Social Sciences Group

TECHNOLOGY AND AGRARIAN DEVELOPMENT

CREATING VARIETIES TOGETHER

A technographic account of partnerships in 3 Participatory Crop Improvement projects in Nicaragua

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SUMMARY

In May 2002, the "Centre de Coopération Internationale en Recherche Agronomique pour le Développement" (Cirad - Center of International Cooperation in Agronomic Research for the Development) in partnership with the "Centre International d'Agriculture Tropicale" (CIAT - International Center for Tropical Agriculture) set up a program of Participatory Crop Improvement (PCI) of rice and sorghum in Nicaragua. This program, planned for 4 years, aims at the development of a PCI methodology and variety improvement to meet local small and medium-scale producers' needs and work in collaboration with local actors on the field. It is implemented in seven project sites representing different agro-ecological and socio-economic zones. One of the actual preoccupations of the program is to go toward a "multi-partnership" in order to foster the PCI activities and achieve a sustainable and more efficient redistribution of benefit among partners in terms of breeding results and dynamism brought by the project. In this context, the CIAT-CIRAD asks me to study the actual situation of the PCI projects in terms of participation and to elaborate some recommendations to improve "partners" participation.

To understand PCI projects context, it is necessary to present national agricultural policy, institutional systems and actors related to seeds issues. Actually, there are four categories of institutional actors involved in national seed production and distribution systems: public institutions, NGOs, farmers' organizations and international organizations. Each of these actors has different agendas and "cultures" (defined as values, believes, attitudes and organization types). They are implementing different strategies on the field according to their objectives and perception of seed systems. The National Research Institute, organized in a "hierarchic" way, promote improved varieties seeds and faith in expert knowledge. Local NGOs focus on food security and promote participatory methodologies to improve farmers' capacity building. Producers' organizations who want to preserve their traditions and patrimony promote local and "criolla" varieties. International institutions who aim to ensure the sustainability of their actions seek to foster links with partners.

To analyse the situation at the local level, I proposed to look at three specific cases. Two of them are initiated by the CIAT-CIRAD program and started two years ago. The first one illustrates the implementation of a PCI project with the collaboration of the National Research Institute. It happens in Chinandega and focuses on market-oriented medium rice producers. The second one addresses PCI activities coordination involving many NGOs "partners" in Somoto. It focuses on subsistence-oriented small sorghum farmers. These two cases allow me to study actors' participation in two different environmental, economic and institutional contexts. The last case presents the experience of a five years old PCI project led by a local NGO, called CIPRES. This experience located in Pueblo Nuevo illustrates a joint learning process involving breeders, technicians and maize and beans farmers. This case study was chosen to compare the CIAT-CIRAD project with an older project and study the differences between a project led by an international agency and one led by a local NGO. In each case, actors' individual "cultures" will be addressed by looking carefully at actors' objectives, attitudes, relationships and perceptions of participation.

In this study, PCI process is defined as technology development process shaped by the interaction of social actors. The process comprises five phases: the ideotype definition, the variability creation, the plant selection in segregating population, the selection of more stable material and the variety selection and diffusion. Each phase is characterized by a particular configuration of three categories of participating actors, which are breeders, technicians and producers. The social interaction occurring between actors shapes the technology design and outcomes. These interactions are influenced by agroecological environment, economic environment, institutional context, project historical context and the institutional and individuals "cultures". Those cultures reflect actors values, believes and perceptions. The coordination of activities among actors in the field implies the establishment of formal and informal linkages. Formal linkages are set up between institutions as contracts and agreements to ensure that the institutions agree on the implementation of a collaborative PCI project. However, the whole coordination process occurs between the individuals at the local level. Their personality and culture and the way they relate to each other by formal or informal linkages are crucial for coordination processes.

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Abbreviations

C$	Cordoba (0,04847 E; rate of 05/05)
CATIE	Tropical Agronomic Centre for Research and Training (Centro Agronomico Tropical de Investigacion y Ensenanza)
CECAP	Spaninsh Confederation of Training Centres (Confederacion Espanola de Centros de Formacion)
CEO	Experimental Centre of Occident
CIAT	International Centre for Tropical Agriculture (Centro Internacional de Agricultura Tropical)
CIPRES	Centre for Promotion, Research and Rural and social Development (Centro para la Promocion, la Investigacion y el Desarollo Rural y Social)
CIRAD	Centre de Cooperation Internationale en recherche agronomique pour le Developpement
CPEC	Community Collective of producers experimenters (Colectivo de Productores Experimentadores Comunitario)
GMO	Genetic Modified Organisms
INEC	National Institute of Statistics (Instituto Nacional de Estatistica y Censos)
INPRHU	Institute of Human Promotion (Instituto de Promocion Humana)
INSFOP	Institute of Permanente Formation (Instituto de Formacion Permanente)
INTA	Nicaraguan Institute of Agrarian Technology (Instituto Nicaraguense de Technologia Agropecuaria)
Lb	Pound (0,45359 Kg)
MAGFOR	Agrarian and Forest Minister
Mz	Manzana (0,698896 Ha)
PAO	Plan Anual Operativo
PCAC	Programme "Farmer to Farmer" (Programa "Campesino a Campesino")
PCI	Participatory Crop Improvement
PPB	Participatory Plant Breeding
PRIAG	Program to Strengthen Agronomic Research on Basic Grains in Central America (Programa Regional de Reforzamiento a la Investigacion Agronomica sobre los Granos Basicos en Centroamerica)
PROFRIJOL	Regional Collaborative Program for Central America and Caraibe (Programa Cooperativo Regional de Frijol para Centro America y El Caraibe)
PTD	Participatory Technology Development
PVS	Participatory Variety Selection
SAS	Statistical Analysis System
UNAG	National Union of Farmers (Union Nacional de Agricultores Ganaderos)
UNICAM	Farmer University (Universidad Campesina)

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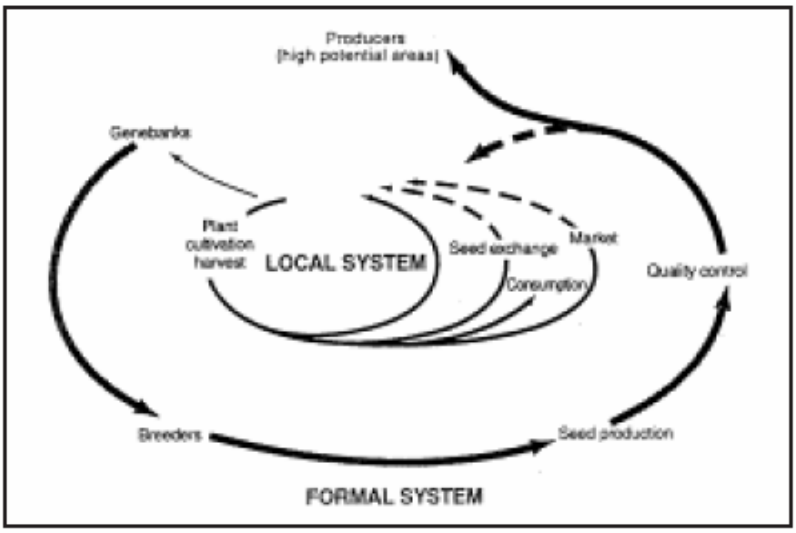


Figure 1: Formal and informal Systems of Genetic Resources Management (based on De Beef, Almekinders and Louwaars, 1998)

1. Introduction

In this study, participation processes among partners involved in Participatory Plant Breeding, as a form of Participatory Technology Development, has been analysed to understand how this influences partnership, and how this finally may influence the technology development and product. This first chapter introduces the technology and participation concepts and presents the research questions

1.1. Participatory Technology Development

Participatory Crop Improvement (PCI) is seen as a form of Participatory Technology Development (PTD) which seeks to bring together knowledge and research capacities of local farming communities with that of the commercial and scientific institutions in an interactive way. REJNTJES et al. (1992) defines PTD as "a complementary process which involves linking the power and capacities of agricultural science to the priorities and capacities of farming communities, in order to develop productive and sustainable farming systems. PTD is a purposeful and creative interaction between local communities and outside facilitators but does not intend to be a substitute for station-based research or scientist-managed on-farm trials." Talking about PCI, the technology development process is plant breeding, the product from it being plant varieties.

Technology paradigm

To understand better the PTD paradigm in the field of plant breeding, it is necessary to introduce the concept of ***seeds systems***. The ***formal and local seeds systems*** have being coexisting in many contexts. However, they generally operate as two separate systems (see figure 1). "Closer relations between the two systems have been blocked not only by a lack of recognition of the farmers' capacities, but also by the differences in character between the two systems". (ALMEKINDERS, 1998)

The ***local system*** is embedded in farmers' livelihood. "The farmer produces a crop for his or her own use or consumption, for sale and for seed to plant in the next cycle. In addition, the farmer may use part of the harvest as seed to give to or exchange with other farmers. This planting, management, harvest and storage of seed on the farm, along with the exchange of seed with other farmers, represent a dynamic process of natural and human selection." (ALMEKINDERS, 1998). Moreover, seeds are in the core of many social networks as farmers exchange seeds. Seeds also have an important meaning for farmers as they make the links between generations. Farmers highly value their seeds, they are part of their patrimony and they like to grow and "conserve" ***local varieties*** as the way to keep traditions.

The ***formal system*** tends to be disconnected from farmers' seed systems from its context. Farmers, the main users, are not anymore actors in the process and they become dependants from the formal system who provide seeds. "The formal system has developed as a seed chain, in which each link is a specialized activity. The chain begins with the collection of genetic resources in local farm production systems and their conservation ex situ in germplasm banks. From the germplasm banks, there is a flow of materials towards plant breeders. The breeders generate (or, rather, re-combine) variation, after which they select or eliminate materials until they are left with a limited number of cultivars that are usually genetically homogeneous. These materials are given to the actor responsible for seed multiplication and distribution. In high-input agriculture, the farmer purchases seed every year or renews the seed at a high rate." (ALMEKINDERS, 1998) This formal system values ***improved varieties*** in terms of technology innovations. In this context, "modern" varieties are considered as "best" in comparison to "old" varieties.

However, experiences have shown that "modern varieties are less successful in areas less favourable to agricultural production; that is, in areas generally characterized as marginal and heterogeneous in agricultural and socioeconomic terms. In these areas, the use of local varieties tends to dominate, and it must be recognized that farmers have not received significant benefits from the efforts of conventional modern programs." (ALMEKINDERS, 1998) Through participatory crop improvement programs, actors from the formal system are looking for an alternative strategy to respond to these farmers' needs and demands. "The incorporation of participatory methods into plant breeding programs began in the mid 1980s by involving farmers in the evaluation of pre-release varieties [Participatory Varieties Selection, PVS]. The gap between users' and breeders' criteria for acceptability of new varieties identified through this type of participatory research has stimulated plant breeders to introduce user-participation at earlier stages in applied plant breeding research.[as Participatory Plant Breeding, PPB]" (SPERLING & ASHBY, 1997)

Participatory Crop Improvement (PCI), as an alternative and complementary breeding approach to Formal Crop Improvement (FCI), aims "to link formal and local systems of crop development, combining the complementary capacities and expertise, seeking to combine the improvement of productivity with the supply of agrobiodiversity needed by farmers (HARDON, 1995).

The lack of uniformity about terminology used in describing farmer participatory approaches in plant breeding call for some clarifications. Terms commonly used include Collaborative Plant Breeding (CPB – used by SOLERI), Farmer Participatory Breeding (FPB – used by COURTEOIS) and Participatory Crop Improvement (PCI – used by WITCOMBE, ALMEKINDERS and ELINGS) In this publication, I use the term PCI that allows easily the distinction between selection of segregating and non-segregating materials. "The PCI-strategy is to insert useful genetic diversity into the local systems and to build on farmers' capacity of seed selection and exchange." (ALMEKINDERS & ELINGS, 2001) Usually, the distinction is made within PCI between ***Participatory Varietal Selection*** (PVS) and ***Participatory Plant Breeding*** (PPB). According to the definitions of WITCOMBE & JOSHI (1996), "Participatory Varietal Selection involves the selection of non-segregating, characterised products from plant breeding programmes. Such material includes released cultivars, varieties in advance stages of testing and advanced non-segregating lines. In contrast, participatory plant breeding involves farmers selecting genotypes from genetically variable, segregating material." PVS and PPB are closely linked, in particular in out crossing crops the distinction is not clear-cut.

However, most of the PCI activities have so far been of the PVS type. “PVS is a logical phase before embarking on PPB: PVS trials can quickly answer farmers’ immediate need for better germplasm, while they are relatively easy to conduct as they do not involve crossing, genetic segregation and maximisation of genetic gain.” (ALMEKINDERS & ELINGS, 2001)

Participation paradigm

Participation has been studied for years and by many authors who developed different typologies to classify the level of participation at stake. The very well known typology of PRETTY (1995) defines seven types of participation. The first type is “***manipulative participation***” when “participation is simply a pretence, with people’s representatives on official boards but who are not elected and have no power”. The other types, “***passive participation***”, “***participation by consultation***”, “***participation for material incentives***” and “***functional participation***” are defined gradually according to the increasing involvement of “people”. In the sixth type “***interactive participation***”, “people participate in joint analysis, development of action plans and formation or strengthening of local institutions. […] The process involves interdisciplinary methodologies that seek multiple perspectives and make use of systemic and structured learning processes. As groups take control over local decisions and determine how available resources are used, so they have a stake in maintaining structures or practices.” In the last level, “***self-mobilisation***”, “people participate by taking initiatives independently of external institutions to change systems. […] Self-mobilisation can spread if governments and NGOs provide an enabling framework of support. Such self-initiated mobilization may or may not challenge existing distributions of wealth and power.” Other authors, like ASHBY (1996), focus more on participation in agricultural research and identify fives types of participation: “***Nominal participation***” occurring when “farmers lends land and labour to researchers”, “***consultative participation***”, “***action-oriented participation***” in which farmers are involved in the implementation of some steps in the research, “***decision-making participation***” in which farmers are involved in the decision-making process, and “***collegial participation***” in which “researchers are involved in strengthening farmers’ own research”.

As ASHBY (1996) highlights “clearly there is no formula for deciding which level of participation is “best”. However, it is important to be able to distinguish which of these levels we refer to when research is called “participatory”. The chosen and implemented level will depend on the research context and objectives.

This study is motivated by a specific demand coming from a French research institute, called CIRAD, that implements a PCI project in Nicaragua. The research team aims to establish a “partnership” between the actors involved in the project. “Partnership” is a very complex concept and difficult to define. First of all, it doesn’t have any exact translation in Spanish, in the field, I used to speak about “colaboración de socios” but this expression may not encompass the whole concept of “partnership” and the actors may have very different ideas about what is a “partnership”. CIRAD-researchers use “partnership” as “the whole of formal links in which actors are engaged to federate the means around projects and programs build together to reach common objectives” (LINDENPERG ,1999) This definition could be seen as a form of Pretty’s “interactive participation”.

1.2. Problem Statement

In May 2002, the "Centre de Coopération Internationale en Recherche Agronomique pour le Développement" (CIRAD) in partnership with the "Centro Internacional de Agricultura Tropical" (CIAT) set up a project of Participatory Crop Improvement (PCI) of rice and sorghum in Nicaragua. This 4-year project, in this study, indicated as the CIAT-CIRAD project, aims at the development of a PCI methodology and variety improvement to meet local small and medium-scale producers' needs and work in collaboration with local actors. One of the preoccupations of the project is the development of a "multi-partnership" in order to foster the PCI activities and achieve a sustainable and more efficient redistribution of benefits among partners in terms of breeding results and dynamics brought by the project

In this context, the CIAT-CIRAD asked me to study the current situation of the project in terms of participation and to elaborate some recommendations to improve the "partnership" and participation of partners. In response, I proposed to analyse three specific PCI-cases. In two cases, the initiating actor, the CIAT-CIRAD team intended to develop "partnership" with the collaborating partners. The third case, a PCI project led by a local NGO, will serve as a comparative case study.

1.3. Research Objective and Questions

The objective of this research was to arrive at a better understanding of "participatory" relationships which link the actors involved in PCI projects in the North of Nicaragua by studying actors linkages, activities collaborations and actors perceptions of the technology.

So following research questions were defined as main working lines.

- How does participation take place?
  - ✓ Which actors are involved and how they relate to each other?
  - ✓ How did they get involved?
  - ✓ What are their roles and functions?

- How do participating actors perceive "participation"?
  - ✓ What means "Participatory Crop Improvement" for each of the actors?
  - ✓ What is the objective of "participating" in the program for each actor and what are actors' expectations?
  - ✓ Are there any differences between perceptions at the institutional level and at the individual level?

- How do actors' perceptions and expectations regarding technology and participation influence the breeding program?
  - ✓ What are the consequences of actors' perceptions/expectations on the "shape" of the breeding program?
  - ✓ What are the consequences of actors' perceptions/expectations on the breeding program "outcome"?

2. Analytical Framework

This chapter outlines the analytical framework used to gain better understanding of the partnership in three different PCI cases and the methodology used to collect the data.

2.1. Participation in Participatory Crop Improvement

SPERLING et al. (2001) define "key variables for discriminating among PPB [for PCI] approaches: the institutional context, the bio-social environment, the goals set and the kind of 'participation' achieved, including the division of labour among scientists and clients."

The ***institutional context*** gives the opportunity to make the distinction between two approaches: "*Formal-led PPB*", "when farmers join in breeding programs which have been initiated by formal breeding program" and "*Farmer-led PPB*", "when scientists seek to support farmers' own systems of breeding, varietal selection and seed maintenance." (SPERLING et al., 2001). It is important to make this distinction, since it strongly influences the power relationships between actors, the objectives of the project and the role distribution of the actors.

The ***bio-social environment*** consists of two parameters. The first one, *agroecological environment*, "ranges from those which are primarily subsistence-oriented and highly unstable, implying that farmers' crop choices are governed by their own adaptive and preference needs, to systems in which crop production is very controlled and largely driven by urban consumers and/or commercial processor needs." The second one, *economic environment*, is defined as the "degree 'homogeneous demand versus heterogeneous demand' for varieties." (SPERLING et al., 2001)

The ***goal setting*** (i.e. the different interests and goals of the stakeholders) and the ***research objectives*** (i.e. overall objectives of the research project) will shape the form of PCI project. For instance, FRANZEL et al. (2001) (in BELLON and MORRIS, 2002) distinguish three types of "varietal evaluation trials" depending on different research objectives: "Type 1 trials, whose objectives are to assess the biophysical properties of different material, are research-design and research-managed. Type 2 trials, which are designed to elicit farmer perceptions about different materials, are researcher-designed and farmer-managed. Type 3 trials, whose objective is to determine the acceptability of different materials and/or promote farmer innovation, are farmer-designed and farmer-managed."

In the model of Sperling, ***participation*** is defined according to three different dimensions: stage of participation, degree of participation and actors' and the roles in participation. The *stage of participation* refers to "the stage of the breeding cycle at which farmers have been involved". Sperling identify five stages: (1) Setting breeding targets; (2) Generating variation through crossing / Accessing variation by using collections; (3) Selecting in segregating populations; (4) Variety testing and characterization; (5) Interacting with seed systems. The *degrees of participation* are "conceived in a form of a wheel, which could evolve through time and according to the stage of involvement". Different typologies can be used to characterise this degree (cf. table). The different *roles and functions* taking by the actors at different stage of the breeding program could be related to the decision-making process.

BELLON and MORRIS (2002) prefer to speak about "***modes of participation***" as "points along a continuum representing different levels of interaction between farmers and breeders. […] characterised in terms of how farmers and plant breeders interact to set objectives, take decisions, share responsibility for decision-making and implementation, and generate products." Three key parameters are then defined: the *stage* of the breeding process at which farmers interact with breeders (as mentioned earlier), the *location* where selection and testing of germplasm takes place and the *design and management* of the germplasm evaluation process which is related to the different roles taking by the actors.

The combination of the concepts defined above helps to characterise different participation types. In the three cases study, the following aspects are looked at:

- institutional context
- agro-ecological and economic environments
- research objectives
- modes of participation: stages of participation, location, degrees of participation, actors' roles and functions, program design and management.

Other aspects that would emerge during the study and that influence the breeding process and the participation types were also to be considered.

2.2. The Cultural Theory

PCI projects involved different types of actors who may have different perceptions and expectations toward the "seed issue". Those actors could get involved in many ways and for many different purposes. These specific perceptions and purposes are used in this study as a reflection of different "cultures" which can explain specific behaviours, in this case in relation to participation and the development of partnerships in PCI. The grid-group cultural theory, developed by Mary DOUGLAS (1982) is used in this study to characterize those cultures and relate them to participatory processes.

2.2.1. What is "culture"?

There exist different paradigms in the social sciences about the meaning of "culture", leading to different research approaches. According to their vision of "cultures", authors use different concepts. DOUGLAS talks about "values and believes", HOOD (1998) focus on "organizational" type, "ways of life", and "structure with attitude", and OLREDAL et al. (2004) in the article on risk perception emphasize "what people fear".

"Culture" has two main components: "values, believes" and "practices or ways of life". PEDERSON (1997) points out "two contrasting definitions" of cultures. "One views culture as the values, beliefs, norms, rationalizations, symbols, ideologies, and other "mental products" that provide descriptive categories. The other views culture as the total way of life of people including their interpersonal relations as well as their attitudes." Many authors seek to integrate these two components. For instance, according to HOFSTEDE (1989) "culture is a mental software which affects the way we think, feel, perceive the world and behave". This definition of "culture" illustrates social psychological approaches, in which "culture is regarded as a variable that can be measured and can be compared". (LIE, 2004) In the field of postmodern, interpretative and ethnographically based approaches, cultural studies emphasize processes of cultural hybridity.

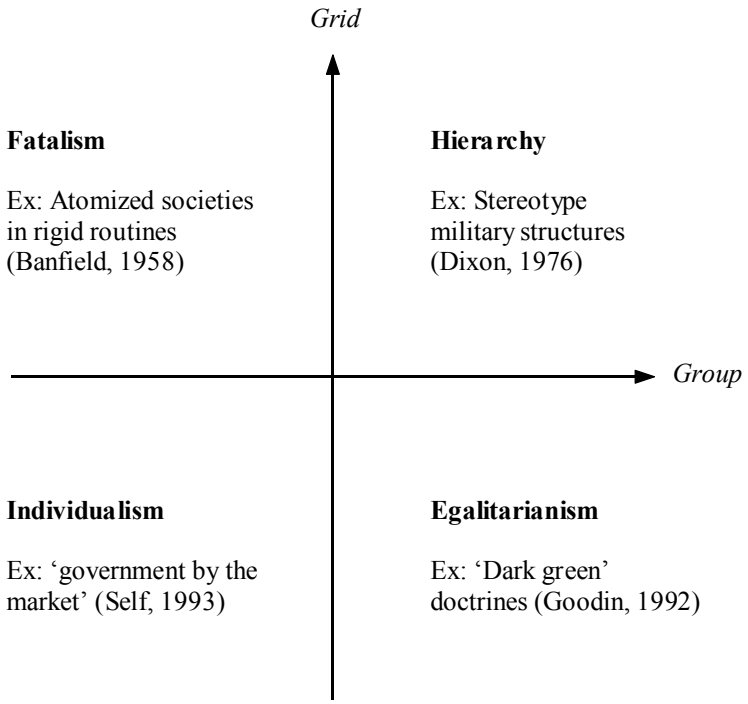


Figure 2: Grid-Group Diagram

In this sense, THOMPSON et al. (1990) talk about “ways of life” as "a viable combination of social relations [defined as “patterns of interpersonal relations”] and cultural bias [or “ shared values and beliefs”]”. In this study, “culture” is seen as the expression of shared values, beliefs, perceptions through specific practices and “ways of life”. These values and practices are shaped by actors’ interactions and contextual factors.

MILLER (1996) highlights that some of the problems of cultural theory (in general) represent the “complexity of culture: multiple functions of cultural meanings, differentiated and dynamic nature of culture, relationship to ecological and socio-political factors.” Culture is expressed in different ways by actors, expression of culture and the culture itself change through time and are embedded in contextual factors. This means that in daily life, in the 'field', individual actors are part of different groups and express different cultures depending on the situation, what group they identify with at this moment or how they perceived other actors’ cultures. This can explain why , in many studies, interviews have not grasped the culture of actors (OLTEDAL et al., 2004)

As I have already mentioned, “culture” is dynamic. This study is not an attempt to capture the dynamics of actors’ cultures, as they cultures evolve constantly through time. However, the Grid-Group typology will be used in a quite instrumental way to compare actors’ values, perceptions and attitudes on the participation field at a certain moment of time. It is important to note that my interpretation of actors’ cultures in this study is not an evaluation of actors’ practices or any kind of personal judgement. Grid-Group typology is, here, used as a tool to compare different ways of life and perception toward participation as a way to increase understanding of interaction taking place between the various actors in PCI projects that were studied.

2.2.2. The Grid-Group cultural theory or Grid-Group typology

As HOOD (1998) highlights, the grid-group cultural theory “aims to capture the diversity of human preferences about “ways of life” and relates those preferences to different possible styles of organization” as expressed in “values, believes, structures and attitudes”. Those preferences are defined according to two dimensions. The first one, “grid” refers to the rules that relate individuals to one another. As Hood explained, it represents“ the degree to which our lives are circumscribed by conventions or rules, reducing the area of life that is open to individual negotiation.” The second variable, “group”, refers to “the extent to which individual choice is constrained by group choice, by binding the individual into a collective body.” It also represents the degree of division between insiders and outsiders. From the combination of these two dimensions arise four “ways of life” or “basic organizational types”. The Fatalist way (high grid, low group) is defined by low cooperation, distrust in human being and a certain apathy. According to THOMPSON (1990) the typical behaviour of a fatalist man is “fickle and untrustworthy.” The Hierarchist way (high grid, high group) is one that is socially coherent and “operates according to well understood rules of procedure.” THOMPSON adds that in the hierarchist model, needs are generally determined by expert and authority. The Individualist way (low grid, low group) presents a certain antipathy to collectivism and a “preference to handle every transaction by trading or negotiation.” According to Thompson, the individualist man is “inherently self-seeking and atomistic”. The Egalitarian way (low grid, high group) implies “high-participation structures” in which “the rules of the game are constantly in play.” It is a way where men are “caring and sharing” (THOMPSON, 1990).

According to HOOD (1998), each 'organizational form' corresponds to a specific "structure" in which actors share beliefs and values. The actors constitute the structure (by their behaviours, values and beliefs..) and are also influenced by the structure itself. Or as GIDDENS (1977) claims "social structures are both constituted by human agency, and yet at the same time are the very *medium* of this constitution". Organizational forms are also "social structures". In this sense, "a way of life consists of a mutually supportive relationship between a structure of organization and a set of values and beliefs" (THOMPSON et al., 1990) The actors having different values and beliefs (may be shared, may be different) interact in the organization creating a shared "culture". However, according to HOOD (1998), if some individuals with others values and beliefs enter the system, the organization or 'way of life' will not be "viable" anymore. As "culture" is dynamic, one can assume that organizations may evolve and acquire a new "culture". However, as individuals may be part of different groups with different cultures, how individual actors deal with contrasting cultures? My hypothesis is that individual actors being part of different groups, thus different cultures, develop their own personal culture, what I call "individual culture". By using the grid group cultural theory with different units of analysis, I aim to compare the institutional "way of life" and how individuals accommodate these in their individual "way of life".

2.3. Methodology

2.3.1. Technography

A technography is defined by RICHARDS (2003) as "an attempt to map the actors, processes and client groups in such a way that the analyst can see beyond the technology itself the problems technological applications are supposed to solve, and to understand what parties and interests are being mobilised in arriving at solutions". By a technographic account of specific PCI projects, we will look for the "mechanisms and processes" which govern the project. This understanding will contribute to knowing "how to make social connection with material outcomes. Actually, the aim of this study is to understand the interaction between the breeding process (which could be seen as the "technology") and the actors and how "social connections" among actors involved in the PCI project shape the technology development process and outcomes. In this sense, the methodological background is embedded in critical realism. The first order analysis will be used to describe the "rules of the game" of participation: what is actually going on between the participants, how does participation takes place? Then, a second order account will serve to build a theoretical perspective about the rules of the game: it will serve to understand why they interact and why they participate in the PCI project. As explained in the previous chapter, my hypothesis is that institutional and individual cultures shape actors interaction and participation in the field.

RICHARDS (2003) emphasises that technography is always methodological plural. However, there are three basic elements in any technography:

- The ***sketch-map exercise*** focus on the issue "what are the main components of the socio-technical system or process?" and highlights where the information collected is strong or weak and which areas need further detailed investigation. The output from such exercise will be a "system diagram, suitably supported by annotations".
- The ***analytical phase*** is problem-focused investigation and aim to explain "what issues you decided to follow up in order to illuminate problems or controversies".
- The ***consultative or participatory phase*** is an "opportunity for a more structured consultation with interest groups" to discuss and revise the sketch-map and problem analysis.

The overall objective of a technographic study is “to facilitate better technological intervention” (RICHARDS, 2003). It precedes a more intervention-oriented phase, which in this case would be the operationalisation of a partnership for the CIAT-CIRAD project.

2.3.2. Research Design

To meet the research objective and better understand the social relationships that link actors in PCI projects, three cases are studied. Two of them are initiated by the CIAT-CIRAD program and started two years ago. The first one illustrates the implementation of a PCI project with the collaboration of the National Agricultural Research Institute INTA (Instituto Nacional de Tecnologia Agraria). The project is implemented in Chinandega area and focuses on market-oriented medium-scale rice producers. The second addresses PCI activities with a range of NGOs “partners” in Somoto. It focuses on subsistence-oriented small-scale sorghum producers in dry environment. These two cases allow the study of actors’ participation in two different economic and institutional environments. The last case presents the experience over five years of a PCI-project led by a local NGO, called CIPRES. This experience situated around Pueblo Nuevo illustrates a joint learning process involving breeders, technicians and maize and beans farmers. This case study was chosen to compare the CIAT-CIRAD project with an older project and study the differences between a project led by an international agency and one led by a local NGO.

To start this study, literature review was needed, especially to present the environmental and institutional contexts and to introduce the projects history. It allows me to understand better the three cases problematic.

Then, I collected information on the institutional culture through semi-structured interviews with the NGOs and research-organization coordinators and technicians. For the Chinandega case, I interviewed 5 INTA-coordinators (from national and regional research departments, national rice program, Chinandega experimental station, regional extension department, and Chinandega extension office), the regional rice breeder and the extension technician involved in the PCI project. I also collected a considerable amount of information from informal interviews with breeders on the Chinandega experimental station and Chinandega technicians. In Somoto, I interviewed extension agencies coordinators (2 from UNICAM, agriculture INPRHU coordinator, 2 from national UNAG seed program, UNAG regional coordinator and 1 from ASSOPROT) and technicians or “promoters” (2 UNICAM technicians working in the area, 1 INPRHU technician, 2 UNAG technicians and 2 PCAC promoters). I did also informal interviews with others technicians. For the Pueblo-Nuevo Case, I interviewed the CIPRES Segovia coordinator, the Pueblo-Nuevo coordinator and the technician involved in the PCI project. I did also many informal discussions with the others CIPRES technicians. These interviews had informed me about the institutions philosophy, objectives, strategies and structures.

Map 1: Location of the three cases study

To develop insight on the cultures and relationships of individuals in the field, I combined interviewing with participant observation. In order to collect good information I felt I had to establish confidential, informal relationships with the local actors. I decided to spend time with technicians to know more about their daily activities and to understand their motivations and perceptions about participation. I spend two weeks (2 times one week) working with the technicians of the Pueblo Nuevo CIPRES, the Chinandega INTA team (one week with the breeder, one with the extension agent), the CIAT-CIRAD technician. I knew the CIAT-CIRAD breeder as I followed him in his activities while doing the literature review. I spend also some days with the others NGOs technicians (UNICAM and UNAG). I attended many workshops and activities organized by those organizations. Many of my findings are based on participant observations and informal talks collected in working and casual situations: during selection activities or others workshops but also sitting on the back of a technician motorcycle or around some beers in a bar with breeders, technicians and producers. Findings concerning producers perceptions are mainly based on personal observations and informal interviews during the PCI activities and others workshops. In my preliminary working plan, I aimed to spend more time with producers to grasp their perception of participation and PCI. However, for time constraints, I was not able to do so. My findings focus therefore mostly on institutional coordination and how the individuals deal with it on the field.

At the end of my fieldwork, I organized a two-days workshop with the actors involved in seed issues in the Northern region of Nicaragua. I focused on this region as two of my case study (Somoto and Pueblo Nuevo) are located there and many institutions have activities in the whole area. Moreover, the actors involved expressed the willing to improve the coordination of activities with other institutions and to formalize this through the constitution of a network. This workshop had two objectives: to improve their knowledge about each other's agendas and to create a basis for a future network. The first objective was relevant, as many actors do not really know about the activities and agendas of other institutions working in the same area. This session was an opportunity to let each institutional actors present its objectives and strategies to the others. Then, there would be opportunity to discuss if they were interested to coordinate their activities and what activities they wanted to do jointly.

In the following chapter, I will introduce the institutions involved in the seed system and farmers experimentation in Nicaragua. I will focus on their organization and their "culture". Then, the other chapters will present two cases related to the CIAT-CIRAD program and one case in which the PCI project is led by a local NGO, the CIPRES.

3. Nicaragua and agricultural development landscape

In this chapter, national agricultural policy and institutional system related to seeds issues will be addressed to set up the institutional context of the three cases studies. We will pay specific attention to the main institutional actors, their organization and "cultures".

3.1. Background

Nicaragua is located in Central America, bordering both the Caribbean Sea and the North Pacific Ocean between Costa Rica and Honduras. It is the largest country (129 494 km^2) in Central America. Its climate, sub-tropical humid, is variable on the territory. Precipitations are irregular and depend on the area. The dry season lasts seven months, generally from December to June and the rain season lasts five months generally from July to November. The rain season is cut by a dry period (around one month, from mi-July to mi-August) called "canicula". The dry season and the "canicule" tend to increase each year and the drought is severely affecting the north of Nicaragua. Moreover, this region has already been affected by climatic catastrophes as the Mitch hurricane in 1998.

Nicaragua is the less densely populated (5 465 100 ,July 2005 est.) in Central America. Around 44% of the Nicaraguan population are rural. The unemployment at the national level is very high (7,8% and underemployment of 46,5% - 2003 est.). Although being an important employer the rural area includes the majority of poor. The labour force by occupation is 30,5% for the agriculture, 17,3% for the industry and 54,6 for the services. (2004 est.). (CIA World Factbook, 2005) "In spite of drought, the onset of a coffee crisis, and the devastation of hurricane Mitch, overall poverty in Nicaragua fell from 50,3% in 1993 to 45,8% in 2001. According to the World Bank's Nicaragua Poverty Assessment, however, extreme poverty in Nicaragua continues to be overwhelmingly rural, where more than 25% of the population struggle to survive on less than one dollar per day." (World Bank, 2003) In 2001, 94,5% of the total population are living below $2 a day (UNDP, 2003). Moreover, "Within the 41 countries classified as poor and highly into debt with the FMI and the World Bank, Nicaragua is part of the group of 8 countries for whom the weight of the extern debt [$5,8 billon] is considered as unsustainable."(UNDP, 2000). The public debt represent 69,5% of GDP (2004 est.) This situation makes the country in an economical unsustainable position and dependant from external donors.

To understand agricultural policy context, we need to set up the Nicaraguan political history. As it is not our aim to develop political issues, this topic will be briefly presented.

Since the independence (1838), the country is divided between two political tendencies. The XIX century was a succession of conflicts between liberals and conservators. During this period, England and the USA compete for controlling the area. In 1909, the Americans invaded the country and controlled Nicaraguan politic. Rivalries between liberals and conservators ended in 1927 with the signature of a pact, "Pacto del Espino Negro". All the liberal leaders accepted the treaty, accept Augusto Cesar Sandino, who rebelled against North American occupation. The fight lasted until the American army finally decided to move out. Before leaving, they organized a Nicaraguan army, called the "Guardia Nacional". In 1934, Anastasio Somoza Garcia, leader of the "Guardia Nacional", set up a complot to assassinate Sandino and take the power. He proclaimed himself president in 1937. The dictatorship of Somoza family lasted for 40 years. In the years 70s, opposition to the Somoza regime increased and actions from FSLN ("Frente Sandinista de Liberation Nacional")

became stronger. Carlos Fonseca, Tomas Borge and Silvio Mayorca created the FSNL in 1962 as an armed organization that aimed to end with the Somoza dictatorship. The Sandinist Revolution celebrated its triumph the 19th of July 1979. The country was destroyed by the civil war and the Sandinists started with difficulties the establishment of the new government. Moreover, the United States didn't approved Sandinism and distrusted the new government. The Sandinist government implemented an alphabetisation campaign and the agrarian reform. "Ten years of agrarian reform profoundly modified the profile of the agricultural structure of the country. The reform has affected 28 % of the land under cultivation and 43% of all peasant families had received land. Mean while large landholdings were reduced from 36.2 to 13.5 % of the land in the decade from 1978 to 1988.[…] In 1986, the non state sector – constituting of the Sandinista Agricultural Cooperatives (CAS), peasant that had received land from the agrarian reform and were organized under credit and service cooperatives (CCS) and individual producers beneficiaries - was larger in area than the sate sector." (BAUMEISTER, 1991) The Sandinist project was to group farmers in cooperatives. Some were disappointed as they thought that the Revolution will allow land property redistribution. Moreover, many liberal Nicaraguans immigrated to USA and constituted a lobby on American politic. The "Guardia Nacional" immigrated in Honduras and Costa Rica, with American funds, they prepared the "Contra-Revolution". To cope with the new war, the Sandinist Government had to institute a military service. Many Nicaraguan who were in favour of the Sandinists at the beginning were disappointed by the government and came to support the "Contra". At the international level, various European countries developed collaborating projects to support the country effort for development. The USA were condemned by the International Tribunal of Den Hague and asked to stop supported the "Contra". Finally, in 1984, Sandinists won the elections and Daniel Ortega became president. However, the USA continued to finance the "Contra" and decreed a national commercial embargo against Nicaragua. To finance the war, the Sandinist government had to devalue the money, which led to inflation. The "Contra-Revolution" finally ended when new elections were organized in 1990 and the UNO (Union Nacional Opositora), a coalition of liberals won. Violeta Chamorro became president. Then, in 1996, Arnoldo Aleman, from the PNL (Partido Nacional Liberal) was elected president. The Sandinist party was in the second place. At the last election, in 2001, the liberal Enrique Bolanos (ex-leader of the "Contra") beat the Sandinist Daniel Ortega. Nicaraguan people, especially in the rural areas, are embedded in this political context and the polarized political situation that oppose sandinists to liberals. The recent revolution is very present in their mind. Nicaraguans are passionate and in general they are devoted to one or the other political party. The liberals are in the government. However, the 19th of July (anniversary of the Sandinist Triumph) is a national day and the founders of the FNSL are considered as national heroes.

3.2. National Plants breeding programs and seed distribution

3.2.1. National Seeds Plan (PNS)

In the context of the agrarian reform, the Sandinist government created a National Seeds Plan in 1988 (by the "Ley creadora del programa nacional de semillas"). The article 7 gave responsibility to the "Minister of agricultural development and agrian reform" for the definition of the regulation of the PNS. However, due to political struggles and changes, the implementation of the law didn't become effective. Then, ten years later, in 1998, the liberal government, through the action of the Ministry of Agriculture and Forestry (MAGFOR), developed a new "Seeds production and commercialisation" law to support the seed industry and the use of basic grain and oleaginous improved varieties. Action lines were defined according to three main objectives, which are (MAGFOR, 2005):

Map 2: Location of INTA extension agencies in Nicaragua

- To guarantee superior quality seeds production to support sufficient volume of superior quality seeds needed through the strengthen of capacities of the public organism in charge (INTA)
- To strengthen seeds demand to guarantee the seeds market development
- To modernize the regulation (legal and institutional) to formulate a seed policy in concordance with the agricultural and technological policies

3.2.2. "Libra por Libra" program

The National program "Libra por Libra" (PNLL) started in 2002 in line with the PNS component: "supporting the development of the seeds market". This program was implemented to promote the seed market by supporting improved varieties seeds demand and establishing distribution networks (MAGFOR, 2005). Funding mainly comes from the World Bank, the FAO, the BID, USAID and Governments of the Netherlands, Denmark, China and Tawain…The program focused on small farmers. The first year, they received one "libra" (0,4536 kg) of improved variety seeds in exchange of one "libra" of their local variety seeds. Then, the modalities changed and producers had to give two "libras" of their local variety seeds in exchange of one "libra" of improved variety seeds. Nowadays, they received improved varieties seeds of maize, beans, white sorghum and rice in exchange of coupons. To implement this program, MAGFOR had to organize a seed distribution system through the involvement of INTA, private companies, associations and NGOs.

In the field, I heard a lot of polemics around this topic. Some actors, especially NGOs and producers, think that the PNLL program aims to recollect local varieties (and conserve these materials in germplasm bank) and to replace local varieties by improved varieties on the field. It is true that the program and the actors who are implementing it tend to devalue local varieties while focusing on the improved varieties advantages. Other actors are concerned about the choice of the diffused varieties (based on arguable criteria), the poor "quality" of the distributed seeds and the fact that these improved varieties are high-input demanding (it needs more fertilizer and pesticides).

3.2.3. INTA

3.2.3.1. Politics and strategies

The Nicaraguan Institute of Agrarian Technology (INTA) started in 1993, as an "organism of executive and decentralised power with its technical, administrative and functional autonomy". However, as an institution of the agricultural public sector, the INTA program based its actions on the political lines from the Minister of Agriculture and Forestry (MAG-FOR). It objective is to "generate and transfer technologies to farming producers families by direct and groups modes through the execution of projects, using different modalities of Technical Assistance (public massive, public co-financed, private co-financed and collaborative), on the concept of rational and sustainable use of natural resources and environment, guaranteeing the effective participation of producers." (Plan Annual Operativo-PAO, 2001) The document doesn't defined what is "effective participation" for INTA.

In 2001, the Government of Nicaragua started the implementation of the "National Program of Agricultural Technology", which was defined for 15 years. The program consists of four phases: Integration and Institutional strengthening (2001-2003),

✓ The **Directive Board** ("Consejo Directivo"), the main administrative organ of activities and goods, conducts the execution of the official policy in terms of technology generation and transfer. It has to approve the annual operative plans, intern regulations and the accounting. It appoints the staff on the proposition of the Executive Officer ("Presidente ejecutivo"). It is composed of different representatives of agricultural national organisations and private companies, the President of the Republic names the president.

✓ The **Executive Officer** ("Presidencia ejecutiva") deals with the administrative part. The Officer is proposed by the MAG-FOR and named by the President of the Republic. He is the legal representative of INTA and carries through the states programs of technology generation and transfer, and the decisions of the Board of Trustees ("Junta Directiva"), prepares and presents with the General Director to the Directive Board the Annual Plan of Activities, the General Budget and the Financial Reports…

✓ The **General Direction** ("Direccion General") is presided by a General Director proposed by the MAG-FOR and named by the President of the Republic for 4 years. It deals with the technical, administrative and financial superintendence. He is the secretary of the Directive Board.

✓ The **National Superintendence of Research and Development** ("Gerancia Nacional de Investigacion y Desarollo") administrates the execution, follow up and evaluation of the investigation projects, coordinates the formulation of projects with the Superintendence of Extension and presents to the General Direction the technical report of investigation projects.

✓ The **National Superintendence of Extension** ("Gerencia Nacional de Extension") for favourable and unfavourable zones administrate the execution, follow up and evaluation of extension projects, coordinates the formulation of projects with the "Gerencia of investigacion and desarollo" and presents to the General Direction the technical report of the extension projects.

✓ The **Local Technical Superintendence** ("Gerancias tecnicas de zonas") subordinates to the Local Superintendence of Research and Development, Local Superintendence of Extension for unfavourable zones and favourable zones and Extension Agencies. Represents INTA at the local level, elaborates proposition for the POA of the zone, administrates the resources of the institution in the zone, conducts the execution and evaluation of the zone programs.

✓ The **Extension Agencies** executes the programs and projects approves in their territory, promoting the participation and organisation of the beneficiaries families.

Box 1: INTA Organization

Coverage enlargement (2004-2007), System Expansion to improve actors' participation in research, extension and training (2008-2011) and System Consolidation to improve technology access (2012-2015). This year (2004), the first phase finished and a working plan (for 2004-2007) was elaborated with INTA staff to achieve the second phase objectives. In the field, some actors are not convinced by this strategy, as they have been witnesses of the implementation of many different plans. A breeder explained me that he worked for INTA during more than 20 years, and during this period, the name of the institute and the programs implemented have changed many times. "They elaborate plans and projects to get funds from the WB or others funding agencies. When the program fails or ends, they used to elaborate another program with a new name." INTA programs are financed by the World Bank, the FAO, COSUDE (Development and Cooperation Swiss Agency), NORAD (Norway agency for International Development), Mission China and JICA (International Cooperation Agency of Japan).

3.2.3.2. INTA Organization

The structure is organized in a centralised and hierarchical way (cf. Organigram INTA – PAO 2001 & Box 1), involving many "layers" in terms of power and regulating by pre-defined rules.

The working strategies are defined with the MAG-FOR and the Directive Board, they reflect the politics tendencies. The two main streams are "to improve the export production chain" and "to cope with national needs". The Rice national coordinator highlights that a part from the given working orientations, the direction organs have a lot of influences on each programs through the budget. "The funding of each programs is one of the main way of incidence."

Thinking in terms of organizational "culture", INTA is organized in a "hierarchical" mode (high grid, high group), as "hierarchical cultures emphasize the "natural order" of the society and the perseverance of this order" (OLTEDAL et al., 2004). The actors involved in a "hierarchical" organization accept the established order and authority "layers" as a "natural" social configuration.

3.2.3.3. Coverage

INTA counts with 27 Extension Offices (cf.Map 2), for each agency, a technical team in agricultural development ("Tecnicos en Desarollo Agropecuario"- TDA) give technical assistance to producers in the incidence area. Moreover, in Experimental Stations, located in Managua, Masatepe, Posoltega, Sebaco and El Recreo, researchers work on experimentation, training to technicians and producers and validation of technology in reference farms.

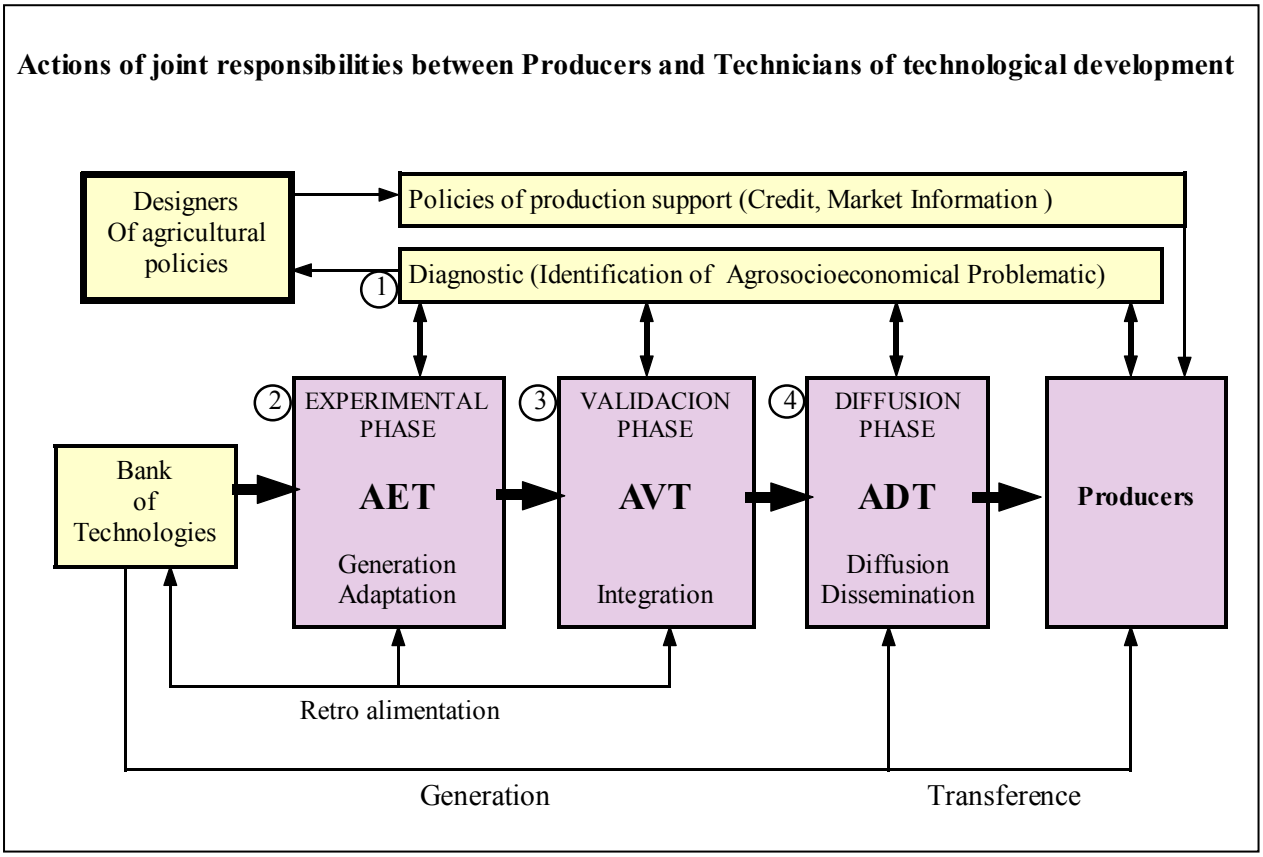


Figure 3: The INTA technological model (Memoria 2000)

3.2.3.4. INTA Research and Development strategy: A formal research system

The national agricultural problematic was established based on "participatory activities" in which producers and INTA technicians have identified the main problems. In the PAO 2002, the basic grains seeds issue is addressed by two main concerns: availability of new varieties seeds and sensitivity to pests and diseases. Its mentions that "the limited availability of grains improved variety seeds leads the producers to continue using local varieties and bad quality seeds acquired in local market, which affects the yield at the national level". The PAO highlights also the need to form INTA staff to "allow the technologies to come to producers units for their uses with more easiness and clarity."

The Research and Development project deals with various programs: Maize, Beans, Rice, Sorghum, Oleaginous, Vegetables, Fruits, Roots and Tubers, Integrated Pest Management, Soils, Water and Agro-forests. Each of these programs has a responsible at national level and at regional level. One regional researcher can be in charge of one o various programs, depending of the problematic, the major crops of the area and according to human resource.

In all the programs, the technology generation follows four key steps (Figure 3). INTA discourse emphasizes "farmers participation" and "actions of joint responsibilities between producers and technician" in the technological model. However this model and the implementation of the steps let us think that there is some discrepancies between the discourse and the practice.

The four main phases are described in the INTA Memoria 2000 as following:

1) **Diagnostic and Characterization of the Territory**: to improve knowledge about the territory, to identify the production problematic, to study relevant products demand on the market, to define "recommendation domains", to categorize producers who constitute INTA clients.

2) **Experimentation Phase**: areas of technological experimentation ("Areas de Experimentacion Tecnologica" -AET) can be establish at " Experimental Station or on producers farms. Plots are conducted by the researchers with support from extension technicians and the ample producers' participation."

3) **Validation Phase**: to "incorporate the new technology to the production system", areas of technological validation ("Areas de Validacion Tecnologica" –AVT) are established in Producers farms " where the new technology face the producers practices. The results pass through an economical analysis to calculate the efficiency and then go to the diffusion phase."

4) **Diffusion Phase**: producers conduct their own areas of technological diffusion ("Areas de Diffusion Tecnologica" –ADT) to become more familiar with the technology. Seed production areas can also be considered as ADT. Moreover, various communication modes are used to promote the new technology (radio, television, publication, trainings, activities, field days, presentations …).

In the field, producers are involved in the last phases (validation and diffusion phases). They conduct the parcel as they want (because the purpose is to "face producers practices"). They have no "explicit" power on the decision making. However, they become more familiar with the technology and start the adoption process. Producers can also be associated in the experimentation phase for two purposes. Experiments are quite often established on producers' farms due to the lack of experimental stations and areas. But, they can also be established in producers farm for specific purposes, as fertility experiments that needs to work in different soil types. Experiments on farms can be established with producers according to different modalities, as the payment of a rent for the land use, a complete productive pack (fertilizer, pesticides…) and technical assistance…Even if INTA use the expression "ample producers' participation" to define the actual involvement of farmers in this phase, one can ask the actual importance of farmers participation in INTA technological model, as they are only involved in the last phases on the process. In terms of participation type, INTA model illustrates "nominal participation" (in which farmers lends land and labour to researchers). Moreover, ASHBY (1996) highlights that "in formal experimentation, there is a recognized hierarchy of levels of farmer participation: researchers lead the design and implementation and invite some farmer participation; researchers and farmers have unique contributions depending on their area of special expertise." The limited farmer participation can be understood as a "cultural characteristic", as OLTEDAL et al. (2004) explain "hierarchists have a great faith in expert knowledge". In this sense, "hierarchists" would be reluctant to let much decision making power to farmers.

Concerning plants breeding, as a rice research technician in Chinandega highlights, "producers participation is minor in selection activities" and it is more about "parcel management". They conduct the parcel with more or less freedom, it depends on the experiment purpose. As they conduct the parcel along the crop cycle, they have, of course, an opinion about it and about the material they prefer. According to the "traditional way of working", the final results about the material performances are based on statistical data and on researchers criteria. However, under the surface, a more informal process occurs in which producers participation may affect some evaluation criteria and researchers decisions. This depends of the relationships between the researcher and the producers. Some researchers are quite close to the producers in the field. During the long process of experimentation, they visit quite frequently the experiments in producers' farms and have the opportunity to establish good relationships with the more involved producers. This close relationship "shapes" researchers' evaluation criteria, as he becomes to understand what farmers really need. A research technician is used to call this process "implicit participation". This phenomenon let us think that two types of cultures influences actors' coordination in the field, the "institutional" and the "individual" cultures.

3.2.3.5. INTA Extension Services

According to the PAO 2002, 30% of the producers families receive technical assistance from INTA, others extension agencies and NGOs. INTA pretends to assist 11% of these families. An average of 27% are attended by ATP1 (participatory co-financed technical assistance), 46% by ATM (massive technical assistance) and 27% by ATP2 (private co-financed technical assistance).

The project for favoured zones is destined to producers families who have a minimum of resources that allow them to pay for technical assistance and who are located in territories with good agroecological potentials. In these zones, participatory co-financed technical assistance ("Asistencia tecnica Participativa Cofinanfiada" –ATP1) is executed by INTA and private co-financed technical assistance "Asistencia Tecnica Privada Cofinanciada" –ATP2) is executed by agricultural services private agencies. To benefit from ATP, producers have to pay a symbolic fee.

- ✓ **ATP1**: It is dedicated to a limited number of producers (average of 80 producers assisted by a technician covering 6 communities). A farmer representative, assigned for a group of 10-15 producers (a technician generally follows 8 groups), makes the link between INTA technicians and the producers group. An INTA technician visits each group representative at least twice a month. During this meeting, the representatives report the difficulties of producers in his group. Then, the technician will visit only the producers with problems and the ones, he didn't visit for a long time. This method allows him to organize his week in a more effective way. The representative is also in charge of inviting the producers for INTA activities.
- ✓ **ATP2**: It is dedicated to a larger number of producers (average of 200 producers). INTA contracts extension services to a private company. The modalities may be different depending on the agency.

The project for unfavoured zones is destined to producers families located in marginal zones with few and degraded natural resources and without access to credits. In these zones, the massive technical assistance ("Asistencia Tecnica Masiva" – ATM) is executed by INTA. It is a free service.

- ✓ **ATM**: As its name mentions, it is for a larger number of producers (average of 200 producers). Usually, there are two different ways of working: "en cascada" (in cascade), in which a representative is trained and then will trained the others producers; or by massive training, producers are invited by radio or by the municipality to participate in a big training session.

In the long term, INTA wants to privatise extension services. Producers will have to pay to benefit from technical assistance services. An extension offices director made the point that it is a very long process, but the aim is that, at the final, producers will be able to take charge of the total cost of technical assistance and could also make their choices among different extension agencies. By ATP, INTA begins to bring into focus that "technical assistance is one input like another and that they have to consider it in their planning." This strategy might be driven by an "individualist" cultural character as individualistic culture emphasizes the importance of individual freedom and support market liberalism (OLTEDAL et al, 2004).

3.2.4. Consequences of the hierarchical organization

As we have seen before, INTA is organized in a hierarchical way that lets little room for novelties at the local level. All decisions come from above, as a researcher mentions, "You cannot change INTA working system. What can you do if everything depends on the political lines which are defined above?". Moreover, decision organs are very linked to national political power that decides the working orientations but also names INTA directors. This influences INTA strategy and organization. Moreover, the "culture" shapes the institutional organization or structure in such a way that "culture" will be reflected and preserved by the organization. In this sense, "conservatism" fosters the "hierarchical" culture.

At the local level, INTA staff generally stays for long time in the institution. They are used to change jobs and responsibilities in the midst of INTA. For instance, the rice breeder involved in the Chinandega Case was formally responsible for the whole program of Basic Grains. Regional researchers change regularly of crop speciality and technicians change attention zones. INTA staff enters a kind of routine in which they only do what they are ask to do. Even if they want to work in a different way, they have to cope with many obstacles. The first one is the lack of money. They can take upon their personal time, but what can they do if there is not enough money to pay workers and to ensure transport? They have to control every travelling expense to adjust with their budget. The result is that workers generally stay in the lines defined above and the "hierarchical" culture is preserved.

3.3. Parallels programs of local varieties conservation, plants breeding, and seed distribution

3.3.1. NGOs

Most of the local NGOs emerged in the 1980s, after 40 years of dictatorship, as a way to express their political opinions and act for citizens' rights and poverty alleviation. Many of them have leaders and technicians who fight in the Sandinist Revolution. Some clearly show their political tendency, while others prefer to stay more discrete in order to work with the population without discriminating among political divergences.

In the following paragraphs, two local NGOs working as "partners" with the CIAT-CIRAD project will be presented.

3.3.1.1. INPRHU: Capacity building

INPRHU (Institute of Human Promotion) is a national ONG that "promote equality of opportunities, citizens participation and promotion of essential rights of vulnerable urban and rural families." (INPRHU, 2004) It is one of the oldest NGOs in Nicaragua, it was constituted in 1979 to promote democracy and has had some political influence. The agency in Somoto was created in 1990. Nowadays, it attends 120 communities of 5 municipalities in the department of Madriz. At the beginning, the focus was on health and natural medicine. In 1994, organic agriculture issues were introduced as a component of natural medicine. Today, the different topic activities (childhood and adolescence issues, preventive health, credits, organic agriculture and strengthen of local governance) are organised in four main programs which are "Infrastructure", "Health", "Attention to childhood (PAN)", and "Agriculture" (called Program of integral rural development –PRODERI). This last program focuses on sustainable agriculture and food security. The coordinator of this program explained that they are working with farmers individual training through training and direct technical assistance on specific topic, they also train "promoters" to create local capacity and abilities within the community. The methodology is based on "horizontal extension"; technicians train "para-technicians" and "promoters", who will train others producers. "Promoters" are local key actors within the community; usually there are one man and one woman in a community to ensure parity and facilitate the training. "Para-technicians" are selected promoters who are trained to work as technicians in others communities. As the PRODERI coordinator explained "to become para-technicians, promoters are selected by INPRHU technicians according to several requisites; their parcels has to be an example for the whole community, usually they

have a leadership role in their community, they also have to be able to transmit their experiences and knowledge to others producers". Para-technicians are "itinerants" (they travel in different communities to work) and generally spend one week per month out of their own community. For this work, they receive 30C$ (1,45 E) per working week and a food package. Before, each stay, they are trained in methodological tools and on the specific topic they will instruct. They are also key actors for INPRHU playing a monitoring role. Actually, as they spend a whole week in a community, they can better know about local problematic and producers needs.

In terms of "cultures", the "horizontal extension" strategy corresponds to an "egalitarian" organization, as the different actors, technicians and producers, interact at the same level. However, there is still a kind of stratification in the actors' roles and the learning process. Different types of actors interact at the same level and come from the same background (as they are producers), but they are defined as "technicians", "para-technicians", "promoters" and "producers", and have different roles and responsibilities according to their status. This reveals a certain "grid" degree (see 2.2).

3.3.1.2. INSFOP / UNICAM: Farmers Experimentation

INSFOP (Instituto de Formacion Permanente) was founded in 1983 to contribute to improve the livelihood of poor neighbourhood in Esteli and rural communities in Las Segovias. To ensure that families become actors of their own development, the NGO focus on capacity building and training. INSFOP consists of three projects: one focus on cultural and communication issues (to make dairies and many publications available for all), another focuses on rural families within and around Esteli and the other focus on rural communities (called UNICAM)

The « Universidad Campesina » (UNICAM) was created in 1991, after the Sandinist period. The INSFOP organised meetings with producers to plan a project to deal with small farmers problems in the region. The project is based on the assumption that "Organised and trained farmers families plan and manage efficiently their farms, in an integral and sustainable way using appropriate technologies and using local resources. By this way, they obtain sufficient food for self-consumption and selling […] and increase their revenue, which allow them to profit from basic services and better quality of life." (INSFOP-UNICAM, 1999). According to UNICAM, community organisation and farmers training are the most efficient ways to achieve a sustainable development.

The idea of working in research with producers emerged in 1993 at an exchange activity realized in el CECAP el Cruzero and facilitated by a French researcher, at this time, coordinator of the PRIAG (Program to Strengthen Agronomic Research on Basic Grains in Central America). UNICAM was invited by PCAC. They were enthusiast about the activity and decided to work more on this topic. As the UNICAM coordinator mentioned, "we realised there was a big potential in farmers to experiment and innovate and that we had to capitalize it in our project development." After several meetings with producers and research institutions, they decided "experimentation had to be collective and to aim at solving problems of the community in its majority." (Coordinator of UNICAM, 2005) So, they organized producers experimenters groups, called "Colectivo de Productores Experimentadores Comunales", CPEC (Collective of Community Producers Experimenters). It has begun by the creation of a CPEC in the community of El Mamel, Cayantu, comarca de Totogalpa in September 1995. Nowadays, UNICAM works with 30 CPEC located in Esteli, Madriz and Nueva Segovia.

« Farmer experimenters »

UNICAM has created a methodology based on group experimentation with CPEC to achieve their main objective, which is defined as "to contribute with a participatory methodology to identify and analyse community agricultural production limitations and then test different technologies which lead to solve specified limitations." (UNICAM, 2004 – Guia para la implementacion de la Metodologia CPEC) They have developed some main working orientations:

- To form producers groups who will try to find solutions to community agricultural problems
- To improve actual community structures
- To stimulate the process of community self-management
- To identify and strengthen human capacities
- To promote participatory process toward local empowerment

and a specific methodology that follows 7 steps:

- Motivation: in the whole process
- Diagnostic: inventory of the farmers problems and prioritisation
- Experiment planning: sowing time, seeds type, treatment
- Experiment set-up: "implementing what we agreed" on the planning phase
- Monitoring: training, field visits…
- Evaluation: evaluating positive and negative results, experiment cost…
- Information devolution: informing the community about the results and thinking how to diffuse the "good" practices

The type of participation presented by UNICAM strategy and methodology is close to a "collegial participation" or "self-mobilisation" in which farmers conduct their own research and technicians and researchers (from INTA) might be involved as advisers. According to the Grid-Group Cultural Theory, the UNICAM organization is also an "egalitarian" one, as it involves high participation structures. They aim to foster producers' capacity building by group and community experimentation. The all community is involved and have a say in the decision making process as the experiments correspond to a specific problem defined by the community. The producers experimenters groups are in charge of the practical part, the experiments. At the end of the experiment, the intern and extern information devolution allow to diffuse experiment results. Intern information devolution refers to the community level while extern information devolution to the regional level, national level or international level. Focusing on information devolution also foster farmers' accountability for their experiment results. They are accountable to the community and to others farmers who might implement their advices in their own fields.

3.3.2. Producers organizations

The Sandinist government focused on the creation of cooperatives. However, few cooperatives actually remain from this period. It seems that at this time, farmers were not used to and prepare to work in cooperatives. Nowadays, NGOs are promoting other forms of cooperatives, however, some farmers stay skeptical about this organization type. Many farmers tend to prefer other organization type as associations or organized groups. The UNAG, national union of farmers, formed during the Sandinist period, played a role in the agrarian reform and is still very present as a lobby to represent farmers.

3.3.2.1. UNAG

The "Union Nacional de Agricultores y Ganaderos" (National Union of Agricultural and Livestock Farmers), funded in 1981, the time of the Sandinist Revolution, is a "corporate organisation that promote and support the sustainable development of his affiliates through their organisation, representation and management." (UNAG, website, 02/05). It is an "union" of producers. Each members has to pay 5C$ (0,24 E) per month.

UNAG works with different projects as "Women attention", "Youth", "Technical Assistance for Organic Coffee", "Local varieties improvement" (Mejoramiento de Variedades Criollas)... Organisation and topic focus can vary depending on the different departments. For instance, as the National PCAC (Program "Farmer to Farmer") coordinator explained "in Boaco, producers are organising small enterprises, while in the North of Nicaragua, small farmers works in PCAC. In Matagalpa, the program focus on familial education…"

To promote local farmers organizations, UNAG has also implemented a program "Farmers to Farmers" or "Campesino a Campesino", called PCAC. As the National PCAC coordinator explained "PCAC is a program, not a project. It is like a movement with it own life, it is a relatively autonomous program [from UNAG] in which producers groups and technical team have a lot of freedom and initiatives." For instance, farmers who are not affiliated to UNAG can participate in PCAC. In the last years, the program has gain importance within the UNAG. The PCAC coordinator explained that over the time, a fusion occurred between the "what to do" (local actions implemented by PCAC at the local level) and the administrative part. Nowadays, many UNAG persons in charge are also PCAC promoters, this integration of responsibilities enforces strong ties between UNAG and PCAC.

The "Local varieties improvement" project is relatively new. The seed topic was very present in many workshops and activities with farmers and PCAC farmers had worked on this topic since the beginning. However, it was more localised initiatives developed by some PCAC. There was not yet a national and coherent effort. The project emerged from thinking about seed problems at the national level. UNAG organized in 2000 three forums about "Farmers agriculture, Seeds and Biodiversity" (Agricultura Campesina, Semillas y Biodiversidad). It allowed to define working orientations and principles about Seeds and Biodiversity (cf. Annex Principios del PCAC sobre Semillas y Biodiversidad). Seeds Exchanges Ferias organised at the local level and the national level were used as a basis to begin a national inventory of local varieties (cf. Annex Feria Nacional de Semillas Criollas "Conservemos Nuestras Semillas Criollas" 2003). The need for a more complete diagnosis emerged. Based on the experience of the PCAC of Nueva Segovia, a questionnaire was developed. It consisted of 16 simple questions. The technicians and PCAC promoters visited more representative communities and selected producers to complete questionnaires. Over the time, questionnaires were adapted to get a final version easily manageable by producers (cf. Annex Questionnaire). Collected data are presented in a catalogue that is regularly reviewed. At the beginning of the project, the idea was about "local varieties recollection and in-situ conservation". However, project coordinators admitted that nowadays, PCAC and UNAG structure are not able to ensure the characterisation and monitoring of all local varieties. So, the project focus emphasizes the re-value of local varieties as local patrimony and knowledge improvement of these varieties rather than the recollection and conservation.

« Campesino a Campesino» (Farmer to Farmer) or PCAC

The program "Campesino a Campesino" is born in Guatemala in the 70s. It was used for first time by an agronomist who wanted to teach some ecological principles to indigenous farmers, he couldn't speak the local language and farmers didn't understand Spanish. At this time, popular education giving importance to student participation, especially in the design, was emerging in Latin America. The agronomist, inspired by this "participatory" type of education, "decided to train some farmers who were speaking Spanish in agricultural techniques […] they were trained as "promoters" in ecological agriculture." (UNAG, 2001, Sistematizacion de la Experiencia en el Departamento de Madriz, Nicaragua) "Promoters" are key producers trained by a specific institution to train others producers. Unfortunately, the Guatemala initiative failed because of "political intolerance", lobbying groups of big farmers were afraid that indigenous farmers became more independent. But the idea was born and expend in Mexico. In 1987, UNAG introduced the methodology in Nicaragua with support from SEDEPAC (Servicio, Desarollo y Paz A.C., Mexico). The idea was to "organise little individual farmers and cooperatives in their profession through a training program." PCAC was born in Nicaragua in the community of Santa Lucia, Boaco.

PCAC aims at valuing farmer knowledge and self esteem. "Farmers have a subsistence strategy, with a lot of knowledge and experiences accumulated from many generations. […] It exists a psychological barrier which has to be considered to take in account the importance of their experience and the knowledge they have, and that it is possible to be trained, even without knowing reading and writing. They realise that their knowledge have a great value." (UNAG, 2001) The methodology is based on exchanges in which farmers share their own experiences and knowledge. As a regional PCAC coordinator explained, the strength of the program is that "PCAC is a program for farmers, realised by farmers with farmers' experiences." He was talking about "horizontal participation" in which "the technical team role is to facilitate the learning process". One aim of this methodology is also to ensure a more sustainable process. As a farmer testified "there is less technicians now, we use more "promoters" abilities, others organisms don' t work in this way, they came, they finished and they left. The program continues because we are us."

Main principles of PCAC methodology are defined in "Sistematizacion de la Experiencia en el Departamento de Madriz":

- To begin slowly and step by step
- To limit the introduction of new technologies
- To experiment
- To learn by doing
- To look for quick and knowledgeable success [to motivate farmers]
- To develop farmers solidarity

The program uses as methodological tools:

- "**Talleres**" or theoretical and practical workshops:

  Workshops organized in farms in the community to enhance participants' motivation and technical knowledge are facilitated by technicians and generally given by "promoters".

- "**Intercambio**s" or exchanges:

  Visits or meetings of producers coming from different communities allow to improve participants' motivation and technical knowledge. Participants "do not exchange only agriculture experiences but also culture, vegetative materials and seeds."

- "**Farmers experimentation**":

Producers have to experiment the new technology in their own parcels to appropriate this technical knowledge. It aims at adapting the technology to specific environment.

- "**Teach to others**":

"Promoters" learn "teaching methodologies and tools" to promote the program in his own communities and others communities.

The type of participation promoted by UNAG will be closed to "self-mobilization", focus on farmers capacity-building and "conserving indigenous knowledge generation processes" (ASHBY, 1996) are relevant for an empowering participation. In terms of "cultures", UNAG and PCAC organizations are located in the "egalitarian" quarter. It structure focus on "participatory" decision-making and their ideology show a high concern for collective nature resource management, especially in terms of local variety conservation.

3.3.3. International organizations

Many international organizations are working in experimentation in Nicaragua. Usually, they collaborate with the national research institute INTA. However, some of them seek to diversify their "partners". In the following paragraphs, we will look at two research centers that are involved in participatory crop improvement in Nicaragua.

3.3.3.1. CIAT

The International Center for Tropical Agriculture (CIAT) is "a not-for-profit research and development organization dedicated to reducing poverty and hunger while protecting natural resources in developing countries".(CIAT, 2005) It focus on "socially and progressive science that offers individuals and communities the means to solve problems and seize opportunities for improving welfare." Its mission is "to reduce hunger and poverty in the tropics through collaborative research that improves agricultural productivity and natural resources management." (CIAT, 2001) CIAT is Tropical American regional center whose work has a global reach. About two third of their resources are dedicated to research for Tropical America and the remaining third is divided between Africa and Asia. Actually, the CIAT is present in 6 countries in Latin America, 7 in Africa and 4 in Asia. The research center conduct research on key crops as common beans, cassava, rice, tropical forage and tropical fruits and major agro ecosystems as hillsides, forest margins and savannas. Research is conducted through six main projects: "Agrobiodiversity and Genetics", "Ecology and Management of Pests and Diseases", "Soil Ecology and Improvement", "Analysis of Spatial Information", "Socioeconomic Analysis" and "Rural Innovations".

"CIAT fully recognizes that, in the case of the complex problems of agriculture, poverty and environmental degradation in the tropics, the needed understanding and technology can be generated and transferred to users only through research and development partnerships. […] CIAT plays different roles in different partnerships and works through a wide variety of alliances.". (CIAT, 2001) Its main partners are National Agricultural Research Systems, universities, Private sector research and NGOs.

In Latin America, CIAT activities concentrate on rice, beans, tropical fruits and agroecosystems. Actually, the CIAT points out (2001) "rice is the most important food grains for Tropical America and rice research is of high priority to the region. Partnerships with rice growers and the private sector play an important part in financing and implementing a

regional rice program through the Latin American and Caribean Fund for Irrigated Rice (FLAR). CIAT has a strategic partnership with the government of Colombia, which supports rice research through the Ministry of Agriculture and Rural Development. […] CIRAD (France) is another important strategic partner [in upland rice]. Priority is given to strategic research that enhance competiveness of regional rice production." (CIAT, 2001)

Activities are implemented at the national level by project teams, which are "responsible for the detailed planning and implementation of output-oriented research. […] to provide a clear framework to integrate the work of diverse scientists and partners, systematic, detailed research planning will be carried out to produce project log frames and individual work plans." (CIAT,2001) Individuals working on the field are international and local scientists and technicians.

The partnership strategy has to be fostered by the individuals working at the local level. As CIAT (2001) highlights "Project teams will foster a culture of cross-boundary teamwork and a results-oriented approach. Projects need to integrate research, relationships with partners [national institutes, local NGOs and producers] and resource mobilization. […] To be effective, projects need to coproduce their research outputs with partners who are close to the problems and provide links for development and with partners who can offer opportunities for using the most advanced research techniques.[…] Project team need to have internal leadership skills to manage these partnerships. […] To support these partnerships and to sustain CIAT's own research programs, project teams will have to substantial responsibility for resource mobilization and management of donor relationships." (CIAT, 2001)

CIAT's views on partnership point out the importance of "institutional" partnerships between the institutional actors at stake. The organization is also aware of the individuals' roles in implementing a partnership. To deal with this issue, it fosters the need of team building and teamwork. Some strategies addressed for team building, as the importance of "internal leadership" reflects some "hierarchical" culture. However, "egalitarian" culture is also present in the willing "to foster a culture of cross-boundary teamwork". Moreover, focusing on results will motivate actors to participate in the project and the shared "responsibility for resource mobilization" will foster ownership feeling.

3.3.3.2. CIRAD

CIRAD is a French Agricultural Research Center working for International Development. It focuses on sustainable development, as "taking into account the long-term ecological, economic and social consequences of change in developing communities and countries." Its objective is to "contribute to rural development in tropical and sub-tropical countries through research, experimentation, training operations in France and overseas, and scientific and technical information, primarily in agriculture, forestry and agro-industry." (CIRAD, 2005). This public institute is born in 1984 by the coalition of different research institute in agronomic, veterinarian, forestry and agribusiness sciences. Nowadays, it consists of seven departments, which are: annual crops (CIRAD-ca), perennial crops (CIRAD-cp), fruits and vegetables production (CIRAD-flhor), livestock and veterinarian medicine (CIRAD-emvt), forests (CIRAD-foret), territories, environment and actors (CIRAD-tera), improvement of scientific innovation methods (CIRAD-amis).

The CIRAD is present in Africa, Latin America and Asia. Most of their research is conduct in partnership. It collaborates with national research institutes, universities, private

companies, NGOs and producers organizations. “The CIRAD permanent presence and its continue relation with partners allow a better understanding of local development problematic, agronomic, economic and social conditions and environmental factors. […] It favors the formulation of questions and answers of world interests.” (CIRAD, 2005) Moreover, it strategy seeks to integrate different field of study. “CIRAD had always privileged multidisciplinary and integrate approaches of problems.” (CIRAD, 2005) In developing countries, CIRAD focus on “long-term partnership with local research or training structures, with which it establishes joint programs”. In Nicaragua, it engages in a joint program with CIAT to set a Participatory Crop Improvement project.

The “partnership” strategy allows the CIRAD to be closer to the field realities and have a better understanding of the research context. Long-term partnerships are also a means to insure a better sustainability of the research project on the field. Moreover, the research institute points out the need for training and knowledge exchanges, working in partnership will also facilitate this process.

The institutional actors involved related to seed systems have different agendas and “cultures” (defined as values, believes, attitudes and organization types). They are implementing different strategies according to their objectives and perception of seed systems. The National Research Institute, organized in a “hierarchic” way, promote improved varieties seeds and faith in expert knowledge. Local NGOs focus on food security and promote participatory methodologies to improve farmers’ capacity building. Producers’ organizations who want to preserve their traditions and patrimony promote local and “criolla” varieties. International institutions who aim to ensure the sustainability of their actions seek to foster links with partners. Implementing a partnership means that these different actors need to negotiate and find common agreement to involve in a collaborative project. How does actually this process occur on the field? Are institutional agreements sufficient to ensure the active collaboration of individuals in the field? These questions will be addressed in the following chapters.

4. Cases CIAT-CIRAD

Two cases of PCI project led by the CIAT-CIRAD program will be analysed in this part. In a first chapter, I will present the program origin and strategy. Then, in the following chapters, I will look at how the strategy and methodology are implemented in the field in Chinandega and Somoto.

4.1. The CIAT-CIRAD PCI program

4.1.1. Origin

The CIAT wanted to develop a rice PCI project in Central America. Upland rice or aerobic rice is a very important crop in many Central American countries, mainly in flat lands as a component of diversification of cropping systems and food security. They knew about some CIRAD works on upland rice in Asia about participatory plant breeding, so they contacted the French institute to elaborate a collaborative project. At this time, some CIRAD researchers from different departments were organising a "Think Tank" about the topic, so CIRAD researchers were quite enthusiastic about the proposition. A researcher was mandated to lead the project on the field. As he had years of experience in sorghum participatory plant breeding in Africa, he and his CIRAD Food Crops Program (CALIM) proposed to integrate this crop to the project. Sorghum provides an alternative production to maize in the semi-arid areas, under dry farming cropping systems of Central America. The project was thus planned for the two crops: rice and sorghum. Then, they had to decide which country to focus on. The CIAT has projects in three countries of Central America (Honduras, Costa Rica, Nicaragua). The CIRAD preferred to focus on Nicaragua due to the agro-ecological context and the problematic of small producers. Moreover, the researchers involved in the project already had some experience in this country. These modalities were discussed in the fifth CIO-CIAT meeting organised in Cali, Colombia in June 2001. The collaborative research project between CIAT and CIRAD started in Nicaragua in April 2002 with the signature of a Memorandum Of Understanding between CIAT and CIRAD-Ca (Annual Crops). This project, planned for 4 years, aims at the development of a PCI methodology and variety improvement to meet local small and medium-scale producers' needs.

In a preliminary work, the research team had determined the more relevant sites to work, considering small farmer major crops and potential partners. Literature and a database were reviewed (National Cense of agriculture and livestock in Nicaragua, regional farming system characterizations…) to identify the main area growing sorghum and rice. Additional interviews and meetings were also conducted with key informants from extension agencies and NGOs and with farmer leaders. The main interesting sites defined, the next step was to identify "partners". The research team begun to establish first contacts with the national research institution and local NGOs. One of the CIRAD researchers (part of the CIRAD Working Group "Selection Participative") had a lot of experience working with local NGOs in Nicaragua. Actually, he had been technical coordinator of the PRIAG ("Programa Regional para el Fortalecimiento de la Investigación Agronómica de Granos Básicos" - Programme to Strengthen Agronomic Research on Basic Grains in Central America,1991-1999). So, he helped to get many key contacts. Although, he is not working directly on the PCI project in Nicaragua, he still keeps contact with the breeder in charge of the project.

Crops	*Sites*	*Departments*	*Systems*	*Type of farmers*	*Research Partners*	*Extension Agency Partners*	*Producers Organizations*
Rice	**Chinandega**	**Chinandega**	**Mechanized upland rice in favourable conditions**	**Intermediate and big producers (2-400 ha)**	**INTA**	**INTA**	**INTA groups**
	Belen	Rivas	Semi-mechanized upland rice in unfavourable climatic conditions	Small and intermediate producers (1-5 ha).	INTA	NITLAPAN	Farmers' groups trained and/or beneficiaries of FDN/Nitlapan funds
	El Cua Bocay Wiwili	Jinotega	No mechanized upland rice in climatic favourable conditions	Small producers (0.5-2 ha)		Servitec	Farmers'groups receiving technical assistance from Servitec
	Siuna	Región Autónoma del Atlántico Norte (RAAN)	No mechanized upland rice in climatic favourable conditions	Small and intermediate producers (1-20 ha).	INTA	UNAG	PCAC UCA
	San Dionisio	Matagalpa	Semi-arid hillsides	Small producers (0.5-2 ha)	CIAT	CIAT	CIALs
Sorghum	**Somoto/ Ocotal**	**Madriz/ Nueva Segovia**	**Semi-arid hillsides**	**Small producers (0.5-2 ha)**	**INTA**	**UNICAM, INPRHU, UNAG,**	**PCAC, CPEC ASOPROT**
	Villa Nueva	Chinandega	Semi-arid plains	Small producers (0.5-2 ha)		NITLAPAN	Farmers' groups trained and/or beneficiaries of FDN/Nitlapan funds
	Ciudad Dario		Semi-arid hillsides	Small producers (0.5-2 ha)		ACTED, ADAA / UCA	Cooperatives
	San Dionisio	Matagalpa	Semi-arid hillsides	Small producers (0.5-2 ha)	CIAT	CIAT	CIALs

Table 1: CIAT-CIRAD working sites

Diagnosis of the main working zones was also needed to characterise local cropping systems and identify key actors. Many workshops with local NGOs were organised in the different zones. Local NGOs helped getting some information, especially concerning rice production (in Chinandega, Rivas, Siuna…). The sorghum issue was more complicated as there are few studies concerning this crop. Student (from Nicaraguan and French universities) thesis works allowed getting a better picture of the situation.

4.1.2. Partnership Strategy

The CIAT-CIRAD PCI program has three principal objectives (TROUCHE, 2001):

- To develop and apply new PVS (Participatory Variety Selection) and PPB (Participatory Plant Breeding) methods including population enhancement and recurrent selection
- To identify and develop new germplasm matching the needs of small and medium farmers' cropping systems
- To enhance partners' capacity:

- Capacity of NARS in conventional and participatory breeding of rice and sorghum
- Capacity of NGOs and farmers' groups to manage PVS and PPB activities and for local seed production

To meet these objectives, the project has defined two main guidelines: to implement a "partnership with existing farmer organizations and other relevant actors like local NGOs or extension agencies" and to "use a broad genetic base through introduction of diversified new germplasm with different genetic and geographic background and through population improvement and recurrent selection".

The research team aims at developing a "partnership" strategy to work in close collaboration with producers and extension agents.(see 3.3.3. 1 & 2) To be able to implement the project in different zones of Nicaragua and with many producers, they had to establish good working cooperation with local NGOs and others research institutions who could support the work at the local level. The idea is to establish formal or informal "partnerships" or "multiparnerships" with key actors who will foster the link between researchers and producers at the local level. These key actors are mainly the National research institute, NGOs and producer organisations.

4.1.3. Location

The program is implemented in seven sites representing different agro-ecological and socio-economic zones (cf. map 1, table 1). In each project site, the research team works in close collaboration with extension organisations.

The table 1 presents the working sites and the "partners" involved in the project. The two cases I will focus on in this study are in black letters.

Picture 1: PVS evaluation activity in the field (Bocay)

First workshop with farmers groups and partners to explain the objectives and the methodology of the PR work

↓

Diagnostic of constraints and farmers needs of new varieties

↓

First on-farm PVS trials:
- **Measurement of agronomic data by scientists**
- **Workshop for participatory evaluation of varieties with farmers**

↓

Workshop of restitution and discussion of final results of the trials and planning of further activities

Figure 4: Trouche et al., 2003 , annex "Process and steps of the PVS work"

The French plant breeder is operating from the CIAT office located in Managua, capital of Nicaragua. The project team also includes a Nicaraguan research assistant also based in Managua and a technician working only in the Somoto-Ocotal Zone. The research assistant has worked with INTA for 15 year, on beans then as regional researcher in Masatepe in charge of the Basic Grains program. Now, she is more focused on the rice component of the CIAT-CIRAD project, while the CIRAD plant breeder supervises the whole project but focusing more on the sorghum component. Both of them regularly visit the different experiments during the year and are present in the activities organised with producers. It represents a lot of travelling and some places are quite difficult to reach, especially during the rain season. The Siuna site, for instance, cannot be easily reached by car (in fact, it is quite dangerous). They have to take a regional flight to go by plane. So, they cannot visit the site that often.

4.1.4. Methodology

4.1.4.1. The approach: Looking for partners

The CIAT-CIRAD team started their activities by looking for interested partners in the rice and sorghum production zone. They contacted NGOs and producer organizations. Some were identified by trainees doing their thesis fieldwork, others by CIRAD researcher who had previously worked in the area. The project team presented the project objectives and strategy to potential partners. These actors advised them to contact other potential partners and help them to establish direct links with producers. Some of these organizations become have involved as partners since the beginning as INTA and UNICAM, others waited to see how the project was working in the area to start the collaboration with them, as UNAG and more recently, INPHRU. The selection of producer experimenters differs according to the partners. In some cases, the NGO partner defines what producer will take the responsibility of the experiments. For instance INPHRU identify 6 producers located in 3 sites of Madriz to establish experiments (only 2 experiments were finally conducted to the end). In others cases, as UNICAM-CPEC and UNAG-PCAC, groups are invited by the NGO partners to a project presentation. During this activity, producers voluntarily choose if they want to conduct an experiment. Many producers join later in the process. They are invited to selection activities by others producers and decide to experiment also in PCI.

The project team have decided to start by PVS (see Figure 3), a late phase of plant breeding process. This strategy allows them to motivate producers as the result is quicker. It is a short-term process. According to the results and the planning session, the actors can be involved in PPB or follow the next phase of the process, the variety liberation and diffusion. Actually, if producers show their interest to develop a new variety corresponding to specific criteria, during PVS activities, the project team introduces PPB activities. For instance, a producer in Somoto explained that he likes one sorghum “criollo” variety for its grain quality and colour and for its good adaptation of local climatic and soils conditions but he would like to reduce its plant height. The breeder carried out the crosses between the local variety and two short-plant and early improved varieties. The generation F2 was then established in the producer field to start the PPB. (Figure 4)

The “partnership” strategy corresponds to an “egalitarian” way of life and implies high active participation of the actors. By starting the program by PVS experiments, the research team also aims at motivating actors and facilitating participation and “partners” active involvement.

Picture 2: PVS evaluation activity (Bocay)

Picture 3: Visit of sorghum experiments (Ciudad Dario)

4.1.4.2. The design

The working methodology includes many phases in which the different actors can be involved in different ways. There are mainly two types of activities: activities in which an individual producer is involved and activities where a producers' group is involved. The former represents the management (sowing, field working and harvesting…) and following up of the experiments, the latter refers to field activities, workshops and meetings in which a whole group participate. In this case, I refer to selection activities, restitution and planning meetings and training activities.

This paragraph aims at presenting general methodology as planned by the CIAT-CIRAD. However, this methodology can be adapted to the different projects depending on the actors involved. The two cases studies permit to look closer at the implementation of the methodology on the field.

Preparation of the experiments
Experiment objectives and modalities are discussed during the planning meeting. The plant breeder is in charge of preparing and delivering the seed quantity needed to set up the experiment to the producer in time. To cope with producers' demand, the research team collects part of the harvest of the previous cycles and establishes in producers fields seed multiplication or increment seeds on station. During the dry season, they have to prepare the next cycle, treating, conserving and preparing the seeds for each producer's experiment. They also prepare protocols for each experiment in which the experiment modalities are defined. The designs for on-farm PVS trials are randomised complete blocks with two or three replications. Usually, a producer manages one repetition in the community and another producer of the same community another repetition of the same experiment The conditions of the experiment are discussed with farmers during the planning meetings, and trials are normally managed following usual farmer practices, unless the farmers express the need to receive some specific input.

Sowing
Seeds and protocols are distributed to producers by extension agents. Extension agents are also in charge of explaining the sowing procedure and discuss the experiment location with the producer. That is to say, mainly choosing a homogeneous field (as much as possible in the producers' field conditions) and relatively "easily accessible", measuring parcels and identifying in which parcel each material will be sown. Then, producers wait for the best time to sow according to their habits, their working availability and the weather conditions. Depending on producers' demand, the extension agent comes back at sowing time to check that there is no problem.

Monitoring of the experiments
The producer is in charge of managing the experiment the way he usually manages his other fields. However, some modalities can be discussed at the beginning, as "not fertilizing", if the aim is to select varieties adapted to low-fertility soils or to low-inputs conditions, or during the process, for instance, if an experiment is about to be lost because of unusual pest infestation (and if the experiment aim is not pest resistance). Extension agents are in charge of data collection. According to the extension agent and the producer, data collection is done jointly or only by the extension agent. It is recommended to do it jointly to train producers to data collection. However, it is not always possible due to technician and producer availabilities.

Picture 4: PPB selection activity (Posoltega)

Picture 5: Sorghum Post-harvest activities, measuring weigh and humidity(Mamel-Madriz)

Evaluation and selection in PVS works

Plant breeders, extension agents and producers work together in this activity. Producers are usually invited by the extension agents, the modality may change: the extension agent can invite directly each producer participant, delegate the invitations to a producer leader or invite some key producers and ask them to invite 3-4 others producers they know would be interested in the topic. The number of producers attending usually varies between 10 and 20. The plant breeder or the extension agent facilitates the activity.

The research team has adapted a methodology developed by CIRAD and partners for sorghum in Burkina Faso (VOM BROCKE et al, 2003). "The basic principle applied are the following: varieties are to be evaluated according to the criteria that farmers consider the most important and that, in discussion with the research team, are the most relevant for the specific conditions of the trial. This information is obtained during a workshop with farmers during the day of evaluation. Evaluation of varieties is achieved mostly at maturity phase, and if necessary, a post-harvest evaluation focused on grain quality for auto consumption is also carried out. For field evaluation, farmers groups are assembled according to geographic, social or gender criteria. [The breeder or technician asks for criteria more pertinent. The number of groups varies according to the number of participants. Usually, each group consists of 5 or 6 participants.] Each variety is evaluated by each farmers' group in two replications of the trial, for the first three or four most important criteria and for an overall general value, using a scoring method with a four level scale (poor, intermediate, good and excellent). At the end of the evaluation, farmers are asked to select the 3-5 best varieties according to their own evaluation." (TROUCHE et al., 2003)

Evaluation and selection in PPB works

There are PPB experiments in the sites of Chinned and Siuna for rice and in Somoto-Ocotal for sorghum (see table and map). The producers who do the selection are proposed by the extension agent or the plant breeder. They are usually the most experienced, most curious and interested by the topic. Producers can also be volunteers. The number of participants is generally reduced to 5, and the methodology is different form PVS selection, as each participant makes their own selection individually. "For the PPB work using composite or F_2 populations, it is usual to give the farmers a small course to explain some basic methodological elements to create genetic variability, genetics and breeding concepts before realizing the selection of individual plants. In this case, both farmers and breeders participate in plant selection because farmers' objectives are mainly site-specific while breeders objectives may consider various sites and conditions." (Annual Report, 2003)

The Harvest

For PVS experiments, extension agents are in charge of explaining the procedure to producers: harvesting each small plot separately, separating also the lateral rows and processing it separately. They also hand out the needed bags to keep the harvested material. As with sowing, producers harvest in appropriate time and in some cases, extension agent is present to help them. For PPB experiments, the selected plants are harvested in separate bags just after the selection activities. Harvest of the field (plants that are not selected) is wholly the responsibility of the producers. The breeder advises this material (which is segregant) be consumed and not used as sowing material.

Post-Harvest

For PVS experiments, producers keep each material in identified separate bags until the extension agent comes to weigh the harvest and measure the grain humidity with a specific tool. The producer is generally present and can help to collect the data.

Data processing
When all data is collected on the field, the research team is in charge of data processing and analysis at the community level, zone level and for each crop.

Restitution and planning meeting
During this activity (usually planned in April), the plant breeder and the extension agent present to producers the results of all collected data of the varieties tested in the community. One producer is in charge of presenting his/her own experiment, what he/she has done and what he/she learnt about it. Then, the producers, the extension agent and the plant breeder discuss about the results and take the decisions for the planning for the next year: numbers of experiments in the community, who will manage them, which material will be tested…

The program design shows a methodology planned by the research team. It might be adapted depending on the different environmental , economic and institutional contexts and on the individual participants. However, the research team enter in the collaboration process with their own way of implementing a PCI project and some established "rules of procedures" to achieve their objectives. It can be interpreted as a certain degree of "hierarchic" culture.

Now having a better idea of the CIAT-CIRAD strategy and methodology, in the following chapters, I aim at describing and analysing what is actually going on on the field and how the different actors involved coordinate their activities. Here are two specific cases.

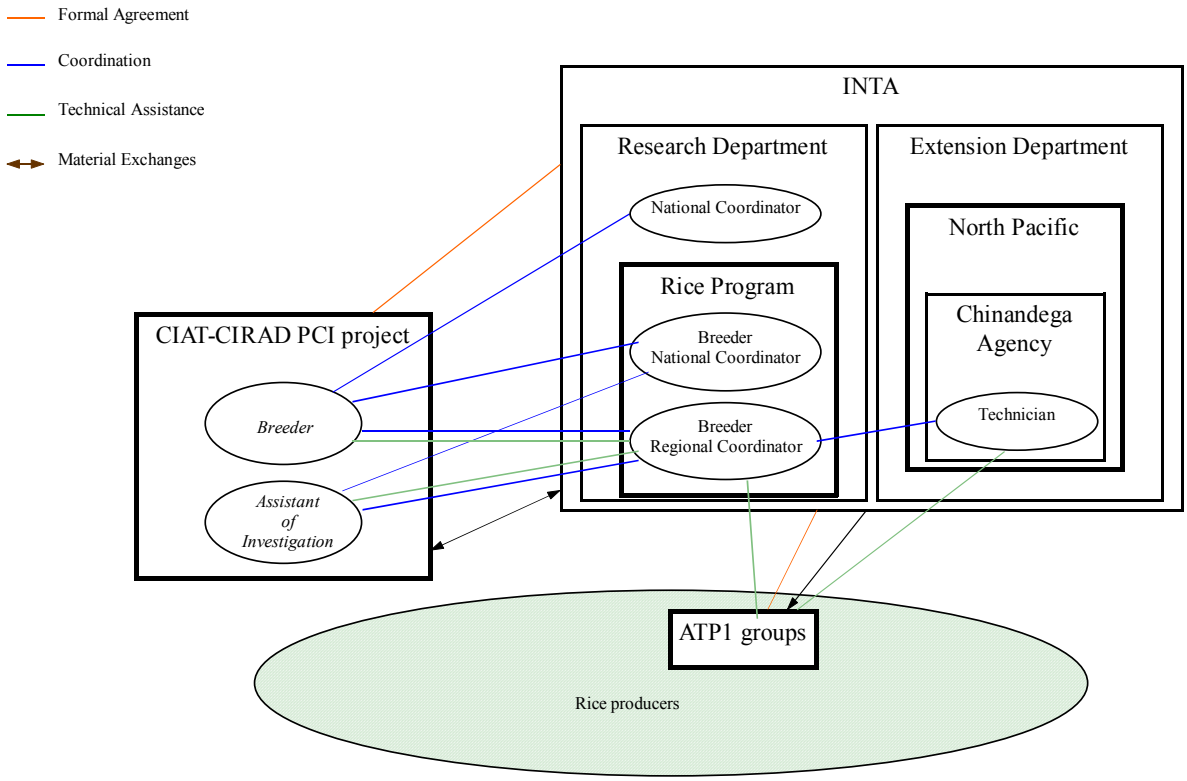


Figure 5: Actors Network Diagram. Chinned Case (personal source)

4.2. Chinandega project: sowing the seeds for a PCI project led by the National Institution of Investigation

Chinandega department is located in the North-East of Nicaragua, close to Honduras and the Pacific Ocean. Characterised by a dry tropical climate, the medium temperature is about 28°C (the maximum temperature being 45°C). Precipitations are about 2000 mm/year. The summer generally lasts from November to April. (Plan ambiental Chinned). The project area encompasses 3 municipalities (Chinandega, Chichigalpa, Posoltega). 25% of the territory is used for annual crops, which consists of maize (63% of the annual crop superficies), beans (11%) and upland rice (15%). Moreover, in this area 51% of the total farms number are smaller than 5 Mz (3,5 Ha), 32% are between 5 and 20 mz (3,5 Ha to 14 Ha) and about 15% of the medium producers grow upland rice. In the agro ecological zone of North Pacific (department of Leon and Chinned), INTA counts 4 extension offices and one experimental station CEO ("Centro Experimental de Occidente) –cf. map. The project area is concentrated in the locality around Posoltega (where CEO is). (CENSO, 2001)

4.2.1. Origin

Since 2002, the CIAT-CIRAD collaborative research project and INTA have signed an agreement to introduce a rice PCI project in Chinned. The CIAT-CIRAD breeder and the INTA national director have agreed on the general modalities and the funding agreement: the CIAT-CIRAD program pays the transport cost (needed for visiting PCI experiments) of the INTA breeder and the food/drinks for the participants of selection activities. The practical modalities (numbers and locations of the experiments, organization of the selection activities) have then been discussed with the superintendent of research and development.

4.2.2. Actors Network

A map of the actors will help us to highlight the central actors involved in the PCI project and to characterize their relationships.(Figure 5)

Three "institutional" actors are involved in this case: the CIAT-CIRAD, the INTA and the ATP1 producers' group. They are linked by formal institutional agreements and by linkages in which individuals engaged. I aim to discuss how the nature of these linkages is shaped by the "institutional" and "individual" cultures. As the institutional "cultures" have been addressed in the third chapter, I will concentrate on the individuals' "cultures" in the following paragraphs.

Picture 6:INTA breeders visit experiments located in farmers' field

Picture 7: PVS evaluation activity (Chinandega)

4.2.3. The main actors involved

4.2.3.1. The CIAT-CIRAD team

In his former experiences in Africa, the CIRAD breeder had already faced the problem of improved variety adoption and diffusion. He has worked in Senegal for 4 years. At this time, he had little experiences in plant breeding. He felt the need to work with more collaboration from the producers. As it was not his "own" project and he was not really recognized by his colleagues (due to his lack of experience in this field), he couldn't implement participatory activities in this project. When the 4 years were over, he was mandated to another project in Burkina Faso and worked there for 7 years. As he was more experienced and more confident, he started to formalize participatory evaluations with farmers, but he received very little support from his African colleagues. However, he could share experience on the topic with his CIRAD colleagues. "Participation" was an important topic at international level and especially on his domain. In this context, he has elaborated a PCI project in West Africa in collaboration with some colleagues working in Mali. This project has got a 4-year funding. In 2000 he came back to France to work in Montpellier for one year. In 2001, he got the CIAT proposition and one year later he was in Nicaragua.

In 2003, the project employed a Nicaraguan research assistant. She previously worked for INTA as an agronomist for 9 years. (The reasons for her dismissal are slightly unclear, but may be because she was a member of a syndicate.) The CIRAD breeder gives her more responsibilities on the rice component of the project. She is dynamic and motivated by the PCI project. However, for her, this job is only a temporary one as she explained: "I know that the CIAT-CIRAD project is only for 4 or 5 years, after, I will have to find another job."

In terms of "cultures", the assistant of research experience with her previous employer fosters our view on the INTA "hierarchical" culture. Actually, «hierarchical» institutions hardly accept that individuals contest the hierarchy and display personal claims. If they do so, the institution tends to reject them to preserve "institutional" culture.

4.2.3.2. INTA Research in the North Pacific

INTA researchers work mainly on the experimental station, CEO, located in Posoltega between the two extension offices of Leon and Chinned. Rice is one of the major crops in the area and it is one of the experimental centre's main program.

INTA has a limited financial situation and researchers in the experimental station are working in difficult conditions. Observing the harvest work in the CEO, I have noticed that INTA doesn't have any material to weigh and measure humidity on the station. Researchers have to use their personal tools and lend them to their colleagues. Moreover, there is not cold room to conserve seeds. The rice breeder uses a big drum. He highlighted that the CIAT-CIRAD facilitates the drum. To treat the seeds he places them in bags, then in the closed drum to fumigate them. Then, he conserves them in this plastic container until the next year. He has to throw away all materials that are not selected.

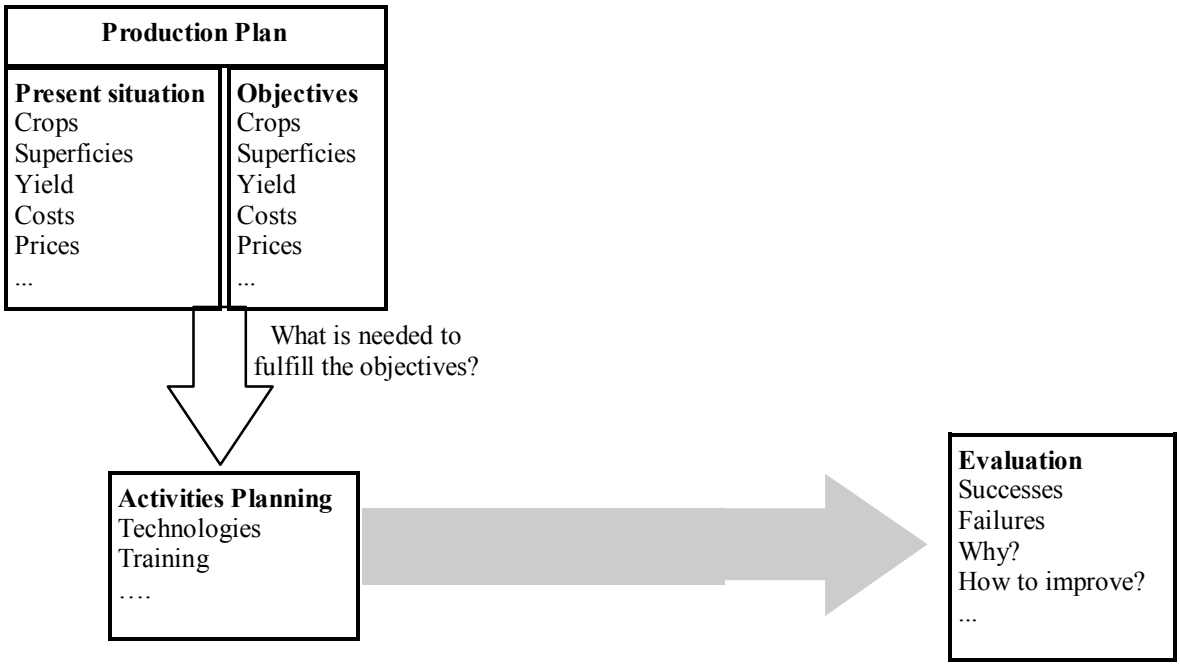


Figure 6: Technical assistance methodology

The rice breeder involved in the PCI project has worked for INTA (or the previous national institute) in the zone for 20 years. He visits producers at least one time a week, he doesn't always look at the experiment but just goes to have a chat with producers and to know whether there are any problems. While some others breeders go to visit farm experiments only if needed and meet the producers only if they are on their parcel. Moreover, he feels very close to producers and their problems, as he expressed it: "We are friends, almost a family, when I don't see them, I miss them, now I have come to feel as this place was my own house patio". This relationship is based on mutual respect. He has worked for 3 years in the technological transference (extension services) and has gained experiences in working with producers. He believes in PCI and likes the idea of involving more producers in research. Actually, this point of view is not the same for the majority of INTA breeders and technicians. Some investigation service staff tend to devalue extension service activities and are not interested in PCI activities, as they tend to think that it is a "waste of time and money" and that the traditional methodology is much more efficient.

The rice breeder's values and attitudes toward farmers reflect a high "group" degree. He defines himself as part of the group: "we are almost a family". Even if he complies with the INTA hierarchic "institutional" culture and has faith in expert knowledge, he contests some of the institutional strategies and thinks that farmers' participation brings benefits to technology development. His attitudes with farmers reflect a lower "grid" degree, as he thinks that the "rules of procedures" have to be adapted depending on the cases. His view on participation might be more "product-oriented" than "process-oriented".

4.2.3.3. INTA Extension services in the North Pacific

In the North Pacific, INTA works with ATM and ATP1 (see Ch 3, B). Until last year, each extension offices were using one or the other depending on the type of producers they addressed. This year two extension offices are working with ATM (Somotillo and El Sauce) and the attention zone is concentrated on two micro-basins . Whereas the other two offices (Leon and Chinned) are working with ATP1 with attention per municipality. The local extension superintendence explained that for ATP1 they used to organize two meetings per month with producers and technicians, one visit to the farm and another one corresponding to the training part. In ATM, there is usually no direct visit to farms, except if there is a very specific problem that needs technical intervention.

The ATP technical assistance follows several steps (figure 1). At the beginning of the year (January or February), extension technicians organize producers' groups by meeting with the representatives to remind the attention modality, the INTA objectives and to discuss the technical assistance agreement. Then a matrix of the 10 producers included in the group is done to establish a diagnosis of their production system. According to producers' demands, the technicians organize a training planning and establish their "production plan" with producers. This allows to evaluate the results in comparison to the former plan at the end of the year. During the year, the producers benefit from individual technical assistance and collective trainings, which include practical demonstration (or "learning by doing" –less than 15 participants), activities "taller" (20-25 participants), training "capacitacion" (practice and theory), Field Day "Dia de Campo" (to show something relevant, new or successful)… Producers have to pay a "symbolic cost" of 150C$/year or 7,08 E/year (15C$/month or 0,7 E/month from March to December) [the main household consumption in rural area is 823 C$ in 1999, INEC] to access the technical assistance. The large majority of the INTA clients in

Picture 8: PVS selection activity in the CEO (Posoltega)

Picture 9: PVS selection activity in the CEO (Posoltega)

the locality are big and medium producers (50 –100 mz or 35- 70 Ha) who can afford the cost of the technical assistance.

Concerning the PCI project, the extension services are not officially involved, but all activities are open to interested agents (breeders or technicians), as the aim of the CIAT-CIRAD breeder who leads the project is also to have more INTA staff interested in participatory strategies. The extension agent responsible for the territory has a particular interest in research and especially plant breeding, he would like to study for a master in this topic. Since the beginning, he is especially interested by the PCI project. Whenever his schedule allows him to be present, he is happy to participate in the different activities. However, he is not involved in the monitoring of the experiments, this is defined by INTA "breeder's work", and as an extension technician he has other activities to handle. He told me he was concerned that coordination between the two services (extension and research) doesn't work so well and that his colleagues are not very interested in PCI. The actual PCI project (done in collaboration with CIAT-CIRAD) focuses on rice that is very important in his working zone. Most of the producers participating in the project are located in his attention zone. So he feels that he has to be involved in this project. On the other hand, some of his colleagues who also attend rice producer participants never show up in PCI activities or present any interest in the topic… The INTA breeder used to invite extension agents to assist the PCI activities, now he contacts one technician directly, as he knows is the most interested in the topic. This technician noted that "technicians' participation depends on each one interest", and that "if they are invited and do not come, why would you want to invite them again"…

There is no institutional agreement of coordination between the PCI project and the INTA extension department. However, one technician has decided to participate in those activities. Individuals take initiatives according to their own personal culture.

It is interesting to note that from an "egalitarian" culture and open system in which every body is invited to the activities, the actors' attitudes and interactions might switch the system to a closed one in which breeder-technician communication becomes exclusive. Certain "rules of procedures" are then needed to maintain the communication open and allow most members to participate.

4.2.3.4. Producers

Producers are organized in groups by INTA technicians. By working with producers groups, INTA aims to promote producers' organisations. The producers themselves choose who to involve or not in their group. Some groups are more or less organized and dynamic. Some groups with the advice of INTA extension services have themselves financed the founding of a cooperative. Actually, producers who participate in the INTA/CIAT-CIRAD PCI project are also involved in a recently formed cooperative. This cooperative includes 20 producers from San Isidro, La Mora and Belen. The cooperative was founded to benefit from a livestock project. The DECOPAN organism wanted to create a livestock project in the zone. One of the requirements was to be organised. At the beginning, 40 producers were to be integrated in the cooperative but 20 refused. As a rice farmer explained me "It costs to create the cooperative and also to keep it functioning, but there are also a lot of advantages. […] Usually organisms finance organised producers." DECOPAN has dedicated the project to livestock farmers. As all farmers involved in the cooperative don't have cows and pasture, they have decided to create an agricultural cooperative; that is to say to enlarge the organisation's general objectives. Thus, they will be able to benefit from other projects with

different working lines in the future. This could be "a land project or a rice project, as there is the majority of the producers involved are rice farmers, …"

The rice PCI project includes 5 rice producers who have an experiment in their fields and approximately 10 others who participate in the evaluation activities. These producers are mainly part of 6 different groups (Chinandega groups: La Mora, La Bolsa, San Isidro, Chichigalpa groups: Pellizco, Evanos, Cinco Cruces).

In this locality, the producers' standard of living is slightly higher, although land holdership is still a problem. One of the farmers explained me "I don't have enough land, I am a tenant, the land doesn't belong to me. As the piece of land I am using for my experiment is located close to where the land owner keeps his cattle, I often have problems with the cows eating crops in my fields. […] I would like to have larger experiments and with more varieties but my problem is the land. To manage an AVT, the neighbour has lent me a piece of land.." Location and the superficies of the experiment can be a problem for farmers. As the zone is flat, problems of parcel homogeneity are reduced. However, experiments need to be located in places where the farmer can easily have a look at them and where they are protected from animals. That is why some producers "prefer to have small experiment. If the area is too large, it is more difficult to follow and to give a good attention to the experiment."

Rice producers involved in the project are market-oriented. They belong to the "individualistic" culture. However, they organize themselves as a group or cooperative when this organization brings them benefits. A cooperative may not correspond to their "values and believes". Some producers actually refuse to integrate the cooperative for this reason. "Cooperatives" in Nicaragua have some negative connotations for "liberal" farmers who associate "cooperatives" to the Sandinist period. Producers who integrated the cooperative didn't change their values or believes but decided to set up a different type of cooperative giving them more individual freedom.

4.2.4. Linkages and exchanges

4.2.4.1. Producers and INTA agents

Producers are used to receive visits from INTA agents (research and extension services) and have had experiments in their parcels for many years (from 4 years to 10 years of working with INTA). The rice breeder usually visits each producer/experiment 3 times a month. As producers have known the INTA agents for long time, they can establish balanced relationships. However, the type of relationships very much depends on the actors' personality, background and objectives (see 4.2.3.3 & 4.2.2.4.).

The "institutional" culture influences the relationship INTA agents- producers by pre-defined organization of the work and different modalities of attention. Moreover, agents generally adhere to the general INTA philosophy based on liberalism. However, "individual" cultures also shape relationships with producers and not all the INTA agents work the same way. They set different priorities according to their personal believes and values.

4.2.4.2. INTA breeder, INTA technician and CIAT-CIRAD team

The CIAT-CIRAD team collaborates with INTA at different levels. An agreement was signed to implement the PCI project in Chinned, and the two institutions shared the cost of this project. At the individual level, the CIAT-CIRAD team also exchange information and materials with INTA breeders. The assistant of investigation explained that the collaboration in Chinandega is important because of the institutional agreement and also because the CIAT-CIRAD is in charge of working costs. Outside the PCI project context, the CIAT-CIRAD has established experiments (as the crosses and F1 or for seeds multiplication) in the experimental station of Managua (CNIA). The CIAT-CIRAD breeder and research assistant meet regularly with the national rice breeder in the CNIA. They share the results of the experiments located in Chinandega. The assistant of research usually takes the opportunity to see her former colleagues.

To coordinate the activities on the Chinandega site, the CIAT-CIRAD team contacts the regional breeder directly. However, they mentioned that phone communications are sometimes difficult. They often planned the activities and future visits when the CIAT-CIRAD team visited the experiments. The regional breeder is then in charge of the organisation of the activities and the invitation of producers and extension technicians.

The two institutions (INTA and CIAT-CIRAD) have signed a formal agreement but the actual relations on the field are setting up the implementation of this "partnership". The establishment of an institutional partnership is needed in a «hierarchic» cultural context which emphasizes "rules of procedures". However, on the field, individuals and their personal cultures define the way the partnership is implemented.

4.2.5. Views on "participation"

4.2.5.1. Producers and "participation"

All the farmers interviewed emphasize that they like to be involved in the research process. They feel closer to the research and the technology generation. For them, "it gives the opportunity to be breeders, to be directly involved in the research process." In this context they can prove that they are able to help the research and they feel proud of experimenting with INTA. As a rice farmer emphasizes: "Even if we are farmers, we are able to do the job and we can add a little sand to the process." During some interviews and informal discussions with producers I also noticed that producers tend to speak using "we" to describe varieties liberated by INTA. As they have been involved in some steps of the breeding process (even if it is the latest steps) they include them when they talk about the results. INTA technicians working in the extension services value producers' abilities and utility in the process. They repeated to the producers "this technology is developed for you, so you should take part in the process." INTA researchers are generally more sceptical about the importance of involving producers in the research process. It is quite interesting to see that producers feel completely included in the INTA breeding process and that this phenomenon is not directly linked to PCI methodologies. I had the feeling that they usually don't make a great difference between experiments lead only by INTA and those lead by INTA and CIAT-CIRAD in a participatory way. It seems that farmers consider them as a whole which is part of the general INTA work. Farmers' attitudes also illustrate a kind of "participatory for recognition", farmers seeking social recognition from other farmers and from the national institute.

Producers are aware that plant breeding is a long process but they know that participating in the process gives them a lot of benefits. They have access to varieties better adapted to their demand and need, "better quality seeds of short cycle and more resistant to diseases." And they also benefit from the process itself. As a farmer explained me: "It is a long term work but all the process is very useful. We have to value it like a school." And another also mentioned: "I like agriculture and I like learning, I never refuse trainings or other learning activities. We need more training. It is important to clarify things when there is any doubt." Contrary to a lot of preconceived ideas, the majority of producers emphasize that training and other learning activities are never wasted time. For them, "it is not so time consuming, one day or half a day is not so much." Moreover, researchers and extension agents are generally aware of the field planning and try to organise the activities when producers are not so overworked. In this sense, farmers see participation as a learning process.

4.2.5.2. INTA and "participation"

Costs: a reality or an excuse

This was an important debate among the actors. Those with more decisions power are not convinced by PCI, as the National superintendent of research and development and the Rice national coordinator pretend that participatory methods are too costly for the organizations that implement them, especially to organise the events (transport, food and drinks…). However, those who are working with the methodology on the field, as the breeder and the extension agents, assert the contrary. As the rice breeder technician highlights, "it doesn't need so much funding, you can do without food, producers do not participate for the lunch. It is true that it is better to offer some drinks and food but if really there is a big money problem, we could organize something different. The higher cost is the transport, but up till now, it is the CIAT-CIRAD who has paid for it." Moreover, "if you ask producers, they say that they prefer to be trained and it doesn't matter whether there is any lunch. They can eat at home."

Breeders' mentality and attitudes

Many INTA directors and plant breeders are not convinced by PCI. They tend to think that participatory methodologies are more costly, too time consuming and are not efficient. They may under-estimate producers' abilities to select plants. The Regional Director highlights that the problem is to change ideas about plant breeding that may have INTA staff and especially breeders. "It takes a lot of time to change people's mind. The problem is not that of adapting the methodology to lower the costs. If people are convinced, dealing with the budget is not a problem." Breeders training and awareness are needed. However, according to the rice breeder technician, technicians on the field are already convinced by the methodology, "the problem is to convince people from above". The National superintendent of research and development seems to have a lot of doubt about PCI results. As he mentions, "PCI methodologies are like cats claws, they are hidden and you don't know when they will scratch. […] the lottery component is mayor, the risk of failure is mayor." It is true that it will be more efficient to have orientations coming from above but it might take more time to see some PCI process emerging and regional directors could choose to implement some activities in their zone.

The CIAT-CIRAD methodology: a well structured methodology

INTA staff at the decision level emphasize that there is already participation in the INTA working model. However, this participation is restricted to the latter phase of the selection process. There can be more or less participation according to the relationship between producers and researchers on the field. I call it "implicit participation". Everybody agrees that the CIAT-CIRAD methodology has brought a more formal and structured methodology in which producers are involved in more key steps. As one researcher mentions, "before, producers participated but in an informal way (consumer opinion, culinary tests in the house),[and it was totally up to the researcher what he did with farmers' information and preferences] now, we use a real methodology". And this methodology takes into account the producers' opinion and preferences in a more explicit and visible way. Extension agents seem to agree. "Experiments before the PCI project and now are implemented in quite the same way on the parcel. What changes with the CIAT-CIRAD project is the participatory methodology: meeting of producers who come from different zones, taking into account the producers' criteria in a more formal way, plenary discussion with producers."

Facilitate the diffusion-adoption phase

All the actors at different levels agree that PCI methodology reduces the diffusion phase and the risk that an unadapted or not-appreciated product comes out. Producers know better the released variety. This is an important quality for INTA actors, as they consider the diffusion-adoption phase as a very problematic step. "The diffusion is a very difficult step, the breeders spend so many years creating a variety and in the end, the producer may reject it. With PCI methodology, the adoption phase is easier, there is more likely adoption as producers already know the new technology" and as a national research and development coordinator mentions, "From now on, producers will not expect something unknown"

A long way…

INTA have very little experience with PCI processes, it takes time to institutionalise a PCI method or to pass from an "implicit participation" to a kind of participation in which farmers' roles is more accepted and recognised by all the actors. However, this project may convince some actors, or at least call for some interest. The experience could be repeated for other programs or in other localities. As a regional director mentions "we have some results which let us think that it is a good methodology. […] We have already had a discussion about this at the national level to see whether it is possible to implement it in other programs." The methodology could be adapted to INTA working lines. Some actors have already started thinking about how to elaborate a methodology "in between", as they see some advantages in PCI process but they are also very attached to the traditional methodology. The national rice coordinator explained me his theory about "combined crop improvement": "It could be an alternative for other programs, but I find it too costly. Maybe if we adapt the methodology to a "mejoramiento combinado", i.e., involving producers at the beginning to take decisions about the strategy, the producers demand and needs and after, in late step of selection, as "pre-validation" [now, producers are involved in validation]. If the population is too segregant, it implies more organisational and training costs. Moreover, it is difficult for producers to evaluate exterior influences. Producers do not have this vision or this knowledge. However, if we do so, it means breeders will work alone for 2 or 3 years to propose advanced material to farmers. And a PCI process have to be sustained during this period…." This points out that INTA breeders and coordinators are thinking about participation as an alternative methodology that can bring them some benefits.

4.2.6. How it influences the breeding process and outcomes

The PCI project is integrated in INTA plant breeding activities. However, it is a specific and "marginal" project for INTA. Producers involved in the project, who are also INTA clients, tend to assimilate the project with the INTA traditional way of working, as it is implemented in the field by the same actors. Moreover, the breeder, the technician and the producers have good relationships and are used to work in collaboration. That is why actors feel confident to express their point of view within the group. Producers appreciate being more involved in the decision making process. However, they are also used to a certain way of working with INTA. So, I had the feeling that farmers didn't so actively involved as they could have been. The more relevant impact is at the INTA level. Seeing the project results, more and more INTA breeders and technicians are getting interested in participatory methodologies. This experience is important as it illustrates alternative plant breeding processes which integrate different types of knowledge.

Picture 10: Cayantu

Picture 11: The Ciat-Cirad breeder and technician visit an sorghum experiment in Santo-Domingo

4.3. Somoto-Ocotal: a multipartnership involving a throng of actors: breeders, NGOs and organised producers groups

Madriz department is located in the North of Nicaragua at the border of Honduras. The climate varies from subtropical to dry with medium temperature of 24°C. Precipitations vary from 800 to 1500 mm/year. The relief and climate heterogeneity promotes an important ecosystem diversity. The project area encompasses 3 municipalities (Somoto, San Lucas, Totogalpa). 14% of this area is used for annual crops, which consists of maize (33% of the annual crop superficies), beans (38%), sorghum "millon"(12%) and white sorghum (17%). Moreover, in this area 46% of the total numbers of farms are smaller than 5 manzanas (3,5ha) and 30% of these small farmers used to grow sorghum. (CENSO, 2001) The site is one of the most representative sorghum areas with small and medium-scale farmers in Nicaragua. The project is present in the communities of Moyote, Coyolito, Chichicaste, Los Mangos (in the Somoto area), Calabacera, Hicariti, Arallanes (of North Ocotal area) and Apamiguel, Cuyal, La Ceiba and El Mamel (of South Ocotal area) It works in collaboration with two NGOs (UNICAM and INPRHU), one producers' union (UNAG) and others producers' organisations (CPEC, PCAC, ASSOPROT….). There are about 80 producers involved working on a total of 120 experiments.

4.3.1. Origin

Since the beginning, the CIAT-CIRAD research team has thought of this site as a key location. Sorghum is very important for farmer livelihood in this zone. The drought is so intense that in many communities, it is difficult for farmers to produce maize. Sorghum is an alternative crop, more resistant to drought and poor soil. It takes an important part in the producers' diet. Replacing maize, women use it to make "tortillas" and a lot of others nice preparations for food or drinks ("atol", "tamale", "fresco", "rosquillas" …). During my fieldwork, the CIAT-CIRAD technician and me visited a producer who lives near a grinder in La Manzana, the all time we stayed here chatting with the producer. Many farmers came to the grinder to grind their grain in order to make "pinol" [typical drink usually from maize, but can also be done with sorghum]. None of them carried maize bag…. Only sorghum…

One of the CIRAD researcher who used to work in Nicaragua for some years as technical coordinator of the PRIAG knew very well the zone and key local actors. He has made the link between the research team and a number of local NGOs. Some NGOs were hesitating to work with a foreigner agency they didn't really know about. As this CIRAD researcher was very appreciated by local NGOs leaders in his former project, he has made some support mission to meet the NGOs and has engaged the discussion. Then, local actors become more confident to cooperate with the actual project.

A detailed diagnostic work also has been done in the area to identify potential partners. In 2002 the thesis of a Nicaraguan student, as part of his requirements to obtain a Master of Science in rural development of the CNEARC, has presented a participatory diagnostic of existing sorghum cropping systems, variety diversity and production and utilization constraints in Madriz. It also is aimed to understand the farmers' perspective and priorities for sorghum varieties. During this study seeds of 35 local sorghum varieties have been collected. During the thesis fieldwork, the student has established contact with producers' groups interested in the project and has identified some producer leaders.

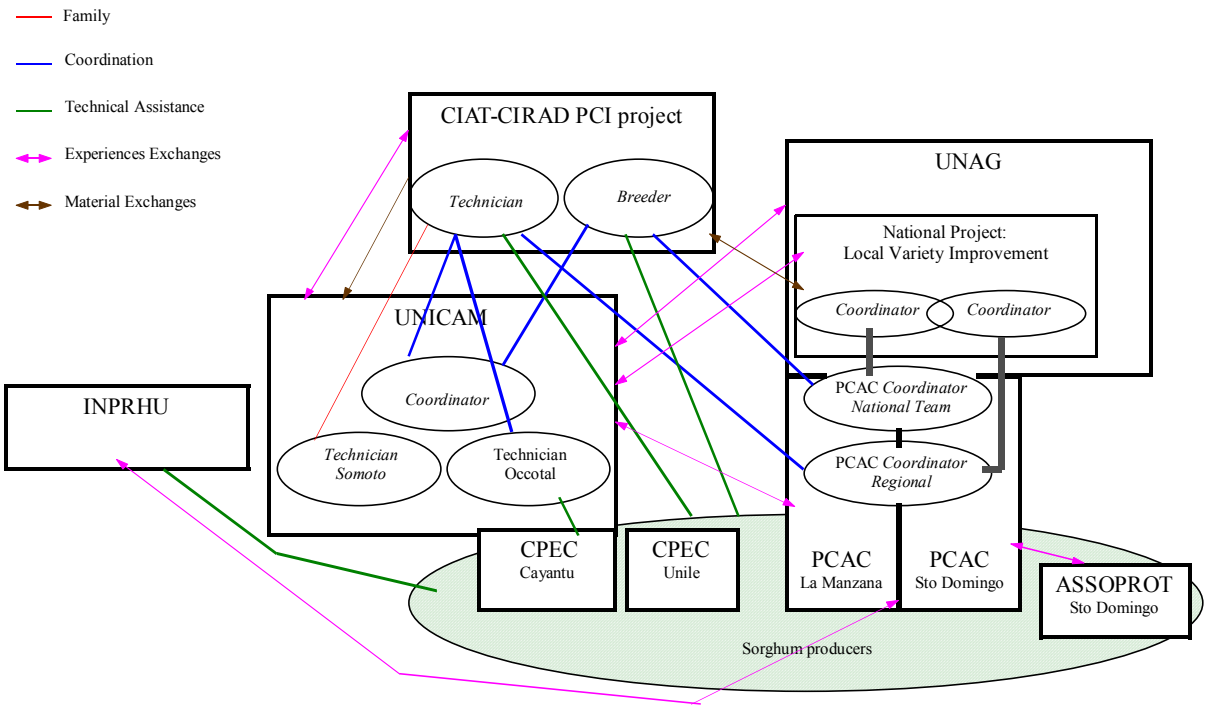


Figure 7: Actors Network Diagram. Somoto-Ocotal Case

4.3.2. Actors Network

An actors' map highlights the central actors involved in the PCI project and allows us to characterize their relationships.(Figure 7)

In this case, many institutional actors are involved, three main types are represented:

- research organizations: the CIAT-CIRAD program
- extension organizations: NGOs (UNICAM, INPRHU) and producers union (UNAG)
- producers organizations: CPEC, PCAC, ASSOPROT

The following paragraphs focus on "individual" cultures of the actors involved in the project and how these cultures influence their relationships and the coordination of activities.

4.3.3. The main actors involved

4.3.3.1. The CIAT-CIRAD team

Many experiments are established in the Somoto / Ocotal zone (250 km from Managua). According to the CIAT-CIRAD strategy, the breeder works in collaboration with local partners who ensure the following up of the experiments. Many NGOs are involved in farmer experimentation in this zone. Thus, the breeder seeks to develop strong partnership with these local actors. However, the breeder has felt that he could not build this partnership from Managua and that he needs another person to ensure the coordination and collaboration with all these local actors. In 2003, he has employed a technician, according to the advices of the UNICAM coordinator. This technician has worked as an UNICAM technician for years. UNICAM has proposed him to ensure the regional coordination on investigation, but he has refused. "At this time, I just refused. My place is Ocotal, I want to keep supporting the Nueva Segovia department." He has also working experiences in others NGOs, as NOCHARI. As he highlighted "I lived here and I know the different organisms which are working in the zone." Moreover, he studied agronomy in Spain. He did his thesis on the Hibiscus crop. However, he doesn't consider himself as specialised in one crop and he is very interested to know more about different crops. This working experience allows him to learn more about sorghum, a basic crop in his region." I couldn't imagine that in one place, you can find so many different type of sorghum. […] Before, I couldn't see them, it was all the same sorghum for me. Now, each plant has his own characteristics." He is also very motivated and interested by investigation. He has read a lot on plant breeding and wants to know more about it. "The doctor explained me quite quickly but I want to know more details. Sometimes, when I ask, he answers my questions. But, we never had the opportunity and time to really go in depth in the topic. I would love to follow a course on plant breeding and to experiment it myself, especially the cruces…" By the "doctor", he refers to the CIAT-CIRAD breeder, actually, in Nicaragua, people call "doctor" everyone who has a certain level of scientific knowledge. This doesn't always means that this person has a Phd degree. However, this title shows some respect and recognition of the scientific knowledge.

4.3.3.2. Producers Organizations

UNAG

Concerning, the case study zone, UNAG Madriz is present in 72 communities and 12 municipalities in Nueva Segovia; and focus on producers' organisation, credits to farmers, food security and women issues.

PCAC : Program « Campesino a Campesino »

PCAC was introduced in Madriz in 1993 through the management of the "Women project" coordinator in UNAG Madriz. The first communities participating in workshops and producers' exchanges were Buena Vista and El Pegador from the municipality of Las Sabanas, Sta Marta and Chichicaste from San Lucas and Sta Rosa from Somoto. During the first three years, the program has focused more about exchanges workshops and institutional coordination. Activities have been organized by a collaborative group of institutions called "ECIS" (Equipo de Coordinacion Interinstitucional) in which INTA, INPRHU, UNICAM, CEPAD and Movimiento Comunal were involved. In this time, producers have been trained as "promoters". "The program talks about the leadership pyramid and the learning cone, which mean that: a producer learns, for instance, two techniques, which could be barriers building and compost elaboration, when having experiences and abilities to spread it, he promotes it to others. The promoter continues to be trained with new technologies and when he dominates it, trains others producers and new promoters, by this way, his experiences is enhancing." (UNAG, 2001, Sistematizacion de la Experiencia en el Departamento de Madriz, Nicaragua). This process looks at "the farmer as agronomist". However, promoters don't have only a role of "teacher". They are also key actors in participants' motivation and group organisation. "It is the responsibility of promoters to organise working groups, to stimulate others producers and exchange experiences, forming a movement of "farmers to farmers". Their role can also go further than the PCAC. As a promoter testified "as promoters, we are the liaison in the community. If a organisms came, it will look for us, we have influence."
At the national level, a five-person team employed by UNAG leads the program, their role is "to give consistency at the national level, to monitor, to systematize the experience and spread it, to organise exchanges and meetings." (PCAC National Coordinator).

CPEC : Colectivo de Productores Experimentadores Comunales

CPEC are defined as « producers organised in collectives of a same community,

- who experiment in their parcels o patios on the same topics, suggested by others producers of the same community to find solutions to agricultural problems
- where the producer experimenters commit themselves to share the experiments results and involve the community in the whole investigation process." (UNICAM, 2004 – Guia para la implementacion de la Metodologia CPEC)

A CPEC can be more or less "mature", the idea is to lead them with training and technical assistance through a process in witch they gain in capacity, ability to experiment but also independency. A young CPEC learns the experimentation methodology through training and technical assistance, a more mature one experiments in more complex and specific issues (interaction soil-plant, for instance) with the help of the extension agents and a very mature one is able to set up its own experiments and ask the institutions what he needs to carry out the experiment.(UNICAM coordinator) Some CPEC, as the CPEC of Unile, Somoto do not receive any more specific attention. UNICAM technicians considered that it is enough mature

Picture 12: Selection activity in Palacaguina

Picture 13: The Ciat-Cirad breeder and technician visit a sorghum experiment with the producer (Madriz)

to be able to function on its own. As the coordinator explained, UNICAM focus on the process. “The process never die, producers learn to knock on the doors. It is better to suppress intermediaries, if CPEC can work with others actors without UNICAM it gives more independence to the group.”

4.3.4. Linkages and exchanges

4.3.4.1. Within the CIAT-CIRAD team

The technician lives in Somoto, so he is present on the working site. He communicates with the breeder by phone or by internet (when he has to send him some documents like the data collected). The breeder conveys the seeds needed for the experiments from Managua to Somoto. Generally, when the crops are at maturation, the breeder travels from Managua to Somoto to visit each experiment and evaluate the results they will get. Some experiments might be lost for many reasons, as cattle eating the field, late sowing or in bad condition, unusual drought or disease… The breeder is also present in all the PPB selection activities and the earlier PVS selection activities (in small parcels).

The breeder is satisfied about the technician work. As the technician is from the locality and knows many organisms working there, he has established new contacts and has improved the communication with the local actors. The technician likes to work in this project and he has the opportunity to learn more about investigation. And as he explained, “the doctor has a lot of knowledge. […] We have to benefit that he is here to learn more about plant breeding. […] INTA has a more “centralised knowledge”. They keep it as a secret.”

The knowledge relation is very strong. The technician values the scientific knowledge of breeders and working in the PCI project is a way to learn more about this scientific knowledge (plant breeding). The breeder also values the technician local knowledge about the area, the organisms and people who are working there and his experience in working with producers.

4.3.4.2. The CIAT-CIRAD team and the local NGOs

The CIAT-CIRAD team and the local NGOs and others extension agencies as UNAG are used to exchange materials (mainly, seeds), information about the producers involved or interested in the project and knowledge (as IPM courses). They are linked at the institutional level by agreements but also at the individuals level, as the actors working in the same zone and on the same topic know each other quite well.

The CIAT-CIRAD and UNICAM

The breeder is used to communicate with the UNICAM coordinator. When the project started, they have negotiated a working agreement. Then, the UNICAM has made the contact with CPEC producers interested to participate in the project in the Ocotal zone. Now, these producers work with the CIAT-CIRAD directly. Because they had a lot of communities to attend, the CIAT-CIRAD team let directly attend the producers of the communities of Hornito, Cuje (Buena Vista, Quebrada Grande), Honzote (Santa Rosa, San Antonio). In these communities, the UNICAM technicians are now in charge of the following up and monitoring. The CIAT-CIRAD delivers seeds and protocols on the demand of UNICAM and

the producers participating. If the UNICAM has difficulties or questions, they call the CIAT-CIRAD technician to help. For all coordination of activities (monitoring, exchange tour…), the technician contacts the local technician directly by phone. If they cannot come, they invite producers to participate.

To foster the partnership, the CIAT-CIRAD breeder wants to keep good communication with the UNICAM coordinator. However, his efforts are not reciprocal. As the UNICAM coordinator admits: "They send us the annual reports, the experiments results and we know well their objectives. I think that heir communication is good. It is more our communication with them that is very bad." The coordinator is very aware that he doesn't make efforts to improve the communication and collaboration with the CIAT-CIRAD. However, this is not a priority for him and he prefers concentrate on others projects.

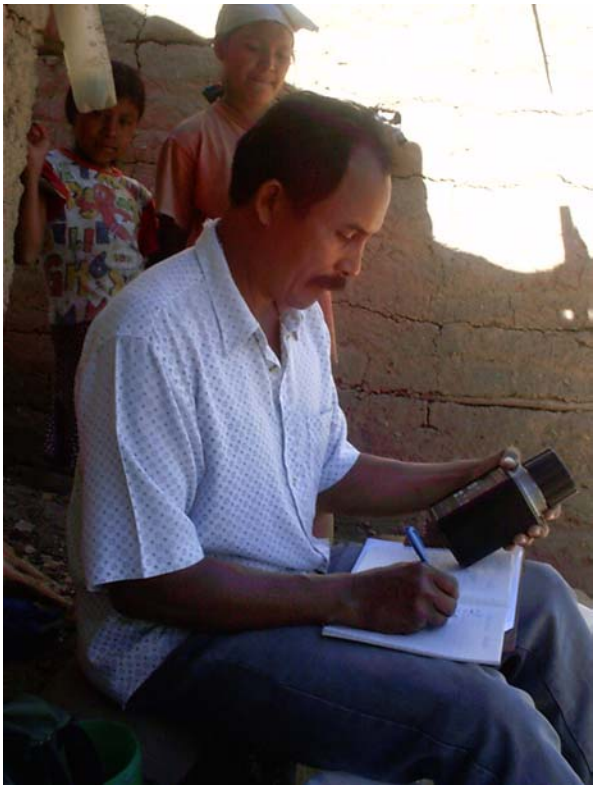
The CIAT-CIRAD technician is highly related to UNICAM as he used to work there. He knows their way of working and people they have to contact. He is also used to UNICAM coordinator's lack of availability. The UNICAM coordinator is always busy and takes too many engagements. The CIAT-CIRAD technician told me: " When, I had to travel from Somoto to Esteli to meet him. Even if we have made an appointment, I was not sure that we could meet. Sometimes, he was just not in his office as he had other engagement and I had to come back without meeting him…" Thus, as another project, if you want to coordinate an activity, it is better to directly deal with the local technicians. "It is good to inform him about what you are doing. But after, go directly speak with the technicians… because, he might forget to tell them about the activity…" Moreover, as the local technicians are quite independent about what they are doing in their zone (when the general working agreement is accepted), it is easier to deal with them directly. The CIAT-CIRAD technician knows well the others UNICAM technicians, due to his former working experiences but also as friend or family: he is married with the Somoto technician. These links facilitate working arrangement and mutual help. He has access to the UNICAM computer and printer in the UNICAM office in Somoto and borrows the truck whenever he needs it (if he puts the combustible). He also feels free to ask UNICAM, INPRHU or UNAG for a room to implement training activities. In the other hand, technicians from these different NGOs know his field of competence, and it is very common that they come to his house asking for advices concerning investigation, hibiscus crop or sorghum crop. For instance, he helps the UNAG regional coordinator to make his thesis proposal on experimentation.

Personal links between the technician and the actors working in the UNICAM foster the collaboration of the two organisms at the local level.

The CIAT-CIRAD and INPRHU

The collaboration with INPRHU is relatively new: it started in March 2003. The first contact has been established during a meeting organised by CATIE (Centro Agronomico Tropical de Investigacion y Ensenanza) in Colonia in which an agricultural diagnosis of the Somoto area has been presented. The CIAT-CIRAD technician was invited. He took the opportunity to present the PCI project when the drought problem in the region was addressed. As the drought is increasing, sorghum becomes a main crop for many producers. The CIAT-CIRAD technician highlighted that very few organisms have worked with sorghum in the area. People see sorghum as a very rustic crop which doesn't need so much care to grow. However, this year many sorghum plots have been lost because of the drought. Technical assistance is also needed in sorghum. Some basic practices can be applied to limit sorghum pests and diseases and improve yield. Moreover, the PCI project seeks to find varieties well

Picture 14: The Ciat-Cirad technician and a producer weight the sorghum "escoba" harvested



Picture 15: The Ciat-Cirad technician measure the humidity

adapted the local conditions and the producers' demand. The INPRHU director was also present in this activity and invited the CIAT-CIRAD technician to have lunch and discuss more in details about the CIAT-CIRAD project. They have agreed on giving an IPM (Integrated Pest Management) course for INPRHU technicians the following year. The INPRHU team took time to mature the idea of being involved in the PCI project. This year, in 2004, during the IPM meeting, INPRHU technicians and the CIAT-CIRAD team have agreed on the modality of their collaboration and have started the implementation of two PVS experiments in Totogalpa.

Contacts with potential partners might be established on the way. Keeping an open communication and being present on events organized by local NGOs enlarge the possibilities to meet potential partners. The CIAT-CIRAD technician points out that in January 2004, a local TV has interviewed him for 15 min about the project. The technician works to improve the project communication with local NGOs and already notices some results: "Since February, I feel that the communication is more open. The organisations and producers know better what we are doing." However, the process of engaging in a partnership is slow as the potential partners want to know more about the project: they want to know how the project is working and have an idea of the results they will get by being partners. Thus, it is important to be clear about the project strategy and to care about the project image. Informal linkages and exchanges also help to get potential partners' confidence.

4.3.4.3. The CIAT-CIRAD team and the producers

The CIAT-CIRAD team visit the producers 1 or 2 times a month. It depends on the period in the year. The technician visits the experiments regularly for data collection. As he has so many experiments to attend, he is not always able to have a chat with producers each time he goes on the field. If the producer house is located near the parcel, he looks for the producer to greet him. However, farmers are generally working in the field during the day and are not that often in at home during the day. He highlighted that when he wants to talk with them, often he has to come back many times to be able to meet producers. Thus, he can lose a part of the day looking for them. Planning and warning when he will come are also difficult as the visit planning may change during the week: if he checks on some experiments that need to be discuss with others producers or if he is late in his planning. Concerning the sowing and harvesting, he assists producers who ask for it. When sowing and harvesting periods are coming, he visits each producer to distribute seeds or bags (for harvesting) and check if producers have some questions or worries. If producers feel that they need his help (often, for the new participants), they just ask him to come when they have plan to sow or harvest. Sometimes, they have to agree on another date because the weather is not good or for other reasons (unexpected events). The breeder is less present in the zone. He comes one or two times a month to Somoto, depending on the period of the year. When he comes, they visit the experiments together with the technician. As the breeder is there for one or two days, they have many experiments to visits and often they don't have time to discuss with producers. They look for the producer only if there is a problem in the experiment or if they have some time left and the breeder wants to meet him.

The technician is very close to the producers, as he is used to visit them frequently. He comes from this locality and has a lot of experience in working with producers. He knows about their family, their preoccupations and their projects. For instance, during the post-harvest activities, we were weighting and measuring humidity with one producer, and a producer son asks him to be his godfather for his communion.

In the study zone, the CIAT-CIRAD team works in collaboration with 80 producers, these include formally organised producers or individual producers. In most of the cases, producers are organised and benefit from NGOs partner support (cf. 3.c). The technician emphasized that it is easier to work with organised producers and gave me the example of inviting them to events. " To invite them, you can tell one producer and he will invite the others. When they are not organised, you have to look for each of them." However, he mentioned that the organization facilitates the process, but the technician has to know this organization. For instance, he explained, "you have to know the producers and their role in the community. When, I invite them for some activities, I usually let the producer who manage the experiment invite the others. However, for some producers, I know that he might give the invitations but nobody will come. So, I have also to ask another producer more "trustfully" to invite. I don't why, maybe some farmers are known to be serious and trustfully" in the community and others are not…"

Since the beginning, the CIAT-CIRAD have seek to tie linkages with the UNAG, as the CIRAD breeder (project adviser) knew this institution and the master thesis student who did a diagnosis of the area has also identify PCAC groups as interested groups. However, the coordination process copes with some difficulties due to lack of communication and misunderstandings. As the CIAT-CIRAD technician points out "at the beginning, the communication was very bad. In some communities, if you invited 35 producers, only 2 would come […] I had to cope with this problem. I didn't understand why there was so much reticence…I couldn't sleep… I had to find out why… Talking with producers and UNAG technicians, I finally understood that they were thinking that we were working with GMOs varieties… The doctor and me organized meetings with UNAG technicians, promoters and producers to present the project, exactly what we were doing and our position on the GMOs problematic. […] Then, we had other meetings…Later, we have agreed on an "official" coordination agreement. […] On the evaluation activities of January 2003, UNAG have invited the producers on the community where we had problems… Then, problems were definitively solved." Moreover, the UNAG tend to reject biotechnology and many producers and technicians associate plant breeding with biotechnology. In his project presentations, the CIAT-CIRAD breeder has to insist that the plant breeding process is "natural", in the sense that "men are using natural mechanisms of the plants to achieve a specific objective" and there is not "laboratory works".

4.3.4.4. The local NGOs and the producers

The modality of attention depends on the NGOs at stake. As we have seen in the previous chapters (especially the 3), "institutional" culture influences the NGOs organization and their strategy to work with farmers. Concerning individuals, technicians usually are close to producers. The relationship technicians-producers depends on the personality of each actor, so each case is unique and I am not able to document all those cases in this thesis.

4.3.5. Views on “participation”

4.3.5.1. The CIAT-CIRAD team

As defined in the problem statement, the CIAT-CIRAD team aims to establish a “partnership” or “multi-partnership” with the actors involved in the project to ensure the PCI project sustainability. The interest of focusing on partnership is that it refers to the “participation of all actors involved in the production chain”, while participation tends to refer to farmers’ participation. The CIAT-CIRAD technician also highlighted that “in general, partners also have to share the costs, not only the activities”. Partners have to negotiate what each one will do and share in inversion and in resources. Building a partnership is a long process. “they have first to be interested in the topic with the magnitude as us. But, it will come, little by little, we see that people are more and more interested by the topic.” It takes time to motivate the potential partners. As the technician also mentioned: “Now, partners are more in a passive position, we need them to be more active. We need that they play their role of partners.”

Talking about farmers’ participation in PCI, the breeder classifies farmers’ participation in three types:

- Participation in events and selection activities
- Farmers experimenters: with three experiments types, experimenting with less advanced material, in small parcels need more motivation.
- Farmers breeders: the most motivated and “passionate” farmer experimenters, the “experts”, there are “few, but you don’t need a lot of them”.

4.3.5.2. The local NGOs

Talking about PTD, NGOs tend to oppose “farmers” knowledge with “scientific” knowledge. According to some actors, as UNICAM, “participation” has to integrate both knowledge. As the UNICAM coordinator emphases “to join the “participatory” and the “scientific”, we have to respect both knowledge and both groups. It is a knowledge relation with two different types of abilities and we have to build on both.” Other extension agents, as UNAG focus more on farmers’ knowledge. It will be developed on the following paragraph.

“Participation” is also seen as a “team process”. To be able to participate producers have to be organized and work as a team. In this process, technicians have an important role in observation of farmers’ abilities. Each actor has his own personality, with his own strength and weaknesses. For team building, you have to build on the producers’ abilities and strengths. As the UNICAM coordinator explained, “to improve team working, you have to locate each people in what they better do.” First, you have to know them.

For many NGOs, farmers’ participation in technology development is a way to improve capacity building. The process seems more important than the results itself. As the UNICAM coordinator emphasizes “the process never dies […] Producers learn to knock at the doors”. That is why, the beneficiaries of the project, i.e. the producers, have to be associated in the decision making process since the beginning. By giving them more responsibilities in the whole process, they feel better commitment and ownership toward the project. Then, as the UNICAM coordinator highlights “it is better to suppress intermediaries, if CPEC can work with others actors without UNICAM, to give independence to the group.”

This could explain why he is not so involved in the PCI project. He thinks that producers from CPEC are able to work with the CIAT-CIRAD team directly without UNICAM involvement.

4.3.5.3. The producers

UNAG promotes a program called "farmers to farmers". This name reflects very well the organization's philosophy and strategy, defined also as "horizontal" participation. They focus on farmers' knowledge and farmers' exchanges. The "outsiders' role" (technicians or breeders) is to facilitate these exchanges and farmers experimentation has to be led by farmers themselves. In the field, actors lack of confidence in breeders, and especially in INTA. This attitude could be explain by emphasize of the opposition farmers versus scientific knowledge and the fact that INTA usually tends to devalue farmers knowledge. Moreover, the group affirms his "egalitarian" culture in opposition to the INTA "hierarchical" culture. The term "horizontal" can be interpreted as the contrary of vertical or hierarchical layers.

In the field, it was quite difficult to grasp farmers' perception of participation. I have made the hypothesis that farmers' "culture" shapes their perceptions. To have an idea of these cultures, I have chosen to focus on what motivate them to participate. I am aware that this will only reflects one side of the coin and that I will miss other perceptions. However, it allows me to differentiate three main participation types:

- Participation for incentives: some farmers, especially those who are newly involved in the process participate to have access to seeds. In this context of seeds scarcity and quality seed problems, participating in a PCI project allows farmers to have access to "good" quality seeds, corresponding to their needs and demands. The quality is guarantee because they first test it in their field. This type of farmers has a short-term vision and their participation is motivated by an emergency situation.
- Participation for learning: the learning process particularly motivates other farmers, they are curious and they want to know more about the different varieties. These types of farmers are potentially "good" farmer experimenters. The NGOs often refers to these farmers type when they are looking for participants in PTD projects
- Participation for recognition: Nicaraguan farmers are usually proud, they like to have visitors. In the field, I was always striking by the way they welcome me and their enthusiasm because I was coming from " so far, a remote country to visit them and know more about their experience." Some farmers participate in PTD project to show that "they are able to experiment", they look for recognition from the community and form the "outsiders". That is why farmers' exchange visits and breeder's visits motivate them.

4.3.6. How it influences the breeding process and outcomes

The diversity of partners makes the process more complex. It is also difficult for the CIAT-CIRAD team to share their time among the field activities (visits and monitoring of the experiments, data collecting, selection activities, …) and the coordination work (training, maintaining strong linkages by formal and informal communication…). They tend to prioritise field activities. On the other hand, the partners are involved in so many others activities that they also have to make priorities. And usually, they prefer to concentrate on projects they have themselves elaborated or on others activities on which they feel more ownership and responsibilities. They know that if they don't do it, the CIAT-CIRAD team

will not be here to assure the activities. As many NGO partners are less actively present in the field, the key steps process involve more the CIAT-CIRAD team (breeder and technician) and producers.

4.4. Challenges and how to deal with it

4.4.1. Too many working sites

The CIAT-CIRAD program works on seven sites in Nicaragua, some are quite far from Managua, where the central office is based. Thus, the research team cannot travel so often to visit these sites. If the local partners are motivated, feel ownership toward the project and actively handle the project, the physical distance of the breeder is not a problem. However, if the partnership is weak, the CIAT-CIRAD team has to be more present. At least, for the time needed to build a stronger links with the local NGOs. Reducing the number of working sites should allow the research team to concentrate their action on some "key projects".

Actually, based on the same observation, the program has already change their way of working. In 2005, they have decided to focus on 4 main sites: 2 for sorghum and 2 for rice. Talking about sorghum, in Somoto-Ocotal, the collaboration with INTA and CIPRES will be strengthened and inVilla-Somotillo, CIPRES will be a key partner. Concerning rice, the focus will be on Chinandega and Siuna. In the other sites (San Dionisio, Bocay et Ciudad Dario), the work will be limited to the validation phase and diffusion of varieties (identified in 2002-2004).

4.4.2. Time constraints

Time pressure often constrains the implementation of the CIAT-CIRAD "egalitarian" culture. However, it reflects also how the team set its priorities. In this sense, the product might be valued more important than the process, which is more relevant for functional participation. Because of the large number of sites and experiments, the CIAT-CIRAD breeder and technician are on time pressure. Often, they cannot talk with each producer whenever they visit the experiments. I have already explained that breeders and technicians visits motivate farmers in the experiment process. Thus, my advice is to reduce the number of working sites

Moreover, the project is quite young and it needs more time to mature. Researchers and extension workers have to spend time with farmers, because time is needed not only to develop and test new technologies but also to establish the strong relationships between researchers and farmers which are needed in a "partnership". The first years of implementation should focus on the strengthening of these relationships.

4.4.3. Playing on actors motivations and objectives

The CIAT-CIRAD team is worried because "actors say they are interested in the project but they do not involve actively in the process". To improve active "partners" participation in the project, the CIAT-CIRAD should motivate them by social events. As social recognition is important for the local actors, organizing more farmers exchanges between the different sites will foster the feeling to be part of a group, a network of farmers

experimenters. UNICAM already uses this strategy to motivate CPEC farmers. Distance between the sites and the finance constraints may limit this option. However, it could possible to organize at least regional exchanges.

Moreover, partners' agendas could be integrated to the PCI project to improve partners' ownership toward the project. The "partnership" process could start by a presentation of each partners' agenda (the CIAT-CIRAD and the "partner" general objectives and strategies) and by the reasons why they decided to engage in collaborative PCI project. Then, they would negotiate on how to achieve these objectives. A joint monitoring and an annual meeting will allow to keep the institutional contact and to check that the both parties objectives are fulfil.

4.4.4. The CIAT-CIRAD "in demand" of partners

In their discourse toward the potential partners, the CIAT-CIRAD team places the project as an "offer", an opportunity for the partners to respond to one of their problems, and an important one as it is directly linked with farmer food security. This position is ambiguous as the project is actually looking for "partners" and partnership. To improve active partners' participation and ownership toward the project, I think that the research team should highlight that "partners" are essential to the project and start from their specific problems. "Accepting an offer" is too easy, they should work on a kind of project elaboration. A working plan with specific objectives can be established jointly. It is important that the objective and strategy are clear for all partners. As an indication:

The objective should specify:

- the time period: "we aim that in 5 years"
- the location: "producers of that communities"
- the crop focus: " will grow "millon" adapted to the local condition and …"
- the farmers needs and demands (ideotype): will be defined with producers during the selection activities

The working plan should specify:

- the number of producers involved (more or less), the way they are selected (the research team can let this decision to the "partner" but talking about it will make the partners reflect on the type of producers involved and why they will be involved)
- the type of experiment: PVS or PPB, the research team will have to explain in what it consists, what are the advantages and limitations of both, and why they chose to start by PVS in their general methodology
- the data collection: at what stages?, who?
- the monitoring process
- ….

This process has to take the time needed by "partners" in such a way that the research team will not go too fast. The partner will may be need more time to really appropriate the PCI project.

4.4.5. Sustainability of the project. Problem of an international agency project

The “partnership” strategy is partially motivated by this preoccupation: how to establish a sustainable project. The CIAT-CIRAD thought that working a close collaboration will help to solve this problem. However, some actors might be also afraid to engage so actively as they know so many examples of international agency projects that just had disappeared when funding left. The assistant of research highlights this issue, “Who will continue the project? It will be nice if INTA could take it, but the problem is for the funding. For a PCI project, you need funding for the transport costs, food and drinks during the selection activities. Who will finance it?” The potential partners might ask the same questions. However, if the partners have a real feeling of ownership toward the project, they will set their priorities differently and find the resource to continue the project.

Moreover, the breeder will move in Colombia in September 2005 to work on CIAT PCI projects. He will stay in contact with the partners. The assistant of research and the technician will keep working on the project in Nicaragua. To finance the technician employment, the CIAT-CIRAD program has establishment agreement with a CIPRES project funded by EU via ACSUR.

Picture 16: Pueblo-Nuevo

Picture 17: COSENUP producers share their experience with PCAC producers

5. Case CIPRES-Pueblo-Nuevo / Condega

5.1. The CIPRES

The CIPRES (Centro para la Promocion, la Investigacion y el Desarollo Rural y Social) is a NGO formed in 1990 which operates as a "centre of socio-economic support to farmers, cooperatives and workers, aiming at improving their livelihood".

The Pueblo-Nuevo program started in 1998 with a project that aimed at organizing and strengthening a cooperative of tobacco producers. The project was interrupted in 1998 by the huragan Mitch without achieving its objectives. In the post-disaster context, NGOs received funding from international organizations. In the case of Pueblo-Nuevo, the CIPRES receives funds from NOVIB, Ruben Dario Association and Paz y Solidaridad. The new project focused on basic grains and vegetables in Condegua, Esteli, Pueblo Nuevo and Jalapa. It was organized in two phases: "actions of urgency" and "producers rehabilitation". One of the strategy in the second phase is to organize producers in cooperative to help them getting land ownerships. The CIPRES also aimed to support many producers in a large area, delivering to farmers' families a "productive packet" (trainings, animals, tools, seeds…). In the last years, the project has decided to reduce the action area and focus on two zones: Pueblo-Nuevo and Condegua, to foster their abilities and concentrate support in these zones. CIPRES selects the beneficiaries on the basis of a preliminary diagnosis and delivers them a "productive packet". The interest is to ensure that farmer families can sustain the production. They also implement "farms tours" in 30 reference farms in Pueblo Nuevo. The idea is to look at the farm and highlight what are the positive points and what can be improved according to farmers' knowledge. After listing what the producer can do to improve his farm, the all group will begin to work on it. "Let's do what we can do in the moment to improve the farm." It allows to take advantages of each farmer knowledge and experience and also to take advantage of the time by group work in the farm. CIPRES assists 5000 beneficiary farmers, in which 80% are women.

The PCI project has been setting up as a component of the Food Security Plan for small farmer families. The CIPRES estimates that 2600 families indirectly benefit from the PCI project, as they grow materials coming from the project.

5.2. Pueblo Nuevo- Condegua: a successful process of "Joint Learning"

Esteli department is located in the North of Nicaragua in between Madriz and Chinned departments. The climate varies from subtropical to dry with medium temperature of 24°C. Precipitations vary from 800 to 1500 mm/year. The project area encompasses 2 municipalities: Pueblo-Nuevo and Condegua. 15 % of this area is used for annual crops, which consists of maize (46 % of the annual crop superficies), beans (46 %), sorghum "millon"(2 %) and white sorghum (6 %). Moreover, 47 % of the total number of farms are smaller than 5 manzanas (3,5ha) in this area. (CENSO, 2001)

5.2.1. Origin of the PCI project

Ten years ago, the lower zone of Pueblo-Nuevo and Condega had a good potential for agricultural production with irrigation and the main crops grown were tobacco, tomato and pepper, they had also some cattle. Big firms saw the potential of this region and started to develop big tobacco farms. From 1996 to 1999, the tobacco production was at its very peak, and 2800 Mz were grown in the municipality. This production has affected the environment as it uses a lot of water for irrigation, a lot of chemical treatments and the trees were used to build hangars to dry tobacco. In 1999, a crisis has affected the production and many tobacco firms went bankrupt. Moreover, the quality was hard to maintain because of the important attack of White Flies (carrying the virus of Golden Mosaic). Thus, producers have decided to come back to traditional crops to ensure their livelihood. However, White Flies had developed resistance to traditional treatments and the Flies population had increased a lot. Golden Mosaic also affected Beans. Dependence to chemical treatment broke down small farmers economy.

The Ministry for Development Cooperation of the Netherlands has been interested in a portfolio of regional projects related to "Agrobiodiversity and Poverty alleviation". It asked the Dutch Genebank to develop projects. In this context, a PPB project has been set up for the Meso-American region. My current thesis supervisor, who was at this time working for the Dutch Genebank was sent out to look for potential partners who were willing to engage. The strategy was to involve a part from the farmers, two institutions, one working on research, the other on extension, in order to guarantee "inter-institutional partnership". In 1999, she proposed to CIPRES to engage in this "partnership" with the National Research Institute INTA and set up a PCI project with the objective of creating beans varieties resistant to Golden Mosaic. The CIPRES has started by doing a diagnosis with 80 farmers to identify farmers' problems in the region. The main problems identified were drought and Golden Mosaic. Farmers also have expressed the willing to recover their "criolla" varieties.

5.2.2. The process

In 2000, the CIPRES started by selecting 70 "curious beans and maize producers with a natural sense of the experimentation" (CIPRES technician). Then, the NGO has presented them the project to make an agreement with them. 50 farmers have accepted the commitment and have engage in this long-term process with the CIPRES and INTA support.. Producers knowledge and abilities were evaluated by CIPRES technicians in order to proposed 10 producers to be in charge of the experiments: 5 farmers for beans experiments and 5 for maize experiments.

When the project started, producers had little knowledge about what was really about this project and plant breeding activities. The INTA breeder gave the first courses, explaining how beans and maize cross. He has worked in close collaboration with the technician to elaborate graphics and drawing which will facilitate producers understanding of plant breeding processes. The CIPRES technician was in charge of recollecting "criollo" material with the help of the farmers involved in the project and the references given by INTA. When the tobacco enter in the area, beans were only cultivated in the upper lands, so he has to look for these materials in specific ecological niches surrounding the valley. He investigated producers who were known to grow very old material and managed to collect 10 maize

Picture 18: Materials coming from the PPB process (Pueblo-Nuevo)

Picture 19:Liberation of Santa-Helena and PN

materials and 6 bean materials. These materials were then send to the Zamorano centre in Honduras, which is also part of the PPB-MA program. In the experimental centre, they have crossed the materials with improved varieties to develop resistance to disease. During this time, the producers needed to practice the theory they get in the courses. So PCI experiments started.

5.2.2.1. Beans PCI

In 2000, INTA has facilitated segregated material to producers. The 15 materials in F3 were originated from a triple cross done by the CIAT. The INTA breeder has defined the protocol for the first experiments: each of the 15 materials were sown in 4 row of 5 m and the technician helped with the parcels measurements and the sowing. For each material, each of the 5 producers (experimenting in beans) selected 20 plants. So, they had 300 materials. By massal selection, they followed the selection step and selected 30 materials the following year, then, 30; 7; 3;and 1, the last year. Each producer has selected his own material. In 2004, they have organised a validation phase with the 5 materials in experiments located in many different environment. They have given 5 Lbs of each material to the 50 producers involved in the project and to others producers who are part of cooperatives supported by CIPRES. In total, they gave seeds for 65 experiments and get results for 42 experiments, as some were lost. To evaluate the results, the INTA breeder has used a statistical tool called SAS which allow to valuate the variety results according to the environment type. The 5 materials were good in comparison to the local witness. 2 lines were better than the others, so were chosen to be liberated in November 2004. The 3 others lines have not been liberated, however producers spread out their material in the all area. The registration is done by the MAGFOR.

In 2002, the Zamorano gave the materials coming from the crosses of the “criollo” materials. There were originally 300 materials, but INTA did a first selection in the Experimentation Centre Carazo and gave 80 materials to CIPRES. One producer of the 5 producer experimenters took the responsibility of this experiment. He had already started to experiment with the CIAT materials and was very motivating to engage in this new “adventure”. The first crop cycle was very disheartening for producers, the technician and the breeder… As the technician expressed “ they felt like crying” when they saw the result. The materials were very affected by the Golden Mosaic and were not well adapted to lower lands. However, they had to stay motivated and select within these materials. This experiment process was a real negotiation between the technician and the producer. They “debated technical questions during hours” until they get agreement and “the decision they took was perfect” (the CIPRES technician). Within the 80 materials, they selected 20 and sow them all mixed in a field. They had to do some cycle with irrigation because the process was slow as the first lines didn’t adapt well to the local conditions. From the field of the mixed materials, they selected 14 plants, which they sow in rows, then 6 and 2 materials in the “primera” of this year. These 2 lines will compete in a validation experiment with others 2 materials coming from PROFRIJOL.

The PROFIJOL organism gave them 340 advanced lines. The CIPRES and INTA did a first selection because the majority of these lines were not adapted to the area and came up with 30 materials. One producer in Condega took the responsibility of this experiment. He selected 10 plants the first cycle, then 7; 4 and 2 in “primera” of this year.

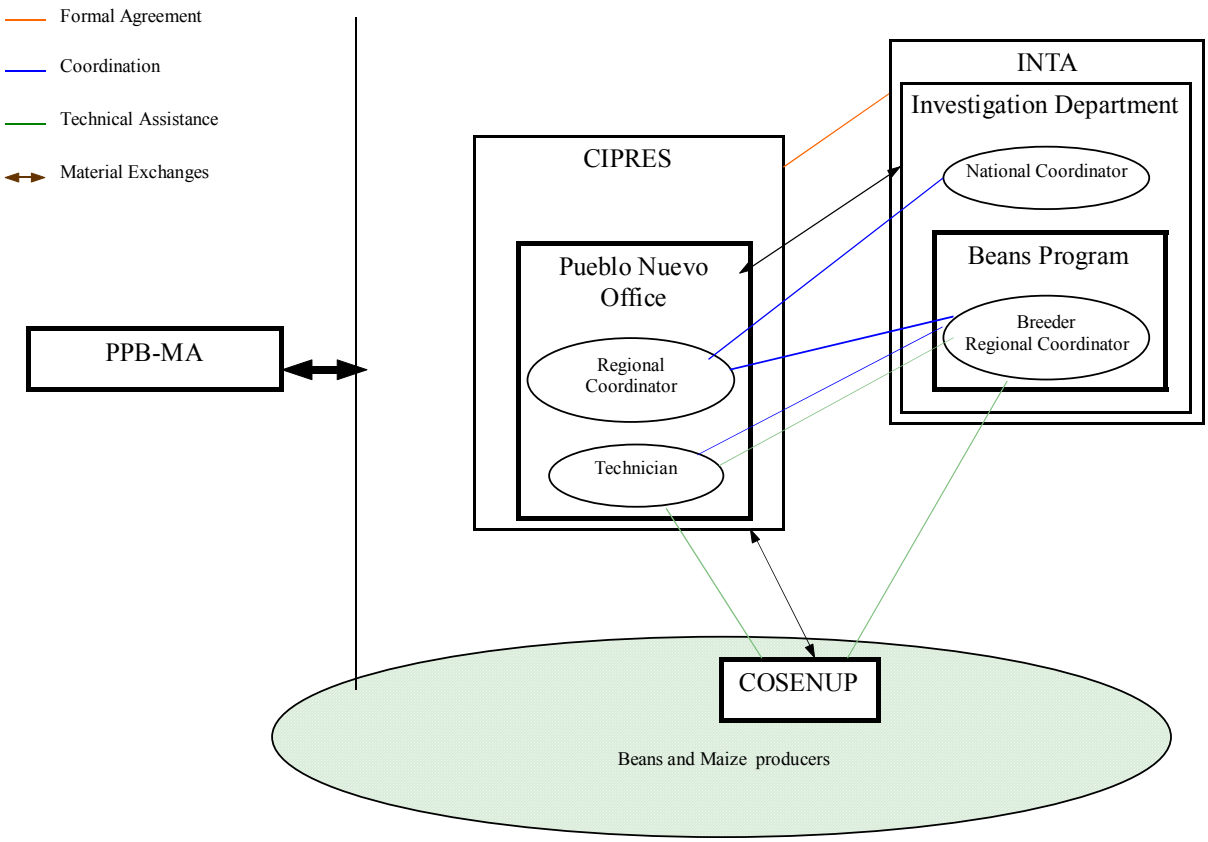


Figure 8: Actor Network Diagram Pueblo-Nuevo Case

5.2.2.2. Maize PCI

An IGTA breeder from Guatemala advised them for the methodology they could use. From the 10 "criollo" material recollected, the producers have selected 3 materials. However, the technician is aware of some limitations: these materials already had crossed as the 10 materials were sown at the same date and flowered at the same time. Each of the 5 producers involved choose the materials to cross and the methodology he wanted to use. 2 producers went for massal selection, while the others producers went for the genealogical selection. It was difficult to get advises from the IGTA breeder, so they asked the INTA breeder when they had some preoccupations. However, the breeder was a beans specialist and the technician felt that he didn't know so well maize plant breeding. In the first cycle, all the producers sow the three local varieties and the improved variety chosen in a same field, what they called a "chacuatol". There was no control of the pollinisation, even for pollen coming from neighbours' fields. Then, each of them selected 200 corn ears.

The 2 producers who have chosen the massal selection methodology sow in the same field the grains coming from the 200 ears selected and selected 100 ears the following cycle. They were also cutting all the coloured ear tips.

The others producers have sown one row for each corn ear selected, so 200 rows. They used the "chacuatol" from the beginning as "father". Each 4 rows, they sow 2 rows with the "father". The next cycle, they have selected 80 corn ears, then 30 corn ears the following cycle.

The process is going on. The CIPRES technician and producers told me that they are having good results and hope to liberate maize varieties in one or two years.

In the future, the CIPRES and the producers involved "want to continue the PCI process while strengthening varieties commercialisation and recollecting wild varieties".

5.2.3. Actors Network

An actors' map will help to highlight the central actors involved in the PCI project and to characterize their relationships.(Figure 8)

The program process and outcome is influenced by the Participatory Plant Breeding Program in Mesoamerica as the program facilitate interaction with others PCI projects in others countries. Actors will benefit from experiences exchanges and genetic materials exchanges. Moreover, the PPB-MA has funds for organizing these exchanges and training activities.

Looking closer at what is happening in Pueblo-Nuevo, three types of actors are involved in the process: breeders (part of the national research institute, INTA), extension agents (part of the local NGO, CIPRES) and producers (part of the cooperative, COSENUP). Let's now look who are actually these actors and how they interact in the project.

5.2.4. The main actors involved

5.2.4.1. The Participatory Plant Breeding Program in Mesoamerica

The PPB-MA is an "umbrella" program financed by "the Development Fund" (Norway organization) which brings together PCI projects located in six countries of the Mesoamerican and Caribbean regions: Nicaragua, Costa-Rica, Honduras, Guatemala, Mexico and Cuba. The general objective defined by the PPB-MA program is "to contribute to the process of improving the standard of living of farmers groups within the program's areas of influence, through the application of participatory plant breeding strategies [or PCI strategies]". Then, the program highlights some specific objectives which are:

- to increase the adoption of germplasm that is adequate for local production and has desirable marketing characteristics
- to strengthen the use and conservation of local biodiversity
- to improve knowledge and approval of PPB techniques and methods among farmers groups, academic and scientific institutions and NGOs on a Mesoamerican level
- to establish networks of actors interested in PPB processes

(PPB-MA, 2002, Base Document, Managua, Nicaragua)

5.2.4.2. The CIPRES team

On the field, two CIPRES technicians are in charge of the PCI process. One is the CIPRES regional coordinator, he is more involved in the administrative and organizational part. He is interested by the PCI process and would like to have more theoretical knowledge about it. The other one is more in charge of the activities implementation on the field and the following up of the experiments. He is passionate by the PCI activities and wants to get more technical knowledge about plant breeding. Above all, he is passionate by the process with producers. He likes to talk about the process, how it begins, how producers become more and enthusiasts about it, how they deal all together with the choices they had to make…

The two technicians are used to work with farmers, they assist them with a "productive packet" which includes training. However, before the project started they had never worked in experimentation. Moreover, in Nicaragua, they were no other projects integrating completely research, producers and technicians. So, for the CIPRES team it was a challenge: a challenge to achieved "good" varieties adapted to the area and producers needs and demands and a challenge to achieved a "good" coordination and collaboration between the different types of actors involved.

5.2.4.3. The INTA and others government institutions

The MAG-FOR gives the agreement for varieties registration in Nicaragua. To register varieties, the demander has to fulfil a number of requisites:

- a minimal stock of 40 Ql
- a demonstrative field of 1 or 2 Mz (0,7 or 1,4 Ha)
- a legal organization who will be the legal responsible for the material registered, it will be responsible for the variety quality and purity

The project fulfils the requirements, as the technician explained "what slow the process was the cooperative creation, but now it is ok, the cooperative is formed, they are organizing themselves…" However, they are still waiting for the MAGFOR agreement. As the administrative process is so slow and to stay in their planning, they decided to do a public liberation of the new beans varieties in. This liberation allows them to start the commercialisation. As a producer explains, "the liberation has made a lot of publicity, after the event, we had many demands."

The first INTA breeder involved in the project was closer to producers and could establish a relation of confidence with them. As the CIPRES technician notices "he knows well how to speak with producers". The new breeder is more distant. He plays a role of adviser or trainer and it is more difficult to know what he really think of the project and if he feels a complete commitment. Technicians and producers would like to have more opportunities to know him in informal contexts to establish stronger links.

Nowadays, as producers have going through the all plant breeding process, they get more recognition from the INTA breeders. The CIPRES technician and a producer experimenter were invited to an exchange activity on "Beans in dry area" organized by INTA. As breeders from Zamorano were also involved, one could ask if they had an influence in the invitation. However, during the activity the producer was considering as a breeder like the others. He presented his experiment and explained the results. It was amazing to observe the group visiting the different experiments: all the breeders (from the formal system) with pen and paper to note what they observe in the parcel and what lines were quite interesting and the producers looking also carefully at the plants and discretely taking some grains when he liked it to make an experiment on his own parcel.

5.2.4.4. Producers

Among the 50 farmers involved in the project, 25 are from Pueblo-Nuevo and the other 25 from Condega. Concerning the ones from Pueblo-Nuevo, 4 are women and 12 are part of the cooperative called COMAXA. Concerning the ones from Condega, there are 15 women and all the farmers are part of cooperatives which are Nueva Esperanza, Arenales, San Ramon, San Pedro.

The producers engaged in the process but were quite insecure at the beginning. They didn't know where they were going. As they mentioned, "we didn't know anything about plant breeding". Actually, they didn't know anything about formal plant breeding. The first plant breeding classes given by the INTA breeder were difficult to understand but awake their interest and future passion. They were asking more and more questions. And, more the process goes, more they are curious about theoretical knowledge in plant breeding. Now,

Picture 20:Exchange activity with UNAG-PCAC (Condegua)

producers say that if it is possible it will be good to know how to make crosses, like that they will become more independent and will be able to control the whole process.

Moreover, producers are very proud of their achievement of also to participate in the process. The CIPRES team also foster this feeling as they know it as a "motor" to motivate producers. They advice producers to give names to their varieties or pre-release material. Talking about the two beans varieties liberated, one producer give the name of "PN-JM- 12-7", corresponding to the initials of Pueblo Nuevo, his name and the first rows he selected. The other producer, from Condega choose the name of "Santa Helena", in homage to his daughter. Producers also diffuse varieties which have not pass the formal process of liberation. For instance, the beans variety "Luicito" (in reference to the producer name) is cultivated in the all area where he is living.

Some producers are less involved in the process. However, they can participate for the validation step as it needs experiments in many different localities. The technician told me that one day he came to one producer to help with the harvest of the validation. They hang beans plants separating the 5 varieties tested close to the house to weigh them later on. As it was late, they have their lunch in the house. While eating, beans were so good and they asked to the wife where did it come from… The wife answered: "but it is the beans you harvested today…" The experiment was lost. Many experiments (in the validation phase) were lost. This shows that producers may have different interests and motivation, so we couldn't except that all of them will involve in the process with so much commitment. The CIPRES team is aware of this and that is why they preferred to "selected" producer experimenter from the original group (of 60). In the 10 who started the process, only 2 give up in the middle, they though that they couldn't afford the job. However, as they felt responsibility toward the project, they looked for other producers to take it over.

The maize process was slower, as it is a cross-pollinisation crop, it is more difficult to obtain stable lines. We could imagine that this slowness would affect producers' motivation and they could be bored to see that it is difficult to get a stable material. However, difficulties they had to cope in maize plant breeding process foster the group motivation. "We have to show that we are able to improve maize varieties."

To be able to register their varieties and also to set up the commercialisation. Producers involved in the project establish a cooperative called COSENUP. The cooperative consists of 50 producers. Only the 10 producer experimenters have experiments. When I asked to the others ones if they also would like to experiment in plant breeding, they just reply that it is not their role. At the beginning, they already have discussed who will take the experiments. These producers are also very important in the process for the validation phase, for the diffusion phase and also to support the producer experimenters.

5.2.5. Linkages and exchanges

5.2.5.1. The CIPRES team / producers and INTA

During the first 2 years, the institutional coordination with INTA has been difficult, as there was no formal agreement between the two institutions. Moreover, as explained a CIPRES technician, the INTA politic and organization change many times, so it was difficult to establish a stable commitment. However, at the individual level, a beans breeder was enthusiastic about the PCI process and decided to support producers and technician using his own time. As the CIPRES regional coordinator explains "we were friends, he used his own time to support the project doing visits on Saturdays and Sundays". He helps them giving courses about plant breeding and advising them for the experiment protocols. Concerning the validation experiments, he helps them with the use of a statistical tool SAS.

As the breeder was not specialised in maize plant breeding, the technician and producers felt that his advices were sometimes not so pertinent for the maize breeding process. Decisions on the experiment methodology had to be taken in coordination between technician, producers and the breeder, and sometimes producers and the technician disagreed on the breeder advices. These argumentations and knowledge confrontations makes the actors struggling, but at the end, it contributes also to strengthen the actors' linkages. Some producers were not so interested in these discussions around methodological issues which were so technical. For them, "what we are looking for is what to eat and it is not so important to follow methodology so strictly."

Nowadays, another INTA breeder supports the project. If the technician or the producers have some preoccupations or questions, the breeder advises them or comes to visit the experiments. These visits generally are punctual. This breeder is less actively involved in the project. The communication is more "difficult". As the CIPRES technician explained "we don't know each other so well". An evening, after an activity about "Beans in dry area" organised by INTA, we were chatting in a bar with the CIPRES technician, one producer and one INTA breeder. The INTA breeder involved in the PCI project had planned to come, but finally he didn't. The technician and the producer were quite disappointed as they were waiting for occasions to know him in an informal context.

Other INTA breeders come punctually to visit the experiments. Producers are very proud to tell that the National Beans Breeder likes the Pueblo-Nuevo experience and keep the contact with the project since the beginning. They are also proud to see that breeders from the formal system are interested in their results and the varieties they liberated. A breeder from the Zamorano centre in Honduras has taken some seeds to test it in his experimental station.

The cooperative COSENUP and INTA continue to exchange genetic material. Producers have carried out a breeding cycle as they liberated beans varieties and planned to liberate maize varieties soon. However, they are still looking for new materials to improve. Some want to continue the breeding process on the same crop and others want to try other crops. Actually, in postrera, INTA has given 12 fixed line of sorghum. Two producers, one in Condega, the other in Pueblo-Nuevo were in charge of an experiment. One had already experimented in the beans project. He find PVS less interesting as the varieties are already fixed, he had less choice to select. He likes three varieties and will try it again in his field. This demand also point out the growing importance of sorghum in the area. One producer highlighted: "Now, instead of maize, we grow sorghum."

5.2.5.2. The CIPRES team and the producers

CIPRES plays an important role in the village. 2 of the 5 technicians working in the CIPRES-PN are actually from the village and live with their family there. The producers see them as "guy from the village". The others three are from Esteli or Managua but they stay in Pueblo Nuevo the all week and come back to their city for the weekends. All of them are involved in the village life and the CIPRES office is a place of conviviality. The TV in the first room attracts children or some others villagers who want to watch a movie, the news or a football match. During my stay there, the two technicians who are also involved in the baseball team, installed the CIPRES data show and screen in the middle of the street to follow a baseball match. All the men of the village were sitting there outside, enjoying the match. Producers know that they can ask CIPRES technicians for help when they need it. When , I was in the office, a producer came to ask a technician to lend him his van to carry the body of one of his familiar who just died from the community to the village. Producers feel confident and close to CIPRES technicians.

Producers and technicians have started from the same point, they didn't know about plant breeding and they had no ideas how they could implement the project. So, they worked in close collaboration to develop their own way of working and their own methodology. As the technician explained, it is very important to "learn by doing" and the interaction in the field is essential. "We go in the field and talk about how the plants behave and how the process is going on… They asked questions…Sometimes, I couldn't answer, so we had to ask the INTA breeder for advices." For them, technician and producers, it was like a school, and they passed through the same learning process.

The process of "joint learning" and the linkages between producers and the technician allow developing producers' confidence and initiatives. For instance, all of them, producers, technician and breeder have agreed that they wanted to select for drought conditions. One day, the technician visiting a producer saw in the field that the producer just irrigated the all field by aspersion. He was quite nervous and disappointed because he thought that the all experiment would be lost by this mistake. However, the producer explained him that his problem was not only the drought and also the rain. As a big rain could suddenly appear in this period of the year and he wanted to see how the crop will react to this big stress as the beans plant were charged. He wanted to check that the plants would not fall down. The process allow them to determine also more selection criteria as "the beans doesn't go up and do "bejuco" because it will wind up on the maize plants", the distance between the charge and the soil…

The methodology was not well defined and technicians, producers and breeders have decided during the process how they could do it. The general selection criteria have been defined at the beginning by the 50 producers as: bully beans plants, medium leaves size, red colour beans… However, on the field, each producer who was in charge of an experiment had the complete authority to select according to his own criteria. The first year (in 2000), each producer selected individually the plants he wanted. The following year, the methodology changed a little, as producers from the same communities were invited for the selection. However, the aim was more to inform the community about the process which was going on and to involve them in this process. At the end of the day, the farmer experimenter decided which plants he will select.

5.2.6. Views on “participation”

5.2.6.1. The CIPRES team

Through their experience, the technician has noticed an evolution in farmers’ participation. At the beginning, producers were interested but they were more “passive”. They didn’t really know where the project will go and how it will go. However, thank to the relationship technicians-producers based on confidence and the intensive training, they have taken more initiatives and have become involved in an “active” way. This reflect the idea that participation is a process which evolves through time and the process needs to mature in order to achieve “effective” or “interactive” participation. Moreover, producers, technicians and breeders need to acquire a common language to be able to communicate in a balanced way. And training is very important to ensure a good communication among the actors, producers and technicians learn about technical issues and plant breeding mechanisms, technicians and breeders learn about farmers’ needs, demands, and vision of the crop. A CIPRES technician highlights “we have to value how producers think and the different points of views. […] For instance, producers like to sow in the same field, early, intermediary and late maize to be able to have three harvests in the year. We know that the different varieties will cross in the same field… but we have to find out a solution to respond to producers need to be able to harvest at different times in the year.”

The focus on joint learning, shared decision making, commitment to the project and shared ownership let me think that this experience can be seen as a “partnership” according to the definition of LINDENPERG (1999, see 1.1). However, the actors on the field don’t usually use these terms.

5.2.6.2. The producers

For producers, “participating” is a way to acquire more knowledge. As a producer of Pueblo-Nuevo points out “the more projects will drive participatory methodologies, the more impact it will have to open the producers eyes”. As explained in the paragraphs above, participation is also important for social recognition, from others producers and from breeders.

5.3. Challenges and how to deal with it

The main challenges for the CIPRES project, at this stage of the process, are released varieties commercialisation and up-scaling of the experience.

COSENUP gets many demands for beans seeds. They have to organize the cooperative to cope with this demand and ensure the production. Moreover, some experimenter producers are not so interested by seed production and are looking forward to start a new plant breeding cycle. The organization is evolving toward member specialisation corresponding to individuals abilities, interests and cultures: some members, “entrepreneurs”, are in charge of management and commercialisation (negotiation with buyers), others, “producers experimenters” are in charge of maintaining the seed quality of released varieties and creating new varieties, and the last, “seed producers” on of seed production. It is interested to note that individual specialisation is strong in “hierarchic” culture in which

individuals have specific power, knowledge and responsibilities. However, individual specialisation, when it is not imposed to individuals, is a natural way to expressed individual cultural differences in a group.

CIPRES wants now to focus on another phase of the project: the "up-scaling". How to repeat the experience in other location with others "partners"? How the Pueblo-Nuevo experience can be used to start or foster new PCI project? One strategy is to establish a red or partnerships with other PCI projects and organisms interested by the topic "to test the varieties in other sites and that others producers could benefit from the PN experience".
In this context, CIPRES is establishing new links and cooperation with others PCI projects. For instance, this year, a collaborating PCI project with CIAT-CIRAD has started in Palacaguina. The project focuses on sorghum. The CIPRES technician expresses that he is a little afraid as he doesn't know well producers in Palacaguina and he thinks that he is difficult to work with producers he is not familiar with. To work in other zone than the CIPRES working zone, he thinks that he would have to take producers reference from other NGOs who are used to work in this zone. Actually, the CIAT-CIRAD technician is now in charge of the project implementation on the field and the CIPRES contributes with funds (part of the CIAT-CIRAD technician and food/drink for the activities). This partnership is based on a joint funding but it doesn't include a joint implementation of the activities on the field. The CIAT-CIRAD was interested for two reasons: the "partnership" strategy; and the limited funding of the program. Actually the breeder (who is also the program leader) didn't know if the program could continue to employ the technician working on the Somoto zone. As, the CIPRES just enters in Palacaguina with another project of Food Security, the NGO is interested in collaborating with the CIRAD to start another PCI project in this zone. However, another CIPRES technician is in charge of this area and he doesn't have any experience in PCI. The one in charge of the Pueblo-Nuevo PCI project is very busy with the project, the cooperative organization and the commercialisation of the new varieties. It is difficult for him to handle the Palacaguina project. However, in the future, it will be interested that the CIAT-CIRAD and the CIPRES get involve in a joint implementation to benefit from each other experiences and to complement their abilities. Actually, this year, they are planning to implement a new collaborative PCI project in Somotillo (Chinned). It will be interesting to analyse the negotiation process and implementation of this future project.

5.4. How it influences the breeding process and outcomes

During the process, the joint learning and struggling to construct a methodology have led to a more informal process. The methodology has evolved and changed through time. Data collection is not systematic. However, the decision taking is more important at the producer level. Each producer experimenter is responsible for his experiment and takes his own decision in the parcel. The dynamic farmers seeds exchange systems lead to diffusion of material earlier and in an uncontrolled way. Thus, it is difficult to know where this new material comes from. Many of materials originally from the PCI project enter the farmer seeds system and are now considered as local (as nobody really know where they come from).

5.5. Participatory Crop Improvement processes

In this research, PCI is defined as a technology development process shaped by the interaction of social actors. The process distinguishes 5 phases: the ideotype definition, the creation of variation, the plant selection in segregating population, the selection of more stable material, and the variety selection and diffusion. Each phase is characterized by a particular configuration of participating actors. The interaction occurring between the actors shapes the technology design and outcomes in many ways. These interactions between the actors and with the technology take place in a specific context, which will also influences the all process. As explained in the theoretical framework, SPERLING et al. (2001) define variables which influence PCI processes: the agro-ecological and economic environment, the institutional context, the research objectives and the actors' goals and the type of participation. My study highlights that participation “shape” (phase and degree) depends very much on the actors-configuration in the field. This configuration occurs in the studied projects between three categories of actors which each have specific roles and functions. Moreover, as the agro-ecological and economic environment change, the institutional context changes over time. This study shows that it is very important to look at the context in which the PCI projects started. The project origin and the first steps of implementation have a major influence on the way the actors got involved and set their coordination.

Actors’ configuration

The three case studies highlight the involvement of 3 categories of actors: breeder, extension agent and producers. They are related by formal linkages such as contracts, working agreements, formal invitations to selection activities, and more informal linkages like family ties and friendship relations. In the PCI-project context, they exchange and share resources (land, work and incentives), genetic material and experiences. The individual personality, the types of linkages they have and their exchanges shape their roles and functions in the PCI process. In all three cases, there is an actor who plays an important role in the coordination of the process, making the links between breeder and producers. In each of the three cases, this “broker” is involved in different activities with producers: his link with producers is broader than the PCI activities per se. His personality is an influential feature. It is a personality that enables him to share two worlds, the producers’ one and the breeders’ one. In two of the three cases, Somoto-Ocotal case and Pueblo-Nuevo case, this role is played by the technician. In the Chinandega case, the INTA regional researcher is more in this position. The “broker” can thus be a technician, breeder or producer but he has to be. His role is essential. As ALMEKINDERS (personal communication, 2005) points it out, there seems to be the need for “champion” to make things work, i.e. somebody who is motivated and ensures the coordination among actors and the continuity of the project.

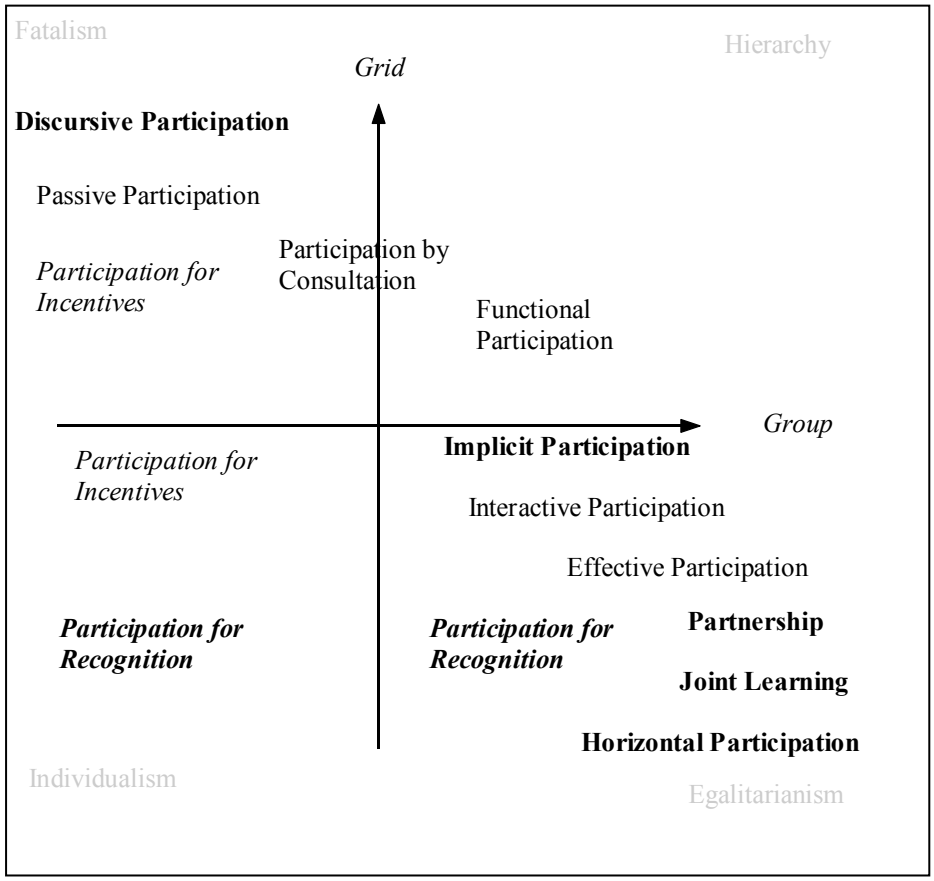


Figure 9: Participation and cultures

The context of the start of the project

The context and especially the one during the project starting phase seems to have been very important for the shape of the participation in the project. It is interesting to compare in this respect the CIPRES project in Pueblo-Nuevo with the CIAT-CIRAD project. The first project started out in a very specific locality and to respond to a very clear and urgent problem of food security due to the lack of beans varieties adapted to the locality (resistant to Golden Mosaic). The second one started out in a much broader context as they aimed to find better adapted rice and sorghum varieties for small farmers in different localities. The first project benefited from a formidable opportunity that, at this time, there were no red bean varieties resistant to Golden Mosaic. ALMEKINDERS (personal communication, 2005) emphasizes that the project could have had very different results and impacts if they had started three years later, when INTA could have developed already some better adapted resistant varieties. Had these varieties been available, it would have been more difficult to develop better varieties and farmers might have been less engaged than it has now been the case.

Actors involved in a PCI process who may have a vision to achieve a certain "participation type" have to be aware of the variables that influence the process in order to understand mechanisms which govern participation types.

5.6. Perceptions of participation

To analyse the influence of actors' perceptions of participation, the study used the Cultural Theory. Cultural Theory as described by DOUGLAS (1982) recognises that there exist in principle four different ways of social organisation: the individualist, hierarchist, egalitarian and fatalist way. Actually, according to LIMA & CASTRO (2005) "cultural theory's main tenet is that our society, like any other, uses cultural lenses—or cultural filters, or worldviews—to look at all types of phenomena, nature and the environment included, positing that there can be no culturally unmediated perception. These worldviews are a result of peoples' socialization and participation in the four main forms of current social organization." In this paragraph, I seek to link perception on participation and culture to study how these cultural lenses influence actors' perceptions of participation. The three projects that formed the case studies reflect different "ways of life" or "culture". "Culture" is shaped according to actors' values, beliefs, perceptions, expectations and social relationships among actors. I have used the grid-group diagram to position different types of participation encountered in the cases study. In the reasoning of the dynamic nature of culture, types of participation evolve and new type may emerge through time.

The Pretty's classification (PRETTY, 1995) of participation types and Mosse's concept of "effective participation" are represented in normal letters.

"***Passive participation***" can be seen as a fatalist view on participation as "people participate by being told what has been decided or has already happened and involves unilateral announcements by an administration or project management without any listening to people's responses". Decision making belongs to the project leader (high grid) who follows a routine marked by low cooperation. As THOMPSON et al. (1990) explains "fatalists feel tied and regulated by social groups they do not belong to". In this sense, project leaders follow rules and procedures defined by others groups (authority, funding agencies) and farmers follow the decisions taken by project leaders.

"***Participation by consultation***" in which "people participate by being consulted or by answering questions." It is still a top down view on participation as people are still regulated by an external group. PRETTY (1995) explains that "external agents define problems and information gathering processes, and so control analysis." However, in this type of participation, people are more active. If we change the unit of analysis and look within a hierarchic organization, this participation type is often used. Technicians are consulted for various issues, for instance, diagnostics of the area. However, the final decision stay at the upper level. In this sense, "participation by consultation" corresponds also to a hierarchic view on participation.

"***Functional participation***" is a very hierarchic view on participation as "participation is seen by external agencies as a means to achieve project goals, especially reduced costs." (PRETTY, 1995) In this case, the project leader use participation to achieve the project objectives. People, or actors, are involved in an interactive way, and share decisions-making. However, the major decisions are often taken at the upper level of the organization or by external agencies.

In "***interactive participation***", "people participate in joint analysis, development of action plans and formation or strengthening of local institutions. Participation is seen as a right, not just the means to achieve project goals. The process involves interdisciplinary methodologies that seek multiple perspectives and make use of systemic and structured learning processes. As groups take control over local decisions and determine how available resources are used, so they have a stake in maintaining structures or practices." (PRETTY, 1995) This can be interpreted as an egalitarian form of participation which strengthens equal power relationship among actors and actors' right to participate. Multiple perspectives and knowledge are involved as in egalitarian structure, "decision-making involve most of the members." (THOMPSON et al., 1990)

"***Effective participation***" is also be seen as an egalitarian view on participation. MOSSE (1996) highlights that an "effective" participation conveys some inter-related ideals: joint information generation and analysis, increased control of information and responsibilities for decision making and action by local groups, adoption of choices which respond to diverse perspective and local needs, acquisition of knowledge and skills, establishment of forms of organisation necessary to mobilise resources, implement sustainable changes in local resource systems and to take independent initiatives in the future. This type of participation involves "high participatory structure" which characterizes egalitarian organizational structures (THOMPSON et al., 1990).

The types of participation that I have found in the field by analyzing the three cases of this study are labeled and added in bold letters in the diagram.

"***Discursive participation***" is used by institutions in a discourse to get funding or support by others institution. In this context, "participation" is a word that opens doors (to get funding from donors), but the actors who use it in this very "fatalist" form don't really believe in its implementation on the field. In this sense it is part of "manipulative participation" of Pretty, in which "participation is only a pretence". According to PRETTY (1995), "manipulative participation" is characterized by "people's representatives on official boards are unelected and have no power".

"***Implicit participation***" is implemented on the field by local actors but in a kind of "hidden" or invisible way, as in this case "participation" is not well accepted by the group and might actually "close some doors" if it is made more explicit or visible. This may be because participatory processes are not recognized by the institution or the rest of the group or because the actors themselves reject the idea of "participation". The producers have an influence on the selection criteria and breeder decisions by informal exchanges and chats. The degree of influence varies according to the actors' personality, relationship and exchanges. I choose to place it in the egalitarian quarter, as the process occurs by informal chats and negotiation between the actors. However, hierarchy has an important role in the process as it might be the cause of inhibition to express and name what is actually going on. This participation type generally occurs in case of "culture clash" (see 6.3) between the institution and the individual actor . Hybridation among opposed cultures occurs when there is enough space created, individual express in this case a hybrid culture influenced by different group cultures.

"***Horizontal participation***" was a term that was mentioned by actors involved in the program "Farmers-to-Farmers". The "horizontal participation" here refers to the type of actors involved. In our case, only producers were involved and they learn from each other's experiences. It correspond to an egalitarian view of participation, as the actors involve in the process involve most of group members who are considered as equal and learn from each other. This participation type focuses on the group and tends to exclude participation from other groups.

"***Joint learning***" corresponds to a part of the whole concept of participation. Processes of joint learning are mentioned in "interactive" and "effective" participation. However, when actors in the field, especially in Pueblo Nuevo, describe the process they talk mainly about "joint learning". I therefore decided to consider it as a participation type and include it in the egalitarian quarter of the diagram.

"***Partnership***", defined as "the whole of formal links in which actors are engaged to federate the means around projects and programs build together to reach common objectives" (LINDENPERG ,1999) points joint construction and implementation. This definition is quite close the one of "effective participation". "Partnership" corresponds to an egalitarian view of participation.

The grid-group framework allows to differentiate among many participation types and how they are rooted in actors' perceptions and cultures. However, it is interesting to note that according to the point of view and the unit of analysis chosen to analyse the situation, some concepts can be located in different quarters. For instance, it is difficult to decide where to position the two participation types (in normal italic), "participation for incentives" and " participation for recognition".

"***Participation for material incentives***" is defined by PRETTY (1995) as "people participating by contributing resources, for example, labour, in return for food, cash or other material incentives." My definition of this type of participation differs from Pretty's one. Pretty's definition has two components: *farmers' contribution* described as "farmers may provide the fields and labour, but are involved in neither experimentation nor the process of learning" (PRETTY, 1995) and *incentives* given by the project to motivate farmers' contribution. However, I think that these two components may be separated. I would rather call the first one "*participation by material contributions*" in which farmers participate providing field and labour but are not involve in the experimentation. This type corresponds

to some experiments of the formal system of INTA: INTA rents land to farmers to establish experiments. This process is not called "participation" in the field, so I choose to not represent it in the diagram. The second component actually corresponds to what I call "***participation for incentives***". In this case, farmers participate in order to have access to material incentives as food or cash. Considering now this type of participation, and focusing on project leaders' point of view, "participation for incentives" correspond to a fatalist view of participation as it represents the implementation of a very strategic way of getting to people involved. Project leaders distrust farmers' motivation and ability to participate in the process and use material incentives to make farmers cooperate as they need farmers involvement to achieve their own specific objectives. Focusing now on farmers' point of view, "participation for incentives" corresponds to a individualist view of participation as farmers participate in order to personal material gain. It fits a market strategy in which you can "buy" farmers participation.

"***Participation for recognition***" is a process that I discovered on the field. Nicaraguan farmers are proud (positive sense of the term). They really enjoy the fact that technicians, breeders and foreigners come to visit them and are interested by the work they are doing, they like to show them that "they are able to select varieties". In this context, some farmers participate to gain personal recognition from breeders, technicians and others producers, to show that "they are able to do it". It represents an individualist view of participation, as producers participate for an individual and personal interest. However, it implies "recognition from others" within the group or from others groups. So, by changing the unit of analysis to the individual from the group influence the location of the concept in the grid-group diagram. Considering "participation for recognition" in a broader context, this participation type correspond to a more group-oriented quarter (high group, low grid), as the aim is recognition from the group and for the group.

The types of participation presented above are only some examples of processes that occur on the field. In the reality, one cannot label a participatory process with only one type of participation as many factors are involved and participatory processes involve many different actors. Participatory processes generally involve different types of participation. And as the relation between the actors develops over time the type of participation co-evolves. Moreover, as cultures are dynamics and participation is embedded in actors cultures, new forms of participation emerge constantly.

5.7. Cultures of Institutions and Individuals

In this research, the Cultural Theory is used to map actors' cultures, according to their values, believes and expectations. Hood (1998) argues that organizational forms reflect those cultures by the actors' interaction and the creation of a shared culture. However, I observed in the field that local actors often act according to a culture that is the opposite from the institutional one. I call this phenomenon "behavioural culture clash". This brings up the question how actors from the same organisation with so different cultures can be bound in a shared same structure (i.e. one that may be envisioned in a partnership)? And how do they deal and adapt to "culture clashes" in such a way that the organizational form will still be viable?

My hypothesis is that individual cultures are the result of individual actors dealing with different cultures. Actually, many authors talk about cultures in terms of collective processes and inherent to a group. However, individuals are part of different groups that may

have different cultures. Thus, they will develop and express their own personal culture according to their personality and how they relate to the different groups they belong to.

Considering an "egalitarian" organizational form (defined by high "group" and low "grid" dimensions), presumably, actors have a strong feeling of being part of the group and their behaviour is influenced by the group culture. As the grid dimension ("how should I behave?") is low, the culture of each individual actor has relatively more space to be expressed. In this case, "culture clashes" appear when individuals are exalted by the group effect and the feeling of being together, then they over-take their own ideals and objectives as shared by the all group. In a certain way, some individuals' objectives become group objectives without explicit agreement from the group. The others members of the group seek to avoid conflicting situations which could put the group in danger. In this case, two scenarios are possible. For example, the others agree to respect the "egalitarian" form and the well-being of the group, but they may stay passive and are not intensively involved in achieving the defined objective. Another scenario is for example when they misunderstand the defined objectives and overreact in favour of it, as a result of the group dynamic. For instance, the "Local variety improvement" project of UNAG is focusing on local varieties and "criolla" varieties. The UNAG position is also one that opposes GMOs. Some actors in the field do not really understand what exactly are GMOs and see plant breeding and biotechnology as the same thing. As the group culture reject biotechnology, they overact and reject plant breeding also.

In an "hierarchical" organization form (defined by high "group" and high "grid" dimensions), individual behaviour is regulated for the safety of the group coherence. "Culture clashes" occur when individuals do not follow the rules or the orientation lines but in front of the authority they will act as if they follow it. This phenomenon can be illustrated with the "implicit participation". "Participation" is not recognised by the organization. However, individuals at the local level believe in participation and take into account producers' opinions in an informal way.

Interacting individuals create organizational form with a specific type of culture. However, they also need to express their individual culture and they are able to do so without putting the structure viability in danger. Organizational form has to be seen as a system in constant interaction and evolution. Individuals' culture might be influenced by the institutional culture but in the field this does not necessarily completely overrule their own personal culture. Individuals express their own culture within the institution, individuals and institutions cultures can be the same or opposite. If the different cultural interactions can be kept in balance, than the system is viable. If there is no balance, it may be assumed that either the person leaves or the institution evolves to another organizational form.

Individuals in a group express different cultures. Individuals' cultures emerge from personal experiences and involvement in different groups and relationship with others culture, as culture is collectively build. Moreover, to deal with contrasting cultures, individuals act and play different roles according to the others actors with who they interact. In this sense, it is difficult to grasp individuals cultures as differences between what actors want, what they say they want and what they actually do will continuously emerge and evolve, depending with whom they interact. It is also interested to note that if we map individual actors' cultures in the Grid Group, the diagram positions will change according to what of these three parameters we choose as unit of analysis.

Coordination between Institutions and between Individuals:

The study indicates that institutions with opposite cultures have difficulties to communicate and coordinate their activities. These difficulties may be the result of different preferential forms of communication associated with the respective cultures or because two opposite cultural types will reject each other.

Actors use formal and informal communication everyday, but a particular culture may have preferences for one or another form. For instance, an "egalitarian" one would prefer informal communication, while an "hierarchy" would prefer formal communication. For example, considering the invitation to an event, the "egalitarians" make more use of oral invitations and the inviter will not necessarily invite each participant personally; he can let the responsibilities to do so to others. For the "hierarchists", a written invitation signed by the responsible of the event and his superior will be send by post mail to each participant. If actors with different cultures are aware of these discrepancies, they adapt naturally their forms of communication to contact and communicate more efficiently with others groups and cultures. Moreover, as the differences in reality are not so sharp, a "way of life" type (fatalist, hierarchist, individualist or egalitarian) may have different degree of "grid" and "group. For instance, producers' communities may have different degrees of hierarchy. In comparison to a national institution, we therefore locate them in the "egalitarian" quarter and we may be tempted to think that they respond well to informal communication. However, the CIAT-CIRAD technician noticed that in some communities, he has to personally invite each producer while in others community, all producers could be in charge of it. In some other cases, he couldn't let the responsibility of invitations to other producers. He could not explain why, but the community will always respond to the invitations of some specific producers (not necessarily the leaders) while the same community may not respond if the invitation came from others. The general type of culture influences the way of communication but each group can also have some specific rules which differentiates them from others groups of the same culture. In the field, actors' experiences in dealing with different cultural groups is important to find efficient ways of communication with groups.

Groups with contrasting cultures tend to reject each other. HOOD explained this phenomenon in the Art of the State (1998): "ways of life tend to go out into the corners because each way of life constitutes a reaction against the disliked alternatives." This phenomenon is illustrated by the way actors from UNAG, an "egalitarian" organisation tends to reject INTA, which represent a very "hierarchical" form. The two institutions are driven by completely different believes, perceptions and ideals. The coordination between the two institutions is then more difficult because the institutional actors are just not willing to coordinate activities. However, within the UNAG, some groups decided to embark on more market-oriented strategies and are collaborating with INTA. Their culture as a sub-group may differ from the general UNAG culture, however they are still considered as an "egalitarian" group. Considering collaboration/partnership between groups, I think that the strategy to achieve specific objectives has also to be considered. Two groups may have opposite cultures but can collaborate because they think that they will achieve their own objective through this collaboration.

The linkages between individuals of different institutions are crucial in the institutional coordination. In the field, I noticed that the world of "Agricultural development" and "Farmers Investigation" in Nicaragua is a small world, as the actors involved in the different institutions knew the actors from others institutions working in the same field quite well. They knew them as friends, relatives or because of former working experiences. However, surprisingly, these linkages do not always make the institutional coordination easier. The reason could be that coordinating punctual activities or service exchanges in the field between individual actors is so easy due to these linkages that it doesn't need the involvement of the whole institution. In occasions when some coordination involves the institutions, the process become more difficult and the actors are not so willing to engage. That is why it can be important to negotiate at the beginning with the institutional coordinator to get an official working agreement and a space to act for the technicians on the ground. Later on, communication can be established directly with the local technicians who will actually follow up the experiments on the field. However, if you have a strong project established on the ground, you may want to go for the reverse strategy: first show success on the ground as a "pilot project" and then try to convince the institutional coordinators.

5.8. Implications for PB processes and outcomes

Comparing the CIAT-CIRAD strategy with the CIPRES strategy allows an analysis of the influence of "cultures" and perceptions of participation on plant breeding processes and outcomes.

Talking about institutional context and institutional culture, the CIAT-CIRAD is an international organization that wants to build "partnership" to ensure the program continuity in the long term. They need "partners" to engage in an active way and handle the project as their own project. They work at the national level in different locations and with different partners. Scaling-up is an important process for CIAT and CIRAD. Moreover, .material which is not well-adapted to one site (because of environmental and human conditions) might a very good potential for another site. In contrast, CIPRES is a local NGO that focuses on food security and strengthening their actions at the local level. Because CIPRES has different objectives and "cultures", the process they set up differs from the CIAT CIRAD program.

The project origin and how it started influences the over-all process. The CIAT-CIRAD research team started the implementation of PCI projects in Nicaragua with already some experiences in this topic and had an idea of a methodology they would try out and implement. They proposed to potential "partners" if they were interested in participating in the implementation of such methodology. While in the case of CIPRES, there was no clear idea on how to implement a PCI project, it was completely new for them. So, they had to construct this methodology with the actors involved and they proposed the "partners" to develop such a methodology together. The CIPRES way demands more engagement of the actors. Even if, at the beginning, farmers and technicians were "lost" because they didn't know about plant breeding, they had to struggle to implement their own way of doing it. The actors were not thinking in terms of "partnership". However, the process of struggling to construct a methodology made them realize that they needed each other to achieve their objectives, they learned to respect each other expertises and how to work together. Finally, they ended up being "partners".

In terms of working strategy, the CIAT-CIRAD choose to start with PVS (Participatory Variety Selection) experiments. PVS is a type of experiment that can quickly yield results as farmers select between stable materials. They are able to find a variety which meets their demand in 1 or 2 crop cycles. Beginning with PVS allowed actors to engage in an easier and shorter process. They learned how to experiment and PVS experiments may have awakened their curiosity for plant breeding. The research team initiated PPB (Participatory Plant Breeding) experiments when the "partners" expressed the willing or need to do so. In the other case, CIPRES engaged directly in PPB, as their first aim was to work with local varieties and to cross them with improved varieties in order to create varieties with characteristics close to the local ones and resistant to Golden Mosaic Virus. This process is more difficult and as the farmers explained, the first cycles were very disappointing. Some farmers decided to stop. However, the ones who stay were the most motivated and interested in the project. They wanted to succeed and show that they were able to create new varieties. By making this choice, they developed a strong feeling of ownership toward the project and the experiments. From this can be concluded that PVS allow easier farmers' involvement in a first step, however PPB fosters a stronger feeling of ownership.

Considering the different methodologies it is clear that he CIAT-CIRAD methodology is well defined and comprises different steps: preparation of the experiments, sowing, monitoring, evaluation and selection, harvest, post-harvest activities, data processing and restitution and planning. The roles and functions of actors in each of these steps are defined with the actors in the field. Some of these activities are done at the individuals levels (like sowing, data collection, monitoring of the experiment…), others at the group level (like selection activities and restitution and planning meeting). Methodological steps in the CIPRES case are less defined. The methodology changed over the time and even over the crop cycle (sometimes, individuals selection, sometimes, group selection). The activities and meetings were planned with the actors when they felt the need to do it. As a consequence, the process is less structured and systematic. The process is also more informal, as actors meet often in casual occasions or for other purposes than the PCI process, they exchange and take decisions "on the spot".

In terms of outputs and dynamics, both types of projects will result in improved farmers' access to varieties adapted to the area and meeting their needs and demands, and in farmers' capacity building. The CIAT-CIRAD projects generate more research data, especially on the varieties tested and material developed. These projects also have a broader impact, as they work in 7 sites. The CIPRES project, focusing on one area, strengthens its impact in this area. Producer-experimenters, actively involved in the whole process of variety creation are nowadays more independent and feel able to repeat the process alone (although they recognise they still need a source of segregating genetic material to start the selection process - a reason why some farmers insist in their wish to learn to make crosses). From the CIPRES project, as it is older, already liberated two new varieties have emerged. Moreover, due to the informality of the process, stable materials have diffused earlier in the process, without been liberated. Farmers' seeds exchanges systems favour the rapid diffusion of planting material in the area. As the general objective is food security, the actors involved in the project consider this "uncontrolled" diffusion of material is a favourable occurrence. In contrast, the CIAT-CIRAD actors like to control the diffusion of materials originally from the PCI project, as it is a result of the whole process.

Each PCI process is unique as it depends from the individuals implementing it on the field. The context, institutional and individual cultures shapes shape the research and actors strategy and methodology. As consequences, the outputs are also different.

6. Conclusion

Participatory Crop Improvement as a technology development process shaped by the interaction of social actors is influenced by agroecological environment, economic environment, institutional context, project historical context and the institutional and individuals cultures. Those cultures reflecting actors values, believes and perceptions shape actors' objectives and the way they interact in the field. Culture is not stable and evolves over time. Some will argue therefore that the use of the Grid-Groups diagram as a tool to differentiate different culture types is too static and does ignore the dynamic nature of culture. However, it was helpful in this study to highlight some of these dynamics such as "culture clashes" and the expression of individuals cultures versus institutional cultures.

PCI processes imply coordination of activities between actors in the field. Formal linkages are set up between institutions in the form of contracts and agreements to ensure that the institutions agree on the implementation of a collaborative PCI project. However, the real on the ground and day-to-day coordination occurs between the individuals at the local level. Their personality and culture and the way they relate to each other through the formal or informal linkages are crucial for the coordination process. That is why each project or case is different and it is difficult to give general recommendations for improving participation. Moreover, participation type will also depend on institutions' and individuals' objectives and agendas. The first step is to understand these objectives and agendas to know what types of participation are the most desirable for the project.

If the aim is "effective" participation, some actions are important to foster the participatory process, such as:

- Multiple opportunities for actors to meet and exchange experience in formal and informal activities in order to foster confidence between actors and commitment in the project. Actors have to feel that they work together on the project.
- Focusing on practical and theoretical training for farmers and technicians to foster active participation and involvement in the decision making process. If they don't really understand plant-breeding processes, they will just agree to what the breeder decides. This limits 'joint learning' and therewith the development of partnership.
- Fostering "partners' ownership" toward the project. It is difficult to feel ownership toward a project elaborated by somebody else. At the beginning of the collaboration or "partnership", the project leader has to allow time for the others actors to appropriate the project. Activities like jointly creating a work plan might be useful.

Knowing partners' agendas is also helpful to understand how actors set their priorities and integrate PCI activities in these agendas.

These actions are easier to implement in small scale processes. Actually, I think that small scale processes facilitate "effective" participation. It is easier for the actors involved in the project to get to know each other. Focusing on some local areas allows to spend more time and resources (for trainings and exchanges activities) more concentrated. It also reduces costs (especially transport cost).

"Effective" participation is fostered by "intensive" partnership in which a limited numbers of partners are involved and focus on a small area. It may however be an "extensive" partnership where the objective is the involvement of a larger number of farmers or farmer groups, where the PCI has the form of PVS and data collection over sites is relevant.

If the aim is “effective” partnership, the focus is on strengthening formal and informal linkages among partners. However, what to understand with effective partnership is not straightforward and depends on the situation. The project leader or the partners (in a joint process) have to find a just balance between partners’ involvement, the number of sites/experiments and the project resources (material, financial and human). “Extensive” partnership, less expensive, is more cost-effective. As it involves more partners, the tie among them is less strong. The key point for the actors involved in such partnership is to accept the different degree of involvement and commitment to the project. To ensure the sustainability of such partnership, partners have to be clear about their perceptions of PCI and participation, the degree to which they are willing to engage and their roles in the project (decision-making and implementation). Sharing the costs and the responsibilities toward the project seems to strengthen the partnership. However, these issues have to be clearly discussed at the start of the project and have to be continuously revised as the project progresses. Each partner has to take his responsibility (what they agreed with the others partners) in the implementation of the project. The danger is that the project leader takes most on the responsibility of the project. In this case, the others partners may remain passive as they think that, anyway, if they don’t ensure what they have planned to do, the project leader will do it.

“Partnership” (intensive or extensive) at the institutional level is needed for general coordination agreements and funding negotiation. At the individual level, local actors have to feel ownership toward the project to engage in a partnership. In this sense, individuals partnership and ownership are generally small-scale processes, strongly dependent on the type of persons involved. Moreover, ownership feeling in a PCI project is fostered by participation in methodology development and working with segregating materials. Actually, in this sense, PPB is more engaging for actors and is used in small scale processes. PVS, however, seems to be fostering more variety diffusion, allows getting results on a shorter term, and less training is needed and it is easier to scale up. The two processes are complementary. However, to ensure a strong partnership at the local level, it is important to focus on small processes and informal actors exchanges. When strong coordination component (i.e. a brokering actor) is available, a larger scale process with less intense partnerships can be an effective form of farmer participation in a breeding program as well

Forms of participation and partnership are embedded in actors cultures. As culture, participation and partnership are dynamic processes. They evolve according to environmental, institutional and human factors. Partnership also needs to mature in order to be more effective. Partners need time to get to know each other, realize that they need each other to achieve their objectives and learn how to work in close collaboration.

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