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FARMER PARTICIPATORY RESEARCH FOR AQUACULTURE IN EASTERN INDIA

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Farmer Participatory Research for Aquaculture in Eastern India

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Over the last ten years a new revolution in agricultural research has developed, bringing in new areas, participants and methodologies. These methodologies can be grouped together as 'farmer participatory research', a term which covers a wide range of activities. I am going to introduce them, and relate them to the goals of this project, then discuss the experience of other projects which may be helpful to you in planning your own research with farmers. My intention is provide you with a range of ideas which will contribute to your own participatory research planning.

What is participation?

Participation is an over-used word these days and it is all too easy to say we are being participatory, without really including all the participants in decision-making. Participation means not just sharing the work, but also sharing the control. This is a difficult concept for some people, if their traditional roles have involved making decisions on behalf of other people.

We can distinguish between *empowering* and *functional* participation (Farrington and Thiele, in press). NGOs generally seek to empower the poor and marginalised, leading to control of their resources and sustainability of livelihoods; government agencies on the other hand often seek participation as a way of increasing the appropriateness (and therefore adoption) of technology generation. Each organisation must be clear about what it means, when it says it is using a participatory approach. It is not enough merely to ask community members what they want; those people must share in controlling the process.

Within the community there are different social groups: caste, class, tribe, gender; each category has access to different resources including money, employment, land and community resources. PRA (participatory rural appraisal), which is the most common form of participatory development, has been criticised for its failure to give the most vulnerable the opportunity to express their needs. This is because in group discussions, the powerful will dominate and weaker people will be afraid to contradict them, and because in some societies women are easily excluded from publicly voicing their opinions and experience (Mosse, 1995).

Developing a new technology will affect each of these groups differently, and their perspectives must be understood. Sometimes we forget or don't know about some of these groups - most commonly the women, or the poorest people in the community. These are the ones who may not be able to join the project, or who may lose out from the results. We have to take care to give all of these groups the opportunity to guide the project development.

When we as outsiders are planning a project, sometimes we benefit more than the community. It is important to be clear about who the project is for, who will benefit from it and who is going to put time and material resources into it. We have to be especially careful when we are talking about research, because if we take away the results and use them in our own work, they are of little value to the community.

These questions are of more interest to some stakeholders than others: for example, KRIBP and its CO's are probably more concerned about social development and justice, while equity and poverty alleviation are also important goals of DFID.

What is farmer participatory research?

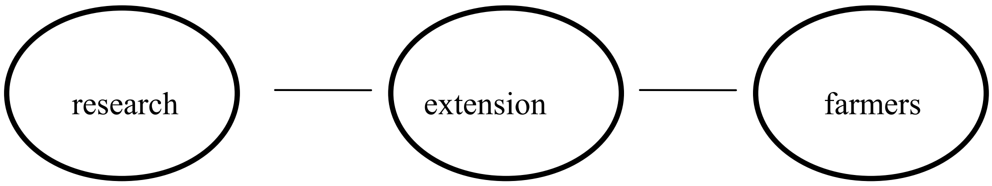
Conventionally, agricultural research is built on a hierarchy of types:

- **basic**: designed to generate new understanding of biological processes.
  For example, the investigation of fish hybrid vigour.
- **strategic**: to solve specific research problems.
  For example, detecting which species exhibit hybrid vigour.
- **applied**: designed to create new technology.
  For example, developing methods for hybridising fish.
- **adaptive**: to adjust technology to the specific needs of a particular set of environmental conditions.

For example, developing self-sustaining populations of hybrid fish within hatcheries.

The results of this agricultural research are transferred to farmers through a linear extension process, the transfer of technology model (fig. 1).

Fig. 1: the linear model of information flow



According to this model, technologies are expected to spread (diffuse) from the contact farmers and early adopters, through the so-called 'trickle-down' effect. The T&V extension system is based on this model.

The model has been more effective under some conditions than others. In India, the following observations have been made (Robinson et al., 1993):

- 'Conditions in homogeneous areas are easy to replicate on research stations. On-station experiments under controlled conditions therefore have good prospects of producing technologies adoptable by farmers operating in these areas.'

- 'By contrast, in CDR [complex, diverse and risk-prone] areas much more time and effort needs to be invested in understanding farmers' objectives, constraints and practices in the context of the agro-ecological and socio-economic complexities in which they operate. Researchers' relations with farmers need to be participatory and collegiate.'

Farming systems in poorer areas are characteristically complex (accommodating a range of livelihood strategies which interact with each other), diverse (with more crops, animals and wild species than in Green Revolution systems) and risk-prone (subject to natural disasters such as flooding or drought; or to financial disaster through debt or changing markets). In addition, poorer rural areas are themselves more diverse, with for example wide differences in soil, slope, or access to water. The insecurity of poor households in such areas means that rural people are often particularly concerned to maintain diversity, and to manage complexity in ways which are not necessarily obvious to outsiders. For example profit may not be their principle motive; reducing risk or dependence on outside inputs, avoiding high demands on scarce resources such as labour, maintaining good social relations, and maintaining nutrient flows between components of the livelihood system may be just as important.

For these reasons, technologies developed for homogeneous environments with good access to markets, requiring high levels of inputs and management for profit, may not be at all suitable for CDR environments. Given the diversity of the systems, it is not possible for outsiders to prepare ready-made technologies which can be adopted by people in these areas. For farmers in these areas, more participatory research is needed to understand their farming systems, and to develop a range of resource-management strategies which can be selected and modified by other farmers.

Researchers in the 1980s recognised the need to understand the complexity of farming systems in poorer areas, and developed an applied approach known as Farming Systems Research. Teams of scientists and sociologists worked together to classify farming systems and design more appropriate technologies. They often designed on-farm trials to observe how a new technology would work in a real farming situation. In its application however, the researchers continued to plan and evaluate the trials, making the decisions on behalf of the farmers; rural people did not have any control of the research agenda and as a result sometimes the wrong questions were addressed, or social problems went unnoticed.

Participatory technology development (PTD) provides part of the answer to this deficiency. PTD practitioners usually introduce farmers to a range of technologies which the farmers then test out and evaluate on their own farms. They have more input into the analysis of the research. A well-known publication, Farming for the Future, defines it as:

> *The process of combining the indigenous knowledge and research capacities of the local farming communities with that of research and development institutions in an interactive way, in order to identify, generate, test and apply*

> *new techniques and practices and to strengthen the existing experimental and technology management capacities of the farmer.* (Reijntjes et al., 1992)

This is a broad definition and brings PTD close to Farmer Participatory Research, a systems-based research process which recognises that farmers are already experimenting, and supports those activities with scientific information. In many ways it does not matter if we call it PTD or FPR: the important point is that we recognise the complexity of farming systems, the range of social categories in the community, and that only local people can fully understand this context for technology development. Another well known publication has pointed out:

> *In some ways the focus of FPR is as much on political, social and institutional processes as on the development and testing of agricultural technology. (*Okali et al., 1994)

So FPR is not just on-farm research. FPR implies a collaboration between farmers, researchers and community workers, to find appropriate results which the farmers want. This collaborative approach is already used by the KRIBHCO Rainfed Farming Project (Jones et al., 1996). Experiments can take place on the farm, or on the research station, but in either case farmers themselves must have more control of the trial or its evaluation, than has happened in the past. Many traditional on-farm trials are still controlled by the scientist, who also measures the results, which may not be relevant to the farmers at all. It is widely recognised that while technologies developed on farm, by farmers, may be more relevant, realistic and adoptable, it is still appropriate to conduct some research on-station. Technologies which may imply a high risk to the farmer, or technologies which are not fully understood scientifically and where better scientific understanding will help to develop more useful practices, can be developed on research sites without cost to the farmers. This project explicitly provides scope for several different strands to the research, allowing ideas to cross-fertilise. To be participatory, all the stakeholders need to have input into the trial design and evaluation, and access to the results.

In summary, Farmer Participatory Research is based on the following observations

- Farmers are already experimenting, in an on-going search for new or improved livelihood options.
- The locations where FPR is appropriate are diverse; blanket recommendations are unlikely to be useful.
- Farmers are more familiar than researchers with local conditions, especially in CDR areas, and will be able to identify their own problems and objectives for research.
- FPR clients are usually low-income rural people who may be fully occupied with agricultural production or related activities, or have other sources of income. Some may be landless, having access only to common property resources.
- Farmers prefer a range of options to work with and adapt to their own situation, not a package.
- Under these complex and diverse conditions, science does not have all the answers, but it does have valuable experience which will be useful to farmers in CDR areas if they are given the opportunity to use it flexibly.
- Scientists will themselves learn from farmers through the participatory research process.

(Adapted from Martin and Sherington, 1996; Veldhuizen et al., 1997b).

Specifically for rainfed areas of India, Jodha (1996) has identified a need for participatory and farmer-first approaches within farming research. He notes that economic liberalization, and environmental concerns have made rainfed farming research more dynamic as well as focused, and recommends the involvement of NGOs, the diversification of agriculture in dry regions, and identification of niches within dry areas to enhance competitiveness. Participatory aquaculture research could respond to these economic and environmental needs.

Institutions and farmers interact in different ways, and can adopt different strategies for conducting research together. Biggs (1989) has classified these in a simple way which gives a framework for thinking about managing the research process, in relation to four types: contractual, consultative, collaborative or collegiate (table 1). FSR and PTD as defined here are consultative types of participatory research, while

PTD is more collaborative. FPR is an attempt to move further towards the collegiate type of research - recognising the farmer as innovator and as experimenter. Through this process FPR can also have a role in empowerment.

Table 1. A classification of participatory research strategies (from van Veldhuizen et al., 1997b, after Biggs 1989)

type	**characteristics**
contractual	scientists contract with farmers to provide land or service
consultative	scientists consult farmers about their problems and then develop solutions
collaborative	scientists and farmers collaborate as partners in the research process
collegiate	scientists work to strengthen farmers' informal research and development systems in rural areas

The selection of collaborating farmers will have important consequences for a FPR project. It is possible to argue that experimentation involves risk, and that only the richer farmers are in a position to accept that risk; when a useful new technology has been developed, then it will be safer for poorer farmers to adopt. But this would be a mistake, because often the richer farmers have different farming systems from poorer farmers, so a technology which works for them will not necessarily work for others; and if the poor or women have been left out of the experimental stage, they will lack the confidence and information to develop technologies and practices which suit them. The objective of farmer participatory research is not to develop a single perfect technology, but to share ideas and encourage a range of rural people to seek management practices which suit them.

Technologies, farming systems or common property management?

PTD has been applied mainly to crop varietal selection, with some well-known success stories such as those conducted within KRIBP (e.g. Witcombe et al., 1996; Joshi and Witcombe, 1996). These ideas are now being used to develop the more complex technologies or resource management systems which apply to the whole farming system, and it is in this area that the term farmer participatory research may be more appropriate. Soil and water conservation is one such area: the practices developed and adopted by farmers affect interactions between crops, animals and humans throughout the farming system. Rice-cum-fish is another, and the types of aquaculture being considered here also come into that category. The goal is not simply increased fish production; the water, nutrients and other resources used, are scarce resources which have to be diverted from other activities; their availability depends on soil and water management in the rest of the catchment, and they may be shared resources whose use affects a number of people. Under these circumstances, 'technology development' is a much more complex business than simply the selection of appropriate species or varieties.

Common property resources, which include some water bodies, may be especially challenging for participatory research, because of the social and organisational issues which are also involved. Facilitators will have to help the user-group to reach agreement about objectives, inputs and division of benefits from a trial using CPRs. While community management has been successful in the management of CPRs, notably forests (Hobley, 1996) there are few examples of experimentation. Although challenging, this should not discourage facilitators, because the results of such trials could be particularly valuable and widely applicable, and will also be likely to benefit the resource poor more than resources which are individually owned.

As a result of the complexity of farming systems, farmers and scientists often have a different approach to experimentation. Farmers are more interested in developing the whole farming system, and do not necessarily apply the same reductionist scientific logic that we do. A common feature of farmers' own experiments is 'multiple simultaneous innovation' which complicates the assessment of the technology. This means that it is not uncommon for a farmer to introduce several new ideas at once. For example, one woman in Laos began stocking her ricefield with fish, at the same time as she began applying chemical fertiliser. It is difficult to separate the different components of her system, and look at what has changed as a result of stocking fish. Another common feature is ‘continuous innovation’, where the end of one experiment is not clearly separated from the beginning of another. The observation of ‘chance’ differences is also important; without deliberately changing their resource management, farmers may notice that an unplanned change has improved their farming system. For example, farmers on steep land in Bolivia noticed that their fruit trees stopped soil erosion where they were planted in close rows along the contour; after that they started planting them like that deliberately (Lawrence et al., 1997b). Another way in which farmers’ approaches may differ from scientists is in the explanation of differences; this is discussed more below.

There are few examples of farmer participatory research with aquaculture. Much aquaculture extension continues to be based on the training of ‘progressive’ farmers, who then act as sources of information for other farmers. This approach means that aquaculture is often only accessible to the richer farmers in the community, and to those with private access to water resources. Water is often a common resource, and if not it is at least a resource which is shared between many components of the farming system. Inputs for aquaculture are often outputs from another component of the system. These links mean that it is therefore highly appropriate for a participatory, systems- or community-approach. Furthermore, in the area of this project there is a range of niches where aquaculture could be developed, from small to large waterbodies, temporary to perennial, and with the possibility of fish in ricefields. The complexity makes this type of research challenging, but also particularly valuable given the scarcity of experience, and the potential to improve the livelihoods of poor people.

At the consultative end of the spectrum, the integrated farm management practices which ICLARM developed with farmers in the Philippines (e.g. Lightfoot et al., 1993), are an example of a farming systems approach which evolved towards farmer participation in planning and implementing resource management ideas. In particular, resource flow diagrams were used to explore how outputs from crops and animals could be used as inputs for pond and rice-fish culture. Another example, from

Zimbabwe, highlights the links between aquaculture and integrated farm development, in this through experimentation by farmers who took the initiative alone, and found that their actions to improve drainage and store water provided them with a pond for fish production (Maseko et al., 1991). In Bangladesh, the Interfish project is known for its strategy to encourage farmer experimentation leading to rice-cum-fish culture (Kamp et al., 1993). This project uses experiential learning to convince farmers of the value of an existing technology, rather than supporting them in discovering new technologies, so it is more participatory extension than participatory research. Another project in Bangladesh asked farmers to evaluate tilapia culture in their ponds, and found a wide range of social and economic criteria which they take into account (Gupta et al., 1992). In Laos, a project managed by Stirling University is adopting a more collegiate approach, supporting farmers who are already interested in trying fish in rice (Haylor et al., 1997). The standard scientific recommendations for rice-cum-fish do not work in the rainfed areas, because the growing season is too short or not enough water is available. By working closely with these farmers, providing technical information where it is requested but otherwise learning from the diversity of their systems, local government staff are understanding the wide range of possibilities for management of fish in rainfed ricefields in Laos, including increased production of wild fish.

Participatory research and the project cycle

Research and technology development follow a process which is similar to the project cycle. Conventionally, this would be modelled on the 'blueprint' approach where the outcome is decided at the identification stage (Cusworth and Franks, 1993). In fact it is hardly a cycle, as in successful cases the technology is considered to be proven, and disseminated to farmers. The adaptive approach allows the results of one cycle of research to feed into the design of the next cycle, leading to a series of increasingly well-adapted technologies, typically experimental through pilot and demonstration to production.

Each experimental cycle involves the following stages

- problem definition
- experimental design
- implementation of experiments
- monitoring
- evaluation of experiments
- feedback / dissemination of results.

In participatory research, the rural community is involved at every stage. In the fields of agricultural and natural resources research, we have progressed with participatory problem identification, or *diagnosis*. PRA is very useful in this respect. But there is a need to take the process further, to plan experiments, support the implementation, monitor and evaluate in collaboration with farmers.

The project follows a similar cycle of identification, design, implementation and evaluation. We are at the design stage just now. Each project cycle can however contain several research cycles, and in order for us to learn as much as possible from the process it is important to observe at least two research cycles, to appreciate the effects of feedback into improved experiments. This will also help with dissemination, as the farmers who are involved in research will also learn from the process of evaluating their research and using the lessons to plan further stages.

Project evaluation therefore becomes an evaluation of the whole process, including the steps of participatory evaluation of technologies. One reason why organisations might be interested in evaluation of the research process is to assess the cost effectiveness of the strategy. There have been few studies on the cost-effectiveness of FPR: clearly some costs are lower because the research is conducted by farmers on their own land, and dissemination happens while the research is going on; but other costs are higher, because the research is highly location-specific, and facilitators need to spend a lot of time with each farmer. Nevertheless, a cost-benefit analysis may not be the most appropriate way to evaluate FPR; it is clear that conventional research does not work for the complex, diverse and risk-prone areas we are talking about, so if it is a priority to work in these areas, we need to use FPR, but we need to find the most effective and efficient methods for doing so. FPR is a relatively new field and this project will contribute to the growing understanding of methods which are suitable under various circumstances.

Information flow and farmer-to-farmer extension

FPR has implications for the research - extension model, which can no longer be considered to be linear as in fig. 1, but has two way flow of information between all the components (fig. 2).

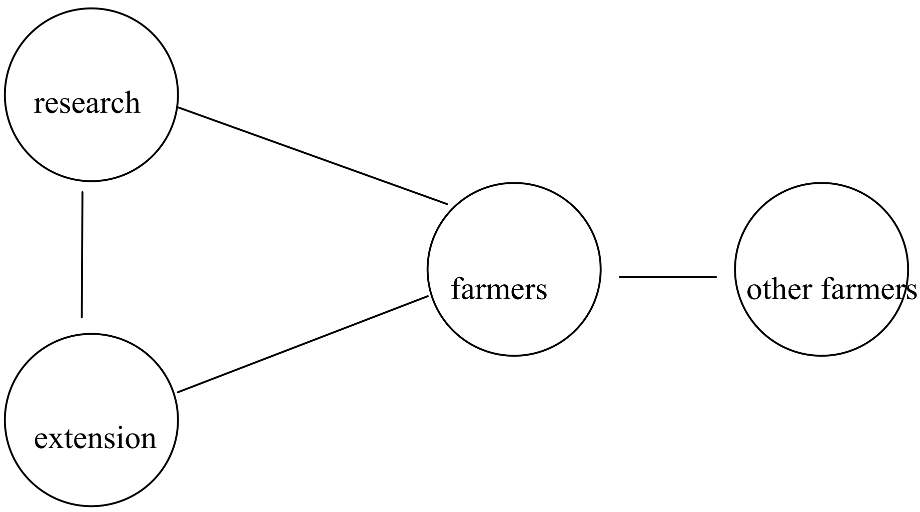


Fig. 2 A participatory model of information flow

The distinction between research and extension is not as clear as before:

- researchers are working directly with farmers and in doing so are learning about farmers' knowledge and problems, and communicating new ideas, which are aspects of extension;
- extension workers are also working with farmers and instead of providing recommendations, they are supporting farmers to experiment, and discovering new practices together, which is research;
- farmers are researching, and communicating the results of the research, which is extension.

In order for all these people to work together efficiently and effectively, we need to look at the roles of the different stakeholders.

Stakeholders and institutional issues

Sometimes we can get the impression that every institution is supposed to be participatory in the sense of collaborating directly with the farmers. This is perhaps a little unrealistic, especially in countries like India which have large bureaucracies, and many NGOs with widely differing philosophies and skills. As John Farrington has pointed out (pers. comm., 1997) functional participation may be the most realistic expectation for large bureaucracies, i.e. client-oriented research.

Government institutions, NGOs and farmers organisations all have different objectives and motives for their work, and it is valuable to recognise this and work with the differences, so that the organisations can fit together like a jigsaw instead of all doing the same work. This means that in any partnership we need to analyse the reasons for participation, the capabilities of the different stakeholders and what they want to get out of the process, and then plan the activities accordingly. The Biggs classification of participation (see table 1 above), often applied to the relations between institutions and farmers, can also be applied to organisations, whose relations may be contractual, consultative, collaborative or even collegiate, as in institutional networks.

Experience in India (Farrington and Thiele, in press) shows the benefits of planning development (or in this case, a participatory research strategy) based on previous experience to enhance efficiency, by agreeing in advance:

- preconditions for successful collaborations
- the respective roles of different organisations
- shared objectives, and where possible intended concrete outputs.

This process is recommended for all institutional collaborations and will be part of our planning process later in this workshop.

NGOs have valuable experience to contribute to FPR, in that they have a strong interest in low external input agriculture, and are usually able to identify farmers' aspirations, and the needs and opportunities to which technologies must be adapted; identify indigenous knowledge and practice, and so help in negotiating how it might interface with modern technologies; and are aware of the wider livelihood contexts in which initiatives towards agricultural change need to be located (Farrington and Thiele, in press).

Looking ahead, the involvement of the state research and extension agencies will be helpful for scaling up (Farrington and Thiele, 1998), or dissemination of the research methodology to other areas. In India the division of functions between extension and research is traditionally quite rigid so it may be important to consider the involvement of extension agents in the research plan. The new links between KRIBP and CIFA will be beneficial for both institutions, and for resource-poor farmers in the areas where they work. Farrington and Bebbington (1993) found few cases where such different organisations were truly collaborating, suggesting that the experience of this project will be valuable (and that documentation of that experience is an important task). State institutions do have experience of working directly with farmers through KVKs, but most of this experience is in training rather than in participatory development; scientists are not yet accustomed to encouraging farmers to try out their own ideas.

The experience of Rajastan State shows the relevance of participatory research methods in one of the poorest states in India, but also some of the pitfalls (Khandelwal et al., 1997). Change in Rajastan government policy called for sustainable agricultural growth in combination with resource conservation, poverty alleviation and the involvement of women, and in response GOs, NGOs and the private sector began to work together. Decentralisation of state institutions is intended to increase participation and relevance of development work, but this example shows that it can lead to intellectual isolation. It is important to maintain communication, information flow and fora where officials can exchange experience over a wider region (Khandelwal et al., 1997). NGOs also benefit from meetings where they can share experiences. In Udaipur District, the KVK has organised a forum where GOs and NGOs can meet together; this is identified as one of the most valuable aspects of participatory research. Farmer participatory research was introduced, but initially the NGOs did not appreciate its value. They had to learn new methods for working with individual farmers rather than groups. In addition, NGOs have not always had very constructive experiences with government institutions so there has been some distrust, but experience has taught them ways of presenting their interests to government, and the value of finding the really motivated government officials.

Government organisations have also found that while senior officials may be highly motivated, this enthusiasm is not transmitted to middle and field staff, who perhaps have no incentives to change the way they have always done things. Particular efforts need to be concentrated on these key officials, to avoid the misunderstanding reported by Khandelwal et al. (1997), that 'collaboration' means contracting out specific tasks which government departments are unable to perform, but which need doing. This project can learn from Rajastan's experience, by analysing together the different roles and contributions which can be expected from each stakeholder in the research process. In the research planning activities, stakeholders need to decide how local government staff can take responsibility for decisions. That is what will make it participatory within the state institutions.

Another type of organisation which can have a role in FPR is farmer-groups, whether cooperatives, producers' organisations, credit groups or research groups. The value of working in groups has received much attention in the last few years, and certainly organisation is a vital element of empowerment. Mosse (1996) has written: 'the KRIBP has been built around a strong belief in the value of collective action and an assumption that development activities will only be sustained and extended if such action takes place through appropriate local institutional forms.' In the field of technology development, farmer organisations also have a role in sharing of information and inputs, reducing risk, and building confidence. Farmer research committees in Colombia successfully managed their own agricultural trials because they were contracted by the community, who therefore covered the costs of any failures in the experiments (Ashby et al., 1995).

This project has goals of poverty reduction and social equity so group formation for research may be an important tool. But collective action has a high social cost (Mosse, 1996) and individuals or families may also have a role to play, in that technology development is often a strongly personal interest, depending on the imagination and resources of individuals. This approach can still be equitable if the facilitators take care to work with the poorer individuals in the community as well. However the poorest may need to form groups in order to combine enough resources to undertake the research. Again, it can be argued that those with more resources are more able to take risk and therefore test out new ideas; if these are successful there may be a stronger case for encouraging the involvement of the poorest in the community. Group formation will however be essential for the management (experimental or otherwise) of common-property resources. The important point is that groups are only helpful in development, if there is a genuine reason for them to work together rather than individually. Existing farmer groups will not be the same as pond user groups for example, so research based on a pond will need to work with a new group of people who have an interest in the pond.

Different stakeholders will have different objectives from the research. One of the most commonly mentioned disincentives to participatory research, for scientists, is that they are rewarded for publishing scientific research results. Green revolution technology produces more reliable and publishable results than low-input technologies appropriate to complex, diverse, risk-prone areas (Robinson et al., 1993). It is common in scientific publications in India that they should contain at least one ANOVA, but this tool of analysis is not always appropriate to FPR. In planning the research strategy, the collaborators must make sure that the scientific collaborators can also be satisfied with the outcome of this project.

Where do the ideas come from in PTD?

Most participatory research projects so far have been based on a participatory diagnosis, but have not really gone beyond that in the participatory selection of options for testing. In a participatory project, the options will come from both within and beyond the community. Sources for such options include:

- farmers
- development projects in the same region
- extension workers / community organisers

- scientists
- other outside sources.

Farmers' knowledge is often referred to as 'indigenous technical knowledge', or ITK. Perhaps the 'indigenous' aspect of this has been over-emphasised, as it suggests a static set of ideas held within the community, not influenced by time and events. Local knowledge is constantly evolving, absorbing information from outside (whether from extension workers, markets, neighbours or other sources) and seeking new knowledge through experimentation. It is sometimes difficult to find out where local ideas came from. This diversity and adaptability make indigenous knowledge a rich source of information for participatory research, which can enhance the results, and improve its relevance and adoption (Blaikie et al., 1997).

Not all communities have the same, or equally useful ITK; different farmers will have different knowledge according to their resources, personalities and chance experience, so it is important to find out those who are innovative and have particular experience with aquaculture. These farmers will be particularly helpful sources of information. Such local innovators and local fish experts are not the same as the 'progressive farmers' favoured by the T&V system (van Veldhuizen et al., 1997b); progressive farmers are often wealthier or more powerful farmers who have better access to information and resources, but do not necessarily have relevant experience or come up with their own useful ideas.

Science also has a role to play in providing options for participatory research. ITK does not cover everything; if it did, farmers would probably already be developing the technology. For example several well-known studies show that farmers are not aware of interactions between pests which lead to natural biological control (Bentley, 1994; Riches et al., 1993). By identifying gaps in farmers' knowledge, or areas where explanations for results are lacking, scientists can provide useful ideas which farmers can test out. This approach in Bangladesh led to a four-fold increase in the number of farmers adopting aquaculture (Dolberg, 1991). Extension workers and community organisers will also know how those ideas have worked in other communities, so they will be able to contribute suggestions for modifying the scientific ideas. They can improve access to external information. For example, by studying Gujarat farmers' requirements, a wide range of cultivars was identified by scientists and tested by farmers. These cultivars already existed but researchers had not considered them to be appropriate to that region (Joshi and Witcombe, 1996).

A useful way to know what knowledge exists and what is needed, is to bring together all the actors. If farmers, extension workers and scientists are given space and respect by everyone, to present their experience and knowledge, the result will be a new set of ideas which can form the basis for local research. The best way to exchange ideas, is to demonstrate them in reality; taking farmers to field stations, and taking scientists to the fields of innovative farmers, is more effective than any slide show or lecture (Lawrence et al., 1997c). It is particularly important to identify the local innovators and experts, and visit their farms.

We also need to use lateral thinking. All the existing knowledge may not be enough to find the option which really works. Think about what assumptions we are making: for example, that a certain pond cannot be used, or that women are not interested in fish-raising. If we challenge these assumptions, we come up with new ideas which can be tested. Part of lateral thinking is just letting go of the control of trials: letting farmers do what they like with a few ideas introduced from outside. This approach produced astonishing results in Colombia, where farmers adopting soil and water conservation practices without credit incentives increased from 2 to 261 in three years (Thomas, 1997). It did however prove challenging to persuade extension workers just to let farmers do what they liked.

For research, particularly where it is participatory and communication between the stakeholders is important, it is helpful to formalise the ideas. Experienced PTD practitioners recommend that the facilitators should encourage experimenting farmers to formulate a hypothesis, to clarify what they are trying to find out from the research (van Veldhuizen et al., 1997b). A useful statement of a hypothesis is 'I am doing X [the experiment], and I expect that this will produce Y [the results], because Z [the reason]'. If the experimenters can explain clearly what X, Y and Z are, all the stakeholders will be able to see the content of the experiment, the expected outcome, and the explanation which the farmer would give for this. X will help to design the experiment, while Y and Z will help to evaluate the results. These aspects are discussed below.

Trial design issues

Experience shows that on-farm trials based on 'formal, complex, researcher-designed experiments run into a maze of problems including logistical support, analytical needs, interdisciplinary compromise, and farmer participation' (Lightfoot and Barker, 1988). In participatory research, scientists may not be the most appropriate people to design the trials. Several factors have to be taken into account:

- Farmers may be experimenting anyway; in this case it will be best to build on what they are already doing rather than undermine their confidence by proposing something radically different.
- If the trials are on-farm, and you really want the farmers' criteria to predominate, it will be best to allow her or him to plan the layout and content of the experiment.
- This however may contradict the scientific training which many of us have been brought up with. We have been taught that trials must be replicated, there must be a control, only one or two factors can vary, and that detailed quantitative measurements must be taken.
- For sustainability and replicability we want to learn as much as possible from the trial, and we also want to know under what other conditions it might work. This makes the use of scientific experimental methods quite attractive to the scientists amongst us.
- Farmers do not always understand *why* an experiment works; improving the experimental design may help to explain (e.g. by comparing two similar ponds with and without manure inputs).
- However, with water resources it may be impossible to divide or replicate the experiments.
- Finally, if we try to control or interfere too much in the farmers' experiments, they will lose interest or think that it is just for our benefit, so the trials will not be relevant to the farmers.

There are two ways to approach these difficulties:

1. use the increasing range of alternative qualitative methods for evaluating trials, and accept that understanding results may be more useful than measuring them; understanding requires explanation, which in complex social and agroecological systems can often only be obtained through open-ended questioning, semi-structured interviewing and other participatory, qualitative methods;
2. introduce to farmers some of the concepts of experimental method, for example the usefulness of a control or replicates; or find other ways to replicate, for example between similar ponds or villages. Farmers often themselves perceive the need for a control, although sometimes they will just compare past experience with present (i.e. before and after). Even if you decide to teach farmers some of the principles of formal experimentation, it may not be a good idea to insist that they use them; some farmers will, and some won't. Those who do not want to, may be discouraged from experimenting altogether if you do not allow flexibility in design.

Whatever approach you choose, you need to be clear what you are trying to find out and why. This is where the research hypothesis comes in. If the farmers have decided what they think the cause of increased fish production will be, you can help them to design an experiment which compares that factor (cause) with the absence of that factor. This will also help in the evaluation of trials.

Farmers will not be familiar with the formal methods used by scientists for planning and designing research. PRA provides us with a range of useful tools which can be adapted for participatory research planning, including:

- matrix scoring of options for testing;
- systems diagrams which can show how the farming or livelihood system has changed as a result of experiments, or predict how it might change (e.g. Lightfoot and Minnick, 1991);
- farm maps - which may need to be expanded to the whole community to consider resource distribution and availability; these help farmers to describe the changes which they will make during the experiments;

- other drawings such as diagrams of activities;
- calendars of activities, to plan the work together.

Participatory Monitoring and Evaluation

Several reviewers have drawn attention to the scarcity of evaluation by clients or beneficiaries in participatory research projects (Okali et al., 1994; Farrington, 1997). Recently an international workshop was held in the Philippines, to bring together people who are beginning to involve a wide range of stakeholders in participatory monitoring and evaluation (PME) of all sorts of development activities. The participants found that we had been developing similar methodologies, and that there are some important common recommendations emerging:

- start PME at the beginning of the project
- involve all the stakeholders in planning the PME
- decide on indicators - different groups of stakeholders may have different indicators
- many of the methods are closely related to PRA methods
- at regular intervals, review the M&E results, adjust project activities accordingly, and plan a revised PME based on what you have learnt

The design of the trial relates to the evaluation requirements. Different stakeholders may have different goals and information needs. For example, farmers will be assessing yields, but they will also be interested in the effect on the rest of their livelihoods, including labour allocation and family nutrition. Scientists may be more interested in the generalisable aspects of the trial, aiming to understand the environmental conditions under which the technology works. NGO workers, on the other hand, may be trying to assess the research methodology and make recommendations for future research processes. Part of the participatory monitoring and evaluation plan, must therefore include decisions about who is going to collect what information and how.

In many cases farmers will not see a need for them to explicitly evaluation their trials. They will know what they like and why. In some ways the PME process is most helpful to outsiders, in helping them to understand farmers' priorities and reasons for adoption. However, farmers who evaluate their own trials, individually and in groups, will often learn from the evaluation process itself, and if the PME is facilitated well, all the participants will be able to think more clearly about why their experiments did or did not work, and how they could improve them. Farmers who have conducted an evaluation will also be in a much better position to explain their new technology to other farmers, hence accelerating the dissemination process. PME is an important step in empowerment, in that it builds up local capacities to design and learn from farmers' own research.

The researchers need ways of recording and publicising the results. For the scientific researchers, pens and notebooks with columns of figures may be appropriate, but for villagers, CO's and all researchers who are interested in the farmers' perspective and the whole system, more graphic methods are desirable. There are plenty of ways to avoid writing if we draw on the rich store of PRA methods that have been developed over the last decade. The PME strategy needs to include decisions about appropriate methods for collecting the data. Monitoring and evaluation is usually based on indicators; different stakeholders have different indicators of success, and it is important to define these before starting the trial, using the hypotheses described earlier. Indicators can be defined through semi-structured interviews, by asking farmers what they would expect to see from the trials, but often a broader range of indicators can be elicited using systems diagrams (Lawrence et al., 1997a). These indicators can then be used in the evaluation exercises, in combination with ranking / scoring methods (Ashby, 1990). Evaluation can be conducted by individual farmers, families or community groups; each will give a different perspective on the usefulness of the technology.

An important aspect of PME is to allow for the unexpected. Experiments may well produced unexpected benefits or problems, which have not been defined as indicators at the beginning of the research. A more open approach is needed at this stage, to discuss with farmers and groups what were the benefits and problems resulting from the experiments, whether they were satisfied with the results and why or why not. For example, in another DFID-KRIBP collaboration in Gujarat, evaluating trials where farmers soaked wheat seed before sowing, the new practice brought not only higher yields (because of the earlier germination and more vigorous growth), but also allowed the second (rabi) crop to be sowed and harvested earlier, leaving farmers free to migrate earlier to seek employment (Harris et al., 1998). These social and economic indicators are not often identified by participants before the research, but are recognised as important benefits at a livelihood systems level, after the results have been seen.

Going back to our original discussion of ‘participatory’, in which it was emphasised that it is important to included disadvantaged groups, a full PME should include an assessment by non-participants. Again, semi-structured interviews and group discussions will help to find out their opinions of the experiments, whether they think that they would be of any benefit to themselves, why they did not participate in the experiments and, if interested, how they could modify the experiments for their own use.

In summary, a PME process has the following key steps, with suggested tools:

- setting expectations (defining indicators using semi-structured interviews, group discussions, systems diagrams)
- monitoring implementation (checking against calendars; changing goals if necessary)
- evaluating the results compared with expectations (ranking and scoring indicators defined at the beginning of the research)
- reviewing achievements (semi-structured interviews and group discussions, with both participants and non-participants; no indicators are used at this stage, to allow for the unexpected)

PME itself should take place within a learning context: in other words, a participatory evaluation of the participatory evaluation. Several projects have learnt the value of bringing together the team of collaborators to review methods and outcomes, and to think again how the process could be improved - then to improve it (Lawrence et al., 1997c; Farrington and Thiele, in press). This evolves into, effectively, a participatory evaluation of the project, which is only feasible if the project planning has also been participatory, so that all the stakeholders can decide if they have fulfilled their objectives.

This type of review also helps institutional stakeholders to see if results are location specific, or to what extent they have wider applicability. In this project the research coordination committee provides a useful forum to do this.

Documentation

The project will only be able to work with a limited number of farmers in a few villages. While these villages will, we hope, benefit from increased fish production as a result, it is important to think about how the institutions involved in the project can learn from and build upon the experience. Keeping a record of the process is an essential component of this, so that staff can learn from both problems and successes encountered in the methods used.

The application FPR is increasing, but it is a broad field and there are still relatively few cases of aquaculture, or of collaboration between state and NGOs in FPR. Documentation is therefore important, not just for the project itself to help institutional learning, but also for sharing lessons with others during and after the project.

Dissemination

The involvement of farmers at all stages of the research will support dissemination of ideas and methods, because farmers will be in an informed position to communicate with other farmers. It has been observed that farmers may not pass on ideas while they are still testing them (Martin and Sherington, 1996), but this depends on how the process is facilitated. FPR certainly leads to quicker dissemination over the local scale, although it must be emphasised that the process does not produce one perfect technology. Instead, it encourages a diversity of options and ideas. More than the technologies, it will be the methods which are transferable from farmer to farmer. This is why it is important for institutions to make sure that they understand the research process, what worked and what did not work, and to facilitate farmers to reflect on their research methods.

At a wider level, the state institutions and NGOs are usually concerned with dissemination into other areas. This project is linked to a development project which will provide an excellent framework for replication and scaling-up. The experience of KRIBP has already made a significant impact on ideas for participatory natural resource management; in a literature search on participatory research in rainfed areas, thirteen of the fifteen papers are about India, mostly referring to the KRIBP project. The involvement of a range of stakeholders is important in promoting these results. Experience in scaling up participatory research in Maharashtra shows that the following factors affect the replicability of methods or technologies over wide areas (Farrington and Lobo, 1997):

- involvement of a wide range of stakeholders from an early stage in the project, at international, national, district and local levels
- creation of a planning methodology (in this case a research methodology) which is technically sound but participatory
- framework for local-level collaboration among NGOs, community-based organisations and government institutions.

Documentation will help, but organisations are also in a position to facilitate exchange visits and farmer-to-farmer extension. As mentioned above, farmers who have thought through the research process, planned and evaluated experiments, will be in a strong position to explain their findings to other farmers. This is the most convincing message to other farmers.

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Glossary of acronyms

CDR Complex, diverse and risk-prone: a term often used to describe the poorer rural areas where Green Revolution technologies have not generally been successful

FPR Farmer Participatory Research: a research methodology in which farmers participate at various stages of the research process

FSR Farming Systems Research: multidisciplinary research conducted by teams of experts to understand farms as complex systems of interacting components, and farmers as decision-makers in the management of these systems

ITK Indigenous Technical Knowledge: the knowledge which farmers have and use in their management of farming systems

PME Participatory Monitoring and Evaluation

PRA Participatory Rural Appraisal: diagnosis of problems and opportunities, with and by farmers, using open, shared and visual methods

PTD Participatory Technology Development: adaptation of technologies by farmers on their farms

PROCESS FOR PREPARING A PARTICIPATORY RESEARCH PLAN

1. Who are the stakeholders here at this workshop? What categories do we fall into? Have we missed out anyone?

2. What do we mean by participation? How does each group of stakeholders want to participate in this project, and what role do you think the villagers will have.

3. In the community what are the different social groups? Who might be missed out? How does each benefit or lose out from aquaculture development? Who tends to take control? How can we share out the control more equally?

4. What expectations do these people already have of the project? How are we going to introduce the project and invite them to participate?

5. Is aquaculture in this part of India a technology, part of a farming system, or part of a community / watershed? What will aquaculture development affect, apart from increasing fish production? (think about the difference between private and common property resources).

6. What do we see as the constraints to aquaculture development? What do we think the community social groups see as constraints to aquaculture development? For each of these, what ideas are available from farmers, and what from scientists, to try out in participatory research?

7. How are we going to give the villagers the opportunity to share their and our knowledge so that we can improve this list of options? E.g.
   - expert farmers
   - innovators' workshop
   - study tours
   - cross-visits to other villages

8. From the information given in points 6 and 7, what type of trials are suitable for on-station research, and what for on-farm research?

9. How are we and the villagers going to decide who participates in the trials, and will this be as groups, individuals, or organisations? Why do you prefer that option? How are we going to involve the villagers in deciding what they are going to test?

10. Choose an example of a trial, and explain what is your hypothesis, in other words, what trial do you plan, what results do you expect, and what do you think will cause those results? How can you the villagers to explain their hypothesis in the same way?

11. Is it best for the villagers to design the trials themselves or do we want some of the elements of scientific trials to be there? If so how are villagers and we going to decide on the trial design? What tools will we use to plan together?

12. Based on point 10, what information do we and villagers need from the trial? How will we and they collect that information (monitoring and evaluation)? What information do villagers already collect? How do we include non-literate villagers?

13. How can we support farmers, and how can we make a commitment to them? E.g. with calendars prepared together, charts of inputs etc.

14. How will we and villagers review the research process and change it if necessary?

15. How are each of us going to communicate with each other, and facilitate passing on the results of this research? A table, showing with scientists - scientists, scientists - NGOs, NGOs - NGOs, farmer - farmer, farmer - scientist, would help to plan this.

16. Review the overall plan with timing, and decide if it is feasible; adjust as necessary.