Compendio:

INVESTIGACION PARTICIPATIVA

Generación e intercambio de conocimientos por y con familias campesinas y nativas

Compilado por:

Cecile Fassaert
Kees Prins
José Oduber Rivera
Silke Mason Westphal

Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)
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SINTESIS DE LITERATURA RELATIVA A ENFOQUES SOBRE INSVESTIGACION PARTICIPATIVA

Compiladores(as)
Cecile Fassaert
SilKe Westphal
José Oduber Rivera
Kees Prins

INTRODUCCION

De acuerdo al propósito y método del taller, se ha preparado una carpeta de artículos sobre procesos endógenos generadores de conocimientos e investigación participativa. La idea es incorporar insumos que enriquescan la discusión que se tendrá durante el taller, acerca de las experiencias del CATIE.

Se ha hecho una selección de literatura que aportan una gran variedad de elementos relevantes, los cuales en su conjunto, abarcan el panorama de la investigación participativa.

Para animar y facilitar la lectura de los artículos y poder digerir mejor el conjunto de sus contenidos, se ha hecho un resumen de los puntos claves de cada artículo.

Síntesis

1. INDAKS: A bibliography and database on indigenous agricultural knowledge systems and sustainable development in the tropics Jan. Slikkerveer.

Muestra el origen y la evolución del interés por el conocimiento indígena (Conferencia Mundial sobre Atención Primaria en Alma Ata; los nuevos item de Ecología y Cultura, la biodiversidad y la diversidad cultural, el Año de los Pueblos Indígenas).

Añade que eso se ha nutrido de las fallas y contratiempos padecidos por proyectos de desarrollo, al no tomar en cuenta la dimensión sociocultural. Las lecciones generadas de esas situaciones, a llevado a que los profesionales en políticas de desarrollo, en aspectos socioeconómicos, biofísicos, etc, estén uniendo esfuerzos para superar esas dificultades.

2. Indigenous comunication and indigenous knowledge P Mundy and J Compton.

Hacen un interesante aporte, cuando anotan que no es correcto hablar de transferecia del conocimiento, ya que el aprendizaje es un proceso activo y acumulativo, en el que las personas, asocian nueva información con el conocimiento ya existente. Plantean que la información sí puede ser transferida, aunque esta debe ser abordada considerando los códigos y formas de comunicación utilizados por los beneficiarios.

Esta noción es relevante para la investigación adaptiva y la mencionada transferencia de tecnología, ya que es el mismo usuario quien genera o modifica los conocimientos, apoyado en este esfuerzo mental por investigadores y extensionistas a través del aporte de nuevos datos y elementos. El productor o productora es quien toma la decisión de si lo adopta o no.

Por otra parte, propone un orden de los distintos canales de comunicación, tanto tradicionales como alternativos, indicando como pueden ser aprovechados e interconectados entre sí. Esto también es un punto importante, ya que muchas veces hay un desencuentro entre ambas formas de comunicación, tanto en el mensaje como en el medio, perjudicando la posibilidad de un enriquecimiento mutuo.

3. Farmers who experiment: an untapped resource for agricultural research and development Robert Rhoades and Anthony Bebbington.

Muestran y explican la tendencia y capacidad que tienen los agricultores de experimentar e innovar.

Esto se da en tres contextos:

-Probar un elemento nuevo en un entorno biofísico conocido.

-Probar una tecnología (o cultivo) conocido en un entorno ecológico nuevo.

-Probar un elemento desconocido en un entorno desconocido.

Mediante el experimento el agricultor trata de encontrar respuesta a incógnitos tales como:

-La nueva tecnología rinde?

-La tecnología conocida funciona en un entorno distinto?

-Puede ser incorporado en el sistema de producción/utilización de recursos/toma de decisiones?

-Interactua positivamente con otros elementos del sistema para que el resultado total sea mejor que antes?

-Es rentable? Los beneficios exceden a los costos, en tiempo y dinero ?

También hay campesinos que experimentan porque son curiosos y quieren saber por ellos mismos. Son investigadores natos.

Otros espectos que abordan, es que a pesar de la capacidad que tienen los campesinos de crear nuevas variedades y prácticas, lo nuevo no es necesariamente sostenible, eso depende de muchos factores del entorno tanto interno como externo y fuera del control de los agricultores, por ejemplo, la dinámica del mercado. También se da el hecho que otros campesinos imitan la nueva práctica en forma mecánica, sin que ello signifique que lo han integrado a sus formas de trabajo.

De manera que es necesario un apoyo institucional en los aspectos en que los agricultores muestran debilidades o en los que no tienen mayor control. Hace falta también estmular una mayor capacidad de gestión para poder influenciar las políticas del Estado.

* 4. Knowledge, network and cultivators: Cassava in the Domican Republic. Louk Box.

Plantea que los productores y los centros de experimentación, muchas veces difieren en cuanto a sus agendas de investigación, generación de tecnología, extensión, etc. Ocurre con frecuencia que la labor de las instuciones no es relevante para los productores. En el caso planteado en el artículo, los productores no estaban interesados en un gran cantidad de nuevas variedades, sino en algunas de mejor resistencia a las plagas, de crecimiento rápido y con un precio interesante.

A pesar de lo pesimistas que pueden resultar algunas de las sus conclusiones, la tendencia del artículo es instar a la capitalización de experiencias, para articular en lo posible los intereses de los productores y las institutuciones.

5. Farmer participation in tecnology development: work with crop varieties. Jane Ashby y coautores.

Muestran como se puede interconectar de una manera creativa, la labor de una institución con los intereses de los los agricultores. Los productores escogieron con sus propios criterios la oferta técnica que más les satisfacía, la cual consistía en la promoción de diferentes variedades de frijoles. La validación del crecimiento y producción se hizo en sus propias parcelas, de esta manera y desde su propio contexto, obtuvieron mejores elementos de juicio para escoger las variedades mas adecuadas a su terreno y economía. Un aspecto interesante es que los hombres y mujeres aplicaron criterios diferenciados, proceso que los condujo a unas opciones parcialmente distintas. Los productores también opinaron y decidieron sobre el diseño de los experimentos en sus parcelas, por ejemplo, introduciendo la variable de la fertilización.

Los procedimientos de investigación participativa, deben crear buenas condiciones de adopción y de replica posterior, y estimular la interacción de los productores y las instituciones.

6. In Stimulating peasant farmer experiments in non chemical pest control in Central America. De J.Bentley.

Hace referencia al gran potencial que hay en la experiencia y conocimientos de los campesinos, pero que también existen vacios de conocimientos que estos no han podido llenar, debido principalmente a la complegidad técnica que ello supone, por ejemplo, en las relaciones entre plagas y plantas, no es posible ver a simple vista todo el ciclo biológico de las plagas, de manera que se escapan aspectos importantes para saber cuando y como intervenir. Es el momento de la participación del investigador o extensionista, su rol es aportar elementos que permitan visulizar lo que hasta ahora ha estadoinvisible. Tan pronto como los productores se apropien de estos *elementos ausentes* en su conocimiento, se vuelven más creativos y aportan ideas nuevas.

7. Facilitating sustainable agriculture: turning policy models upside down, tambien Niels Roling.

Hace énfasis en la importancia de visualizar lo invisible (para los productores). Esto aumenta la capacidad del monitoreo por el productor de su entorno social y biofísico para una toma de decisiones mas oportuna y adecuada.

Es relevante la observación, en el sentido que en la agricultura sostenible o ecológica se requiere de una información más compleja que en la agricultura tradicional, de manera que el productor requiere mayor capacidad de observación y de interpretación de los fenómenos.

8. Interactions for local innovation

Describe el resultado de una sistematización, que evidencia elementos relevantes de la interacción entre los distintos actores: científicos, extensionistas y usuarios en el proceso de ligar investigación con desarrollo. Indica distintos mecanismos para facilitar tal interacción: grupos de productores, talleres de innovadores, diálogo con ayuda visual.

Muestra la gran capacidad de aporte que tienen las familias campesinas, cuando los proyectos se adecuan a su lógica y objetivos.

9. Interactive research

Hace observaciones valiosas sobre la relación entre investigadores sociales y biofísicas. Entre ellos también se dan desencuentros y contradicciones. Lo que hace uno no siempre es relevante para el otro. No está en cuestión quién tiene la razón, se asume simplemente, que el conocimiento se construye en conjunto, con las verdades y equivocaciones de todos.

Se indica como puede y debe ser la relación:

- De apertura y respeto mutuo.
- De verdadera inter y transdisciplinaridad.
- Tomar la realidad (de los agricultores) como medio para el entendimiento, observar esa misma realidad con distintas miradas para que su comprensión sea multifacética y que la intervención en ella sea más adecuada.
- Preveer un balance entre hombres y mujeres para así entender mejor la percepción de las mujeres del campo y facilitar su participación.

La relación entre investigadores y agricultores debe ser de interacción. Las familias deben ser sujetos de opinión, investigación y acción.

Farmer Participation in Agricultutal Research: a review of concepts and practices, de J farrington and Adrienne Martin.

Hace un resumen del origen de la participación en investigacion agricola. Esto se nutre en dos fuentes:

1. Una corriente de las ciencias sociales que busca mayor equidad y igualdad de oportunidades. Se quiere dar voz y potenciar las capacidades de grupos disprivilegiados.

2. Otra corriente tiene que ver con el análisis de las limitaciones y oportunidades de los sistemas de produccion (de pequeños agricultores), para facilitar en ellos la adaptación o modificación de tecnologias. Se empieza a hacer experimentos in situ.

La confluencia de esas corrientes no siempre a llevado a posiciones idénticas. La posición más radical es de Chambers: Farmers First and Last. El agricultor debe tener el peso mayor en la definición de la agenda de investigacion y la forma de llevarla a cabo. El papel del investigadores es orientar, asesorar y acompañar a los agricultores. Otros plantean que los investigadores deben definir la agenda y guiar el proceso, porque tienen mayores elementos de juicio y que conocen mejor el potencial de la producción de la zona. A su vez admiten que deben adecuarse los procedimientos a los agricultores para facilitar su participación y que estos deben tener la última palabra en la aplicación de los resultados.

Una posición intermedia es de Rhoades and Booth (ex colaboradores del CIP) que plantean que debe haber una interacción y una relación de igual a igual entre agricultores e investigadores en todo el proceso de la investigación. Esto implica gran flexibilidad y si fuera necesario, modificar las prioridades y énfasis de la investigación.

10. La variable del género en la investigación agrícola" de Hilary Sims Feldstein. Aborda el tema de la perspectiva de género en relación a la investigación agícola, especialmente la que tiene como fin mejorar la calidad de vida de los sector pobres, en cuyo contexto social dado se dan relaciones de género desiguales. Esto tiene implicaciones para la investigación agrícola desde la identificación del problema hasta la metodología, la aplicación y la multiplicación.

El desafío para la investigación agrícola, consiste en ir enfocando mejor la investigación hacia grupos específicos para incrementar la equidad y la eficiencia. El análisis de género ayuda a responder a este desafío. Algunas veces las tecnologías pueden beneficiar a los hombres, por ejemplo, la introducción de la mecanización en la preparación del suelo, pero no a las mujeres, que deben seguir desyerbando una superficie extensa.

El desarrollo de tecnologías va dirigido mayoritariamente a cultivos manejados por hombres, cultivos de exportación y/o comerciales, mientras las mujeres están más involucradas en cultivos para la subsistencia, arroz, frijoles, maíz. Y observando el desarrollo de tecnología dentro de un solo cultivo, se puede constatar que se ha concentrado más en estas actividades del proceso productivo donde participan los hombres, cómo es la preparación de la tierra y la siembra y menos a la parte donde la mujer tiene más involucramiento, como el deshierbe y la parte post-cosecha. El capítulo indica de una manera sistemática cuales son los efectos que puede tener la investigación agrícola en las actividades de hombres y mujeres.

11. Gender and Indigenous Kwowledge, de María Fernández:

Trata el tema de la innovación agrícola desde el concepto de conocimientos indígenas, indicando que se ha invisibilizado y despreciado la capacidad inovativa de productores en general y de mujeres productoras en especial. Enfatisa también que entender el papel de género, como también el valor intrínseco del conocimiento indígena es crucial para la solución de problemas en situaciones específicas. Hombres y mujeres ejecutan diferentes actividades, lo que resulta en especialización de conocimientos y habilidades en áreas y prioridades diferenciadas para la innovación. A las mujeres les interesan diferentes tecnologías que a los hombres. Se presenta cuatro maneras para pensar sobre diferencias de género en sistemas de conocimiento: conocimientos diferentes sobre la misma cosa; conocimientos diferentes sobre cosas diferentes; diferencia en la manera de organizar la información; diferencias en la manera de preservar y transferir el conocimiento.

12. On farm research in a silvopastoral project: a case study de Rolain Borel and Francisco Romero.

Se hace una descripción de todo el proceso de diseño y implementación de este proyecto de CATIE. Los agricultores no participaron en el diseño de la investigacion, aunque los resultados de agricultores exitosos fueron tomados en cuenta para definir los nuevos componentes por introducir en los sistemas de producción. Por otra parte, estos componentes eran cercanos a lo que las demás familias campesinas ya conocían y practicaban. El propósito del proyecto era desarrollar sistemas de producción mejorados (en términos de productividad y ingresos), persistentes y sostenibles.

Se analizan las tensiones que ocurren cuando se busca conciliar los propósitos y procedimientos de los agricultores con los del proyecto. También los criterios de evaluación de los resultados pueden variar.

Se sintetiza claramente el meollo de la cuestión de la investigación participativa en: "*Without farmers participation research advances may remain unutilised, while the absence of outside tecnical inputs and ideas reduces the posibility of overcoming the farmers'own limitations*".

Finalmente, se comenta sobre el papel y las actitudes de los profesionales de campo: Deben aprender a actuar como facilitadores de procesos de investigación participativa.

13. Local inovation and knowledge builling processes related to the management of forest resources. FAO: Forests, Trees and People Programa.

El documento es rico en contenido tanto por el marco conceptual y analítico utilizado, algunos aspectos abordados son:

La realidad campesina no es estática sino dinámica. En ella se dan múltiples procesos de innovación y de construcción de conocimientos que precisan ser potenciados. Para eso deben ser debidamente analizados.

Un factor que se dio en todos los casos de innovación examinados es el "stress": La aguda sensación de un problema no resuelto y la búsqueda de su solución y de nuevas alternativas, hace a la gente inquieta e investigativa. Una sólida base organizativa y un conjunto de valores positivos ayudan a materializar ese deseo.

Un factor importante y coadyuvante es la presencia de instituciones de investigación y desarrollo permeables a esos procesos, precisamente cuando las comunidades requieren orientación y apoyo, es preciso que las instituciones sepan responder. No solamente se trata de hacer participar a las comunidades en los proyectos de investigación y de desarrollo, sino también hacer participar estos proyectos en los procesos y proyecciones de la población.

En unos diagramas ilustrativos se visualiza como, en esos procesos de innovación y creación de conocimientos, los distintos factores y actores interactúan y se coadyuvan.

14. Farmers participation in agricultural research and extension: Lessons from the ultimate decade de John Farrington.

El autor hace una evaluación clara y crítica de una década de aplicación de investigación participativa, analiza sus fortalezas y debilidades e indica cuando su aplicación es más y cuando es menos útil. Algunos de los puntos centrales son:

La investigación participativa tiene bastante bondades: adecuación a la situación muy diversa, compleja y llena de riesgos de pequeños agricultores; comprensión de sus oportunidades y limitaciones (también de sus conocimientos); esto puede aumentar la eficiencia del desarrollo y aplicación de nuevas tecnologías (con agricultores de bajos recursos).

También señala que hay mucho discurso sobre la participación y que a veces la discusión se vuelve "borrosa".

En cuanto al sector campesino, debe distinguirse entre productores "acomodados" y pobres. Los primeros son mas asertivos, obtienen lo que quieren y hasta puede pagar por los servicios de investigación, cuando así lo requiera su proceso productivo.

El segundo caso es al sector agrícola de recursos modestos. Aquí se manifiestan los problemas de presión demográfica, pobreza y degradación de recursos, pero también se da la interacción de múltiples componentes y la oportunidad de recombinarlos en aras de conservación y mejor aprovechamiento de los recursos. A su vez les cuesta a las familias convertir sus necesidades y oportunidades en demandas.

También hace un análisis sobre los papeles, fortalezas y debilidades de distintas agencias. Así, una ONG generalmente tiene mayor experiencia y capacidad en organización social, que en materia de desarrollo tecnológico. Un intercambio e complementaridad de capacidades entre un centro de investigación y una ONG aumenta la calidad y el impacto de ambos.

Ese análisis de papeles y fortalezas es también relevante desde el punto de vista de impacto y ratio costo-beneficio: Ocurre que una ONG concentra muchos esfuerzos y personal en organizar un par de comunidades. Este gasto de recursos generalmente no es disponible para las demás comunidades. Entonces cómo divulgar los resultados de la intervención a otras comunidades? Vale involucrar a las agencias del gobierno que trabajan en la zona. Para eso estas deben hacerse mas permeables y participativas en su relación con la población. También debe aprovecharse de organizaciones de productores de segundo grado y facilitar, mediante pasantías, visitas de una comunidad a la otra. (compara la experiencia del movimiento Campesino a Campesino en Nicaragua). El contacto cara a cara debe combinarse con el uso de medios de comunicación masiva.

47. INDAKS: A bibliography and database on indigenous agricultural knowledge systems and sustainable development in the tropics

L. JAN SLIKKERVEER

Introduction

OVER THE PAST decades, among scientists, planners and extension workers, the concern on the progress of modern, Western-oriented programmes and projects of socio-economic development in many Third World countries has gradually increased, and a general awareness has emerged that, if present trends will continue, humankind will soon face the virtually certain prospect of a global collapse. As widely experienced in many sectors of society, such as human health, agriculture, forestry, fishery and natural resources management, the model of Transfer-of-Technology from Western to non-Western countries has too often led to overexploitation, depletion of resources and a general threat of extinction of species.

In response to the general call for alternative approaches encompassing a more sustainable mode of development, a renewed interest in the role of local farmers, medical practitioners and women's groups in the management of their environment and natural resources has emerged, bringing indigenous knowledge and skills firmly into the international debate. Indeed, in addition to the significance of biodiversity conservation, the interest in the role of cultural diversity in terms of indigenous peoples' various systems of knowledge and practice has generated a totally new, interdisciplinary field of indigenous knowledge systems theory and practice.

Departing from the results of early ethnoscientific studies which have shown the efficacy and appropriateness of alternative, locally oriented approaches towards development projects, the first true break-through in this field took place by the end of the seventies, when at the *International Conference on Primary Health Care* of WHO in Alma Ata (1978) the role of traditional medicine was purposely introduced into the global effort to attain the objective of 'Health for All by the Year 2000'. Partly engendered by promising examples of local and regional medical systems which proved to be more effective and less costly, and – perhaps even more important – partly by the increased assertiveness and political consciousness of client and patient groups, traditional medicine has come to be generally accepted and officially integrated in most health care delivery systems around the world (*cf.* Kleinman 1980; Bannerman, Burton and Ch'en Wen-Chieh 1983; Leslie 1988; Slikkerveer 1990). The inductive processes of involving indigenous medical knowledge and practice 'from the bottom' into national health care systems has not only led to a more realistic attitude of national health planners and administrators, but also to an increased awareness among international donor agencies. of the importance of participatory orientations in the health sector.

Later on, during the 1980s, a second break-through in the recognition of indigenous knowledge and practice in the international development effort took place in the related sectors of agriculture and environment. Indeed, in the West,

the environmental movement gained such public weight that soon ecological issues came to dominate the political agendas of many nations.

In the developing world, an increasing number of countries – particularly in Sub-Saharan Africa – became faced with rapid environmental depredation and declining agricultural production which soon led to the widely acknowledged 'Crisis in African Agriculture'. As Mazur and Titilola (1992) rightly note, natural resource degradation encouraged by population pressure, poverty and the implementation of inappropriate technology are generally considered to cause adverse trends in crop production and productivity. Particularly in agriculture, the combination of massive external inputs of costly fertilizers, herbicides, fungicides and pesticides has not only been unable to maintain adequate production levels, but has created an alarming situation of near-bankruptcy and pollution in both the economical and ecological sectors of developing countries.

By consequence, an international call for 'alternative agriculture' which could lead to 'Sustainable Agriculture and Rural Development' (SARD) has prompted the current resort to sustainable approaches in agriculture. As such reorientation seems to require a fundamentally new paradigm of sustainable development in which indigenous agricultural knowledge and practice plays a central role, anthropologists and development sociologists have come to join agronomists, botanists and soil scientist to document, study, analyse and re-integrate local farmers knowledge into the overall agricultural development efforts.

Since the interest in indigenous knowledge systems has virtually emerged from experiences of the practical setting of the applied, development-oriented sciences in the tropics, the theoretical and methodological aspects of the newly-developing field of agricultural knowledge systems theory and practice have so far remained in the background. Among the few theoretical orientations are the innovative studies from the extension sciences related to knowledge, information and agricultural development by Röling (1986, 1988a; 1988b), Röling and Engel (1989), from the cognitive sciences concerning knowledge creation, exchange and utilisation by Beal, Wassanayake and Konoshima (1986), and from anthropology and development sociology, focused on knowledge, cognition and culture by Pearce (1988), Warren, Slikkerveer and Titilola (1989), and Leakey and Slikkerveer (1991). As a result, the study of indigenous knowledge systems in relation to the development process has largely remained outside the academic arena. By consequence, the conceptualisation of such systems and their components certainly need further clarification. Not only for the full understanding of what in fact encompasses indigenous – or local – knowledge and practice, but even more so, of what changing connotations are currently connected to the term 'indigenous'?

Indigenous Knowledge Systems (IKS) have been defined as systems of knowledge and practice, developed over generations in a particular field of anthropological study, and as such unique to a specific culture or region. Sometimes referred to as systems of 'local knowledge', 'traditional knowledge', or even 'commonsense knowledge', these systems have mainly evolved outside – or in contrast with – Western-oriented, 'scientific', or 'modern' systems of knowledge and technology generated through universities, research institutes and industries. Indigenous Knowledge (IT) has formed the basis for local-level decision-making in sectors of the society such as human and animal health, agriculture and food production, natural resources management and fisheries (*cf.* Warren, Slikkerveer and Titilola 1989; Warren 1991; Slikkerveer *et al.* 1993)

Apart from 'Western' or 'scientific' knowledge which has developed on a rather separatist, monodisciplinary basis, Indigenous Knowledge encompasses a strong interdisciplinary orientation towards practice and experience. As there are both similarities and differences between 'traditional' and 'Western' knowledge, it is interesting to note, that from an anthropological, cultural-relativist's point of view, as Bronowski (1978) stresses, the practice of science, including belief and magic, forms a fundamental characteristic of all human societies. The implication of such position pertains to the conclusion, that both Western and indigenous science are the result of the same general, intellectual process of creating order out of disorder. Since such adaptive knowledge and practices are often passed down the generations through the oral tradition, these systems are – in contrast with some Western stereotyping of the past – not 'simple', 'static', 'old-fashioned' or even 'archaic', but rather dynamic with elements of both continuity and change, embedded in their adaptive capacity, selection mechanisms and appropriate use (*cf.* Jiggins 1989, Slikkerveer 1989, Warren 1989). In this context, the term 'indigenous' should not be confused with former concepts with strong negative connotations from the colonial past including Dutch terms such as *inheems* or *inlands*, or the Eng;lish terms *primitive*, *native* or *aboriginal*.

On the contrary. While these terms previously indeed tended to refer to 'rurality' and 'backwardness' often in connection with particular ethnic groups, the designation 'indigenous' has lately come to highlight the uniqueness, the artisan and the rich heritage aspects of specific cultures and communities in their particular locality. It is therefore not surprising, that recently, partly out of a resentment or even rejection of Western, often materialistic life-styles, several cultures around the globe have proudly adopted the term 'indigenous' to stress the values, attitudes and life-styles underlying their own cultural identity and uniqueness in a world that seems to glide to globalization and Westernization.

The revaluation of local cultures in terms of 'indigenous' providing an expression of their own cultural heritage was recently strongly encouraged by the Official United Nations 'Year of the Indigenous Peoples' of 1993, enhancing the process of 'reculturation' or 'indigenization' *(indiginismo)* of many cultures around the world. While the specific conditions of indigenous systems show a vast variety over different regions, nations, culture areas, and continents, distinct *principia media* could however be identified at the theoretical level, providing the preconditions for the advancement of the newly-developing field of IKS & D.

Particularly in the agricultural sector, as a result of failing Western knowledge and technology inputs by the beginning of the 1990s, national governments and international donor organisations and development agencies seem finally prepared to acknowledge the importance of so far largely ignored local people's empirical knowledge and experience, as well as of their values, perceptions and practices in the development process: the 'cultural dimension of development'. Although for a long time, the concept of culture has been regarded as an 'obstacle to change' by development experts and extension workers, often directly linked with stereotyped labels of 'rurality' and 'traditional life-styles', now its potential for facilitating the development process seems finally to undergo a significant reorientation.

7. Indigenous Communication and Indigenous Knowledge

PAUL A. MUNDY AND J. LIN COMPTON

Introduction

MOST DEFINITIONS OF indigenous knowledge refer to the accumulation of experience and the passing down of information from one generation to the next within a society (Wang 1982, CIKARD 1988). Yet, despite frequent expressions of concern for enculturation, little attention has been given to how knowledge is accumulated and shared within local societies. Communication is one of several processes essential for the continuity and spread of knowledge and the culture in which it is embedded.

Every society seemingly has evolved elaborate ways for transmitting information from person to person. Such indigenous communication includes the transmission of not only technical information, but also all other messages: entertainment, news, persuasion, announcements and social exchanges of every type within the expansive sweep defined by Doob (1960). This chapter deals primarily with the communication of technical information, though it will be necessary to mention other types of content also. We choose to concentrate on technical communication because this has been relatively ignored in the literature. The neglect by outsiders of the interface between indigenous knowledge and indigenous communication is despite its central place in the perpetuation of culture. This chapter describes indigenous communication and proposes a heuristic framework for studying this interface.

In the following discussion we must keep in mind the distinction between knowledge and information. Knowledge is the process of knowing, of individual cognition (Freire 1971, 1973). It resides in people. It cannot be communicated but is created in the minds of individuals as a result of each person's perceptions of the environment or through communication with others. An information sender must first encode knowledge into a form of information and transmit this. The receiver then decodes and analyses the information, forming connotations with schemata and memorised experiences and relating it to knowledge he or she already has. The receiver's verbal or other reactions form feedback, which in turn may create new knowledge in the mind of the sender. The communication process thereby enables both partners to create new knowledge in their minds.

Communication may occur without any conscious or deliberate attempt by an information sender. Observers may infer much from others' actions, dress and body language. Much childhood learning consists of imitation. Animals, plants, and inanimate objects such as stars and clouds convey much information to those able to interpret it. The receiver must similarly decode the incoming information and match it with existing knowledge.

This encoding, decoding and matching process produces 'noise' in the communication channel and results in no two people having exactly the same knowledge about anything. It also means that rural people and scientists see the same item of 'indigenous knowledge' in completely different ways. For this reason, in this chapter we are careful not to talk of the 'communication of indigenous

knowledge'; rather, we talk of the 'communication of indigenous information' to refer to the process of encoding and decoding and the associated generation of new knowledge in the sender's and receiver's minds.

What is indigenous communication?

The problems of defining indigenous communication are very similar to those facing a formal definition of indigenous knowledge (*see*, for example, Swift 1979 and Howes and Chambers 1979). Gradations, overlaps and exceptions abound. Wang's (1982: 3) definition of the indigenous communication system implies that changes in technology and organisation make it difficult to draw a firm line separating indigenous from non-indigenous, or exogenous, communication: 'the communication system which existed before the arrival of mass media and formally organised bureaucratic system, and is still existing today despite changes.'

This historical perspective fits the developing world – where mass media and bureaucracies are relatively new – better than the developed world. One might argue, however, that small-circulation newsletters, telephones, personal correspondence and electronic mail in the West perform the same functions as more traditional channels in developing countries. Wang (1982: 3) goes on to list examples of indigenous communication: 'folk media such as puppet shows; folk drama; storytelling; interpersonal communication channels, including the Korean village meetings, the Chinese loaning club; or even local meeting places (community teahouse and open market). Although the primary function of these media and channels may not be communicative, together they interact with one another to form a network which constitutes the information environment of people in most of the rural areas in the Third World.' We will mention many other instances of indigenous channels in this chapter.

We can see indigenous communication as operating at different levels in society. Interpersonal communication operates primarily at the individual and small group levels. Grassroots organisations such as irrigation associations and housing cooperatives allow structured discussions involving organisation leaders and larger audiences than is possible in unstructured situations. The audiences of folk media are larger still and may involve virtually everyone in a community as well as people from outside.

Why study indigenous communication?

Indigenous communication has value in its own right It is an important aspect of culture and is the means by which a culture is preserved, handed down, responds to new situations and adapts. The erosion of indigenous communication systems by exogenous education and media endangers the survival of much indigenous knowledge.

Exogenous channels have limited range Television and newspapers are largely confined to urban areas in the Third World. Even the most widespread of exogenous channels, extension personnel and radio, fail to reach many rural people. Indigenous channels, by contrast, are ubiquitous. They are needed to convey messages to people out of the reach of exogenous channels.

Indigenous channels have high credibility Because they are familiar and are controlled locally, indigenous channels are highly credible. Audiences throughout the world often greet with scepticism or hostility messages transmitted through the externally controlled mass media.

Indigenous channels are important conduits of change Because of the above factors. Research on the diffusion of innovations has shown the importance of informal, interpersonal contacts in persuading people to adopt, or reject, innovations (Rogers 1983). Such contacts are often made through indigenous channels.

Development programmes can use indigenous communication For both information collection and dissemination. Outsiders can tap indigenous channels for information about the local situation and responses to outside initiatives. Much can be learned by attending village or organisation meetings and interviewing local individuals who have accumulated knowledge through direct experience and communication. Integrating indigenous and exogenous communication systems can strengthen both (Howes 1979): for instance, Schwabe and Kuojok (1981) propose an animal disease surveillance system using indigenous veterinarians in southern Sudan. Collaboration between the local hospital and indigenous healers in central Ghana has allowed the healers to refer patients to the hospital and vice-versa (D. M. Warren 1989).

Many projects rely on information diffusion processes to carry innovations and development messages to their intended beneficiaries. Some projects target opinion leaders and people likely to be innovators in the expectation that indigenous channels will spread the message. Others have made explicit use of indigenous channels such as folk media and village organisations.

Indigenous channels offer opportunities for participation by local people in development efforts. They allow local people to communicate among themselves and with development professionals and decision makers. Local people can retain control over more indigenous more easily than over technologically intensive media.

If ignored, indigenous communication can result in inappropriate development efforts For instance, failure to recognise the role of a network of 'water temples' in controlling irrigation in Bali, Indonesia, led to the introduction of cropping technologies and the construction of canals and dams that were not appropriate to local conditions (Cowley 1989; Lansing 1987).

Indigenous and exogenous communication compared

We may conveniently contrast indigenous communication channels with exogenous channels: mass media (radio, television, newspapers, magazines, and the like) and such bureaucratically organised networks as firms, schools, banks, postal and telephone services, agricultural extension and other government agencies.

In general, indigenous communication systems have three features: they have developed locally, are under local control, and use low levels of technology. Many indigenous communication systems share a fourth characteristic: a lack of bureaucratic organisation. However, some systems we might regard as indigenous (mosques, churches) are organised bureaucratically, while some exogenous forms (computer bulletin boards, small-circulation newsletters) are not. Despite these exceptions, we might describe exogenous systems as 'institutionally organised communication,' a phrase parallel to Compton's (1984a) term for science and technology 'institutionally organised knowledge systems'.

As with exogenous and indigenous knowledge, there is sometimes no sharp line between exogenous and indigenous communication. The two systems overlap in all four elements of the SMCR model of communication: source, message, channel, and receiver.

- While the two systems are distinguishable primarily by the *channels* used (radio, TV and the printed word vs. informal face-to-face communication and folk media), exogenous communication also makes ample use of interpersonal communication, as in extension activities and telephones.
- The *sources* often are different. Exogenous communication is originated by an outside institution such as a television or radio station, while indigenous communication derives from local people. But here too there is overlap. A television program may show a local source such as a village farmer who has adopted and benefited from a new technology, while folk media such as puppets have been widely used to convey family planning and other developmental messages designed by national governments.
- *Messages* conveyed by the two systems are sometimes similar. News and entertainment may travel through either network, for instance. However, most indigenous information flows through indigenous channels, while exogenous information typically is carried by exogenous channels. Later in this chapter we discuss exceptions to this. The smaller, more intimate audiences typical of indigenous channels mean that messages are more easily tailored to local conditions than is possible in mass exogenous channels (Wang and Dissanayake 1984: 22). Some forms are unique to exogenous communication systems (television soap operas and satellite weather forecasting, for instance) while others are found almost exclusively in indigenous systems (such as indigenous healing methods). Even here there may be mutual borrowing, though, as in a TV documentary about traditional acupuncture methods or the puppet shows about family planning mentioned above.
- The *receivers* of both types of communication also coincide, though the mass media forms of exogenous communication typically reach a much larger audience than do indigenous channels (Wang and Dissanayake 1984: 22). While television and newspapers have limited ranges, radios are common even in remote areas. And even the most highly educated urbanite still relies on indigenous communication for much information.

We discuss each of these aspects of indigenous communication in more detail below.

Indigenous communication channels

We divide indigenous communication channels into six types: folk media, indigenous organisations, deliberate instruction, records, unorganised channels, and direct observation.

Folk media Folk media are the indigenous equivalents of exogenous mass media. This broad range of art forms is used primarily for entertainment, but also is used to promote education, values and cultural continuity. They are distinguishable from indigenous organisations, the following category, because they entail a performance by an actor or actors before an audience.

Types of folk media include festivals, plays and puppet shows, dance, song, storytelling, poetry, debates such as the Filipino *balagtasan*, parades and carnivals (Valbuena 1986). These traditional forms of entertainment were thought to be in danger of being superseded by radio and television, but fears of cultural imperialism and realisation of the limitations of the mass media have sometimes led to their revival (Wang and Dissanayake 1982). This sometimes has occurred with the aid of modern broadcast media, with traditional performances, albeit somewhat changed in form, being broadcast over television and radio (Lent 1982).

Indigenous organisations and forms of social gatherings Indigenous organisations include religious groups, village meetings, irrigation associations such as Balinese *subak* (Lansing 1987), mothers' clubs and loan associations. These organisations orchestrate much communication through formal meetings of members, by messages sent about activities and obligations, and through work activities. There is inevitably overlap between this and other categories. For instance, indigenous organisations often arrange folk media performances, though performance is not usually their major aim. They provide many opportunities for unorganised communication among organisation members.

Deliberate instruction A large part of the enculturation process occurs through what C. P. Warren (1964: 10) terms 'deliberate instruction': 'an institutionalised act or set of acts performed by an individual to modify the behaviour of another individual and induce habit formation'.

Thus defined, deliberate instruction includes both 'directed learning' ('...informal acts of teaching...') and 'schooling' ('...formalised institutional activity...found only in literate societies with a few exceptions') (C. P. Warren 1964: 3-4). It includes child-rearing practices such as feeding, sphincter control and weaning, training during childhood and adolescence, as well as traditional (often religious) schools, and the instructions given by parents and other older people as a child works and plays in the fields or at home (Mosende 1981). It continues during adolescence and adulthood through initiation rites and other rites of passage, apprenticeship arrangements and the instructions given by indigenous authorities.

C. P. Warren (1964: 22) points out that the number of *agents of deliberate instruction* (those giving the training) increases as an infant grows into an adult. An infant typically receives training only from immediate kin (parents and older siblings); as the child matures, he or she interacts with larger and more diverse groups of kin and non-kin as a result of greater awareness and mobility, increasing reciprocal obligations and numbers of siblings. The relative influence of the immediate kin consequently decreases. Deliberate instruction continues after adolescence, however (C.P. Warren 1964: 6): 'any individual can learn and habituate something – an act or an idea – throughout the entire life cycle; the ability to learn is a matter of degree and is not confined to any particular phase of the life cycle.'

Despite the importance of deliberate instruction in enculturation and innovation diffusion, this topic has received little attention from development specialists. It seems that deliberate instruction is far more important in the communication of information than are occasional Indonesian *wayang kulit* puppet performances or village festivals, or even than the more ubiquitous exogenous channels of radio, television and schools.

Records Formal records – written, carved, painted or memorised – are another way of communicating indigenous information. Examples of this are the South Asian treatises on animal management written on palm leaves (FAO 1980), ancient scripts on *bai lan* leaves preserved in Thai Buddhist temples, and similar leaves containing records of land ownership and tax obligations in Bali (Geertz 1980: 179; Rupa 1985). Perhaps a study of 'indigenous librarianship' would turn up many examples of knowledge thus recorded. Such records do not have to be written. African storytellers narrate memorised historical epics and genealogies

at length. Proverbs and folklore are other vehicles for transmitting cultural information.

Unstructured channels Indigenous communication occurs in many other settings: talk at home and at the well, in the fields and on the road, in the teahouse and coffee shop, in the chief's house and at the market, and wherever else people meet and talk. This communication is not organised or orchestrated but is spontaneous and informal. Communication among peer groups forms a major part of it. Folk media and indigenous organisations provide many opportunities for such unstructured communication before, during and after meetings and other activities. The importance of such channels is illustrated by the role of informal networks in Iranian bazaars in the overthrow of the Shah (Mowlana 1979).

Direct observation Doob (1960) points out that communication does not have to be intentional to take place. A farmer may see another's bumper crop and infer that the variety or technique used is good. An example of this process is given by Johnson (1983), who describes how a group of Machiguenga Indians in Peru began planting coffee after seeing others experiment with the crop. Nor does the source have to be another person. A dark cloud alerts us to a coming thunderstorm just as clearly as a verbal warning from another person could.

Indigenous communication sources

Not everyone in a society has the same indigenous technical knowledge (Swift 1979). Differences among individuals occur because of age, gender, experience, profession and personality. A person may be a highly skilled smith but know little of farming; another may be held in high esteem for her midwifery or gardening skills. In general, we can differentiate five different types of sources of information:

Indigenous experts are referred to as 'farmer paragons' by McCorkle *et al.* (1988: 71), are generally recognised as being skilled in areas such as crop or livestock raising. Everyone engaged in these activities has these skills to some degree; but the indigenous experts are sought out for advice on farming and other problems. These experts are probably opinion leaders in their specialties. Because men and women often perform different tasks, knowledge may be gender-specific or held in common by people of both sexes (Norem *et al.* 1989).

Indigenous professionals are a special type of indigenous expert with knowledge and skills not widely distributed among others in the society. This category includes healers, sorcerers, shamans, scribes, midwives, blacksmiths, irrigation-tunnel builders (in Bali) and water-temple priests who oversee irrigation systems in whole watersheds (also in Bali) (Lansing 1987). The ... belong to certain clans or guilds and derive status or income from th ... they learn through long apprenticeships or on-the-job training ... indigenous veterinarians in Nepal, for instance, receive va... ranging from formal government-sponsored instructi... observation on the job (FAO 1984: 4-8). Non-indigen... group also are seen as professionals: doctors, lawy... accountants; however, their knowledge and skills ... knowledge and are acquired through formal educati... ships.

Innovators are often considered deviants in their ... experiment and try out new ideas. Examples in th... ...ch- ... seems ... media, for ... received from and 'Mr. Researcher,' Nigerian farmers who experimented with new millet varieties (McCorkle 1988); 'El Loco,' a Peruvian farmer who successfully planted potatoes 1000 m. below the lowest elevation at which the crop normally grows (Rhoades and Bebbington 1988); and Mukibat, an East Javanese who developed and gave his name to a method of grafting hardy cassava tops onto high-yielding roots (Aumeeruddy and Pinglo 1989: 26). These innovators may develop new knowledge themselves, or they may introduce ideas they have obtained elsewhere through their frequent travels. They are a major source of the indigenous innovations that enter the society.

*Intermediaries1*who are formally designated as such. One example is the *juru arah* or herald in Balinese irrigation associations, who is responsible for informing association members about meetings and maintenance duties (Rupa 1985). Other examples are the linguists attached to West African rulers' courts (Doob 1960), town criers in West Africa, *akyeame* in Ghana and griots in francophone West Africa (McCorkle 1989a, personal communication). Non-indigenous equivalents of this group are the extension agent, interpreter and journalist – who do not originate but merely report, information.

Recipient-disseminators (Doob 1960) are informal intermediaries in the information chain. Unlike the previous category, the recipient-disseminator may receive an item of information and react to it (for instance by testing a new crop variety) before passing it on. Everyone in a communication system acts as a recipient-disseminator at some time. Recipient-disseminators who have links outside the local society are important conduits for the lateral exchange of both indigenous and exogenous innovations.

Table 7.1: Typology of the interface between knowledge and communication types

Communication systems	*Knowledge systems*	
	Exogenous	*Indigenous*
Exogenous	A. Technology transfer	C. Indigenous knowledge-based development
Indigenous	B. Diffusion; co-opting of traditional media	D. Cultural continuity and change

Information diffusion theory and network analysis provide a useful approach to studying the roles of these sources. Much indigenous communication occurs within highly homophilous groups or cliques. Such cliques facilitate efficient communication among their members but act as a barrier preventing new information from entering the clique. Boundary spanners such as bridges, liaisons and cosmopolites have links with people outside their own cliques; together with innovators, they introduce information to the network (Rogers and Agarwala-Rogers 1976).

A typology of the knowledge and communication interface

Despite the overlaps between types of communication, and corresponding problems in distinguishing indigenous from exogenous knowledge, it is helpful to think of a matrix that opposes both exogenous and indigenous types of each system (Table 7.1). The four quadrants represent the communication of each type

of information through each type of channel. For ease of explanation, we deal first with the two quadrants on the diagonal (A and D) and then briefly discuss quadrants B and C.

Quadrant A: exogenous communication of exogenous information

Exogenous communication systems are used for many functions: to entertain, inform, educate, persuade and advertise. Perhaps the main channel for exogenous *technical* information in many countries is the school system. Technical information is a small part of most mass media fare; entertainment has the lion's share of most television and radio programming, while newspapers contain mainly news and advertising. The transmission of technical knowledge typically is relegated to unused time slots at inconvenient hours on the broadcast media and to the inside pages of newspapers. Books, pamphlets, newsletters and – in the developed world – magazines, are the main printed channels for technical information. The extension service is charged with delivering exogenous information to farmers through interpersonal contacts and the mass media.

This quadrant is the focus of most research in advertising and development communication. Much of the literature on agricultural technology transfer (for example, see Hornik 1988; World Bank 1985) is devoted to discovering how best to disseminate researcher-developed crop varieties and agricultural practices through the mass media and extension system. The idea behind the technology transfer strategy is to develop technologies that are clearly superior to current practices and to disseminate them through channels over which the disseminating agency has some control. Indigenous channels are seen as multipliers that will take over the dissemination process once the innovation has proven superior.

Quadrant D: indigenous communication of indigenous information

Just as exogenous information is communicated mainly by exogenous channels, indigenous information is transmitted almost exclusively through indigenous channels. But there seems to be very little in the communication literature about this topic. Most studies have concentrated on the spread of exogenous innovations rather than of locally generated information. Study of traditional communication systems has fallen largely into the realm of cultural anthropology rather than communication. But many anthropologists have not regarded the communication of technical knowledge as worthy of study, and what information there is on this topic likely is buried within ethnographies and studies devoted to other topics. There is a need to search for clues on how these communication systems work and to incorporate this knowledge into communication studies and development projects.

Information about technical knowledge forms only a small percentage of the total volume of messages in indigenous (or exogenous) communication. Other information in the realm of indigenous knowledge pertains to social organisation, actions and decision processes, values and beliefs, while entertainment, news, instructions and everyday social discourse account for the greater part of messages. Each of the six indigenous channels described earlier can carry technical messages, though some are more suited to this task than others. It seems that deliberate instruction is likely to be more important than folk media, for instance, despite the disproportionate attention the latter have received from anthropologists and communication scientists.

Technical messages may contain information, take the form of an object, or both. *Information* may be about an indigenous innovation or an item of traditional knowledge. It may relate to knowledge (cognitive domain), skills (psychomotor) or attitudes (affective). It may encapsulate the indigenous knowledge in verbal form ('plant maize on this type of soil') or may be in the form of news ('the store has some new seed' or 'the healer in the neighbouring village cured my daughter'). The distance travelled by such messages is shown by the far-flung reputations of traditional healers in Central Ghana, who attract apprentices from as far afield as Mali, Burkina Faso, Togo and Ivory Coast (D. M. Warren, personal communication).

The message also may take the form of an *object:* tools, for example, or germplasm such as seeds or cuttings. McCorkle *et al.* (1988: 38) describe how a man collected millet grains that had fallen to the ground after hearing a neighbour describe the benefits of the seed. Markets enable the exchange or purchase of such items as the orange cuttings that farmers in Central Java planted in their rice fields after the price of rice plummeted and that of oranges soared in the mid 1980s.

As Richards (1989) points out, indigenous knowledge is not static; it is constantly changing, adapting to new conditions and technologies. We can thus view indigenous knowledge, and hence messages about it, as having stable and dynamic components. The *dynamic* component arises through the introduction of innovations from outside (such as from neighbouring villages) and through the generation of innovations locally. These innovations are generated by farmers and other local people through a variety of means: deliberate experimentation, chance discoveries, or adapting practices introduced from outside. Rogers (1983) calls the last process 'reinvention'.

Intergenerational communication The *stable* component is derived from the stock of existing knowledge held in the society. This is re-created through communication from one generation to the next – the process of accumulation and passing down referred to by Wang (1982) and CIKARD (1988) and alluded to earlier in this chapter. This component has a stabilising function because it perpetuates the knowledge base of the society and serves to maintain the culture.

Much indigenous knowledge is not written but is preserved in peoples' minds, often with remarkable accuracy. Because of the failings of memory, however, it must be repeated to ensure it is not forgotten. Such repetition can take two forms: *use*, as when an indigenous professional practices his or her skills, and *communication* to others. The process of communication can thus be seen as a method of preserving the body of indigenous knowledge within a culture.

Breakdowns in intergenerational communication can have disastrous effects on culture. For instance, the Kayapó Indians in the Amazon are thought to have changed from a peaceful tribe to a number of warlike, mutually hostile groups because introduced diseases wiped out the tribe's older people, destroying the seat of culture (Posey 1987). Barth (1975) mentions a tribe in Papua New Guinea that lost most of its traditional initiation rites because all the older men died. Similar cultural destruction is occurring today in refugee camps in many parts of Africa.

Lateral communication Lateral communication is the diffusion of information, including indigenous innovations, from one area to another or among peer groups. These lateral networks bring new ideas into the culture; they are thus a *dynamic* aspect of indigenous communication. McCorkle *et al.*'s (1988) case study of the spread of indigenous innovations in Niger is one of the few studies of such mechanisms. It is possible that the same networks are active for indigenous as for comparable exogenous innovations. Techniques used in diffusion research (Rogers 1983) could be applied to the study of these networks.

Through the process of development, acceptance, adaptation, use and communication to others, both indigenous and exogenous innovations may enter the corpus of knowledge that is replicated in successive generations. The acceptance and communication of such information to the next generation within the culture are features that distinguish indigenous from exogenous knowledge.

Quadrant B: indigenous communication of exogenous information

As with indigenous technical information, any of the six indigenous communication channels may transmit exogenous messages, though some are more likely to than others. For instance, news about a successful new crop variety will spread quickly through direct observation and unorganised channels. Lent (1982) gives several examples of successful uses of indigenous opinion leaders in spreading family planning and other innovations. The spread of exogenous information and technologies through such interpersonal networks has been the focus of much of the vast literature on innovation diffusion. While most of this research has been conducted in the United States, numerous studies of innovation diffusion also have been made in Third World societies, identifying such features as opinion leadership, the importance of homophily, socioeconomic status, interpersonal networks, and so forth. Much effort has been put into identifying characteristics of key actors (innovators and opinion leaders) in order to target them for development messages (Rogers 1983).

Organised channels and folk media are also frequently coopted to spread exogenous information. Many extensionists try to use traditional organisations to spread family planning and agricultural messages. In the last two decades much attention has been given to the folk media. Kidd (1982) lists 1779 references on their conscious use to promote social change. Successful examples include Cashman's (1987) use of plays to advertise the 'fertiliser bush' (alley cropping using leguminous trees) in Nigeria and the Indonesian government's use of *wayang* puppet plays to spread family planning messages (Surdjodiningrat 1982). Kidd (1982), Lent (1982), Parmar (1975), Rangagath (1980), Valbuena (1986), and Wang and Dissanayake (1982, 1984) discuss such uses of folk media. The advantages of using these media as an element in a communication campaign include their familiarity and credibility to local people and the potential for the involvement of the audience in performances.

Two problems are evident in using folk media to spread development messages produced by others. The first is that even though in their original forms they may contain morals or substantive messages, these media carry primarily entertainment in the same way as Western mass media do. Audiences may therefore not perceive or understand the development messages included in the script (Lent 1982).

The second problem is that audiences may resent the use of traditional forms to convey development messages (Lent 1982; Diaz Bordenave 1975; Compton 1980). Because message production is outside local control, such adaptation may lead to 'domestication' ('the process whereby groups in power seek to channel and neutralise...oppressed peoples' (Freire 1973)) rather than 'liberation.' One way to avoid this is to enable local people to develop their own messages and performances, as described by Compton (1980) in the Philippines.

There is also a need to follow up the folk media campaign with practical support, as with the use of literacy workers to organise reading groups following performances by Filipino *barrio* cultural groups.

Quadrant C: exogenous communication of indigenous information

Few examples exist of indigenous information being transmitted via exogenous channels, though this has great growth potential. One example if the Foxfire Project in Georgia, in which school children collect information on traditional skills from older people in the area and public it in the form of magazines and books. Another example is the growing scientific literature on indigenous knowledge (for example, Brokensha *et al.* 1980) and the documentation efforts of Iowa State University's Centre for Indigenous Knowledge for Agriculture and Rural Development (CIKARD) and other institutions described elsewhere in this volume. A third example is the emphasis given to farming systems research in many countries, and within this, the movement toward farmer-managed research. Technology emerging from field surveys and on-farm trials is inserted into the scientific information system, and from there may filter through to the extension services or is disseminated directly to neighbouring farmers (*e.g.* McCorkle 1989b).

A major area of potential growth is in the use of exogenous communication techniques to enable farmers to learn directly about indigenous knowledge. Among the few examples of this in the developing world is *Minka*, a low-cost magazine devoted to recording and disseminating the knowledge of local farmers to other farmers in the Peruvian Andes (Altieri 1984). The 'farm tips' pages of US farm magazines and the growing number of sustainable agriculture newsletters are First World equivalents. The potential for developing research and extension systems that draw on indigenous knowledge and farmers' proclivity to experiment is enormous.

Indigenous communication: where do we go from here?

Indigenous communication has been touched on by specialists in various disciplines, including development communication, extension, sociology, cultural anthropology, education, folklore and theatre, as well as by scientists in several agricultural and health-related disciplines. Much of this work has, however, concentrated on using indigenous channels to promote exogenous innovations (quadrant B in Table 7.1). While more work is clearly needed in this area, development efforts are likely to be less effective if we continue to ignore the communication of information on indigenous knowledge (quadrants C and D). It is necessary to study communication patterns to design interventions that benefit from this knowledge. While each of the disciplines mentioned has a role to play, we believe that ethnographic methods will prove particularly useful in discovering how indigenous communication operates.

Any development strategy based on indigenous knowledge must consider the repositories of that knowledge. The benefits of integrating indigenous and exogenous specialists into a single system are illustrated by a benefit-cost analysis (Zessin and Carpenter 1985) that showed that Schwabe and Kuojok's (1981) proposal to use indigenous veterinarians as a disease surveillance system in southern Sudan was cheaper than a conventional mass-vaccination programme.

We echo Compton's (1973) plea that indigenous specialists not be regarded as paraprofessional aides to exogenous professionals. Rather, they must be seen and treated as experts in their own right, for that is what they are. Training activities for such specialists should seek to build on their existing knowledge rather than replace it with alien practices. And these specialists should be used as expert consultants to advise in the planning and implementation of development efforts.

We are deceiving ourselves if we think we can manoeuvre local people into doing what we think is best for them. Local initiative has often been neglected in the design of development efforts. Tapping indigenous communication channels can help ensure that this initiative is incorporated. An understanding of indigenous communication improves the chances of true collegial participation by local people and outsiders in such efforts.

PART IV. INDIGENOUS EXPERIMENTATION AND INNOVATIONS

22. Farmers Who Experiment: An untapped resource for agricultural research and development

ROBERT RHOADES AND ANTHONY BEBBINGTON

Introduction

THROUGHOUT THE CHANCHAMAYO Valley of Peru's Eastern high jungle, he was known as 'El Loco,' the crazy one. He had migrated in 1978 to the Chanchamayo from the Highland Department of Huancavelica. Although his real name was Anchuraycu, he quickly acquired his nickname from a reputation of bold and sometimes comical experimenting. 'El Loco' was notorious for moving plants or seeds of important crops between extreme climates on the Andean slopes where temperature and climates change rapidly as one climbs from the jungle to the mountains. He uprooted potato seeds from their cool Highland home and carried them downhill to the hot, sultry jungle. With the banana, he carted it up the mountain to the point where he suspected it would not do well just to see what would happen. He was an incurable grafter, planter of many varieties, but above all an expert in home-designed agricultural experiments.

We first met 'El Loco' in 1980 while surveying possibilities of introducing the potato *(Solanum tuberosum)* into the hot, humid tropics (Rhoades and Recharte n.d.). The International Potato Centre had established an experimental station on the valley floor of the Chanchamayo at 800 m to conduct basic research in the development of a tropical potato. Our job as anthropologists was to explore the surrounding countryside to see if any farmers had attempted to grow potatoes. We stumbled upon 'El Loco' while he was cultivating a maize field. Our altimeter told us we were standing at around 890 metres, approximately a thousand metres below where potatoes can be grown satisfactorily. To our amazement, hidden and shaded among his maize was a beautiful stand of potatoes. 'El Loco' was obviously proud of this experiment, in a way reminiscent of our biological science colleagues. 'I'll castrate anyone who touches these potatoes', he scolded while waving a large machete. Experimentation for 'El Loco' was obviously serious business.

'El Loco' was one of the more extreme cases we encountered, but he was not the only farmer in the Chanchamayo who experimented with potatoes. In fact, our 1980 survey revealed that 90 per cent of all settler farmers of the upper Chanchamayo were avid experimenters. Perhaps some were more active than others, but virtually all conducted *pruebas* or trials, particularly with the potato. Although the Chanchamayo is an in-migrant zone, which links two major climatic zones and agricultural systems (highlands and lowland jungle) and therefore particularly conducive to farmer-based experimentation, evidence is now

rapidly accumulating that small-scale producers of the Andes and elsewhere in the world are systematic, folk scientists in the creation of their own indigenous technologies or in the testing of introduced techniques (Chambers, Pacey and Thrupp 1989; Rhoades 1987).

The objectives of this chapter are three-fold:

- to discuss farmer experimentation as revealed in the literature;
- to analyse case studies of different kinds of farm experimentation with potatoes in Peru; and
- to draw out the implications of this farmer-based research for scientists.

We will deal only slightly with the actual design, method and underlying epistemologies involved in farmer experimentation. The data for this chapter were collected as a by-product of several independent studies of potato production in Peru, in particular, an agrarian ecological study of the Chanchamayo Valley and adjacent higher lying communities of Peru's *ceja de selva* (Rhoades and Recharte n.d.; Recharte 1981; Bebbington 1988). At the time of data collection, we were impressed by, but not fully aware of, the significance of widespread experimentation by farmers.

Farmers as experimenters: what the literature tells us

In the vast literature on agricultural development, almost no attention has been given to farmers as active experimenters or innovators in their own right (Rhoades 1987). Farmers have been primarily seen as adopters of technologies introduced from the outside, but not as creators of their own solutions (*see* the 1962 diffusion/adoption literature of the E. Rogers' School of Rural Sociology). The image we have come to accept is that peasant agriculture is stagnant and impetus for change must come from extraneous credit, education, and new technologies (Schultz 1964). Peasants, although seen as rational actors in a constrained circumstance, have been portrayed as shackled by low state investment in agriculture, by traditional culture, or by a marginal environment. Any innovations or technological breakthroughs made by farmers on their own were thought to be accidental and to have developed unsystematically through trial and error.

A small but growing literature challenges this view of the passive, small-scale producer in developing countries. Carl Sauer (1969) was an early proponent of the inventiveness of such farmers. He based his arguments both upon Latin American fieldwork and deductions about the origins of agriculture – deductions that drew explicitly on the idea that proto-farmers with spare time would have been interested experimenters, who based their projects on their observations of the local ecology. Also in the cultural-historical/cultural-ecological vein, discussions of the pioneer experience at the frontier have documented conscious experimentation by farmers encountering new environments (*e.g.* Thompson 1973). For Thompson such experimentation is part of the process of ecological adaptation (1973: 14–15). Turner (1961: 3) also implies that this process of learning a new ecology – as 'Little by little...[the colonist]...transforms the wilderness' – is part of the essence of the frontier experience.

A more explicit discussion of farmer creativity is offered in the seminal article of anthropologist Allen Johnson (1972). He points to discrepancies between his, Harold Conklin's (1957) and others' observations in the field and anthropological assumptions about culture-bound farmers who blindly follow the dictates of cultural traditions. Rather than pursuing time-tested rules, Johnson's evidence suggests that farmers act creatively and individually. He argues that, like biological evolution, cultural evolution (including agricultural change) also requires individual variation and adaptation (*see* also Denevan 1983). In a later article, Stephen Biggs and Edward Clay (1981) drew an important distinction between informal and formal research and development systems. In the informal system, farmers engage in indigenous experimentation and purposive selection in a continuous process of innovation. The advantage 'lies in the users of the technology innovating to meet their own needs by drawing on detailed knowledge of their environment and exploiting the opportunities offered by natural selection' (Biggs and Clay 1981: 325). The generator and user is therefore the same. The problems of communication and relevancy are greatly diminished.

In a workshop held in 1987 at the Institute of Development Studies (U.K.), the 'farmer as experimenter' was more fully developed in a series of papers (Rhoades 1987; Richards 1987; Box 1987; Edwards 1987). Rhoades (1987) and Richards (1987) argue that the archaeological and historical record show a long string of important agricultural technology breakthroughs made by farmers in traditional societies, although their rapidity and diffusion might have been slower than innovations in modern agricultural science.

Rhoades (1987) further posits that a scientific method, broadly defined, is followed by experimenting farmers. This notion was developed earlier in the writings of Claude Lévi-Strauss (1966: 14) who, in commenting on humankind's great achievements including the development of agriculture and domestication of animals, noted: 'Each of these techniques assumes centuries of active and methodical observation, of bold hypothesis testing by means of endlessly repeated experiments.' Lévi-Strauss readily admits that the peasants *science of the concrete*' as opposed to scientists' *science of the abstract*, as in the natural sciences, represent different levels of science. However, the science of the concrete is 'no less scientific and its results no less genuine. They were secured ten thousand years earlier and still remain at the basis of our own civilisation' (Lévi-Strauss 1966: 16).

Howes and Chambers (1979), in contrasting Indigenous Technical Knowledge (ITK) and Institutionally Organised Science, also stress that: 'the mode of ITK is concrete, not abstract' (see Farrington and Martin 1987). Indeed, conditions inherent in farm reality may limit the relevance of abstract 'basic' science while enhancing the power of concrete, 'applied' science. Potato scientists, for example, study 'how potatoes grow' (physiological changes, tuber formation, and nutrient uptake), but they may not know 'how to grow potatoes.' Furthermore, scientists, out of touch with farm reality, may not know how to transform their important knowledge of 'how potatoes grow' into practical knowledge of actually growing potatoes. Farmers, on the other hand, are often experts in growing potatoes, but could not necessarily explain scientifically the basis of that growth. However, they may advance lay explanations of crop performance. The trick is to link productively the two levels of 'science.' Dovetailing indigenous farmers' experiments with scientists' experiments is one option to improve the generation and transfer of appropriate technologies for traditional agriculture.

Given the paucity of research on how and why farmers experiment, this chapter attempts to examine from a critical perspective farmer's experimentation in three situations in Peru: (1) a traditional potato producing zone, the highlands above 2,500 m above sea level; (2) a hot, humid non-traditional potato zone, below 2,000 m above seal level, where the crop meets its environmental limits; and (3) a district where farmer experimentation succeeded beyond scientific and governmental imagination. The third situation illustrates both the great potential as well as the risks inherent in indigenous farmer's experimentation. It further shows how the learning process stimulated through experimentation will be tested against and brought back in line with broader ecological and economic realities.

Farmer experimentation in two Peruvian potato production zones

Experiments in the traditional zone The mountains of the Peruvian Andes, flanked by a rainless arid coast on the west and the humid, Amazon jungle on the east, are one of the earth's ecologically-diverse regions. As one of the great centres of plant genetic diversity and crop evolution (Vavilov 1949), this region still sustains wild species and land races of the potato, sweet potato, lima bean, tomato, sea island cotton, papaya, and tobacco, along with dozens of minor crops. Over the centuries, Andean women and men have experimented with and manipulated these plants so that both plants and people are interdependent for survival (Gade 1975).

Among the world's most experienced potato farmers and consumers are found in Peruvian communities located between 2500 and 4500 m above sea level. Both cash income and household consumption depend on the hardy potato crop more than any other. Since the Andean potato production system is both ancient and well-defined, experimentation rarely takes on a radical character. Three kinds of experiments with potatoes can be identified:

- curiosity experiments;
- problem-solving experiments;
- adaptation experiments.

Curiosity experiments Farmers, like most people, are curious. Indeed, Sauer (1969) identified such curiosity as a crucial factor in the original development of agriculture. He argues that populations, in stress-free environments and with time on their hands, would use that time to identify patterns of plant growth, experiment, and ultimately plant crops they had gathered previously. Farmers commonly set up a simple experiment to test an idea that comes to mind. These experiments may or may not have an immediate practical end. CIP anthropologist Gordon Prain (personal communication) tells of a farmer in the village of Chicche in Mantaro Valley who developed the hypothesis that cultivars expressing apical dominance would yield fewer but larger tubers, which would bring a better price, than cultivars without apical dominance, which have more shoots, but smaller tubers at maturity. To test this hypothesis, he has now planted two rows in his country yard garden: one row with apical dominance and the other row without. Although this experiment may ultimately have a practical end, it was stimulated fundamentally by curiosity.

Another example of the curiosity experiment is the planting of true botanical potato seed by farmers. Potatoes are almost universally planted using tubers or cut 'eyes,' and very rarely by true botanical seed produced by flowering cultivars. However, the authors have observed experimental plantings with true seeds along the shores of Lake Titicaca in Southern Peru. Farmers, and sometimes their children, who guard the fields over long periods, select out true seed balls, carefully separate the seeds, and then plant them in small, well-prepared beds near their guard huts. Such experimentation may arise out of boredom, but basic curiosity is the driving force. In similar vein, Christine Franquemont (1987: 3, 5) has described the experiments of *a highly skilled plant specialist*, Don Eugenio Aucapuma, of Chincheros, Cusco. Don Eugenio uses true botanical seed in experiments aimed at isolating new varieties of potato and improving existing varieties. One variety he developed has become widely used throughout Southern Peru. In fact, Carlos Ochoa (personal communication) posits that the continuing experimentation of farmers with true botanical seeds, which are sexually instead of clonally reproduced, explains in part the great genetic diversity of potatoes in the Andes.

Problem-solving experiments Farmers are keen to seek practical solutions to old and new problems through experimentation. In fact, propensity to experiment and try new ideas may be more pronounced in areas of diversified agriculture and poor extension services than in developed countries with less diversification and excellent research and extension facilities. Farmers' experimentation attempts to overcome recent perceived increases in insect damage in the Andean region provide cases in point. For example, increased attacks of the Andean weevil *(gorgojo de los Andes)* in improved potatoes led farmers to test effects of sunlight on seed. They spread potatoes to be used for seed in direct sunlight for short periods (Gordon Prain, personal communication). The effect was to drive the worm from the tubers. Tests are always done first on a small scale and later amplified if successful.

Farmers frequently develop ideas for experimentation that seem strange to scientists (Gupta 1987). For example, in adoption of diffused light potato stores, farmers often insisted that diffused light increased the incidence of the tuber moth pest *(Phthorimaea operculella)* in their stores. Since no scientific explanation for this observation had been developed, the suggestion was written off by scientists as absurd or more flippantly as 'now-they-can-see-the-tuber-moth, before-they-could-not.' However, scientists now suspect that the ecology of tuber moth may after all be tied to different intensities of light and darkness. After continued problems with tuber moth, scientific research verified farmers' observation that tuber moth does increase under diffused light conditions (Parker 1980–81: 35).

In the Guatemalan Highlands, farmers have difficulty with another pest, the aphid *(Myzus persicae)*. Through careful observation several farmers observed that aphids are attracted to green but not to red sprouts on potatoes. They were curious if colour attraction exists. Their pleas with local researchers to conduct experiments on this simple idea fell on deaf ears. So, farmers themselves designed experiments with small numbers of tubers. They insisted that their research showed the green aphid preferred green sprouts. The farmers concluded that one way to control aphids is to select red- or purple-sprouting potatoes (Rhoades 1986).

Farmers have two major advantages over agricultural scientists with regard to problem-solving experiments. First, due to the large numbers of farmers and their constant presence in the field, they have a greater opportunity to observe plants and the environment. On the contrary, most scientists spend much of their time at a desk or in a laboratory. Second, farmers are in a better position to determine which problems affect them directly and therefore to assist in guiding research directed toward solutions (Rhoades and Booth 1982; Lightfoot 1987; Ashby 1984). This advantage of farmers, when combined with the power of the natural sciences to trace connections and order data not visible to the human eye, can help us shape a new approach to experimental agricultural research (Richards 1985).

Adaptation experiments Adaptation experiments are conducted by farmers after they acquire a new technology, or after they have observed a new technology demonstrated elsewhere (for example, in another farmer's field, or in an extension service demonstration plot). Such experiments can occur in three contexts:

- when farmers are testing an unknown component technology within a known physical environment;
- when farmers are testing a known technology within an unknown environment, such as a zone of colonisation;
- when testing an unknown technology in an unknown environment.

Farmers expect experiments to answer such questions as:

- Does the technology work?
- How can it be fitted into the existing production-utilisation system?
- Is it profitable? (in cases of commercial markets)

Before they work out the economics, however, they must answer the first two questions.

Farmers' selection and use of new cultivars are a case in point. In the potato production zones of the Andes, the most intense interest in experimentation revolves around new cultivars. Planting of new cultivars, however, sets in motion a number of experiments on best use of the cultivars in specific locations (farmers generally plant in several agricultural zones and at different times in the production cycle). Because the Highland zone is where potatoes do best, experiments are aimed at discovering which cultivar does better than another, given the ever changing disease and climatic conditions.

Highland potato farmers realise that a broad genetic base of potatoes must be maintained, given the diversity of planting situations and potential risks (Brush *et al.* 1981). They do this through maintenance of individually-held 'germplasm banks,' generally consisting of six to seven varieties (Rhoades 1987). Whenever possible, either on trips or when government agronomists/extension personnel visit villages, farmers try to pick up an additional tuber or two. The 'reserve' potatoes are grown on a small-scale, while the majority of fields is sown to two or three 'proven' cultivars. Once a new cultivar is obtained, a few tubers are planted by farmers in a kitchen garden or a short row along a field boundary. This simple experiment they call a *prueba*, or trial.

Throughout the growing season, farmers monitor carefully the growth and performance of the new cultivar. If the farmer likes what he sees, then he amplifies production, restricted, of course, by the amount of seed available. Depending on the market and seed supply, they will put more and more of their land to the new cultivar. In the meantime, they maintain and replenish their 'germplasm' banks. Tubers will be counted, storability observed, processing qualities tested, culinary quality tasted, and so on. The storehouse of knowledge about cultivars is built up through such experimentation, giving farmers the ability to talk for hours about the pros and cons of different cultivars.

Another well-documented example of adaptation experiments by farmers is the well-known case of diffused light potato storage (Rhoades and Booth 1982). The basic principle that diffused light storage of potatoes, as opposed to dark storage, inhibits sprout elongation and improves overall seed quality was promoted by the International Potato Centre as a low cost solution to potato seed storage. Model demonstration stores were developed by over 25 national programs and introduced to thousands of farmers. Farmers exposed to the idea rarely copied the 'model'; rather, they adapted the principle of using diffused light to their own conditions, cultural preferences, and budgets (Rhoades and Booth 1982). Few farmers in the first year stored all of their potatoes in diffused light, preferring to test the idea on their own terms first. These initial experiments often consisted of placing a few tubers on a window sill just to see if the principle actually worked.

Experiments in the non-traditional potato zone

Peru's *ceja de selva* ('eyebrow of the jungle') is a tropical hill zone (also called the *montaña*), which links the high Andes with the lower Amazon Basin. Highland Indian and *mestizo* populations are colonising these lower elevations. Across Peru's high jungle zone, tens of thousands of settlers, such as 'El Loco,' the farmer we mentioned in the introduction of this chapter, carry out systematic experiments in an effort to define for themselves an appropriate land use and cropping patterns which will best provide for their needs. These experiments are similar in form to the literally thousands of experiments which have been conducted by farmers throughout the ages. Colonists of the high jungle bring with them their own agricultural systems/technologies and food habits to a new environment which must be understood and ultimately mastered. Experimentation, defined by Webster's Dictionary as: 'any action or process designed to find out whether something is effective, workable, or valid', is one of the fundamental strategies involved in the settlers' attempt to learn about and control their environment.

Two agroecological aspects of the Chanchamayo make it conducive for experimentation by farmers. First, the tropical hill zone is a major ecotone ('transition between two major biomes or vegetation communities') linking the Highlands and the Lowlands (see Rhoades 1978). This means that both Highland and lowland crops reach their effective limits around 1500 m (*i.e.* Highland crops, such as the potato, face more difficult growing conditions while lowland plants such as the banana or cassava face the same). Second, migrants from the Highlands come to the jungle area for land and the possibility of establishing a small plantation, primarily of coffee, tropical fruits, or coca. While their plantations are becoming established, farmers attempt, as much as possible, not only to grow their own subsistence food but also to replicate their Highland diets. Without potato, like bread in Europe or rice in Asia, the Highlander's meal is considered incomplete.

Because potatoes are relatively expensive in the local Chanchamayo market, farmers are keen to grow their own. For these reasons, experimentation with potatoes occurs on a widespread scale among Highland farmers inhabiting the ecological zone between 1000 and 1800 m. Virtually every farmer we interviewed in 1980 and living in this zone had experimented with potatoes over several seasons (Rhoades and Recharte, n.d.). Many had given up, but newcomers always tried their luck. Settlers from the Highlands, compared with farmers who have been in the area for many decades, did not initially carry with them the belief that potatoes could not be produced. In this regard, their innocence of possibilities is one of the positive points favouring creative experimentation.

Experiments in this transition zone are adaptation experiments with a crop or technology in a non-traditional environment. The challenge in this case is not to learn how a new technology fits a known system (*e.g.* new cultivars in the Highlands), but to adapt a known component or crop to an unknown environment and system. The immigrants have a knowledge of potato production but not of the new environment in which the new form of production is to take place.

The 15-member Colquechagua family, which resides in the high zone of the Colorado River, one of the tributaries of the Chanchamayo River, is a good example of how a household experiments. Among their subsistence goals is to produce enough vegetables on their land so they do not have to buy at the local market. Experimentation follows a 'start slowly, start small' pattern. They bring back from their Highland communities a few small sacks of the seed they want to try. In the first year, they brought approximately ten potato varieties: *Mariva*, *Revolucion*, *Renacimiento*, *Yungay*, *Huayro*, *Huamantay*, and several cultivars of a native type called *chaucha*. The first year they planted only a few kilos of each.

Gradually, they eliminated varieties which did not do well while doubling the amount of seed planted in the more adapted cultivars. During the first year, all *chaucha* varieties were eliminated due to their susceptibility to late blight (*Phytophtora infestans*). In the second season, *Huayro* and *Huamantay* were eliminated. This left only 'hybrids' among which two varieties, *Mariva* and *Yungay*, yielded best. After four years of experimentation, they were relying mainly on the variety *Mariva*. Small-scale experiments continued each year with newly-acquired varieties.

In addition to cultivar testing, the Colquechagua family experimented with different periods of planting. They first tried the schedule of the *sierra* planting calendar; then, they shifted to the drier season schedule. Mental notes were kept on performance, attacks of disease, insects, and rotations. Over time and with experience, they learned where and when the crop performs best.

When farmers' experiments succeed: a case study of agricultural change

Indigenous experimentation reflects important areas of interest to farmers. However, experimentation is only one part of the on-going learning process required by the farming enterprise. Adaptation to the farming environment is a continuous process with no given end-point (Bebbington 1988; Ellen 1982).

The purpose of this last section is to place experimentation within this larger context of technological change. It illustrates how perception of the environment, individual innovation, and experimentation can interact to bring about rapid technological change. However, for an experiment to be successful, the resulting innovations must survive longer-term changes. The following case traces experimentation of farmers and its subsequent impact in Oxapampa, a district located just to the north of the Chanchamayo Valley in the same high jungle ecological zone, although slightly higher in elevation. Farmers from the Highlands, who are called *serranos*, have been migrating into Oxapampa, bringing with them their 'cultural baggage' which includes beliefs about what foods taste best and what they might be able to grow. Like the Chanchamayo, therefore, Oxapampa has been a zone of intense experimentation by in-migrants.

Located at an altitude of 1800–1850 m in the valley floor, the climatic and ecological context of Oxapampa is, however, peculiarly two-faced for potato cultivation. The high rainfall and warm temperatures are extremely conducive for late blight *(Phytophtora infestans)*, a fungus capable of destroying the crop within a couple of days after summer rains if fungicides are not applied immediately. This rainfall can also be very variable from year to year (1250–3000 mm) and from month to month, and summer drought can hinder production. On the other hand, warm conditions and relatively fertile soils mean that an adapted potato or one grown under environmentally altered conditions could produce high yields in a cultivation period a month faster than in the Highlands. Return on production investment could theoretically occur in a very short time and deliver high profits.

The idea for developing potato production in Oxapampa was fostered among the *serranos*, the ethnic group culturally disposed to the crop, but not among the older settlers of European descent or the native Amuesha Indians of the region. Unlike the latter, migrants from the *sierra* were not psychologically constrained in their image of what cropping patterns were possible. Before the 1970s, potato production had been largely confined to small gardens for home consumption, but, as more and more settlers arrived from the Highlands, experiments with the crop proliferated. As in the Chanchamayo, production failed and migrants returned to the Highlands after using methods, particularly the use of planting cycles, that were appropriate for the sierra but not the high jungle. Those who stayed, however, continued to experiment with different techniques to grow their beloved potato.

In the early years of innovation, information on the results of these experiments was constantly exchanged among these Highland settlers, although, as in the Chanchamayo, no set ideal on how to cultivate potato evolved. An important figure in these patterns of information exchange was one enterprising, experimenting Highlander who served as information broker for the idea of expanded potato production. He first became a district-wide source of expertise for Highland migrants and later for the established European settlers of the region. The farmers he advised experimented consciously with cultivars of seed, types and methods of fertilization and pest control, and devised agronomic strategies that gave notable increases in yields. Because the yield increases provided visible proof of the technical feasibility of commercial production, such experiments by farmers became an important forerunner to the rapid expansion of potato cultivation that was to occur in the 1980s.

Contacts between this Highland group and the earlier colonists of European and *mestizo* descent were, however, limited and during the initial stages of experimentation the exchange of information about potato cultivation remained confined largely to the poor in-migrant group which had little ability to expand production. This began to change as innovators more socially accessible to the wealthier farmers of *mestizo* and European descent helped promote the idea of potato cultivation among this group. One such innovating unit was one migrant and his German-descended Oxapampina wife who, after planting smaller experimental plots in 1981 and 1982, planted over 20 ha in 1983. Together, these yielded remarkable profits that helped them purchase a house, car and tractor.

This evidence of the potential profitability of the potato, along with the decision of the Peruvian Agrarian Bank to lend money freely for potato production and the visits of Lima wholesale merchants to purchase potato, removed psychological, credit and demand constraints to expanded production. In sum, this prompted an explosion of potato cultivation in 1984 (Figure 22.1). This increase reflected both the entry of new producers, and the expanded acreages of existing producers. The former lacked experience on crop production and the latter entered domains for which their experiments had not prepared them. All were building on accumulated stocks of knowledge generated from experience of the economic and ecological environment, as it had been encountered up to 1984. There was no reason to expect that this experience included all pertinent dimensions of environmental variability. Moreover, should problems arise, there was no strong institutional support and assistance outside the farmers' community. Staff of the extension services and the agrarian bank and local agro-chemical dealers had little experience regarding the crop, especially in the ecological context.

All this added up to a vulnerable regional production system about which prior experimentation, although showing the technical feasibility of potato cultivation, had not taught farmers everything – in particular, the constraints and complexities of the wider and longer term marketing and production environment in which they were operating. The events of 1984, however, did reveal these constraints and shattered this vulnerable system. Three particular problems, not experienced beforehand, arose that year (Bebbington 1988):

- A late rainy season and wet summer brought severe late blight and tuber-rot problems, fungicide costs soaring as a consequence;
- The labour supply required to apply fungicides to such a large area immediately after the rains was not available when needed;
- As production costs rose, potato prices in Lima collapsed unexpectedly.

In the end, farmers suffered the worst possible combination of high production costs, low prices, and reduced yields (BAP, 1984). Fields went unharvested and widespread bankruptcy occurred. The number of ha in potatoes dropped drastically (see Figure 22.1). Farmers subsequently shifted back to livestock management and lower input, lower risk crops such as maize and beans. Today, a vastly reduced number of farmers in Oxapampa still try to produce potatoes, but with a seasoned knowledge of the technical, ecological and economic context in which they operate.

The relevance of the Oxapampa potato experience lies in its warning that experiments are only a part of the larger learning process in agricultural change. Experiments are capable of altering how a human population perceives and acts upon a farming environment, but experiments alone cannot provide the knowledge needed to implement new innovations successfully. Experimentation occurs in an economic environment that exists beyond the farm gate. This environment not only has a temporality and variability that the farmer cannot control, but also takes on new characteristics as the innovation is more widely adopted. Furthermore, experimentation occurs in an ecological context, which also has dimensions of variability and whose periodicity exceeds the time during which initial experiments were undertaken.

This is equally true of experiments or demonstrations organised by agricultural research scientists. All too often, the experiment becomes, in formal research and development, both an end in itself or, if successful, a model upon which farmers and extension agents are expected to act. This, like potato production in Oxapampa, is 'risky business'. Experiments are the seeds of change but they are not the final harvest. Experimental research must be kept in this broader perspective.

Conclusions

Recent years have witnessed both academics and practitioners lauding and describing, farmers' knowledge (Brokensha *et al.* 1980; Barker *et al.* 1977;

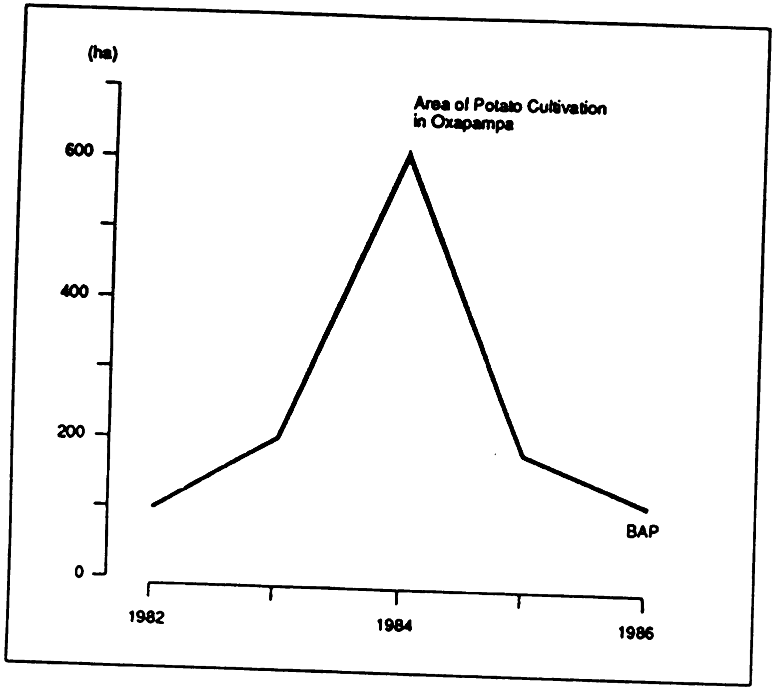

Figure 22.1: *Area of Potato Cultivation in Oxapampa*
Source: BAP (Banco Agrario del Peru), various years.
Note: 1986 area 10 July only.

Richards 1985), and making claims about the propensity of farmers to conduct experiments. However, the second claim has not been well-documented. In this chapter, we have offered empirical evidence of this propensity, and have suggested its almost ubiquity and irrepressibility.

Our extended examples have been taken from areas of considerable change ('adaptation experiments'), but we have also documented experimentation in more stable environments ('curiosity experiments' and 'problem-solving experiments'). This illustrates that such 'research' is not only the preserve of the colonist, migrant or recipient of a new technology.

The examples suggest that there is a thriving 'people's scientific community' 'out there,' parallel to the community of formal agricultural scientists. Not all – but definitely much – of the knowledge or endeavour of the 'people's scientific community' is necessarily useful. The knowledge, and the willingness and ability to pursue it, together constitute a great resource with which agricultural science should engage. With Lightfoot *et al.* (1987), we therefore suggest that scientists should conduct cooperative research with farmers on technical issues by letting farmers participate in and, in many cases, lead experimental strategies. This is what Biggs and Clay (1989) termed a *collegial* type of farmer participation.

We dealt little with the actual design of farmers' experiments, or comparisons between them and those of formal science. Unlike scientists, farmers show limited concern with statistical proof and complicated replication. In general, their social and ecological context does not allow this. While they will conduct comparative treatments in one season, they will deal with replication by conducting experiments across several seasons. Moreover, while scientists tend to think in terms of generalisable results and laws (Norgaard 1984), we suspect farmers are much more sceptical of extrapolation and their knowledge remains more location-specific. These comments raise questions about the relationship between material context, epistemology, and experimental method.

While the discussion has been pitched primarily at the level of the experiment itself, the example from Oxapampa shows clearly that experimentation should be seen conceptually as part of a larger process. It is by experimenting that farmers learn about new environments, changing environments, and new technologies. Experimenting is thus part of a goal-oriented adaptation strategy. Nonetheless, because the social, economic and ecological environment is always changing (sometimes due to the very process of experimentation), these goals are rarely reached, and never maintained for long. As environment changes, new experiments are conducted. Thus, experimentation is just part of a broader process of agricultural change. This is true of experiments conducted not only on the farm, but those at the research station as well.

Note

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VI. KNOWLEDGE, NETWORKS AND CULTIVATORS: CASSAVA IN THE DOMINICAN REPUBLIC

Louk Box

The social structure of agricultural knowledge can be studied in a variety of ways. In this chapter I look at agricultural knowledge from the point of view that it is, to a large extent, generated by farmers or cultivators (and not by researchers), and that it is transferred through cultivator and trader networks (and not only through extension systems). I also argue that formal interfaces between parties, instead of permitting, often inhibit the flow of knowledge. This is the reason for structural ignorance among the different parties engaged in agricultural knowledge creation and distribution. These ideas are tested against a case study of cassava production in the Dominican Republic.

High in the sierra region of the Dominican Republic, cassava has been cultivated for hundreds of years: first by occasional Taino indians, then by adventurers leaving the rich Cibao valley; then at the beginning of this century by forest workers and occasional settlers practising "subsistence" farming; and now by smallholders who scarcely make a living out of cultivating the steep hills with this poor man's crop.

When I first came to the sierra in 1979, there was only one main road through the area. Transport was mainly by mule. In the thirties, communication had been easier; forest exploitation was in full swing then. But, by 1979, there were no roads to speak of in the higher areas, few shops, no facilities. Consequently, the State was almost absent: no police, no health officials and no extensionists. By 1985 this had all changed. A minor army of officials had descended upon the region; clinics had been established, regional extension offices furnished, researchers doing their inevitable surveys and government-assisted farmers' organizations struggling on.

Cassava continued to be cultivated as it had always been, or so it seemed to the occasional observer. Shifting cultivation seemed to be the main cropping system; according to researchers and extensionists, varieties were all "traditional". Processing was basically done as the Tainos did it; cassava was rasped and pressed to eliminate the toxic prussic acid. It was then baked into casabe or cassava flatcakes!

Officials had done quite a lot to improve cropping, processing and marketing. They had furnished advice through extensionists, had established a processing centre and the State Marketing Board made a contract to buy casabe. But by 1988 the cultivators had not followed the advice of the extensionists; they had not constructed the recommended infrastructure in their fields to reduce erosion, had not adopted the new varieties coming from an international research centre, and could not sell their cassava to the processing centre established by the State. In one word, stagnation.

Between 1979 and 1985, fieldwork was carried out in the sierra by a team of sociologists and agronomists. They observed cultivation practices and discussed these with cultivators, extensionists, researchers, traders and agrobureaucrats. Various case studies and surveys were executed involving these four parties.

In this chapter an analysis is made allowing a greater understanding of what went wrong at the interface between these parties. The analysis focuses on the notion that guided change in cultural practices depends on knowledge network articulation. Three points are stressed:

1. the complexity of knowledge networks, so easily disregarded when using the term "knowledge system" (Röling 1985);
2. the diversity of world views among those engaged in transforming cassava cultivation patterns, resulting in the saddening experiences described above;
3. the role of the sociologist in creating interfaces between these worlds of cultivators, traders, extensionists, researchers and bureaucrats.

Knowledge, networks and systems

The term "knowledge system" is used in variety of ways in the literature. Röling (1985, 1987), following Nagel (1980), assumes that an overall structure exists by referring to research, extension and education as "subsystems". The users, in this view, form a subsystem as well. But do they really? Users may only be called a subsystem if stable relations exist among individual users, and among them and the other "subsystems". Given the fact that one of the key problems in extension science is exactly the lack of communication between different parties, such relations may not be assumed.

When I use the term knowledge system, I will use it in a limited sense to refer exclusively to a model we have in our heads regarding knowledge exchanges through social networks in a particular realm of human activity. I stress the element of "model" to prevent confusion with other system definitions which refer to actual reality as such, as in "a computer system". Rather the notion of social networks (Mitchell, 1969) is stressed, or the chains of interactions and communications linking actors in a realm of human activity. The term "interface" was suggested by Norman Long (1984:10), who points out that it "suggests some kind of face-to-face encounter between individuals or units representing different interests and backed by different resources." In this chapter, I take it to refer to the sets of interactions and communications between actors involved in different knowledge networks. The linkage (or lack of it) of such networks is a profitable field of study, as other studies in this book show.

My conclusion is simple: the case of Dominican cassava cultivation shows that knowledge networks are highly segmented. They are, like the sierra landscape with its cleavages, holding communities apart. Instead of one knowledge system there are many complex networks, which lack articulation among each other. The life-worlds of the participants, or their values, norms and interests, differ so greatly that they do not allow for communication and interaction between parties. Sociologists may play a part in the articulation of the networks; thus sociological research can in fact be seen as part of such "networking".

This perspective is in line with authors who stress the important role of farmers or cultivators in the generation of technology (De Schlippe, 1957; Hill, 1970, Johnson, 1972; for recent studies see

Brammer, 1980, Brokensha, 1980, Chambers, 1983, Hildebrand, 1984, Kurin, 1983, and Richards, 1984, 1987). Cultivators are not viewed merely as "users" or consumers of technology generated by others, but rather as essential contributors to technological change, not as the reproducers of traditional lore, but as partners in agricultural experimentation. When I started my research in 1979, however, these notions were so uncommon that I found it hard to get acceptance among fellow agricultural scientists ("peasants do not experiment") and among fellow researchers in the Dominican Republic ("peasants are traditional"). Nevertheless, I designed the research with the following ideas in mind:

- cultivators experiment
- these experiments are indicative of agrarian change
- the direction of change indicates farmer problems
- problem definitions can be used to define researchable questions
- research questions and results can thus be translated back again to interested cultivators through the elaborate formal networks of research, extension and planning agencies.

The method: adaptive networking

Before showing the differences between the worlds of cultivators and others, a brief description of the method is necessary. In essence, the method is based on the premise that the respective world views (with regard to cassava production) need to be defined before the differences can be demonstrated to parties, and subsequently overcome. Researchers and extensionists are hardly aware of the differences in problem perception existing among them. Cultivators may be aware of the differences between themselves and the "technicians" but most of the time are not aware of different problem perceptions among themselves. One of the first tasks of the sociologist, therefore, is to establish these differences, so that the parties become aware of them.

The approach adopted was to follow step-by-step the different networks existing among cassava cultivators and the other parties involved. The team started in 1979 with the researchers, who in turn indicated national and local agricultural officials with whom they worked. Through them, the leaders of two farmers' federations were

contacted; one federation in the mountain region and the other in the valley. In this way, comparisons could be made between a marginal hill area with petty commodity production and a fairly rich valley area, in which capitalist agriculture dominated. The two federations formed the base for the research: everything was done with and through them. It was felt that they were the prime information base and would profit most from the research. In other words, they provided the network, and the team wished to contribute its knowledge through it to cassava cultivators.

"Networking" might therefore be considered as the central concept around which I designed the research. The team profited from the existing networks; ultimately it hoped that local networks would be strengthened through the research results.

The phases of the research can be summarized as follows:

- reconnaissance to identify the main parties in existing cassava knowledge networks, through unstructured interviews, establishing contact with the main networks among cultivators, extensionists, researchers, officials and traders or processors;
- informant inventory, through semi-structured interviews with key informants in different communities, providing insight into the structure of the network through which new knowledge on cassava was exchanged;
- informant selection, through a simple test of their knowledge (of cassava varieties), their history with experimentation, their capacity to verbalize, and their availability for further interviews and adaptive trials;
- identification of ongoing cultivator experiments, through case studies on informants. This led to identification of problem areas faced by cultivators and to suggestions for further agronomic research (adaptive field and station trials) as well as quantitative socio-economic research (surveys);
- adaptive trials on intercropping, erosion control, root rot and stake planting position in both research areas in order to test particular cultivator or researcher strategies;
- surveys among the cassava cultivators in the two areas studied to test the preliminary conclusions we had drawn from the case studies;

- interviews with the other parties: researchers, extensionists, officials, traders and processors, and bank officials. This allows for comparisons of cultivator and other networks, and for discovering to what extent one "cassava knowledge system" exists;
- group meetings with informants, groups of cultivators, associations, federations, extensionists, researchers to test individual conclusions. The research was concluded with a seminar bringing together, for the first time, experimenting farmers with the other parties.

Adaptive networking, then, shifted its emphasis during the course of the research. At the outset it entailed tracking interaction and communication chains. Later it came to mean: testing preliminary conclusions with the individual, his or her peer group, farmers' association or federation, and ultimately the other parties. And towards the end of the research it meant: feeding information back into the networks, showing the parties the differences in world views existing between them and attempting to generate further integration between networks.

The parties and the networks

The 360 people who cooperated with this study had only one thing in common: their interest in cassava. They belonged to different social classes, manifested contrasting life styles and came from different generations and different geographical areas. They had different interests, or belonged to different "parties" in the game of agrarian change; accordingly they interacted and communicated with different actors, or shared in different networks of agricultural knowledge. Most of them never met, although a number did as a result of our research. Yet evidence emerged that the chains of interaction and communication did intersect. Those actors involved in the formal institutions of research, extension and banking were at least aware of each others' presence: but even here their relations proved to be limited.

Cassava cultivators: adaptive craftsmen

Cassava is a poor man's crop: cultivated by poor people, on poor lands, for poor consumers. This is true for the Dominican Republic, as it is true for the other main producer countries, such as Brazil, Zaire or Indonesia (Cock, 1985).

Who are these cultivators? For the purpose of the present study, they are cultivators growing at least a quarter of an acre of cassava in 1981 in the main production areas of Moca and Monción. Moca, the centre of sweet cassava production for national markets and for some export, is located in the rich Cibao Valley characterized by capitalist relations of production. In Monción, bitter cassava is primarily grown for national processing and subsequent marketing and also for export of casabe to the Dominican community in New York. It is located in the poor sierra hill region (see Crouch, 1981).

The cultivators are generally old and poor. In the valley area of Moca more than half of our respondents were over 55 years old. In the sierra region of Monción cultivators tended to be younger, with a little less than half between 35 and 55. Average farm size was about 3 hectares in the valley, compared with 2 hectares in the hills, less than half of which was under cassava. One out of five respondents did not own any land at all.

For most of these cultivators cassava was the most important income generating crop. Most cultivators in the valley area used to grow the crop for both sale and subsistence, and still do so. In the hills, it was and still is a subsistence crop to most, although about one third of our respondents indicated that they grow it for sale to traders. Bitter cassava is almost exclusively for sale, the sweet variety for subsistence.

If these cultivators have a problem they cannot solve, they generally do not go to an official agency such as the extension service. As Brammer (1980:25) puts it, the "unofficial research network is overlooked by all except small farmers themselves." In fact less than 3 percent in the valley area, and only 6 percent in the hill area indicated they would consult extension personnel. Most resort to farmers' associations and traders. Does this mean then that they do not change their practices or varieties? No, they do so all the time. Moreover, our case studies indicated that experimenting cultivators maintained collections of up to 25 varieties, some old and some new, so as to test them under varying conditions. Our sample survey confirmed this experimentation. About half of our respondents had tested a new variety over the past five years. This indicated that experimentation occurred on a much wider scale than was hitherto supposed.

From the case studies we carried out (Box, 1984a) we learned that four concerns dominated this search for new varieties or cropping systems: the changing demand for cassava (from subsistence to market, and within the market to varieties which could be processed for export); the concern for a shorter maturation period, or the need for varieties with short production cycles; soil degradation, or varieties which tolerate poor soils; and lastly root deterioration through pre-harvest rot or other causes.

Cultivators carefully scanned new varieties in terms of these criteria. The corresponding changes were impressive. In the hill region, for example, a so-called "black" bitter variety, little known 10 years before, had taken over the area through intervention of traders who proved its value as a short-cycle, easily-marketable crop. This suggested that new varieties are transmitted through a network of local experimenting cultivators who are linked to small traders who, in turn, are linked to particular markets. It is significant to note that the dominant varieties in both regions are named after the small traders who also engaged in testing them (e.g. Facundo, a trader in the sierra and Zenon, a colleague working in the Cibao Valley).

The network could therefore be characterized as dynamic (50% of the respondents testing new varieties in the past five years), market oriented (most cassava being grown for markets), and without clear linkage to the formal institutional networks of research and extension (most cultivators did not communicate with extensionists). Cassava cultivators depend on themselves or on traders for new knowledge on what the market wants. They make changes continually; they are adaptive craftsmen at heart.

The world of researchers: risk avoidance

The researcher's world stands far apart from the cultivator's. Cassava researchers in the Dominican Republic are typically young (between 25

and 35 years of age), stem from urban backgrounds, and work within the state bureaucracy or affiliated research branches. Despite their comparative youth, they average about seven and a half years of research experience in the crop. They work in two research institutes, one in the south (Centro Sur de Desarrollo Agropecuario or CESDA) and the other in the rich agricultural area of the north (Centro Norte de Desarrollo Agropecuario, or CENDA). Cassava research has been going on for half a century in the country, ever since it was started by a private firm in the 1930's. It is notable that present-day cassava researchers do not refer in their articles to this research, even though quite interesting observations were made at the time. A study made of cassava research (Castellanos and Box, 1981) suggests in fact that there is little continuity in Dominican cassava research. Interviews in both institutes indicated that even within institutions research findings do not accumulate over time. Old information is not used and new information tends to get lost in archives. Publication of results hardly occurs and if this happens it is through non-national agencies like CIAT (International Centre for Tropical Agriculture in Cali, Colombia).

This leads to the interesting question of how researchers' networks are composed. Given the small number of informants, it is risky to make any generalizations. The differences are great: some researchers have intricate networks, articulated with cultivators, whilst others are mainly oriented to survival in a heavily politicized agrobureaucracy. Nevertheless, three generalizations might be made, regarding the researchers' networks: they are bureaucratic in character, have a very weak linkage with field extension and almost no linkage with cultivator networks.

Part of the reason for this may stem from the exclusive dependence on the huge state bureaucracy for funding. Centre directors spend a good deal of their working time visiting ministerial offices to try to obtain the money promised in their budgets. Networks develop around these contacts, and loyalties emerge. This type of funding leads to inflated personnel budgets, and leaves other items (operating funds, transport, publication) quite vulnerable to cuts. Researchers feel, therefore, that the publication of their findings is hampered and their results do not reach extensionists or farmers. Among those interviewed, the most frequent contacts mentioned were those with officials in the regional offices of the agrobureaucracy. If one clear strategy emerges from our interviews it is the linkage with state and local agrobureaucrats. Sometimes powerful farmers form part of these networks, and to this extent the networks are articulated with cultivators.

On the whole, researchers have little contact with farmers or their organizations. Various of them could not even indicate when they had last met with farmers' organizations or interest groups. Of five researchers interviewed, only one had been in contact with such groups over the past year. Part of the problem lies with low transportation budgets, prohibiting frequent field visits. But, whatever the cause, this suggests that researchers' problem definitions are not influenced by contacts with those who represent cultivators' interests.

There is also limited contact with other networks, like those of traders and of extensionists. On the national level, this communication gap has been the subject of many studies and critiques (ISNAR 1983; Marte, 1984:31-33). Three of our five cassava researchers had not had contact with any field extensionists at all over a three-month period. They did not listen to agricultural radio programmes either, which could have made them more aware of what types of messages were sent out by the extension service. Only one of them occasionally listened to these programmes to inform himself on topics of current interest among farmers.

It is perhaps due to this lack of contact that the priorities of researchers are different from those of the cultivators. We found that researchers considered the prime problems to be: the great diversity of existing varieties and their uncontrolled distribution (the exact condition for cultivator experimentation!); low market prices; lack of credit and lack of crop rotation. To tackle these problems, researchers primarily orient themselves to the testing of promising new varieties, brought from international centres such as CIAT. The researchers were quite satisfied with their contribution to crop development through these promising new varieties, four out of five indicating that such research had contributed to such technological changes. However, over the past decade, not a single foreign variety has in fact been adopted on any scale in the country. The only variety which seemed to have promise and was widely acclaimed by the researchers later turned out to be a complete failure (Box, 1982:42). Researchers tend to define the crop's problems in terms of the lack of new varieties and

the absence of disease control measures. This is the reason why we found that most of the ongoing studies were variety-oriented (Castellanos and Box, 1981). When we presented the researchers with problem areas as defined by cultivators, these were either redefined in terms of "modern versus traditional varieties" (i.e. foreign versus local germ-plasm) or were discarded as irrelevant. "Modern varieties" (implying high-yielding material, imported from abroad, generally requiring particular treatments) had no priority among the cultivators we interviewed; only 1 respondent out of 247 indicated a need for them.

A good example of alleged "irrelevant problems" was root deterioration, and the different forms under which this presented itself. Researchers were not aware of high cultivator losses due to root rot, and of a particular type of deterioration called **sancocho** or "cooking". Dominican farmers refer to sancocho when mature cassava roots are deteriorating after a mid-day rain on a heated soil. The roots then "stew" in the hot soil, and the root consistency changes. Researchers, however, disqualified sancocho as a legitimate cause for root deterioration and reference was made to cultivator ignorance (Naut and Box, 1984:26). It took three years of convincing, graphic examples of different forms of root deterioration and a reference in a CIAT manual, before the researchers would admit that the cultivators were right after all.

The world of the researchers may therefore be characterized by a focus on new varieties. Researchers define problems in terms of the solution they can provide, by acquiring foreign material through germplasm collections such as the one at CIAT. They do not have adequate communication with farmers or their interest groups so as to define research questions in terms of cultivators' problems. Moreover we noted that research has contributed very little to technological change in cassava cultivation. Due to a focus on modern (and foreign) technology, researchers seem to be excessively preoccupied with problems as defined abroad and far too little concerned with the results of experiments carried out locally (by peers or by cultivators).

Researchers' networks, therefore, lack dynamism and are State bureaucracy-oriented and not articulated with cultivator, field extensionist or trader networks. This results from a "professional" strategy characterized by risk avoidance, dependence on developments from abroad as far as technologies are concerned, and on developments in the agrobureaucracy for priority setting and funding. Accumulation of research findings hardly takes place in this context; and articulation with cultivator knowledge networks is unlikely to occur.

Extension: the broken bridge

Extensionists stand somewhere in between researchers and cultivators. This is an organizational cliché and a sociological problem. The problem is that these actors form an undefined social category and do not produce the "interface" that is often wished, assumed or simply posited in agrobureaucratic ideologies covering "rural development".

The 28 extensionists we interviewed were young (in their twenties), with a moderate (3-4 year) training in agronomy, poor wages (our "main problem", according to every single one of the respondents), and an almost exclusive dedication to cassava production. Although having quite varied backgrounds, two categories dominated:

- the recent college or university graduate with almost no experience, a minimal salary and a fair amount of ambition to move into the ("urban") bureaucratic hierarchy;
- the experienced extensionist, with a number of years in a number of assignments, a continuing minimal salary, and less hope that he can ever make it in the bureaucracy under the present domination of the political party.

Both categories would agree, however, that field extensionists working in cassava are poorly paid, work on a poor crop, and face poor prospects for a career. Better to work in rice, tomato or some other crop which shows rapid advance (in terms of financial gain for the cultivator and in status for the extensionist). The corresponding interests (and occupational strategies) result in networks which can be considered a mix of the ones we described for cultivators and researchers. They are partially bureaucratic and political, partially linked to private or farmer interests (traders, input-firms, farmer or tenant associations). They have a weak linkage with other State agencies and particular rural interest groups (such as wage labourers) and little articulation with researchers and their world of knowledge.

The views of extensionists form a curious mixture of the worlds they belong to. On the one hand, they ascribe to the view that cultivator ignorance and traditionalism are among the prime causes of the backwardness that Dominican agriculture finds itself in. Other factors mentioned are lack of mechanization and inadequate production conditions (Naut and Box, 1984:33). On the other hand, they depend on those same cultivators (and on input-firms) for their knowledge of the crop. When we asked for their most important source of information on cassava, 9 out of 28 referred to a fertilizer firm and 6 to the cultivators themselves. The local cassava programme coordinator came third with only 3 mentions. It is with this coordinator that researchers have their most important contacts.

The networks they maintain reflect these evaluations. Extensionists interact and communicate most with cultivators, their peers in the extension office and representatives of input-firms. They do not interact with land reform officials (71% never did), local agricultural credit officials (57% never did), local cassava programme coordinators (43% never did!), nor with researchers (43% had not had contact with them in the past 3 years). Most of them (63%) found the agrobureaucracy to be poorly coordinated and almost three-quarters (71%) did not know about national research results on cassava.

Those extensionists who did know about research results, referred to the positive effect of vertical planting of cassava stakes (hardly ever practised by farmers and not generally recommended by extensionists) and of obtaining new high yielding varieties (which do not exist in the country). This shows fairly well the ambivalent position of the extensionist. Formally he has to bridge the worlds of researcher and cultivator; in fact he finds himself facing a rift.

He cannot depend on the cultivators who are "traditional and ignorant". He does not depend upon the researchers who are inaccessible and provide no useful results. He does not want his sons to become farmers (the view of 85% of our respondents), wishing them instead to achieve a "better" position through higher education. Yet those who have such positions (such as those researchers whom he knows) do not automatically impress him by their knowledge. This is the fundamental ambivalence of the extensionist; and why he stands between the two worlds of cultivators and researchers, without being part of either, or being capable of bridging the gap between them.

This position manifests itself when one asks what the main problems are that cultivators face. Extensionists stress pest and disease control (37.5% found this the main cultivator problem), erosion control or soil-fertility management (25%) and marketing (12.5%). Here there is no mention of a need for new high yielding varieties or anything of the kind researchers saw as the main cultivator problem, though there exists one correspondence with researchers: they define problems in terms of the solutions they can offer. Extensionists see as their prime task the diagnosis and therapy of diseases; for this they can use quite well the propaganda offered by input firms. They cannot, however, do very much about new varieties (known to have failed) or root rot or root "boiling" (sancocho, acknowledged as a problem, but not easily solved by them under present circumstances). On the one hand, they correspond with cultivators in their emphasis on soil degradation and inadequate marketing; and on the other, with researchers by stressing phytosanitary control.

Extensionists, then, cannot bridge the gap existing between these two worlds: either on the level of knowledge, due to the inherent contradictions between the worlds of the cultivators and the scientists; or on the level of interaction, since they are precluded from having contacts with scientists. What remains is not the assumed "interface" role these actors might be expected to play. There is no interface, at best a broken bridge.

Traders and programme coordinators: factual and fictional brokers

Before drawing some conclusions, two other types of actors need analysis: the traders and agrobureaucrats coordinating programmes.

The traders form a fairly close-knit network characterized by frequent interaction with cultivators and other traders, but little or no interaction with researchers, extensionists or agrobureaucrats. Those interviewed (4) corresponded in their problem analysis fairly closely with the views of cultivators. The traders varied in age and in wealth but could be characterized as persons who maintained close ties with producers through family ties, informal relations and by providing incidental credit or other services.

They have been, or still are, cassava cultivators. By luck, endowment, good contacts or hard work they have made enough money to buy a secondhand pick-up truck which makes the single largest difference between them and the cultivators. Owning a truck is seen as a necessary and sufficient condition for leaving the misery of being a farmer. I shall not expand on the traders here, because only four of them could be interviewed. It is clear, however, that they play a central role in the spread of new varieties (as noted before) and new technology in general. They are traders, but knowledge brokers as well.

Agrobureaucrats also have a tight network, based on professional and political (party) linkages. Our respondents differed from researchers and extensionists in giving first priority to marketing as the principal problem faced by cultivators (mentioned by one quarter of those responding), followed by phytosanitary control (mentioned by one in five), and lack of infrastructure (one in seven)(Naut and Box, 1984:35ff). They find that cassava has a rather high priority in government programmes. They attach importance to contacts with cultivators through visits, which about half of the respondents indicated as being the best way to get to know farmers' problems. Development plans therefore should primarily be based on views expressed by cultivators (41% suggested this). Twenty-nine percent mentioned the importance of extensionists and only six percent researchers.

However, few of them regularly visit farmers or their interest groups. They do acknowledge the importance of research findings when formulating priorities for extension and stressed the use of international publications (29% of the respondents) or national findings (24%). For these recommendations only a fraction (10%) said they would depend on cultivators. Their brokerage in this respect is fictional.

Both traders and agrobureaucrats might nevertheless fulfill a particular role in the linking of various networks. Traders do not really see a task for themselves in this respect, but they do play a part; the agrobureaucrats do see a role, but their role in linking with cultivator interests may be marginal. Both groups are generally not included in knowledge system analysis. Nor is a third group - the social scientists studying network articulation. My closing remarks therefore deal with the role of social science in "interfacing" or network articulation.

Conclusion: sociology and interfacing

Not one cassava knowledge system emerges from this analysis, but rather a number of networks which are more or less articulated. Indeed the ruptures or disjunctions are more striking than the linkages or articulations. When discussing these findings with all parties involved, we were struck time and again by the surprise and incredulity of our informants. They were aware of course that they were different parties to the process of technology generation, transfer and utilization. But they had no idea that their priorities could be so different and that the networks could operate so far apart from each other.

At the end of our research we organized a workshop bringing together all parties to the research: the rich and the poor cultivator, the humble extensionist and the powerful political appointee, the researcher and the programme coordinator. For many of them it was the first time they had met. Some did not wish to speak to one another and found our invitation to be less than courteous. The communist labour union leader was upset to be seen in the company of the leading anti-land reform politician. The latter, a politician and large landowner, found it embarrassing to exchange opinions with simple **campesinos**. The national programme director wondered what made the man he knew as a wage labourer, so respected as an "experimenting farmer". Nevertheless, they were all surprised after two days of meetings, how many different points of view were presented and how much knowledge was exchanged. All wondered how sociologists could have managed this.

Social scientists, it seems to me, are in the business of confronting different views on reality. If we accept the view on reality suggested by some researchers, an agricultural knowledge system consists of those generating, transferring and utilizing knowledge (i.e. scientists, extensionists and farmers). A knowledge system is then a conceptual model which depicts the total set of relations linking these three sets of actors. Such relations, however, are rather the exception than the rule in the cassava case just described. Therefore I chose at the outset not to follow the knowledge system model as proposed by Röling (1985, 1987), but rather to study the existing networks involving the participants in cassava knowledge.

The situation in cassava is not much different from the Dominican "top crop": rice. When Doorman and Naut (1986) replicated the study for rice, they noticed essentially the same phenomena albeit at different levels of articulation. Cultivators had more need for, and access to, the formal networks incorporating researchers, extensionists and programme coordinators. They also found that researchers and extensionists had more contact than in the cassava case, and that problem priorities coincided to a greater extent among parties. But problems of network articulation remained and so did the disqualification of other parties in priority setting and problem formulation. I therefore suggest that network articulation is differentiated, both among the parties involved in technology transformation for one crop, as well as among crops.

It is this notion which the sociologist can contribute. Most participants in the networks are only vaguely aware of the values and interests setting them apart from others. Since a number of these values may imply disqualification of other parties, network articulation becomes difficult. When extensionists do not expect researchers to contribute anything to their knowledge, or when researchers do not expect cultivators to do so, knowledge does not flow any more.

One task for the sociologist is to find out where and when communication blockages exist and structural ignorance occurs. Arce and Long (1987) have indicated this in their study of Mexican agrobureaucrats; and recently Botchway (1988) has shown structural ignorance among Ghanaian extensionists and researchers. Once these blockages are defined, the sociologist can indicate how a knowledge flow can be established. The applied sociologist helps to develop the organizational means for interfaces that enable knowledge to flow. Creating such contacts is what could be called "interfacing". From the actor's point of view, an unexpected meeting takes place: researcher meets experimenting farmer, etc. From a structural point of view, network articulation takes place and the flow of knowledge is stimulated. From a methodological perspective this could be called "adaptive networking".

Interfacing and adaptive networking can be done in a number of ways. In the Dominican research it was done through meetings, through the creation of teams, involving researchers and cultivators; through trial adaptation, or the transformation of farmers' experiments into researcher-managed trials, and vice versa. It is exactly this whole gamut of activities, which allows interfacing; each activity by itself would not create network articulation. The dialogue which thus emerges allows knowledge to flow. It creates an interface which mends extension's broken bridges.

3.2 Farmer participation in technology development: work with crop varieties

JACQUELINE A ASHBY, CARLOS A QUIROS, YOLANDA M RIVERS

Farmers at first hand

Technology development programmes oriented to small farmers often start with elaborate surveys designed to set objectives for the on-farm experiments and to formulate research agendas. The complexity of small-farmers' decision-making is such that it can take a team of specially trained researchers weeks of fieldwork to achieve this, using *sondeo* teams, informal surveys, rapid appraisals, key informant surveys, etc. The assumption behind this activity is that farmers cannot articulate their problems and goals but require highly educated intermediaries to interpret their preferences. There is, of course, some truth in this, but it has seemed to us worth testing the alternative view that in crop breeding programmes, at least, farmers can articulate their views directly to researchers. Therefore, the farmer participation in trials of crop varieties discussed here was designed to address the following questions:

- instead of using surveys to interpret farmer preferences and objectives second hand, was it possible to elicit these preferences first hand, by structuring appropriate situations where farmers could and would express their criteria for selecting among different varieties?
- could these preferences and criteria then be applied to selecting varieties suitable for testing within the farmers' own cropping system?

The farmer evaluations which followed were conducted in 1985 at Pescador in Colombia at an early stage in on-farm research. The objective was to pre-screen with farmers a large number of improved varieties of bush beans and cassava; to determine which were worth testing in farmer-managed trials; to obtain suggestions from farmers on how factors other than variety, such as fertilization or planting distance, should be incorporated into the design of on-farm trials. We were therefore attempting to involve the farmers in the design of the trials, as well as carrying them out, which is very rarely done.

Farmer evaluations have been carried out in several types of trials, such as regional trials which include large numbers of varieties (as many as 35 varieties in one case); exploratory trials with up to 10 varieties at two different levels of fertilization; farmer-managed trials with up to 10 varieties superimposed on farmers' levels of management in the test crop.

The project has therefore consistently worked with relatively large numbers of treatments for farmer evaluation. This has been done in an effort to test another assumption common in on-farm research, that farmers can only evaluate limited comparisons such as, for example, the researchers' 'best' treatment compared with a farmer check.

Pre-screening varietal materials by farmers

The first step in establishing trials of crop varieties was to give farmers an opportunity to select materials from a wide range of possible varieties for inclusion in the trials. With bush beans, individual farmers were shown samples of the seed from different lines identified as promising for their agroclimatic region by the CIAT bean programme. Each farmer was asked to indicate those grain types of interest and those less acceptable. With cassava, a group of farmers visited a CIAT regional varietal trial at a site near the research area where the cassava plants on the borders of each experimental parcel in the trial had been left standing. Farmers were therefore able to inspect plants of each variety, uproot sample plants to examine cassava roots and thereby make a selection of the varieties they perceived as interesting for further testing. In a group discussion of how to test the varieties they had selected, the farmers talked about their observations that the same cassava variety would give very different yield and root quality in different fertility conditions, and suggested different fertilizer treatments for inclusion in the on-farm trials.

Prescreening of beans focused on the initial evaluation of bean grain types by farmers. A CIAT breeder selected ten bush bean materials which were potentially adapted to the agroclimatic conditions of the research site and ranked them in order of expected acceptability to farmers. Subsequently farmers examined and ranked samples of each variety and discussed acceptability with the research staff.

Farmers were readily disposed to rank the materials according to grain type: their ordering varied somewhat from that of the breeder, because their most important criterion for grain acceptability was grain *size*, as shown in Table 3.1. There was however, one intriguing exception to this rule: the interest shown in a small grain variety, BAT 1297. Analysis of the interviews in which farmers made these initial selections suggested that the unexpectedly high ranking given to this variety was the result of women taking part in the selections and their perceptions that traditionally small grain varieties similar in appearance to BAT 1297 had been the more flavourful and higher yielding. Women viewed a small grain type such as BAT 1297 as desirable from the point of view of subsistence and consumption objectives of the small farm. Men on the other hand were selecting grain types for size primarily with reference to marketability.

The initial selection of varieties was intended to accomplish two objectives: first to ensure that materials obviously unacceptable to farmers did not enter the on-farm trials; second to create an opportunity for farmers to make suggestions about how trials to be established on their farms should be designed. This helped to ensure that the crop varieties would be tested in conditions that farmers viewed as realistic and representative for their conditions. It also established in the farmers' minds from the outset, that the trials were not intended to convince them that any given variety was superior. This is important because small farmers who have encountered scientific experts before expect that the experts will tell them what to do, and try to convince them that 'new' is 'better'. In order to create a relationship with farmers where free and open communication

Table 3.1: Prescreening Seed According to Grain Quality

Bush Bean	*Grain Type*	*Farmers' ranking*[1]	*Breeders' ranking*
AFR-205	Large, purple mottled	1	3
A-486	Large, pink opaque	2	2
A-36	Medium, red opaque	3	1
ANCASH-66	Medium, white	4	9
PVAD-1261	Medium, white	5	7
BAT-1297	Very small, red opaque	6	10
G-4453 × BAT 1386 C	Small, red opaque	7	8
HORSEHEAD XYC 206	Small, red opaque	8	4
G 7223 × BAT 1276 C	Small, red opaque	9	6
ANTIOQUIA 8L-40	Small, red opaque	10	5

[1] Farmers were asked to select six preferred grain types out of the total ten and rank them from most preferred (score = 6) to least preferred (score = 1); the final ranking is based on total score for each variety.

about the performance of new technology in their fields is the norm, research staff need to convey to farmers the importance of expressing opinions frankly about what is acceptable.

The farmers who were invited to take part were identified by asking local farmers to name people whom they considered 'expert' bean or cassava producers, defined as years of experience and interest in trying new ideas for cultivating these crops. Each farmer interviewed gave opinions as to who were the local experts in one or the other crop. The additional farmers identified by this approach were also visited, with the result that the list of names expanded and certain individuals were repeatedly mentioned. Those farmers whose names occurred more than twice were considered experienced cassava farmers or expert bean growers in the community and were invited to the pre-screening exercise.

In the trials which followed, farmers had to plant a commercial-scale plot of the test crop, so that the trial was situated within the plot. The nine farmers who took part in each set of trials were chosen from the lists of bean or cassava growers compiled for the pre-screening stage, but were selected carefully to represent a range of socio-economic resources. This was done by observation of their housing quality, ownership of consumer durables, ownership of livestock and other qualitative indicators.

In each subsequent season when trials were planted, the farmers who managed them were different individuals from the previous season. The project wanted to avoid the 'trained farmer' syndrome, so that fresh evaluations could be obtained in different seasons with the same varietal materials and also to avoid pestering farmers with repetitive interviewing.

Trial establishment

For testing bean varieties the trial design consisted of eight bean varieties including the local variety as a check, superimposed on farmer management practices which varied from farmer to farmer. Each of the 15 farms on which this trial was planted was a replication. Farmers designated sites for a varietal trial within a field where they planned to plant beans. Farmers planted one bean variety to each of eight plots staked out at the designated sites, some ordering their varieties by grain size, others by grain colour. The remainder of the bean field was planted by the farmer with the local variety. Planting densities, fertilization and all other crop management operations in the trials were determined and carried out independently by each farmer.

The cassava trials used two approaches. The first was similar to that used in the bean variety trials, but because of a shortage of planting material and the desire of farmers to include fertilizer treatments in the trials, it was not possible to give each participant all the varieties to evaluate. Instead, each of nine farmers was randomly assigned three of the CIAT varieties and the local check to be planted at two levels of fertilization, as defined with the group of farmers in the initial selection discussed above. Since the main objective of these trials was to obtain farmers' reactions to the new technology, it was decided to reconvene the same group of farmers at harvest time to pool experience and to see if a group could produce a consensus about which materials looked sufficiently promising for them to be included in further on-farm testing.

The second approach (suggested by Ted Carey, Breeder, CIAT Cassava Programme) was simply to make gifts to farmers of three cassava varieties in separate packages of planting material, each labelled with a different number. The farmer was told that he or she could plant the material however desired and that follow-up visits would be made by research staff to see how the varieties were performing. Follow-up visits suggest that a few farmers may be planting the cassava stakes in a way that reflects concern that the agronomist might be displeased if the gift is not given special treatment. In these instances, the purpose of the exercise is being frustrated in that researchers are not able to observe an authentic farmer reaction to the material.

Evaluating varietal trials with farmer participation

The central objective of establishing the varietal trials was to create opportunities to listen to farmers' reactions. The primary data of interest in trial evaluations are therefore the opinions, preferences and ideas expressed by farmers.

These 'preference evaluations' have been conducted on two occasions in

the growth cycle of each of the two crops. In the bush bean varietal trials, one evaluation is carried out when the bean pods first begin to form. In the cassava trials, the first evaluation is carried out after farmers have carried out the first weeding. These evaluations focus on plant architecture, growth habits, disease susceptibility, periodicity and aspects of management to date, as observed by farmers. The second 'preference evaluation' follows the harvest and focuses on yield, profitability, marketability and consumption aspects, but aims to capture any relevant varietal characteristic which farmers like or dislike.

The 'preference evaluations' require interviewers skilled in the techniques of open-ended interviewing, which involves stimulating the farmer-respondent to express opinions and concepts, and to explain observations of different varieties, without prompting or suggesting that the interviewer has a point of view, which will bias farmers' responses. Experience with these interviews suggests that it is helpful for the interviewer to communicate a priori a complete absence of vested interest in the 'success' of the new varieties relative to local varieties. It is necessary to bear in mind that farmers in these interviews tend to expect that the research staff want to hear favourable comments. The interviewer has therefore to establish at the outset that a farmer's negative reactions are equally acceptable, and that the reasons for such reactions are of profound interest, without prompting the farmer to express ideas that appear to be what the interviewer wants to hear (Table 3.2).

At the time of trial establishment each farmer is given a map of the trial, stored in a plastic folder, with a simple form in which labour and other inputs to the whole field are recorded by the farmer.

When visiting a trial, the research staff make a point of relying on the farmer to show them around. The aim here is to communicate the feeling that this is the farmer's trial for which he or she is responsible, not the researchers' trial. Reliance on the farmer to act as the guide around the trial layout also enables the research staff to assess readily how seriously the farmer takes the trial: whether or not he or she knows his way around the trial and can identify the different plots and varieties is a sure indicator of how attentively the farmer is observing their progress. Most farmers readily locate varieties they are interested in without using a map, and have evidently studied them because they learn the reference letters and numbers of varieties (such as A-36, XAN-212, BAT 1297) and can locate them in the trial by these names, or by the numbers given to the cassava varieties (51, 52, 53, etc). In several instances farmers have begun to name cassava or bean varieties of particular interest to them from their appearance, eg, 'la blanca' (cassava hybrid CG 406-6) or 'la pequenita' (bean variety BAT 1297).

To date the most workable procedure for carrying out preference evaluations in the trials has been to note farmers' comments in columns under broad topic headings in the order that these are spontaneously brought up by farmers during the interview. At the conclusion of the interview the farmer is asked to indicate the three or four varieties of most interest, rank these in order from most to least interesting, and explain this ranking.

Table 3.2: Excerpt from a farmer's evaluation of the standing bean crop, Pescador, Cauca, 1985

INTERVIEWER:	Which variety is this? What's this one called?
FARMER:	A=66, I don't like this plot very much. This one has a lot of leaves and few pods.
INTERVIEWER:	A lot of leaves?
FARMER:	And few pods, that's to say that it's flowered a lot but only formed a few pods.
INTERVIEWER:	Is it a disadvantage that it has a lot of leaves?
FARMER:	Yes, it really has a lot, I'm afraid of a bean plant which is so leafy, it's grown into a mountain of bean plants and then the diseases take hold more easily because of the humidity.
INTERVIEWER:	I see.
FARMER:	That's why I don't like it, because it has to be planted a bit further apart and as it's formed few pods well, the yield would be very low. So it's better to look for a variety which doesn't have a lot of leaves and which has more pods.
INTERVIEWER:	That's ve y important for us to know ...
FARMER:	There's no comparison with another plot we can see over there, a plot I really like, it's formed a lot of pods and the plant is like this ... look.
INTERVIEWER:	It's small?
FARMER:	Yes, look at the number of pods, you can tell from a distance. So that plot will yield more because you can plant closer and you can harvest more (plants). Now this here is very nice plot, I like this bean a lot ... Look at the difference between this bean plant and the one we saw over there with lots of leaves. The plant is still pretty leafy but it also formed a lot of pods, look at this plant here ... it's healthy–almost no disease. Yes, this plot is really healthy-looking. Do you know what to do with this type of bean plant, they're bush beans but they put out tendrils, the right thing to do for this one is always plant in a straight line so you have space to walk through between the lines.

Subsequently it is possible to do a content analysis of the interviews recorded in this fashion and to tabulate the frequency with which specific varietal characteristics or criteria for evaluating the crop in question have been spontaneously mentioned by farmers. Table 3.3 is an example of a frequency tabulation of criteria mentioned by farmers in bean varietal evaluations. Performing a content analysis with the frequency tabulation highlights the criteria which are important considerations for farmers in a visual evaluation of the bean crop: for example, farmers universally commented on yield potential. While several noticed disease resistance or susceptibility, this did not appear as an important criterion for farmers to rank the varieties placed in first, second and third place in Table 3.3.

The second preference evaluation which follows harvest of a trial involves weighing grain or root yield from each experimental parcel which is recorded with the farmer on a prepared form. The farmer and agronomist evaluating the trial each make a copy when farmer literacy permits. Yields are expressed in returns to seed or to area, depending on local units of measurement for expressing yield for the crop. The farmer is asked to rank treatments in order of preference based on a visual appreciation of yields and quality aspects of different varieties. Next a simple cost-benefit analysis is performed, calculating value of the yield according to the prices obtained by each farmer for each variety and costs of purchased inputs of concern to the farmer. The farmer is then asked to rank treatments in order of preference based on this cost-benefit analysis and the reasons for preferences are discussed.

Table 3.3: Farmer Evaluations of the Standing Crop (9 farmers)

		BEAN VARIETY CHARACTERISTIC							
VARIETY		*High yield*	*Low yield*	*Early*	*Late*	*Disease resistant*	*Infected*	*Upright plant*	*Sprawling plant*
Rank	*Most preferred*								
1	A-486	9	–	2	–	1	2	1	–
2	PVAD-1261	9	–	–	1	2	1	4	–
3	BAT-1297	7	–	–	1	2	–	–	4
4	A-36	5	–	–	1	1	1	–	1
	Least preferred								
	Calima	5	–	–	–	1	4	–	–
	Antioquia	–	1	–	5	1	3	–	1
	Ancash-66	–	1	–	5	3	1	–	4
	AFR-205	–	1	–	–	1	4	–	1

Sometimes a simple visual appreciation is the most effective evaluation, but often the cost-benefit analysis is a useful tool for eliciting perceptions of constraints when costs or prices vary among treatments in a trial.

Concluding remarks

The value of these farmer evaluations is not principally to select the two or three varieties which the majority prefer, but more important, to understand the objectives which farmers are addressing as they make selections among crop varieties. This information is important for narrowing down the combinations of varietal characteristics which breeders consider when taking farmers' views into account during breeding programmes.

Following the on-farm trials, the project undertook further research into farmers' preferences, using group participatory methods, which are explained as part of section 3.4.

Stimulating peasant farmer experiments in non-chemical pest control in Central America

JEFFREY W. BENTLEY

Farmer-scientist collaboration

Starting with the hypothesis that farmers and scientists can collaborate to develop better technologies than either group could invent alone, my colleagues at the Escuela Agricole Panamericana, El Zamorano, in Honduras, and I have been attempting to stimulate the work of innovative peasant farmers. We do this by teaching a short course on non-chemical pest control to small groups of *campesinos*, most of whom work for NGOs as extension agents, which offers them new techniques and scientific concepts, and aims to fill key gaps in their knowledge.

Since 1991, we have taught over 300 *campesinos*, many of whom have gone on to teach hundreds and possibly thousands of others. Our hope is that some of these *campesinos* will be real innovators who will go on to develop new, appropriate technologies or devise effective modifications of existing practices.

Farmers know some things that scientists know, some things that scientists do not know, and, also, farmers do not know some things that scientists do know. There are, in addition, a lot of things that neither group knows (Chambers, 1991). Knowledge overlaps, but is different. Much of this epistemological difference can be attributed to different styles of observation, to what I call 'the importance of importance', and to the ease of observation. These concepts are discussed briefly below, before returning to a description of the short course.

Understanding who knows what and why

Styles of observation

Despite the flashes of insight that may come while taking a bath, scientists are supposed to design hypotheses, then test them by formalized experimental observations. Peasant farmers rarely do this (although examples do exist; e.g. Stolzenbach, Millar, Part II). They perceive the natural environment through cultural filters as they modify it through work. Sometimes the difference in observation style is not very important. For example, scientists learn that ear rots cause maize ears to lose weight by weighing a random sample of damaged and healthy ears; but farmers learn the same thing by hefting ears while harvesting. In other cases, different styles of observation lead to radically different conclusions about how the world is made up. Farmers have no way of perceiving chronic toxicity in agrochemicals, and believe that the smell has something to do with toxic strength. They generally apply pesticides with no protective gear, often eating and smoking, cleaning stopped-up nozzles with their mouths and allowing pesticide from the backpack sprayer to drip down their backs. Farmers think that because they do not get ill as they spray, they must be building up a resistance to the agrochemicals. Only recently have Honduran farmers started to notice that years of pesticide use is making them sick, lame and sterile.

The importance of importance

People (including scientists and peasant farmers) pay more attention to things that are culturally and economically important. Entomologists have identified virtually all agricultural insect pests, and many of their natural enemies, while innocuous forest arthropods are poorly documented. In the same way, farmers understand weeds better than many harmless plants.

The ease of observation

People perceive more about things that are easy to observe. All things being equal, people are more likely to name and know large, brightly coloured, diurnal, social animals than small, cryptic, nocturnal, solitary ones. Britain is easier for most scientists to get to and observe than are the rain forests, so entomologists have documented 90 per cent of the insects of Britain (LaSalle and Gauld, 1991), while the tropical rain forests are being destroyed before we have even begun to learn what is in them (Wilson, 1988). Equally, Honduran peasant farmers have many words to describe social wasps, but do not know that solitary, parasitic wasps exist.

A short course on non-chemical pest control

Our short course for *campesinos* on natural pest control incorporates the notion that farmers' knowledge is profound, but that the gaps in their knowledge are consistent with topics that are not culturally important or are difficult to observe. The course has five main sections: (1) insect reproduction; (2) entomopathogens; (3) parasitoids; (4) predators; and (5) manipulation of natural enemies.

Insect reproduction is important and difficult to observe. Because insect pest populations are important to farmers, the farmers pay attention to them, but many insects spend parts of their life cycle underground, or are active only at night, or in some other way it is difficult for the farmer to see the whole metamorphosis from egg to larva, pupa and adult. Farmers often think that insect pests (especially caterpillars) are generated by the crops themselves, or increasingly, from the agrochemicals that farmers apply. Insect reproduction is difficult to teach to farmers, because we must contradict farmers' deeply believed perceptions of the world, while maintaining respect for them and their ideas. We challenge the farmers to rethink their belief that insect pests are spontaneously generated by collecting insects and watching them pupate and emerge as adults, and by asking farmers to tell us about the reproduction of bees – which they understand well – and encouraging them to draw analogies from bees to other insects.

Parasitoids and entomopathogens are not (culturally) important and are difficult to observe. Parasitoids are a vast complex of insects, mostly tiny, solitary wasps and flies that spend their larval stages living inside other insect species, eating them to death one organ at a time. Agriculture would be impossible without parasitoids playing the grim reaper on phytophagous insect species, yet I found Honduran *campesinos* (like most people) are unaware that parasitoids exist. Entomopathogens – also unknown to *campesinos* – are the fungal, bacterial and viral diseases that infect and kill insects. Farmers are fascinated by both topics, which we teach using slide shows and by collecting insects in the field and watching parasitoids emerge from them. The topics are relatively easy to teach because farmers have few conflicting, preconceived notions about them.

Predators are not (culturally) important, but are easy to observe. Because predators are generally larger than their prey and are equipped with death-dealing appendages, Honduran *campesinos* often know them, have names for many and are familiar with many of their habits, without understanding that these insects eat others. While it is arguably not as easy to see wasps killing insects as it is to see wasps sipping flower nectar, not knowing about insect predators is consistent with a cultural preconception that all insects (with the possible exception of bees) are bad. To show farmers that social wasps and ants, which farmers know well, are predators of insect pests, we capture *Polybia* spp. (Vespid) wasps returning to the nest with prey, and release the wasp to show the prey item to the farmers. Soon the farmers learn to recognize wasps coming in with the luckless caterpillars, and watch as the wasps eat them on the nest envelope. We place caterpillars on maize plants and ask the farmers to watch them. Within minutes ants begin carrying them off.

Manipulation of natural enemies is important and easy to observe. Once farmers know about predators, they become important and easy to observe. We haye learned a lot from farmers who taught themselves to move wasp nests onto their fields, after learning that wasps are predators (Bentley, 1992). We teach manipulation of natural enemies in a seminar-style discussion, asking farmers to tell us how they think they could go about it. Many farmers suggest ways of protecting wasp nests, and other ways of increasing natural enemy populations. Natural enemies of crop pests can be manipulated using traditional practices like intercropping, avoiding herbicides and growing flowers, all of which raise the number of flowering plants – and hence provide supplemental food to many beneficial insects.

While there is much to admire about traditional agriculture, there is no reason to assume that cultural evolution leads to an optimum adaptation any more that biological evolution does (Burnham, 1973). Small-scale farming has room to improve, especially in light of the demands of rising populations and deteriorating natural environments (Cleveland, 1990). Farmers have always experimented, and may be doing so even faster now, in the face of a rapidly changing environment and the availability of new biological and chemical products (Goldman, 1991). The challenge for us is to learn from farmers, and help guide the stream of spontaneous farmer experiments by teaching farmers what they do not know, in a way that is consistent with what they already do know.

Facilitating sustainable agriculture: turning policy models upside down

NIELS RÖLING

When the paradigm fails

Over the last 25 years, we had become satisfied that technology transfer was the basis for non-coercive change in agriculture. First, we generalized from the thousands of empirical studies on adoption and diffusion to try and understand the basic processes underpinning innovation in agriculture (Rogers, 1983). Next, we formulated a linear model of technology transfer from generation by scientific research, and transfer by extension to use by farmers. Finally, we elaborated a systems approach to knowledge management so as to enhance the mutual articulation of institutions involved in the science–practice continuum (Röling and Engel, 1991).

Over time, these efforts began to gel into a consistent paradigm for deciding about investment in agricultural extension and research, institutional design and staff training, and for supporting day-to-day management. What is more, this achievement culminated in a simple and apparently indestructible management system, the Training and Visit (T&V) system of extension delivery. Millions of dollars are invested every year in T&V, supposedly enhancing the mutual linkages between research, extension and farmers, and so transforming the science-practice continuum into a super highway.

The whole situation appeared highly satisfactory . . . until the experiences with efforts to introduce more sustainable forms of agriculture made us aware of painful inconsistencies between the technology transfer paradigm and actual practice. Thus, the paradigm, once thought to be all-encompassing, was shown to have only limited applicability.

From technology transfer to facilitation

Technology transfer focuses on technology generation by scientists, and passing on to farmers via extension. Farmers are basically considered as passive receivers of expertize from outside. Adoption is usually only possible under three conditions: if technology transfer focuses on farmers who are helped through other sources (such as special projects) to acquire credit and inputs; if technology transfer focuses on rich farmers; or if the technology transferred is carefully targeted to the conditions of designated farmers, which requires collaboration between research and extension, and farmer influence on technology development.

Needless to say, a focus on richer farmers is the usual option. The fact that technologies are developed by research institutes implies that the products are usually blanket recommendations, comprising routine, calendar-based applications. For example, in the Netherlands, broad recommendations by research and extension services usually only cover individual crops and practices, leaving the farmer to adapt and integrate them into the complex system. Even the 'study clubs' which flourish in Dutch horticulture usually only deal with one crop. There is no study club which helps farmers with complex system management.

Compared with conventional, modern, industrial agriculture, more sustainable agriculture is more complex, requiring the management of a greater ecological and economic diversity. Sustainable agriculture is information-intensive instead of physical input-intensive. Information is critical in the management of highly complex systems for taking timely and multi-faceted decisions in accordance with season, climate, crop needs, pest and disease prevention, etc. Sustainable agriculture relies, above all, on the management of natural processes, such as rotation, crop combinations, the characteristics of cultivars, natural predation and so on. General principles must be carefully applied in locality-specific systems through active experimentation by local people. System management relies on careful observation and monitoring. Farmers must know what they see and be able to anticipate outcomes on the basis of observation. This requires a great deal of knowledge about local conditions, seasonality and natural processes. Decision-making is usually complex and must take many factors into consideration.

In technology transfer, the focus of the intervention is on transfer via various extension methods, such as farm visits, demonstrations, group training sessions, articles in farm journals and other forms of access to outside expertize. In the T&V system, transfer has been developed into a highly regulated and controllable management system, whereby extension workers are provided small chunks of calendar-based knowledge every month to pass on to farmers whom they visit every two weeks.

Of course, technology development and transfer is also applicable to enhancing sustainable agriculture. The development of resistant cultivars, working out beneficial rotations, developing nitrogen-fixing qualities in plant species and developing biological controls are all essential components. But facilitating sustainable agriculture differs in some very important respects. Technical information alone is insufficient; a great deal of

information needs to be provided about the nature of the policy and the context which it creates for agricultural production. In the Netherlands, policy information is now as important as research and market information. Farmers are keenly interested in policy; they assess the extent to which it will be able to affect their lives, will be actually implemented, can be circumvented and is to be taken seriously. Government has privatized technical agricultural extension, but still has a special office in each province to explain its agricultural policies to the public.

Making things visible also becomes vitally important (Bentley, Part II). In Indonesia farmers are urged to keep simple insect zoos made of a piece of netting, some bamboo stick and a rice plant in a container. Thus, the nature of predation by natural enemies on pests was made very visible indeed (Winarto, Part II). In the Netherlands, making things visible has become a national pastime. For instance, experiments are under way with mineral bookkeeping, a prelude to exact registration of the amounts of N, P, K that go into a farm and leave it, itself a condition for focused training and sanction of emissions.

A crucial element in sustainable agriculture is thus continuous observation and feedback from the physical environment, leading to the development over time of a body of local data, knowledge and wisdom which grows and becomes more finely tuned and responsive with each passing season. To tackle broader environmental issues, entire communities not just individual farmers, must become involved in monitoring the condition

Box 1: Contrasting paradigms in extension science

Item	*Transfer of technology*	*Facilitation*
Criterion variable	Adoption, knowledge utilisation	Ownership of problem, quality of decision-making, convergence
Model of farmer	Individual adopter client, target	Independent, strategic actor, capable of expertise (indigenous knowledge), knowledge generation and exchange, local group process
Relevant disciplines	Communication, diffusion, information processing, social psychology	Policy science, sociology, convergence models, group dynamics, networks
Relevant applied sciences	Marketing, advertising, applied communication	Adult learning and education soft systems methodology (Checkland, 1981; 1989)
Philosophical foundations	Science is the basis of truth	Consensus is the basis of truth. Reality is socially constructed

of natural resources, an area of environmental education which is rapidly growing in Australia under the name 'Land Literacy' (Campbell, Part III).

The most important aspect of supporting sustainable agriculture is facilitation. The central issue is, after all, that farmers take charge of managing local agroecosystems in a manner consistent with the public good. Thus, an important aspect of intervention is to create a shared perspective on the problem and help developing decision-making capacity to deal with it. This is perhaps the most distinguishing characteristic of facilitation.

A system for supporting sustainable agriculture will be highly decentralized, with facilitators in the field, who have considerable 'people skills', in addition to technical understanding. They need to be supported by a network of specialists and local experiment stations. But such attempts to introduce decentralized, 'bottom-up' approaches must be complemented by strong 'top-down' commitment and a very clear, shared view of the mission of the organization, permeating its culture at all levels. The emergence of facilitation as a professional practice has major consequences for extension science (Box 1).

1.7 Interactions for local innovation

IDS WORKSHOP[8]

Scientists and farmers

The theme of interactions runs through this book. Effective research and development by and with resource-poor farmers requires understanding and interactions of many types and at many stages. This includes social relationships, exchanges of ideas and information, linkages between people, and institutional dimensions (to be considered in Part 4). Here we consider interactions between researchers and farmers, between extension workers and farmers, between women and men and between outside science and technology and local capacities.

The importance of the farmer-scientist link has been illustrated by the examples already described; and methods used to improve this relationship for effective R&D programmes to benefit the rural poor will be discussed throughout the book. Farmers' groups and workshops are one useful way to help elicit farmers' ideas, to improve communication, and to foster local initiatives, and will be discussed in Part 3. They can be a good means of overcoming barriers between researchers and farmers and sometimes extensionists as well. For example, the case study contributed by Abedin and Haque (Section 3.1), illustrates an 'innovators workshop' in Bangladesh, which helped farmers to reveal their discoveries and knowledge and researchers to break down their prejudices. The workshop was attended by science-trained professional researchers and 30 extension officers who 'enthusiastically' learned from four farmers who described their innovations in potato farming. Discussing farmers' innovations in such group meetings is one way to bridge gaps and overcome biased views.

'Visual-aided dialogue' is another good method for researchers with farmers and for farmers with researchers. This involves discussing items which are in front of the participants. Insect pests can be shown to farmers to elicit comments on pest control, or farmers can display and discuss the varieties of seeds in their stores and discuss their preferences and reasons for them. Using such visual aids has been found useful at the beginning of a research process, to break the ice and establish rapport, to stimulate interest, curiosity and discussion and to enable researchers to learn from farmers.

Another method is what Anil Gupta calls manual discriminant analysis. This can be used in group discussions among farmers and researchers about farming practices and constraints. The basic concept is to compare and contrast. Farmers are asked to describe their management practices, for example for tillage, cropping patterns, input use, or techniques for maintaining soil fertility. Data are collected to find out the range of plotwise practices. The researcher then contacts the farmers whose practices are at the two contrasted ends of the distribution. Each group is asked to explain the behaviour of the other. For instance, farmers using the highest seed rates are asked about farmers with the lowest seed rates, and vice-versa. This calibrates the frame of reference and makes clearer to farmers the distinctiveness of their own behaviour. Only after hypothesizing why the others behave differently is the group asked to explain the reasons for its own practices.

Although one of the objects of such discussions is to separate out the role of class from that of ecology, Gupta suggests that the researcher should avoid asking leading questions, or using the categories of rich or poor farmers when asking questions. If practices differ on the basis of class, it will become apparent from the data (Gupta 1987a).

Matrices to list who will gain and who will lose from alternative interventions or technologies are a simple check that outsiders can use. One form of this is what Rocheleau calls 'multiple-user analysis'. In this, multiple users of the same resource are identified. They may be women and men in households and farms, or different social groups. The analysis

can be used to modify action to make it more equitable especially for the disadvantaged and those who might be left out.

Extensionists and farmers

Recognition of farmers' knowledge and innovative capacity does not necessarily mean that they do not need extension services. Rather, it points to needs to improve the interaction between extensionists and local people to reverse and balance conventional 'top-down' communication and to overcome gaps and miscommunication. Some of the contributors to this volume describe how to improve such interactions.

For example, Suriya Smutkupt (1987) sees the role of extension officers as 'facilitators', promoting interaction between farmers and thus encouraging farmer-to-farmer extension. He describes the application of this idea to the dissemination in Thailand of a cropping system in which peanuts are grown after rice. The facilitator concept is useful. Farmer-to-farmer interactions are as important for innovation and development as farmer-researcher interactions.

Another example, described by Noel Chavangi and Agnes Ngugi (1987), is tree-planting in Kenya, to which extensionists, researchers and farmers all contributed. In the beginning of this programme, four new quick-growing trees suitable for fuelwood production were introduced, including *leucaena*. Each of 28 farmers were given 15 to 20 seedlings of three of the species and 50 seeds of one of them. The programme staff assumed that the farm people could be left to grow the new tree species *without* advice from extension workers, because they knew that farmers in the area had been planting trees for decades on their own. Therefore, all the farmers were told was that these were quick-growing fuelwood species similar to *Sesbania sesban*, a tree they already knew.

This approach of providing minimal advice 'worked' to the extent that the farmers successfully established trees from most of the seeds and seedlings. However, harvesting the trees for firewood was sporadic because people did not know how big they would grow or whether they could be coppiced. It was clear, in retrospect, that information from extension workers was needed on these matters. The staff also realized later that they had not adequately understood important social issues pertaining to tree planting, in that trees on a man's farm are seen as his property, but responsibility for gathering firewood falls on the women. Therefore, trees grown especially for firewood were perceived differently by each gender group. Where men expressed interest in planting more trees of these new species, it was often with the intention of using them to produce poles for construction and fencing.

In the next phase of the programme, more extension work was done to explain the growth characteristics of the trees and harvesting techniques, pointing out that some species could be coppiced for fuel within two years. The fuel-wood issue and its social implications were also discussed.

This project raises an important point about the nature of innovation. Farmers certainly possess relevant knowledge and are keen observers of trees, herbaceous plants and soils and they often carry out experiments, but knowledge, observation and experiment are not the only roots of innovation. Interaction between people with different kinds of knowledge and different areas of experience can be a necessary stimulus. A strategy of minimal extension work leaving maximum scope for farmer initiatives may give insufficient stimulus as well as insufficient information about an unfamiliar species.

However, the open and flexible approach adopted in this tree-planting project makes a welcome change from the old habit of offering new technology as a 'package' of materials, tools and procedures which was not supposed to be modified, and which made stimulating interaction all but impossible. One example was a package of watershed management techniques introduced into a dryland farming area in India under British auspices. Describing the experience, Verma (1987) comments that in the absence of 'adequate contact of the committee members with the common farmers', the project staff failed to notice that the farmers, in fact, disapproved of the soil conservation measures they proposed to introduce. Only after a near-stalemate forced the project scientists to be more responsive to the farmers did a compromise programme begin to make headway.

Another case of a similar lesson was discussed by Bashir Jama, who describes a Kenya government agroforestry programme in the Kilifi District. In this situation, researchers and extensionists (from both agriculture and forestry disciplines) began agroforestry and afforestation projects with a 'top-down approach', with little farmer participation; this involved mainly on-station trials and demonstrations and attempts to induce farmers to adopt a technical package of *leucaena* alley-cropping which included management recommendations. The researchers' main interest was to promote a way of using trees as nutrient-pumps and for nitrogen-fixation. After the initial stage, it was realized that this was inappropriate, because it did not meet farmers' immediate priorities. The farmers rejected a 'rigid' package; they instead modified the alley-cropping according to their knowledge, needs and own inventiveness.

After the staff recognized the problems with their approach and the importance of the farmers' initiatives, they changed the researcher-extension-farmer relationships and adopted a 'bottom-up' approach which emphasized learning from farmers and giving priority to local choices and ideas. As a result, farmers adopted *leucaena* not just to help soil fertility, but mainly for the leaves for livestock fodder, which was scarce and valued in the area. As a 'spin-off' result, they developed milk production from the improved livestock fed on the new fodder and farmers' earnings from milk sales then led them to establish a dairy development project. The resulting farmyard manure also increased yields of food crops substantially. Thus, the farmers' initial adoption of agroforestry ideas, along with flexible interaction with supportive extensionists, led to a chain of useful unexpected events and the project developed its own momentum and sustainability, based largely on farmers' initiatives.

Experiences of this sort demonstrate why there is need for a more open,

interactive approach in which a 'basket' of technologies are offered (Maurya, Section 1.2) instead of complete packages, with a range of alternatives from which farmers can choose. The old idea of a 'transfer of technology' to the farmer from some island of expertise is thus being displaced by something more like a technology exchange, with benefits on both sides.

2.8 *Interactive research*

IDS WORKSHOP[3]

Interdisciplinary team interaction

Interactive research has two aspects: interactions between researchers themselves; and interactions between farmers and researchers.

Interactions between researchers themselves have been a subject of study and reflection (see eg, Hildebrand, 1981; Maxwell, 1984; Rhoades et al, 1985). A major contribution of farming systems research has been the recognition that many disciplines can contribute to understanding farmers' problems and opportunities. Sometimes more concern is expressed about difficulties of interaction between people with university training in different disciplines than about interaction between farmers and university-trained researchers. Indeed, problems of 'team interaction' among the scientists of a multi-disciplinary group do often arise. For example, agriculturalists and social scientists may disagree about research agendas,

even though they share common goals, but it is often important to bring to bear on farmers' problems the expertise and insights of several disciplines and for this good team interaction is needed.

Several conditions have been found to promote fruitful interaction between specialists. First, field reports are unanimous in noting how this is helped when specialists work together on the ground, in joint participation in group activities, interviews with farmers, mapping, undertaking trials and all other kinds of tasks (Colfer, 1987a and c). When researchers and extension workers are in direct physical contact with the reality of the farmers they are serving, their specialist single-disciplinary preoccupations become less dominant.

Second, multidisciplinary teams evidently work best if they are fairly small and stable in membership. One danger with large teams in the field is that members will talk and listen to each other and not to farmers. Not only does this impede learning from farmers; it is also discourteous and can make farmers feel uncomfortable and inferior.

Third, it is an advantage for differences in team members' views to be anticipated and discussed before disagreements arise. Such early discussions can then be used constructively to shed light on a subject from different angles.

Fourth, report-writing provides opportunities for interaction. Responsibilities for writing can be divided among team members both to speed up production of a report and to make sure that all contribute to the final recommendations. However, Colfer (1987a) comments that disciplinary conventions differ and each team member naturally feels some professional responsibility to abide by his/her conventions and emphasize particular topics. There may be no easy solution to the dilemma of wishing to combine the value of different insights and orientations and of diverse views, with the need for consistent style and coherent conclusions and here, as elsewhere with teamwork, negotiations and compromises are needed.

Perhaps more important than these aspects two other vital issues concerning the composition of research teams are: the balance between sexes in team membership and the role played by social scientists. These can significantly influence interactions between the researchers and the farmers.

Women's key role in agriculture is well known, as farmers, heads of households and through their responsibilities for grain storage, fuel collecting, seed gathering etc. Understanding women's roles and working with women can be difficult where the researchers are mostly men. Even a senior woman in a research team can be frustrated in efforts to encourage participation by women when local team members are all young men (Colfer, 1987c: 8). There are some topics and areas for which all-female or even all-male teams may be appropriate but research teams should usually aim for equal numbers of each sex at senior professional and extension levels. Ensuring the 'ideal' gender balance can be difficult where there is a lack of women who work professionally or as assistants in this field. Interviews with women farmers are usually best conducted by female team members who know the local language, but it is then important that the women interviewers are also involved in analysing and writing up the results.

Similarly, anthropologists or social scientists (of either sex) in teams can help foster close and effective interaction with farmers. In section 2.2, Box portrayed the social scientist as an intermediary or 'two-way translator', explaining farmers' experience to agricultural scientists and vice versa. Colfer (1987a) makes a similar point, commenting that, 'most agricultural scientists do not know how to get the information they need on farmers without some help', and adds that unless the agricultural and social scientists communicate well, the latter usually do not understand the needs of agricultural research. She concludes that there are important 'structural and ideological aspects of project management' that can either facilitate or hinder farmer involvement and these depend on whether the input of the social scientist is 'integrated or marginalized'. In a climate which is 'hospitable' to interdisciplinary communication, a social scientist can function effectively as 'spokesperson for and liaison to farmers'.

But without interest and support from team-mates, 'the social scientist is hamstrung. The valuable contribution that he/she could make is never realized. The lack of interaction keeps the social scientist ignorant of what is relevant to the agricultural scientist and keeps the agricultural scientist ignorant of what the social scientist is finding out. Titbits of information that may make their way to the agricultural scientist are then likely to be attacked as (perhaps rightfully) irrelevant – thus digging the gulf between the disciplines still deeper. Meanwhile for the farmers, it's business as usual . . .' (Colfer 1987a: 9).

The diagnostic stage in research

Preoccupations with team interactions and team management can divert attention from the primacy of farmers' priorities. The challenges of rural development now include not just raising productivity but also increasing sustainability, both economic and ecological (Conway 1987a).

The key to sustainability is that interventions help people to meet their priorities and are so fully compatible with local culture that farm people can build on them independently by means of their own experiments (Bunch 1985). People will sustain what meets their objectives and reject what does not. This requires a reversal of the one-sided relationship between specialists and farmers, so that specialists learn from farmers, with mutual learning and exchange of ideas, skills and knowledge.

Growing recognition of the need to involve farmers in research is found in countries as diverse as Thailand (Charoenwatana, 1987) and Colombia, as well as those countries which have figured prominently in previous pages: Nepal, the Philippines, India and Bangladesh. The shift of emphasis towards the realities of farming and of farm families has progressed under various labels or banners, including farming systems research (FSR), rapid rural appraisal (RRA), and now farmer participatory research (FPR) (Farrington and Martin, 1987). All of these aim to get closer to the farming

realities but they do not always or necessarily involve farmers or farm families to a major degree.

In FPR for example, the farmer may participate, but the work is often 'researcher-driven' and generates insights only within the researcher's categories of thought.

While most researchers agree on the desirability of directing research toward topics which farmers perceive as problems, the way they go about identifying such topics differs greatly. At one extreme, farmers are merely observed or information is obtained without any dialogue. In other cases, information is obtained *from* farmers through surveys and questions and the research agenda takes its origin from some aspects of the farmers' situation, but it is not an agenda developed *with* or *by* farmers. It is an agenda based on questions asked by researchers and there is no guarantee that these are questions which make sense to the farmer, or that they are capable of pointing the research in a direction that will benefit him or her.

Ashby et al (1987) are among practitioners in this field who sense that an excessive concern with refinements of method is tending to divert researchers from talking interactively with farmers. They complain that: 'diagnostic research has become a hothouse of methodology development, spawning *sondeo* teams, informal surveys, rapid appraisals, key informant surveys etc. The farmer is an object of investigation, just as plants, soils, insects or viruses are objects to be studied and measured. In this process the farmer's voice has been lost. Asking farmers questions has become an industry. Listening to farmers has been forgotten as a research tool.'

In the move towards giving more prominence to farmers' agendas, many approaches and variants have been used. In Colombia, the adaptive on-farm research now seen as necessary begins with 'diagnosis of a technological, social and economic situation', in which two approaches to farmer participation are being tried. They are 'auto-diagnosis' in which small farmers define and analyse the technological realities of their farms and express their own views in their own frameworks, and 'participative diagnosis' (Chaves, 1987:15), in which cultivators express the problems they face and their needs and expectations in relation to agricultural technology.

Similarly, Eklund (1987) argues for a form of rapid rural appraisal as an improved diagnostic method, taking great care to ensure that farmers' agendas are elicited. He cites his study in Zaire which included interviews at the household level and interviews and dialogue with farmers in groups. Statistical analysis of data also shed light on farmers' practices. Open-ended questions were included to guard against imposing researchers' agendas on farmers' responses. Farmers were asked to state their three main problems, regardless of domain.

The importance of open-ended enquiry is paramount. As Box comments in section 2.2, some appraisal methods presuppose that the researchers know what questions to ask. By contrast, in an interactive mode farmers contribute to formulating the questions. That this happened in the Philippines cogon work is evident from the surprise which the researchers expressed at the topics which emerged and also by their willingness to interpret any loss of interest by farmers as an indication that the wrong questions were being asked.

It is also instructive to note the sense of excitement and discovery among those investigators who do feel free enough to let research agendas develop new directions after interaction with farm people (sections 2.2, 2.5 and 2.6). An open, unreserved and completely mutual exchange is implied by 'interaction' and researchers stand to benefit as much as or more than farmers in terms of the unknown and unexpected which are brought to their attention.

Reversals in diagnosis, whatever their labels, shift initiative, analysis and choice to farmers and farm families. This implies and requires that they can command and use the tools of analysis. One part of this is to enable them, in Gordon Conway's words: 'to better analyse their existing situations so that they can understand the likely impact of interventions and innovations from outside and hence make sounder development decisions' (Conway 1987b). But beyond this, it is for them to analyse and actively generate requests and demands, and seek and use support from outside. For this, methods such as those described in preceeding chapters need further development and adoption and outsider professionals need the orientation and commitment to enable farmers to use them and then to be guided by the results.

Respect for farmers

The dimension missing from most accounts of farmer-first approaches, whether described as parts of FSR, RRA or FPR, is the basic personal attitude of the outsider professional to the farmer. Often there is an underlying conviction that the modern specialized knowledge of the outsider has a universal validity and application which should override whatever farmers know. The attitudes, demeanour and behaviour which go with this belief prevent learning from farmers. Reversals of behaviour and attitude, to respect farmers as people and to desire to learn from them, are essential complements of the farmer-first methods described in this book.

Behaviour and attitude interact. The most effective way to change attitudes – from despising or undervaluing farmers' practices and knowledge to recognizing their validity – may often be to start by changing behaviour through the adoption of farmer-first methods. One example is team composition. The value of multi-disciplinary teams walking through an area and interviewing farmers is frequently mentioned, but much depends on whether farmers are included as team members, as happens in the Philippines (section 2.4) but not so explicitly in Nepal (section 2.3). Then there is the question: if they are included, are they merely regarded as guides, or do they play an equal or dominant part with the researchers in discussion? Another example is mapping and diagramming. Mapping may be an important tool for researcher-planned work, as described by Edwards (section 2.7), in which the use of maps for agronomic monitoring facilitates group interaction among members of an outsider research team,

to the benefit of resource-poor farmers. Beyond that, mapping can be used in a farmer-researcher interactive mode, with cultivators, pastoralists or village-level extensionists themselves drawing maps and diagrams, or where maps and diagrams are developed through discussions with a group (sections 2.5 and 2.6). The key questions are whose knowledge and ideas determine what is represented, and whose analysis elicits priorities.

Yet another example is ethnohistorical and biographical descriptions. Asking farm people about the history of their village and its landscape and about their lives has been recommended by several authors as a means of identifying problems for research and of developing research agendas in collaboration with farmers (Okali, 1983; Rocheleau and Weber, 1987) and forces outsiders to listen and learn.

Methods such as these can be used to change not just behaviour but also attitudes and understanding. Required to include farmers in teams, to elicit maps and diagrams from farmers or to ask for ethnohistorical and biographical histories, outsiders can be helped to listen and learn. Listening and learning can in turn lead to a change of attitude from superiority to respect. This respect for farmers extends to giving them credit for information and innovations. In Part 1 of this book, it was suggested that when farmers are responsible for a technological innovation, they should be recognized and acknowledged by name, a principle which applies also to innovations in research methods.

Many of these, and other reversals, are not easy. Conventional professionalism is so strong that only resolute and sustained reversals can achieve the best balance between the knowledge, ideas and analysis of outsiders and farmers. Fortunately, as the contributions to this book show, methods for these reversals exist, and are being further developed. The means do exist for identifying farmers' agendas and for putting them first. For them to be well used requires of outsiders a transparent respect for farmers, a sensitive interaction with them and a recognition and acceptance of them as fellow professionals and colleagues.

Notes

1 This paragraph comes from Gupta (1987a), p. 52.
2 Based on Gupta (1987a), p. 58–61.
3 Based on discussions in the ITK study group and informal comments by Anil Gupta, Roland Bunch, Lori Ann Thrupp and Ed Barrow.

1
Introduction and Conceptual Framework

Participation in agricultural research draws on two broad sources: it was preceded by a move towards participation in social science research, motivated by concern that conventional quantitative and neutral research methods tended to preserve social inequality. Its features included problem orientation, a respect for people's capability to produce and analyse knowledge, the researchers' commitment to and involvement with the community, the rejection of 'value neutrality' and the recognition that research is an educational process for researcher and community. An underlying purpose of participatory approaches was therefore the 'empowerment' of disadvantaged groups — a recurrent theme in some of the literature reviewed here — and one of the principal means of interaction between researcher and people became known as 'action research', a widely-used social science research technique which has found some application in agriculture (ILEIA, 1985).

Participatory research was one of the two major themes adopted by UNRISD for the 1980s (Pearse and Stiefel, 1979) and formed the theme of an international conference held in Yugoslavia in 1980 (Dubell *et al.* (eds.) 1981) at which three parallel purposes of participation were defined:

— community involvement in social research
— community action for development
— community education as part of the mobilisation for development

Freire's (1972) 'conscientisation' as a strategy for liberation was recognised as a pioneering effort to popularise participatory research on an international scale.

A second source on which farmer participatory research (FPR) draws is Farming Systems Research (FSR).

Considerable confusion has arisen over the relationship between FSR and FPR. As indicated below, some proponents of FPR seek to distance themselves from conventional agricultural research institutes which are seen as defending the status quo in relations between researcher and farmer, and, ultimately, in the imbalance between rich and poor farmers in ldcs. On the other hand, even in its earliest formulations, FSR stressed the need to involve and learn from the farmer in research, and where departures from this principle occur, they are generally attributable to poor interpretation of FSR's objectives or to funding constraints.

To some extent, the tension between FPR and FSR reflects that between participatory approaches and institutions in the social sciences. As Dubell *et al.* (1981) note, participation is likely to be constrained by the expectations and intentions of any sponsoring agency. Furthermore, any material arising from participatory approaches and released beyond the community in which it was generated may be interpreted and used in unintended ways, having repercussions beyond the control of the community. For these reasons, in the social sciences approaches have been favoured which are independent of existing institutions. Such 'distancing' is much more difficult in the agricultural sciences, where a vast body of technical knowledge has accumulated in institutions and, for problems to be solved and opportunities exploited efficiently, elements of both institutionalised and indigenous knowledge must be drawn upon. The central concern of this paper is not, therefore, whether one mode of research should replace the other, but how — in terms of methods and institutions — the most relevant aspects of each can be brought to bear on the issues at hand.

The more immediate origins of interest in FPR lie in the realisation that resource-poor farmers (RPF) stand to gain little from the processes of development and transfer of technology characteristic of the Green Revolution, namely the breeding of early maturing fertilizer-responsive semi-dwarf varieties and their diffusion into environments enhanced by irrigation and agro-chemicals. For them, production increases in the future would derive more from evolutionary than revolutionary processes, requiring an understanding of the diverse and complex environments in which they operate so that developments in technology can be tailored to suit their circumstances, building, where possible, on farmers' indigenous technical knowledge (ITK).

Conceptual framework

Analysed below are the concepts underlying three approaches to farmer-participatory research, by Harwood (1979) on the basis of IRRI experience; by Rhoades *et al.* (1985) derived from work at CIP, and by Chambers and Ghildyal (1985).

Before examining the approaches proposed by these, a useful point of reference for comparative purposes can be obtained from an approach suggested for CIMMYT's on-farm experimentation (Tripp, 1982) which, in turn, is drawn from the Production Research Programme at Ecuador's INIAP. The main features of all four approaches are summarised in Figure 1.

1. *Tripp* (1982) outlines the main opportunities offered by OFT and the methods most appropriate to exploit these.

Learning from farmers is a piecemeal, fragmented and iterative process requiring repeated interaction between researcher and farmer over an extended period. An attitude of honest curiosity on the part of the researcher will generate confidence among farmers to react openly and frankly to what they see. The researcher stands to gain an understanding of the role of the technology he is introducing within the frequently complex farming systems, and an insight into how farmers might adapt the technology. Farmers stand to benefit from technology more adequately tailored to the 'recommendation domain' of which they form a part.

The design of the experiment is principally the responsibility of the researcher, as is management of those variables being examined in the experiment. The farmer will be responsible for the remaining operations, but it should be ensured that his practices correspond with the norm for the target group. Collinson (1987 and per. comm.) emphasises the significance attached by CIMMYT to techniques (such as the recommendation domain) which allow the costs of participatory approaches to be spread over a large number of clients.

2. Whilst *Harwood* (1979) recognises the continuing need for 'basic research into varietal improvement, disease and pest management, plant physiology and soil fertility' (p.33), he proposes a method in which 'the major emphasis is on production research, planned and carried out by and with the farmers on their own fields'.

Emphasising flexibility and local adaptation as the key to success, he draws on elements of three existing research systems:

(i) the Japanese practice of establishing many small testing stations throughout the country to ensure local adaptation.

Figure 1: *Conceptual features of principal approaches to farmer participatory research*

	Tripp	Harwood	Rhoades and Booth Rhoades, Batugal and Booth	Chambers and Ghildyal Chambers and Jiggins
Methodological issues				
Who decides on trial design/content?	researcher incorporating farmers's views on content	farmer and researcher jointly	farmer, technologist, extensionist (where possible) and social scientist, jointly	principally farmer with consultative inputs from researcher, if required
Who manages the trial?	researcher manages the variables being tested, farmer manages the remainder	farmer and researcher jointly	farmer and researcher jointly	farmer
Who evaluates the trial?*	not indicated	researcher and farmer, in the light of farmer's goals	farmer has final judgement on appropriateness	farmer
What should characterise farmer/researcher relations?	'honest curiosity' by researchers	farmer and researcher equal	farmer and researcher equal partners	ITK and farmer goals fundamentally important; 'reversals' required if researcher is to learn from farmer; researcher as consultant
What should characterise the research process?	OFT as iterative multi-season process; time needed to gain farmer confidence, and test new hypotheses arising from trial results and his views of them	OFT as iterative multi-season process; farmer to decide whether/in what form he wishes to continue trial; important to test through inter-year climatic variations	flexibility needed: consult farmer through research process and change design where necessary. May be useful to conduct an experiment *before* a survey	farmer to dominate all decisions on research process. Apparently unstructured
Institutional issues				
What should be the interaction between OFR and more basic or commodity/factor oriented research?	ideas for OFR testing to be obtained in part from other components of research, and trial results to feed back to them	OFR teams should be based at the same stations as other research to facilitate interchanges. Unproductive to send 'basic' researchers to field for long periods.	'other research' to provide ideas as one component in 'constructive conflict' process of defining researchable problems. Station-based research should complement OFR	'other research' should have a purely referral role. No indication that it should provide ideas for OFR testing or that OFR results can usefully be fed back into it
What is the role of extentionists in OFR?	help identify sites; to help run trials which may eventually become demonstrations	may be brought in to assess trial and learn from successful ones	involved throughout research, especially in spreading technology among farmers	none defined
How far should OFR researchers monitor the agro-ecological and socio-economic environment with a view to introducing the technology elsewhere?	in detail, to facilitate dissemination	in detail, to facilitate dissemination	in detail, to facilitate dissemination and monitor consequences	not indicated

*Rhoades (pers.comm.) indicates that CIP makes the useful distinction between an evaluation (done mainly by the farmer) of 'solutions' arising from a trial and that (done by researcher and farmer) of the trial's technical performance in combining materials and techniques in order to produce a set of outcomes. The former interpretation is principally of interest here. Collinson's (1987) discussion of the (mainly) CIMMYT-based approach to FSR indicates the need for a wide range of evaluators, which is not incompatible with Tripp's earlier exposition.

(ii) the Chinese requirement that all research scientists spend at least a year living with farmers (though he recognises that it would be unfruitful to send *basic* researchers out to the field for long periods).

(iii) the IRRI programme of testing packages of seeds and materials on farmers' fields, dating back to the 1960s.

Drawing on these observations, Harwood proposes a methodology progressing in a 'logical sequence of steps' through selection of target area, description of the environment, design, testing and evaluation of technologies, and their dissemination.

The design of alternative technologies is participatory in character: 'working closely with the selected farmers, the scientist plans what tests can be done to accomplish specific mutual goals with the available resources . . . The range of possible alternative technologies is determined by the scientists, based on their knowledge of the area and its production potential. The farmer, however, should have the last word on what innovations will be made on his land'.

Evaluation should be conducted with the farmer and in the light of his goals.

Harwood emphasises that this participatory approach should be clearly distinguished from research in farmers' fields initiated and controlled completely by scientists.

3. *Rhoades and Booth* (1982), whilst welcoming the emerging trend in the 1970s towards complementing research with a farming systems approach, note that practically all reported efforts had been multi-rather than inter-disciplinary. The development of potato storage technologies at CIP which they describe is an example of *inter*-disciplinary research, and provided the impetus for their participatory 'farmer-back-to-farmer' model. This they contrast with both top-down technology transfer (research station to extensionist to farmer) and feedback (ie topdown modified by farmer feedback) models (Rhoades *et al*. 1985).

The principal stages of the FBTF model are:

1. Diagnosis	Common definition of problem by farmers and scientists
2. Interdisciplinary team research	Identify and develop a potential solution to the problem.
3. On-farm testing and adaptation	Better adapt the proposed solution to farmers' conditions.
4. Farmer evaluation/adaptation	Modify technology to fit local conditions; understand farmer response; monitor adoption.

But, by contrast with some presentations of FSR, the emphasis in FBTF is on developing a broad approach flexible enough (if necessary) to begin with an experiment and end with a survey, or to abandon lines of research which emerge as unpromising during the course of work, and reformulate the problem and develop new hypotheses. Collinson (pers. comm.) accepts that flexibility is a desirable prerequisite, but argues that prior training in a basic framework and logical sequence of the CIMMYT type is essential if ldc researchers are to gain the confidence necessary for flexibility.

4. The *farmer-first-and-last* approach entails 'fundamental reversals of learning and location' (Chambers and Ghildyal, 1985) from a pure TOT model. Some of these reversals are already evident in 'prototypes' of FFL, but 'have not been fully explored, fitted together and evolved' (ibid).

The FFL approach is characterised by 3 major components:

(i) a diagnostic procedure involving learning from farmers;

(ii) generating technology on-farm and with-farmer;

(iii) using the level of farmer adoption as a criterion for evaluating research.

The Chambers/Ghildyal paper identifies five complementary or supporting measures essential to the wider implementation of an FFL approach: methodological flexibility and innovation; full interdisciplinarity; resources, particularly for travel; scientific rewards geared to practical field achievements and not to publications alone; training in the necessary techniques for learning from farmers.

Developing the FFL approach, Chambers and Jiggins (1986) argue that the ecological and social complexity of resource-poor farming systems can only be adequately addressed through a parsimony of demands on research resources. To facilitate the necessary simplifications, it is essential to 'encourage and enable RPF families themselves to identify priority research issues' (Chambers and Jiggins, p17). This, in turn, will require:

— training of scientists in 'reversals' — ie to treat the farmer on a basis of mutual respect and to take time to learn from his ITK;
— procedures to identify and work with RPF families;
— encouragement of farmer groups in the identification of researchable problems;
— diffusion of innovations (and the generation of hypotheses for new

research) through innovator workshops.

Two points meriting emphasis emerge from the comparison of these four approaches in Figure 1:

(i) in *methodological* issues the approach advocated by Chambers *et al*. represents a strongly farmer-centric view; that of Tripp, whilst recognising the importance of farmers' views, places the researcher firmly in control of the trials. Harwood and Rhoades *et al*. occupy an intermediate position;

(ii) Apart from that of Chambers *et al*., all the approaches identify important and active *linkages* between OFR and other components of the research system. Chambers' focus on farmer-led experiments leaves both the interaction with the remainder of the research and extension system and the scope for disseminating successful trial results ill-defined.

LA VARIABLE DEL GENERO EN LA INVESTIGACION AGRICOLA

Por
Hilary Sims Feldstein, Cornelia Butler Flora y Susan V. Poats[1]

Proyecto "El Género y la Agricultura".

INTRODUCCION

Como ya estamos preparados para ingresar en la década de 1990, necesitamos algo más que tener conciencia de que las mujeres desempeñan un papel importante en el proceso y la producción agrícolas de los países en desarrollo. Necesitamos instrumentos que nos permitan vincular esa toma de conciencia con la investigación agrícola. Esta breve monografía tiene por objeto brindar a todos los que se dedican a la investigación agrícola el fundamento y los instrumentos necesarios para llevar a cabo el análisis por género.

Está destinada a personas que se ocupan de la investigación agrícola, tales como investigadores, formuladores de políticas y funcionarios de proyectos de los países en desarrollo; con el fin de ayudarlos a definir y planear las necesidades de los granjeros en sus países.

PARTE I: FUNDAMENTO

La mayoría de las veces, la práctica de la investigación agrícola se relaciona con el sexo solamente en función de reproducción de animales y plantas. No obstante, el hecho de que la investigación agrícola, especialmente la que tiene por fin mejorar la calidad de vida del sector pobre, mayoritario en los países en desarrollo, tiene lugar en un contexto social, exige que se observe el sexo a través de su sentido social, el género. Todos los aspectos de la investigación agrícola tienen implicaciones sociales, desde la elección del problema hasta la metodología, comprobación y difusión. El desafío para la investigación agrícola, un reto que el análisis por género ayuda a superar consiste en comenzar a precisar mejor la investigación hacia grupos específicos para incrementar la equidad y la eficiencia. Al precisar la investigación por grupo de usuarios aparecen los prejuicios reales intrínsecos de ciertas tecnologías. Por ejemplo, cuando desarrollamos una variedad de trigo más productivo y de alto consumo de nitrógeno, sabemos que la tecnología del trigo está orientada hacia granjeros ricos. En todas las culturas la clase tiene identificadores económicos definidos. El prejuicio del sexo en la tecnología es menos visible, pero igualmente pernicioso.

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1. *Los autores se mencionan por orden alfabético. Hilary Feldstein y Susan Poats son Directoras del Proyecto "el Género y la Agricultura" del Consejo Demográfico de la Ciudad de Nueva York; Cornelia Flora es Catedrática de la Universidad del Estado de Kansas, en el departamento de Sociología, Antropología y Asistencia Social.*

El prejuicio del género no se puede identificar tan fácilmente, porque se trata de una característica más definida culturalmente que la Clase. Nuestra capacidad de generalizar con respecto al sexo, especialmente las interacciones de género con agricultura, es aún más limitada que nuestra capacidad para generalizar sobre variables económicas tales como ingresos o posesión de tierras. Es importante iniciar el análisis por sexo al comienzo de la elección del problema de investigación agrícola en cada ambiente específico, ya que puede ser decisivo comprender las limitaciones socioeconómicas. Más aún, los instrumentos del análisis por sexo se pueden extender a otras restricciones socioeconómicas. La aplicación del análisis por género ayudará a que los investigadores tomen conciencia de la diversidad de limitaciones no agroecológicas que deben superarse, si se quieren satisfacer las necesidades de las familias de campesinos de escasos recursos.

Cinco hechos basicos respecto al genero y la agricultura

(1) Muchas familias de los países en desarrollo tienen diferentes ingresos (de él y de ella) que provienen de fuentes diferentes y tienen distintos destinos en el hogar. Por ejemplo, él puede cultivar árboles para exportación. Ella puede tener cultivos debajo de esos árboles cosechados por él, que venderá en el mercado interno. Los ingresos generados por él se podrán destinar a la construcción de la casa o ampliar sus propiedades. Los ingresos de ella pueden utilizarse para alimentar a los niños así como costear su educación.

(2) Aún cuando no haya ingresos totalmente separados, la sociedad asigna diferencias a los papeles y recursos de hombres y mujeres.

(3) El aumento del ingreso familiar no beneficia de igual manera a todos sus integrantes.

(4) En la mayoría de los lugares del mundo, la innovación tecnológica ha tendido a poner en desventaja a la mujer con respecto al hombre.

(5) Las campesinas producen tanto como los hombres de campo cuando se les brinda acceso a recursos similares.

Objetivo de la investigacion agricola.

Con esta base concreta, en función de género y agricultura, podemos examinar el objetivo de la investigación agrícola, como lo estamos usando aquí: <u>desarrollo de tecnologías que los granjeros utilizarán para mejorar su bienestar y el de su país</u>

Ese objetivo se divide en cuatro partes, todas las cuales tienen implicaciones de género. La primera es el desarrollo de tecnologías. La investigación agrícola está orientada hacia la tecnología. No se trata de investigación básica solamente, aunque ésta es crucialmente importante para que pueda producirse el desarrollo tecnológico en última instancia. Las tecnologías solamente son eficaces si se utilizan. Por mejor que funcionen las tecnologías nuevas en la estación experimental, si los granjeros no las usan, su desarrollo habrá sido en vano. Este problema se discute con mayor detenimiento más adelante.

En segundo lugar, esas tecnologías deben mejorar el bienestar de la familia de granjeros. Algunas veces, las tecnologías pueden utilizarse en forma beneficiosa a corto plazo, pero tienen consecuencias negativas que no se advierten, a mediano plazo. Por ejemplo, las tecnologías que pueden aumentar el bienestar del hombre mediante una producción más alta y mayores ingresos pueden no alcanzar el resto de la familia de campo. O pueden beneficiar a los hombres - por ejemplo, la introducción de la mecanización en la preparación del suelo - pero no a las mujeres, que deben escardar una superficie más extensa.

Finalmente, una tecnología debe mejorar el bienestar del país. En consecuencia, tenemos la obligación de examinar cómo incide la investigación agrícola en problemas tales como reintegro de la deuda, deterioro ambiental, etc, como parte del objetivo que incluye el bienestar nacional. Si se ignora el bienestar nacional, es improbable que la burocracia del país abogue por la tecnología desarrollada, aún cuando ésta pareciera ideal para los pequeños agricultores involucrados.

La investigación agrícola es un proceso progresivo y los objetivos específicos van a experimentar cambios. A medida que se desarrolla y utiliza una tecnología, el sistema de producción cambia. Una nueva restricción se convierte en lo más limitativo y debe obtenerse una nueva tecnología.

En el contexto de todo proyecto o investigación determinados, los objetivos pueden enfocarse más precisamente conforme a una política gubernamental, interés del donante o recursos disponibles. El enfoque puede estar centrado en un cultivo o animal específicos, o en cultivos comerciales solamente, o bien en cultivos alimentarios. Es importante tener en mente tales objetivos específicos cuando se apliquen los conceptos del análisis por género descritos a continuación.

Necesidad de un enfoque en el usuario

El desarrollo de la tecnología responde perfectamente a las necesidades del usuario. Estas pueden variar a medida que se superan las diferentes limitaciones. La perspectiva del usuario es importante en dos niveles — quién empleará las nuevas tecnologías (semillas, insumos, regímenes de escarda, etc) y quién utilizará el rendimiento total de la producción mejorada. Los que están afectados por la tecnología misma pueden ser muchos y variados, según el alcance de las operaciones agrícolas involucradas. Para los usuarios de los productos (incluso subproductos o residuos), los cambios en la naturaleza, cantidad o plazos de la producción total pueden tener consecuencias. Las opiniones de ambos grupos de usuarios influirán en la aceptación final de los cambios propuestos.

En las economías de mercado, donde los agricultores están totalmente integrados al sistema comercializado y tienen ingresos adecuados, el proceso de desarrollo de la tecnología es relativamente fácil. La tecnología se desarrolla en respuesta a las necesidades de los que la adquieren. Con frecuencia, este enlace entre el usuario y el que elabora esta tecnología se realiza mediante la investigación de mercado que emprende el sector privado en anticipación de las ganancias. En algunas regiones de los Estados Unidos, Canadá y en muchos países en desarrollo, cuando los granjeros que se encontraban en una zona, generalmente propietarios de pequeñas tierras con recursos limitados,no utilizaban las tecnolo-gías desarrolladas, se obligaba a estos propietarios a mudarse o bien se convertían en trabajadores agrícolas, y los granjeros de mayores recursos, que podían utilizar las tecnologías, se apoderaban de la tierra.

En los países en desarrollo ésta no es una solución viable especialmente para los programas destinados a granjeros de recursos limitados. Más aún, en los países en desarrollo, hay una discontinuidad entre el uso y la compra de tecnología. Los compradores de tecnología (los que pagan por su elaboración) son donantes internacionales y gobiernos nacionales, los que poco pueden tener en común con los pequeños agricultores que son los que finalmente juzgarán si la tecnología satisface o no sus necesidades de bienestar.

Una de las consecuencias de separar la investigación del usuario es que la investigación para el desarrollo está a menudo manejada por la tecnología, no por el usuario. Por ejemplo, un inventor entusiasta aparece con una tecnología (tal como una estufa de gran rendimiento de combustible) y luego determina la necesidad. Este prescribe una solución para resolver el problema y luego define la utilidad del aparato. Si se establece el problema primero, tal como problemas de desforestación a los que contribuye el uso de madera para combustible, un proyecto de agroforestación puede demostrar ser la solución más viable. Un diagnóstico imperfecto del problema, como también un diagnóstico imperfecto de las necesidades y posibilidades del usuario, ha conducido en muchos casos a poner énfasis en una tecnología inapropiada y fuera de contexto.

Para que se justifique toda la investigación agrícola, el problema debe surgir antes que la tecnología. Debe ponerse mucho más énfasis en desarrollar tecnologías que los agricultores utilizarán, no meramente tecnologías abstractamente eficaces para lograr ciertos objetivos de producción. El hecho de adoptar la perspectiva del usuario incrementa la eficacia de la investigación agrícola mediante una mejor fijación de objetivos y especificación. La relación entre la perspectiva del usuario, el desarrollo de tecnología y los sistemas de producción se ilustra en la Figura 1.

La adecuación de una tecnología es a menudo específica del sexo, basada en el contexto social de quién la utiliza realmente dentro de la familia. Sólo recientemente la comunidad donante ha hecho que el análisis por sexo forme parte de los criterios de evaluación de proyectos, aunque la especificidad del mismo durante mucho tiempo fue parte integral de cómo los agricultores decidían adoptar o no los resultados de la investigación agrícola.

Patrones de responsabilidad conforme al genero en la agricultura

Hay un acuerdo general con respecto a la existencia de cinco patrones generales de responsabilidad conforme al sexo en las ciencias agrícolas, todos ellos con implicaciones para la investigación agrícola (Cloud 1985).[1]

El primer patrón es: explotaciones separadas. En virtud de este patrón, mujeres y hombres son responsables de la producción y disposición de diferentes cultivos y ganadería dentro del sistema de producción familiar. Las mujeres pueden especializarse en ciertos cultivos, como así también participar con los hombres en la producción de otros. Puede haber una división entre los cultivos de subsistencia de las mujeres y los cultivos comerciales de los hombres, entre dos cultivos de cereales tales como mijo y arroz, los cultivos de plantas hortícolas de las mujeres y los cultivos de cereales de los hombres, el arroz de pantano de las mujeres y el de regadío de los hombres, o las cabras de ellas y el ganado vacuno de ellos. A su vez, las mujeres pueden especializarse en aves de corral, pequeños rumiantes, recolección de cultivos silvestres, vegetales o frutos arbóreos, frijoles, caupís y otras plantas leguminosas. Los investigadores deben preguntar si la investigación se realizará sobre cultivos realizados por hombres o por mujeres.

El segundo patrón es: campos separados. En este patrón, las mujeres producen las mismas cosechas que el hombre pero en campos diferentes. Los cultivos realizados por mujeres usualmente son para consumo interno y mercados locales, mientras que los cultivos de los hombres pueden tener un mercado regional o nacional. Este patrón se encuentra en los sistemas de Africa Occidental, donde los campos de las mujeres usualmente forman parte de un sistema más grande, en el que el trabajo de ambos sexos también se aporta a los campos comunales de las familias ampliadas. En este caso hay tres sistemas de producción unidos: los campos de las esposas, los campos del marido y los campos conjuntos de la familia ampliada. El investigador debe averiguar si las pruebas en la granja se llevan a cabo conforme a las condiciones de él, de ella o de la familia conjunta.

El tercer patrón es: tareas separadas. En este patrón, algunas o todas las tareas dentro de un solo ciclo se asignan por sexo. En asignaciones de tareas comunes los hombres deben preparar el terreno, mientras las mujeres plantan o trasplantan los cultivos. Este patrón es el que prevalece especialmente en la producción de arroz y plantas hortícolas africanas. En muchos sistemas, la selección de la semilla y el almacenamiento son tareas realizadas por mujeres. En la mayoría de los sistemas, el hombre es el que efectúa el arado de la tierra. Puede asignarse a la mujer ciertos tipos de protección vegetal; y ciertas clases de tareas de recolección de cosechas puede asignarse por género. El proceso y almacenamiento de cereales, vegetales, frutos arbóreos, y productos lácteos con frecuencia son tareas femeninas. A menudo es trabajo de mujeres el cuidado de animales cuando son pequeños y están enfermos. Ordeñar frecuentemente se asigna a uno u otro sexo. A veces, esto difiere según los animales. Por ejemplo, entre los tuareg, los hombres ordeñan a los camellos, las mujeres a las cabras, y ambos al ganado vacuno. La investigación debe averiguar si el análisis ex ante revela que el cambio tecnológico propuesto aumentará considerablemente las tareas masculinas o femeninas o desplazará el trabajo asalariado de hombres y mujeres.

El cuarto patrón es: tareas compartidas. En este patrón, hombres y mujeres comparten tareas en el mismo cultivo. Esto puede significar que ambos aceptan hacer la tarea o que hay una coparticipación real de responsabilidades. En muchos sistemas, solamente se comparten las tareas de trabajo intensivo, tales como escarda y recolección de cultivos. Los investigadores deben averiguar si la nueva tecnología hará que la práctica de los cultivos sea una tarea separada, y a su vez, determinar las implicaciones de dicho cambio para el resto del sistema. Una tarea compartida puede significar una mayor flexibilidad en función de satisfacer las demandas laborales de esa actividad.

El quinto patrón es: campos explotados por mujeres. E[illegible]n de dos tipos: de facto y de jure. En el sistema de facto, los hombr[illegible]an lejos de la granja durante días semanas o aún años, mientras que la[illegible]es la explotan en su ausencia. Cloud señala las variaciones, que son muchas. Por ejemplo, los hombres pueden trabajar fuera de la granja pero regresar cada noche. Muchas mujeres kenianas y japonesas, administran granjas durante la semana mientras sus maridos trabajan en la ciudad. En Nepal, algunos maridos pueden ausentarse durante varios meses. En Jamaica, Lesotho, Botswana, Yemen, Zimbabwe y en la Cuenca del Río Senegal, la migración masculina al exterior puede durar años, mientras en algunos sistemas muy patriarcales, la explotación de la granja y la inversión de remesas puede quedar en manos de hombres de más edad. En muchos sistemas, las mujeres se convierten en eficaces directoras de explotaciones rurales. Muchas de estas granjas disponen de recursos importantes, pero las directoras pueden, sin embargo, carecer de autoridad jurídica para firmar acuerdos crediticios y disponer de los recursos. Los investigadores deben preguntar si, para estos tipos de granja, se poseen los recursos necesarios para adoptar la tecnología, ya que la separación entre propiedad y explotación, puede limitar en gran medida el tipo de tecnología que se pueda adoptar.

Las familias mantenidas por mujeres de jure están aumentando considerablemente. Se trata de familias legalmente encabezadas por mujeres. Son algunas de las familias agrícolas más pobres y cuentan con escasos recursos y severas limitaciones laborales. Sin embargo, como señalan Due y White (1986), hay muchas personas cuya supervivencia depende de las familias mantenidas por mujeres de jure. Estas pautas y sus implicaciones para la investigación se sintetizan en la Tabla 1.

Así como no podemos suponer que todos los granjeros son similares y todas las familias las mismas, tampoco podemos suponer que todas las mujeres son iguales. Por ejemplo, Jones (1983) en su estudio en Camerún Norte descubrió que las mujeres actuaban en forma muy diferente en las casas donde los maridos estaban presentes que donde no lo estaban. En los lugares donde los hombres estaban a cargo del cultivo comercial de arroz y las mujeres del cultivo de subsistencia de mijo, la demanda de trabajos incompatibles durante el ciclo de producción afectaba negativamente el éxito del proyecto arrocero gubernamental. Tradicionalmente, los economistas y otros presuponen que se aprobará el policultivo que reditúe los mayores beneficios a las familias en general. Esto es lo que se denomina frecuentemente función utilitaria familiar. Dados los precios relativos de los dos cultivos en virtud de dicha suposición, hubiera sido más racional para las familias de la zona invertir la mano de obra necesaria en arroz, venderlo y comprar mijo extra. Eso ocurrió en familias dirigidas por mujeres en las que ellas eran responsables de ambos cultivos. Sin

embargo, en las familias donde el marido se hallaba presente, las mujeres racionaban su mano de obra, la invertían en arroz en proporción directa a la cantidad de dinero que sus maridos les habían dado como regalo al final de la estación previa. El resto de la mano de obra se destinaba al mijo, para alimentar a la familia. Las relaciones interfamiliares, no sólo si uno es jefe de familia, sino el grado en que las mujeres reciben retribución de los hombres en reconocimiento de su trabajo, tienen un enorme impacto sobre lo que ocurre a los cultivos de los hombres. Jones sostiene convincentemente que no deberíamos adoptar una función utilitaria de la familia al planificar los proyectos, incluso la investigación agrícola, sino dirigir más bien la atención a lo que ocurre dentro de la familia.

La clase y la etapa del ciclo vital también diferencia a las mujeres entre sí. En un estudio efectuado en Pescador, Colombia, se descubrió que las mujeres jóvenes casadas sin hijos, se ocupaban directamente de la producción agrícola comercial, prefiriendo los frejoles para el mercado urbano; las mujeres casadas de más edad, con familias numerosas y la responsabilidad de proveer alimentación a la mano de obra asalariada, preferían un frejol que aumentaba de tamaño y tenía buen sabor. Con esta información, los genetistas de frejoles continuaron produciendo ambas clases (Ashby, 1989). Entre los tubai de la Polinesia francesa, las mujeres que probablemente aprovechan las oportunidades de producción comercial de la papa o patata, son aquellas cuyos maridos tienen empleo fuera de la casa pero ellas no (Lockwood, 1989).

Conocer los diferentes patrones de responsabilidad por sexo en la agricultura puede parecer una tarea muy extensa. Sin embargo, los instrumentos para el análisis por género descritos a continuación definen el campo de estudio de manera que los investigadores agrícolas puedan concentrarse en lo que es más importante para su trabajo.

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On-farm research in a silvopastoral project: a case study

ROLAIN BOREL* and FRANCISCO ROMERO**

* *Former coordinator of the CATIE/IDRC Silvopastoral Project, presently associate professor at the University for Peace, San José, Costa Rica;* ** *Coordinator of the CATIE/IDRC Silvopastoral Project, CATIE, Turrialba, Costa Rica*

Key words: Costa Rica, silvopastoral systems, *Gliricidia sepium*, *Erythrina berteroana*, live fences, tree establishment, on-farm experiments, farmers participation

Abstract. The Silvopastoral Project is being implemented by CATIE in the Atlantic humid lowland of Costa Rica, in order to develop alternatives to the current destructive mode of livestock production. The overall approach is briefly described and two superimposed on-farm experiments are discussed in more detail. The main constraints for on-farm research within the project are analysed: the limited previous knowledge of the area and of the local species, the difficulty of achieving a common understanding about research with collaborating farmers, the need for additional staff supervision and the complexity of the statistical analyses. An attempt is made to draw lessons from the ongoing project regarding how to resolve the apparent contradiction between rigorous scientific requirements and questions of immediate value to extension, the compromises to be achieved between different types of evaluation (statistical, risk, etc.) and the potentials and limitations of farmers' participation in research.

Introduction

In the Atlantic Region of Costa Rica, the last 40 years have been marked by dramatic land use changes, which have deeply affected both the landscape and the life of the people. There is thus a double challenge of finding alternatives to resource over-exploitation and of adapting research methodologies to a changing situation. On the one hand this is an advantage, because historical evaluation can help to explain better the actual land use systems (history being considered a "laboratory" for social sciences). On the other hand it is clearly a disadvantage because the search for long term oriented systems within a changing situation causes evaluation problems and difficulties in adjusting to changing farmers objectives.

The objective of this paper is to analyse a development oriented agroforestry research project being implemented within the region, from which to extract lessons for future projects in similar situations.

Project area

The Atlantic Northern Region of Costa Rica belongs to the "humid to very humid tropical rain forest region" according to Holdrige's classification.

The main crops of economic significance are banana (*Musa sp.*), cocoa (*Theobroma cacao*), maize (*Zea mais*) and plantain (*Musa sp.*) [Van Sluys et al., 1987]. "New" and relatively fast expanding crops in the region are: dryland rice, pejibaye (*Bactris gasipaes*) — a fruit and "palm heart" producing native palm, ornamentals and fruit trees. A recently opened direct road to the capital city is providing strong incentives and new opportunities in the region (horticulture, tourism, etc.).

A tremendous (over six-fold) increase in the area under pastures, most of it for extensive beef production and for colonization schemes, has taken place in the last 40 years, with the incentive of favourable export prices. The export value per hectare would, however, not compensate for the lost value of the converted forests [Leonard, 1986]. Whatever the economic value of extensive cattle ranching is today, the large tracts of extensive pastures remain a permanent and prominant feature of the landscape.

From the long-term observers' point of view, the main problem is the one of resource destruction: deforestation and inappropriate land use.

Uncertainty in land tenure and an overload of accumulated debts reduce access to the necessary credit for long term investments in more sustainable practices.

Lack of appropriate technology and know how (specially in forest and crop management) and the inefficient use of existing techniques (in timber extraction, use of crop residues and grazing management, weeds and pests & diseases, etc.) reduce the production efficiency of most of the farms.

Organization of the project

The Silvopastoral Project is executed by CATIE, a regional research and teaching institution for Central America, in collaboration with the Costa Rican ministries of Agriculture (MAG), and Natural Resources (MIRENEM) and with the Agrarian Reform Agency (IDA). Funding for the project comes from IDRC and the CATIE core budget. During the first 3-year phase, the staff included two senior scientists (agroforestry and animal science), two professionals (forester and zootechnician) and two technical assistants in addition to 5—10 field workers. Two to three students (at the graduate or post-graduate levels) would collaborate with the project. MIRENEM would also second two regional foresters on a part-time basis. Local offices and land at the regional research station were granted by MAG and IDA. Two 4WD vehicles and two motorcycles were available to the project. Project planning covered a nine-year period, to be implemented in three-year phases.

Project objectives

The main project objective was to develop adoptable, persistent and sustainable production systems, that would show an increase in productivity and in economic returns for small farmers.

Specifically the project would DESIGN new system components, by learning either from successful farmers or from formal experiments and it would EVALUATE their effectiveness either on project- or farmer-managed farms [Borel and Romero, 1988].

As a general approach, the project would work on complex, low input, silvopastoral systems, trying to involve as closely as feasible the farmers in the research (getting ideas from "successful farmers"). The research would be focussed on components, rather than development of "packages." It would eventually accent new technologies, closely related to the ones the farmer know or remember, for example, evolution of the live fences of legume trees into a more integrated system.

The project was designed by a multidisciplinary CATIE team (agricultural economists, pasture and livestock scientists) in consultation with representatives of the prospective donor (IDRC). Once approved, the project was presented to the different collaborating national institutions (MAG, IDA, MIRENEM), who included it in their own planning.

That the national institutions were not invited to participate in the initial design steps can be considered as a planning weakness, even if it did not eventually affect their collaboration.

Design of the research programme

Specific research objectives

The specific research objectives may be better expressed in terms of expected achievements (outputs):

1. Adoptable and economically viable techniques would be available to extension agencies and farmers.
2. Useful interactions between trees, pastures and livestock would optimize land use productivity in the long run and provide economical alternatives.
3. The biomass production potential and quality of locally available and newly introduced herbs, shrubs and trees would be optimized for different purposes on farms.
4. Technologies successfully practiced by advanced farmers in the region would be described and the basis for their success would be understood.
5. The evolution of the land use systems over the last 20 years would be described and understood and the related farmers' perspectives and expectations would be identified.

As it appears from the presented sequence of specific objectives, the process of objective setting started from the "end product". At each step, the question asked was: "What do we need to know in order to achieve that specific goal?" The answer would then clearly indicate the content of specific objectives to be achieved "earlier". It does not mean, however, that the five specific objectives would be attained in a (reverse)sequence. In fact, single activities leading to specific objectives 2, 3 or 4 did at times run in parallel.

Not only the specific objectives but also most of the proposed experiments were planned by the initial project design team. Only after the project began, two-day planning meetings were organised yearly with representatives from the national institutions, banks, local farmers cooperatives, milk plants and other interested parties, to inform them about project advances and prioritize future actions (CATIE, 1986).

Specific research tools and sequence selected

The individual experiments corresponding to each specific objective are listed below, and their design, location and relation to other experiments is also indicated. The two starred on-farm trials will be explained in detail in the next two sections.

Specific objective: the evolution of the land use systems. . .

1. Evolution of land use (1960—1984). Mapping from aerial photographs. Input into 2, 3, 4, 5, 6, 11, 12, 13.
2. Land use evolution among farmers within different zones and from contrasting origins. Survey. Input into 3, 13.

Specific objective: the technologies practiced by advanced farmers. . .

3. Description of significant technologies from successful farms. Farm monitoring. Input into 13.

Specific objective: the biomass production potential. . .

*4. Biomass productivity of existing tree species. Superimposed trial. 6 treatments, 3 replications, randomized complete block (RCB) on 8 sites (on-farms). Input into 5, 11, 12, 13.
5. Adaptability of newly-introduced tree species. 10 treatments, 3 reps., RCB on 2 sites (1 on-station, 1 on-farm). Input into 12, 13.
*6a. Tree establishment methods. 7 treatments, 7 reps., completely randomized. 2 sites on-farm. Input into 12, 13.
6b. Tree establishment methods. Factorial: 2 species, 6 methods, 4 reps. completely randomized. 2 sites (1 on-farm, 1 on-station). Input into 12. 13.
7. Adaptability of newly introduced grass and legume species and ecotypes. 25 species, 3 reps., RCB on station. Input into 8, 11, 12, 13.
8. Renovation of degraded pastures (animals as grazers). Factorial: 2 soil preparations. 2 P2O5. 3 N. 2 reps., RCB on-station. Input into 10, 11, 12. 13.

Specific objective: useful interactions between trees. . .

9. Carrying capacity of grass/legume mixtures. Not defined yet. Input into 12. 13.
10. Supplementation with tree fodder. Grazing expt. 4 supplement levels. 2 steers/treatment 3 reps., RCB on-station. Input into 12, 13.
11. Effects of trees on soils and pastures. Animal grazers. Factorial: Trees present/absent, livestock present/absent. RCB on-farm: 1 block on each farm. Input into 12, 13.

Specific objective: adoptable and economically viable. . .

12. Implementation of project managed "farms." Not implemented yet.
13. Comparison of farms with high and low levels of adoption of the proposed technologies. Not implemented yet.

The planned experiments were all carefully prioritized to bring part of the necessary solutions within a given time-frame. Although logically they should have been conducted sequentially (e.g., that the results of the tree adaptation trial be used to design the tree biomass trial), most of them have been started within the first 2—3 years of the project. It was assumed, for example, that the local species were the best available components, until the adaptation trials would clearly show the contrary, in which case the better species/ecotypes would then be substituted in the recommendations. This kind of shortcut is not failproof, but saves a considerable amount of time, until the first recommendations can be made.

Trials which required a large number of treatments, or needed to obtain results over the long run, or required large numbers of homogeneous animal or large areas of homogeneous land were carried out on-station. Trials which required evaluation under different soils, or needed to submit treatments closely to the local conditions or required the convenience of having the farmer collaborate and/or evaluate results were carried out on-farm.

Role of farmer in research design

The farmers were not asked to participate in the design of the experiments. Only minor adjustments were considered. For example, one block (farm) in one tree species adaptation trial was sold after a few years. The new owner opened the trial to grazing animals but still agreed to have the remaining trees measured. This gave a fairly accurate (however unforeseen!) estimation of the small trees' tolerance to grazing.

Examples of on-farm experimentation

Species comparison and management for tree biomass production

Live fences are a common landscape feature in the region, but apparently underutilised for biomass production. The objectives of this trial were therefore to determine the biomass production potential and the nutritive value of *Gliricidia sepium* (Jacq.) Walp. and *Erythrina berteroana* Urban, under an appropriate cutting interval.

Six experimental treatments were considered: 2 tree species (*G. sepium* and *E. berteroana*) each subject to 3 cutting intervals (2, 4, and 6 month intervals between pollarding). Each plot was composed of 10 trees, and replicated 3 times at each site. Three sites were originally chosen for *E. berteroana* and five for *G. sepium*. The site selection criteria were: even distribution over the project area, owner's consent, ease of access, presence of at least a hundred 4 to 10-year old trees in a row, showing uniform growth and crown shape and showing signs of being regularly pollarded (not less than every 2 years) [CATIE, 1987b]. One of the *G. sepium* sites had later to be dropped and another site was added for *E. berteroana*, thus giving eventually each species 4 experimental sites.

The measurements taken were: number and length of branches, crown diameter, and total cut biomass at each pollarding. Biomass was separated into leaf, twig and branch components, which were then dried and analyzed for dry matter content, N, and in vitro dry matter digestibility (IVDMD). Data were stored in a spreadsheet program (for dry matter, crude protein and digestibility percentages), then entered into a PROC GLM SAS computer programme for statistical analysis [Smits, 1988a].

One of the main conclusions of this trial was that the "optimal" interval seemed to increase with successive pollardings. At the beginning, it seemed that a 2—3 month interval might be optimal, but then the productivity of the 2-month interval treatments declined (ending with the death of many trees) and it was eventually concluded that the optimal interval lay between 5 and 6 months.

It was also confirmed that both species show a sub-optimal dry matter digestibility (between 45 and 50%) which limits their use as a supplement for livestock, at least at higher levels of supplementation [Smits, 1988b].

Cash flow analysis suggested, however, that intensifying live fences management is a profitable practice.

Tree establishment methods on existing pastures

The damage by livestock to recently established stakes is of two kinds: browsing, which is avoided with stakes taller than 2 meters, and scratching, which might be reduced by reinforcing the stakes or by the way of "spines" either natural or artificial.

The objective was to compare different protection measures for large stakes established vegetatively in grazed pastures. The 7 treatments were: no protection (negative control)(NC); barbed wire enrolled around each stake (WIRE); 3 stakes planted in a triangle and bound together at the top (TRIPOD); 3 stakes planted in line and bound together by 2 sticks running diagonally, like an X (X); 3 stakes planted in a line and bound together in the middle with a horizontal stick (3L); 5 stakes, planted as in the preview treatment (5L); 3 stakes bound at the top to a tensed wire (positive control) (PC).

Each plot was composed of 3 or 5 stakes, each evaluated individually. Seven plots of each treatment (reps) were located randomly on the pasture. The same experiment was located on two farms.

Visual estimates of survival, inclination, firmness in the ground, browsing and scratching damage, sprout numbers and twig development were taken at weekly intervals during 14 weeks, later at one month interval for one year. Data were stored and analysed in a spreadsheet programme.

Large differences occurred between farms: where the stocking rate was higher and the presence of other trees was less, the damage to most of the treatments was nearly total, while in the other case, the WIRE, X and PC treatments showed a good survival, stability and biomass production, although sometimes confounded with another factor: stake height. When the established stakes were shorter than 2 m, they were heavily damaged, irrespective of the protective treatment [CATIE, 1987b].

Constraints in on-farm experimentation

On the whole, the experiments gave the results which they were expected to provide: estimates of biological potential, management recommendations and even some economic evaluations. A few expectations, however, were not fulfilled, which gave opportunity for an analysis of some research constraints that should have been considered.

1) *The limited previous knowledge about the region and local plant ecotypes affected experimental planning and implementation*

Different sites had been considered (4 sites for each species in one experiment and 2 sites in the other), because a great deal of variability (e.g., in soil fertility) had been "intuitively" recognized. However, the reasons for the variability between sites, were not much clearer at the end of the experiments. In the first experiment, for example, the large variation between sites remained unexplained, although standard soil analysis had been taken at each site and climatic conditions were not expected to vary significantly. In addition, one location was lost for one species and another was added for the other, when a suitable site was later "discovered". In the second experiment, stocking rate (not considered in the beginning, but later shown to be different between sites) and the presence of other trees appeared to be of importance, because they affected the "pressure" on the recently established stakes, but were impossible to quantify a posteriori.

Along the same lines, it was assumed that the "local" species were sufficiently well known (especially pollarding management and plantation techniques) from research done in similar regions, for the experiments to be planned with little risk of failure. There were problems however, since one of the treatments (2 month intervals) had to be dropped because of excessive plant mortality.

The limited previous knowledge about the area and the species is probably the rule rather than the exception within R&D projects and has its consequences. From the statistical standpoint the loss of a location and the adding of another one in the course of the experiment is far from desirable, although these changes may lose their importance when considered over the full term of fairly long experiments. The necessity of a thorough description of each site is another consequence of the same constraint. In any case, the description needs to be much more "complete" than a "project report" would normally require, so that calling in short term specialists will probably be necessary. As far as experimental design is concerned, it might be necessary to choose more "conservative" treatments than normal.

2) *Difficulties existed in trying to achieve a common understanding about research with collaborating farmers*

Although the reasons for locating the experiments on-farm were mainly ecological in nature, it was also expected that the farmers would offer their own criteria in the evaluation. Farm owners were consulted about the site for the trial, and the general purpose of the experiment was discussed, but the nature of the treatments was not fully explained, nor were farmers consulted in their selection. Although it was repeatedly explained that the farmers should consider themselves participants in the trial, they would still refer occasionally to: "CATIE's trial . . .". This may be explained as a way for collaborating farmers to demonstrate "status", by indicating that they had been specially chosen to host one of CATIE's trials. Farmers also demonstrated less interest in the trials than expected (e.g., asking for some results or commenting on a specific treatment), unless directly addressed.

The concept of research/experimentation is familiar to farmers [Rhoades and Bebbington, 1988], but not the methodology traditionally used by researchers. Feeling a bit uneasy, farmers may not like to express their opinions in front of a team of "ingenieros". This attitude is a set-back for any project, because one of the potential advantages of on-farm experimentation is not fully realized. The recommendation for any project is thus to spend a considerable amount of time explaining to farmers the purpose and methods of the experiments and take every occasion offered to make decisions jointly with them, well beyond the usual "choice of the land". This time, as well spent as it might be, is normally in excess of that taken for on-station experiments.

3) *Field staff needed much more supervision than expected*

Where the environment is more diverse, experiments tend to be widespread over a large area. Also, as the research methodology is new and at times still in the making, field staff, collaborating students, etc. are more prone to errors than under a controlled environment. In our case, for example, the trial on one of the sites nearly failed, because some of the stakes were too short (about 1.8 m above ground, instead of 2 m) and were browsed to death. In the other trial, the 2 month interval treatments were not monitored closely enough, until a great number of plants were about to die. Had the assistants been more closely supervised by researchers, these mistakes might have been avoided.

4) *Statistical analysis of superimposed trials was relatively complex*

The on-farm trials were kept as simple as possible, as it should be in this kind of environment: a factorial 2 × 3 with 3 replications in one case and 7 treatments with 7 replications in the other. Reality, however proved far more complex. Site selection did not offer problems, but it was nearly impossible to locate fence lines of both species at the same farm. This made true species comparisons within site impossible.

Use of existing fences had the advantage over a newly established experiment, in that data could be collected immediately [Borel and Romero, 1988]. However, data from supervised trials were more complicated to analyze, due to randomization problems, as well as the loss and addition of sites. Time series data (successive observations, pollardings, etc. over several years) are also frequent in this type of trials and far more complex to analyse than a standard RCB. These constraints were eventually overcome with the use of sophisticated models, but it is not expected that every R&D project would have access to the resources necessary [Smits, 1988a].

Lessons learned and challenges identified for on-farm agroforestry research

The experience of the Silvopastoral Project also raises some more fundamental questions about the planning, organization and implementation of agroforestry research. How can formal research be made effective for addressing developmental objectives? How can research results be evaluated in terms of farmer criteria? And how can research projects be designed to effectively use farmer participation?

Contradictory research objectives (scientific analysis vs. extension relevance)

The project has tried, with varying success, to compromise between the contrasting and sometimes contradictory requirements of rigorous scientific research on component response, and technical questions of immediate value to extensionists and farmers. This same challenge faces many agroforestry development projects.

Due to the site-specificity of so many agroforestry practices, it is relatively common for development projects to have a "technology adaptation" component, sometimes planned, sometimes "acquired" after initial failures.

The technology adaptation process can take many forms, from intuitive modifications brought each season to the proposed technologies (and perhaps accompanied by evaluation in demonstration plots) to the use of well designed experiments to filter new technologies prior to release for farmers. Basically, both approaches, and the whole array of combinations between them, may generate the same solutions: a good practitioner and a good scientist both use their imagination and knowledge to propose solutions. The differences between the approaches reside in the objectivity of the evaluation process and the confidence of the research results' application over a wide area. The latter can only be secured by a formal experimental approach. However, this requirement can be met within a decentralized focused research programme.

On the whole, there is no need to compromise quality in a decentralized research programme provided the principles of replication and randomization are always maintained. Simple designs allow for sound research results, assuming that the priority problems are well focused, and that informed guesses have been made about the potential solutions, in order to reduce safely the number of treatment combinations.

One of the main difficulties is the duration required for a reliable evaluation (an obstacle frequently mentioned by project managers). Even then, shortcuts are available. While intervention based on early research results are carefully disseminated (that is, with close monitoring), the trials may be continued in order to confirm the validity of the recommendations and to evaluate the residual effects.

Greater collaboration between development and research institutions could enhance the quality and relevance of agroforestry research. Development projects or institutions are frequently weak both in staff and equipment. Items commonly missing include scales and other measuring instruments, oven, statistical software, and particularly laboratory access. Universities and research institutes (and even some "R&D" projects), on the other hand, have difficulties in focussing on relevant subjects and relating to development efforts. The natural arrangement would be for the development projects to contract with specialized research groups a) to collaborate in overall research planning, b) to advise on specific experiments (design, measurements, analysis, etc.) that the development project might undertake directly, and c) to implement other experiments, particularly those requiring specialized equipment and know-how.

The issue is therefore not how much research a development project should undertake or how many extension activities should be included in a research project, but how to establish effective working relationships between the two. It is the responsibility of the development-oriented projects to attract researchers towards the relevant problems and support their research, while research organizations, *quasi* by definition, should not undertake research which is not assured of being absorbed into a development action.

Contradictory criteria for evaluation (statistical vs. real significance and risk)

The concept of "statistical significance" has to be reviewed. When we deal with complex systems, with interventions and products or services spread out over many years, the farmers' decisions for change would normally be based on observations of:

a) significant, practical differences from the actual situation (meaning that the effects of the proposed change depart rather radically from the existing level);
b) differences that remain fairly constant in time and over various locations.

In these conditions, the standard test for *statistical* significance becomes a "justification" that the research was well conducted. It merely establishes whether or not observed differences between treatments could have occurred even if true average treatment responses were the same. On the other hand, the only valid evaluation of the *practical* significance of treatment differences is the farmers' acceptance, based on perceptions that may or may not coincide with scientific parameters.

A key factor in farmer evaluation will often be the effect of the new technology on farming risks. In the Silvopastoral Project, location of the same experiments in different sites allowed for assessment of the superiority of the best treatments in terms of the risks involved. For instance, the unexplained variation between sites in the first trial should have a strong bearing upon future recommendations. When only the utilization of existing fence lines is considered, a certain risk must be asssumed, though it may not be significant. But the risks may be considerable if the establishment of *new* fence lines is attempted. Indeed, despite the fact that the financial analysis of the "improved live fences system" was highly positive and the system was well received by the farmers, when farmers were asked about their preferences, this system was still out-ranked by another alternative: enrichment of secondary forest. This preferred alternative showed lower financial returns but required a much lower initial investment and was practically insensitive to price changes, i.e., less risky [CATIE, 1987a].

Farmers participation: dream vs. reality

The main debate around farmers' participation in research relates to the type of technical changes that can be pursued and how fast they can diffuse.

Without farmer participation, research advances may remain unutilised, while the absence of outside technical inputs and ideas reduces the possibility of overcoming the farmers'own limitations [Etesse, 1988].

Any new project in an area is faced with two basic options in selecting research priorities. The first option is for researchers to propose from the beginning (after some rapid appraisal) some alternatives that may appeal to the population. The second option is to start organizing people for participatory research planning without prior reference to specific changes that could be pursued. The first option demonstrates quickly the project team's good intentions and allows for a rapid reaction to the proposed changes, while the second option should provide a deeper understanding of the people's objectives and problems and increase their real participation. Each option also has its disadvantages. The first approach may restrict from the onset the range of potential activities, including those that may be most needed, while the second may delay the initiation of long-term research activities [Etesse, 1988].

The Silvo-pastoral Project clearly took the first approach because, at its conception, the benefits of more decisive farmer participation were not clearly understood. Moreover, "project planning requirements" demanded that the proponents show evidence of working hypotheses, present a detailed time-table of the main activities and even a rough description of the main experiments. All these requirements decrease the possibility of involving farmers from the design stage. Thus, a pre-project activity is necessary, during which the principal activities would be to organize farmers and design the main project. It is imperative that the modalities for designing, financing, staffing, and implementing new projects be thoroughly reviewed in such a way that project interventions would be selected directly from the initial field studies [Etesse, 1988].

Other limitations to using farmers' ideas originated from project inertia. In one of the first surveys, the farmers manifested a clear interest in fruit and timber trees, rather than "forage" trees. The project failed to react to this interest for a number of reasons: there was no staff vacancy which could have been diverted for a fruit tree specialist; resources were already marked for on-going activities and long-term trials; agreements had been reached with farmers about other types of activities, etc. This example is presented to illustrate the difficulties in adjusting projects once they are underway.

Beyond these practical issues, a major restriction to increased farmer participation in research may be the attitude of young professionals towards farmers and their perception of their role in development. In today's circumstances, the role of the scientist or outside researcher should no longer be one of "the expert" researcher doing research for farmers (nor of the "specialist" diagnosing "sick," meaning ignorant, farmers). Rather, this role should be one of a person helping farmers in their own investigations as a catalyst (speeding up reactions), a colleague, and/or a consultant. In most situations, a wide repertoire of methods may be required [Chambers, 1989].

Training priorities over the next few years should focus on encouraging such changes in the role of technical staff during the development process.

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FAO: Forests, Trees and People Programme

DISCUSSION PAPER

prepared for FTPP's sattelite meeting / expert consultation on Farmers Research and extension

LOCAL INNOVATION AND KNOWLEDGE BUILDING PROCESSES RELATED TO THE MANAGEMENT OF FOREST RESOURCES

A PERSPECTIVE FROM LATIN AMERICA

January, 1997

prepared by: Jean-Marie E. Laurent
with inputs from: Jaime Valverde
Carlos Brenes Castillo

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Introduction

This paper presents a synthesis of a four-years process carried out in Latin America for developing the topic of "Farmers' Research and Extension" in the framework of the Forests, Trees and People Programme of the Food and Agriculture Organization of the United Nations.

The first chapter presents the way the problem has been defined and the initial hypothesis strategy proposed in the region for addressing it.

The second chapter introduces the conceptual and analytical framework which has been developed and applied to the analysis of a series of 10 field-based case studies.

The third chapter is an analysis of the case studies and a presentation of emerging patterns and major lessons gained throughout the process.

The fourth chapter -conclusions- re-assesses the validity of the initial hypothesis and definition of the problem and examines the current status of the development of the topic inthe region.

The last chapter presents a series of recommendations on the potential role of different kinds of institutions, as well as suggestions for a follow-up of FTPP's activities.

The paper is the result of a collaborative effort of grass-root organizations, governement agencies, field projects and NGOs and research and training institutions, and of the work of both professional and community members.

1. Background, problem definition and FTPP strategy in the region

1.1. Background

1.2. Initial problem definition and hypothesis

The perception that classical research and extension strategies were inadapted to community forestry development, and that a major effort should be undertaken to propose new alternatives, has been a shared concern of FTPP's global programme and of some of its components (particularly of the Central American component at an early stage).

The problem had originally been defined in early internal documents as follows:

. most technological packages developed by research institutions are not adapted to the situation and possibilities of farmers, particularly of the poorest strata.

. very few research results actually reach farmers anyway, this being increasingly the case in countries where official extension services have been reduced or disappeared as a consequence of structural adjustment plans.

. innovative approaches to agricultural extension and research where completely ignored by institutions working in the forestry sector.

There has been, however, an increasing difference in the perception between the global programme and its Latin American component on the question of how to address the basic problem.

The global programme was emphasing the need for a collaborative work with major research centers (mostly those belonging to the CGIAR system), which were considered as the "main target group". It was perceived that by developing the topic of Farmers Research and Extension in close collaboration with those institutions from an early stage, the programme could achieve an impact in terms of inducing a shift in attitudes and approaches adopted by those institutions. However, it became evident that beyond the expression of a polite interest, none of the major players approached was ready to make any substantial institutional commitment.

Conversely, the Latin American component proposed from an early stage a rather different strategy. It was felt that the situation was not mature for challenging the "research and extension establishment" on convincing grounds. An alternative strategy has been slowly developed, based on the following assumptions:

. that local innovation processes in forestry, agroforestry or natural resources management did exist, but had never been put in evidence.

. that local knowledge generation processes, through farmers' own research and/or horizontal dissemination were also likely to take place, but that they had never been seriously taken into account (at the most, local knowledge was considered as some kind of anecdotic cultural attribute of traditional rural societies).

. that there was a fundamental contradiction in donors' strategies: while funding the spreading of participatory approaches at project level, most donors and international agencies continued to support the classical kind of research which does not respond to the needs of local processes.

. that most research institutions would only change their attitudes and apply new approaches to research if induced to do so by clear demands of their clientele and by determined pressures by the donor community.

. that external institutions (including field projects and research institutions) were not equiped, from a conceptual, methodological and instrumental perspective, to identify and analyse local innovation and knowledge building processes, let alone to support them.

. that FTPP itself had only a remote idea of how to do so.

1.3. FTPP strategy for addressing the problem in the region

The initial strategy, keeping in mind the ultimate goal of strengthening and improving the local capacities for managing forest and natural resources, has thus been the following:

. identifying and highlighting the existence of local innovation processes related to the management of natural resources, in their different dimensions (technical, institutional, etc),

. developing two pilot case studies (in Costa Rica), aimed not only at documenting the innovation processes, but also at developing preliminary methodological guidelines and capacities for analysing such processes.

. promoting the participation of indigenous people and farmers, women and men, in a series of regional seminars and congresses, where they could contribute with their own testimonies, experiences, suggestions and declarations.

. supporting or promoting a series of local initiatives of inventory of forest resources, of horizontal extension and communication, and of dissemination of local initiatives, both in Central America and in the Ecuadorian Amazon.

. supporting farmers organizations in the formulation of their own forestry related agendas.

At the same time, an effort was made to support various initiatives (including regional seminars on extension organized by FAO and CATIE) aiming at discussing and analyzing, from an institutional perspective, progress made in participatory forestry development, with emphasis on research and extension.

Key inputs and contributions were also brought in from inside and outside the region, such as alternative approaches like Participatory Action-Research, innovative methods like "RAAKS - Rapid Appraisal of Agricultural Knowledge Systems" and "Understanding Farmers' networks, and case studies like the one developed by Biggelaar in Rwanda.

Finally, an effort was made to initiate the development of the alternative conceptual frameworks and epistemological corpus, required for addressing the issues of local innovation, endogenous knowledge building, and horizontal communication.

With this in hand, a second series of eight case studies has been carried out in Guatemala, Honduras, Nicaragua, Costa Rica, Ecuador, Colombia and Bolivia, in a collaborative effort with FAO and non-FAO field projects, farmers organizations, agroforestry networks, local NGOs and academic institutions, under the coordination of CUDECA, the Lead Institution in charge of the development of the topic and with the active support of FTPP's Latin American facilitators.

The process has lead to the organization of a regional workshop organized in September 1996 at CATIE, were case studies were presented and discussed, leading to a series of conclusions, recommendations and where possible pathways for follow-up have been suggested.

The findings and recommendations of the workshop have then been incorporated for developing a new conceptual and analytical framework which has been used for carrying out a more in-depth analysis of the 10 Latin American case studies, and fine-tuning findings, lessons, conclusions and recommendations.

In general terms, FTPP's strategy in the region has primarely focused on working toguether with grass-roots institutions and development support institutions, in order to develop a consistent set of alternative approaches, concepts and frameworks, prior to try to influence major research centers. Recommendations on how to further develop the strategy are presented in Chapter 5.

2. Proposed conceptual and analytical framework

A two-fold framework has been developed for understanding farmers and indigenous innovation processes related to local management of natural resources in the region. The framework is not carved in stone, and has no pretention to be exhaustive: it is specific in scope and is based on the authors' understanding of the basic problem affecting research and extension initiatives in Latin America. Otherwise, this framework is expected to be improved as we learn and understand more from farmers innovation processes and rationales and from the interaction between local processes and formal institutional interventions. It should be taken as a collaborative discussion paper.

The first level of the framework constitutes an attempt to identifying, defining and putting in relation key "macro-concepts" which have been considered central for approaching local innovation in its technical, social and institutional dimensions, and whose management by outside institutions and professionals strongly determines the way they can perceive, value and support local innovation processes.

The second level of the framework has a more analytical dimension and draws on: a) the lessons gained from the field-based case studies; b) the analysis of formal research and extension initiatives; and c) inputs from other grass-roots processes. It puts in relation a series of additional factors, both endogenous and exogenous, which have been perceived as determining, facilitating or hampering innovation and knowledge building processes. Such an analytical framework is also an attempt to proposing a preliminary operational method for external institutions interested in better understanding (and eventually supporting) local innovation processes.

The articulation between the two levels of the framework is fundamental, since an increased coherence between conceptual and methodological approaches constitutes a compelling challenge for most development support institutions.

2.1 Macro-conceptual framework

The following concepts have been identified as important and discussed during the regional workshop:

. Local innovation in its technical, social, cultural and institutional dimensions

. Local versus mainstream development

. Instrumental versus transformational participation

. Local knowledge and dynamics of local knowledge systems

. Change and cultural resistances to change

. Sustainability in its technical-ecological and social-institutional dimensions

. Local control and empowerment

. Farmers linkages and capacity of agency

Local innovation: local innovation by farmers and indigenous people is conceived as the very process through which they generate answers to the problems they face in the management of their natural resource base. Innovation is the search for new practices and arrangements related to the technical, socio-cultural and institutional dimensions of natural resources management.

Innovation by farmers and indigenous people themselves has lead to most agricultural and forestry management systems in place until recently, and has broadened the array of available varieties, adapted species and technical practices.

Farmers capacity to experiment on, adapt, validate and spread new practices, as well as to build and share new knowledge related to those practices has been a key determinant in the historical evolution of farming and natural resources management systems. However, a series of externally-driven factors, such as increased pressures for change and the imposition of modernization strategies which irrespects and contributes to destructuring local cultures and world views, may have lead to disruptions of traditional and culturally embedded knowledge systems and institutional arrangements, and to a decay of local innovation capacity. The emergence of new problems, whose solutions may also be beyond the scope and innovative capacities of the local people, also needs to be taken into consideration.

Notwithstanding, the recognition of the failure of many formal research and extension strategies based on knowledge transfer has lead to a search for participatory approaches to support sustainable locally-based management of natural resources. This implies the need for a closer -and critical- look at the potential of farmers' efforts to innovate and generate socially acceptable and ecologically sound practices and knowledge.

Understanding farmers innovation processes today requires looking beyond their strictly local dimension. The core issue is not just to "recognize how creative farmers are", to "give a mythical status to local knowledge" or to be "marvelled by farmers' innovative capacity", but rather to try to apprehend the rationale, strengths and weaknesses of local innovation processes vis-a-vis those of formal research and extension institutional initiatives. Devising new pathways towards a mutual understanding and a constructive co-operation, based on the respect for cultural differences, constitutes a crucial challenge indeed.

Local knowledge and dynamics of local knowledge systems: Local knowledge is a also perceived as a central concept for understanding local innovation by farmers and indigenous people. Farmers' knowledge is conceived as embedded in local knowledge systems, which are able to evolve in response to pressures, disruptions, constraints and opportunities. While local innovation processes lead to new, adapted or renewed technical, social and institutional practices and arrangements, they also imply the generation of new knowledge, which in turn allows for an increased control by local people on those new practices and arrangements.

Conversely, existing local knowledge may also determine the nature and extent of local innovation. A better understanding of the dynamics of farmers's knowledge systems (loss versus incorporation, permanence versus disruptions, holistic perspective versus fragmentation, control versus sharing, etc) is deemed a necessary condition for supporting local change and adaptation processes. The potential for a dialogue at the interface between local and scientific knowledge systems is strongly conditioned by outsiders' awareness and attitude towards local knowlede.

Local versus mainstream development: Mainstream development concepts are currently synonimous of privatization, structural adjustment, reduction of the role of the State to its normative dimension, withdrawal of governmental agencies from their executive role, promotion of free-market solutions, and imposition of an ideology of modernization and globalization ("get hooked or disappear"). The increased penetration of those concepts leads to both a series of constraints and opportunities for the development of local initiatives and processes. The concept of local development is central, since it allows for a possibility of transforming this balance of constraints and opportunities in benefit of local communities. It also facilitates the understanding of communities development rationales, goals and agendas, as well as of their innovation and adaptation initiatives and processes.

Instrumental versus transformational participation: most projects and institutions working on participatory forestry development and management of natural resources still conceive participation in a rather instrumental way. Farmers are considered as participants in the initiatives and strategies promoted by external institutions. Transformational participation is conceived as the transformation of this biaised relation between insiders and outsiders, leading to a situation where insiders become increasingly the subjects of their own developement processes and where outsiders' participation evolves towards a more supportive dimension.

Local control and empowerment: local control refers to the capacity of local groups and communities of actually controlling key aspects affecting their own development, such as access to resources, relations with external institutions, internal organizational patterns, evolution of their farming systems and practices, etc. Increased knowledge is seen as an important factor contributing to local control. The degree of local control is perceived as strongly determining farmers' reactions to externally-driven pressures for change and their ability to find their own solutions to the problems they face. Empowerment is conceived as the process through which communities and farmers groups and institutions gain local control, power of determination and a series of related capacities and abilities.

Linkages and capacity of agency: local communities are increasingly integrated into the local, regional, national and global economy. Linkages refer to the gamut and intensity of inter-relations of the community with not only other communities and farmers organizations, but also with external institutions or projects. Agency refers to the ability of farmers groups and organizations to make use of those linkages in a proactive way, articulate their own development agendas, enter into negotiation and develop positive partnerships.

Sustainability: sustainability should not be considered only in its technical-ecological dimensions, but also from the perspective of the sustainability of social and institutional change deriving from local innovation processes. It should also be analyzed in view of the degree of control on change by local communities.

2.2. Framework used for analysing the case studies

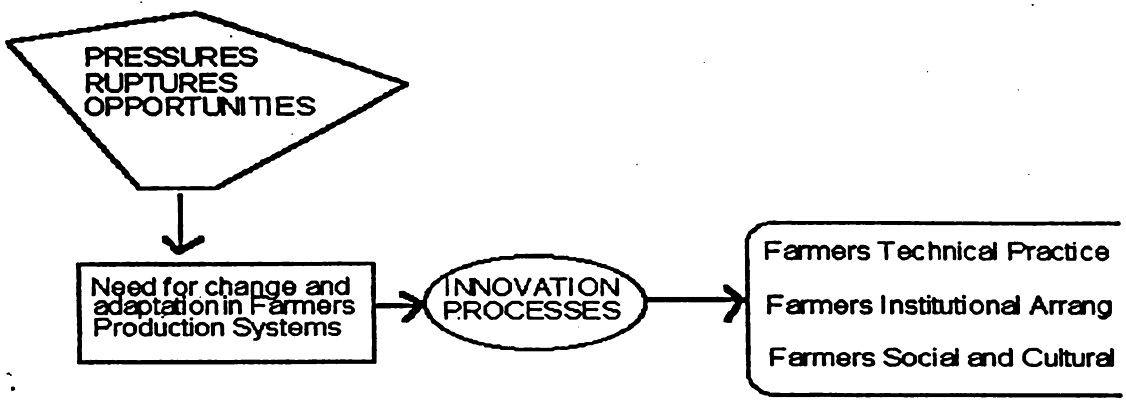
The conceptual framework presented above defines and puts in relation key "macro-concepts" deemed necessary to put innovation and knowledge building processes into a broader development perspective. The analytical framework described below aims at allowing for a better understanding of key factors influencing communities' innovation ability ánd processes. The framework also makes extensive use of the macro-concepts explicited above, and puts them into a more operational perspective.

Key factors highlighted through field-based case studies and through the assessment of both grass-roots processes and formal institutional initiatives related to innovation, research and extension are listed below and will be discussed in Chapter 3. Figure 2 presents the analytical framework in a graphical way.

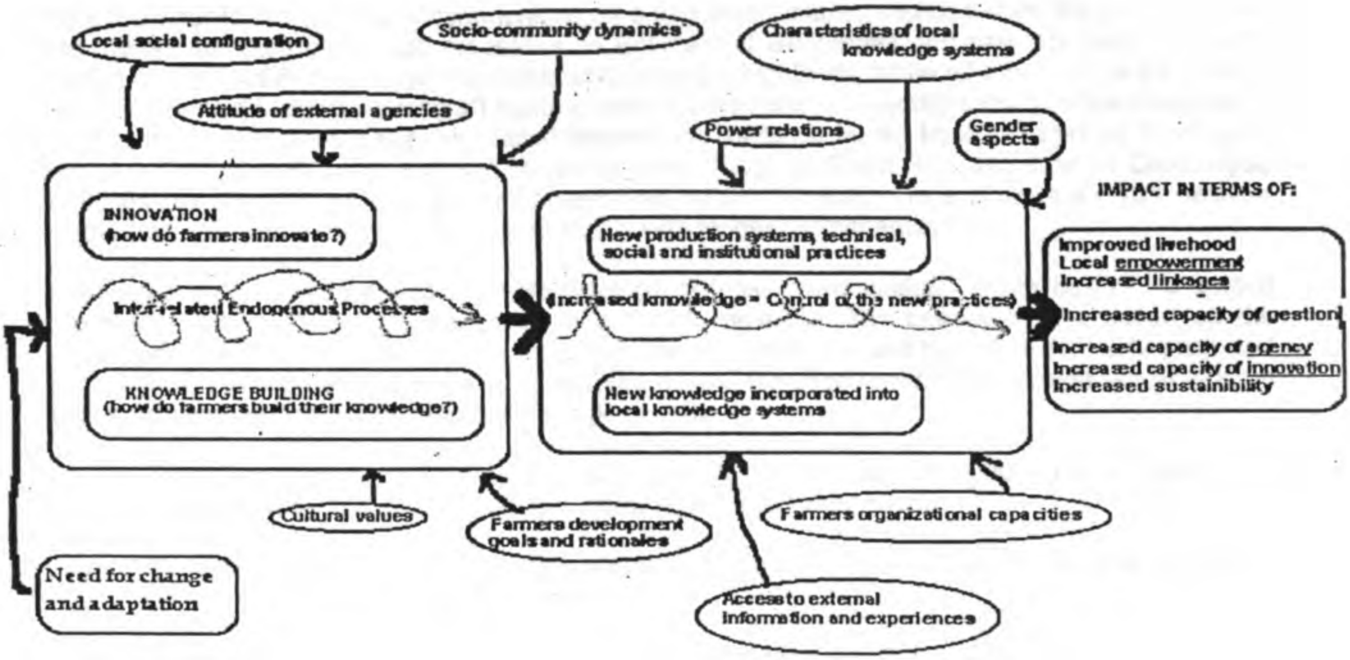
Identified key factors influencing local innovation processes are the following:

- Pressures, disruptions and opportunities
- Local social configuration
- Social-community dynamics
- Characteristics of local knowledge systems
- Attitude of external agencies
- Power relations
- Gender aspects
- Cultural values
- Farmers development goals and rationales
- Farmers organizational capacities
- Access to external information and experiences

FRAMEWORK FOR ANALYZING FARMERS INNOVATIONS RELATED TO MANAGEMENT OF FORESTRY AND AGROFORESTRY RESOURCES IN LATIN AMERICA



ANALYTICAL FRAMEWORK: RELATIONSHIP BETWEEN INNOVATION AND KNOWLEDGE BUILDING PROCESSES, AND KEY ENDOGENOUS AND EXOGENOUS FACTORS.



3. Analysis: lessons, patterns and emerging issues

3.1. Initial considerations on the characteristics of the communities represented in the case studies

Most of the communities represented in the case studies, with the exception of Hojancha, Costa Rica, are poor to marginal rural communities, or a had those characteristics before they got involved into the documented innovation processes. In Bolivia and Guatemala, the case studies have been carried out in "traditional" indigenous communities of the highlands, while all other cases have been developed within farmers ("peasant") communities. Of the latter, a majority belong to the category of migrant farmers who have been displaced towards the lowlands humid tropics (cases of Nicaragua, Ecuador, Colombia-Ecuador and San Miguel in Costa Rica). In Costa Rica, the case of Chorotegua analyzes the situation of official resettlement-land reform schemes in a dryer area; the case of Hojancha deals with a more "well-off" community with longer permanence.

It is somehow difficult to define a simple typology of those communities, on the basis of a limited number of key criteria, representative of a broad diversity. The one we use is based on the "development rationales, strategies or goals" of the communities, and had been formerly proposed by C. Brenes. This typology has been considered usefull for understanding the processes of change and resistances and for putting innovation in perspective.

Type 1 communities: Communities which are in the situation of "enduring" or "holding on", below powerty-line and dedicated to meeting basic survival needs.

Type 2 communities: Communities whose basic needs may be considered as met or close to be met (transition to better livelihoods).

Type 3 communities: Communities with more resources, with an increased diversification of socio-economic options.

3.2. Analysis of the case studies

Typology of innovations

Four basic categories of innovations have been identified through the case studies:
. innovations in specific technical practices (agriculture and soil conservation, agroforestry, forestry management),
. innovations affecting farmers production systems (shifts to new production systems, significant changes and adjustments in existing ones)
. innovations in institutional arrangements (creation of new local organizations, changes in rules, etc)
. innovations in the cultural/social praxis (new attitudes, new communication patterns, etc).

It has been noted that the different types of innovations are often inter-related. For example, technical innovation may lead to the search of new institutional arrangements required for ensuring the control on the new practices. Cultural innovation, often in terms of developing new attitudes towards natural resources is also frequently associated with the shifts in production systems.

Pressures, disruptions and crisis

All of the communities studied have or are being exposed to different kinds pressures, disruptions or crisis, which are not only or allways directly related with the degradation of their natural resource base. They include for example:

. pressures such as the intent of external institutions of imposing new schemes and practices for managing a traditional communal forest (case of Totonicapan, Guatemala),

. pressures such as the progressive degradation and reduction of the available resource base for agricultural production and self-consumption (case of Bolivia),

. the crisis affecting for example the Honduran farmers situated in a new protected area, whose production alternatives have been dramatically reduced by the enforcement of rigid management rules,

. the crisis experienced by the relatively "well-off" farmers of Hojancha, Costa Rica, when their cattle-based production system collapsed in the late 70s and early 80s.

. the complete disruption experienced by migrant farmers forced to abandon their traditional homelands and start a new life from scratch in a completely different ecological and social environment.

It may be true that most of the communities selected for the development of the case studies have been experiencing particularly "stressing" situations, not representative of the conditions of the majority of rural communities in Latin America: not all of the latter are affected by conservation policies, displaced or experiencing drastic externally induced crisis. However, all of them are under some kind of pressure.

It is interesting to put the "stressing" situations experienced by the communities analyzed in the case studies, in relation with the fact that they have been precisely selected on the basis of our perception of their involvement in series of innovation processes.

Pressures, disruptions and crisis seem to be mayor factors explaining why communities get involved into innovation processes. Communities seem to have or have maintained capacities for generating internal change in reaction to pressures, disruptions and crisis.

Perception of a need for change, adaptation or resistance

The perception of a need for change, adaptation or resistance, in reaction to increased or new pressures, disruption or crisis affecting farmers production systems and living conditions is the very first step of an endogenous innovative process. Perceiving this need constitutes a necessary, but not a sufficient condition for generating the process of endogenous innovation, which is expected to generate satisfactory answers to farmers perceived needs.

Understanding farmers' own perception of this need for change is central, since it may differ significantly from outsiders' perception. Their perception has a direct influence on the kind of innovations farmers may decide to initiate.

Certain factors, which may contribute to determining farmers' perception of the need for change, adaptation or resistance, such as:

. their own cultural values,
. their life strategies and development goals
. their access to external information, experiences and opportunities
. the nature and intensity of the pressures and disruptions they experience

Cultural values

The case studies have highlighted the diversity of cultural values within the limited number of communities documented.

In the case of the two indigenous communities in Bolivia and Guatemala, strong indigenous identity and community values are associated with processes of cultural resistance. In the other cases, the "campesino" cultural values (typical of the case of Nicaragua) present a rather wide array of nuances. In Hojancha, modernization and profit making are fully integrated into farmers cultural value, while San Miguel's farmers have developed an ethics of conservation of forest resource associated with a strong group-family identity feeling. In Chorotegua, there is a strong opposition between the cultural values of the different communities of settlers, deriving from the settlers' previous situations: a group of communities show values strongly associated with a "culture of independent farmer" based on autonomy and self-reliance, while an other group's values are articulated with a "culture of hacienda", based on wage-dependency and taking orders from above. In case studied in Honduras, "campesino" values are influenced by urban proximity.

A major lesson from the case studies is that the sets of cultural values associated with a given communities are extremely diverse and that they strongly influence farmers attitudes towards change and their perception of the need for change, adapatation and resistance to change. Cultural values are a key determinant of the nature and extent of innovation. They also explain certain characteristics of the knowledge generation processes. They also condition the attitude of communities towards external initiatives.

Relations between the communities and external institutions

Conflicts and tensions ....

A general pattern emerging about the relation between communities and external institutions is that the relation is frequently characterized by a series of conflicts and/or tensions. Conflits should not be seen negative by nature, but rather as the expression of the capacity of the community or of its institutions to react to external initiatives or pressures and express their differences.

Most identified conflictive situations fall into four categories:

. conflicts deriving from farmers resistance to a homogeneous and externally-designed technical offer which do no correspond to the diversity of farmers realities and development processes (case of Totonicapan - Guatemala, Hojancha - Costa Rica in the early phase of the process, some settlements in Chorotega - Costa Rica, cases of Ecuador and Colombia).

. conflicts deriving from the attitude of external research and extension institutions towards local people (case of San Miguel - Costa Rica when CATIE proposed a home-designed research experiment using San Miguel farmers' land and labour).

. conflicts deriving from the authoritative impositions of plans and rules by official institutions (case of Honduras).

. conflicts deriving from a feeling of exclusion from sector marginalized in the innovation and development process (case of Hojancha)

No specific conflicts have been identified in two cases: Nicaragua, where the "external institution" is in fact a programme coordinated by the country's bigger Farmers Syndicate, and Bolivia, where the community has been mostly approached by research NGOs working on social sciences related issues.

How did the conflicts evolve?

It should be noticed that those conflicts have evolved in different ways. In Guatemala, the conflict was resolve by cutting access of external agents to the local community (resistance). In Hojancha, the conflict has progressively desappeared as the local innovation processes lead to new technical solutions and claims increasingly accepted by the official institutions. A similar "conflict resolution process" seems to have been initiated in Ecuador and Colombia as a results of the case studies. In Honduras, the conflict has not evolved in a positive ways, since official institutions have not (yet?) modified their authoritative position.

In some cases, the conflicts between insiders and outsiders have contributed to dynamize the search of solutions by the insiders themselves and thus the local innovation processes. Conversely, the results of the innovation processes (new technical practices, adapted production systems, specific institutional arrangements) have been used by the farmers in negotiating with external institutions and have contributed to a resolution of existing conflicts.

Types of relationship

The kind of relations observable today between the communities and the external institutions range from horizontal and based on mutual respect (Nicaragua, Hojancha in Costa Rica) to vertical and impositive (case of Honduras). In the case of Hojancha, a continuum between "well-off" farmers' and external institutions can be observed, where people from the community (young leaders) can now be found in both kinds of institutions.

As it has been mentionned allready, the community of Totonicapan in Guatemala has almost cut relations with outside institutions.

Openness but also caution in the relation with outsiders is characteristic of the community of San Miguel, where the local organization has defined a clear development agenda which sets the ground for negotiation.

The relations in the framework of formal cooperation projects like in Chorotega, Costa Rica, or in Ecuador and Colombia is still perceived by some communities as remaining vertical, in spite of the "participatory strategies" adopted by the projects.

A general trend tends to emerge from the case studies: there is a correlation between the magnitude of the local innovation and dissemination processes, and the the kind and intensity of the relationship developed between local communities and external institutions. This is where outsiders' support has been better accepted, valued and used by the community, and has been built on more horizontal grounds, that the endogenous processes have gained a wider dimension and extent. Conversely, when the relationship between outsiders and insiders remains dominated by conflicts, tensions and caution or has simply diseappeared, innovation and dissemination processes tend to remain in a slighly more local dimension. A major lesson is that external institutions have a potentially very important role in dynamizing, supporting and facilitating endogenous processes of innovation and dissemination of innovations.

Community dynamics and local social configuration

The internal dynamic of the community and other caracteristics of the local social configuration has been considered in most of the case studies as key aspects playing a crucial role in both the innovation and knowledge building processes.

The case of Chorotega, Costa Rica, is very illustrative at this respect. The differences in the set of cultural values among the different communities of settlers have lead (in spite of the similarities in the formal organizational structures imposed by the re-settlement Board) to very different community dynamics. In those communities were the "culture of independant farmers" is dominant, the network of relations between farmers is much denser, and there there are numerous unformal institutions. As a consequence, there is a high frequency of contacts, exchanges, discussions, visits to neighbours, meetings, etc. The adoption, adaptation and experimentation on new techniques and practices is facilitated by the existing community dynamics. Conversely, in those communities were the "culture of hacienda" is the dominant one, the community dynamics and appears to be far weaker, with less unformal institutions and a lower frequency of exchanges among farmers. It is in those communities where the process of adoption, adaptation and experimentation is weaker.

The cases of Hojancha, Costa Rica, and Bosawas, Nicaragua, are also illustratrative of this correlation. In both cases, the community dynamics is rather intense, and the processes of innovation, experimentation and dissemination of practices are very strong: Were the local social configuration is characterized by a deficient community dynamics, innovation processes tend to be more limited in scope, and fundamentally dissemination is limited within closer social circles.

Power relations

Power relations between insiders and outsiders have been discussed above when we examined the reations between both. Power relations inside the communities have appeared to strongly determine the way innovations are spread or retained within local power networks. Discussions held during the Regional Workshop have put greater emphasis on the relationship between power and knowledge. It has been recognized that increased knowledge can lead to increased power at two levels:

. on one hand, increased knowledge within the community can reinforce its negotiation power with external institutions, as well as its actual capacity of generating its own answers to the problem it faces.

. on the other hand, the accumulation of new knowledge within restricted power networks in the community may lead to an increased power of the member of those networks, that they can excercise on other groups of the community. While the forms of excercising power within the community is strictly regulated by customary rules in traditional indigenous communities, this may not be the case in "campesino" communities. In the latter, there is a risk that innovation and knowledge building processes may lead to increased gaps between communty groups.

Conversely, existing power networks strongly determine the knowledge-building processes. This is a reality that needs to be taken into account by external agents when they get involved in supporting local innovation and knowledge building processes. Experience gained from the case studies shows, however, that the influence of this kind of characteristic of the local social configuration can be counterbalanced though a dynamization of the community's communication channels. The experience of Campesino a Campesino (Nicaragua) shows that by promoting the development of intense linkages among farmers (within and without their own community), an external intervention can contribute to by-passing established power networks through improves spreading of information and experiences: This in turn contributes to broadening the social basis for innovation and knowledge building.

An other important lesson from the case studies is that external interventions can contribute to broadening the social basis on which knowledge is being built through sharing.

Access to external Information and experiences

One of the limitations or weaknesses of famers innovation processes is that farmers often lack access to existing sources of information and relevant experiences. The problem is not a matter of "transfer of external knowledge". Communities do build their own knowledge but are limited by gaps in the information they need. The usefulness of the information for the communities obviously depends on the local capacity of processing this information. It is why it appears that more use is made of external information and experiences when community members are actively involved in local innovation and knowledge building processes and have thus a better processing capacity. Useful and/or necessary information include marketing, credit, technical data, as well as other farmers experiences.

Outsiders obviously have a fundamental role to play in making information more available, accessible and "processable" for local communities.

Gender aspects

Most of the case studies carried out in the region have failed to incorporate the gender dimension. The Bolivian case study, however, has demonstrated the importance of taking into consideration the differences between men and women within different age groups in terms of responsabilities, access to information, involvement in local experimentation and knowledge management.

One of the conclusions of the workshop was that it was surprising that case studies supported by the Forests, Trees and People programme could have been so gender-biaised, and that the gender dimension should be systematically incorporated in any future activity.

Role of farmers organizations

The role played by farmers organizations has been highlighted in various case studies. While the presence of strong first-level organizations is often correlated with strong community dynamics and innovation processes, the role of second or third-level organizations (like in Nicaragua) may be instrumental as an alternative to other forms of external intervention. Risks related to control of information, knowledge and benefits within power networks internal to the organizations could not, however, be assessed, and should be kept in mind.

Impacts of the local innovation and knowledge-building processes

The impact of those processes at community level have not been analyzed in detail in the case study. The question has been discussed at various points during the regional workshop, and the following possible impacts will need to be further assessed:

. Impact in terms of improvement of livelihood

. Impact in terms of empowerment

. Impact in terms of increased linkages and capacity of agency

. Impact in terms of management of natural resources

. Impact in terms of increased innovation capacities

. Impact in terms of sustainability

4. Conclusions

The initial definition of the problem also remains valid, but would need to be slighly reformulated, since:

. it seems that in the case of Central America, where there are hundreds of cooperation projects under way, the withdrawal of government agencies has been compensated by an increased presence of NGOs and external agencies, and that plenty of "extension messages" are actually being channelled towards communities.

. it appears that under those circumstances, a significant proportion of farmers' research efforts are in fact geared towards the adaptation of (or resistance to) externally introduced technology and practices.

Some of the basic hypothesis or assumptions formulated at an early stage of the process have also been validated. This is particularly the case of the existence of local innovation and knowledge building processes, and of the fact that they were not actually taken into account by external institutions (with a few exceptions like in the case of the "campesino a campesino" programme).

It also appeared that farmers' innovation and knowledge building processes present a series of inherent limitations, and that they can be catalyzed, strengthened and complemented by the action of external institutions. The analysis of the case studies has shown that there are needs and opportunities for support by external institutions, but that specific approaches, attitudes, methods and instruments are required.

The current status of the development of the topic in Latin America can be caracterized as follows:

. a preliminary analysis of the documented processes and experiences has been carried out,

. a number of key concepts related to endogenous research and extension processes have been identified, defined or clarified, and a preliminary conceptual and analytical framework has been developed.

. some recommendations have been formulated regarding the possible roles of different types of institutions,

. a new set of hypothesis has been formulated regarding the existence of important factors to be taken into account for analysing and supporting local innovation processes.

At the present stage of the process, however, we do not dispose yet of a field-tested set of operational set of methods and tools for analyzing and supporting those local processes. Our epistemological, conceptual and analytical frameworks also need to be further improved or fine-tuned. Available results and outputs also need to be progressively integrated into training activities and susbstantial efforts are required for inducing changes and attitudes and policies at institutional level. A strategy for follow-up has been devised, which is presented in the next chapter.

5. Recommendations

5.1. Recommendations regarding the potential role of institutions

The potential role of institutions in contributing to the strengthening of local innovation and knowledge building processes has been discussed during the regional workshop held in Costa Rica and are synthetized below:

. *development support institutions*, like governement agencies, field-oriented NGOs and projects, could introduce and test, in their appraisal work, preliminary methods and instruments for assessing the dynamics and logics of local innovation, research and knowledge-building, which could lead to redefining or fine-tuning their extension approaches. They could also play a key role in the adaptation and testing of operational methods and tools for supporting farmers initiatives. A major shift in the attitude of those institutions towards local communities is required.

. *farmers' organizations* could play important roles in:

defining farmers' agendas and needs in terms of research and extension, and presenting those agendas to research and extension institutions, as well as to international agencies and the donor community.

monitoring and giving feed-back on the development and testing of operational methods and tools.

developing their own capacities of catalysing and supporting farmers initiatives and implementing "campesino a campesino" programmes.

. *research institutions* could participate in the development and testing of operational methods and tools. They should, however, undertake a major effort of redefinition of their approaches, attitudes and strategies in order to be prepared to respond to farmers' needs and priorities.

. *training institutions and universities* are expected to contribute at two levels:

the incorporation of key principles and concepts in formal educational programmes, in order to prepare new professional with a more open attitude towards local knowledge.

The development and implementation of specific in-service training course, aimed at improving operational, methodological and ionstrumental skills of the field staff of the development support institutions.

. *international agencies and donors* should define new policies regarding research and extension, and should channel their funding to institutions whose strategies do correspond to those policies.

5.2. Recommendations for a follow-up of FTPP activities

5.2.1. At regional level

A proposal for follow-up in Latin America has been briefly presented at the regional workshop held in Costa Rica in September 1996, based on a collaborative Action-Research and Training strategy involving key institutional partners.

It has not been fully discussed during the meeting, since no specific space had been planned for it. In further informal discussions, participants to the workshop have, however, demostrated interest in participating in the implementation of the proposal. This Action-Research and Training contains the following basic components:

. the strengthening of local processes and the facilitation of encounters betweeen actors of those processes (networking),

. the fine-tuning of available epistemological, conceptual and analytical frameworks,

. the testing, development and adaptation of region- or culture-specific operational methods and tools,

. the support to projects and research and development support institutions interested in supporting local innovation processes,

. the introduction of the topic in training programmes and university curricula,

. the dissemination of results and materials to relevant institutions, in order to induce changes in attitudes and policies.

It is clear that FTPP by itself does not have the capacity to implement such a strategy on its own. FTPP's role could be catalytic in nature and its funding limited to specific activities. Institutions which could participate in this collaborative effort can be divided in various clusters, and could play specific roles:

. Grass-root organizations,

. Field projects (FAO and non-FAO) and development support institutions (both governmental and non-governmental),

. Universities and training centers,

. Research centers and institutions belonging to the academia.

It is fundamental that CUDECA (the Lead Institution for the development of the topic) and FTPP initiate in the next months a planning process envolving potential partner institutions, in order to carry-out the regional proposal during the 1997-98 period, and to define specific needs of support from the global programme.

5.2.2. At global level

It is our opinion that global activities should generally aim at supporting the different regional processes, rather than at developping a full generic package which may fail to address regional specificities and demands, and would then need to be tested and adapted. There are, however, specific steps and products which would be better taken and developed globally, taking advantage of the availability of potentially valuable contributions from different regions and resource persons. It is felt that this is particularly the case of:

- . the development or fine-tuning of our epistemological, conceptual and analytical frameworks,

- . the identification and "pre-packaging" of available methods and tools, considered as potentially usefull for supporting the local innovation,

- . the preparation of a policy paper and audiovisual materials for awareness-raising among donors, decision-makers and project managers.

Otherwise, it is our feeling that the global programme could be instrumental in supporting specific needs and demands from the regions. From the Latin American perspective, priority should be given to:

- . supporting the formulation and implementation of region-specific strategies for the development of the topic,

- . providing support to the regions (upon request) for methods and tools development or adaptation,

- . ensuring or supporting efficient inter-regional networking mechanisms, allowing for effectively sharing experiences and results on a wider basis.

·armers' participation in agricultural research and ·xtension: Lessons from the last decade

is article is a conceptual review of a decade of work on *Farmer ·ticipation in Research and Extension (FPR/E)*. Though FPR/E does ·e an important role, it has generated over-optimistic ·ectations. This is caused by lack of clarity in the objectives of ·ferent kinds of participation; the way participatory approaches ·ate to other modes of client orientation; and the various roles of ·ferent organizations in promoting participation. A major ·unresolved issue is the need to complement depth of participation ·with breadth of coverage. Inter-agency collaboration may hold ·ome, but not all of the solutions to this dilemma.

Stronger participation by farmers in agricultural research and extension is fuelled by the realisation that the socio-economic and agro-ecological conditions of (especially low-income) farmers are complex, diverse and risk-prone. Conventional approaches, based on research station trials followed by unidirectional technology transfer, are unlikely to be fruitful. Close engagement with farmers is needed throughout the cycle of diagnosis, experimentation and technology dissemination. This increases the understanding of the opportunities and constraints farmers face, and of their own technical knowledge. This in turn enhances the prospects that externally promoted technologies will be adoptable, and environmentally and institutionally sustainable. The approach may thus, enhance the efficiency of the technology development processes.

What is participation?

'Participation' is becoming a devalued term. For instance, senior administrators, partly in response to donor exhortation, deploy much of the rhetoric, and occasionally the form, of participation without the substance. For this paper, participation conveys that the intended clients of agricultural research and extension (R&E) influence the focus and content of R&E. Public sector, private commercial and private non-profit organizations involved in R&E serve a wide range of clients. Their clients are not only farmers. They also include processing industries; scientists; and government departments concerned, for example, with land rehabilitation. With all types of client, the crucial link and the most difficult to make is between what 'science' has to offer and what clients require.

Clients participate with different technology suppliers in numerous ways. There is a subset of types of research (applied and adaptive), of 'suppliers' (mainly public sector and Non-Governmental Organizations (NGOs), and of clients (farmers). Our focus here is an adaptive/applied research for farmer clients. Within these sub-sets, several types of participation exist. For instance, farmers in the middle and higher income ranges, may participate in R&E through the market by contracting advisory services, or by buying inputs which incorporate new technologies. Additionally, they can exert pressure through lobby groups. They can also respond vocally to the technologies offered during, for example, research station visits. These farmers tend to specialize in a small number of market-oriented commodities, and tend to operate on an individualistic, not group, basis. For these situations, the functions of public sector research organizations are easily defined. If these public sector research organizations can identify the needs of client farmers, and if these organizations efficiently manage the research project cycle, it should not be difficult to deliver relevant and adoptable technologies.

However, the situation of low-income farmers is more complex. *In biological and physical terms, it is characterized by:*

- poor infrastructure;
- diverse and risk-prone agro-ecological conditions;
- strong interaction between crop, livestock, tree and fodder components of the farming system, and between on- and off-farm resource management.

In socio-economic terms, it is characterized by:

- a degree of political and economic marginalisation, implying limited access to markets;
- diverse socio-economic conditions: some households being fully committed to farming; off-farm employment being important for others;
- the importance of group action in some traditional practices (e.g. exchange labour) and for soil and water conservation through the management of common resources;
- a high proportion of female headed households and of female farm labour since men are often employed in off-farm activities;
- strong local knowledge underpinning traditional farming practices.

These characteristics help to define the scope of participation in three ways. First, low-income farmers are less likely to 'lead' participation, either via the market or by making vocal demands. Second, their agro-ecological conditions are difficult to replicate on research stations. Hence, more effort is required from the researchers to understand these conditions and to experiment on-farm. Third, farmers may need support from outside agencies to identify and articulate their priorities for technical change and to help in the management of their common resources.

Different interpretations and implementations

The objectives of the public sector in pursuing participatory FPR/E are primarily functional. It aims to enhance the efficiency of research services in delivering adoptable technologies that are environmentally and institutionally sustainable. Within this functional context, group approaches have occasionally been used, such as in *integrated pest management*. However, the public sector largely work with farmers in an individualistic way.

By contrast, the objective of participation for most NGOs is the social, economic and political empowerment of the disadvantaged and marginalized. Almost universally, NGOs have used a range of group building techniques. This includes awareness creation, conflict resolution and the development of leadership skills. NGOs have pioneered the use of *Participatory Rural Appraisal* (PRA). In much of South Asia, NGOs have taken the lead in promoting group management of common resources. This includes trees and grazing land, with a focus in undulating areas on raising water tables to permit agricultural intensification. NGOs' strengths lie in group formation and diagnosis. However, their capacity for experimentation, wide scale replication of approaches, or adoption of technology remains limited. They particularly need support in sourcing new candidate technologies and management practices.

A further weakness is that many NGOs ignore the fact that farming makes only a marginal contribution to the livelihoods of many poor households. This misperception generates mistaken confidence among many NGOs. They think that sustainable technical change through participatory approaches, can make all farmers succeed.

NGOs' pioneering of PRA has led some to equate PRA with FPR/E. There remain important distinctions, however. PRA has been used almost exclusively at the diagnostic stage of the research cycle. PRA has powerfully demonstrated the ability of village households to contribute to rural development planning. It has generated a sense of community ownership of development projects and processes. It has further created a recognition among administrators that participation enhances the prospects of success. However, PRA is increasingly seen as a 'new orthodoxy'. Like all orthodoxy, it attracts diverse challenges. One has to do with intellectual property. Namely, the argument that a number of its methods predate the term 'PRA'. Another is that some PRA enthusiasts create bias by carelessness in phrasing questions and facilitating discussions. A third is that enthusiasm for methods has led many to ignore differences in objectives and in the comparative advantage of different kinds of organizations. Generally, NGOs can mandate themselves to spend considerable resources in a few villages. Hence, they can pursue costly, empowering face-to-face types of participation. Many see the public sector's efforts as deficient since these are not as fully empowering. This ignores the much wider mandate of government departments that requires them to spread resources more thinly. The concern of government is necessarily with functional rather than with empowering types of participation.

A fourth is the realization that diagnostic methods (e.g. PRA) are not implemented within social and political voids. The outcomes of PRA meetings are determined by the 'mix' of community groups. For instance, in some cultural settings, it is difficult to assess women's needs. Overall, there is a need for better understanding of the processes of institutional, political and economic change at local levels. Additionally, a more judicious selection and application of participatory methods is needed.

Policy implications

The public sector can validly limit itself to functional types of participation, as distinct from the empowering types undertaken by many NGOs. Several conditions have to be met before public sector researchers can implement participatory approaches effectively.

First, the institutes should be committed to produce results which are of use to the identified clients.

Second, the performance criteria, reward, and incentives must be provided in delivering technologies that meet clients' needs.

Third, scientists will need training in participatory methods. Providing that the potential shortcomings of PRA are made clear, training in PRA methods is a good first step. However, scientists must have the resources to pursue the research issues identified by PRA. They must be able to maintain participatory approaches throughout the research project, and so go beyond mere diagnosis.

Participatory approaches can only become fast and cost-effective, if they are part of the daily practice of researchers. It will not be adequate for researchers to rely on specialist participatory units. Some farming systems research fell into that trap. Lessons should be learned from this.

Different approaches to participation are likely to be needed according to the biophysical setting. Where the intention is to increase crop yields, approaches can be largely individualistic. However, in many undulating semi-arid areas, the scope for agricultural improvement will be limited unless water tables can first be raised. To increase percolation, soil and water conservation measures are needed. Almost invariably, such measures require joint action. However, the public sector rarely has group formation skills. Of course, training can be given. Nevertheless, a potentially better alternative is to collaborate with organization(s) (such as NGOs) which already have many of the requisite skills.

The major dilemma in FPR/E is that of combining breadth with depth. If it concerns technological change but not with empowerment, this is not difficult to address. If participatory approaches have succeeded in identifying technologies acceptable to farmers of known socio-economic and agro-ecological characteristics, then the same technology could be offered to other similar groups. In more empowering approaches it is problematic. As the experience of several NGOs suggests (see e.g. Fernandez, 1993), more than a year of intensive face-to-face interaction is needed with small groups of low-income farmers to diagnose and identify pathways for addressing their needs. Does this suggest that the only expansion path is to repeat the exact process elsewhere? If so, the spread of participatory approaches is likely to be slow and resource-demanding.

Can participatory approaches spread in a less resource intensive fashion? Experimentation with different approaches is essential. For example, 'lateral spread' may be achieved by cross visits between villages. The rural spread of media such as radio, television and video can reinforce group-based approaches. For instance, groups could record how they have become organised and how they have introduced technical change. Intensive, face-to-face participatory methods have become part of the raison-d'être of NGOs. Not surprisingly, they have tended to dismiss mass media approaches as 'top down'. In reality, these may usefully supplement face-to-face approaches. This is not to disregard other settings, wherein only face-to-face methods can create the necessary confidence and negotiating skills to redress the biases against low-income groups.

Different types of organization have different strengths and weaknesses. NGOs' strengths in diagnosis and group formation could be complemented by the technical skills of public sector R&E services. Exploitation of these complementarities would make farmer participatory research more effective and wider spread. Equally, complementarities among government departments could be exploited. These deal with agriculture, horticulture, livestock, water resources and trees. A number of pilot efforts towards multi-agency and participatory approaches are being tried with some success. The process requires careful building of trust and monitoring of progress against expectations. Likewise, it is vulnerable to changes in personnel on each side. Despite the difficulties facing multi-agency approaches, this merits extensive donor and government support.

Conclusions

Much of the confusion, and in some cases, excessively high expectations, surrounding FPR/E can be resolved by examining it within its agro-ecological and socio-economic settings. It is important to examine the objectives of the organizations implementing FPR/E. The functional approaches of public sector researchers can be complemented through collaboration with those organizations (such as NGOs) taking a more empowering approach. However, collaboration among different types of organization, no matter how appealing, requires much patience in practice. To engage effectively in participatory approaches, implies several preconditions for the public sector. Scientists must have rewards and incentives to work towards close client-orientation. Authorities must be sufficiently decentralised for rapid and flexible decision making.

John Farrington

Research Fellow, Overseas Development Institute
and Visiting Professor, Agricultural Extension and Rural Development Department, University of Reading
ODI, Portland House, Stag Place, London SW1E 5DP.
Fax (+44) 171 393 1699
E-mail j.farrington@odi.org.uk

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Gender and indigenous knowledge

Indigenous knowledge systems have long been undervalued. Fortunately, an increasing amount of research on indigenous knowledge systems is now coming to the fore. But unfortunately, in these studies the role of gender is often neglected. It is argued in the present article that indigenous knowledge and gender are inextricably bound up with each other. It is also maintained that if indigenous knowledge systems are capable of forming a basis for sustainable development, their capacity to innovate on the basis of gendered-knowledge-generating processes must be recognized and respected.

Indigenous knowledge is still not always recognized as the product of holistic systems of perceptions, relationships and organizational arrangements.

The nature of indigenous knowledge systems

The terms 'indigenous' and 'local knowledge' are used to refer to that knowledge which is generated and transmitted by communities, over time, in an effort to cope with their own agroecological and socio-economic environments. This knowledge is generated and transformed through a systematic process of observing local conditions, experimenting with solutions, and readapting previously identified solutions to modified environmental, socio-economic and technological situations (Brouwers, 1993).

Until recently, these knowledge systems have been under attack for being 'backward', 'static' and a 'hindrance to modernization'. Terms such as 'objective', 'rigorous', 'control' and 'testing' have helped to develop the perception that science and technology are value-free, and that they operate outside of the societies in which they are rooted (Hill, 1993). This attitude has undermined the capacity of indigenous knowledge systems to innovate, and lowered the status of grass-roots innovators, especially women, whose contribution to technology development has traditionally been undervalued.

Although an increasing amount of research on indigenous knowledge systems is now being done, reversing this negative trend, a review of the literature shows that indigenous knowledge is still not always recognized as the product of holistic systems of perceptions, relationships and organizational arrangements. Furthermore, it is still difficult to identify references to the critical role of gender in the development of the indigenous knowledge systems themselves. An understanding of the role of gender, as well as the intrinsic value of indigenous knowledge, is crucial to the solution of situation-specific problems.

Gender and indigenous knowledge systems

Bodies of local knowledge are structured by systems of classification, sets of empirical observations about local environments, and systems of self-management that govern resource use. They are accessible, in the first place, to those members of a social group charged with specific resource management and production responsibilities. In this sense, indigenous knowledge systems are by their very nature gendered (Warren, 1989). They are fuelled by the experimentation and innovation of those groups within a community which have been assigned specific production and management responsibilities.

As gender is the primary social differentiation among adult, economically active members of a society, it is logical that specific spheres of activity will become the specialized domains of different genders, as they increase their knowledge and skill over time. As a result of this gender specialization, the indigenous knowledge and skills held by women often differ from those held by men. In addition, the kinds of relationships which exist between these two sets of innovators will affect hierarchies of access, use, and control, resulting in different perceptions and priorities for the innovation and use of technology by women and men (Appleton, 1993b).

Today we are all aware that gender is a cultural construct related to the behaviour learned by men and women; it affects what they do and how they do it within a specific social group. Gender differentiation comes about as a result of the specific experiences, knowledge and skills which women and men develop as they carry out the productive and reproductive responsibilities assigned to them (Feldstien and Poats, 1988). The degree of gender specificity attached to the knowledge and skills within a society depends not only on the way responsibilities are allocated among men and women, but also on the degree of flexibility men and women have to carry out the other's assignments.

For example, in parts of the Andes, women have much more knowledge of livestock management practices than men, while men know much more about soil classification criteria than women. Public recognition of this specialized knowledge is reflected in the fact that women are consulted when choices are made as to the appropriate grazing and/or breeding strategies. On the other hand, men make the choices pertaining to the selection of appropriate fields for specific crops. However, if for some reason a woman were obliged to run the farm alone, she would have to make specialized decisions regarding both the animal and crop sectors (Fernández, 1992).

Thus both women's and men's generation, adaptation and use of knowledge and technology are shaped by the economic, social, cultural, political and geographical contexts in which the two sexes live, but which each gender experiences in a different way (Appleton, 1993a). Since the primary social differentiation among adult, economically active members of a society is gender, it is not surprising that responsibility for spheres of activity is distributed first along gender lines. The practice of solving problems in these 'assigned' areas leads not only to specialization in those areas, but also to the generation of knowledge which can be applied to the solution of future problems.

Indigenous knowledge and skills held by women often differ from those held by men.

Depending upon the culture, some types of knowledge may be complementary, meaning that both female and male knowledge systems are needed to understand a particular dimension of production or decision-making. Other types of knowledge however, may be shared, although such 'shared knowledge' cannot be assumed. There are at least four ways to think about gender differences in knowledge systems (Norem, Yoder and Martin, 1988). Women and men may have:

- a different knowledge of similar things;
- a different knowledge of different things;
- different ways of organizing knowledge; and
- different ways of preserving and transferring knowledge.

There are at least four ways to think about gender differences in knowledge systems.

Sustainable development

The historical need to deal with agro-ecological specificity is closely linked to the development of socio-cultural diversity and gender-differentiated knowledge and skills. In the quest for generalization, the risk of loosing diversity and the possible contributions of knowledge from different systems to sustainable development have been overlooked. We are trapped in what we are beginning to recognize as obsolete ways of evaluating contributions to economic growth and well-being. Unfortunately, as local knowledge systems gain new recognitiom, their holistic and gendered nature is often overlooked. Women, who are often visible in their own cultures and production systems, are becoming less and less visible as disconnected 'bits' of local--indigenous--knowledge are made known to the outside world. There is little or no reference to the differentiated role of men and women in the generation, transmission and use of knowledge.

The recognition and reinforcement of indigenous knowledge systems can form the basis for an alternative development model. The capacity of these systems to integrate multiple disciplines, and the resultant synergism are beginning to demonstrate higher levels of efficiency, effectiveness, adaptability and sustainability than many of the conventional technology systems (Mathias-Mundy, 1993).

Innovation in indigenous knowledge systems must be encouraged, so that individuals can find new opportunities to mitigate the effects of the scarcity of natural resources, migration from rural to urban areas, drought, wars and unfavourable market conditions. If indigenous knowledge systems are to continue to contribute to the quest for sustainable development, their capacity to focus on diversity and locality as well as to innovate on the basis of gendered-knowledge-generating processes must be recognized and respected.

Maria E. Fernández, PhD
IAC
P.O. Box 88
6700 AB Wageningen
The Netherlands
E-mail: Fernandez@iac.agro.nl

After 1 March 1995
ILEIA
P.O. Box 64
3830 AB Leusden
The Netherlands
E-mail: ETC@antenna.nl

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Implementing on-farm agroforestry research: lessons learned in Talamanca, Costa Rica

JOHN BEER
Apdo. 44, GTZ-CATIE Agroforestry project, Turrialba, Costa Rica

Key words: agroforestry, boundary planting, farmer selection, on-farm research, *Piper nigrum*, shade trees, *Theobroma cacao*, timber production

Abstract. The rapid appraisal and farmer selection procedures, preceding the establishment of over fifty agroforestry research trials on farms in Talamanca, Costa Rica are described. The highest probability of success and impact of these long-term collaborative trials is obtained by selecting innovative, experienced, motivated and locally respected farmers. The methodological lessons learned from implementing three types of researcher managed trials (shade-cacao; black pepper on living support posts; timber production in boundary lines) are discussed. The importance of fitting farmer selection criteria to project objectives, experimental designs to on-farm limitations, and project goals to farmers' goals, are emphasized.

Introduction

The general objective of the CATIE-GTZ project "Agroforestry Cooperation with CATIE" is the development and dissemination of agroforestry production systems for small farmers in the Central American Isthmus (see acknowledgements). The project concentrates on applied or adaptive research to develop suitable technologies for subsequent/simultaneous extension activities in national priority zones in each country. The researcher managed on-farm trials, described in this paper, were primarily designed to evaluate the biological potential of various agroforestry alternatives for particular crops and hence attempts were made to adapt standard experimental methodologies (developed on-station) to on-farm conditions. There was no intention, at this stage, to test the technology under all the limitations and uncontrollable factors which occur under farmer management. The emphasis was on production measurements (e.g., crop yields per hectare) rather than socio-economic indicators (e.g., increase in farmer's net income) and research criteria/inputs dominated the management of the on-farm plots. On the other hand, working with the farmers on these research plots, rather than just instructing them about the results, provided valuable feedback to the project and was an important part of the process of gaining the farmer's confidence, and hence increasing the probability that they will later accept a new technology as something which is feasible and desirable for them [Farrington and Martin, 1988].

A review of agroforestry research literature (particularly the journal

Agroforestry Systems and papers presented at the 1990 ICRAF international workshop on "Methods for participatory on-farm agroforestry research") shows that many attempts have been made to use on-station methodologies, especially the randomized complete block design, for on-farm agroforestry research. Based on the experiences of the above mentioned project over ten years, and particularly its work in the Talamanca zone of Costa Rica (1987—89), this paper seeks to illustrate some of the pitfalls of this approach and subsequently make some suggestions on how such research studies should be implemented. The characteristics of the Talamanca zone, and the planning aspects of the Project's activities there, have been described previously [Beer et al., 1990]. The major issues discussed here concern implementation and particularly the critical importance of fitting: 1) the farmer selection criteria to project objectives; 2) the experimental designs to on-farm limitations; and 3) the management and goals of the project to those of the collaborating farmers, especially when long term trials are involved.

Background to on-farm experimentation in Talamanca

In CATIE's development projects, the agroforestry technologies under trial are usually improved versions of traditional practices [Borel, 1987], although sometimes a novel technology is introduced. Many of these technologies have previously been studied by CATIE within its experimental lands or one of the off-station research areas [Beer et al., 1987]; i.e., there is a very strong link between the more basic research, such as the study of nutrient cycling in a shade-cacao association, and the applied or adaptive on-farm experiments, which are themselves precursors to extension activities.

Research results from previous phases (1980—87) of the CATIE-GTZ project, conducted in different zones, had mostly not been transferred to extension staff, and even less to farmers. Therefore a network of on-farm trials was proposed to improve the effectiveness of the typical top-down approach to research and extension, which is still prevalent in Costa Rica. Hence, in Talamanca the on-farm experimental sites were stratified in accordance with the future extension needs and were distributed over as wide an area as possible; i.e., one trial per community. Research criteria, such as the location of trials according to a bio-physical stratification (e.g., major soil groups) were given second priority. The trials served as local demonstrations that can be more influential on farmers than any other future extension activity. If such trials are successful, adoption can occur without needing institutional support [Chambers, 1983] and may even occur when the institutions try to halt dissemination [Weirsum, 1987].

Following previous experiences [Beer et al., 1987], basic studies of the zone, such as formal surveys (including detailed evaluations of traditional agroforestry technologies) were given a low priority compared to on-farm experimentation. However, to aid planning decisions, all published and

unpublished information on the zone was summarized [Kapp, 1989]. This paper discusses the rapid appraisal and farmer selection procedures that were used and the implementation of the principal on-farm experiments.

Informal farmer interviews[1]

One main objective of the interviews was to gain information on the farmers' agricultural problems, interests and priorities [Segleau and Mora, 1989] in order to select agroforestry technologies to be tested. The other main objective was to assess each farmer's potential as a collaborator for on-farm experiments. In the initial phase, 125 farmers were interviewed on their farms, using a check-list of 12 open-ended questions. The community nursery secretaries of a non-government organization (NGO), the Asociacion de Nuevos Alquimistas Incorporado (ANAI) helped announce and programme the interviews (15—20 farmers per community), which were carried out by locally contracted project assistants.

On-farm agroforestry technology trials have a much longer duration than most agricultural (seasonal) trials. The selection of a motivated farmer for this long-term commitment is thus very important. One aim of the Talamanca trials was to test agroforestry technologies within the bio-physical limitations of the project zone (e.g., soil, climate, pest conditions that were not represented on-station). A second aim was to get feedback from the farmers about the possible socio-economic limitations (financial, education, motivation, traditions and culture, resources, land tenure, etc). Initially the most propitious sites were chosen; i.e., avoiding the most difficult site conditions and selecting farmers with whom there was a high probability of establishing well managed and hence reliable experiments. (These farmers and sites were still part of the target group.) The reasoning behind this was that once the staff of a project have gained experience with the technologies they may want to promote, a more representative group of farmers can be selected and the remaining problems that occur when introducing a new technology (principally socio-economic) can be faced. Thus, in this paper the selection criteria for farmers and sites on farms are emphasized as one of the critical aspects of on-farm agroforestry research. (A full list of criteria are provided in Annexes 1 and 2.) The essence of the procedure was to select motivated farmers first and only then, together with them, to choose the research sites on their land; in contrast to the typical research procedure of first selecting suitable sites and later ascertaining if the owners are willing to cooperate. The latter procedure is not an auspicious start to a collaborative programme

[1] Within the zone, this process was always referred to as "interviews" and not as a "survey," to avoid the damaging connotations associated with the idea of a survey in a zone where farmers are suspicious of officials seeking statistics about their socio-economic situation.

and will often result in inadequate or no participation of the farmer in the trial.

In common with most rapid appraisal methods [Chambers, 1981], the results of the interviews were checked with experienced technicians working in the area ("qualified informants"), but the results could still include some false perceptions; for example, on the relative priority that should be given to different crops and/or possible management studies of any one crop. Owing to the long-term nature of the field trials, once they are established drastic programme changes (in research priorities and/or plot management) are difficult to implement.

An evaluation of progress and re-evaluation of priorities, prior to the formulation of each annual work plan, was foreseen. It was hoped that the same interviewed farmers could provide feedback for this annual monitoring and planning [Farrington and Martin, 1988] but it has not been possible to organize meetings with the original ANAI nursery groups owing to a general decrease and frequent changes of nursery participants. Some of the reasons for this were: lack of suitable farm land to continue out-planting; loss of enthusiasm and/or inter-participant conflicts; change of priorities including obtaining paid employment; and development of new activities by ANAI. Logistical difficulties of national counterpart staff, responsible for organizing these community meetings, also limited such consultations. Instead, the project has had to rely upon feedback from the thirty participating farmers, in order to review programmes. There have been shortcomings in this respect as well, as the planned formal evaluation of each trial by the participating farmer has yet to be implemented. In part this can be justified since the two-year-old trials involve perennial crops (timber, cacao, black pepper) which are not yet producing, but this omission was also due to the low priority which has been given to socio-economic measurements by the agricultural and forestry staff of the project. The incorporation of two extension experts and an economist in January 1990, should help overcome this shortcoming.

On-farm agroforestry technology trials

Research objectives

The principal objective of the on-farm trials was to obtain yield data for a limited number of promising technology alternatives (treatments) which differed in many factors. For example, the pruning intensity and crown architecture of candidate cacao shade trees were managed to provide the light conditions considered optimal for cacao in this zone. Hence in this case, the differences between treatments included changes in various management factors as well as species. However, as far as was possible, any one treatment was managed in the same way on all sites (researcher controlled).

In addition to production data, all inputs and outputs were recorded for

rough economic evaluations and for project monitoring purposes. Biomass production from tree pruning in the cacao and pepper plantations was also measured to complement basic research at CATIE and in the hope of relating these values to changes in soil properties with time (≥ 5 years). The evaluation of some socio-economic variables, such as the collaborating farmer's perception of the economic potential, the limitations and the possible modifications, is also planned.

Criteria for selecting technologies

The following criteria were used to choose agroforestry technologies for on-farm experimentation. The technology should:

- Have commercial potential;
- Respond to problems, needs, limitations and/or interests identified by the majority of the farmers;
- Be based on existing practice and/or traditional knowledge;
- Involve locally known, tested and available tree and crop components (includes Costa Rican provenances of exotic species);
- Use locally available materials with minimal reliance on imported (to the project area) materials and equipment;
- Provide significant service functions *as well as* increasing commercial production;
- Be adoptable by the majority of the farmers, within local limitations of land quality and availability, resources, knowledge, etc;
- Promote diversification of land-use and farm products;
- Match the priorities of local extension organizations (governmental and NGO.).

Some decisions were subjective (e.g., assessments of market possibilities). The technologies were finally chosen through a consensus of project staff, farmers, other technicians (e.g., extensionists) and local farmer leaders, based on feasibility (including consideration of project limitations) and the probability of having a noticeable impact in the medium term (approximately 5 years). All technologies chosen for research were amongst the farmers' priorities but many had to be excluded, such as fruit trees, for which the project had no experience and few resources.

The agroforestry practices which were selected for research and development were:

1) High density planting of timber trees, or frequently pruned leguminous trees which produce large quantities of organic residues (mulch), as shade in hybrid cacao plantations
2) Vegetative propagation of large stakes of leguminous trees as living sup-

port poles (which also produce, *via* pruning, large quantities of organic residues) for black pepper, established at high densities
3) Closely spaced timber trees planted around farm/field boundaries or fence lines

Research designs

One of the major problems encountered was the unsuitability of traditional experimental designs, such as randomized complete blocks, for incorporating the large plots required to quantify the commercial production of perennial crops, especially timber trees (for cacao shade trees at 6 × 6 m, the minimum plot size is 0.13 ha). The absolute minimum, in terms of total number of plots, repetitions and number of sample trees (internal) per plot, as well as the closest acceptable spacing of the shade trees, were chosen in order to keep plot and experiment sizes to a minimum (Table 1) and theoretical considerations, based on estimated variation, were unworkable because of space limitations. Despite applying these strict limitations, the experiments were too large to fit on many farms. This was usually because of the absence of a reasonably homogeneous piece of land of this size (not already used by the farmer), rather than an absolute limitation on available land. As a consequence intra-block variation was often greater than would be acceptable for establishing on-station trials, or blocks were distributed amongst adjacent farms which caused conflicts with the farmer selection procedure. It may also lead to large differences between blocks and the risk of undesirable block-treatment interactions.

On-farm experimental security is not always good and the loss of one or

Table 1. Examples of agroforestry experiments[*] in Talamanca, Costa Rica.

Experiment	Cacao shade	Pepper posts	Fence lines
Treatments	*Erythrina poeppigiana* *Gliricidia sepium* *Inga edulis*	*Erythrina berteroana* *Erythrina glauca* *Gliricidia sepium*	*Cordia alliodora* *Terminalia ivorensis* *Eucalyptus deglupta*
Replications (on-farm)	3	3	3
Sites (farms)	2	7	7
Plot shape	Square	Square	Linear
Plot size	1296 m^2	225 m^2	60 m
Experiment size (per site)	1.2 ha	0.2 ha	540 m

[*] All experiments were established with the randomized complete block design.

more plots is often a risk. Hence the incomplete block design, which is less robust, has not been used for these trials, which start with few treatments and replications. More complex approaches involving, for example, uniformity trials, systematic spacing designs and covariance analysis were discussed and have been used for on-station studies. However, there are several disadvantages of such approaches.

i) They are less suitable for demonstration to both farmers and development workers;
ii) Space limitations drastically restrict the number of plots and hence treatment levels that can be established for regression analysis (an exception to both the above points can be the systematic spacing design);
iii) Layout and maintenance problems may increase;
iv) Rather than encountering a gradient of bio-physical characteristics across a site, there may be one or more discontinuities.

As a general rule, for on-farm agroforestry research "The simpler the better" seems to be good advice.

The comparison of timber-producing trees in boundary lines necessitated, by definition, blocks which were in one long line (three species, each with a minimum of 20 trees per linear plot at 2.5 m spacing gave blocks of 150 m length) and therefore were unlikely to serve the purpose of maximizing inter-block variation whilst minimizing intra-block variation. However, on some sites it was arguable whether a completely randomized design would have been better and the project, for want of a better alternative, continued to use the randomized complete block design. Location of suitable homogeneous sites for these timber line trials has proven to be difficult on flat valley or coastal farms and virtually impossible in the hilly areas, thus excluding some communities and soil types from these studies.

Superimposed experiments (using existing plantations of crops and/or trees) were not used because the information on the crop/tree genetic origin was inaccurate or non-existent, site and crop/tree management history was poorly known, intra-plot variation was generally high and blocking difficult.

The variation of many site/management factors between trial sites (farms) precludes detailed interpretation of treatment-site interactions although provisional analyses show the existence of statistical differences between sites. To permit such combined analysis, the same design, plot size, etc. was used on all farms but it was not necessarily the most appropriate for each site (site homogeneity changed from farm to farm and hence the optimal design also changed from farm to farm).

Research implementation

The success of a participative on-farm trial depends upon understanding and commitment between project staff and a motivated farmer and cannot be en-forced with a legal document. If the farmer loses interest, plot management may deteriorate to the point where its scientific and demonstration value is lost and the project is forced to take over all activities or abandon the trial. Moreover, the legal process is too slow and such a contractual agreement can provoke negative feelings towards a project. However in Talamanca, to reduce the risk of misunderstandings between the project and farmer, and to ensure continuity even in the event of staff or farmer changes, it was considered desirable to write down the terms which were verbally agreed upon. These terms covered: the division of responsibilities to provide labour and materials; the project's right of access for measurements and sampling; and the farmer's right to all products from the trial. It was necessary to specify the time scale with allowance for extensions. These letters of understanding helped to avoid disagreement about inputs, particularly in defining what the project was offering, so that the farmers were not disappointed and hence demotivated at a later date. However, they were not always effective in ensuring the farmer's contribution.

Virtually all farmers participated as planned during the establishment of the Talamanca trials, which is the most labour demanding time, but as they became accustomed to the project and its relatively huge investment of resources (compared to theirs), there was a tendency to leave all the management of the trial to the project staff. This trend was reinforced by the attitude of project field staff, that it was better to complete a task than to wait an unknown time for the farmer to do it. The involvement of farmers in decisions and trial management took time and complicated the work programme of research technicians. This reinforced the tendency to carry out actions without the involvement of the farmer; alternatively, the farmer ended up being treated as a labourer rather than as a collaborator.

The participation of the farmers during the two-year establishment period (i.e., when there was no production or other financial compensation) was better than expected. In general, the project-farmer relationship was excellent and very few of the fifty plus trials had to be abandoned due to a complete lack of cooperation from the farm owners. However, in some cases inadequate or spatially variable plot management by the farmer (e.g., weeding) has affected the quality of the trial results; e.g., the confidence limits which can be calculated for the production estimates. Damage by wild animals, birds, pests, etc. was occasionally serious and highly spatially variable (armadillos do not respect experimental blocking!) thus also affecting the confidence limits of the results.

In the least complicated trials (timber trees in boundary lines) the methodology and cooperation generally succeeded as planned but in the case of the new demanding technology "black pepper on living support posts" it was necessary for the project to take over virtually all activities to avoid losing most of the trials, although there were a few exceptional farmers. The cacao shade trials were an intermediate case. Although cacao management was also complex, cooperation was better because highly experienced farmers were

deliberately picked. The project staff have now accepted that a general participatory methodology is not applicable to all trials and when the technology is new and/or more precise scientific results are expected, the project participation has to be greater. If the main objective was to test the technology within the farmers' socio-economic limitations, obviously their participation becomes essential. However, in this latter case a traditional experimental design, such as a randomized block, should no longer be used and the "prototype" methodology, as outlined by ICRAF [Huxley and Mead, 1988] would be a better alternative.

The presence of the project changed a farmer's status in the community and selected Talamanca farmers have been referred to as having "won the lottery" [Brenes, 1988]. A farmer's income may also change, e.g., through sale of black pepper plant cuttings from an experimental site. These changes may result in his being increasingly less representative of the target group. It has been claimed that in extreme cases, socio-economic differentials in a community could be increased to the detriment of actions designed to promote communal activities[2]; e.g. nurseries. On the other hand, any project which achieved this level of impact would usually be judged an outstanding success!

Use of research results

The existing trials are still too new to produce definitive results but field days were organized both for local extension staff (principally the NGO ANAI) and in turn by them for farmers who are not collaborating with the project. The project partially succeeded in one of its stated aims, which was to anticipate extension needs from the very beginning of the research. However, the link with the government and NGO extension organizations was not as strong as was hoped, due to limited resources of all groups, differences in philosophy (e.g., the value attached to formal experimental designs *vs* unreplicated exploratory trials), and differences in the socio-economic objectives of each organization.

Conclusions and recommendations

Based on the above problems and limitations, and other experiences of the CATIE-GTZ project over ten years, the following conclusions and recommendations can be made for on-farm agroforestry technology trials. They are presented in the order they are likely to be encountered when setting up a project.

1. It is very important to choose local assistants with the same cultural as

[2] Personal communication from the NGO "ANAI", Talamanca, 1986.

well as linguistic background as the farmers in order that they can relate to, as well as talk to, each other. Their ability to communicate with farmers is more important than research experience. The latter can be rapidly taught; the former only to a limited extent.

2. When possible, it is advantageous to initiate farmer contacts *via* a community network, such as a nursery. Before working through official channels, check whether the farmers have a positive perception of the organizations involved. Existing projects in an area should not be treated as rivals and hopefully will be willing to facilitate the rapid implementation of new on-farm trials.
3. Farmers need time to digest the general ideas of a new project before being asked to make decisions. Information on the project should be provided more than once and preferably through different informants. However once a farmer agrees to collaborate, field work, with technicians working alongside farmers, should be started rapidly ("Action, not plans").
4. Formal surveys have many drawbacks and should not necessarily be carried out during the initiation of a project. If essential, they can be more effective (and due to their inquisitive nature, less damaging) when carried out after the project has been established and accepted by the target group.
5. The selection of motivated, innovative, experienced, respected farmers is vital during the *initiation* of an on-farm agroforestry research project, which includes testing technologies as well as demonstration amongst the main aims. It may be a mistake to involve a group of farmers which represent all strata of the target group during the initial stage of on-farm testing of a new technology. Likewise it is unlikely that all possible socio-economic limitations can be overcome at the same time. The project team has to gain experience with the bio-physical management before attempting widespread trials.
6. The establishment of a large number of identical research trials on different farms, designed to leave a network of demonstration plots for extension, implies either an excessive number of research plots (i.e., an inefficient use of research resources) or an inadequate number of demonstration plots favouring a limited number of communities.
7. Research requirements may result in a demonstration which is either difficult for the farmers to comprehend (e.g., complex design with many replications) or an example that has some negative impact (e.g., the inclusion of extreme treatments for regression analysis which results in poor performance; or clearing of a large area to reduce external shading of a small trial). Thus the combination of research and demonstration objectives within any one on-farm trial, has many disadvantages. One kind of objective must take precedence to avoid the trial failing to fulfill either of the objectives.
8. Traditional experimental designs (from on-station work) are often inappropriate for on-farm agroforestry technology trials. In such cases simpler designs, which compare a limited number of prototypes replicated on many farms, might be more useful.
9. Farmer-farmer exchanges are a valuable method to initiate on-farm trials. Potential collaborating farmers should be taken to existing plantations to learn, directly from the owners, what management is involved.
10. Recording observations, as well as quantitative information, is especially important for on-farm agroforestry trials which are complex (assessing socio-economic as well as bio-physical variables), long-term, include factors which may change with time, and may produce many unanticipated results. Statistical proofs tend to be over-emphasized when the simple fact that farmers like or do not like a technology has far more weight.
11. Data files for on-farm technology trials will be very diverse. It is therefore important to start coding and organizing data from the very beginning of the study to avoid later problems of analysis and interpretation.
12. The use of biological experimental plots for obtaining economic data is not recommended unless they were also designed for that purpose, since in many cases they are too small and non-representative of commercial management intensity (2).
13. Bio-physical academic research (e.g., for a higher degree) within existing on-farm technology trials can create management conflicts between student, farmer and project and therefore should be attempted with caution. The involvement of students can be complementary to the main line of work but the activities should be kept separate in most cases. The objectives of obtaining biological (e.g., production) and socio-economic (e.g., farmer adaptation) results from the same trial may also be mutually exclusive due to management conflicts.
14. Existing trials of the kind described in this paper, which have an experimental design appropriate to answer a specific question, should not be adapted for new or additional studies, at least not before they have fulfilled their original purpose. Thus an annual project re-evaluation may be limited to recommending minor changes in existing trial management and measurements. This limitation is not easily accepted by many farmers and extensionists, who make conclusions (and hence want changes) from early results, whilst the researcher is obliged to continue a trial until he has quantified the visual differences, in order that others can make their own judgement on the relative benefits and costs of treatments.
15. On-farm research requires the ability to listen as well as to instruct, something which is difficult for some professionals, especially those with an extension background [Chambers, 1983; Steiner, 1987]. Constant reinforcement of the importance of the farmer's participation, his involvement in management decisions and attention to his point of view,

are all important to maintain his role in long-term on-farm trials. However, work programmes must take this into account, as field technicians are often left insufficient time to maintain close contacts.

16. A work programme for on-farm agroforestry research must include some extension activities to explain the limitations/potentials of each trial design and management, to avoid false perceptions and/or inadequate imitations by neighbouring farmers who are not going to wait for published results.

Final comment

The approaches described in this report were developed empirically with little input from outside of the Institution or project zone. A later review of literature showed many similarities with other projects, which is to be expected since common sense and listening to farmers will lead to the same general approaches, even in different cultures. It must, however, be admitted that it took the project a long time to arrive at the present level of farmer participation, and considerable improvements are still required. This is partly a consequence of the project being managed by foresters and agronomists, with little input from socio-economic disciplines. Successful incorporation of farmers into research projects does not require complicated theories or designs, or even specially trained staff. Rather it depends upon choosing technicial staff with the time and aptitude to listen and talk to farmers and then seek ways to incorporate their ideas into new or ongoing research programmes. Unfortunately, time is a luxury that few staff are given. The failure of many projects must certainly be due as much to a lack of time as to a lack of technical ability or will of the implementors.

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Annex 1

Criteria used for selecting farmers for collaborative agroforestry research trials in Costa Rica[3]

1. **Age:** Farmers neither too young nor too old are preferred (35—45 may be optimal).
2. **Residence:** Resident farmers preferred; working with an absentee owner is not desirable.
3. **Local Status:** Farmers preferred are those who are already respected and recognized leaders[4] in their community; e.g., nursery secretary, member of community development committee. One must, however, be careful not to alienate the majority because of excessive backing of an elite group.
4. **Reputation:** Is the farmer respected by his neighbours as a successful farmer?
5. **Recommendations:** Researchers should seek advice from local officials (e.g., government or NGO extension officers), priests, teachers, etc.
6. **Management skill:** Within the context of local land use, how well managed is the farm? Pick the *best* farmers from the target group.
7. **Responsiveness:** In initial interview(s) how does he respond to the idea of a trial? Does he make suggestions? Avoid unresponsive farmers. (This assumes that the project has been adequately explained so that he understands the proposals.)
8. **Availability:** Does the farmer (may include family but the farmer should personally participate) have the time to participate or does he show concern about the commitment required? A responsible farmer would check what is required. However, avoid anyone who indicates that he might not be available — *collaborative trials are required, not land lent to the project.*
9. **Areas of interest:** Check which of the specific technologies, proposed for testing, are of interest to him. He may be interested in only one of the project's activities.
10. **Personality of the farmer:** Is the farmer's personality changeable or stable? Has he tried many new crops/technologies only to abandon the innovation before it was fully tested?
11. **Off-farm income:** Avoid farmers who also have outside incomes/jobs as being outside of the target group. (They are also less likely to be available for collaborative work.)

[3] It is highly unlikely and not necessary that any one farmer will fulfill all criteria.
[4] It may be preferable that the local political leaders are involved as informal assistants, reinforcing the suggestions from project staff, rather than as collaborating farmers.

Annex 2

Criteria used for selecting suitable sites on farms for collaborative agroforestry research in Costa Rica

1. **Proximity to established extension infrastructure.** There *may be* a logistical advantage in working in a resettlement scheme or similar situation where access to farmers is facilitated through a regional office and technicians with experience in the area.
2. **Proximity to other trial sites.** For logistical efficiency of the project, trial sites should be near to one another.
3. **Central location.** The sites should be in a central location with respect to other farmers who might be recipients of an extension programme. The trial should be visible near a road, communal nursery or other meeting point.
4. **Accessibility.** The site should not be more than 30 minutes from vehicle access during the rainy season (but not all along the main road).
5. **Security of land tenure.** Tenure security should be sufficient to guarantee that the farmer

or his family can harvest any tree products which may require a long rotation. There should be evidence of permanence on the site (e.g., a permanent home).

6. **Representative soil.** The soil of a chosen site should be representative of one of the main soil types in the study area.
7. **Site homogeneity.** Choose flat land or a constant slope; avoid plots with internal changes in soil fertility (e.g., due to adjacent road construction) or spatially variable land-use history.
8. **Drainage.** Drainage should be good or easily provided. Avoid areas subject to occasional inundation (unless a system is being proposed for areas which suffer this specific problem).
9. **Wind susceptibility.** Avoid the most exposed, susceptible areas such as mountain ridge tops (subject to the condition noted in "8" above).
10. **Existing tree cover.** Avoid areas with heavy forest cover in view of the negative demonstration effect of clear-felling and logistical problems of laying out a trial where tree stumps interfere. Avoid plots with large trees at less than 20 m from the border, due to early morning or late afternoon lateral shade.
11. **Distribution of trials.** Only one trial per farmer should be established unless a demonstration farm is programmed. Spread the benefits and risks (for both parties) of collaborative research trials.
12. **Ecological suitability.** The site should be ecologically suitable for the proposed system. For example, black pepper on living support trees should be planted on well-drained sloping land rather than flat, valley-bottom sites, even though the latter might be more fertile.
13. **Plot security.** Assess the risk of damage by animals (e.g., proximity to goat herds is a disadvantage) or by people (e.g., proximity to collaborating farmer's house is an advantage).
14. **Existence of farm statistics.** It is an advantage if the extension service, or other organization (e.g., local agricultural cooperative), can provide production statistics from previous years (e.g., cacao sales).

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