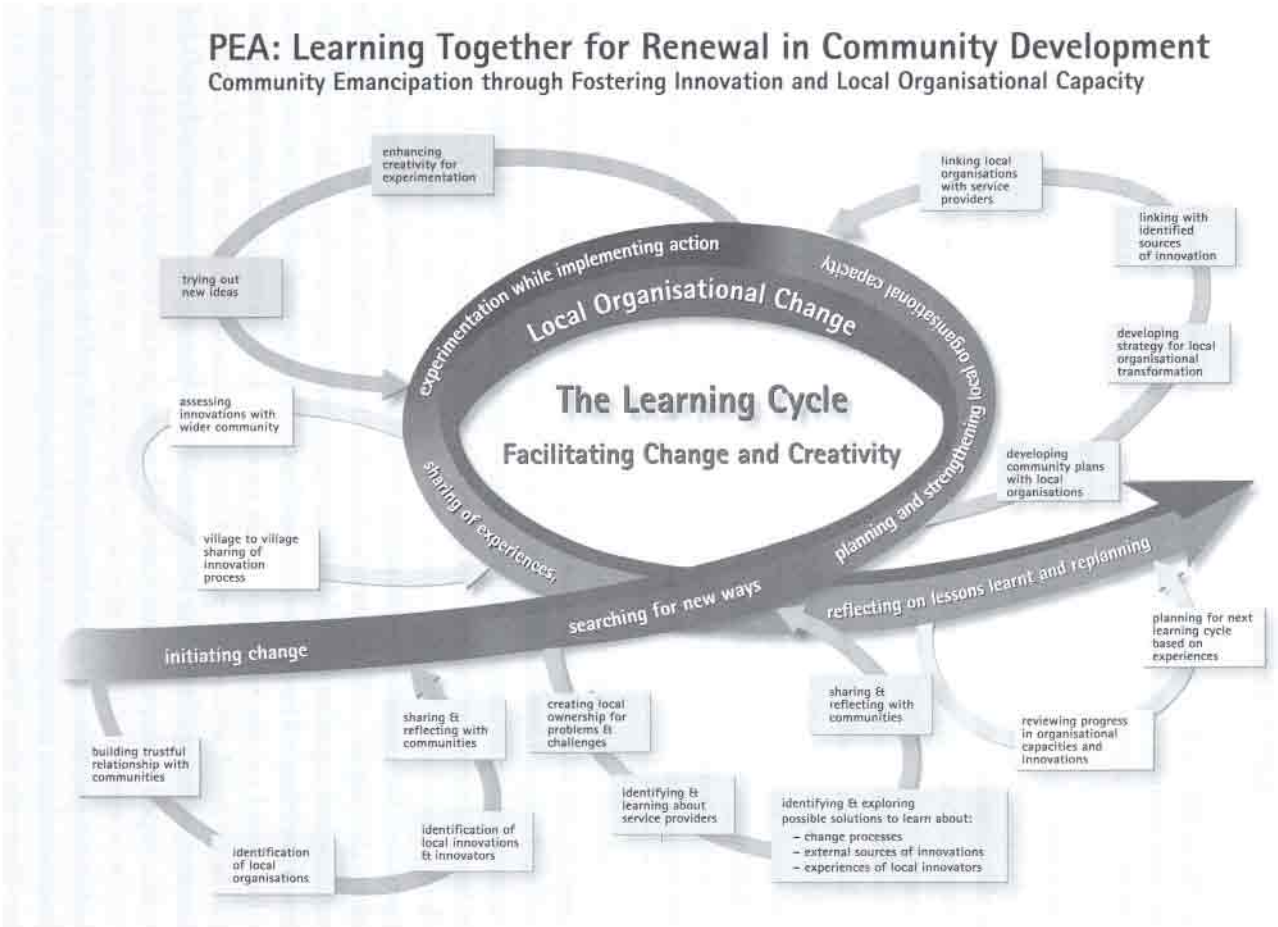

Figure 1. The basic phases of the learning cycle as developed through an action-research process in South Africa (Hagmann et al.*, 2003).*

Perceptions of farmers about the declining soil fertility

The research team (composed of the scientist and extension officers) wanted first to assess farmers' perceptions of soil fertility in the area. This was seen as an opportunity to learn about practices previously used by farmers and get suggestions from them on how to move forward. At this stage, members of the research team were trying to bring into practice what they had learned from PEA and the PTD workshops – how to involve farmers right from the start of participatory research processes. Key questions that guided the discussions during the meeting with farmers were:

- What do you understand by declining soil fertility?
- How does this problem present and how long has it existed?
- What did you do to address the problem and what were the results?
- What do you think should be done to solve this problem in the future?

These questions provided an opportunity to start discussions with farmers and were followed by deeper discussions to unpack some issues. Table 2 shows some of the responses from farmers in the problem analysis exercise.

> 'Just like when we go to the doctor for a check up when we are sick, we now know that soils also need to be tested or doctored to determine their nutritional status and for farmers to apply necessary inputs' (farmers from Spitzkop, March 2000).

During the discussions, farmers indicated that soil samples had been taken before by the extension officers and fertiliser agencies, but the results were never discussed with them. It was then agreed with farmers that since there were no previous records on soil analysis, be it from the extension officer or the fertiliser companies, soils samples would be taken from farmer groups that were interested. The research team saw this as an opportunity to get to know the nutritional status of the soils and widen the scope of options that could be tried out by farmers. Furthermore, agreement at the end of the meeting was that those who were part of these awareness meetings would hold meetings with their constituencies to report what transpired. During these meetings, they would also share with the members agreements on steps that would be followed to solve the problem of declining soil fertility. The farmers

Table 2. Perceptions held by farmers on declining soil fertility in one of the three villages.

Village	Description of the problem
GaMogano	Declining yields
	Crops become stunted after weeding
	Maize leaves turn yellow, even after application of fertilisers
	Maize grown on infertile soils is badly infested with striga

also agreed that they were going to discuss with their colleagues how they were going to pay for the cost of analysis since this service was no longer given for free.

Farmer mobilisation for paying for the costs of soil analysis

It emerged from several interactive meetings that although extension officers and fertiliser companies used to take soil samples from farmers' fields, farmers working in the project groups[3] were often unaware that their soils had been tested, as they were neither involved in the sampling nor fed back the results. Having been largely ignored by extension agents in the past, most of the farmers from communal groups[4] were also unaware of the benefits of soil analysis. The first awareness meeting aroused the interest of farmers from the communal field to have their soils tested as well.

Farmers agreed during their meetings that they were going to collect money to pay for the costs of soil analysis. There was a difference in the manner in which farmer groups paid for the costs of soil analysis. All project groups contributed money from their joint project savings account, whereas the communal groups had to make individual collections to make up the required amount. This meant an initiation to mobilise the communal farmers who had previously operated independently from the extension officers and researchers. Soil samples were analysed for physical and *chemicals properties* at a 60% discount, negotiated by the research team on behalf of the farmers (Table 3). Once farmers had collected all the money, arrangements were made with their representatives to set up a demonstration on how to take soil samples. The demonstrations to the farmers were done in the field by the research team, thereafter farmers had to do it themselves. When doing the soil sampling,

[3] Project group is a group of farmers working closely with the extension officer and following the orders and decisions of the officer. More often than not, the group constitution governing the farmers was developed by the officer.

[4] A communal group is a group of farmers who practise their agriculture independently without the help of the local extension officers. Their group is formed on an informal base and they are not obliged to form a management committee. The officers have no influence on the decision-making processes of the group.

Table 3. Soil sampling in the pilot and other villages (R 8=1 US$).

Factor	Trend over seasons			
	99/00	00/01	01/02	Total
No of villages	3	12	8	23
No. of samples collected	16	29	23	68
Money paid by farmers	R 1,070	R 1,885	R 2,065	R 4,990

farmers would argue and correct each other when mistakes were made, which was a sign that they were beginning to comprehend the soil sampling process.

Simplifying feedback of soil analysis results to the farmers

> 'We are used to seeing our extension officers and fertiliser agents taking soil samples from our fields, but we never hear from them again' (comments by farmers at GaMogano village - August 1999).

The last part of this statement by farmers from this village created a lot of discomfort to the research team. It meant that farmers were expecting us to do things differently from the way it was done by other researchers in the past, but most importantly, that they were curious to know the nutritional status of their soil.

After getting the results, the research team used guidelines from Borman *et al.* (1989) to rate the levels of essential elements and suggest different options for improvement. To simplify the presentation of the scientific information to farmers, the team developed several tools. They made colour posters illustrating the symptoms of nutrient deficiency and using the local language. They also used a lever scale (Figure 2) to illustrate the water-retaining capacity of soil and manure, and a magnet and pins to demonstrate the importance of manure in increasing the nutrient-retaining capacity of soils. These tools proved highly effective as a means of presenting analytical results in a simple format that enabled farmers to understand the nutritional status of their soils (see the comment from a PhD researcher in Box 1).

Figure 2. Level scale for demonstrating the water–retaining capacity of the soils.
'Now our extension officers are able to explain to us in a simplistic and practical manner things that we thought were complicated' (A farmer at GaMogano, August 1999).

Box 1. E-mail message reaction to Ramaru *et al.* (2000), Thursday, May 31, 2001 10:35 AM.

Sir, I was thrilled reading through a piece of work you wrote on improving soil fertility management in South Africa. I am a WARDA PhD research fellow in IITA Ibadan. My field of research is soil chemistry with emphasis on how to improve soil fertility through a participatory approach in a rice based soil in South-Western Nigeria. I know that information on soil testing result is valuable and needed for soil fertility management. All the while my major challenge was how to get such information across to farmers. However, on reading your publication I was glad. ...I would also appreciate any other information that would aid my research work... Thanks...

The first results were fed back by the researchers at a village called GaMogano and there was a frightening misunderstanding at the start of the meeting. The meeting opened with the usual prayer, welcome and introductions. Researchers outlined the objectives of the meeting and linked the meeting to those held in the past. Next, the research team had planned an exercise designed to raise awareness about declining soil fertility, and to enable farmers to understand how the causes of declining soil fertility lead to the results shown in the soil analysis. Suddenly, the mood of farmers changed when they were asked to form small groups to do the exercise. To everyone's amazement, they refused to do so, arguing that they had formed groups in the previous meeting and handed out information, and they were fed up with it. The farmers wanted to see the results of the soil analysis immediately. Although the facilitators tried to explain the purpose of the exercise and how it was linked to feedback on the results, farmers were adamant that they would only stay at the meeting if they were given the results of the soil samples first. The local village leaders tried to persuade them to keep to the planned programme, but when the farmers refused to back down, the facilitators aligned the programme according to the wishes of the farmers (Ramaru *et al.*, 2000).

Before soil results were presented, farmers shared their knowledge on the nutritional levels of soils that had been analysed. As an indicator of the level of soil fertility, they provided information about the plants that would be found on poor or fertile soils (Figure 3). Discussions on the results of the different sets of soils were held and, interestingly, the knowledge of farmers and laboratory results correlated well. The results of soil analysis showed a higher level of nutritional elements in the project fields than in the communal fields (Table 4). Based on the results, a set of options for soil fertility improvement were suggested by the research team and they included application of fertilisers, manures, compost, and dolomitic liming material.

Farmers were excited to learn that they had a choice from a pool of options to improve their soil fertility. They could also try out different combinations of the inputs and then

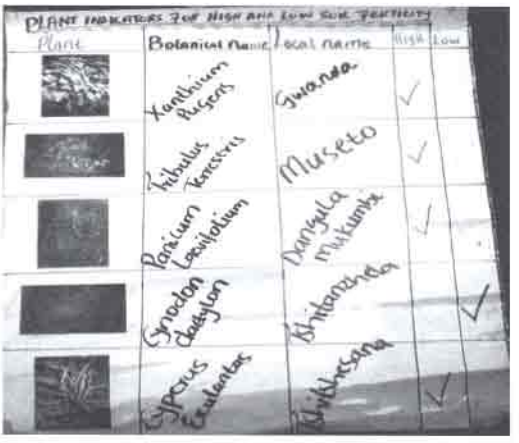

Figure 3. Illustrations by farmers on plants that are found on poor and fertile soils.

Table 4. Results of chemical soil analysis taken in 1999.

Soil parameter	GaThaba		GaMogano		Spitzkop	
	PF N=1	CF N=7	PF N= 2	CF N=2	PF N=1	CF N=3
pH (water)	5.6	6.3	5.8	7.2	6.0	5.9
P (Bray1) mg/kg	15.0	15.1	28.1	18.4	6.0	0.9
Ca ($cmol_c$/kg)	2.4	1.8	1.0	3.8	1.3	2.2
Mg ($cmol_c$/kg)	0.98	0.80	0.54	1.54	0.67	1.02
K ($cmol_c$/kg)	0.39	0.26	0.35	0.45	0.18	0.27
Na ($cmol_c$/kg)	0.10	0.05	0.05	0.06	0.05	0.06
Titratable acidity ($cmol_c$/kg)	0	0	0.08	0	0	0

Note: PF = project field; CF = communal field, N= number of samples.

share the lessons and the results. In the past, the decision on what to apply in the field came as a command from the extension officers. But at this stage there were still more questions than solutions. The first challenge that farmers had to address was how to access some of the options discussed.

'We made it, the tools worked according to plan'. This was an expression made by one of the officers during the reflection meeting.

Farmer linkages with the suppliers for inputs

> 'In the past it was only the extension officer who knew where to get inputs. When he/she died, he/she would be buried with the input, and when he/she was transferred, the input would also follow' (farmer in Spitzkop, 1999).

Having agreed with farmers to start improving their soil fertility status using various types of inputs, farmers were faced with challenges such as:

- How are we going to access different inputs and purchase them?
- How are we going to get contact with the various suppliers and the quotations for prices of inputs?
- What would be the most cost-efficient way of buying inputs? What about the delivery of the inputs to the communities?
- How could the newly established umbrella organisations[5] (UOs) help in facilitating the process of accessing the inputs?

The formulation of those challenges helped the research team and farmers to develop strategies for accessing suggested inputs.

Farmer representatives, mainly from the established umbrella organisations, were chosen to start the negotiation with the input suppliers. The meetings were such that more than one supplier would be invited to offer services and discuss prices and terms of delivery of the inputs to the community. Agreements would be reached about the volume of inputs bought by farmers, how they could qualify for a discount and how farmers would make payments. After meeting with the suppliers, farmer representatives would arrange community meetings together with the local leadership for feedback on the agreements with the service providers. The final decision to choose an appropriate input supplier is made during feedback meetings by representatives to the communities (Ramaru *et al.*, 2004). This process was used mainly for accessing fertilisers and dolomitic lime (see Figure 4). The difference with other inputs was that with cattle and poultry manure, the farmers only had to pay for hiring transport since the inputs were donated by big commercial livestock companies. The overall results from this process are shown in Table 5.

The original assumption by the research team was that farmers were not buying inputs such as fertilisers because they did not have money (mostly the communal farmers). This process revealed that once farmers were aware of the soil nutritional status, they were keen to form community forums such as umbrella organisations that would link with input suppliers. These processes made farmers internalise negotiation skills. They also started to exercise their purchasing power to their own benefit.

[5] Umbrella organizations (UOs) have just been formed. They are functioning as a village forum from which all the different farmer groups would select two representatives for the purposes of accessing services.

Figure 4. Lime delivered by the input supplier to the village.

Table 5. Number of villages and farmers involved in the acquisition of inputs (total amount of money that was contributed by farmers to purchase inputs, R 8 = 1 US$).

Input	Factor	1999/2000	2000/2001	2001/2002	Average in 3 years	Money collected by farmers [R]
Fertilisers	number of villages	3	4	26	11	
	number of farmers	494	333	2,211	1,012	
	number of bags (50 kg)	887	624	3,818	1,776	458,547
Dolomitic lime	number of villages	3	2	9	5	
	number of farmers	74	4	198	92	
	number of bags (50 kg)	648	18	2,541	1,069	39,149
Poultry manure	number of villages	3	4	2	3	
	number of farmers	60	53	54	56	
	amount of manure collected (tons)	27	21	83	43	15,436
Cattle manure	number of villages	0	0	9	3	
	number of farmers	0	0	168	56	
	amount of manure collected (tons)	0	0	155.2	52	37,485

Experimenting with new options and sharing with others

At this stage of the process, farmers managed to acquire inputs to improve the fertility of their soil, some of which were new to them. Most of them did not want to apply the new inputs to all their land for fear of losing their production in case the untested inputs would

damage their crops. For the research team, this provided an opportunity to initiate and discuss with farmers the concept of farmers' experiments.

Awareness on the concept of experimentation

Field meetings were organised with farmers interested in trying out new options to discuss possible experimental designs (see Figure 5). During these meetings, the research team and farmers would agree on a set of indicators that would be used to assess the performance of the different inputs on their crops in the fields.

These meetings were guided by the following questions:

- What do we want to learn from the experiments?
- How do we know if something has worked or not?
- What do we measure or observe and who does what?
- When do we take the measurements?
- What results do we share?
- When do we want to share this information?
- Who will be responsible for what?

During those meetings, the research team informed farmers that they wanted to monitor and assess certain parameters that included number of days crops take to emerge, tassel, silk and ripen; number of cobs; signs of nutrient deficiency; infestation by pests and yield (grain yield and mass of stover). Farmers, on the other hand, indicated that they would be interested in observing the *speed* (in terms of the number of days) at which crops responded to the different options and greenness or signs of nutrient deficiency. In this regard, it turned out that farmers were observing changes brought about by the different inputs in a broad context.

> 'I always thought that the issue of experimentation and designing of trials was a mammoth and complicated task and was the sole work of researchers. But having

Figure 5. A farmer demonstrating a trial on a small portion of land.

done this step practically with farmers, I can now understand the experimentation process much better than I would have learned this at a university or college' (An extension officer during monitoring of farmers' experiments, January 2000).

Although many farmers were initially enthusiastic about experimenting with several options, relatively few went beyond the planning stage and actually carried out tests in their fields (See Table 6). It soon turned out that some farmers preferred to see how trials could be designed and would later implement them independently in their fields. These farmers wanted to try out different options and combinations on their own. This is after they realised that trials made with the help of researchers were limited to certain options and conditions which did not necessarily correspond to the conditions on their own land.

During the monitoring of the experiments, there were instances where farmers shared what changes they observed in terms of soil structures and reduction of some soil pests where lime was used. This was a surprise to the research team because they could not detect those differences even though they were often visiting the fields. The researchers began to recognise that farmers had years of knowledge of their soils enabling them to see the most subtle differences in their land.

Table 6. Number and types of experiments tested by farmers (Ramaru et al.*, 2000).*

Type of experiment	GaThaba		GaMogano		Spitzkop		Total
	PF	CF	PF	CF	PF	CF	
Fertiliser[1]	-	5	4	-	4	-	13
Dolomite	2	1	-	1	3	1	8
Dolomite + fertilisers	1	4	3	1	6	1	16
Chicken manure	5	1	-	-	-	-	6
Chicken manure + dolomite	7	2	-	-	-	-	9
Kraal manure	4	2	-	-	-	-	6
Kraal manure + dolomite	4	1	-	-	-	-	5
Goat manure + fertiliser	-	-	1	-	-	-	1
Total	23	16	8	2	13	2	64

Note: PF= project field; CF= communal field.

[1] Fertiliser formula is N:P:K = 2:3:2 (N = nitrogen; P = phosphorus; K = potassium).

Farmers sharing with other farmers and outsiders

In addition to the usual field days that extension officers had organised for farmers in the past, the farmers - with the help of the research team - organised what is called mid-season evaluations (MSE). This event was a new concept for the farmers and researchers but they wanted to try it after they learned about it from farmers in Zimbabwe during an exposure visit. Hagmann *et al.* (1998) distinguish between mid-season evaluations and classical field days; in the former, all farmers within and outside the village are invited to see experiments in the fields whereas the latter is organised around a homestead or an office.

During the mid-season evaluation, farmers would share successes and challenges that they experienced in trying out different options to solve their technical problems in the field (Figure 6). For the first time, farmers shared with others how they managed to organise themselves into umbrella organisations to help them access inputs. These mid-season evaluations were so successful that they have turned into annual events organised by farmers.

Figure 6. Farmers from other villages were invited to share in the knowledge acquired during MSE.

Assessing the different options and planning for the coming season

The next step was for the research team to get farmers' judgement on the performance of the different options in the fields. Furthermore, it had to be decided how farmers would plan activities for the coming season.

Assessing technological options

The research team developed an assessment matrix on a large and laminated sheet allowing farmers to write technological options in a vertical column and criteria in a horizontal row. Depending on the number of criteria used to judge the options, a range of scores were developed to rank the performance of each option. Each group selected a spokesperson to present and explain the assessment of the options in a plenary meeting. The farmers would then analyse the differences and similarities across the different groups.

It was reported in the meeting that a number of farmers had carried out their own and independent experiments without the help of the researchers (see Table 7 and compare with Table 6). It was then decided that farmer-led experiments should also be included in the assessment exercise. It transpired that these kinds of informal experiments have always been done by a few farmers but there was no regular forum to share and discuss these innovations. In general, most of the farmers at the meetings developed more interest in technological options initiated by the fellow-farmer innovators and were willing to explore on them further the following season. These experimentation processes provided an opportunity for the farmers and the research team to engage in the learning process, something that had never been done before.

> 'I harvested 40 bags of sweet potato seed vines on the plot where I applied lime last season and harvested only 25 bags of vines on an area where lime was not applied' (Rosinah Libago, a farmers from Mbahela).

Table 7. Rating of soil fertility options independently initiated and implemented by farmers (Ramaru et al.*, 2000).*

GaThaba		GaMogano		Spitzkop	
Technology	Average score	Technology	Average score	Technology	Average score
Goat manure	12	Goat manure	15	Ash	15
Goat manure + dolomite	10	Chicken manure	15	Saw dust	14
		Malt + dolomite + fertiliser	13	Goat manure	13
		Cattle manure	6	Malt	11

Planning for the coming season

Village meetings to develop plans for the coming season started with recapitulating the results of the assessment of the different technological options. This exercise led to new discussions that either validated the assessment results or clarified what was discussed during the last meeting on the assessment of the technological options. The plans for the coming seasons were based on the following challenges:

- How best to spread the options that have proved to work?
- How can farmers strengthen their organisational capacity to access inputs for the options that are working?
- What is the best way to do more experiments on the options that are still questionable and who should do these experiments?

3.4 The spread of the soil fertility management innovation process

The sharing of knowledge during the organised mid – season evaluations has been the most effective means by which other farmers and officers have been exposed to the soil fertility management process. It is not unusual to hear farmers asking: *'When are researchers coming to do the same thing at our village?'* or *'When is our officer going to be trained in the Participatory Extension Approach and soil fertility management process?'*

The experience gained from the implementation of soil fertility management in the three pilot villages provided an opportunity for the research team to design a training workshop for other extension officers and scientists. This would enable other officers to get acquainted with the process and enable them to engage more farmers in their villages. Two workshops were designed:

- The first was a five-day workshop where the participants were taken through all the steps of soil fertility management. During the workshop, officers would be exposed to the laboratory setup to better understand the process of soil analysis. The officers also developed operational plans illustrating how they could implement soil fertility management in the villages that they supported.
- The same officer was given the opportunity to attend an advanced workshop in which a lecturer from the local university elaborated on the scientific aspects of soil science.

The farmers received a simplified version of the first soil fertility management training workshop that was given to the officers. They also managed to visit the soil science laboratory and had an opportunity to do some simple tests such as determining the acidity and alkalinity of the soil through a pH metre. Back in their villages, they shared the knowledge they acquired at a meeting organised by the community leaders. These farmers were then invited to:

- Train the local farmers groups in their villages and beyond

- Create awareness among extension officers and scientists who were not trained in the Participatory Extension Approach process. Realising that the farmers were able to be articulate about the process and were confidently sharing their experiences, the officers selected to be trained had a vision of what kind of farmers these participatory processes could produce.

From the assessment process conducted during 2004/2005, it was found that all the technical innovations had spread over all the districts of the Limpopo Province. For soil fertility management, Kganyago *et al.* (2005) showed that this innovation was implemented in 105 villages around the districts as follows: 24 in Capricorn, 74 in Vhembe, 2 in Mopani, 2 in Sekhukhune and 3 in Bohlabela.

3.5 Lessons from the reflection on the experiences

The reflection on the process of soil fertility management by the research team resulted in the identification of the success factors that were of importance for the unfolding process (Figure 7).

Subsequent reflection by the research team revealed that both the farmers and officers had gone through a process of joint learning during the development of the soil fertility management process. Table 8 documents changes that occurred among the farmers and officers at different stages of the soil fertility management process.

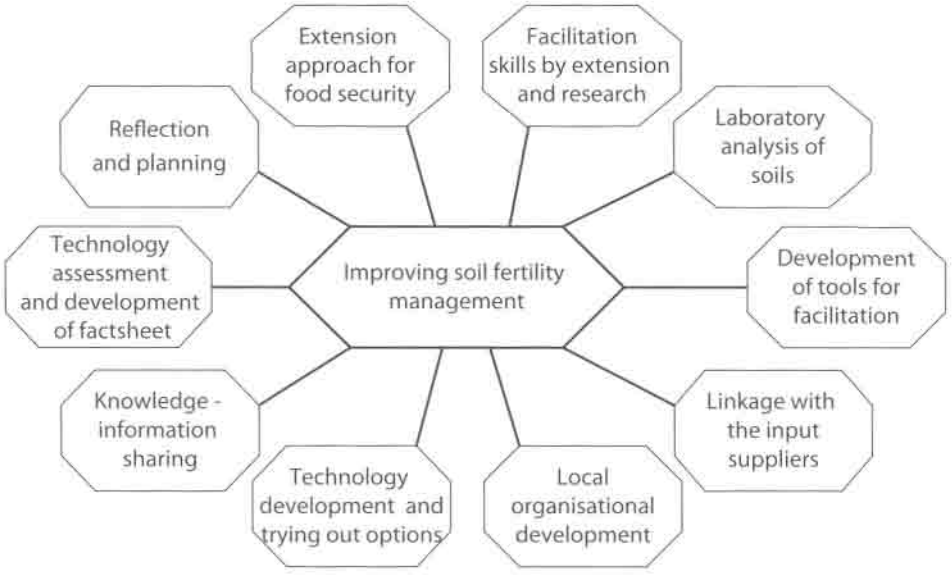

Figure 7. Strategy for soil fertility management in smallholder farming systems.

Table 8. The learning of researchers and farmers in the different steps of the process.

SFM process step	What changed and what was learned		How the process manifested itself
	Researchers	Farmers	
SFM step 0: PEA Training workshops of Researchers & Extension officers (EO)	Extension officers & scientist internalise some of the values such as recognising farmers / local knowledge, self-organisation, self-reliance	From participatory rural appraisal (PRA) workshops, farmers are aware of their situation and identify their technical problems	Mentoring and backstopping on the PEA provided by external consultants
SFM step 0: Soil Problem identification	Wanted to help farmers but did not know how to do it	Farmers were desperate and needed new types of fertilisers	Established research teams composed of extension officers and scientists to support new needs
SFM step 0: Planning the research process	After the PTD training, started to have a vision on how to start the process of SFM in selected villages		Plans were shared with the supervisors of the officers so that they would give logistical support
SFM step 1: Farmers' perceptions on soil fertility	Learned that farmers use local language to describe scientific things, e.g. yellowing of leaves	Farmers became curious to test their soils and volunteered to pay for the costs	Facilitation skills gained during the PEA helped officers to communicate scientific information to farmers through the use of tools
SFM Step 2: Planning soil sampling with farmers	Realised that farmers understand how to take soil samples with a spade rather than with an auger	Farmers were scared initially of experimenting but built up confidence as they practised	Farmers demand the results of soil analysis through feedback because they have paid for the costs of analysis
SFM step 3: Discussing the results of soil analysis	As researchers, we were happy that we managed to develop tools that represent scientific information in a simplified way	Farmers were happy about the results. The results correlate with experience from farmers	The extension officers who are involved are able to help other groups with interpretation of soil results

Table 8. Continued

SFM process step	What changed and what was learned		How the process manifested itself
	Researchers	Farmers	
SFM step 4: Linkages with service providers	We use to think that farmers didn't have money – because they were not buying fertilisers (mostly the communal farmers)	Farmers are existed to get discounts when buying inputs in bulks. In addition, inputs are delivered at not costs to the villages	Umbrella organisations have been established to negotiate with input suppliers for inputs on behalf of the farmers
SFM step 5: Designing experiments with farmers	'I can now understand the experimentation process much easier than I would have learned this at a university or college' (An extension officer during monitoring of farmers' experiments, January 2000)	More farmers come to learn how to design experiments but some are not interested in being involved in trials managed together with a research team	A core team of experimenters selected by farmers to try several options which will be shared during the mid-season evaluation
SFM step 6: Experimenting with new options and sharing with others	Learned that farmers see and measure parameters beyond the scope of our agreement (researchers & farmers)	Exposure to experimentation made other farmers initiate farmer-led trials	The mid-season evaluation caused more farmers from in this and other villages to get interested as well as try out options to solve their problems
SFM step 7: Assessing different options & planning new ones	Learned how to develop an assessment tool that helps farmers to assess their tested technologies	Farmers impressions *'It was the first time we tried some of these technologies and most of them did very well in terms of increasing the yield. In most of the cases, application of individual inputs did not give better yields as compared to when the inputs were combined (farmers from GaMogano, June 2002)*	Farmers are ready to choose those who will undergo training in soil fertility management – most of those chosen have participated in the trials

It is important to emphasise that the SFM process as a learning case was not dealt with in isolation. It was part of other innovation processes which were fostered within community development. For this purpose, PEA is seen as a guiding process and as a mechanism to help rural communities take charge of their own development by organising themselves, innovate and manage their own dynamic change, and bargain/negotiate with service providers (Hagmann *et al.*, 1998; Ramaru *et al.*, 2000).

3.6 Conclusions

The soil fertility management process is now implemented in areas such as:

a. high schools, as part of the demonstrations to help students understand the theoretical aspects of soil science in their syllabus; and
b. other donor-funded programmes (MacDev, LADEP & Land Care) to help their project beneficiaries to improve their soil fertility.

The facilitators who started with the process of soil fertility management are now facilitating other innovation processes (e.g. livestock mobilisation). They are functioning as learners in the new technical areas and as mentors in soil fertility management for new trainees. More farmers have been trained by the soil fertility management facilitators with the help of other farmer trainers. The farmer-trainers are serving as coaches and mentors of newly trained farmers during the facilitation of soil fertility management in the communities.

Also relevant to other innovation processes (soil and water conservation, small-scale seed production and livestock management) which were developed during the implementation of the Participatory Extension Approach process, was the fact that the innovation process unfolded as the result of continuous joint learning among the stakeholders involved. Success factors for the implementation of these innovations within the framework of Participatory Extension Approach are described as follows:

- Facilitation skills are import to start a process of innovation in the community. Where possible, these skills can be learned not only by the extension officers but also by the scientist.
- Within the research team joint planning is encouraged in order to enhance learning from peers in the group. The importance of preparing and sometimes rehearsing each step together within a team of facilitators cannot be overemphasised.
- A reflection meeting by the research teams after the village workshop is also important so that those who acted as facilitators could improve on the weaknesses that might have been identified. Continuous sharing and giving feedback should be the group norm to facilitate learning from each other and to enhance conceptualisation of the lessons.
- Awareness creation at all levels of the innovation process is important for farmers to be able to take informed decisions on what to do next. This can best be done with tools designed to simplify complicated scientific information.

- Also important are the exposure visits by the community representatives to sources of innovations within and outside their localities, as well as giving feedback about the findings to the community at large. This exposure is important to enable the research teams to change their way of doing things.
- Strengthening the local organisations is important for linkages with external service providers and input suppliers. They also play an important role in the monitoring of experiments and the organisation of sharing events.
- Experimentation is a tool for joint learning and can be fuelled by awarding prizes for best experiments and selection of promising technologies for further trials in the coming seasons.
- The pillar of any innovation rests in the available mentoring/coaching mechanisms. Where this does not exist (yet), an attempt should be made to develop it at the level of researchers and farmers.

It is important that facilitators of this process open their ears and document any striking feelings, concerns, appreciations and comments from farmers about the process and developments resulting from their involvement.

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