MAKING BEST USE OF LIMITED RESOURCES: USING PARTICIPATIVE ACTION RESEARCH TO ACHIEVE FODDER SECURITY WITH SMALLHOLDER LIVESTOCK FARMERS IN INDONESIA

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Abstract

This paper discusses how smallholder farmers in Tombolo village, South Sulawesi, improved the productivity of their cattle through a process of Participative Action Research (PAR). The PAR first identified the problems and needs of the farmers, and then developed strategies with them to meet these needs. Fodder security throughout the year was found to be the major constraint to cattle production. This was improved by planting fodder trees (*Gliricidia*) as fences around the boundaries of homesteads and fields; as well as Napier grass in waste ground adjacent to existing crops, in unused land within the homestead, and under existing Kapuk trees.

The production of these fodder sources represented new technologies for these villagers, but their introduction was adapted to local issues and needs. While local extension services had aimed at improving livestock production through breeding and veterinary health measures, it had been assumed by them that sufficient livestock fodder was available. The PAR process identified this shortcoming, and how to overcome it in a sustainable way. The results have been threefold. The farmers moved from a system of tethering animals in fields to eat weeds, to a cut-and-carry stall-feeding system utilising more nutritious fodder sources. Secondly they now have two or three cows, where they only had one before. Finally, growth rates of young cattle have improved from 0.3kg/day to 0.5kg/day. It is our belief that these encouraging results would not have been achieved with traditional transfer-of-technology extension methods.

Introduction

In South Sulawesi, Indonesia, livestock make up an integral part of smallholders farming systems. These smallholders maintain a diversity of crops and livestock to minimise their risks. The institutions that serve the needs of smallholder livestock farmers are mostly concerned with production issues, rather than the more systemic ideas of rural development. The latter ideas are more to do with the livelihood of people, and consider farming systems as being made up of both biophysical and socio-cultural elements (Bawden *et al*, 1984; Rajasekaran *et al*, 1991). Livestock technologies are often adopted directly from other regions without adequate assessment, and without due consideration for the site characteristics of current locations. This frequently results in a failure of adoption, particularly caused by a lack of farmer participation (Rajasekaran *et al*, 1994).

To meet the needs of smallholders, many alternatives to the conventional extension approach have emerged in recent times. The framework of Participative Action Research (PAR) adopted for this study is one such alternative to transfer-of-technology in agricultural extension. PAR was adopted to identify important problems and needs of some smallholder

livestock farmers, and then to develop strategies with them to meet these needs. The approach was based on the belief that greater participation can occur by giving a voice to the smallholder livestock farmers in decision-making. This paper does not focus on the process of transfer-of-technology itself, but rather on how PAR works in enhancing the livelihood of the smallholder livestock farmers themselves.

Study Area

The study was conducted in Tombolo village, located 14 kilometres of the west side of Bantaeng district, and about 135 kilometres from Makassar, the capital of South Sulawesi province. The village was about 350 metres above sea level, and the average monthly rainfall was 107 mm. Rainy season occurs between March and August, followed by a dry period beginning in September and lasting till February. The agriculture is characterised by mixed crop-livestock production systems where the principle crops are maize, cotton, and paddy. Livestock include cattle, goats, horses, buffalo and poultry.

Participative Action Research (PAR)

PAR is an acknowledged form of intervention within the tradition of action research. The four major phases of PAR, namely, plan, act, observe and reflect, were developed from the work of Kurt Lewin (McTaggart 1991; Greenwood and Levin, 1998; Kemmis, and McTaggart, 2000). The process of this action research cycle combines theory and practices into a critical process, or *praxis* (Bawden, 1991). In addition to these features of a self-reflective spiral, PAR also consists of social processes that are participatory, collaborative, practical and emancipatory (Kemmis and McTaggart, 2000). In PAR, some of the people in the organisation or community being studied actively participate with the professional researcher(s) throughout the research process, from the initial design to the final presentation of the results and discussion of the action implications (Whyte, 1991). It can also become a forum in which people join together as co-participants in the struggle to remake the practice in which they interact (Kemmis and McTaggart, 2000). In addition, this process creates self-critical communities of people who participate in this research process (McTaggart, 1999).

Overview of the PAR in Tombolo Village

The first action research cycle was entered with the aim of finding out about the problematic issues by exploring the situation from many perspectives (see below). This initial activity built up a *rich picture* of the situation of the study area of Tombolo village, and included a formal workshop that was held to gain information from the stakeholders; Stakeholders were defined here as anyone living in or directly associated with the activities of the village, with the information coming from anyone willing to join in the meetings and other activities of the research group. A key problematic issue emerged from this process - farmers perceived that a scarcity of fodder for animal feeding was an important issue that needed to be solved. The PAR team then worked with this issue to collect pertinent data, conducting a series of focus group interviews. Following data analysis, results were fed back to the community at a group discussion held in the village to which all stakeholders were invited. Here, the focus was threefold: to identify needed change and the direction that change might take; to identify improved management practices; and to identify ways of using forage to improve cattle nutrition. At the meeting, farmers were introduced to forage technologies, and to a variety of options for integrating different forages into farming systems. Following this they participatively selected options that were considered appropriate to the local conditions.

Moving into a second cycle of research, the PAR team decided to conduct a workshop on developing forage technology. This introduced forage management practices such as *Three Strata Forage Systems* (TSFS) (Nitis, 1989a&b) that had been used successfully in other parts of Indonesia, and included the introduction of some species of fodder grass and fodder trees. The farmers who attended this workshop subjected TSFS and the possible use of some species of forages to (what we would call) critical analysis. After due consideration, these farmers rejected the adoption of the TSFS, because of the unavailability of supplies of the necessary forage species in this study area, as well as the lack of available land to meet the requirements of this TSFS system. In its place, farmers developed their own model of planting forage, based on their particular land conditions. After deciding on the broad management practices to be applied, the farmers then chose the appropriate forage species to put into the system. In making this choice, two key questions were asked and answered: *Was the forage species suited to the proposed management practice? Was the forage species adapted to their soils and climate?* From this process, it emerged that these farmers preferred to plant Napier grass (a tall growing fodder grass) and Gliricidia (a forage tree), due to their potential high yield, drought tolerance and the availability of seed and stock in this region. Gliricidia could be planted as a border around their maize fields and also as a fence around their homestead.

Two further action steps then ensued. Firstly, the farmers developed their own model for forage planting, dependent upon their current land use and condition: was it under existing Kapuk trees, in waste ground adjacent to existing crops or in unused land around the homestead? The second action was for the learning group (see next section) to develop demonstration plots on their own farms, so they could experience what to do, and how to do it.

A third PAR cycle then began by evaluating the effect of these proposed changes. This was carried out over a period of three months, with the participating farmer group discussing the results of the evaluation process. One important finding was that some women wanted to look after the forage being grown, particularly the forage within their own homestead. Accordingly, the PAR team decided to involve women more in group discussions, and to conduct a small training programme for them on forage management.

The rest of this paper is a more detailed presentation of the process outlined above and a discussion of the major outcome and reflections.

Conducting PAR and Farmer Participation

Conducting action research with communities requires the formation of a research team in order to carry out the fieldwork. The PAR team for this research consisted of four people, one of whom was the senior author of this paper who also led the team. The other three were; a government extension worker who had previously worked in the village; the elected village leader; and a social economist who held a position with the provincial government, but who had previously worked for an NGO in the village. Two were male and two female. The PAR research team endeavoured to integrate with the community, particularly through involvement in socio-religious ceremonies and other general social activities.

The research team began by developing a rapport with the farmers of the village, this being achieved through formal and informal meetings during village visits. A detailed knowledge of seasonal village activity was unfolded, revealing the time constraints and availability of villagers. Through social learning activities, such as group discussions and workshops, the people's participation was encouraged and fostered. A *Learning group* was formed at this stage, to act as a forum for the community to discuss issues, such as those related to their fodder management. This learning group was representative of the community, and members acted as co-learners in the whole research process. It was made up of seven farmers, all male

and all recognised leaders, who volunteered for this role and agreed to be committed to the research project, particularly by allocating time to attend meetings and promote discussion amongst the wider community. Regular weekly meetings were held between the PAR team and the learning group. In this village, men had the responsibility for raising livestock, except for chickens, although women shared the responsibility for deciding when to market the livestock.

A second group was also formed – the *discussion group*. This was open to anyone from the village, and was called upon whenever a particular topic emerged which needed to be fully discussed with the broader stakeholder community. In all six meetings of this group were held during the course of the PAR. The function of this group was to test ideas, engage with local knowledge about these ideas, and to generate acceptable action plans to implement. Both men and women participated in this group, although men were in the majority.

Problem Identification

Participatory Rural Appraisal (note difference from PAR) methods were initially adopted to gather information from the stakeholders, in this case defined as village farmers and livestock officers that serviced them. The PRA consisted of three stages: (1) Understanding - consisting of observation and transect mapping; (2) interaction, and (3) development and analysis of issues.

1.Understanding Stage

Observation: During this stage, key informants were spoken with, to elucidate information concerning socio-cultural conditions, and the socio-economic and biophysical environments of the study village. These observations provided valuable information on site characteristics, opportunities and constraints.

Transecting: For this, the research team walked through the village to map the various agro-ecological zones. These transects provided an opportunity to characterise the village in terms of farming systems, land use patterns, resource utilisation, and crop-livestock interactions.

2. Interaction stage

Open-ended semi-structured interviews, formal and informal meetings, livelihood analysis, and discussion workshops were conducted to understand the problems and needs of the local people. A formal workshop was conducted to develop a *rich picture* of the study area, as well as to discuss problems in depth, as perceived by the farmers. All stakeholders were invited to this. This was seen as an appropriate way to discuss issues, because stakeholders (farmers, and livestock services officers) could sit together at one table, something that did not normally occur in this context. It was during these discussions that problematic issues emerged and possible solutions were discussed.

3. Development and analysis of issues stage

Here, problems were developed and analysed through group discussion. The problems as perceived by farmers were analysed by considering factors such as; farm size, cropping systems, socio-cultural factors and the availability of existing local fodder resources. This development stage provided information about the possibilities for introducing forage into the farming systems.

Problem Definition

Through the PRA, fodder security was found to be the key problematic issue for farmers in this study area. Previously, cattle rearing had been identified by the government agricultural services to be one of the potential on-farm income generating activities for these villagers, particularly as crop production was a high-risk activity (due to high input needs, and unstable

market prices). During the past few years the cattle population in this village had steadily increased, creating a heavy demand for feed.
Even though the cattle population had increased, no land was specifically being allocated for growing fodder. For animal feeding, farmers were collecting grass from around their field crops or from road verges, or they were tethering animals in their fields to eat weeds. This was a traditional approach to cattle rearing, but resulted in a high risk of animals eating crops rather than weeds, and necessitated time being spent by the farmers to search out and collect fodder grass. As revealed from interviews with farmers, the average time spent in collecting grass was 3- 4 hours a day; this could increase to well over 4 hours during the dry season.
Many extension programs had been conducted by government services to improve livestock production, but most of these had been concerned with breeding and veterinary health measures, assuming that there was a sufficiency of livestock fodder. Furthermore, most of these programs reflected national, rather than local, priorities. Farmers were being viewed as passive recipients of government aid.

Experiential Learning

Experiential learning is a process of using our innate critical intelligence to inform action, and then to develop social action; a process which becomes a praxis through which people may consistently live their social values (McTaggart, 1999). Experiential learning can be seen as the basis of PAR, in which the actors who engaged in PAR can learn from each stage of the process. This was illustrated by some of the interview responses of this research, demonstrating that learning does emerge from the PRA process. An example was this recorded interview comment, spoken in Bahasa, and translated by the senior author:

> *If we try new things in our farm, it obviously means we have learned. Moreover, learning has also happened if discussion is generated…. for example we are sharing information, we are asking questions and we are confronting the ideas.*

Learning from action is a part of the daily practice of farmers. Farmers can learn through reflection on trial and error, underpinned by experience. In this context learning is considered to be a voluntary activity that people engage in to improve the real situations they are encountering in their everyday live. Learning created in this way is an active process which combines finding out about the problems and taking action to improve them (Brown and Packham, 1999). In the finding out process, the participants work together to develop a rich picture of the situation, observing it from many perspectives. They involve themselves deeply in the situation being studied, seeking insight and considering the different epistemologies of participants. What is experienced and observed is then assimilated, made sense of, and interpreted to yield understanding about the problem (Sriskandarajah, Packham and Fisher, 1993). In the action process, the participants transform their understanding and insights into a plan of action to implement possible solution to problems. These plans are then tested in the real situation where the problem exists, leading to a change in that situation. The following section illustrates these ideas as expressed in the current research.

Building Knowledge and Skills for Sustainable Forage Production

To address the issue of fodder security, the research needed to not only identify the forages that were being, or could be, grown in this area, but also propose fodder planting alternatives that could be considered by the farmers. In relation to this, the research team organised a workshop, a number of group discussions, and a small training programme on forage technology over the period from March 2000 to March 2001. Each activity involved at least half a day in the village. The workshop to develop forage technology competence had over 26

farmers participating, including two women farmers. Following this, plot demonstrations were conducted on farms belonging to the members of the *learning group*. These farmers recorded their activities as they experimented with the planting of fodder grass and fodder trees. Weekly meetings of the learning group were held to discuss progress and any issues arising. The learning group also carried out regular field visits to each other's farms, together with relevant livestock services officers, to observe and learn what was happening with the demonstrations.

Here, knowledge was being generated not only from propositional learning (learning for knowing) and practical learning (learning for doing) but also from experiential learning (learning for being and learning from critical reflection). The knowledge was generated from the critical analysis of real life problems, and the opportunities that arose to take action to solve these problems. It came from discussions related to how different people in the learning group saw the same problems, and then proposed alternative solutions from their different perspectives.

The overall PAR process produced knowledge relevant to all the four dimensions of experiential learning:

1. ***On the basis of participants' concrete experience (divergent knowledge).*** The participants collaborated in developing a *rich picture* of their situation, exploring the situation from many perspectives; the question asked was *what is there*? The participants began to identify with their own experiences and practices, and the situation enabled people to understand their own situation. The experience of the PAR team showed that people gained knowledge from sharing their different perspectives, including differences in feelings, attitudes, values, and of their worldview. One of the participants stated:

   I had the opportunity to impart my ideas, thinking, and feelings to the whole group and I felt that everybody appreciated other peoples' opinions. I shared the information and discussed it with other participants.

2. ***Through observing and reflecting on that experience (assimilative knowledge).*** In this context, knowledge was produced through a critical analysis of the situation. The question asked was *what does it mean*? The information from the concrete experience was analysed in order to make meaning from, and to value those experiences. By reliving and reflecting on their experiences, participants were able to articulate their problems. It was here that the scarcity of fodder emerged as a real issue for consideration. An example of the evidence from interviews about how farmers gained knowledge from this stage was this quote :

   Now, I am able to distinguish what is the problem and what is not the problem? Why and how the problem is occurring?

3. ***By forming abstract concepts and generalisations (convergent knowledge).*** Here participants collaborate in designing creative and responsible strategies for change from their experience. This process requires a lot of critical thinking and a careful consideration of the concrete situation. The question was *what will we do*? Community meetings with the *discussion group* were held to open up the results to public criticism. These open discussions enabled participants, the PAR team and the learning group to validate their descriptions and analyses. Further, it enabled participants to identify different views and perceptions regarding these finding. Discussion soon narrowed to some specific livestock production issues, such as fodder management, fodder species, soil, rainfall, and socio-economic considerations. Farmers were also exposed to some theoretical and technical aspects of forage production and management, such as the

positive effects of fodder trees and shrubs on soil nutrients, the contribution fodder trees can make to the provision of protein to cattle diets, and the adverse effects of land degradation on soil fertility. Farmers thus gained some theoretical perspectives about some of their farm practice. As one farmer was recorded as saying :

We want some things to be not too complicated, just a simple concept but with in-depth stuff behind it. So it will then be easy for us to go into more detail. For example, what kind of fodder grass and tree are appropriate to our conditions…not only that, but we are also looking for something that will not cut our income.

4. ***By testing the implications of these concepts in new situations (accommodative knowledge).*** What has been decided and planned in order to improve the situation is then transformed to the real world through implementation of the changes proposed. The question now becomes *How will we do it*? This stage concluded the first round of the action research cycle. Participants were involved in discussion and debate about feasible methods of implementation, and this was followed by action to implement the agreed changes. Of course, the results of the implementation needed to be evaluated, forming a continuation into the next PAR cycle. Interviews revealed that participants gained knowledge from this stage. For example, an extension worker commented on her experience of being involved in this participative learning as follows :

   It had been my belief that our technology was better than the farmers' own practice. However, after I became involved in this learning process, it became clear to me that farmers had their own interests and values, and that these are different between them…. and I think our technology cannot capture these variously.

Three general kinds knowledge recipients can be identified from the PAR/experiential learning processes:

(1) Knowledge developed by individual farmers: For example, recommendation of forage production and management, such as the optimum cutting time, ways of land preparation etc.
(2) Knowledge shared by the learning group: For example, the emerging fodder technology which was appropriate to the local conditions, and
(3) Knowledge developed by academics: For example, facilitating the stakeholders in a participative learning process to be aware of their situation for change (after McTaggart, 1991).

The PRA team experienced the integrated aspects of learning arising from the PAR process, these being knowing; thinking, feeling and acting; knowledge was being generated through a process of social praxis, where praxis was the dialectic between thinking and action (Selener, 1997)

Evaluation and Outcomes of the PAR

Evaluation is best seen as a continuous process that occurs by examining the direct impacts of an activity throughout the seasons, rather than by only evaluating the outputs. In such an evaluation process a range of different criteria are used, including: how an initiative fits into the existing labour systems, how the forage grows, what expenditures are needed, and the reaction of other farmers. Besides considering these criteria, the evaluation of this PAR was also conducted through a workshop with farmers. Here farmers from the *learning group* reported on the process and outcomes of their on-farm trials, what they learned, reflections on why they did what they did, how they did what they did, and what they would like to do to further improve their forage production in the future. The results of the evaluation will now be described under three categories – technical, economic and social.

Technical Aspects

Farmers preferred to plant Napier grass (*Pennisetum purpurium*) rather than other species of grass such as *rumput benggala*, also known as Guinea grass (*Panicum maximum*) or *rumput afrika* (*Panicum coloratum),* because of the higher yield of the Napier grass, its drought tolerance, and the fact that it grew well in this particular area. This relates well to other studies from Kenya, that found that smallholders in densely populated areas showed greater interest in growing Napier grass (Bayer, 1990).

Under Kapuk trees, the grass grew well when planted at a spacing of 70 cm within rows and 90 cm between rows. The optimal cutting interval for this fodder grass was recommended as 6-10 weeks, but it was found by the farmers to be between 6-8 weeks; farmers also learnt that grass of a younger age had a higher palatability but was lower in carrying capacity.

Studies have found that with availability of fertiliser, Napier grass could produce very high yields, as high as 250 tons per hectare (AAK, 1985; Gill 1988), and showing no decline in yield even after 30 years (Bayer, 1990). Bayer, (1990) also found that Napier grass could be grown without fertiliser, but then the yield decreased substantially in the second year after planting and the grass stand became unproductive after 4 years. In our research area, the farmers also found that Napier grass responded well to fertiliser, and that the response was at an economic level. Farmers applied both chemical and organic fertiliser to their grass. Applications of chemical fertiliser were at the rate of 10kg/ha, and manure (fresh weight) at 3 t/ha.

Most of the farmers planted Gamal tree (*Gliricidia*) as a source of fodder, while some also planted Lamtoro (*Leucaena leucocephala*). They planted these fodder trees as fences around the boundaries of homestead and fields, with intervals of 2-2.5 m in the line. Farmers found that from 8-10 months after planting the trees as cuttings, they were ready for lopping, and could be lopped for a second and third time after intervals of 5 months. Farmers lopped the low branches first, then the upper branches.

Farmers also found that the leaves of these fodder trees had a low palatability, particularly when given fresh to livestock. To manage this problem, farmers partially wilted the leaves during the daytime prior to feeding. in combination with Napier grass. Farmers found that by using this system, the palatability of the fodder tree leaves improved.

It was concluded from the technical evaluation that cultivating Napier grass with *Gliricidia* or *Leucaena* could form the basis of a cow-fattening enterprise in this area. Napier grass would supply the basic fodder ration, while *Gliricidia* or *Leucaena* trees would provide the necessary additional protein.

Economic aspects

Planting fodder had direct and indirect economic benefits to the farmers. Farmers planted fodder in unused land, thus land could be used more efficiently. Introducing the cultivation of fodder grass and trees also improved farmers' practices in raising cows. For example, most farmers who were interviewed had changed their practices in cow raising, moving from a system of tethering animals in fields to eat weeds, to a cut-and-carry stall-feeding system that utilised more of the fodder nutrition. Farmers described how the growth rate of young cattle had improved from 0.3 kg/day to 0.5 kg/day. Farmers were also convinced that the cut-and-carry system had increased the amount of manure available for collection and use as fertiliser. One farmer said:

What I have done was to establish my cow fattening. By improving my fodder grass and tree I am able to get better feeding for my cow. Now, I do not feel worried to raise more cows, I have enough grass to feed my cows. At the moment, I am able to feed 2 - 3 cows.

Our interviews revealed that 50 % of farmers who planted fodder grass and trees were able to increase their cow numbers by an extra 1 or 2 cows.

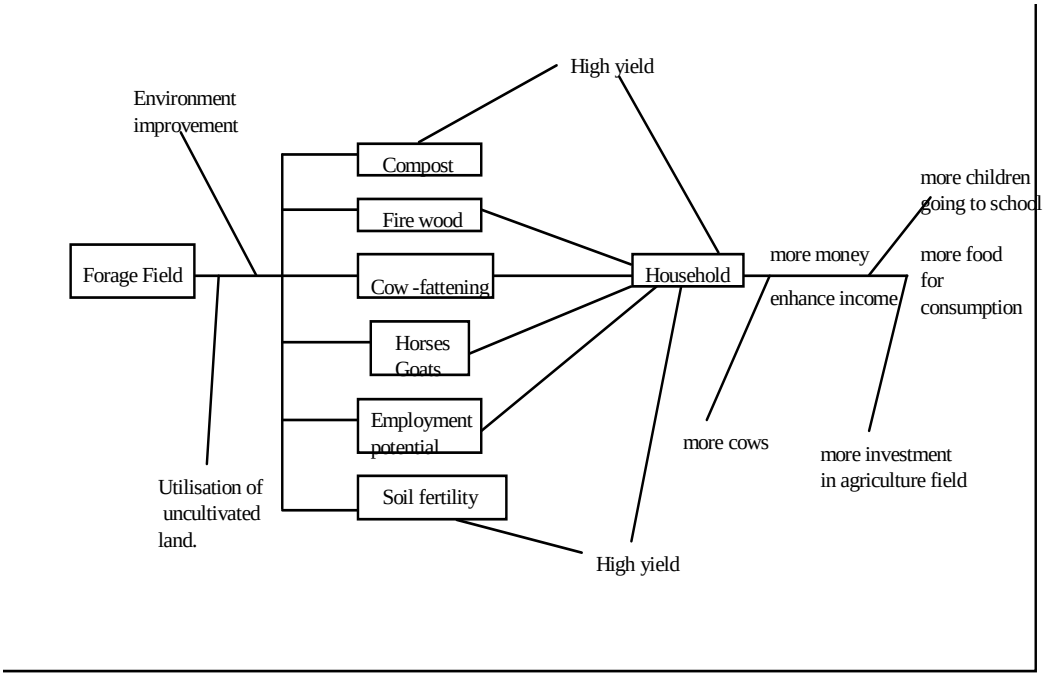
Social aspects

Planting forage affected the division and use of labour in the family. In this study area, the collection of fodder for ruminants had been the responsibility of fathers and sons. The evaluation produced evidence that the young boys had the main task of collecting fodder before and after school. After the introduction of the fodder growing system, the burden on the children was reduced, since fodder was now available near to the house. In addition, the men now had time available for other productive activities. For example, one male farmer stated that he could now earn extra income working as a farmhand for big farmers in a neighbouring village.

Planting forage also effected the gender division of labour. Planting forage around and near to the homestead attracted women's interest to cultivating fodder trees. The interviews with women revealed to us that women could become beneficiaries by getting firewood from these trees near the house, rather than having to scavenge for sources far from home. In this way, the children also had more time to help them to do housework rather than helping to find firewood.

As part of the evaluation process, participants were asked to draw the relationships of the new forage production system to their household (see figure 1). This clarified for the research team the linkages between community action and its economic implications.

Figure 1: Farmer's mapping diagram linking forage production to their households



Conclusions

This study of farmers in Tombolo village has identified the need for farmers to plant fodder as a part of their farming system. Even though this technology was new to many farmers it has

shown a high adoption rate, as evidenced by the number of farmers who planted fodder grass and fodder trees. Of the 511 farm families, about 303 of them owned some kind of livestock (cattle, goats and horses), and about 242 of them had planted fodder grass and trees. At the beginning of our research intervention, we started with four farms growing fodder, but this increased dramatically during the one and half-year period of the first two PRA research cycles. It is sometimes remarked that for new innovation to succeed, farmers need to be educated and motivated. We found that this was an oversimplification. Farmers already knew about the benefits of fodder; they became interested in the technology when information appropriate to their local conditions, such as species of fodder grass and trees that were suitable, and the appropriateness of their land, was unfolded through their participation. The use of PAR as the methodology for this study enabled the people to use their limited resources to improve their own situation. More specifically, in Tombolo village the application of PAR by the stakeholders enabled them to:

- produce knowledge to improve their understanding of the situation in which they practiced farming and livestock production.
- be empowered, by being active participants in the research process, and to take action to improve their own practice.
- improve the situation in which their farming and livestock production was done
- analyse the situation to make the technology more appropriate
- change the extension methods used to a participatory approach, in which the stakeholders became partners in learning and development.

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