

PARTICIPATORY APPROACHES IN AGRICULTURAL RESEARCH: A CASE STUDY OF THE ANDHRA PRADESH NETHERLANDS BIOTECHNOLOGY PROGRAMME

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Introduction

In the continuum of basic to applied to adaptive research in agriculture, farmers were seen as valuable source of knowledge, which in the process was respected and empowered. However, the mainstream research and development (R&D) organizations still have to acknowledge farmers as partners of technology development. In addition to the on-farm research and extension activities, an exclusive domain of development intervention is needed to enhance the farmers' capacities in developing new technologies. In this endeavour, a number of tools and techniques were developed by the concerted efforts of sociologists, economists and scientists. Among these, the most widely used tools are the *rapid rural appraisal (RRA)*, *participatory rural appraisal (PRA)*, *participatory technology development (PTD)* and *interactive bottom up (IBU)* approaches. The APNL Biotechnology Programme is one such programme which uses IBU approach for developing agricultural biotechnologies for small-scale farmers and tries to assess its impact. Programme involves various stakeholders including farmers, scientists, extensionists, NGO staff, policy makers, etc. in the technology development process.

Participation in Technology Development

The traditional view of technology development and transfer is a one-way process. According to this, research produces innovation, which is passed on to extensionists, who in turn pass them on to farmers. This approach was called "*sock-it-to-them*" by Roiling¹ and top-down transfer of technology (TOT) by Chambers². In this

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approach, however efficient technology transfer mechanism may be, there is a bias in favour of 'big' or 'prosperous farmers' for a variety of reasons (their influence, quick short-term results in terms of increased production for national self-sufficiency, market, etc.). This way, many agricultural research scientists, development experts remain frustrated by the limited success of their research projects in the farmers fields especially the resource poor. This aspect is attributed as '*technology application gap*'. Several other common problem areas in technology research, technology design and technology transfer and extension were resulted mainly due to the disregard or misconception of critical socio-economic and technical factors³. However, if appropriate agricultural technologies are to be developed, it is essential that the various groups of people involved in the process need to participate and interact with one another effectively to discuss the common problem areas. These groups include not only farmers and scientists but also extensionists, NGO staff, representatives of farmers' and women organizations, policy makers, donors, traders, processors, input sales staff and others⁴. All the stakeholders in the technology development should have the clear conviction about the participatory aspects.

What is Participation?

Experts opine that 'participation' in the real spirit means '*involvement*' of all the stakeholders at different stages of technology development process. In the true sense participation cannot be imposed on the people from above, it should be voluntary and based on will to participate. People's participation or involvement can better be understood in four senses – (i). Participation in decision making (ii). Participation in implementation of development programmes and projects (iii). Participation in monitoring and evaluation and (iv). Participation in sharing the benefits⁵.

Genesis of Participatory Research

During the last few decades '*peoples' participation*' has been the widely used term in development literature. People's participation has been regarded as a pre-condition for the success of many developmental programmes. In fact, Socrates, Lord Buddha, Lord Jesus Christ and Saints of Siva and Vaishnava cults and other great spiritual leaders respected people from all walks of life as participants of

the development process⁶. This way, the foundation was laid for development activities that were built on the existing knowledge and conditions of the people. Over the decades, there had also been small beginnings of changes in modes of learning. Systematic studies were undertaken to understand the people's role in the development process. Farmers' participation in agricultural research became a focus since 1970s and Farrington⁷, Paul Richards⁸, Roland Bunch⁹ and Stephen Biggs¹⁰ were among those who recognized farmers as experimenters. However, for successful implementation one should 'know how' to participate and equip with various modes of participatory approaches.

How to Participate in the Process of Technology Development

The participatory orientation has given a new impetus to the development of different methods of participation. Besides understanding innovative professional approach to farmer participation during technology development, conscious efforts were made to discuss important stakeholders' perceptions on feasibility of experimenting with farmer-participatory research methodologies. In this regard, a number of tools and techniques were employed. The most widely accepted and employed approaches and methods are *i) farming systems approach of 1970s, ii) rapid rural appraisal (RRA) which spread in the 1980s and its further evolution into iii) participatory rural appraisal (PRA) which has come in the 1990s and spread fast and further refinements into current approaches of iv) participatory technology development (PTD) and (v) interactive bottom up approach (IBU).*

In the latter 1980s and early 1990s it was increasingly recognized that farmers should and could play a much greater role and take part in agricultural research. Thus field research on farming systems contributed especially to the appreciation and understanding of the complexity, diversity and risk proneness of many farming systems, the knowledge, profession and rationality of small and poor farmers.¹¹ In the 1970s and 1980s many research strategies started using 'farming systems research' wherein social scientists were asked to give complementary information on the socio-economic impacts of technologies. However, as pointed out by Bunders et.al¹² (1991) 'farming systems approach' is actually a tool to help research station scientists more accurately analyzing

the markets for their own preferred technologies. Farmers still did not have any power to exert influence on research programmes. Among the parallel moves in different parts of the world in search of better ways to utilize farmers' knowledge '*rapid rural appraisal*'¹³ emerged in the late 1970s. In establishing the methods and principles of RRA many people and institutions took active part at national and international level. RRA was evolved on its own principles and rigour^{14, 15,16} In the latter 1980s RRA was further developed and disseminated through extensive training by the International Institute for Environment and Development (IIED) based in London and the widely used 'RRA notes' was published in 1988. However, the RRA was also ended up like farming systems approach with more benefits to outsiders in obtaining information and analyzing it. Realizing this IIED team developed participatory RRA i.e. participatory rural appraisal¹³ (PRA) where voluntary sectors played major role. In this process, there is a scope for continuous innovation, sharing and exchange of ideas of researchers and endusers. PRA is a continuum of RRA, which is done in a more participatory manner. Basically the PRA is intended for outsiders learning and is also intended for enabling local people to conduct their own analysis and often to plan and take action.

Whatsoever may be the efforts of scientists and benefits of PRA, there still existed a gap between the scope and adoption of PRA and RRA techniques and were not widely accepted and adopted by universities and institutions in their core systems. John et.al,¹⁷ as a part of farmer participatory study commissioned by Government of India through National Institute of Agricultural Research and Management (MANAGE) based at Hyderabad in India highlighted some of the bottlenecks to participatory mechanisms as - socio-cultural, administrative, methodological, conceptual and resource scarcity. During their study, it was also observed that farmers are more willing to participate in activities, which meet their felt needs. Sanghi¹⁸ emphasized that if people are to become partners in their own future, they have to be actively involved from programme planning itself.

Despite the efforts of involving people in the process of technology development it became clear that farmers/enduser of the technologies were still left outside the technological framework. Realising this fact, the concept of '*participatory technology development*'¹³ (PTD) was introduced in the late 1980s wherein farmer

was recognized as partner in 'on farm research trails'. PTD is also a process of creative interaction within rural communities in which indigenous and scientific knowledge are combined in order to find solutions to farmers' problems and to take fullest possible advantage of local opportunities^{19, 20}. In PTD, farmers are encouraged to generate and evaluate indigenous technologies and also exercise option to choose, test and adopt external technologies on the basis of their own knowledge and value systems²¹. The complementary strengths of PTD help to fill gaps in conventional research by providing farmers with better tools to sustain the process of adapting to the change²². Haverkort et al.,²⁰ and Reijnitjes et al.,²¹, elicited the efforts and contributions made by various national and international institutions in organizing PTD. However, the issues relating to the institutionalization, cost effectiveness and sustainability of the process of PTD are still to be answered. To overcome this lack of broader perspective Broerse and Bunders⁴ have suggested a new approach in participatory technology development i.e. the '*interactive bottom up*' (IBU) approach. The 'interactive bottom up' approach was named deliberately in contrast to 'top-down' approach as in this approach the end user of the technology is considered first. This approach has a number of important features. The approach starts with an analysis of farmers' problems and reviews scientific developments that are relevant to address those needs where there is a need for technology intervention. The IBU model was originally developed by the Department of Biology and Society, Vrije Universiteit, Amsterdam, the Netherlands^{23, 24} for assessing the potential of biotechnology for small-scale farmers in developing countries. The concern for small farmers was expressed primarily from the risk that technological advancement (like biotechnology) may bypass them or worsen and result in adverse impact on them from not only direct impact of the technological change but also indirectly due to economic, social and environmental changes that follow a technological change²⁵. Experience with the approach is described by Bunders et al.¹² and Broerse²⁶. However, for many organizations, participatory or interactive approaches to coordinating and organizing technology development are still the exceptions rather than a rule. Here we describe the case study of APNL Biotechnology Programme, wherein the agricultural biotechnologies are being developed using participatory approaches mainly through *interactive bottom up* approach.

Participatory Approaches in Andhra Pradesh Netherlands Biotechnology Programme (APNLBP)

Introduction

The Andhra Pradesh Netherlands Biotechnology Programme is sponsored by the Ministry of Foreign Affairs, Government of the Netherlands. The Programme is for a period of six years starting from the beginning of 1996. The broad objective of the Programme is to contribute to poverty alleviation through biotechnologies. It follows an '*interactive bottom up*' approach and aims at developing appropriate biotechnologies for small scale farmers through participatory approaches by involving various groups/stakeholders including farmers, scientists, extensionists, NGO staff, policy makers etc. in the technology development process.

Rationale

To be relevant to society's needs, agricultural biotechnology requires a close integration with agricultural development viz., growth of production, equity, food security and sustainability. To highlight and realize some of these concepts, *demand oriented biotechnology* has formed the basis for the implementation of the APNL Biotechnology Programme. The Programme lays emphasis on the needs of end users and beneficiaries of new technologies and specifically small-scale producers and processors.

Objectives

Specific objectives of the Programme are:

- To promote application of biotechnologies relevant to small-scale agricultural producers and processors in Andhra Pradesh, one of the federal states of India.
- To develop appropriate bio-technologies through research activities that focus on identified priority problems;
- To conduct supportive activities required to ensure development and adoption of biotechnologies including training, transfer of technology activities, workshops and information dissemination;

- To strengthen capacities of local organizations in Andhra Pradesh to develop and transfer biotechnologies and conduct analysis in the field of technology assessment; and
- To promote the adoption of biosafety measures and to contribute to discussions on issues of intellectual property where appropriate.

Methodology and Approach

The *Interactive Bottom Up* (IBU) approach followed in the APNL Biotechnology Programme is developed basically on the principles of participatory technology development (PTD). The approach regards the research agenda suggested by the farmer/end-user and facilitates the exchange of information amongst all groups, which are involved in the development and application of biotechnology innovation eventually leading to innovations that are realizable and easy to adopt by small-scale farmers¹². Following the identification of priorities through local need assessment survey the phase of project formulation and implementation started. *The process is time consuming but, if done properly, it is time well spent*. Although building consensus among multi-stakeholder group takes time and effort, the experience has been considered as useful as it produces valuable information and results in a sharper focus on problem areas, a genuine dialogue between users, researchers and policy makers, resulting in a consensus on Programme Development.

Public Priority Setting, Planning and Programme Formulation

Followed by an initial preparatory phase and local need assessment survey, a priority setting and planning workshop was organized to bring together all the stakeholders in the Programme. The deliberations of the workshop helped in prioritizing the following specific problem areas in dryland agriculture²⁷.

Priorities

- *Foodgrains and pulses*
- *Oil seeds,*
- *Agro-forestry, tree crops, horticulture and sericulture and*
- *Animal production and health*

Institutional Set-Up

The Programme is unique in the sense that the entire decision making powers are vested with local institutions. The donor agency has transferred the ownership to a multistake holder steering committee called the **Biotechnology Programme Committee (BPC)**. The BPC is responsible for all policy matters. The Committee is supported by an intermediary organization i.e, the **Biotechnology Unit (BTU)** hosted by the Institute of Public Enterprise, Hyderabad that manages programme implementation. The other set of institutions are those engaged in research and extension activities with the support of the Programme. *Barbara Marcus*²⁸ in the SCOT (Social Construction of Technology) analysis of the APNL Biotechnology Programme referred **BTU** as '*obligatory point of passage*' linking up with Ministry of Foreign Affairs (MOFA), The Netherlands and the relevant social groups. The obligatory point of passage is the 'nodal point' between the local and global network where the interactions between the networks are coordinated. Besides linking up with MOFA, the BTU works with two different social groups — the scientists and the farmers.

Project Formulation and Implementation

The Programme has been using *pre-project formulation workshops* (PPFW) as a method of refining the priorities already identified and launching the specific projects for funding. PPFWs give enough scope for different stakeholders including farmers/farmer representatives to deliberate specific issues at length. Farmers' representatives explain their constraints and expectations which in turn form the basis for further deliberations. *Group discussions* play a key role in identifying the critical issues and problems to be pursued in the form of projects. The Programme also evolved certain guidelines for monitoring and evaluation of the projects and programme. These are based on the *principles of participatory monitoring system* wherein the endusers are also consulted and their viewpoints are considered for further finetuning of the projects.

Progress Made

During the last six years, the Programme made significant contributions in terms

of evolving methodologies for problem identification, prioritization of interventions, people's participation and project formulation and monitoring. It succeeded in achieving greater commitment from laboratory scientists towards achieving the identified goals. It also succeeded in establishing good networks with researchers on one hand and farming community on the other. Problems of resource poor farmers received focused attention of the Programme. Following the IBU approach the Programme so far supported 56 projects with a total commitment of Rs.17.62 crores. The projects deal with a range of technologies starting from simple, well-established ones such as vermiculture, biofertilizers, biopesticides, botanical pesticides, biocontrol agents and tissue culture to high-tech biotechnologies such as genetic engineering.

The Programme established a number of tissue culture laboratories to produce and popularize qualitatively superior planting material of neem, teak, custard apple, tamarind, amla, karaya and some important medicinal plants. Using elite germplasm more than 30,000 teak and 2,500 neem tissue cultured plantlets were produced and distributed to the farmers. About 25 hectares were covered under block plantations and nearly 500 families in the Programme operating villages were supported with plantlets of teak for homestead farming. Besides development of tissue culture protocols and large-scale micropropagation of agroforestry species the Programme covered an area of 300 hectares under agroforestry through a network of institutions and NGOs.

From the biofertilizers production cum extension unit established at one of the identified villages about 4,800 kgs of biofertilizers such as *Rhizobium*, *Azospirillum* and phosphate solubilizing bacteria were produced and distributed to the farmers. About 1,000 farmers were trained in the application of biofertilizers. The Programme is also engaged in a big way in popularizing vermiculture technology by way of bringing awareness and training the youth and women in vermicompost production and application. Eight large scale production units by the NGOs and 80 small vermicompost production units by the farmers were established in the villages. 800 farmers from 40 villages are actively involved in large-scale propagation of vermiculture technology.

Considerable progress was achieved in the area of botanical and biopesticides. Field trials were carried out in 80 farmers' fields to test the efficacy of botanical pesticides from the extracts of custard apple and *Vitex negundo*.

Technology development and transfer for biocontrol agents such as *Bacillus thuringiensis*, *Baculovirus*, *Trichoderma* etc. was also taken up for castor and groundnut crops. Extensive surveys were conducted in farmers' fields for isolation and identification of antagonistic fungi to manage castor wilt. Collection and screening of geographical isolates of semilooper *Baculovirus* and identifying potential strains of *Bacillus thuringiensis* was undertaken. Cost effective mass multiplication technology for *Bacillus thuringiensis* was developed. Farmers were also trained in IPM practices.

Propagation of medicinal plants for general health and income generation also received due attention of the Programme. About 10,000 medicinal plants seedlings/seeds to 600 families were distributed. Farmers were trained in preparation of important herbal products for treating some of the common ailments. The Programme is also engaged in the development and popularization of post harvest technologies. About 100 farmers were trained in mushroom preservation and processing. Also economically feasible post harvest technologies for increasing shelf life of tomatoes and custard apple using biochemical approaches were standardized.

The projects on genetic transformation technology address the problems of biotic and abiotic stresses in the priority crops viz., sorghum, pigeonpea, castor and groundnut and also aim at capacity building of the individuals and institutions working in this area of research. The progress in the projects dealing with biotic stress has been encouraging. Regeneration and transformation protocols were standardized for castor and sorghum. Four antifungal proteins have been purified from sorghum seed. Similarly regeneration and transformation protocols are being standardized for developing disease resistant transgenic pigeonpea and groundnut. In all putative transgenics were produced and some of them have even been confirmed for the presence of introduced gene/s. Efforts are on in all these crops to produce large number of independent transgenics. Projects on abiotic stress management in sorghum, pigeonpea and groundnut are also expected to create impact in the coming years wherein isolation and introduction of stress responsive gene/s is taken up.

Animal health and production is another important area that made substantial progress in the programme. The projects in this area were intended for de-

veloping diagnostic kits and vaccines. About four lakh dosages of sheep pox vaccine was already produced and supplied. Antigens and antiserums were prepared and toxins were purified for developing diagnostic kits for Hemorrhagic Septicaemia, Black Quarter and Enterotoxaemia. Intensive field trials were carried out for feed improvement through application of yeast culture and expander and extruder technologies for improved utilization of agro industrial by-products. About 25 farmers were involved in the technology demonstrations. Experiments were also carried out for long-range supplement of protected fat for improving feed utilization in grazing sheep during fodder scarcity. An innovative programme on integrated livestock development was implemented in a big way covering all the aspects of livestock health and production viz. artificial insemination, vaccination, fodder improvement, feed supply, ram exchange, market linkages etc. Educated unemployed youth from the selected villages have been trained and provided with kits to attend animal health requirements in the villages. Realising the importance of public awareness on the introduction of new technologies like biotechnologies Programme is also engaged in a big way in organizing systematic campaigns in biotechnology for different stakeholders in a project mode.

Entrepreneur incubation has already taken place by way of setting up village level rural units for production of tissue-cultured plantlets, bio and botanical pesticides and biofertilisers by the farmers. The Andhra Pradesh Netherlands Biotechnology Programme also played a significant role in capacity building in biotechnology at the individual and institutional level in the State of Andhra Pradesh. As a part of this, it provided necessary support in the research projects for human resource development and infrastructural facilities. It also brought greater awareness at the state level about biotechnology at the decision making level in universities and agricultural research organizations.

Conclusion and Way Forward

Earlier experiences with the introduction of new technologies in agriculture reiterated the need for participatory approaches involving end users in the technology development process. Recognizing this fact, the Andhra Pradesh Netherlands Biotechnology Programme follows an *interactive bottom up*

approach wherein it combines participatory approaches with biotechnologies to improve the rainfed agriculture situation. Ecofriendly biotechnologies such as biofertilisers, biopesticides, vermicompost, tissue culture, animal vaccines and diagnostic kits have already started creating positive impact in the selected villages. Results in the basic research projects at the laboratory level are quite encouraging. In the coming years the Programme would focus on technology demonstration and transfer at field level and embark on new interventions in biotechnology.

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