PARTICIPATORY TECHNOLOGY DEVELOPMENT WITH GOAT-KEEPERS IN SEMI-ARID INDIA

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Introduction

Scientists have acquired a tremendous amount of knowledge about the feed resources and nutrition of ruminants, both large and small (Acharya and Bhattacharyya, 1992). Despite this, the adoption of technologies developed by researchers, for enhancing fodder production and improving grazing management systems, has been poor (*ibid*.; Sidahmed, 1995). This is partly because feed technologies have often been developed without the involvement of the intended users, and without an adequate understanding of their farming systems and constraints.

A participatory approach to technology development (PTD) can help to ensure that new technologies are appropriate to farmers' and livestock-keepers' needs and circumstances, and hence increase the likelihood of adoption (Conroy *et al*., 1999; Reijntjes *et al*., 1992). Greater participation of the intended users can mean, *inter alia*, that: farmers' knowledge and experience can be incorporated into the search for solutions, and highly inappropriate technologies can be 'weeded out' early on; and researchers receive rapid feedback, enabling promising technologies to be identified, modified and disseminated more quickly.

Livestock research and development work has tended to lag behind crop production work in the development and application of methods for PTD. There are relatively few documented examples of projects in which livestock are a central focus, particularly ones addressing feed issues. However, there has been increasing recognition that livestock research needs to give greater emphasis to farmer participation (Sidahmed, 1995).

Since October 1997 BAIF Development Research Foundation (India) and the Natural Resources Institute (UK) have been managing a four-year research project to identify and address feed-related constraints affecting goat production in parts of semi-arid India. The project aims to develop technologies to ease or remove the constraints identified, based primarily on a *collaborative* relationship with goat-keepers, as described in Table 1. This is more participatory than the *contract* and *consultative* modes, which have probably been the ones most commonly used in on-farm livestock research. (The degree of farmer involvement increases in the modes to the right hand side of the table.) This paper describes the feed supplementation trials conducted by the project. It then assesses to what extent the postulated benefits of PTD have been realised, and the factors affecting this.

Material and Methods

Diagnosis and needs assessment

The BAIF/NRI project team began by doing surveys in several villages in three districts of north-west India. The surveys involved rapid rural appraisals with groups of goat-keepers, using semi-structured interviews and mapping and diagramming. The surveys generated descriptions of the goat production and feeding systems. In PTD it is essential to identify priority needs: simple ranking was used to identify major problems and their relative importance, and the results of the ranking were generally cross-checked with other survey findings. This was sometimes followed by participatory problem tree analysis to gain a deeper understanding of the nature of the constraint. (The constraints identified are summarised and discussed in another paper for this conference, by the same author.)

If an important feed-related problem was identified through the group discussions, more detailed livestock productivity data (e.g. on kid mortality) were often sought subsequently through individual interviews, as such data can help to identify critical periods in the nutrition of the animals. However, the project found that conventional methods based on farmer recall, such as "Herder recall" and "Progeny history" (Waters-Bayer and Bayer, 1994), tended to produce unreliable information.

From the second year onwards this kind of data was collected using the 'participatory herd history' method, a new method developed by the project that is based on the use of cards to symbolise each goat in the herd. It involves making an inventory of the current herd, and working backwards over 1-2 years to document what changes to the herd have taken place and when, either in terms of acquisitions or removals, and hence the productivity of the animals. Each card has a picture of the animal drawn on it, with the sex indicated in the case of adults. A calendar, covering one or two years up to the present, is constructed on the ground, showing the seasons, months and important festivals. Several rows are made below the temporal headings, one for each adult doe. (For further information about this method, see Conroy (in press).) Representing the herd pictorially in this way facilitated recall by the goat-keepers and reduced the potential for misunderstanding between them and the researchers.

The trials

The project then established some on-farm trials that focused on supplementation of feed at critical points in time to address the problem identified. The process of designing, monitoring and evaluating the trials was intended to involve goat-keepers actively. The trials, which have all taken place during the dry season, were designed with a treatment and control group in the same village, so that a 'with/without' comparison could be made. The project's aim has been to select goat-keepers of similar socio-economic status for the two groups (although this has not always been achieved); and the project has worked primarily with poor people, belonging to scheduled castes or scheduled tribes. Non-experimental variables have not been controlled in any way, and, apart from applying the treatment, goat-keepers have been encouraged to follow their normal practices.

The project team concluded at the outset that it would be necessary to subsidise treatments to some extent, in order to: (a) encourage participation; and (b) to compensate people in the treatment groups for any potential risk to which their animals might be exposed, and for the time they contributed to the monitoring of the trial. People in the control groups were also provided with material incentives of a different nature that would not affect the outcome of the trial (e.g. provision of a breeding buck). However, the project team also considered it important that goat-keepers contribute to the costs of the treatment, as a demonstration of their interest in the technology to be tested and the problem being addressed. The project's approach has been to phase out subsidies where technologies prove to be effective. This is reflected in the fact that in the 1998 trials the project contributed 66% or 100% of the cost of the treatment; while in the 1999 trials this was reduced to 0%, 50% or 66%.

Monitoring and evaluation In most trials there has been a two-pronged monitoring system, comprising: fortnightly monitoring of goat productivity parameters (e.g. milk production); and monthly meetings with participants to discuss how the trials were progressing. The former provides quantitative information, while the latter provides qualitative information, including the goat-keepers' perceptions of how the animals are responding to the treatment and any issues that are concerning them. One or more literate persons from each trial village is given training by the project in how to measure and monitor the relevant goat productivity parameter(s), and is paid for doing this. Joint evaluation meetings with participants (from both the treatment and control groups) have been held at the end of the trials.

Results and Discussion

Results of treatments in relation to problems identified

Three priority problems were identified that appeared to be (at least potentially) feed-related. The production systems are different in each district, hence the feed-related problems are too (see Table 2). So far, nine trials have been implemented in north-west India, all but one of them in Rajasthan. The two most recent are ongoing and the results will not be known until the end of December 2000.

The UMG trial in Bhavnagar had the intended effect of increasing milk production. However, the size of the increase was limited and goat-keepers said that they would like any further feed supplementation trials to take place around the time of kidding, rather than in the dry season. They also said that water scarcity was their main constraint, and the project subsequently focused on addressing this. In the three Udaipur trials the effects of the treatments were difficult to isolate, due to confounding factors, including;

(a) members of the control group applying the treatment during the later stages of the trial, after observing its benefits;
(b) control group members grazing their goats on different (and superior) pasture land to that of treatment group members.

In trials 2 and 5 in Bhilwara the treatment was a mixture of *Prosopis juliflora* pods and barley, in equal proportions. The pods were collected when the trees produced them (in April and early May), and stored for use when feed scarcity was more acute (late May to late July). This treatment was found to be: (a) effective, in that the kidding rates of does in the treatment groups were significantly higher than those for does in the control groups; and (b) profitable, with a cost benefit ratio of 1:1.38 (Conroy *et al*., 2000).

Nevertheless, the project is seeking to reduce the cost of the treatment, and had undertaken trials (6 and 8) with *Prosopis juliflora* pods but no barley. This is because the pods are cheaper than barley; and they can be collected instead of purchased, thereby eliminating any cash requirement. (Cash is thought to be more severely constrained than labour at this time of the year.) Trial 6, implemented in 1999, showed promising results. However, these were not conclusive, as the number of trial goats was not large, and a substantial percentage of goats was sold off during the trial. Trial 8 is replicating the treatment this year, with a larger number of goats. The results so far are again positive, with the conception rate in the treatment group (73%) being 17% higher than that in the control group (56%).

Trial 9 involves the use of *Acacia nilotica* pods, instead of *Prosopis juliflora* pods, to investigate whether the basic technology can be applied to pods of other tree species.

Results in relation to degree of goat-keeper participation

The actual degree of goat-keeper participation in the design of the trials has been moderate in relation to: (a) relating the trials to priority needs; and (b) the determination of the treatment (see Table 3). The reasons for this are discussed in the concluding section.

Addressing of a priority need To ensure the active involvement of goat-keepers in PTD it is essential that the research is addressing a need that they regard as important. The researchers generally *sought* to address a priority need of the goat-keepers. However, in four of the trials it is questionable whether the project actually *succeeded* in doing so (see Table 3), due to inadequate discussions with goat-keepers about the precise nature of the constraint and/or the suitability of the proposed treatment to address it.

Determination of treatment In all of the trials it was the researchers who identified the type of supplement to be used. However, this was based on knowledge of livestock-keepers' experiences with similar technologies in other localities. In most trials, the participants appeared to agree that the proposed treatment was a sensible one, and contributed 33-100% of the cost of the treatment. In Trials 6 and 7 goat-keepers were more actively involved in determining the treatment, in the latter case having the major say in the daily quantity.

Summary and Conclusions

The adoption of technologies developed by researchers, for enhancing fodder production and improving grazing management systems, has been poor. A participatory approach to technology development (PTD) can help to ensure that new technologies are appropriate to livestock-keepers' needs and circumstances, and hence increase the likelihood of adoption. This paper describes the feed supplementation trials conducted in India by a research project that is seeking to take a participatory approach, and assesses to what extent the postulated benefits of PTD have been realised, and the factors affecting this.

Technology development is a gradual and iterative process. Thus, a number of trials may be required before a technology is developed that meets livestock-keepers' priority needs and is suitable for adoption. The experience of this project appears to confirm the widely held view that the more and the earlier farmers and livestock-keepers are involved in the research process, the more rapidly appropriate technologies will be identified.

Factors facilitating increased participation

A high degree of participation (such as type 3 in Table 1) is not usually possible from the outset. However, if researchers are committed to achieving it there is likely to be a gradual shift along the spectrum towards greater participation. In the experience of the BAIF/NRI project this may be due to one or more of the following factors: (a) development of positive rapport between researchers and participants when successive trials are conducted in the same village, as illustrated by Trials 2 and 5; (b) improved understanding of problems (illustrated by the Bhavnagar experience, discussed above) or opportunities (e.g. Trial 3 identified an opportunity that was then explored further in Trial 7); (c) the efficacy and profitability of the technologies is demonstrated (Trials 2 and 5), or improved through modifications (the aim of Trials 6, 7, 8 and 9); and technologies found to be ineffective are abandoned (Trial 1).

Factors hindering a participatory approach

The shift towards a collaborative relationship with farmers is not automatic. It is important to be aware of, and to address, factors that may hinder the adoption of a participatory approach. These include (see also Conroy *et al*., 1999): (a) researchers lacking experience and orientation in PTD; (b) researchers not thinking in terms of the profitability of treatments; (c) researchers lacking awareness of constraints on goat-keepers' factors of production (capital, labour and land); (d) pressure to move quickly from the diagnosis and needs assessment phase to the establishment of trials (due to the short lifetime of some projects), resulting in inadequate needs assessment; (e) small project budget, resulting in insufficient staff time to encourage full farmer involvement; (f) late scheduling of project activities (related to previous point); and (g) staff turnover and involvement of inexperienced staff.

The project has sought to address points (a), (b) and (c) by providing relevant training, in the form of one-week courses in PTD, to members of the research team. In addition, before any trials are authorised, the researcher is required to complete a protocol, and to provide, *inter alia*:

- evidence that the researcher has done a thorough needs assessment (upon which the case for the trial is based) and understands well the problem or opportunity; and
- quantified estimates of the cost of the proposed treatment and the likely or possible benefits, indicating good prospects for the treatment to be profitable.

Prospects for adoption

The ultimate test of the appropriateness of the technology tested is whether or not participants show evidence of adopting it. The prospects for adoption of the technology involving the collection and storage of *Prosopis juliflora* pods look very good. Three women who took part in Trial 6 in 1999 were interviewed individually by the author in August 2000 to find out whether they had also used the technology this year, when they did not participate in any trials. All three said that they had used the technology, although they had modified its application somewhat (e.g. they gave the supplement to all of their goats, not just the breeding does). They also said that they knew of other goat-keepers who had adopted it. The project is about to undertake a larger and more systematic survey into the adoption (and modification) of this technology in the trial villages.

For goat-keepers living in areas where *Prosopis juliflora* is present in substantial quantities on common land (where it is often found), the technology has the advantage of not requiring any cash expenditure. Furthermore, although there is a labour cost, the pods are produced at a time of the year (April) when labour is not particularly constrained (crop production-related activities are limited), making it relatively easy for people to fit this activity into their work schedules. If the pods were not harvested, any ruminant grazing in the area would be able to consume them. Thus, collection of pods for feeding to goats represents a re-allocation away from other animals, particularly large ruminants. Fortunately, owners of large ruminants do not appear to object to this.

The seeds in *Prosopis juliflora* pods are highly nutritious, but a large percentage of them are not broken down during the digestion process and emerge intact in the faeces. Therefore, the project is considering implementing new trials involving the use of ground pods as a supplement, so that the full nutritional value of the pods is utilised.

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Tables and Illustrations

Table 1 Four Different Modes of Farmer Participation in Agricultural Research

1. Contract	2. Consultative	3. Collaborative	4. Collegiate
Farmers' land & services are hired or borrowed: e.g. researcher contracts with farmers to provide specific types of land	There is a doctor-patient relationship. Researchers consult farmers, diagnose their problems and try to find solutions	Researchers and farmers are roughly equal partners in the research process & continuously collaborate in activities	Researchers actively encourage & support farmers' own research & experiments

Source: Biggs, 1989.

Table 2 Problems, Supplements and Classes of Goats in the On-farm Trials

District (State)	Main product	Feed-related Problem (or opportunity)	Supplement (generally given at 250g/day)	Goats targetted
Bhavnagar 1998 (Gujarat)	Milk	Low milk production in dry season	Trial 1. Urea/molasses granules (UMG)	Lactating does
Bhilwara 1998 (Rajasthan)	Meat	Sub-optimal reproductive performance of does	Trial 2.Mixture of *Prosopis juliflora* (PJ) pods and barley	Breeding does
Udaipur 1998 (Rajasthan)	Meat	Disease-related mortality in kids early in the rainy season	Trial 3. Barley Trial 4Urea/molasses granules	Kids
Bhilwara 1999 (Rajasthan)	Meat	Sub-optimal reproductive performance of does	Trial 5.Mixture of *Prosopis juliflora* (PJ) pods and barley Trial 6. PJ pods only	Breeding does
Udaipur 1999 (Rajasthan)	Meat	1 Disease-related mortality? 2 (Rapid maturation of females)	Trial 7. Barley	Kids
Bhilwara 2000 (Rajasthan)	Meat	Sub-optimal reproductive performance of does	Trial 8. PJ pods only	Breeding does
Bhilwara 2000 (Rajasthan)	Meat	Sub-optimal reproductive performance of does	Trial 9. AN pods	Breeding does

Table 3 Indications of the Degree of Goat-Keeper Participation in the Trials

Trial – number, supplement & year	Overall mode of participation*	Was a Priority Need Addressed?	Who Decided Nature of Treatment?	Joint Evaluation?	Is treatment likely to be adopted?
1. UMG – 98 (Bhavnagar)	1/2	X	R	✓	X
2. PJ pods & barley – 98	2	✓	R, with G-Ks' agreement	✓	✓ (with modification)
3. Barley – 98	2	?	R, with G-Ks' agreement	✓	X
4. UMG – 98	2	?	R, with G-Ks' agreement	✓	X
5. PJ pods & barley – 99	1/2	✓	R	✓	✓ (with modification)
6. PJ pods – 99	3	✓	R/G-K jointly	✓	✓
7. Barley – 99	2	?	R/G-K jointly	✓	X
8. PJ pods – 2000	2	✓	R, with G-Ks' agreement	---	✓
9. AN pods--2000	2	✓	R, with G-Ks' agreement	---	?

*Code: 1 = Contract 2 = Consultative 3 = Collaborative. R = Researchers. G-Ks = Goat-keepers