Chapter 11

On-farm research: a discussion of some practical examples and procedures

This chapter was contributed by Frands Dolberg, University of Aarhus, Denmark. Examples are given of studies which in most cases have been conducted within the framework of development projects and they do therefore illustrate on-farm research with a development perspective, i.e., the knowledge gained has been deemed important for better project implementation. Some of the concepts that apply in this kind of research were discussed in Chapter 10.

INTRODUCTION

The present chapter of the handbook dealing with on-farm research can be written with much more confidence than was the case for the first edition (Preston, 1986) for the simple reason that there is much more experience to draw from. There is also evidence that technologies beginning to find uptake among small farmers in developing countries and featuring more prominently on research agendas - such as "by-pass" protein (Preston and Leng, 1987) and surplus fibrous crop residue feeding (Owen, 1994) - in fact are old farmer practices to which recent work has lent a scientific understanding. The sucking calf is common across the tropics and the practice has some scientific merit as will be discussed below.

The reader should also consult sources such as Amir and Knipscheer (1989) and Daniels *et al.*(1993), which contain detailed guidelines for on-farm research and examples of routine data collection. On-farm studies have served several objectives at one time like monitoring and evaluation, and not exclusively research (Rangnekar, 1994).

ON-FARM RESEARCH

On-farm research in its model form involves several discreet steps:

- Selection of target areas and farmers, description of their production systems and identification of constraints or opportunities.
- Formulation of research project, i.e., an intervention to overcome the constraints or exploit the opportunities.
- Conduct of the research.
- Provided the research led to positive results, recommendations have to be worked out and training conducted of farmers and extension workers.
- Evaluation of impact of the recommendations, which may lead to identification of new research problems.

However, as these steps are described in the sources cited above, the chapter will be organized so as to illustrate:

- How to set up programmes for integrated base line data collection and technology transfer on small farms and the associated problems of establishing agreement with farmers and the community.
- Measurements to make and how.
- Recording and interpretation.

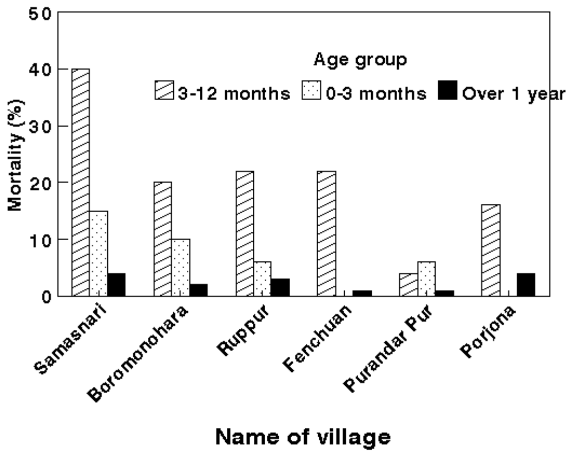
BASELINE DATA

Age-specific mortality in calves

In order to design appropriate interventions it is important to know the weak points in a traditional production system. Data on age-specific calf mortality from six villages in Bangladesh will be used as an illustration (Figure 11.1).

In work reported by Hermans *et al.*(1989), mortality was estimated in the age intervals birth to 3 months, 3 to 12 months and above 1 year. It was found that mortality for calves above 1 year was consistently the lowest in all six villages with a range of from 1.1 to 4.1%. Among the new-born to 3 months old calves it was high in one village at 15.7%, but was reported to be zero in two villages and only in one village was the mortality rate marginally (6.0 against 5.2%) higher among the very young calves compared to the 3-12 months old, the age group where the highest mortality rate was found.

Figure 11.1. Calf mortality according to age in villages in Bangladesh (Source: Hermans *et al.*1989).

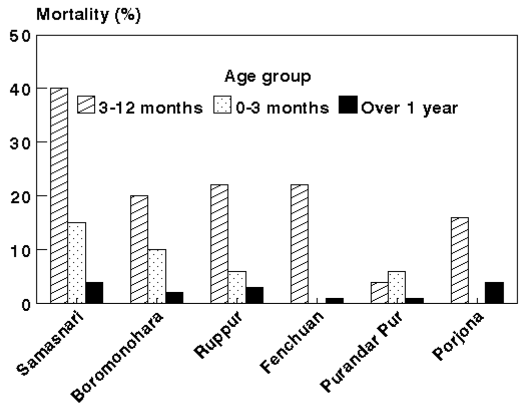


Perhaps this is a somewhat surprising observation as established knowledge would hold that the youngest animals were the most delicate and the highest mortality should be expected in this age group. However, the smallholder, suckling system may represent a different case of relatively well nourished young calves, while the 3 - 12 months old calves encounter nutritional problems (Figure 11.2), an aspect of calf rearing which ought to be researched in many more countries to understand to what extent it can be generalized.

Collection of the data

The problem with collection of mortality data is to be available on the farm when the death occurs to avoid problems of farmer recall. To overcome this problem, the data were collected by the Bangladesh Cattle Development Project, but analyzed and interpreted by staff of the Dutch Centre for World Food Studies. As the Cattle Development Project had a veterinary service in regular contact with farmers in the area, data collection gained in reliability as the veterinary field workers knew the farmers and their animals and were aware of the prevailing diseases. The problem was to have the data analyzed and a solution was only found some years after the project was closed and staff involved in the original data collection established contact with the Dutch team.

Figure 11.2. Calf mortality according to age in villages in Bangladesh (Source: Hermans *et al.*1989).



Obviously, the lesson is that a working relationship between a development project, with a good opportunity to collect useful data due to frequency of village visits and trust developed with farmers, on the one side, and an Institute having the ability to analyze such data on the other, should be established from the outset. But such a statement misses reality. In many situations interest, competence and money are not synchronized (Chambers, 1983) and the example illustrates that there can be a fair degree of coincidence associated with generation of interesting data.

COMPARING FARMER PRACTICES WITH INTERVENTION

Effect of supplementing suckling calves in a traditional system

The insights gained in Bangladesh suggested that calves reared in a traditional smallholder system begin to encounter problems around 3 month of age. In the following example from China (Gu *et al.*,1993), it was assumed:

- That nutrition was a major difficulty.
- That low mortality in the early period of the calf's life was due to the merits of the traditional suckling system (see Table 11.1).
- And perhaps also - but this has not been studied - the very low number of calves per household, which may minimize contagious disease risk for certain diseases.

In the control group (C) no intervention was made, but the growth pattern of calves in the traditional system was described. The experimental treatments were:
A: A supplement of cottonseed cake *ad libitum*.
B: Cottonseed cake *ad libitum* and ammoniated wheat straw *ad libitum.*

Organization of the trial

Getting a negative control often represent a special problem as farmers prefer the treatments producing better animal performance and income.

However, there are various ways of settling this issue with farmers. In this case a large UNDO/FAO sponsored feeding trial involving 1027 animals from 312 farms in 12 villages of Henan and Hebei Provinces had been undertaken with the same farmers. This had established a sense of goodwill and farmers could be identified, who were prepared to accept the negative control. The project provided the experimental inputs free (cottonseed cake and urea) and in return the farmers accepted the interruptions caused by fortnightly weighing and frequent visits by officers, responsible for the trial. The results are reported in Figure 11.2.

Growth rates were very good for all three groups during the first month at 850 - 950 g/day, probably as a consequence of the suckling system. However, at 1.5 months, the calves in the control group apparently encountered a nutritional constraint, as growth rate fell to 533 g/day, while it remained high around 900 g/day in both experimental groups.

The growth rates in the control group fell after the first month and remained consistently lower throughout the rest of the six months experimental period. The calves on a supplement of cottonseed cake maintained their high growth rate throughout, although growth rates were reduced slightly after 3 months from above 800 to 700 g/day. In contrast, the calves in the third group, receiving both cottonseed cake and ammoniated wheat straw, maintained a growth rate above 800 g/day.

At six months, the average calf weight was 136, 166 and 174 kg in the control and two experimental groups respectively. But more importantly, the growth rate at six months of age was 449, 700 and 830 g/day respectively.

The explanation for the very satisfactory performance of the calves in the experimental groups A, and especially B, is likely to be that the suckled milk provided very efficient by-pass nutrients (Preston and Leng, 1987). Thus, simple interventions like a protein supplement and roughage of only medium quality (ammoniated wheat straw) had a very positive effect.

Combined baseline data collection and testing of intervention

The Chinese trial also demonstrates that it is possible to combine collection of baseline data (the negative control) with testing of an intervention. This point is probably important as it allows time and money to be saved and several objectives are accomplished at the same time (Rangnekar, 1994). Additionally, it is much easier to establish a working relationship with farmers, when the scientists undertake some work which is tangible and visible.

Backup on-station work

On-farm work is incomplete unless it can count on on-station research. when a need arises. However, this linkage between the field and the station is still poorly developed and in most cases it operates the other way round, i.e., research is done on-station, which is subsequently tested in the village.

The following example on restricted suckling is therefore included, not because it was the actual sequence of events, but to illustrate how important it is to develop a well-founded, scientific understanding of sometimes unexpected occurrences in the villages; in this case, the unexpected high growth rates in the first month of the life of the calf.

RESTRICTED SUCKLING

Allowing the calf to be suckled by its dam is an age-old farmer practice in many developing countries. On the basis of this custom, Ugarte and Preston (1972) in Cuba and Alvarez *et al.*(1980) in Mexico developed a restricted suckling system which demonstrated increased total milk production in the cow and improved calf growth rate for a lower quantity of milk consumed - characteristics also found by Khan and Preston (1992) in their work in Pakistan (Table 11.1). These observations can be interpreted to support the village-based observation that calves grow well in early life, when their nutritional requirements can be met by suckled milk.

Table 11.1. Performance of calves reared by restricted suckling or artificial rearing (Source: Khan and Preston, 1992).

	Artificial rearing	Restricted suckling	SEM	Significance level
Liveweight, kg				
Birth	32.6	30.9	1.63	NS
At 92 d	64.4	83.1	3.12	.001
Daily gain, g	370	552	32	.001
Milk intake, kg/d	3.04	2.67	0.097	.05
Milk conversion*	8.98	4.97	0.79	.01

* Milk consumed (kg)/Liveweight gain (kg).

While it is still poorly understood, what happens in the cow, the reactions in the young ruminant have been described as the suckled liquid milk passes through the rumen to the abomasum by the application of the oesophageal groove reflex (Ryle and Ørskov, 1990).

One interesting question to pursue is to what extent restricted suckling can be applied to lactating goats and sheep. Although the practice is known, results of research have not been reported. However, on-going work in Vietnam indicates restricted suckling can be applied to goats (Preston,T.R., personal communication).

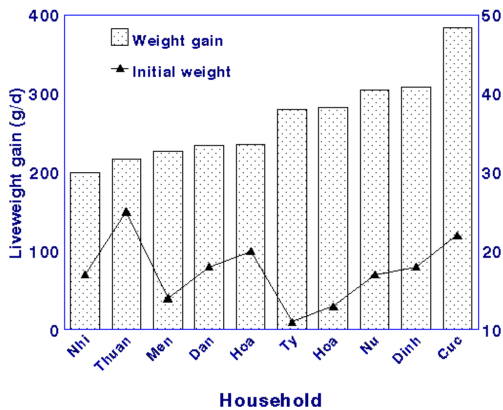
THE MANAGEMENT FACTOR

The questions

As already mentioned village trials set up for one purpose may turn out to answer other questions as well or raise new ones. Data from an on-farm trial testing sugar cane juice as a source of energy to pigs in Vietnam can be used to illustrate the point.

A first analysis had revealed no relationship between initial and final pig weight, while a relationship was indicated between household management practices and pig daily gain (Figure 11.3). The next logical question to try to answer would be: what causes this difference between households?

Figure 11.3. Influence of household on pig performance in villages in Vietnam (Source: SIDA.MSc 1992/94).



Organization of the work - A Women's Union and a revolving fund

The work in Vietnam (Dolberg, 1993) has benefited strongly from collaboration with local chapters of the Vietnamese Women's Union. The Union has been responsible for selection of participating women farmers and day-to-day supervision of the trials. Initially, an agreement was worked out between the Research Project funded by Sweden (SIDA MSc, 1992/94) and the Women's Union, which stipulated obligations of both parties. An experimental fund was provided to be administered by the Union and farmers were only subsidized, if it could be demonstrated that they had encountered a loss due to the trials. However, in most cases farmers have recovered their costs and, as money is returned to the experimental fund, it allows new trials to be undertaken.

While such an arrangement may not be appropriate in all cases, in Vietnam it has proved a very effective instrument. Working with an established development institution like the Women's Union has the advantage that, if a technology is successful and starts to spread, the transition from on-farm trials to large scale extension work can be smooth as it can happen within the same institution with a core of people who knows about the technology from the early phases of its introduction.

THE COMPARATIVE ANALYSIS IN TECHNOLOGY ADOPTION

Technologies may fit under one set of circumstances, but not under another. Ammoniation of fibrous crop residues with urea as a source of ammonia has found adoption in China, Niger, Tunisia and Iran but failed in many other countries. A comparison of some relevant factors from China and Bangladesh is made in Table 11.2.

The objective here is not to discuss the specific factors, but to point out that there can be several reasons - and many of them non-technical - for adoption or rejection of technologies. Straw treatment now (autumn 1994) seems to find uptake in Bangladesh, precisely because the technology finally is receiving institutional support.

INTERACTION BETWEEN RESEARCH AND DEVELOPMENT

While the examples above have been included to provide practical illustrations of on-farm work, an attempt will be made in this section to generalize on important features of the approach.

Feedback

To be able to generate feedback from farmers and deal with it constructively is, according to Bunch (1982), a most important condition for success. However, it has been difficult to put into practice (Merrill-Sands and McAllister, 1989). Doing on-farm work early, and not late, in the technology research and development process is an important means of generating feedback.

Table 11.2. Straw utilization factors in China and Bangladesh (Source: Dolberg, 1992).

Factors	China	Bangladesh
Plenty of straw?		
National perspective	Yes	Yes
Farmer perspective	Yes	No
Urea available	Yes	Yes
Protein supplements	Cheap	Avail.
Access to land	Even	Uneven
Share cropping	No	Yes
Price of straw	Low	High
Straw used as fuel	No	Yes
Tillage power	Tractors	Cattle
Management decisions	On-farm	Off-farm
Absentee landlords	No	Yes
Political and adm. support	Yes	No
Training of scientists	No	Yes
Socio-economic factors conducive to technical assistance	Yes	No

Technology - identification of strengths and weaknesses

Instead of the conventional "from laboratory to research station; to farmer-testing; to wide-scale application through the extension system" sequence of events, it is argued that early in the technology research and development phase it is important to get out and make a test on-farm. This is not so much to promote the technology as for the project planners and scientists to learn about weak and strong points of the technology and project design. It is an iterative process and it is important to stress that this is a learning phase for the planners, project personnel, scientists and farmers alike. It is argued that, if more technologies that are claimed to be ready on the shelf for extension were subjected to this test, it would be realized that many of them are in fact not ready and, logically, research would be better focused and planning would become more realistic.

Creation of a farmer-extension-scientist alliance

If successful, it is likely that the iterative process outlined above will have identified leaders at farmer, extensionist and scientist levels, who by joining forces can do the necessary research and development of the technology *in situ*. This approach is still sparsely used, but teams using it can reinforce each other by communicating with collegial groups elsewhere in the World through modern means of communication. By offering scholarships to host country students (Dolberg, 1991), projects can meet several objectives at one time: baseline data can be collected, ongoing monitoring and evaluation can be conducted and future scientists and extensionists can be trained. To facilitate the approach, development projects should contain a budget line for research, as limitations in knowledge are frequently identified during project implementation.

The methodological tool kit

A further important reason to get out on farms is to develop and improve researchers' awareness of the methods for data collection and analyses, which can be applied under these conditions. It is by being out on farms dealing with farmers, that new ideas arise and arrangements like the revolving, experimental fund are created.

For data analysis, a graphics programme can be used to illustrate patterns and consistencies quickly as illustrated in this chapter. In fact, in many on-farm situations, it is very important to demonstrate patterns and consistencies due to factors such as location, season, age, management, breed and land tenure which, subsequently, may be subjected to more careful analysis.

There is an argument here as some scientists feel very uncomfortable without applying statistics to their data. Others find farmer uptake of technologies the most important criteria for data evaluation and -relevance (Chambers *et al.*,1989; Pretty and Chambers, 1992). One important point is that many smallholder farmers deliberately pursue complexity in their farming practices in contrast to the standardization which is often a pre-requisite for application of conventional statistical analyses.

CONCLUSION: TOWARDS THE FARMER-FOCUSED RESEARCH FRAMEWORK

To exploit fully the potential that smallholder farmers possess to increase animal production, more work is required to describe scientifically, and to understand, their current practices and to test new ones under their conditions.

The examples presented in this chapter illustrate that the objective of the first step should not be to promote a technology, but rather to identify problems some of which may require further research and development in an iterative manner.

A small start has merit as a means of testing the basic idea before proceeding to large-scale application of a technology. It is a means of identifying farmers, researchers and extensionists who have a natural talent for this type of work and an alliance of such people is critical for future expansion of smallholder livestock production. If the technology is a failure, it is easier to redirect or close down a small project than a big one.

When a critical mass of people and institutions are identified then on-farm work will accelerate the research process and make it move faster than if the scientists confine themselves to the research station and laboratory, or the farmers to their farms.

An important condition for success is that the leading scientists should:

- Take the approach seriously.
- Be prepared to spend time in the field with farmers in order to identify topics for on-farm and on-station research.
- Demonstrate to their juniors how to deal constructively with feedback from farmers.