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Farmers' Experiments - The Farmers' View

Farmers' perceptions of implicit and explicit experimentation, exemplified on two research areas in rural Cuba

Diploma thesis
Diplomarbeit

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Dedicated to my grandmothers

Preface

This thesis was done within the framework of the research project “Organic Farmers’ Experiments – Learning Local Knowledge” at the Division of Organic Farming of the University of Natural Resources and Applied Life Sciences, Vienna, funded by the Austrian Science Funds (FWF) and scheduled for two years (2006 to 2008).

The emergence of the organic farming movement has highlighted the process of farmers’ innovation because organic farming systems were first of all developed and brought forward by pioneer farmers. These farmers had to rely on their own ideas, inventions and learning experiences, since there were no formal structures and scientific expertise to support their agricultural development. By doing so, they often re-discovered traditional knowledge and farming techniques. The research project wants to explore and compare the process of organic farmers’ experimentation in three countries of interest, Austria, Cuba and Israel, which dispose of strongly differing agricultural backgrounds and basic conditions.

The project is supervised by Christian Vogl, the project proposal stems from Racheli Ninio and Christian Vogl. Racheli Ninio works on the process of farmers’ experimentation in Israel. Susanne Kummer conducts field work in Austria and Friedrich Leitgeb is responsible for data collection in Cuba. Apart from these three investigations, which cumulate in the researchers’ doctoral theses, two Master theses were performed. Elena Sanz Soro and the author of this study did field work in Cuba.

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To my parents and my brother, for their loving and support in all purpose.

To Alex.

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Used abbreviations

ACAO	Cuban Association of Organic Agriculture *Associación Cubana de Agricultura Orgánica*
ACTAF	Cuban Agricultural and Forestry Technicians Association *Asociación Cubana de Tecnicos Agrícolas y Forestales*
ANAP	National Association of Small Farmers *Associación Nacional de Agricultores Pequeños*
BOKU	University of Natural Resources and Applied Life Sciences, Vienna *Universität für Bodenkultur Wien*
CCS	Credit and Service Cooperative *Cooperativas de Créditos y Servicios*
CPA	Agricultural Production Cooperative *Cooperativas de Producción Agropecuaria*
CREE	Centres for the Reproduction of Entomophages and Enteropathogens *Centros de Reproducción de Entomófagos y Enteropathógenos*
EEPFIH	Experimental Station of Pastures and Forages “Indio Hatuey”, University of Matanzas “Camilo Cienfuegos” *Estación de Pastos y Forrajes “Indio Hatuey”, Universidad de Matanzas “Camilo Cienfuegos”*
FP	Participatory Plant Breeding *Fitomejoramiento Participativo*
FWF	Austrian Science Funds (*Fonds zur Förderung wissenschaftlicher Forschung*)
GENT	State farms of the new type *Granjas estatales de Nuevo Tipo*
ICA	Institute of Animal Sciences *Instituto de Ciencia Animal*
IIHLD	Liliana Dimitrova Horticultural Research Institute *Instituto de Investigaciones Hortícolas Liliana Dimitrova*
INCA	National Institute of Agricultural Sciences *Instituto Nacional de Ciencias Agrícolas*
MINAGRI	Ministry of Agriculture *Ministerio de la Agricultura*
MINAZ	Ministry of Sugar *Ministerio del Azúcar*
UBPC	Basic Units of Cooperative Production *Unidades Básicas de Producción Cooperativa*

1. Introduction

„To date scientists have little understanding of farmers' own experimental processes." (Sheperd, 1998, p. 193)

Attention to farmers' experiments is growing only slowly in the scientific agricultural community. However, farmers have developed agricultural practices without the contributions of modern science and research institutions for thousands of years (Hoffmann et al., 2007). Since then, farming has been part of human culture and its practices have been constantly developed by the farming population. The ongoing process of agricultural evolution has lasted for centuries through the means of farmers' experimentation, adaptation and innovation, embedded in the farmers' local knowledge on specific farming sites, conditions and practices (Saad, 2002).

Although several historians and cultural anthropologists highlighted the importance of experimentation and innovation in agrarian livelihoods since the Neolithic Revolution, because of its contribution to agricultural, and by that also to societal, development (Rhoades, 1989), it was not incorporated in agricultural research up to recently. Commonly, researchers did not understand or even accept that farmers were experimenters. Farmers were seen as conservative and bound to tradition, simply adopting new technologies, developed by researchers (Pretty, 1995).

Within the last few decades, the view on farmers and on farmers' experiments has changed. Especially within development contexts, where agricultural extensionism programmes are linked to rural people's empowerment, farmers' active contribution in the generation of knowledge has become accredited (Sheperd, 1998). The acknowledgement of farmers' potential to experiment currently cumulates in vast literature on participatory research programmes, actively implementing farmers' experimentation processes (Hoffmann et al., 2007). If by doing so a scientific logic is imposed on farmers, or local experimentation processes are complemented, is under discussion (Saad, 2002).

The researcher of this study has to admit that despite several years of education in agricultural sciences she did not recognize the experimental nature of farmers' work either. In lectures on local knowledge by Christian Vogl she realized the potential of informal knowledge creation and the challenges imposed by its unconscious character. Finally, the research-project on organic farmers' experiments offered the opportunity to work in-depth on these insights. Due to the fluent language skills in Spanish, she chose Cuba as country of interest and conducted a field study for four months there.

Cuba offers a fertile ground of innovativeness in search for new methods of farming due to the economic crisis it suffered after the fall of the Soviet Union block. Because of the lack of import of food stuff as well as chemical agricultural inputs, Cuban food security became severely threatened and its agricultural system encountered great challenges (Nieto and Delgado, 2002). By necessity, farmers and also people with non-agricultural background had to innovate in order to secure their food and income. Alternative technologies, geared towards an agro-ecological production system, emerged (Funes-Monzote, 2006). Also a programme of Participatory Plant Breeding has been implemented by the National Institute of Agricultural Sciences (INCA), which provided the basis for research contacts for this study.

Whereas the amount of literature concerning scientists' interpretations and applications of farmers' experiments is increasing, explorations of the farmers' view points remain scarce. This thesis focuses on the farmers' perception of their own experimental processes and analyses to what extent experimentation is done actively in a planned manner or "by default" as part of the farming process.

2. State of the art

After defining some concepts related to farmers' experiments, the different approaches towards farmers' experimental processes found in literature are presented. These provide the basis to understand the perception of farmers' experiments, by scientists and by the farmers themselves. By that, communication and knowledge transmission on experimental processes play an important role.

2.1. Related Concepts and definitions

2.1.1. Local knowledge/Indigenous knowledge and farmers' experiments

Traditional farming practices have *"developed a wide range of site-specific technologies embedded in the culture of people in a certain area. Indigenous knowledge is the actual knowledge of a certain farming population which reflects the experiences based on traditions and includes more recent experiences with modern technologies.[…] It is not static. […] This knowledge should not be treated as something that could be collected, frozen in models or expert systems, stored for future use by scientists, or as something that could be easily transplanted to other regions. Such knowledge is generated and continues to develop in specific cultural and ecological systems and cannot be seen independent on these systems"* (Haverkort, 1995, p. 454-455).

In literature different concepts referring to context-specific knowledge can be found, for example local knowledge (Antweiler, 1995), traditional ecological knowledge (Berkes, 1993), tacit knowledge (Hoffmann et al, 2007), indigenous knowledge (Haverkort, 1995, or Lalonde, 1993) or indigenous agricultural knowledge systems (Slikkerveer, 1994). Whilst these concepts focus on different aspects, e.g. site-specificity, ecological cognition, implicit characteristics or maintenance by indigenous people, they share the recognition of experiential knowledge, which is part of everyday life, bound to its context and highly dynamic. In this study the expression "local knowledge" (Antweiler, 1995) is used.

With the emergence of the concept of local knowledge, farmers' experimentation gains appreciation and receives growing interest. From this perspective, the view on farmers has changed. They are not longer seen as passive recipients of scientifically developed technology and inventions, but as active agents who take conscious decisions in their farming activities and who are knowledgeable about the processes on their farm and its environment (Sumberg and Okali, 1997). Farmers' experiments play an important role in the "practical knowledge" sphere where it is part of an ongoing learning and experimentation process in the daily life of every farmer (Antweiler, 1995). A broad range of experiments can take place: small adaptations made due to changing environments, adaptations of new technologies received from outside to make them fit the individual farming conditions (Sumberg and Okali, 2003) or completely new technologies, developed by inventive farmers (Rhoades, 1989).

2.1.2. Local innovation and farmers' experiments

Innovation is one of the key terms in recent scientific discourses, closely connected to farmers' experimentation. It is often linked to rural development and improvement of livelihoods for rural people (for examples see Araya, 2006; Gupta et al., 1997; Waters-Bayer et al., 2007; and Wu and Pretty, 2004). Generally, innovations are considered as outcomes of experimental processes:

"An innovation can be a new material or tool (e.g. seed, hand pump etc) or a new way of doing something (e.g. crop rotation). The novelty need not be new to the world, nor to science but new to the contexts where they are being used. Thus a farmer who is for the first time using a new land preparation method, crop rotation, crop variety etc. is an innovator. Experimentation is the process by which the innovator generates, tests and evaluates an innovation." (Saad, 2002, p. 5-6)

However, not all experiments result in innovations. Ninio and Vogl (2006) classified the possible outcomes of experimental processes into adaptations, local innovations, inventions and failures. In some literature, the terms innovation and experimentation might be used jointly, leading to misunderstandings and confusion. In this study, the focus lies on farmers' experiments, understood as a process, of which innovations can be a possible outcome. The exploration of innovations as such is not the purpose of this study.

2.1.3. Definition of the term "experiment"

According to the Webster's Online Dictionary (2008), an experiment can be defined in the following ways ways:

1. The act of conducting a controlled test or investigation.

2. The testing of an idea; "it was an experiment in living"; "not all experimentation is done in laboratories".

3. A venture at something new or different; "as an experiment he decided to grow a beard".

While point 1 refers to a classic point of view on experiments in the field of natural sciences, point 2 and 3 express a broader understanding of the term "experiment", which can be used in social sciences or even colloquial language. These different points of view become also influential in a scientific discourse on farmers' experiments. Eventually, the identification of farmers' experiments and local innovators may vary according to the researchers' perception and definition of experimentation (Saad, 2002).

2.2. Scientific approaches towards farmers' experiments

Two different approaches towards farmers' experiments can be found in scientific literature:

- A basic research approach, oriented towards the genuine understanding of farmers' experimentation processes,
- And an applied research approach, seeking to promote farmers' experimentation as a means to drive forward agricultural development.

2.2.1. Basic research approach

„My purpose […] is to […] demonstrate […] the existence both of a high degree of individual diversity in the practice of traditional agriculture and of systematic experimentation with new and exotic agricultural factors in traditional societies." (Johnson, 1972, p. 149)

A basic research oriented approach understands farmers' experiments as implicit part of farming activities and farmers' life throughout agrarian history, which have been neglected up to now. The anthropologist Johnson (1972) was one of the first who challenged the image of conservative static farmers by arguing that *"experimentation is probably as natural as conformity in traditional communities"* (ibid, p. 156) and by highlighting a high degree of individual diversity in the practice of traditional agriculture. Also Chambers (1999) criticized the lack of recognition of the role of experimentation in local people's knowledge. *"Perhaps the least recognized aspect of rural people's knowledge is its experimental nature"* (ibid, p. 91). Despites, experimentation, screening and integration of knowledge are constant farming activities, as normal as tilling of the soil (Haverkort, 1995).

In their study on Peruvian farmers experimenting with potato varieties, Rhoades and Bebbington (1999) offer empirical evidence that farmers' propensity to conduct experiments is almost ubiquitous and irrepressible. Still, they argue that experimentation has to be seen as part of a broader process of agricultural change: *"Experiments are the*

seeds of change but they are not the final harvest" (ibid, p. 305). Sumberg and Okali (1997) conducted an extensive study on farmers' experiments in Africa and concluded that farmers' experimentation is widespread and an important part of everyday farming. It leads primarily to small adaptations of farming practices because farmers are involved in on-going processes of local knowledge creation through site-specific learning. In the long term, this contributes to the development of new farming systems.

Saad (2002) explicitly excludes literature on participatory research from her literature review on farmers' experimentation and focuses on experiments as part of local knowledge creation. In her view, first it has to be understood, how farmer processes of experimentation and innovation work, before scientific attempts to foster farmers' innovativeness can be made. It may result more fruitful, to support processes that are already present in rural communities instead of replacing them with scientific procedures. Also Hoffmann (et al., 2007) claims more openness towards farmers' informal experiments, occurring in day-to-day practice like a life-long longitudinal case study, by those supporting farmers' experimentation. Finally, the research project, this thesis is embedded in, highlights the lack of comprehension of how farmers carry out their experiments and concentrates on the understanding of farmers' genuine experimentation processes and their influencing factors (Ninio and Vogl, 2006).

2.2.2. Applied research approach

„Through a process of small-scale experimentation, farmers anywhere can develop and adapt new technologies that will carry their production on to steadily higher levels and by learning to become teachers of these new technologies, they can spread them throughout the programme area and beyond." (Bunch 1998, p. 56)

A more practically oriented approach stresses the need of stimulation and active support for farmers' experiments in order to drive forward agricultural development and progress. In this applied research context, farmers' experiments are seen as methodology to achieve better cooperation between researchers and farmers and are often linked to participatory programmes and a social development agenda, especially in so-called developing countries (Sumberg & Okali, 1997). Farmers' experiments are seen as a tool to generate locally adapted technological alternatives in farming, which has to be taught and promoted by extensionists (Triomphe, 1998).

Examples for cooperation between scientists, extensionists and farmers in the implementation of farmers' experiments are wide-spread and range from research-driven to farmer-driven experimental processes (Saad, 2002). Lopez and Bunch (2000) describe the incorporation of farmers' experiments into basic and adaptive research practiced in Central America. Farmer experimenters are seen as the key link between researchers and a local farming community and as promoters of new technologies. Also Connell (1990) describes the enhancing effect of making farmers' active experimentation part of the extension programme in the case of wheat production in Thailand. Teaching farmers in small-scale experimentation, including the use of scientific experimental designs, in order to achieve self-sustained systems of developing and disseminating new technology is found as valuable methodology (Bunch, 1998; Ruddell and Beingolea, 1995). Yet, farmers' experiments can also be understood as a basis for further scientific investigation (Box, 1998). In his research on cassava in the Dominican Republic Box (1998) observed trials by researchers and farmers to be aimed at different objectives with results that were not verifiable by the other party. Therefore, better interaction between farmer and scientist networks has to be created.

Especially participatory research projects often seek technology adaptation and dissemination via the encouragement of farmers' experiments (for examples see Aguilar, s.a.; Arevalo, 2006; Bunch, 2002; and Bruce et al., 2004). Above all, in participatory plant breeding programmes farmers' experiments have found application as research

methodology (Belay et al, 2005; Hocdé, 2006; Misiko et al, 2008; Witcombe et al, 2005). Also in Cuba, a participatory plant breeding project is implemented (section 5.1.4).

2.3. Perception of farmers' experiments by scientists

Since the 1990s, literature on farmers' experimentation processes has been increasing and various agronomists have laid out their view on farmers' experiments. Two strands in the discussion can be observed: While one opinion outlines farmers' experiments as rather analytical problem-oriented process, the other view highlights the variety of triggers for experimentation, going beyond a linear rationale.

2.3.1. Farmers' experiments as analytical undertakings

„ […] farmer's experiments are largely planned and purposeful undertakings." (Sumberg & Okali, 1997, p. 152)

„Para un agricultor, experimentar es solucionar un problema." ("For a farmer, experimenting means solving a problem." Hocdé, 1998, p. 30)

Farmers do actively take part in the production of knowledge. Therefore, their experiments are conscious decisions and processes geared towards problem-solution or observable results, e.g. better crop performance or livestock improvement (Mudege, 2005). Sumberg and Okali (1997) found that farmers' experiments share many characteristics with formal agronomic experimentation such as control groups, repetition or trial plots. Nevertheless, they see no need to bring farmers' experimentation processes more in line with formal research methods. Instead, farmers have to be provided with "raw material" that they can incorporate in their ongoing farming and experimental activities. The responsibilities for making new technologies work, in the sense of final specification and adaptation, must rest with the farmers themselves (Sumberg and Okali, 2003). According to Hocdé (1998), the driving force for farmers in Central America to experiment is the search for a solution to a certain problem. Farmers experiment out of necessity contrarily to researchers who carry out experiments as their profession. By his own experience of project work in Central America, Bentley (2006) finds "folk experiments", done by every farmer via the combination of old and new ideas, oriented towards labour and capital savings on the one side and towards adaptation to environmental or economic changes on the other.

The assumption of problem-orientation often builds the basis for development and participatory research in technology creation and dissemination. By aiming at the improvement of livelihoods, farmers' role is first of all focused on formulating their demands (Bentley, 2006). This might be spurious, because sometimes people are initially not aware of their problems, which can be implicit. Only over the years, working in a project, technology demands of local people become more specific (Bentley et al., 2007).

2.3.2. Farmers' experiments as unconscious performances

„Even when farmers do not design experiments deliberately, they frequently find themselves in spontaneous situations from which they learn merely by observing and discussing." (Stolzenbach, 1997, p. 45)

„ […] I start to realize there might be aspects of creativity which we have not yet touched upon with our scientific procedures". (Scheuermeier, 1997, p. 31)

Increasing evidence is given, that farmers' experiments are not only consciously directed towards clearly stated purposes, but that experiments in many cases are triggered spontaneously and accidentally by mere observation, out of curiosity or personal interest. Scheuermeier (1997) negates the assumption that farmers' experiments follow a linear pattern of situation analysis and problem definition. Although in retrospect it is easy to identify problems in order to justify actions having been undertaken, triggers for experimentation are diverse and rely on ideas instead of problems. From his own

experience, Scheuermeier (1997) describes four cases where the triggering impulses for experiments stemmed from migrating relatives, from a joke in a bar among farmers, from observing children playing or from the availability of tools and materials.

By some authors, a clear difference between farmers' experiments and scientific experiments is stated: Although in local knowledge creation and scientific knowledge creation experiments are used as a learning method, farmers' experiments stem from trial-and-error – observations and "natural experiments", i.e. impacts caused by natural changes of a certain variable, and do not occur in a controlled setting (Antweiler, 1995). Hence, farmers' experimentation goes beyond problem-solving and linear adaptation. Discovery of things which were not being looked for happens frequently (Chambers, 1999). Further, a holistic worldview and cosmovision can influence and contribute to farmers' experimentation in a way that non-material indicators supersede material ones in determining the success of an innovation (Haverkort and Millar, 1992). Haverkort and Millar (1992) criticize the assumption that farmers use a "western logic" in their experimentation and emphasize that spiritual aspects take a prominent place. Cosmovision determines the way people go about knowledge and development, it is more complex than a direct cause-effect relationship assumed between different biophysical variables (Haverkort, 1995). Farmers' learning experiences occur on a day-to-day practice and are experiential rather than experimental. They are not planned but a series of rolling adjustments during the agricultural season (Hoffmann et al., 2007).

However, traditional people also possess scientific curiosity (Berkes, 1993). In Berkes' (1993) eyes, traditional ecological knowledge does not only encompass matters of immediate practical interest and it differs from scientific ecological knowledge in several points. Despite of that, he also recognizes that traditional people can carry out controlled field experiments; although generally he finds traditional ecological knowledge based on empirical observation and accumulation of facts by trial-and-error. This multitude of reasoning behind farmers' experiments is also acknowledged by Rhoades and Bebbington (1999). They classified three types of experiments with potatoes in the Peruvian Andes: Curiosity experiments, problem solving experiments and adaptation experiments.

2.4. Perception of farmers' experiments by farmers

The farmers' view on their own experimental experiences is more difficult to assess since they don't publish articles by themselves. In literature, solely anecdotic data on farmers' perceptions of experiments can be found.

Stolzenbach (1997) found in his research in Mali on farmers' experiments that farmers partly don't consider their experiments as experiments but simply experience, inherent to agriculture. The local word for experimentation was "shifleli" and also used by the researchers. One farmer showed Stolzenbach his "shifleli" in a corner of a garden with different bean varieties. One plot involved intercropping different bean varieties in rows. For the researcher, this was also "shifleli"; however, for the farmer it was not because he knew these varieties already from last year. In the farmers' view, this was just to "spread the time of harvest" and he found it "interesting just to mix them". In this case, his experimentation process was driven rather by intuition than by an explicit desire to learn. It was "just experience" in the farmer's eyes (ibid, p. 45).

Also Patiño (1990) supports the notion, that farmers in Colombia most of the time do not see their experiments as such. For them, experimentation is a part of their normal every-day-life, which does not have much consequence unless the results show a clear improvement over their current practice (Patiño, 1990, cited in Saad, 2002).

Lawrence (1999) outlines, that farmers in Bolivia were ready to incorporate new ideas for soil conservation, stemming from extension workers, into trials on their farm. Nevertheless, she highlights clear differences in the perception of problems between

farmers and extension workers: While extension workers identified irresponsible cattle management and expanding slash-and-burn practices as major constraints, farmers did not perceive their farming practices as unsustainable. They perceived declining water availability and emigration of the younger generation as major constraints to future farming. Such substantially different points of view easily hinder project progressing.

Hocdé (1998) cites one Central American farmer who explained in his own words the difference between farmers' and scientists' experiments: *"Los campesinos no somos estudiados ni mucho menos matématicos, por lo tanto, la tierra es el cuaderno del campesino y el lapicero es el machete o el azadón, hacemos el esfuerzo de hacer algunas mediciones, para comparar…"* ("As farmers, we are no graduates, even less mathematicians; hence, the soil is the paper of a farmer and the pencil is the machete or the hoe. We make an effort to make some measurements, to compare…", ibid, p. 27). The practical work experience contrasts in the farmer's eyes with scientific research methodology.

2.5. Communication and knowledge transmission on farmers' experiments

As many farmers might not consider their experiments as experiments but simply experience or day-to-day practice, communication patterns and knowledge transmission on farmers' experiments become a challenge for scientists. If farmers' experiments are seen as part of people's local knowledge, much of it stays implicit and is learnt by observation and in practice (Antweiler, 1995). In the context of cosmovision, knowledge is transferred via implicit demonstration, storytelling and initiation rites (Haverkort and Millar, 1992). Also Mudege (2005) cites observation and popular narratives as important source of knowledge for experiments. Wu and Pretty (2004) highlight that informal household communication networks, relying on family, kinship, neighbours and friends, facilitate household technology learning and innovation. Learning by doing and learning spill-overs from experienced neighbours positively affect farmer's willingness to experiment (Foster and Rosenzweig, 1995). Bentley (2006) states that new ideas for experimentation can be even exchanged without any verbal communication, as it was the case in Brazil where Ka'apor Indians while raiding the settlements of Portuguese-speaking Brazilians collected new crops and experimented with them in their homegardens.

Scientists working on farmers' experiments are challenged by these communication patterns as they have to determine how to gain knowledge on them if they are not perceived as experiments. First, specific terms in the local language, which are used and understood by the local population, have to be figured out. In Peru, Rhoades and Bebbington (1999) found the word „*pruebas*" (trials) to be the most used term when working with experimenting farmers. Still, different interpretations can occur as the experience of Stolzenbach (1997) with "shifleli" points out (section 2.4). Box (1998) stresses the importance of talking *with* farmers instead of talking *to* them. Hoffmann et al. (2007) argue that scientists have to put much more efforts in making tacit knowledge of expert farmers explicit, which needs above all physical proximity, socialisation and time.

3. Definition of concepts

The scientific interpretations outlined in sections 2.2 and 2.3 do not necessarily contradict each other but show two different aspects of farmers' experimentation. In this study, the terms *"implicit experiments"* and *"explicit experiments"* will be used to distinguish between these two manifestations of farmers' experiments.

3.1. Implicit experiments

On the one side, farming is a literally creative task that has to deal every day, every season, and every year with individual and specific challenges resulting from changing weather conditions, instable market conditions, varying needs for food stuff, personal preferences and so on. Because of this, continuous adaptation to dynamic circumstances is part of everyday-farming-life and may lead from minor changes in production patterns to innovations – understood as introduction of new practices on the farm-level – and even real inventions – new practices on a regional level. It is an ongoing process without a clear starting point or a sudden end (Rhoades, 1989). Therefore, the farmers are not aware of their innovativeness and don't consider their try-outs as experiments, it is simply part of their farming life. And it is part of their local knowledge, as scientists label it (Antweiler, 1995). In this paper, such experiments that emerge "by default" in daily farming practice are referred to as *"implicit experiments"*.

3.2. Explicit experiments

On the other side, there is also clear evidence that farmers do actively perform experiments, in order to test new ideas and hypotheses either developed by their own or brought in from outside, e.g. testing new seed varieties, new crop combinations or new technologies. Often these experiments even share characteristics with scientific experiments such as repetition, trial plots, control groups, documentation and evaluation. Sumberg and Okali (1997) call these types of experiments based on a certain degree of planning or control "proactive experiments". In this paper, experiments which are actively performed by the farmers with the clear intention to "try something new" and similarities to scientific experiments are labelled as *"explicit experiments"*.

4. Problem definition and research questions

Obviously, implicit experiments are more difficult to explore due to their unaware and self-evident character to their conductors than explicit experiments, which can be explained orally. Consequently, the mere use of interviewing techniques as methodology can result in a bias towards explicit experimentation. In this study, that bias shall be overcome by the use of methods common in anthropology such as participant and non-participant observation (section 5.7.1). The view of the observer on the one hand and the farmers' perception of his own work and experiments on the other, shall provide deeper insight into the character of farmers' experimentation. Further, the way how farmers communicate about their experiments and how they transmit their knowledge to others shall be explained and can contribute to an improved communication between researchers and farmers. A better understanding of the role of farmers' experiments, whether they are actively planned and purposefully conducted or they are unconsciously performed by the farmers, by focussing on the farmers' perspective, is the overall goal of this study. In this context, the research questions of interest are:

- Does the dichotomy "explicit planned purposeful experiments" versus "implicit constantly generated experiments" exist?
- Are both types excluding each other or do they coexist on farm level?
- How do farmers perceive their experiments, also in relation to experiments done by scientists?
- What do they understand by the term "experiment"?
- How do they label their experiments? Which vocabulary do they use?

4.1. Hypotheses

From the above stated theoretical considerations, the following hypotheses for this study result:

Hypothesis 1 (H 1): Farmers conduct both explicit experiments, similar to scientific experiments, and implicit experiments, which are part of their everyday farming practice.

In this study it is assumed, due to the widely ranged empirical evidence cited in literature (e.g. Bunch, 1998), that both types of experimentation are conducted by a farmer and can therefore be detected on one farm. Nevertheless, it has to be emphasized that the distinction between implicit and explicit experimentation will be drawn not by the farmer but by the researcher and involves an analytical but still subjective decision on the matter itself.

Sub-Hypothesis 1.1 (SH 1.1): Farmers conduct more implicit experiments than explicit experiments, in number.

It is expected that on a farm more implicit than explicit experiments can be detected if careful observation and attentive questioning are performed. Implicit experiments might be smaller in their impacts and outcomes, e.g. little variations in planting distances or small adaptations of used machinery and tools, than explicit experiments, e.g. trials with different crop varieties or incorporation of new technologies, but the total number of implicit experiments will be higher because of their ongoing incorporation in daily farming routine.

SH 1.2: A higher level of education/a non-agricultural background/contact to research staff increases the number of explicit experiments.

Through a higher level of education farmers are more familiar with scientific experiments and therefore more willing and better enabled to perform experiments on their own. Contact to research staff also increases the familiarity with formal experimentation and by

that fosters its introduction on farm-level. A non-agricultural background on the contrary provides the farmer with a different basis of knowledge which opens channels for new sources for innovation. Further, these farmers are not so familiar with farming yet, therefore they have a higher need to experiment in their new field of work, in order to learn its craft.

SH 1.3: A strong commitment to farming increases the number of explicit experiments.

Sumberg & Okali (1997, p. 154) identified commitment to farming as a crucial factor for motivation to experiment. This consideration shall be taken further here. A strong commitment to farming, in the sense of dedication and devotion to agricultural work, increases the farmer's interest in his/her work and its processes. He or she wants to improve his/her farming performance both on economic and personal level. Explicit experiments are one way of how this interest is expressed and how the personal connection to the working area is further developed.

SH 1.4: The number of implicit experiments is not influenced by the above mentioned variables (higher level of education/a non-agricultural background/contact to research staff, strong commitment to farming).

As being a fundamental part of farming life, occurring constantly, often without the awareness of the farmer, implicit experiments belong to the activity of farming itself and are not influenced by individual variables of the farmer.

H 2: The farmers' perception and labelling of their own experiments is different from what they understand under the term "experiment".

The difference in perception of farmers' and researchers' experiments becomes visible when the understanding of a farmer's own experiments is contrasted to their general understanding of the term "experiment". This may be underlined by the vocabulary used by farmers when commenting on their own experiments. They might use different words, like trials, effort, attempt, test, instead of the term "experiment" which they use when talking about scientific experiments.

SH 2.1: Farmers perceive their experiments different from "scientific experiments" conducted by researchers.

The perception and understanding of farmers' experiments differs between farmers and researchers. It is also assumed that farmers make a clear distinction between their own experiments and experiments conducted by researchers. In their view, these are different kinds of experiments.

SH 2.2: A higher level of education/a non-agricultural background/contact to research staff increase the use of formal vocabulary, such as the term "experiment".

Again, through a higher level of education and contact to research staff farmers are more familiar with scientific experimentation and therefore also with the formal vocabulary used for it. They incorporate this knowledge into their own language, for example by using the term "experiments" also for their own experimental processes. A non-agricultural background provides farmers with a different perspective on agriculture and fosters the use of differentiated formal vocabulary.

SH 2.3: Farmers communicate orally deliberately about their explicit experiments whereas their implicit experiments are "mute", usually invisible to their owners.

The different characteristics of implicit and explicit experiments lead to different modes of communication by their owners. Explicit experiments are actively planned and have a clear purpose, meaning that the farmer made a conscious decision on the experiment's content before he/she started it. Therefore, he/she is able to express the procedure of his/her experiments and the reasoning behind in words. In contrast, implicit experiments lack a clear intention behind since they are an ongoing part of farming life and often

performed without the consciousness of the farmer. Being part of the unaware daily routine, it results very difficult up to impossible to express their meaning in words. That is also why implicit experiments can be easily overlooked when performing research on farmers' experiments. Nevertheless, their muteness does not prove their inexistence.

SH 2.4: Demonstration and "learning by observation" play a key role in the transmission of knowledge on implicit experiments.

As outlined above, implicit experiments are hardly accessible via words and direct questioning. Still believing in their existence, knowledge on these has to be transmitted by other means of communication. Communication via action, understood as farmers showing and demonstrating processes, tools etc. to others and the other party carefully observing and even putting into practice this offered knowledge, leads to information exchange and knowledge transmission on implicit experimentation.

4.2. Research objectives

The following goals shall be achieved within the thesis:

- The variety and number of experiments in the observed farms, classified in explicit and implicit, shall be pointed out.
- The farmers' perception and understanding of their own experiments relatively to scientific experiments shall be presented.
- The communication patterns and vocabulary used by farmers when commenting on their experiments shall be outlined.
- The impact of socioeconomic factors, including the level of education, a non-agricultural background, contact to research staff and commitment to farming, on the above stated goals shall be highlighted.

5. Methodology

5.1. The case of Cuba

5.1.1. Country description

Cuba is the biggest island within the Cuban archipelago which comprises a total of about 1,600 islands (Figure 1). It is located in the Caribbean Sea between the North Atlantic Ocean and the Gulf of Mexico and represents the biggest and westernmost island of the Greater Antilles with an extension of 109,886 km² (ONE, 2005).

Figure 1: Map of the Cuban archipelago, located in the Caribbean Sea (Source: CIA, 2008).

Cuba lies within the northern tropics and is characterized by a tropical climate, moderated by trade winds. The rainy season lasts from May to October and accounts for approximately 80% of the average annual precipitation of 1,300 mm. The dry season with sporadic precipitation goes from November to April. Average daily temperatures range from 21 °C in winter to 27 °C in summer, relative humidity is 80% (ONE, 2005). The period from June to November is subject to hurricanes.

Approximately two-thirds of Cuba consists of plains or rolling lands with low elevation. One third of the territory is formed by three groups of mountains: the Organos range and the Rosario mountains in the west, the Trinidad mountains in the center and the Sierra Maestra in the East. The highest peak of Cuba is Pico Turquino with 1,974 metres above sea level, located in the Sierra Maestra. Approximately a fourth of the Cuba's total land area is covered by forest and other wooded land (FAO, 2008).

Historically, Cuba was colonized by the Spanish for four centuries. Soon after its discovery by Christopher Columbus in 1492, Cuba's native Amerindian population declined and Spanish settlers dominated the land (CIA, 2008). After a lengthy struggle over 30 years, Cubans gained independence from Spain in 1898, with the help of the USA. Several political regimes led the country through the first half of the 20th century; its policy was dominated by US-American intervention though (Fischer, 2005). In 1959, Fidel Castro led his rebel army to victory and established, with Soviet support, Cuba's Communist revolution, which is still in force. After the fall of the Soviet Union in 1989, Cuba suffered a severe economic crisis, called "Special Period". Between 1989 and 1993, imports fell by 75% and exports decreased 79% (Nieto and Delegado, 2002). Since then, the Cuban government has implemented several new political strategies, e.g. opening

towards foreign investments or the liberation of dollar tenancy, in order to alleviate the country's economic situation (Funes, 2002). Nevertheless, shortcuts were drastic and challenges remain high.

Today, Cuba accounts for 11.2 million inhabitants with a population density of 102 inhabitants/km² and an urban population of 76% (Census 2002; ONE, 2005). The country is divided into 14 provinces and a special municipality (*Isla de la Juventud*), the capital is Havana, located in the northwest. The official language is Spanish (Funes, 2002).

5.1.2. Cuban agriculture

In pre-colombian times, Cuba's indigenous population practiced a rudimental agriculture for subsistence, in combination with fishing and hunting activities (Funes, 2002). Spanish settlers introduced European agriculture, based on cattle rearing and fruit and vegetable production, above all for self-subsistence. Tobacco, sugar cane and coffee[1] played an inferior role. At the end of the 18th century, Cuba's position in the world trade began to grow with the occupation of Havana by the British. During the 19th century, sugar production increased rapidly and so did the import of African slaves. Starting from the provinces Havana and Matanzas, sugar cane plantations spread over the whole island and sugar became most the important export good. Although slavery was abolished in 1886, sugar production was intensified further, thanks to technological advances in the sugar mill industry and financial investments by the USA. During the 20th century, Cuba's agriculture remained dominated by industrialized sugar cane plantations and its economy depended further on sugar exports, first towards the USA and after 1959 towards the Soviet Union (Pfeisinger, 2005).

After the Cuban revolution, more than 70% of the land was concentrated in the hands of the state and agriculture followed the indications of the Green Revolution. It was characterized by intensified monocultures and high dependency on external inputs like synthetic fertilizers and pesticides. Consequently, it led to soil degradation, erosion, salinization and deforestation. Many of Cuba's rural population migrated to urban areas (rural population 56% in 1959, less than 25% in 1990) (Nova Gonzalez, 2006). During the 1980s yields levelled off, dependency on imports of external inputs tightened Cuba's economic situation and environmental problems became visible (Nova Gonzalez, 2002). Cuban scientists started to investigate into agricultural alternatives which should become a crucial resource for the challenges faced during the 1990s (Rosset, 1997).

The fall of the Soviet Union in 1989 caused a severe economic crisis - referred to as "Special Period" - since 85% of the Cuban trade relations were held with the socialist bloc. Also agricultural production was severely hurt by the omission of buying partners on the international market on the one side, and by drastic decreases in the import of inputs such as petrol, synthetic fertilizers and pesticides as well as machinery, on the other side. Also imports of wheat and other grains for human consumption dropped by more than 50% and caused a food crisis among the Cuban population, most pertinent in the years 1989 – 1993 (Rosset, 1997). At the end of 1993, a process of significant changes in agricultural production started with the creation of a new cooperative type, the Basic Units of Cooperative Production (UBPC, *Unidades Básicas de Producción Cooperativa*) and the opening of free agricultural markets for the population in October 1994 (Nova Gonzalez, 2006).

Cuba's agriculture experienced several re-structuring since 1959. It is administered on national level by the ministry of agriculture (MINAGRI, *ministerio de la agricultura*) and by the ministry of sugar (MINAZ, *ministerio del azúcar*), which hold representations on province and muncipiality level. The agricultural department of a municipality is

[1] Scientific denominations and Cuban expressions for all crops and livestock cited in this paper are listed in the annex, section 12.1, Table 9.

responsible for the administration, organisation and control of the total agricultural production within the municipality (Agricultural Department La Palma, 2007). Today, Cuba's agricultural sector is organized in a state, a non-state and a mixed sector (Table 1). As a consequence of the crisis in the 1990s, much of the state land was given in usufruct rights to the newly created UBPCs. Nowadays, the majority of Cuban arable land is worked by cooperative units of production (Martín, 2002).

Table 1: Productive organisation and structures in Cuban agriculture ("-" no data available) (Source: modified after Martín, 2002).

Sector		Structure	Land Tenure	Year of creation	Percentage of agricultural land (as in 1997)
State sector		State enterprises	State land	1960s	32,8%
		State farms of the new type (GENT, *Granjas estatales de Nuevo tipo*)		Post-1993	
		State farms of the military forces		-	
		Farms of self-supply for state units (*Autoabastecimientos*)		1993	
Non-state sector	***Collective Production***	Basic Units of Cooperative Production (UBPC, *Unidades Básicas de Producción Cooperativa*)	Formerly state land; given in usufruct to workers	1993	42%
		Agricultural Production Cooperatives (CPA, *Cooperativas de Producción Agropecuaria*)	Formerly private land; associated voluntarily to cooperatives in usufruct	1977	9,4%
	Individual Production	Credit and Service Cooperatives (CCS, *Cooperativas de Créditos y Servicios*)	Private land	1960s	11,8%
		Usufructs (individuals and families)	Land of state or CCS; Usufruct rights	Post-1993	-
		Dispersed land-owners	Private land	1960s	-
Mixed sector		Mixed state enterprises	State land with foreign investments	Post-1993	-

The "Special Period", still persisting but already alleviated, forced Cuba to focus its agricultural production on higher self-sufficiency with less dependence on external inputs through building on the country's own resources and skills, in an environmentally sound and sustainable way (Wright, 2006). It turned out that small farmers were the most productive agricultural producers and their traditional knowledge on low-input agriculture finally received valuation (Nova Gonzalez, 2006). Peasant production, including farmers

associated in CPA and CCS, by keeping only 20% of agricultural land in 1994, yet yielded more than 40% of Cuba's domestic food production (Rosset, 1997). Land was distributed in usufruct to individuals and a process of "repeasantization" took place: People not previously engaged in agricultural labour moved into small-scale farming, reversing the historical trend of small farmers being pushed off the land with the spread of large-scale agriculture (Enríquez, 2003).

In the beginning of the crisis, steps towards an agro-ecological way of farming were taken spontaneously by individuals out of necessity, e.g. the urban agricultural movement observable in Cuban cities, especially Havana. Then, Cuban scientists together with farmers and planners responded to the challenge of food security with a wide range of alternative agricultural technologies (Altieri et al, 1999). Biological fertilizers and biological pest control mechanisms, produced in more than 220 Centres for the Reproduction of Entomophages and Enteropathogens (CREEs, *Centros de Reproducción de Entomófagos y Enteropathógenos*), the revival of animal traction and traditional cropping practices (crop rotations and intercropping) help firstly to substitute missing inputs and show secondly the way into an agro-ecological production system approach (Funes Monzote, 2006). The National Association of Small Farmers (ANAP, *Associación Nacional de Agricultores Pequeños*) is the political representative of Cuban farmers organized in CCS or CPA with representations on municipality, province and national level. It provides, amongst others, agro-ecological trainings and workshops to its members and disseminates information on sustainable ways of production (Garcia, 2002). By these means, Cuba managed to overcome its food crisis and shifted its agricultural policy towards sustainable land use and production systems (Rosset and Bourque, 2002).

As result of the transformation process, agricultural production increased by 35% between the years 1993 and 2000. Some sectors, for example starch crops, vegetables, maize, beans and citrus fruits, reached even higher levels of production than before the crisis. Still, cattle production suffers low levels of production due to a lack of a suitable alimentary base and missing structural changes. Nowadays, Cuba produces approximately half of its consumption locally; another half has to be imported. Dependency on food imports has increased again since 2000, which threatens food security, and Cuban households still spend 70% of their income on alimentation (Nova González, 2006).

5.1.3. Organic farming in Cuba

Already during the 1970s and 1980s, Cuban engineers, agrarian scientists and producers set first steps towards alternative, ecologically sound ways of agricultural production, as the negative environmental side effects of the Green Revolution became visible. During the 1990s, experts from several Cuban research institutions came together to discuss how to promote a shift towards agro-ecological production techniques. In 1993, the Cuban Association of Organic Agriculture (ACAO, *Associación Cubana de Agricultura Orgánica*)[2] was founded (Funes, 2002). However, the driving force for Cuba's shift towards agro-ecological and organic production approaches was not a deliberate change in people's thinking but it was enforced by the lack of agrochemicals and petrol, and the need for self-sufficiency (Wright, 2006). Still, Cuba's experience is considered as the first nation-wide attempt to convert a national food system and provides a remarkable starting point for the development of an integrated, sustainable agriculture (Funes Monzote, 2006).

At present, two strands in Cuba's organic farming movement can be observed: first a wide range of non-certified organic producers, producing for domestic consumption; and second, certified organic producers, producing for export purposes (Kilcher, 2006). Whereas many Cuban small-scale farmers still practice traditional low-input agriculture,

[2] ACAO was not existent anymore, when the field work for this study was conducted.

close to the principles of organic farming, also new branches of Cuban agriculture that emerged during the "Special period" are based on organic production techniques, for example the urban agriculture movement, the movement of popular rice production on individual plots for home consumption or the organized production of medicinal plants, started in 1992 (Funes, 2002).

In 2005, Cuba accounted for 5,222 certified organic producers, cultivating an area of 10,445 hectares, equivalent to 0.16% of Cuba's total agricultural land (Kilcher, 2006). Organic production started in the eastern provinces of Cuba, which hosted still a traditional, sustainable way of farming, including intercropping and agroforestry-systems, because industrialized agriculture was hardly developed there. Principal products in Cuban certified organic agriculture, dedicated to export to the European market, are coffee, cacao, sugar, citric and other tropical fruits and honey (Castellon, 2003). In the growing sector of tourism, further market potential for certified organic produce is seen (Kilcher, 2001).

Although organic agriculture offers several advantages to producers and Cuban agriculture as a whole, like higher prices for producers than in conventional agriculture, conservation and improvement of farm resources such as water and soil, the production of healthy food stuff and the maintenance and/or recovery of a sound environment, it still lacks several crucial bases: Yet, no legal framework for organic agriculture was implemented in Cuba. Further, no national certification body exists; all certification done up to now is linked to foreign certification bodies. Quality and quantity demands of foreign clients often cannot be met; post-harvest processing is poorly developed. Incentives for producers to convert to organic farming don't exist, knowledge on organic food stuff and certification is low among the Cuban population and no national policy strategy towards organic agriculture has been developed yet. These shortfalls can hamper further initiatives towards an increase of organic production systems in Cuba (Castellon, 2003). It has to be awaited, if Cuba will turn towards an organic revolution in agriculture or if organic agriculture in Cuba will remain fragmented and agro-ecological approaches will decrease as soon as external inputs are more readily available again (Wright, 2006).

5.1.4. The project of "Participatory Plant Breeding" ("Fitomejoramiento Participativo")

Cuba's experience of the Green Revolution in agriculture went together with the implementation of a centralized, certified system of seed distribution. A state enterprise reproduced seeds of conventionally bred high yielding varieties, developed by research institutions, and distributed them to the production units. However, this formal seed system collapsed as well during Cuba's crisis. First, because necessary inputs for research and distribution in plant breeding lacked and second because the thoroughbred high-yielding varieties performed poorly under the newly encountered production conditions of low inputs and decentralized small-scale production by individual farmers (Montes, 2006).

Whilst Cuban agriculture experienced drastic re-structuring during the "Special Period", its formal seed system was slower in adapting to the new circumstances and official research institutions went on with a top-down approach in seed diffusion. By recognizing this gap, a programme of Participatory Plant Breeding (FP, *Fitomejoramiento Participativo*) aiming at the development of participatory seed production and distribution practices emerged in the National Institute of Agricultural Sciences (INCA, *Instituto Nacional de Ciencias Agrícolas*). By fostering seed diversification, the programme wants to increase yields and levels of production as well as genetic diversity in Cuba (Ríos, 2008).

The programme follows several steps in its implementation. First, the project-staff gets acquainted with a community and identifies farmers of interest. Second, selected farmers are invited to a so-called "diversity fair" where both autochthonous local varieties and

thoroughbred varieties of breeding institutions of one crop are exposed in the field. There, farmers can choose five varieties according to their own selection criteria in order to reproduce them in their own fields and test them. This third stage is called “farmer’s experimentation” (*experimentación campesina*) at which farmers are encouraged to experiment with the newly gained seed material in order to find out which varieties adapt best to their farming conditions and fulfil their criteria of selection (Ríos, 2003a). Whilst the farmers try out the new varieties under their own circumstances according to their own knowledge, experience and practices, they also receive technical assistance and basic training in genetics, experimental designs and breeding techniques by the INCA research staff and local project representatives (Martin et al., 2006). The programme started originally with genetic diversification and improvement in only two crops, maize and beans; but it has extended its work towards diverse farming issues, also in dependency on the demands raised by the farmers. Diversity is further increased in common crops like rice, tomato and cassava. New crops, for example soybean, sorghum, triticale and wheat, have been constantly introduced and offered to farmers’ choice. Moreover, farmers receive trainings in improved farm management practices and organic farming techniques, such as seed conservation and storage, grafting and pruning of fruit trees, the creation of living fences to prevent soil erosion, the production of compost and earthworm-humus and the integration of green manure plants, cover crops and animal manure for fertilization purposes (Ríos and Ferro, 2006). The programme shows to be an effective and rapid form of knowledge and diversity dissemination, which is also attractive to farmers since its work is based in the farming practices and experimentation processes of its participants (Chaveco et al., 2006). It contributes to an increase in diversity in the participating communities and offers the farmers the opportunity to choose and develop the varieties best adapted to their individual farming conditions and preferences. By that, the programme complements the current formal Cuban plant breeding and seed distribution system (Ortiz et al., 2006).

The first diversity fair was held in 1999 at the INCA, inviting farmers from province Havana. In 2000 the project of Participatory Plant Breeding in Cuba started with international financial support in two rural communities (Ríos, 2008). Nowadays, the programme is implemented in 10 Cuban provinces, comprising more than 7,000 farmers (INCA, 2007). It collaborates with several national administrational and research institutes, international research and funding institutions (Ríos, 2003b) and other participatory plant breeding projects worldwide, especially within Mesoamerica (Hocdé, 2006).

5.2. Research counterparts and working partners

This study is part of the FWF-funded research project „Organic Farmers' Experiments – Learning Local Knowledge", conducted at the Division of Organic Farming, University of Natural Resources and Applied Life Sciences, Vienna (BOKU). The research project investigates farmers' experiments in three countries of interest, Austria, Cuba and Israel and is supervised by Christian Vogl. The research team for Cuba includes, apart from the author, a PhD student Friedrich Leitgeb and a Master student Elena Sanz Soro. The team travelled together to Cuba and met several times to exchange research experiences.

Official contracts for research partnerships in Cuba exist between the University of Natural Resources and Applied Life Sciences, Vienna (BOKU) and the Experimental Station of Pastures and Forages "Indio Hatuey" (EEPFIH), University of Matanzas "Camilo Cienfuegos", and the National Institute of Agricultural Sciences in Cuba (INCA). As coordinator and thesis supervisor in Cuba acted Fernando Funes Monzote from the EEPFIH. Humberto Rios and the staff of the FP-project represented the working partners at the INCA.

5.3. Research plan and time schedule

The whole thesis was projected for one year: four months of preparation in Austria, four months field work in Cuba and four months of data analysis and thesis writing in Austria. The time management in Cuba was the most challenging task. Due to the difficult transportation situation in Cuba, bureaucratic obstacles, delays and vacation time for Cubans during August, the time plan had to be rescheduled several times. Finally, a field stay of approximately one month in each research area was enabled (Table 2).

Table 2: Time schedule of the research work performed in Cuba from 29th of July 2007 until 29th of October 2007.

	Week 1	**Week 2**	**Week 3**	**Week 4**
July	Orientation phase INCA	Orientation phase EEPFIH		Team Work Havana
August	**Field Stay I La Palma**			Team Work Havana
September	**Field Stay I Batabanó**			*Vacation*
October	*Vacation*	**Field Stay II La Palma**	**Field Stay II Batabanó**	Team Work Havana

The entire field stay in Cuba lasted from 29th of July 2007 until 29th of October 2007. The first month served above all for orientation and introduction to the new surrounding and the partner institutions with its staff. Three separated weeks were used for team work within the BOKU-team, including preparation for field trips and exchange of first research experiences.

The field stays in each research area were split up in two parts. Data collection was done during a first field stay over a period of three weeks. In the shorter second stay, missing data were collected, feedback was given to farmers and – since it was shortly before leaving the country – farewell was bidden.

With the project colleagues of the partner institutions INCA and EEPFIH four workshops, each lasting one day, were held in order to coordinate work proceeding and collaboration. They took place the 30th of June, 20th of July, 20th of August and 26th of October.

In La Palma, also two FP-project activities were attended: a farmers-workshop on "*experimentación campesina*" (farmers' experimentation) in San Andrés (municipality La

Palma) on the 6th of August and a start-up event for a new farmers group in Viñales (neighbour municipality of La Palma) on the 10th of August.

5.4. Description of study sites

In accordance with the Cuban research counterparts, two study areas were selected. Both study sites are located in rural Cuba (Figure 2) and the FP-project has been implemented there for more than five years. Therefore, contacts to farmers were established first via the FP-team.

Figure 2: Location of the two municipalities La Palma and Batabanó, which served as research areas (modified after Ferro, 2007).

Although the two study areas are not very distant in geographical location (appr. 200 km), they differ strongly in topography and agricultural conditions, which are more closely described in the following two sections.

5.4.1. Municipio La Palma, province Pinar del Rio

The municipality (*municipio*) La Palma with 35,422 inhabitants is one of the 14 municipalities of Cuban's most eastern province (*provincia*) Pinar del Rio. It is located on the North Coast of Cuba with an extension of 622 km² at a distance of 140 km from the capital Havana. Annual precipitation was 1,222 mm in 2004, average temperatures ranged between 20.5 and 30.2 °C (ONE, 2005).

La Palma's topography is characterized by a mountainous countryside (75% of total area), altitude ranges from 0 to 600 metres above sea level. Sandy and clayey soils predominate; due to its topography soil erosion is a major problem. 47,6% of the municipality area is covered by forests (Agricultural Department La Palma, 2007).

The agricultural sector in La Palma consists of eight UBPC, nine CPA and 23 CCS. 22,000 hectares of land are used for agricultural purposes (35% of the total area). 88% of the agricultural production in the municipality is produced by 2,600 small farmers, summarized in cooperatives of the type CPA or CCS. Their principal crops include starch crops, above all cassava, and tobacco, further vegetables, fruits and grains, especially maize and beans. The state production units are specialized in coffee, sugar cane, livestock and forestry. All production systems work without irrigation and depend solely on precipitation. 1,300 pairs of oxen are in use to replace machinery, most of them by small farmers (Agricultural Department La Palma, 2007).

The FP-project is present in La Palma already since 2000 and approximately 70 farmers are directly engaged in its activities. The FP-project cooperates with the local representation of ANAP and the local agricultural department (ANAP La Palma, 2007).

5.4.2. Municipio Batabanó, province Havana

The municipality (*municipio*) Batabanó with 27,943 inhabitants is one of the 19 municipalities of the province (*provincia*) Havana. It is located on the South Coast of Cuba and covers an area of 187 km². The distance to the capital Havana accounts for 60 km. Climate data of Batabanó are not available to the researcher, but in the neighbour municipality Melena del Sur precipitation was 1,254 mm and average temperatures ranged from 19.1 to 30.2 °C (ONE, 2005).

Batabanó's landscape is flat, close to sea level, and is characterised by very fertile soils, predominately Ferralsols and Cambisols. 3 km of wetlands along the coast are covered by mangrove woods (ANAP Batabanó, 2007).

4,309 hectares of land are dedicated to agricultural production and are divided between eight UBPC, six CPA and ten CCS. Apart from the local consumption within the municipality, Batabanó supplies two municipalities of the capital Havana with foodstuffs. 68% of its total production is provided by 1,550 small farmers, who are members in cooperatives of the type CPA or CCS (ANAP Batabanó, 2007).

Batabanó, typical for the whole province Havana, has a long tradition in intensified farming due to its favourable topography, fertile soils and closeness to the capital. Therefore its agriculture received special attention by the state. During the 1960s, after the revolutionary government came into force, a plan for rice production on large scale was implemented in the municipality area. But due to rapidly increasing salinization problems because of high withdrawal of water, rice production was shifted to other regions in Cuba that are less susceptible to soil salinization. In the 1970s major parts of the area, including state and farmers' lands, were dedicated to coffee production. As it did not reach the expected results, coffee plantations were demolished during the 1980s. Since then, Batabanó's agriculture is dedicated to the production of starch crops and vegetables, grains and fruits. Until 2001 three productive units were dedicated to sugar cane production; afterwards they also shifted towards cultivation of diverse crops. Principal crops are potato (solely produced by state units), sweet potato, banana, taro and tomato. All productive entities, both state units and small farmers, possess irrigation systems and the level of mechanization is generally high (ANAP Batabanó, 2007). Since 20 years, Batabanó also disposes of a local CREE, a production centre of beneficial organisms for biological pest control in agricultural applications. The unit in Batabanó is one of the most productive CREEs in Cuba and supplies above all UBPCs with their products. But also individual farmers can purchase its products there and ask for advice in plant protection (CREE, 2007).

Batabanó also was one of the first locations where the FP-project was introduced (INCA, 2007). Since 2003, it fortified its activities within the municipality. At the moment of field work, six farmers were directly engaged in the project. It cooperates with the local representation of ANAP and CREE (ANAP Batabanó, 2007; CREE, 2007).

But also other scientific institutions cooperate with farmers via the farmers' association ANAP in diverse projects on agricultural improvement, e.g. with the Cuban Agricultural and Forestry Technicians Association (ACTAF, *Asociación Cubana de Tecnicos Agrícolas y Forestales*), the Liliana Dimitrova Horticultural Research Institute (IIHLD, *Instituto de Investigaciones Hortícolas Liliana Dimitrova*) or the Institute of Animal Sciences (ICA, *Instituto de Ciencia Animal*) (ANAP Batabanó, 2007).

In comparison, La Palma and Batabanó have very different characteristics, especially if seen from an agricultural point of view. While La Palma still represents a rather traditional form of Cuban agriculture with diversified farms and artisan ways of production, Batabanó is part of an industrialized agricultural production zone. As one expert said: *"Son dos mundos diferentes."* ("They are two different worlds.", Exp1, 19.10.2007).

5.5. Sampling

The focus in both study areas lay on private farmers (members in CCS) and as selection criteria participation in the FP-project versus no participation in the FP-project was used in order to maximise the between-group variance as done in a stratified sample (Bernard, 2002).

The first contact in each research area was to FP-farmer-families who served on the one hand as key informants about the region, its agriculture and its inhabitants and on the other established the contacts to further interview partners, both farmers and local experts. In La Palma also two local FP-staff-members acted as key informants by giving additional information, supporting organisational tasks and providing contacts. By following their recommendations, a snowball sample was taken (Bernard, 2002). In addition, representatives of agricultural research institutions, extension services and farmers' associations in Cuba were purposefully selected in order to conduct expert interviews and to explore their view on farmers' experiments.

5.6. Description of respondents

In total 35 persons were interviewed and visited. Of these, 27 were farmers and eight were categorized as experts, stemming from research institutions or official agricultural organisations. Ex-post, one of the farmers was excluded from the sample because he was at the time of interviewing only little engaged in farming activities and focused his work life on other occupations.

Therefore the valid sample, building the empirical basis for this study, comprises a total of 26 farmers in two distant research areas and eight experts who are directly linked to the research areas. For anonymity reasons, a coding scheme for the designation of respondents was developed. Letters indicate the according group of respondents: LP – farmers in La Palma, Bat – farmers in Batabanó and Exp – Experts. The individual code for each respondent is completed with a consecutive number.

5.6.1. La Palma

5.6.1.1. Farmers

In La Palma 15 farmers were interviewed, including two women and 13 men. The average age was 56 years; the youngest farmer was 34 years old, the oldest 68. Only two farmers were born outside the farm they are managing now. All grew up in rural areas and 13 farmers also experienced a traditional agricultural background, in the sense of growing up on a farm. Only two farmers started their farming activities without having an agricultural family background.

Five farmers had finished twelve years of schooling; two of them also completed a five-year-grade in higher education. Eight farmers disposed of between six and ten years of formal education. In two cases exact data are not available.

Except two farmers, all had followed another employment by the state next to their farming activities. Eight of them were already retired. Four either left their job in order to work full-time on the farm because their parents could not work it alone anymore, or lost their job due to the economic crisis in the Special Period. Only one farmer was still following another profession in construction next to his farm work.

All had at least once contact to agricultural engineers or knew where they could ask for technical advice and help, for example concerning plant diseases and pests. None of them had ever worked together with scientists, apart from the farmers participating in the FP-project. Those FP-farmers were having contacts to scientists and/or research institutions solely via the FP-project and had not interacted with research staff before the beginning of the FP-project or with scientists outside the FP-project.

Table 3: Interviewed farmers in La Palma, representing their contacts to scientists and to the FP-project ("-" no contact; "+" contact; "([number])" number of years the contact exists; "+/-" acquaintance with FP-project but no interest in participation).

Farmer code	Contact to Scientists	Contact to FP	Explanation FP
LP1	-	+ (7)	In FP-project since 2000
LP2	-	+ (7)	In FP-project since 2000
LP3	-	+ (7)	In FP-project since 2000
LP4	-	+/-	Knows FP-project, but not interested
LP5	-	+ (5)	In FP-project since 2002
LP6	-	+ (7)	In FP-project since 2000
LP7	-	-	Does not know FP-project, no participation
LP8	-	-	Does not know FP-project, no participation
LP9	-	-	Does not know FP-project, no participation
LP10	-	-	Does not know FP-project, no participation
LP11	-	+ (1)	In FP-project since 2006
LP12	-	+ (0)	In new farmer group, evolving in 2007
LP13	-	+ (0)	In new farmer group, evolving in 2007
LP14	-	+ (0)	In new farmer group, evolving in 2007
LP15	-	+ (0)	In new farmer group, evolving in 2007

La Palma was one of the first communities where the work of the FP-project was implemented; therefore, four farmers of the sample were members of the project already since the year 2000 (Table 3). Two farmers joined later. One of them (LP11) was currently building a new farmer group in his neighbourhood (LP12 – LP15). In total, ten farmers participated in the FP-project. Four farmers did not know the project and haven't participated in its activities; one farmer (LP4) knew it because of his neighbourhood but was not interested in it.

Commitment to farming was generally regular to high (section 5.7.2, SH 1.3). Only one farmer argued that he would prefer his former job to the farm work. He was engaged in farming because his father could not do the work any longer for health reasons.

5.6.1.2. Farms

Eleven of the managed farms were worked by the same family for at least two generations or 50 years. Two farms were relatively new because they belonged to the farmers without agricultural family background. In two other more recent cases, the farmers had lived on another farm, outside of La Palma, before.

Farm size varied from one hectare to 27 hectares with an average of 12.7 hectares per farm. Five farms comprised less than six hectares of land, the other ten farms ranged from eight to 27 hectares. All were worked by family members, between one and five persons; only five farmers also employed seasonal workers in peak times. Nine farms were located directly around or next to the farmer's living place. In five cases the farms were situated further away, in up to one hour walking distance. Paths were often hilly and in bad conditions, distances were covered by horse, oxen or foot.

The farms included a wide range of agricultural branches since a major part of production served self-subsistence. Most farmers grew fruits, vegetables, maize and starch crops and kept some pigs, cattle and chicken for home consumption. Rice production depended on the soil quality on the one hand and on labour availability on the other, since it was a very labour intensive crop. Of highest economic importance were generally starch crops, maize and fruits. Four farmers increased their pig rearing for economic benefits and four farmers were engaged in tobacco production for the state. One farm specialised in flower production.

All farmers, except the owner of the smallest farm, had their own pair of oxen for working purposes. Nobody possessed his/her own tractor, but some received machinery services from state production units, e.g. the tobacco farmers. Water supply in most cases was managed manually from a well, a water reservoir or a river in or close to the farm. Three farmers disposed of their own water pump, working with petrol. In two cases data on water supply were not available.

Crop management was still dominated by the use of synthetic fertilizers, pesticides and herbicides. Alternative techniques of using compost, earth-worm-compost, green manure crops or animal manure were above all applied by the FP-farmers, since the FP-project focused also on training in agro-ecological farm-management. Nevertheless, only one farmer said to abstain completely from the use of synthetic inputs.

5.6.2. Batabanó

5.6.2.1. Farmers

In Batabanó, eleven farmers were interviewed, all were men. The average age was 56.9 years over a range from 32 to 74 years. All were born on the farm they were working at the moment of research, except one farmer who had lived on another farm before. Therefore, also all had a traditional agricultural family background since they grew up on a farm. The two youngest farmers had finished twelve years of formal education. The elder farmers' education ranged from five to eleven years of schooling. The group of full-time farmers was much bigger than in La Palma: Only three farmers had worked beside their farm work also in a state employment and were retired by the moment of interviewing.

Table 4: Interviewed farmers in Batabanó, representing their contacts to scientists and to the FP-project ("-" no contact; "+" contact; "([number])" number of years the contact exists; "+/-" acquaintance with FP-project but no interest in participation).

Farmer code	Contact to Scientists	Contact to FP	Explanation FP
Bat1	-	-	Does not know FP-project, no participation
Bat2	+	(+)	Participated once in a diversity fair
Bat3	-	-	Does not know FP-project, no participation
Bat4	+	+ (3)	In FP-project since 2004
Bat5	-	+/-	Knows FP-project, but not interested
Bat6	-	-	Does not know FP-project, no participation
Bat7	-	+ (4)	In FP-project since 2003
Bat8	+	+ (4)	In FP-project since 2003
Bat9	-	+/-	Knows FP-project, but not interested
Bat10	-	-	Does not know FP-project, no participation
Bat11	+	+ (7)	In FP-project since 2000

All farmers received advisory services from engineers and four farmers cooperated with scientists from different Cuban research institutions. Four farmers were directly involved in the FP-project, one had participated once in a diversity fair and two knew it because of personal contacts but were not interested in it (Table 4). Four farmers did not know the project.

Commitment to farming was generally high; only in three cases regular commitment was expressed.

5.6.2.2. Farms

All farms had an agricultural family tradition for at least two generations or 50 years. Only one farmer moved on his current farm 23 years ago, nevertheless he and his family had been farmers already before that in another place.

The average farm size was 15.9 hectares with a range from two to 47 hectares. Four farms had less than six hectares of land, the others varied from 13 to 47 hectares. Only one farm was solely worked by two family members, all the others employed at least seasonal workers in peak times as well. Six farms also disposed of fix employees, between three and eight farm workers. All farm lands were located directly around or next to the living place of the owners and were easily accessible.

The farmers in Batabanó also produced for their self-subsistence but orientation towards market was much stronger than in La Palma, due to the proximity to the capital Havana. Dominating crops for the market were vegetables, starch crops and fruits. Two farmers also specialised in flower production and two farmers cultivated rice on large scale.

All farmers, except one, owned at least one tractor, eight farmers further used oxen for farm labour as well. One farmer without tractor or oxen received machinery services from his cooperative. All farms disposed of a pump for water supply; two farms also had electrified water pumps so that they were not dependent on petrol availability.

The application rates of synthetic fertilizers, pesticides and herbicides were generally high and common, also because these were more available than in La Palma. Only three farmers out of eleven, all members in the FP-project, showed interest and concern in decreasing the amount of synthetic products used on their farm. Although a CREE is located in the municipality, only four farmers confirmed that they had used products of the CREE at least once.

5.6.3. Experts

Eight men were interviewed as experts, whose work was directly related to the Cuban agricultural sector and who worked together with Cuban farmers. All experts knew the FP-project and had participated at least once in one of its events. Further, all were directly linked to at least one of the two research areas; some of them even knew both due to their participation in the FP-project.

Two experts were scientists in the INCA and worked in the FP-project. Both were familiar with the two research areas. A member of the research staff of the Faculty of Agricultural Sciences in Mountainous Areas, which is located in the municipality La Palma and belongs to the University of Pinar del Río (*Universidad de Pinar del Rio, Facultad de Agronomía de Montaña*), gave support during the field stay and was interviewed. He was also directly involved in the work of the FP-project. One interview-partner was an expert farmer in fruit, fruit tree and ornamental production, situated in province Pinar del Río. He was invited once to give a class on fruit production and fruit tree management to the FP-farmers of La Palma.

In each research area the local representatives of the ANAP were interviewed. In both research areas the local ANAP representations cooperated with the FP-project and supported its local activities. In La Palma, the representative of the agricultural department was interviewed. The institution also participated in local FP-activities. Finally, in Batabanó the director of the local CREE was interviewed. He cooperated with the FP-project and has participated several times as expert in project activities. He knew both research areas.

5.6.4. Visualized sample

In La Palma three farmers acted as key informants (LP3, LP6 and LP11) and gave crucial advice for sampling within their neighbourhood or their circle of acquaintances (Figure 3). All three participated in the FP-project. A new FP-farmers-group was in formation around farmer LP11 (LP12 – LP15). In this new group, one introductory event had been held before the time of field work, a second one was scheduled for November 2007. Farmer LP11 acted as group leader, providing his neighbours with information and seed material. Apart from farmer LP11, none of this new group had participated in a diversity fair yet.

In Batabanó the sample of farmers was chosen with the help of one farmer and his family. Therefore all arrows part from one interview partner (Bat11).

Three experts were directly located in La Palma (Exp2, Exp4, Exp5) and two experts were living and working in Batabanó (Exp7, Exp8) because they all belonged to institutions on municipality level. Two members of the FP-staff worked in both research areas (Exp1, Exp6) but lived in the capital Havana. Exp3 who had interacted with the FP-farmers in La Palma also lived outside the research area.

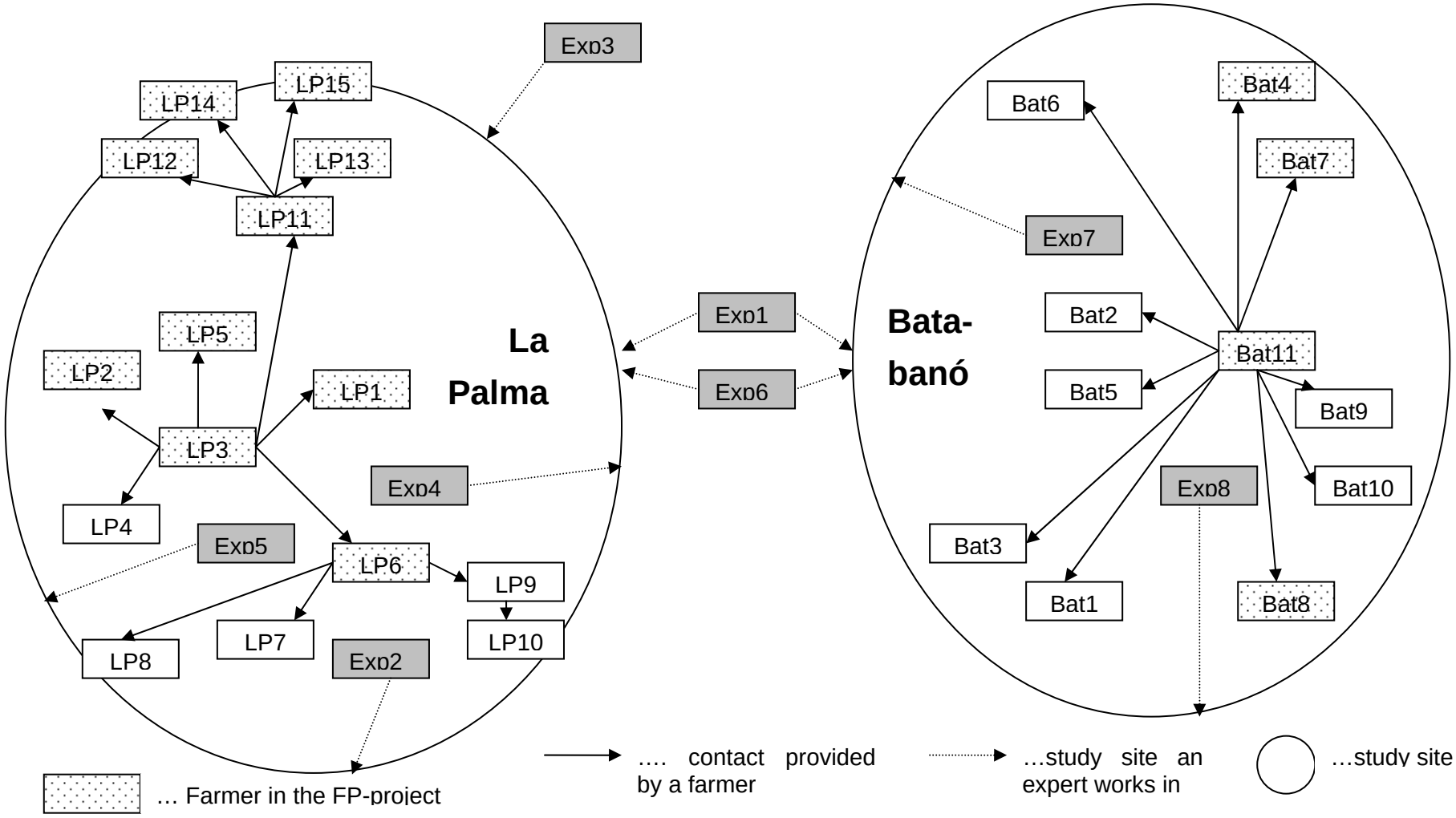

Figure 3: Visualization of the sample. Vicinity expresses neighbourhood or closeness in real site locations but distances are not reproduced in corresponding relations. Connecting arrows between farmers indicate which farmer provided contacts to another farmer for the researcher. Arrows of experts indicate the study site they were working in. Five experts also lived in a research area; three experts lived outside the research areas.

5.7. Data collection

Since this study deals with people and individuals and tries to assess their personal perceptions, communication patterns and farming practices related to farmers' experimentation, qualitative research methods common in anthropological studies were used. A set of different methods, each fitting different research questions, was applied to foster triangulation of data (Miles & Huberman, 1994).

Usually basic anthropological research takes one year or more of fieldwork in cultural anthropology. However, this research was limited to a field stay of four months with a focus on agricultural practices. Therefore, a rapid assessment was appropriate (Bernard, 2002, p. 31). Because of time limitation, it was not possible to account on everything happening in the field and to fully understand the social processes behind the observed actions.

Nevertheless, the guidelines of sound anthropological research, such as building rapport, developing trust and being aware of ethical considerations, had to be followed. Also the double role of the researcher, being an active participant on the one side and an analytical observer on the other, was critically reflected during the stay (Bortz & Döring, 2006). Each evening the researcher tried to step out of her participating shoes into an analytical position, writing down her field notes, reflecting on them, detecting missing information and starting to compare and analyze the data.

5.7.1. Methods and Tools[3]

5.7.1.1. Key informants

Key informants in each research area were a valuable source for different kinds of information (section 5.5). They helped to adapt to the new environment for the researcher, provided contacts to interview partners, gave additional information about the agricultural background in the region and often helped to complete or triangulate collected data of other farmers that had remained unclear to the researcher. In many cases, their explanations could clarify the researcher's doubts and made it easier to prepare proper questions for second field visits.

5.7.1.2. Participant observation

As Richards (1985) recommends, participant observation, meaning learning by doing, was applied to understand the agricultural working process on the farm and the experiments included in it. It was done basically within the environments of key informants. Still, it served little for data collection on farmers' experimentation as such. Instead, it enabled above all "getting closer to people and making them feel comfortable with your presence" (Bernard, 2002, p. 322). And it helped the researcher to accommodate herself in a new culture. Therefore, it included above all learning experiences for the researcher since many situations were completely new to her, for example the harvest of maize in Batabanó. By doing so, it helped to explore the wider context of the study. Several of these learning experiences probably also included implicit experiments, e.g. individual practices of harvesting maize. But since these experiences were only lived in single cases, it could not be analysed by the researcher if it was common practice and only new to her, or if it was a new practice indeed. Therefore these data were not drawn on in the analytical phase of farmers' experiments.

[3] If no other source is mentioned, the explanatory information outlined for each method is taken from Bernard, 2002.

5.7.1.3. Non-participant observation

Non-participant observation was an important tool first to get familiar with the new environment and build rapport with people and second to detect possible implicit experiments. While visiting farmers, implicit experiments on household level could be detected. In Batabanó, the farms were situated directly around the house; therefore observation on farm activities could be performed also during an interview session. In La Palma, farms were often distant from the living places, but observation could be done in the homegardens around the houses. Further, observation was important during the field walks in order to determine implicit experiments and built the basis for further questioning.

5.7.1.4. Farm Walks

In order to ask proper questions on the farming activities observed on the farm, it was pre-requisite to get acquainted with the new farming environment first. Therefore, usually first a farm walk was done and afterwards the interview was conducted. In two cases in La Palma no farm walk could be done due to health reasons of the respondents. Primarily, farm walks served to provide a first orientation to the researcher and to make her acquainted with the farm environment. But it was the overall goal of the farm walks to collect information on the farm itself and especially on possible experiments. In other words, the researcher had to follow her informant, perceive openly the surrounding and ask for explanations of everything that called her attention along the walk. This sometimes took a lot of time and was tiring for the researcher. If more visits were enabled, data collection could be completed during further informal field walks and missed issues or new discoveries could be re-addressed. If the farm stay was limited to only one visiting session, the farm walk was the essential tool to collect data on farmers' experiments, especially on implicit ones.

5.7.1.5. Unstructured interviews

Unstructured interviewing was done constantly during the farm walks, at the farmers' houses, e.g. during meals, on the ways to another farm, while hanging out, etc. Again, it was used on the one side to better understand the context and clarify doubts and to gain insight on implicit, and also explicit, experiments on the other. If a possible experiment was detected, similar questions were asked (Table 5).

Table 5: Guideline for questions asked if a possible experiment was encountered.

Crop management/Animal husbandry	Farm equipment
What are you doing here?	What is this?
How is it called?	How is it called?
What is it for?	What is it used for?
Why do you do it?	Why do you use it?
When did you change it? How was it before that?	Where did you get it from? Since when do you use it?
Where did you get the idea from?	Where did you get the idea from?
Do you take notes on it? Do you have a plan for it?	Did you make a plan for it?
Do other people/your neighbours do that to?	Do other people/your neighbours use it too?
Can you show me how you do it?	Can you show me how you use it?
Are you satisfied with it?	Are you satisfied with it?
Will you go on using it?	Do you still use it?
Do you want to change anything on it?	Do you want to change anything on it?

5.7.1.6. Semi-structured interviews

Each farm visit concluded with a semi-structured interview of the farmer conducted by the researcher. The interview aimed firstly at determining individual socioeconomic data and farm describing data in a structured way and secondly at unravelling the farmer's view on experimentation in general and his/her own explicit experiments in special. Another advantage of putting the interview session in the end of a stay was seen in the matter that up to this point the farmer had already been confronted with his/her experimental processes through the continuous questioning of the researcher during the farm walks and visits. So he/she might have become more aware of the experimentation processes, clarified his/her mind on it and was able to express his/her opinion on it more clearly. But as stated in section 3.1, implicit experiments are often unconsciously performed by farmers as part of their everyday work; therefore, indirect indicators for their existence had to be used. Because of this, questions on farm changes, learning experiences and future plans were included assuming that they can go together with trying a new production idea or trying to handle new farm equipment, for example (interview guidelines see annex, sections 12.2 and12.4).

Semi-structured interviews with experts were used to assess the official and scientific Cuban view on farmers' experimentation. For the researcher, expert interviews also served to understand better the network of Cuban agricultural institutions and their relations to farmers (interview guidelines see annex, sections 12.3 and 12.5). As in any research session, sound anthropological standards, such as introduction, prior informed consent, confidentiality and respect, were followed (section 5.12).

5.7.1.7. Second visits of research areas

Since both research areas were visited a second time for a week before leaving the country (section 5.3), interview partners could be met again to collect missing data. Where farms were not too distant from the living place, also a second farm walk was performed. This gave the opportunity to observe and evaluate the development of some experiments that had been detected during the first visit and to ask their owners concretely about the experimental processes. However, five farmers in La Palma and two farmers in Batabanó could not be visited a second time due to transportation difficulties and/or time constraints.

5.7.1.8. Pre-testing of methodology

Pre-tests for interviews and farm visit situations were performed during the first three weeks of orientation phase in order to get acquainted with the methodology and to adapt to the Cuban surrounding. The wording of the questionnaire was checked and adjusted to real-life situations of farmers to avoid biases due to translation mistakes (Scheuermeier, 1997).

These first farm visits were organized by the partner institutions and were completed in a group of people, the three BOKU-students together with colleagues from the partner institutions. In the beginning, these circumstances were very irritating and made the researchers feel uncomfortable because originally it was planned to do interviews alone, only one researcher and one interviewee. But it proved to be a good training since also later in the field it was almost impossible to conduct an interview session or visit alone. Either further family members, the person who provided the contact and/or transport, or simply people dropping by joined the conversations. It needed patience, adaptation and sensitiveness of the researcher to convince working partners politely not to interfere in the interview. In few cases, interventions simply had to be accepted. Sometimes, these interventions also resulted helpful, for example if the companion asked further questions of interest or helped to clarify misunderstandings due to language difficulties between the researcher and the interview partner.

Also the advice of the Cuban research colleagues, not to hold a sheet with the questionnaire in the hand but to keep the questions in mind, was difficult to follow first, but over time showed to pay off in the sense that farmers seemed to feel more comfortable in a more informal interview situation.

5.7.2. Methods according to hypotheses

In this section, the used methods are listed according to the hypothesis they support. If a method or tool refers to more hypotheses, cross-references are made.

Hypothesis 1 (H 1): Farmers conduct both explicit experiments, similar to scientific experiments, and implicit experiments, which are part of their everyday farming practice.

Difficulties in assessing the two different types of experiments were faced especially because of their different characteristics as being part of the aware and unaware performance of farmers (section 4). To avoid a bias towards explicit experiments, semi-structured interviews were combined with farm walks, informal interviewing and direct observation. Constant careful observation and questioning were the essential parts of the research performance.

Sub-Hypothesis 1.1 (SH 1.1): Farmers conduct more implicit experiments than explicit experiments, in number.

Notes taken in the field on observations and informal interviewing were transcribed every evening in a cleared and structured way. The distinction if an experiment is implicit or explicit was drawn by the researcher according to following indicators:

- Did the farmer show me the experiment (explicit) or did I ask for it (implicit)?
- Is it used/worked with it in a daily routine-manner (implicit) or does it receive special attention (explicit)?
- Is it labelled by the farmer as experiment or trial (explicit) or something different (implicit)?
- Is it a small adaptation of a common technique (implicit)?
- Can the farmer explain easily why does he do it like this and what is his/her reasoning behind (explicit)?

After this evaluation for each experiment detected, numbers of implicit and explicit experiments could be obtained for each farm studied.

SH 1.2: A higher level of education/a non-agricultural background/contact to research staff increases the number of explicit experiments.

The level of education, the professional background and the contact to research staff were assessed during the interview session.

SH 1.3: A strong commitment to farming increases the number of explicit experiments.

The commitment to farming was also measured in the interview session with the help of the questions “Do you like your work in agriculture? Would you prefer to work in another field of work? If you would get offered another job now/your former job again, would you accept it?”. Further, the researcher’s observations were taken into account, if a farmer was talking enthusiastically about his work, if he seemed proud of showing it and if he/she gave a satisfied impression. According to these criteria, a farmer’s commitment was rated as low, regular or high.

SH 1.4: The number of implicit experiments is not influenced by the above mentioned variables (higher level of education/a non-agricultural background/contact to research staff, strong commitment to farming).

After transcribing all the experiment data, numbers of implicit experiments were expected not to differ between different groups of respondents.

H 2: The farmers' perception and labelling of their own experiments is different from what they understand under the term "experiment".

A definition of the term "experiment" was asked in the interview sessions. During field walks and informal interviewing, notes were taken on the wording and terms used by the farmer when talking about his/her work and experimentation.

SH 2.1: Farmers perceive their experiments different from "scientific experiments" conducted by researchers.

The farmers' perception of their own experiments and scientists' experiments were collected in the interviews.

Additionally, farmers' perceptions were compared to the perception of Cuban scientists, extensionists and other experts on farmers' experiments and agricultural experimentation in general. Their points of view were revealed in expert interviews.

SH 2.2: A higher level of education/a non-agricultural background/contact to research staff increase the use of formal vocabulary, such as the term "experiment".

The labelling of experiments by the farmer was written down, so that the use of different terms could be counted and related to sociodemographic characteristics.

SH 2.3: Farmers communicate orally deliberately about their explicit experiments whereas their implicit experiments are "mute", usually invisible to their owners.

To answer this hypothesis, reference has to be made to the distinction process of implicit and explicit experiments described in Sub-Hypothesis 1.1. Next to the analytical decision made by the researcher if an experiment was implicit or explicit, two more indicators for the farmers' way of verbal expression are used: Explicit experiments were expected to be mentioned by the farmer in the interview session. This firstly allowed to cross-check the adequacy of the researcher's judgement and secondly answered the first part of this hypothesis. The second part of the hypothesis on the "muteness" of implicit experiments could be answered only indirectly concluding on the way how information on these experiments was achieved.

SH 2.4: Demonstration and "learning by observation" play a key role in the transmission of knowledge on implicit experiments.

The answer to this hypothesis is closely linked to the one before. Again the way of transmission of knowledge, if it was explained in words, demonstrated, tried out or just observed, was recorded in the field notes. Indirect questioning for learning experiences, problems, failures or sources of information could help to reveal the further patterns of knowledge transmission.

5.8. Storage of data

In the matter of data storage, it was the aim to save collected data as soon as possible in a digital form on the computer. During participatory work, farm walks and observation phases, field jottings were made on the spot (Bernard, 2002), which were digitalized as field notes on the computer at the end of the same day. In the beginning it was planned to record all interviews with a digital voice recorder. Nevertheless, during the research process, the researcher gained the impression that often farmers felt uncomfortable by being recorded and spoke more freely as soon as the voice recorder was turned off,

although they had allowed to be recorded initially. Therefore, it was decided not to record anymore but to take only field notes during the interviews which were written down directly afterwards. In La Palma, nine out of 15 farmers were recorded; in Batabanó no farmer was recorded with a voice recorder. Six out of eight experts were recorded as well. The records were transcribed with the programme ExpressScribe back in Austria.

Digital photos were put into the computer and annotated in the programme PixVue with all information necessary to make it accessible for later analysis (place, date, time, farm, farmer, description of picture content). A research diary was written by hand every night. Pictures were taken regularly to secure its contents also in a digital way. Back in Austria, contents were re-read and important findings were digitalised as well. Apart from the research data, a personal diary and log was kept (Bernard, 2002). The working environment in the field was generally good and a rapid digitalisation of data was possible. Only a few times digitalisation had to be postponed for a day or two due to power blackouts. A back-up of the data was sent home with visitors and in addition saved on memory sticks and CD-Roms. Uploading onto the internet was not possible due to few internet access facilities and the slow upload speed of Cuban internet. Print outs were kept personally and at the partner research institution.

5.9. Data analysis

After transforming the field notes and interviews into text documents, these were coded with the help of the analysis software Atlas.ti. The codes were developed mostly a priori according to the interview questions and research hypotheses (content analysis); nevertheless, some codes also emerged via in-vivo-coding, following a grounded theory approach (Bernard, 2002). In total, a list of 62 codes was used (see annex, section 12.6, Table 10). Outputs were generated for specific codes or code combinations and for different groups, e.g. experts, farmers in Batabanó, farmers in La Palma, FP-farmers and non-FP-farmers. Qualitative descriptive analysis was performed to compare farmers' and experts' perceptions of farmers' experimentation, definitions of terms and communication patterns. In the case of farmers' perception of their experimentation processes, categories were built. Frequency distributions of certain codes were calculated in order to get an impression of the magnitude of different types of experiments (section 6.1). Matrices, tables and graphs were created to describe and visualize the sample and to reveal structures in the findings on experimentation, its perception and the farmers' communication patterns. Photos were selected to support the findings visually and to provide examples of farmers' experiments.

The sample size was too small to perform any quantitative analysis like correlations between individual variables of farmers and the amount and type of experiments conducted. Only qualitative descriptive indications on the influences of sociodemographic data could be made.

5.10. Materials and Matters

The most important equipment for this study was provided by the researcher herself, through her abilities to adapt to a new country, culture and climate, to build rapport with her research partners and interviewees, to speak Spanish, to ask proper questions, to listen attentively and to watch carefully.

Still, some digital hardware made the work much easier and, more importantly, also accessible to other parties. A laptop (Acer Aspire 1620), a digital camera (Sony DSC-W35) and a digital voice recorder (Olympus VN-3100PC) were the tools of constant use during the field work. The programmes of Microsoft Office, ExpressScribe (audio-file transcription), Atlas.ti (text-file coding) and PixVue (picture annotation) built the basis for digital data processing and analysis. USB-memory sticks and CD-Roms were used for back-ups, both of data and programmes. Finally paper and pen also fulfilled useful tasks

and were prepared for the worst-case-scenario of having to perform the entire field work in handwriting. Also an analogue camera was taken along as back-up.

5.11. Authorizations and contracts

A research visa was received at the Cuban embassy in Vienna on May 29th 2007, valid until July 28th 2007 (Visa number: B 0088323). Prolongation of the visa until October was successfully applied after entering Cuba, in cooperation with the partner institution. Furthermore, a student identity card of the EEPFIH, belonging to the University of Matanzas, was obtained for the four months of stay. Also the national ANAP representation was officially informed on the research stay of the BOKU-students with the help of the partner institutions and released a letter of acceptance for the interaction with farmers in the research areas. For interviewing, participation and farm-visits oral consent was requested from the respondents. Official letters of confirmation from both universities in Austria and Cuba were held available if requested (Bernard, 2002).

5.12. Ethical considerations

Since this study was primarily interested in peoples' behaviour, perceptions and opinions, ethical questions had to be considered. In any case, harm or increased risks for respondents in the field work was to be avoided (Miles & Huberman, 1994). Respect and honesty from the researcher's part towards her respondents was the fundamental basis to enable the development of rapport, trust and a mutually beneficial working environment. Both parties, researcher and respondent, should get the opportunity to learn from each other, exchange and share experiences in the field. Respondents received full information on the research purpose and were asked for their consent to participate, take notes, pictures and records. Any negation of these was respected. Confidentiality was assured from the beginning, anonymity warranted if requested by the respondent. Respondents had the free choice to quit the research process at any time. Especially in the final report writing and data presentation phase care was taken that data presentation did not involve any potential risk for people involved in the research process. Research results and pictures were also fed back to research partners and respondents.

6. Results

This section is structured according to the research objectives (section 4.2). As the sample is too small, no quantitative analysis was performed. Nevertheless, if there are qualitative indications for influences of sociodemographic data, this is mentioned directly in the section of the corresponding research objective.

6.1. Farmers' Experiments

Information on concrete experiments done by farmers was collected in the interviews and especially during the field visits. In the phase of data analysis six codes were used which refer to a type of experimentation or learning experience:

IMPL – implicit experiments: This code was assigned to experiments that go along with the definition outlined in section 3.1. The criteria used for deciding on the implicit character of an experiment are described in section 5.7.2.

CHANGE – farm changes: This code was used for changes that had occurred on a farm during its family tradition, e.g. shifts in production emphasis, introduction of new crops on bigger scale or orientation towards a new branch in production.

FUTURE – future plans: This code was given to information on future projects which included the introduction of something new on the farm, for example new crops, new machineries, changes in production cycles or implementation of a new production branch.

LEARN – learning experiences: Farmers' explanations and examples of how they were learning their craft of agriculture were summarized under this code.

PROBAR – to try something out: When farmers talked about trials they did or new things they tried out, this code was used.

EXPL – explicit experiments: This code was assigned to concrete experiments that also the farmer labelled as such or gave as example to the interview answer "Do you do experiments?"

The codes CHANGE, FUTURE and LEARN contribute in its content to the concept of implicit experimentation. In this study, they are understood as indicators for implicit experiments because they request the adaptation to new conditions. A change on a farm or a learning experience can go together with trying a new production idea or learning to handle new farm equipment, for example. As implicit experiments are often unconsciously performed by farmers as part of their everyday work; therefore, indirect indicators for their existence had to be used.

The absolute numbers of each code used in the different cases **must not be understood as complete representation of each farmer's experimental processes** but again only as their indicators (Table 6). A code was counted only once for one experimental process. The times how often a code was used depend, apart of his/her experimental characteristics, on the duration of the interaction with the farmer, how long an interview lasted, if a field visit was possible, if the farmer was visited several times, and finally on the character of each individual farmer, since some like to talk more and some less. Nevertheless, qualitative conclusions can be drawn.

Table 6: Frequency and sum of codes related to experimentation processes ascribed in each farmer case. The counts have to be read as qualitative indicators, not as absolute quantitative measures. The column of “Scie.” represents the farmer’s contact to scientists, the column “FP” his/her contacts to the FP-project (“-“ no contact; “+” contact; “([number])”number of years the contact exists; “+/-“ acquaintance with FP-project but no interest in participation).

Farmer	*Scie.*	*FP*	IMPL	CHANGE	FUTURE	LEARN	PROBAR	EXPL	**Sum codes**
LP1	-	+ *(7)*	7	5	1	4	1	4	**22**
LP2	-	+ *(7)*	1	4	3	5	0	5	**18**
LP3	-	+ *(7)*	7	4	5	4	4	8	**32**
LP4	-	+/-	4	1	1	1	3	0	**10**
LP5	-	+ *(5)*	4	1	1	0	3	2	**11**
LP6	-	+ *(7)*	1	4	3	6	1	8	**23**
LP7	-	-	3	2	4	1	3	1	**14**
LP8	-	-	2	0	2	1	2	1	**8**
LP9	-	-	6	3	3	1	3	1	**17**
LP10	-	-	7	5	1	3	6	1	**23**
LP11	-	+ *(1)*	11	4	4	10	2	10	**41**
LP12	-	+ *(0)*	3	3	1	5	4	1	**17**
LP13	-	+ *(0)*	2	0	0	1	0	1	**4**
LP14	-	+ *(0)*	3	1	3	1	3	1	**12**
LP15	-	+ *(0)*	4	1	1	1	4	2	**13**
Bat1	-	-	9	4	0	10	0	1	**24**
Bat2	+	*(+)*	14	4	7	6	4	1	**36**
Bat3	-	-	3	2	0	4	0	2	**11**
Bat4	+	+ *(3)*	4	1	4	2	2	10	**23**
Bat5	-	+/-	2	2	0	2	2	2	**10**
Bat6	-	-	3	1	0	2	1	1	**8**
Bat7	-	+ *(4)*	1	3	2	3	1	1	**11**
Bat8	+	+ *(4)*	3	2	2	0	3	1	**11**
Bat9	-	+/-	1	1	0	1	2	0	**5**
Bat10	-	-	3	1	0	1	1	0	**6**
Bat11	+	+ *(7)*	5	1	0	1	0	9	**16**
Sum of codes			**113**	**60**	**48**	**76**	**55**	**74**	**426**

Implicit experiments

In all cases at least one example of implicit experimentation was found. A higher number of implicit experiments indicates a very active personality of the farmer, a diversified farm or a longer interaction with the farmer and an extended farm visit. Because of that, it can be concluded that all farmers did implicit experiments, but it cannot serve as evidence for quantitative measurements of implicit experimentation.

Farm changes

Only in two cases no detailed farm changes were reported. In these two cases, not necessarily farm changes did not happen, but it was not talked about it in the data collection phase. Since all farmers either dispose of a traditional agricultural family background or grew up in a rural livelihood and their farms are managed by their families already for several years or decades (section 5.6), it can be assumed that they have lived changes in agricultural production at least once. Especially in Batabanó agriculture was several times influenced by major production changes through political planning decisions (section 5.4.2).

Future plans

The relatively high number of "0" future codes was connected to age as a limiting factor for future plans. Eight farmers explicitly stated that they felt already too old or are suffering health problems and therefore they would not change their farm or try out new things anymore. They would just continue their work and hand it over step by step to the younger generation: *"Estaba probando muchos cultivos, toda mi vida, llevo ya 50 años trabajando en el campo. Pero esta [la guayaba] es mi ultima prueba, ya no voy a probar nada."* ("I have tried many cultivars, all my life, because I have been working in agriculture already for 50 years now. But this one [of guava] is my last try out, I will not try anything new anymore."[4], Bat9, 14.09.2007).

Learning experiences

All farmers, except two who did not give a statement on learning experiences, emphasized that working in agriculture is an ongoing learning process. Two factors were crucial to this process: First, farmers are learning their craft over time; with the years of farming they gain more and more experience: *"Se aprende con los años."* ("One learns over time.", Bat4, 17.09.2007). *"Estamos grabando conocimiento y vamos ganando experiencia."* ("We are accumulating knowledge and gaining experience.", Bat1, 19.09.2007). Second, farmers are learning by doing; practicing agriculture is the major source for learning it: *"La practica te enseña."* ("Practice teaches you.", Bat2, 01.09.2007), *"La experiencia te va terminando lo que vas a sembrar."* ("Your experience tells you what to sow.", LP13, 16.08.2007). Additionally, two important sources for learning experiences were mentioned: 22 farmers mentioned at least once failures as trigger for learning processes: *"Los golpes enseñan. Como si fueras estudiante, el campo te enseña."* ("The setbacks teach; as if you were a student, your fields teach you.", Bat10, 20.09.2007), *"El campesino mejor aprende tropezando."* ("A farmer learns best stumbling.", LP14, 16.08.2007). And agricultural tradition, learning the craft of agriculture from ancestors and other farmers, was mentioned by 14 farmers: *"Fui aprendiendo del Viejo mio, de generaciones."* ("I learnt from my father, from generations.", Bat7, 30.08.2007*), "Los científicos aquí son los viejos."* ("Here, the scientists are the old.", LP10, 09.08.2007).

[4] All translations of original citations in Spanish into English were done by the researcher herself.

Try-outs

All farmers gave examples of new things they had tried out. Those who score 0 in "PROBAR" but score higher in "EXPL" used the words "probar" and "experimentar" equivalently with the same meaning and the counts were done in the category "EXPL". Especially FP-farmers might score high in "EXPL" but low in "PROBAR" because for them everything they did newly was an experiment (see cases LP2, Bat4, Bat11).

Explicit experiments

In the "EXPL"-column the influence of the FP-project becomes even more visible. All farmers who score high in this category are actively involved in the FP-project. In those cases, the participation in the FP-project created awareness and consciousness for the farmers' own experimentation processes (section 6.2.1.4). The farmers who score low in this category are either FP-farmers who gave new crops and crop varieties received via the project as examples, or farmers who created some awareness for experimentation during the interview and gave examples of what could be seen as an experiment in their eyes. In the case of three farmers no explicit experiments were encountered.

Innovative farmers

Finally, farmers who score high in total on experimentation codes and have all categories covered, are considered more innovative than the other farmers visited, which was affirmed during the farm visits. This was the case for farmers LP3, LP6, LP10, LP11, Bat2 and Bat4. Four out of these are active members in the FP-project. Bat2 has well-established contacts to scientific institutions. LP10 based his success and innovativeness upon his commitment to agriculture; since he was 15 years old he loved to sow many different things.

6.1.1. Implicit experiments

Due to its unconscious and routine character implicit experimentation includes a wide range of possible try outs, changes, innovations and experiments which are also indicated by the different codes used. It was impossible to catch a complete picture on each farm. For this reason, only some examples are presented in order to illustrate the amplitude of this field. Although they resemble picked-out single cases here, similar processes might occur on many other farms as well.

6.1.1.1. Examples of implicit experiments

Mostly, examples for implicit experiments were related to introductions of new crops or livestock on farm level, different intercropping systems and crop combinations, new machinery and facilities they had in use or in construction. The motive behind was either a problem that had to be solved or improvements in production that should be achieved like higher outputs, less labour inputs or cost reduction. All the examples might be understood as farmers' experiments from a scientific point of view. However, they were not considered as "experiments" by the farmers at all. For them it was simply part of their work, sometimes a trial or a learning lesson, or just experience (section 6.3). No differences between FP-farmers and non-FP-farmers were noticed.

New crops

LP9 was the first farmer in his surrounding who produced papaya on large scale because it grows fast, is easy to handle and has a good price.

Farmers LP14 and LP7 were recently including pineapple into their production plans because it was a labour- and input-extensive cultivar and seedlings could be received easily from other farmers who had pineapple already in their fields.

Farmer Bat8 was the first in his municipality who focussed his production on rice seedlings, 20 years ago. Now he planned to widen his spectrum towards vegetables. During the winter season he wanted to sow tomato as well.

Farmer LP4 and farmer Bat2 were the only ones in their neighbourhood focussing on the production of ornamental plants. LP4 was producing flowers for the funeral industry and tried at the moment sunflower as a new crop. Bat2 produced flowers for tourist facilities and collected and reproduced all kinds of new planting material he could get.

Although it is not a common crop at all in La Palma, Farmer LP1 was cultivating okra because his grandfather always liked to consume it.

New crop varieties

Also many farmers were constantly trying out new varieties, recommended by other farmers or engineers, and replacing their old varieties if the new ones gave better results, in the sense of higher yields or better resistance to pests or climatic adversities. Especially in crops like beans, maize, cassava and tomato the refreshment of seeds was emphasized.

In La Palma six farmers reported on a new variety in taro they were trying out because the traditional varieties were falling ill and the new one was said to be resistant. They received some seedlings from neighbours, family or other farmers, sowed them on small plots and tried to multiply them. Another crop of high diversity was banana. Both, farmers in La Palma and farmers in Batabanó, independently if members of the FP-project or not, were searching and constantly trying out new varieties, either for resistance, faster and higher production or better prices on the market. LP6 and Bat2 were planning to increase their number of varieties in avocado in order to achieve its production the whole year round.

Crop management practices

Also in crop management, a variety of individual approaches was detected. For example, guava was a very popular crop in Batabanó at that moment. Many farmers introduced it during the last years because of good prices and easy handling. Some reproduced it via shoots, others via graftage; one farmer intercropped it with grains, another farmer with avocado.

In La Palma, farmer LP10 generally dedicated much of his land to intercropping, for example in coffee-orange-pumpkin, avocado-banana-taro or avocado-pumpkin-cassava, combinations not detected on the other farms.

Farmer LP3 was the first in his neighbourhood planting rice in wetlands instead of dry fields; he brought this innovation from his brother who lived in another region specialised on rice-production.

Farmer LP5 was confronted with water logging in a plot planted for the first time with cassava. He combated it with a small channel for drainage. For the next year he would search for a water resistant variety.

Farmer LP14 tried already two different planting distances in pineapple: either two narrow furrows combined with one wider furrow or only wide furrows. Narrow furrows are supposed to suppress better weeds but on the other hand it is impossible to clean weeds that emerge between the narrow furrows. Therefore he selected the system with wider planting distance.

Livestock management practices

In livestock management, the piglets of farmer LP12 wore a wire in their nose in order to keep them off digging out tuber crops since they were moving freely on the farm area during the day.

Farmer LP14 highlighted his learning experiences with the implementation of commercial pig production for the state. Engineers supplied him with thoroughbred piglets and concentrated feed stuff and further explained him how to feed and treat them correctly in order to achieve fast weight increases. He was impressed by the effectiveness of this new production process because they were feeding their traditional breeds for home-consumption with starch crops and kitchen residues.

Farmer LP11 introduced sheep on his farm a few years ago, first only to keep weeds from the land he had cleared before. Recently he also started with breeding them for commercialisation.

Farmer LP10 collected the manure of his cows for using it as fertilizer in his field crops because he saw a documentary on television about farmers in Africa who used cow manure as fertilizer and pesticide in banana. Consequently, he remembered that his father always had put his cows in the fields of tobacco for one year and he had achieved extraordinary yields. Nowadays his farm is too small for leaving a field one year without production and he has only few cows. Still, he makes use of the manure as far as possible.

Farm equipment as Cuban "inventos"

In the area of machinery and tools the Cuban innovativeness, forced by the economic crisis suffered since the fall of the Soviet Union, became readily visible. Due to the shortage in the availability of new machinery and technology, Cubans have learnt to improvise and recycle old material in creative ways. *"Como no hay uno tiene que vivir inventando."* ("As many things are not available, we have to invent.", LP4, 06.08.2007) *"Aquí se inventa mucho, la necesidad te hace inventar."* ("Here people invent a lot, necessity makes you inventive." Bat2, 01.09.2007). For example, Farmer LP6 made ropes out of old textiles and plastics, also for commercial purposes.

In agriculture, farmers generally repaired their machinery themselves and replaced broken pieces with metal parts obtained from other discarded machines or old factories. Several tools they had to make by themselves because they could not be bought or are very expensive. *"Porque hay veces que el campesino tiene que inventar debido a las necesidades. No es porque quiere inventar."* ("Because sometimes a farmer has to invent out of necessity, not because he wants to invent.", LP11, 16.08.2007).

For example, farmers LP11 and Bat11 showed their self made locks for their stables. All stables encountered were constructed by the farmers and their families, either made of wood, concrete or metal. Farmer LP11 made the stable for his sheep around the small house where he stored his implements. By using the already existing construction as central structure, he could save building material.

Farmer Bat2 disposed of education in agricultural engineering; therefore he even had a self made grain mill and an implement to roast soy or other grains. His latest project was the construction of a grain dryer. Finally, also his car was a complete self-construction out of collected and recycled pieces.

But not only shortages in machinery were solved by farmers inventiveness, also problems in crop management were addressed. Farmer Bat2 had problems with earthworms in his tree nursery because the worms entered the plastic bags with the seedlings and loosened the substrate material in there. As a solution he planned to make beds of concrete so that the earthworms could not enter anymore from the soil below. Further he could use these structures also as seed beds for vegetables during summer.

6.1.1.2. Methodology issues

In matters of methodology, 15 farmers emphasized that it was important to try out small quantities first and if the results were satisfying to amplify production in a next step. As

farmer LP14 put it: *"Si no tienes conocimiento de la semilla, no debes sembrar mucho. Lo siembras en pequeño y si te da buen rendimiento sigues al año siguiente."* ("If you don't know a seed, you must not sow much of it. You sow it first on a small plot and if it gives good yields, you can go further in the next year.", LP15, 16.08.2007).

Finally, it turned out that the homegardens and plots of land assigned to self-subsistence were the experimental fields for farmers because there crop diversity was usually higher than in their fields. Asked how they knew how to grow a new crop, the farmers explained that they always had been producing these crops before but on small scale for private consumption: Therefore, the crops were not completely new to them. *"Antes se sembraba de todo pero en menos cantidad."* ("In former times, we sowed everything but in less quantity." LP10, 09.08.2007) Three farmers added that producing on large scale was different though because requirements of fertilisation and pest control were more difficult to meet and needed to be learnt as well.

One current example provided the family of farmer LP3: Banana has always been a principal crop for Cuban food habits, so it has always been present in Cuban homegardens. But only three years ago the farmer started to experiment and plant more banana trees in her homegarden in order to raise production for economic purposes. When her husband and her son recognized that she was achieving very good results with it, they took some seedlings from the banana trees to their farm and started banana production there. At that moment, they were one of the first banana growers for market purposes and therefore they could sell their produce easily. Nowadays many farmers grew banana as well.

Additionally, farmers highlighted the importance to ask other farmers for advice if one wanted to start with a new crop. *"Tienes que asesorarte de uno que tiene buen resultado. [...] Estamos aprendiendo de la experiencia acumulada por otros campesinos."* ("You have to inform yourself by somebody who achieves good results. […] We are learning from the accumulated experience of other farmers.", Bat1, 19.09.2007) *"Si pruebas un cultivo nuevo, tienes que recojer experiencia de alguien que ya sepa."* ("If you want to try out a new crop, you have to ask somebody who is already experienced in it." Bat6, 14.09.2007).

6.1.1.3. Failures as a learning experience

Many farmers explained that often they were learning from their own mistakes, things that failed during the production process (section 6.1, paragraph "learning experiences"). While trying something new, they recognized the failure of one of their actions and had to redirect the affected practice, change it or try something different. Some examples shall be provided here.

Farmer Bat1 showed the researcher his cassava plants in between the furrows of banana trees. The problem was that only the lateral plants showed good growth and greenish colours, the plants in between the bananas were yellowish and weak in performance. Farmer Bat1 explained that this was his strategy to conserve and multiply the casava seedlings in order to have his own planting material in the next season. Unfortunately, he planted the cassava after the banana trees and now they were affected by too much shade under the roof of banana leaves. Next time he would plant them at the same time.

Farmer Bat3 outlined that crop rotation was an issue he had to learn via trial and error in younger years. It happened to him once that he sowed cassava after pineapple and he achieved very high yields. Afterwards he sowed cassava a second time in the same soil, but it failed completely. Since then, he followed crop rotations carefully.

Also farmer Bat10 explained the reason why he did not sow rice anymore. He sowed in some years ago and was also very satisfied with the harvests, but any other crop planted afterwards in the same soil failed. *"El arroz se lleva la fuerza de la tierra."* ("The rice takes

the vigour of the soil with it.", Bat10, 20.09.2007). Therefore he preferred to stay with other crops and to quit rice production.

Finally, farmer LP10 described how he learnt that different varieties had to be sowed separately if one did not want them to cross. He made this experience in maize. He used to sow a variety of maize with yellow grains. His nephew brought him some seeds of white maize and asked him to try it out. So he sowed the new variety next to his own variety and in the end it turned out that the white maize contained yellow grains as well as the yellow maize had white grains inside. The next year he did not sow his nephew's variety anymore because he did not like its characteristics. But since then he knew that it would be necessary to sow them at distance.

6.1.1.4. Spontaneity as a source

Also in several cases, farmers pointed out that they discovered new things by chance, without the intention of trying something new. But later on they included their newly gained knowledge purposefully into their work. *"A veces se aprende casualmente."* ("Sometimes you learn by chance.", Bat2, 01.09.2007).

Farmer Bat1 demonstrated that his harvest in taro was extraordinary successful and much better than the harvest of his neighbour who planted in the same soil type and had a similar management to his. Then he realized that he had sown in accidentally in waning moon which was the factor of success in his eyes. He had worked according to moon phases already before in banana, but taro was a new crop for him so he did not know it. But next season he wanted to sow it on purpose according to the moon phases.

Farmer Bat2 found a material-saving technique to replace poorly developed guava-seedlings in his tree nursery. Usually he multiplied guava-trees via simple shoots, putting them into a plastic bag with a mixture of earth and sand until they rooted. Some of them failed to root and had to be replaced by a new shoot and start again. Once he found by accident a shoot between two bags that had built roots as well. He transplanted it into the bag of the failed one and it sprouted successfully. Since then, he put some shoots on purpose between the plastic bags and used them as back-ups for failed seedlings.

Farmer LP11 discovered by accident a mulching technique to better maintain soil humidity in taro in order to prevent it from water stress: Originally, he trained a new pair of young oxen in working as draft animals. To start with light-weighted tasks, he filled the carriage with palm leaves and took it to his farm with the new oxen. When he did not need the palm leaves anymore for teaching purposes, he put them between his furrows of taro, with the idea that they would suppress weeds for a while. Once chatting with his neighbour farmer, he realized that his harvest in taro was much better than the yields of his neighbour. On closer examination, he found out that the soil under the palm leaves was still wet, whereas the other fields suffered a dry summer during that season. Since then, he used palm leaves on purpose in his taro plants in order to keep soil humidity.

Farmer LP2 found during the field walk with the researcher a plant of tomato sprouting between his banana trees. He concluded that it was sown there with the manure he used for fertilization. Since it was growing there vigorously out of season though, he decided to maintain it carefully because it seemed to be a variety of good resistance to high temperatures and precipitation.

Generally, on many farms fruit trees had not been sown on purpose but had germinated spontaneously close to the houses. Nevertheless, later on they were attended and taken care of for home-consumption.

6.1.1.5. Adaptations

Farmers also gave evidence for their flexibility in either adapting their methods to new circumstances or in adapting ideas of other farmers to their own conditions.

For example, farmers LP7 and LP11 raised concerns about weather adversities and argued for the adaptation to climate changes, e.g. shifts in sowing or harvesting dates.

Farmer LP4 was tobacco farmer before he changed to flower production. Nevertheless, he still used his tobacco knife to cut the flowers because it turned to fit much better the requirements for cutting flowers than normal knifes.

Farmer Bat2 adapted technological solutions of other farmers to his farm. First he received the construction information on a hydraulic watering system, developed by another farmer in province Havana, via the institution of Urban Agriculture and then he built it by himself. Since he lacked some materials the creator had used, he found his own solutions to some technical devices, e.g. he used the regulators of infusion tubes from a hospital to regulate the water flow rate. Also in ornamental production, another farmer told him about “his secret” of lighting flowering plants in his greenhouses during the night in order to shift the flowering periods and to achieve an all-year-round production. Following this advice, he installed a lantern in his yard and produced flowers there since then.

Farmer Bat4 explained the difference in planting distances in cucumber between his fields and the fields of other farmers as an adaptation to his machinery requirements. In cucumber production, a common crop in Batabanó, it was general practice to leave always one furrow empty between two furrows of plants. Nevertheless, he planted cucumbers in two furrows next to each other and left the third furrow empty. This was because his tractor was wider in tire distance and with the traditional method it would drive over the leaves since cucumber was a very broad spreading plant. Although it was not optimal to plant them close to each other because they hindered one another, it was still better than crunching them, he explicated.

6.1.2. Explicit experiments

The number of experiments, explicitly named as such, depended strongly on the farmers' involvement in the FP-project (Table 7). Therefore, this section is divided in experiments inside and outside the FP-project.

Table 7: Types of explicit experiments encountered, listed according to the number of farmers who reported on it.

Type of experiment	FP-triggered	Number of farmers
Variety-testing in common crops	Yes/No	9/8
Living fences against soil erosion	Yes/No	3/2
Testing of newly introduced crops	Yes/No	3/1
Genetic livestock improvement (crosses)	Yes/No	2/2
Increased fruit size in banana by direct fertilizer application	No	3
Production and use of compost or earthworm-humus for fertilization	Yes	3
Testing of the same variety in different seasons/dates of planting and harvesting	Yes/No	2/1
Crosses in beans	Yes	2
Crosses in maize	Yes	2
Testing of different green manure plants	Yes	2
Testing of different types of fertilizers in a crop	Yes	2
Testing of the same variety in different soils	Yes/No	1/1
Acceleration of ripening processes in banana by the use of accompanying plants	No	1
Changes in planting distances and arrangements	No	1
Crop rotations	No	1
Intercropping of annual and perennial crops	Yes	1
Testing of mixtures in animal fodder	Yes	1
Preservation of soil humidity by soil coverage	No	1
Pruning and grafting of fruit trees	No	1
Testing of different dates of fertilizer application	Yes	1
Testing of planting and multiplication techniques in a tree nursery	Yes	1

6.1.2.1. Experiments triggered by the FP-project

All farmers involved in the FP-project referred first of all to experiments with different varieties either in well-known crops like maize, beans, rice, cassava and tomato or in new crops like wheat, sorghum, soybean and cow pea. Not surprisingly, these represent the central issues of the FP-project, the increase of crop and variety diversity on farm level and the experimentation with it under on-farm-conditions. Also crosses of varieties in beans and maize, as learnt in the project activities, were cited by several FP-farmers. Additionally, other farming practices, adopted via the project, like the production of

compost, the use of green manure plants for soil fertilization, living fences against erosion, the storage of sowing material and grafting, were reported.

Farmer Bat4 did many experiments which went beyond the average spectrum of FP-experimentation. Since the introduction of soybean on his farm, he focused more intensively on pig production. He did several crosses between traditional and thoroughbred races and he experimented with the feed stuff requirements and sooner ablactating of the piglets in order to speed up the reproduction process. He weighted the animals regularly and took notes on each step.

He also did a comparison of five different green manure plants, brought by the FP-staff, in a field of old banana trees. Afterwards, he continued to experiment with the green manure crop he liked best. He made three trial plots with maize, one with synthetic fertilizer, one with the green manure crop and the third one without any type of fertilizer. He achieved the same yields with the green manure crop as with the synthetic fertilizer and now aims at changing his complete farm to organic production methods.

Farmer Bat11 was doing the breed of a new variety in maize in cooperation with the FP-staff. After five years of refinement he achieved already his own homogenous population and was waiting for certification allowance as his own variety.

In La Palma, farmer LP3 started as a result of her participation in the project to experiment more in detail in her homegarden. She introduced a tree nursery and reproduced her own fruit trees in plastic bags with earth and compost substrates. It turned out that this reproduction technique was much more secure than the direct sowing she had practiced before. She planned to start also with grafting and inoculation by herself.

Farmer LP11 took his FP-experiences with organic matter for fertilization further and was conducting an experiment in taro at the moment of visit. He compared the effects of fertilization, first if the organic matter was incorporated into the soil and the taro planted afterwards and second if the organic matter was put on top of the soil after the taro was planted.

6.1.2.2. Experiments outside of the FP-project

Outside of the FP-project, fewer examples were reported. Farmers with a holistic understanding of farmers' experimentation (section 6.2.1.1, category 3) did not give concrete examples of their own experiments, but farming practices that include experimental processes in their eyes.

For instance, Farmer Bat1 mentioned the search for the best seed material and its trials in the fields. Farmer Bat3 cited crop rotations and the search for best corresponding breeding animals in livestock as examples for experimental processes that are part of each farmer's work. Farmer Bat5 remembered the change from animal traction to the use of tractors in the planting of tomato: Since the plough blades of a tractor were inclined towards one side, they had to figure out first on which side of a furrow the tomato seedlings had to be planted. Many farmers had to undergo this experimental process and usually did it with the help of other farmers who were already handling the new technology.

Farmer LP7 mentioned shifts in planting dates, according to the weather forecast and changing climate conditions, as possible experiments done by farmers. Farmer LP8 admitted that he would like to experiment in his own farm with soy for animal feed, although in his opinion "real" experiments were done by scientific institutions.

Farmer LP12 did one small experiment in papaya. He had already two fields of his farm planted with papaya and he wanted to extend his production onto a third field. Therefore he had planted one seedling of papaya in that field, which was still under production of cassava, in order to see if papaya also adapted well to the soil conditions there.

Farmer LP2 carried out one experiment in his homegarden without information inputs of the FP-staff. An acquaintance he had met in the street had told him about a technique how to increase the size of bananas on a bunch. By cutting the end of the bunch and putting a small plastic bag with synthetic fertilizer around, the growth of the bananas could be enhanced. Farmer LP2 tried it out with two bunches of bananas that were in a similar state of development. One he put the new implement, the other he left without in his traditional management. The day of starting the experiment he knew by heart. His sister, farmer LP3, adopted the idea and repeated the experiment in her homegarden. Further, she did a repetition with organic matter instead of synthetic fertilizer. Farmer LP11 had heard about it and also planned to repeat the experiment in his farm.

6.1.3. Comparisons and outcomes: first and second research visit

As both research areas were visited a second time for a few days, the further development of some of the experiments outlined in the foregone sections could be evaluated.

Farmer Bat8 had put his plan of sowing tomato for the winter season aside due to bad weather conditions. Autumn was too wet so that he could not prepare his fields in time. Therefore he cancelled it for this season; he would try it the next year again, if the weather would allow it.

Farmer LP3 described in a second visit the outcomes of her experiments in banana with fertilizers to increase fruit size. The first one with synthetic fertilizer, she showed already in the first visit, resulted very well and motivated her to go on with it. But the second one she put with synthetic fertilizer failed because it burnt the stem of the bunch and she had to take it off. She ascribed the failure to the quality of the fertilizer that was worse the second time. Also the two trials with organic matter did not give satisfying results. No difference to the comparison bunches without treatments were noticed up to that moment. Therefore she decided to await the final point of harvest and decide then if she would do another repetition or not.

Farmer LP11 commented of a mistake he made in his process of sheep breeding. He had bought more sheep in order to increase his livestock population and possible crosses. But it turned out that the new sheep had an illness on their claws and he had to slaughter them. Neighbours meant that the illness resulted from the wet soil but he did not believe in that theory since his own sheep did not fell ill once. He wanted to buy new sheep again but next time he would be more careful in selecting the animals.

Farmer LP12 was disappointed by the poor development of the papaya plant within his cassava field. Nevertheless, he planned to plant the whole field with papaya the next year because he attributed the poor plant performance to the shade suffered from the neighbouring cassava plants and not to soil quality. Despite of this, one of his papaya fields, which had been almost eradicated by constant water logging in summer, could be recovered completely and gave already first fruits.

These experiences made the constantly flexible working manner of farmers visible. Within days, weeks or few months their plans could change completely and expected outcomes had to be revised. Because of their highly dynamic working environment, influenced by many different factors, they were forced to – but they were also used to – constantly adapt and realign towards new conditions.

6.2. Perception of farmers' experiments

6.2.1. The Farmers' view

The key aim of this study is to explore the farmers' point of view on farmers' experiments and their understanding of it. In order to achieve this, three main questions were asked during the interview: First, "Do you do experiments?"; Second "What is an experiment for

you?" and third, "What is the difference between farmers' experiments and scientists' experiments in your opinion?".

6.2.1.1. Do you do experiments?

Since the expression "experiment" or "experimentation" constitutes a rather specific term that might induce a formal and constrained atmosphere of talk and hamper a farmer's willingness to speak freely, especially when asked by a university student, the questioning was supplemented with the question "Do you try new things?" (see annex, section 12.7, Table 11). The expressions "to try out" and "try new things" (*probar, probar cosas nuevas*) are commonly used in everyday language and people are more familiar with those terms.

Usually, farmers were first asked on a more general level if they tried out new things and then more specifically if they did experiments. Only the FP-farmers in La Palma were, because of the project influence, so familiar with the terms experimenting and experimentation that they were first directly asked about their experiments and later on about trials. If already during the field visit it had become obvious that farmers were trying out new things because they showed them and gave examples, the question on "trying out new things" was not anymore explicitly asked during the interview, which occurred above all in Batabanó.

For the question "Do you do experiments?" three categories of answers could be distinguished (Figure 4):

- No, I don't do experiments (Category NO).
- Yes, I do experiments, in relation to the FP-project (Category YES_FP).
- Yes, in the end farmers are constantly experimenting (Category YES).

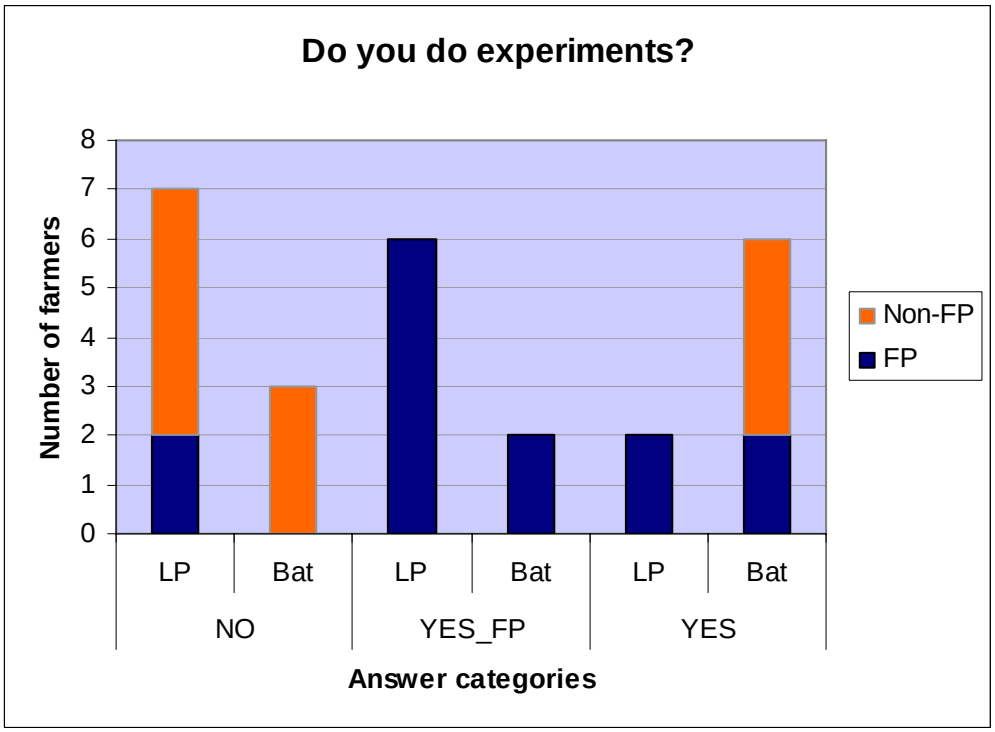

Figure 4: Display of categories of respondents to the question "Do you do experiments?", grouped according to research sites and FP-involvement.

Category 1 (NO) was bigger in La Palma (7) than in Batabanó (3). In La Palma it included five farmers who did not work together with the FP-project or any other scientific institution

and two farmers who were in the newly emerging FP-farmers-group. The three answers in Batabanó stemmed from farmers who didn't interact in any scientific project.

Category 2 (YES_FP) comprised only farmers who were engaged in the FP-project. Again, the group of respondents in La Palma (6) was bigger than in Batabanó (2). Examples given were related above all to experiments with different varieties in one crop, received from the FP-staff, e.g. in beans, rice or potato.

Finally, category 3 (YES) was dominated by farmers of Batabanó (6) and included only two farmers from La Palma. Those two farmers in La Palma were members of the FP-project and explained that because of the work with the project they became aware of their own experimentation and engaged more actively in it (section 6.2.1.4). In Batabanó, two farmers were involved in the FP-project and deepened their consciousness for experimentation there. One farmer had worked together with different research institutions and was very open towards the introduction of innovations on his farm. Three farmers did not have any contact to research staff but they interpreted the expression "experiment" in a comprehensive way, including trials, introduction of new crops and learning experiences. With this holistic point of view, they concluded that experimentation was an on-going part of their farming activities, in their words: *"Es tan cotidiano que lo haces sin darte cuenta."* ("It is so quotidian that you don't realize it.", Bat1, 19.09.2007) or *"Mira, al final experimentamos siempre. Probamos y preguntamos a gente que tiene más experiencia que nosotros."* ("In the end we are always experimenting. We try and we ask somebody who has more experience than we have." Bat3, 23.10.2007)

As expected, farmers were more familiar with the term "probar/to try". 18 farmers were asked the question "Do you try out new things?" and all farmers interviewed answered with yes. Only one farmer in Batabanó said that he did not try new things anymore because he is already old: *"En este momento no. Ya no hay el espíritu de la juventud."* ("At this moment not. There is no spirit of youth anymore." Bat5, 16.09.2007). The majority related trials to the introduction of new crops or new varieties of crops on their farm. Seven farmers (4 FP) also emphasized that they were constantly trying out new things and it was essential to the process of farming: *"Cada rato hay que probar cosas nuevas."* ("Constantly you have to try new things." LP4, 06.08.2007).

To sum up, the question for experimentation as such generated differentiated answers, whereas all farmers agreed that trying out new things on their farm was part of their work activities.

6.2.1.2. What is an experiment in your eyes?

The most important question to explore the farmers' perception of farmers' experiments was "What is an experiment for you?" (see annex, section 12.7, Table 12). Only one farmer in La Palma and one farmer in Batabanó were not asked this question. Another farmer in Batabanó gave only an evasive answer and always changed topic so that in the end he did not answer the question, although before he had said to experiment a lot.

The FP-farmers in La Palma, except the five starting in the new farmer-group, had a more concrete concept of experiments and could explain it clearly. Two FP-farmers highlighted the role of selection criteria in an experimenting process that determine which variety to choose. In the words of one farmer: *"En si mismo, un experimento es, por ejemplo en las variedades, tienes que basarte en que son los factores para seleccionar. Producción, lo que antes viene es la producción, el consumo, la resistencia a plagas y enfermedades y a la sequia. Estos factores tienes que tener."* ("Fundamentally, in an experiment, for example in variety-testing, you have to determine what criteria for selection to use. First of all, level of production, consumption characteristics, resistance against pests and diseases. Those are the factors you have to keep in mind." LP1, 01.08.2007). The two female FP-farmers associated an experiment with a comparison of certain plant characteristics: *"Para mi un experimento es, cuando siembro dos plantas. Y comparo lo*

que es una y la otra con el mismo tratamiento, el mismo sistema de siembra." (For me it is an experiment if I sow two plants and y compare one with the other, with the same treatment and the same system of sowing.", LP3, 30.07.2007).

The two farmers in La Palma who had completed five years of higher education (and who are not in the FP-project) also gave a more concrete definition of an experiment related to comparison processes over time and their results. *"Para mi un experimento es hacer una cosa y estudiarla através del tiempo y ver el resultado que da."* ("In my opinion, an experiment means to do something and study it over time and see the results it gives." LP8, 08.08.2007). The farmer cited here also added that those things were done by engineers and scientists, not by farmers. A farmer in Batabanó also related experiments to agricultural institutions: *"El abono organico y cosas del CREE serían cosas así."* ("Organic fertilizer [which was distributed by the institution of Urban Agriculture] and products of the CREE would be things like that." Bat10, 20.09.2007).

The other farmers gave more general definitions of an experiment related to examples of their field of work, mostly crop performance. Commonly, three main characteristics were mentioned:

- to try something out (*probar algo*)
- to implement a new thing one did not have before (*una cosa nueva*)
- and to evaluate the visible results (*a ver como da*).

As one farmer explained: *"Sembrar una mata que no tenías antes y ver como da, ver en el terreno si me da."* ("To sow a plant that you have not sown before and see how it develops, see in the field if it gives results", LP12, 17.08.2007). Three farmers (among these one FP-farmer) also used the term "innovation" in order to define an experiment, in the sense of doing something new: *"Es parecido a una innovación, innovar algo, por ejemplo sembrar algo donde no habías sembrado nunca y ver como da."* ("It is similar to an innovation, to innovate something, for example to sow something where you never sowed before and see the results." LP14, 16.08.2007). The most general definition out of all answers could be given as "To experiment means to try something new".

6.2.1.3. What is the difference between farmers' experiments and scientists' experiments?

This question was only asked if the farmers had said to do experiments and if they seemed to have a clear concept of experimentation as such (see annex, section 12.7, Table 13).The group of respondents included therefore ten farmers in total, six in La Palma (five FP-farmers) and four in Batabanó (three FP-farmers).

In the opinion of the FP-farmers, there is little difference between their own experiments and experiments done by scientists. Although they indicated that scientists' experiments occur under more sophisticated conditions, on an advanced level of study and preparation, the basis and process of experimentation are similar. In the farmers' eyes, both require attentive management, careful observation and accurate evaluation in order to reach results and to come to conclusions. One farmer in La Palma put it the following way: *"Yo creo que son parecidos. Siempre la agricultura es de aprender siempre algo nuevo. Y un cientifico, eso es lo que busca siempre. Y viene en la práctica, el objectivo de lo que tu buscas. Eso tambien sería... Igual que un cientifico. Buscas saber."* ("I think that they are similar. Agriculture is always about learning something new. And a scientist, that's what he is looking for. And here it comes into practice, the objective of what you are looking for. That's the same as a scientist is doing. You search for knowledge." LP3, 30.07.2007). Farmer LP11 outlined that the FP-project changed his perception of scientists' experiments. Formerly he considered them as theoretical considerations, done in an office and written down in a book, obliging farmers to follow their recommendations. In the FP-project instead, scientists work together with farmers, teaching them by doing

and leaving the choice to the farmer. One farmer in Batabanó further highlighted the importance of the personal experience in the farmers' experiments: *"No son diferentes pero los experimentos de los campesinos te dan la posibilidad de verlo tu mismo, para ver si es mentira o verdad."* ("They are not different but the experiments done by farmers give you the opportunity to see it with your own eyes, to see if it is false or true." Bat7, 30.08.2007).

The two farmers outside of the FP-movement gave less clear answers but saw a difference in the more practical, intuitive character of farmers' experiments, learning by doing via trial and error: *"Nosotros hacemos experimentos prácticos. Vamos viendo en la práctica, sobre todo vía el fracaso."* ("We are doing practical experiments. We are learning in practice, above all through failures." Bat3, 23.10.2007).

6.2.1.4. Awareness creation for farmers' experiments

The FP-project strongly influenced the perception of experimental processes of their members. Before the project team started to teach their farmers' groups in agricultural management techniques, it built consciousness among the farmers for their own actions and working manners, how and why they were doing certain things:

"Son tantas la cantidades de cosas que tú aprendes que tú las sabes. Y tú a veces tú dices porque yo lo hago? Y ni tú misma sabes porque tú lo haces. Entonces, a mi este proyecto [del FP] me ha enseñado. Pero a lo que más me enseñaron, es a descubrirme a mí misma." ("There are so many things that you learn that you know them already. And sometimes you ask yourself, why am I doing that? And even you yourself don't know. So, this project [of FP] taught me a lot. But most importantly they taught me to discover myself.", LP6, 29.07.2007).

The husband of farmer LP6 put it the following way in a farmers' meeting organized by the team of the FP-project: *"Se miraba y no se veía. A partir de la introducción del proyecto aquí en La Palma comenzamos a mirar y a ver. Empezamos a experimentar."* ("We looked and we did not see. With the introduction of the project here in La Palma we started to look and see. We started to experiment.", 06.08.2007)

Also farmer LP11 explained the difference between aware and unaware experimentation: *"Mira, la mayoría de la gente dice que no experimenta. Y yo digo que la mayoría experimenta. Lo que no se esta dando cuenta que experimenta."* ("Look, the majority of the people say that they don't experiment. And I say, yes they do experiment. It is just that they don't realize that they are experimenting.", LP11, 11.12.2007). In retrospective, he considers his entire development of becoming a farmer a process of experimentation. He started clearing land for a farm 17 years ago. He had to prepare the soil, sow for the first time maize, plant lines of bananas on the slopes to prevent erosion and so on. Every step he had to do for a first time. Since it was unknown to him then, from his actual perspective he considered it as an experiment. Nowadays, as having learnt from the project experiences, he conducts concrete experiments on questions of interest by the means of trial plots, comparisons and evaluation.

During the interview sessions, five farmers, not participating in the FP-project, finally also agreed that some of their practices could be considered as experiments as well. Following dialogue occurred at the end of an interview between the researcher's companion, explaining the work of the FP-project and asking for the farmer's interest, and farmer LP9 who had stated before that he did not perform experiments:

"Y a usted le gustaría experimentar en su finca con muy poquitos granos en dos surcos o varios surcos y compararlas juntas con las de usted? Y que usted mismo evalue el nivel de producción de cadauno de las variedades que trae con respeto a las tradicionales que usted tiene?

Eso es lo que hago yo casi siempre con las cosas esas! Cuando veo que...dicen no aquello da más rendimiento, yo busco la manera de buscarle rendimiento y experimentar con ello."

("Would you like to experiment in your farm with a few grains in two or several furrows and compare them to your own ones? And you would evaluate the level of production of each variety in relation to your traditional varieties?

But that is what I am usually doing with those things! If I hear that somebody says that another variety gives higher yields, I try to achieve these yields and to experiment with it.", LP9, 09.08.2007).

This conversation underlines that the farmer was actually used to constantly trying out new varieties and comparing them with his own ones, only up to that moment he did not consider that as an experiment, it was just part of his normal farm work. However, these five farmers admitted to experiment only as a consequence of the interaction with the researcher. The FP-farmers in contrast proclaimed to experiment since the very beginning of research interaction, without any effort on the researcher's part.

6.2.2. The Experts' view

The farmers' view shall be compared with the experts' view on farmers' experiments. Therefore, experts were asked similar questions: "Does your institution do experiments?", "Do you think farmers do experiments?", "What is an experiment for you?" And "What is the difference between farmers' experiments and scientists' experiments in your eyes?"

6.2.2.1. Does your institution do experiments?

First, the engagement in experimentation by the corresponding institution was clarified (see annex, section 12.7, Table 14). Since three experts belonged to agricultural research institutions, they were involved in scientific experimentation themselves. Also the director of the CREE in Batabanó gave references of several successful experiments and innovations achieved by his institution in the production methods of biological pest control mechanisms. The expert in fruit production outlined that he had already made experiments on different strategies to combat diseases in fruit trees. The three representatives of organisational and administrational units on the contrary, did not do any experiments within their institutions as these had different functions to fulfil.

6.2.2.2. Do you think farmers do experiments?

As many experts first of all referred to the farmers' experiments done within the FP-project, the question was supplemented with the apposition "Do you think farmers do experiments? Also outside the FP-project?" (see annex, section 12.7, Table 14).

Only one expert negated that farmers did experiments on their own: *"No. Hay que enseñarles mucho y son muy repetitivos."* (No, you have to teach them a lot and they are very repetitive." Exp3, 13.08.2007).

Two experts acknowledged that farmers did experiments but emphasized that it was necessary to keep on motivating them, giving them incentives and teaching them how to do research on their farms. If that was not done, perhaps not all of them would start to experiment. Whereas one expert pointed out that farmers did experiments on their own. In his eyes it was the purpose of participatory research, including the FP-project, to accredit and reinforce farmers' experimentation.

The other four experts agreed that farmers were doing experiments on their farms. In their opinion, farmers were constantly experimenting in an empirical way, stemming from tradition and the knowledge of their ancestors. As evidence for this kind of experimentation one expert mentioned farmers' knowledge on production cycles, the influence of the moon phases and climate conditions: *"Hay cosas que ellos saben y no se les dice ningún científico."* ("There are things they know that no scientist has told them.", Exp5, 15.10.2007).

All in all, farmers' experimentation processes, interlinked to farmers' knowledge, seemed to be accredited by the Cuban agricultural institutions interviewed. The majority of the experts also recognized the implicit character of farmers' experiments.

Exp8 confirmed the case of guava described in section 6.1.1.1. When the production of guava started to augment in Batabanó, first farmers went to other municipalities to learn from colleagues who were already more experienced in its cultivation. Then farmers exchanged their experiences among them, how to achieve high yields, how to cut the trees, how to combat diseases, how to clean the fields properly and so on. Finally, although there were many farmers who grew the same crop guava, all had their individual peculiarities in their management, based on their personal day-to-day observation in differing farm conditions. *"El campesino logra, está mirando día y noche como está evolucionando su siembra. Y se da cuenta como tiene que hacerlo[...]...eso es experimentación, el campesino lo hace cotidiano."* ("The farmer achieves results; he is watching day and night how his crops are developing. And he realizes how he has to do it […]…that is experimentation; the farmer does it every day." Exp8, 22.10.2008).

Also Exp4 gave a similar explication: *"Quizá cuando va a visitar algunos campesinos, no vea un experimento montado como dice la experimentación, con métodos con sistema de experimentos. Pero, en la realidad cotidiana uno siembra por ejemplo una réplica de una variedad, una réplica de otra variedad. Y así va sembrando, pues tiene su propia experiencia."* ("Maybe when you will visit some farmers, you will not find experiments carried out as it is said in theory, with systematic methodology of experimentation. But in his daily reality, a farmer might sow a replication of a variety or another. And that is how he is producing, he is following his own experiences." Exp4, 30.07.2007).

Exp1 finally confirmed that individual variations are part of a farmer's work. *"Yo no soy campesino. Pero sí sé que hacen variaciones continuas de lo que historicamente han hecho. Siempre están introduciendo nuevas variaciones. Si antes echaban una semilla, ahora echan dos. [...] Si alguien le ha dado una planta que controla una plaga o una enfermedad, tratan de sembrarla. Esos son como continuos cambios que van introduciendo por cada cultivo."* ("I am not a farmer. But I know that they are doing continuous variations of what they were historically doing. They are always introducing new variants. If formerly they sowed one grain, now they sow two. […] If somebody gives them a plant that controls diseases, they will try to sow it. And these are like continuous changes that they are introducing in each cultivar." Exp1, 19.10.2007). He also provided examples for farmers' variations within the experiments done with the FP-project: The first diversity fair of beans was done by scientists at the INCA. Later on, farmers did the diversity fairs in their own fields. The INCA-staff sowed the beans as monoculture in quadrate plots. Despite of that, some farmers sowed their beans in between their banana trees. Others put them in furrows instead of quadrate plots. *"Ellos lo adaptaron a su sistema productivo."* ("They adapted it to their productive system.", Exp1, 19.10.2007).

Also Exp2 gave one example for the farmers' individual adaptation and variation of FP-methodology to their own mind set. The farmer who was supposed to do the second diversity fair in beans could not attend the first diversity fair that was made. When Exp2 brought him the seeds, he told him to sow them in furrows and expected him to sow one variety in one furrow. But the farmer did it the way he was used to sow his beans and sowed one variety after the other. Since the number of seeds varied between varieties and he wanted to sow all he had received, some varieties covered more space than others. Only the last ones contained always the same amount of seeds (Figure 5).

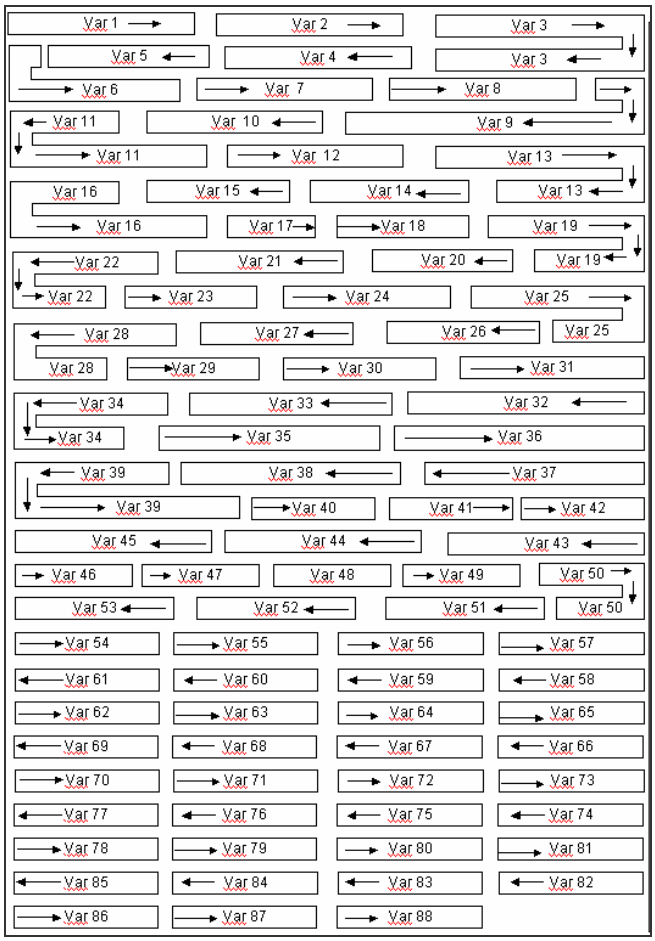

Figure 5: Sketch of the planting pattern of a farmer in a FP-diversity fair in beans (Source: Ferro, 2007).

As another example, the problem of scarcity in potato seeds was introduced in one FP-activity in La Palma. The solutions found by different farmers represented farmers' individual dispositions and preferences. While some farmers started to reproduce potato seedlings with different methods, others searched for suitable ways to store them.

6.2.2.3. What is an experiment in your eyes?

Seven out of eight experts were asked for their definition of an experiment (see annex, section 12.7, Table 15). Since the interview as such was about the topic of farmers' experimentation (*la experimentación campesina)* and all the experts knew the FP-project, the answers of five experts were related to the project work and to farmers' experiments, though it was not explicitly asked like that.

The most elaborate answer stemmed from an expert within the FP-project: *"Es la capacidad que tienen los agricultores de introducir nuevas variantes, sistematizar y diseminar lo que están haciendo."* ("It is the capacity of farmers to introduce new variants, systematize and disseminate what they are doing." Exp1, 19.10.2008). Another expert outlined that for him as a scientist an experiment was the validation of a suspicion like a hypothesis whereas for farmers it was the search for solutions to their problems. Two experts defined an experiment as search for results. One expert explained experiments, according to his experiences with the FP-project, as the introduction of new crops and crop varieties on municipality level as it was the case for wheat, cow pea and soy. While one scientist related experiments above all to the methodology of comparison and evaluation, either in the field or in the laboratory, one administrational representative

understood farmers' experiments as putting into practice the results achieved by scientists.

6.2.2.4. What is the difference between farmers' experiments and scientists' experiments?

Four out of eight experts were asked this question (see annex, section 12.7, Table 16). Three of them stated the difference in the methodology applied. While scientists used quantitative statistical methods and clear research designs to validate their experimental results, farmers used a more qualitative approach and evaluate their experiments with the means of daily observation, interrelated to the production processes in and around their farm. Because of this fundamental difference, farmers were interested in outcomes caused by a multitude of influencing factors whereas scientists tried to separate and control the influencing factors and analyse the effects of each on its own: *"Los experimentos de los campesinos yo me he dado cuenta que ellos no importa tanto separar la influencia de la variedad con la influencia del ambiente. Sino les interesa la integración de todo eso. Tienen un concepto mucho más de sistema, mucho más holístico de los resultados."* ("I recognized that for the farmers it is not so important to separate the influence of a crop variety from the influence of the environment. They are much more interested in the integration of all these factors. They have a more systemic and holistic concept of the results." Exp1, 19.10.2007).

One expert did not relate at all to methodological aspects but highlighted the differences in the recognition of the outcomes of experimentation processes: A scientist's work is recognized by his research institution while farmers might lack recognition of their work because they are not linked to such institutions.

All experts asked affirmed that both types of experimentation were valid and influential for agricultural development.

6.2.3. Comparison farmers' view – experts' view

A comparison between the farmers' view and the experts' view shows points of linkage and points of desegregation between farmers and experts. Whereas only 16 farmers out of 26 stated that they did experiments, either within the FP-project or holistically within their normal farming practices; all experts except for one recognized farmers' active role in experimentation, on the one hand within the FP-project, on the other hand understood as part of their daily farm experience and tradition. Nevertheless, all farmers gave evidence, either during the interview or during the farm visit that they were trying out new things. By that, they affirmed the experts' perception of implicit experiments.

Both farmers closely linked to scientific institutions (via the FP-project or via a higher level of education) and experts closely linked to scientific institutions (as scientists themselves) defined the term experiment in more elaborate ways and made in their own words references to characteristics of classic scientific experiments, such as comparisons, new variants, control groups, evaluation mechanisms or hypothesis testing. The other farmers related the term experiment above all to the introduction and trial of something new. Further experts defined experiments generally by their orientation towards results or problem solutions.

Although FP-farmers did not see much difference between their experiments and scientists' experiments, they acknowledged the more sophisticated methodology applied by researchers. This was also the major difference outlined by non-FP-farmers and experts: While farmers' experiments are more qualitatively evaluated, scientists' experiments are approved quantitatively with statistical methods and clearly defined measurement procedures.

6.3. Communication patterns

6.3.1. Knowledge transmission

Examples of explicit experiments were assessed during the interview sessions. It turned out that farmers explained deliberately and extensively their contents and purposes, since they were conscious and planned undertakings. In the case of FP-triggered experiments (section 6.1.2.1), ideas and knowledge inputs for experiments stemmed from the FP-team or other FP-farmers.

Data on examples for implicit experiments were first of all collected during the field walks. Either the researcher asked questions (section 5.7.1.5) on issues that attracted her attention as possible experiment or the farmer gave explanations and demonstrations of his/her farm work in the field, which turned out to be implicit experiments along the conversation. Answers to questions on farm changes and learning experiences revealed that most farmers ranked practical experience and learning from their ancestors as very important factors (section 6.1). This seemed also plausible since all respondents were living in a rural livelihood and only two did not grow up on a farm.

The importance of constant exchange with other farmers was also highlighted by all farmers and in several cases even practiced when the researcher was accompanied by another farmer. Especially the two farmers without agricultural family background pointed out that they were learning by doing on the one side and learning from their neighbours on the other. Also farmer LP10 told the story of one of his neighbours who moved into the area during the 1970s and started with farming on a fertile piece of land which had not been cultivated before. Despite of that, he did not achieve positive production results in the beginning. Only after 10 years, when he started to ask for advice and to learn from experienced farmers in his neighbourhood, he improved his levels of production. Since then he was harvesting good yields too.

The examples of farmer Bat1 and farmer LP11 in section 6.1.1.4 also give evidence for the important role of exchange with other farmers as spontaneous experimentation triggers. Whereas farmer Bat1 drew his conclusions on the influence of the moon phases after observation and comparison with a neighbouring field, LP11 realized his successful strategy for preserving soil humidity during a chat with his neighbour. The idea for the explicit experiment of increased banana size conducted first by farmer LP2 and then by farmer LP3, stemmed from an informal conversation in the street as well: *"Se aprende caminando con la gente"* ("One learns while walking with people." LP2, 03.08.2007). Farmer LP3 brought the idea of rice cultivation in wetlands from a relative living in region specialised in rice production (section 6.1.1.1). Farmer Bat2 actively searched for new ideas in conversations with other farmers, scientists and visitors to his farm. One expert outlined that the management of the fruit tree guava was learnt by the farmers in Batabanó first via informal exchange with more experienced farmers from neighbouring municipalities (section 6.2.2.2).

All in all, learning via action and observation such as learning via oral exchange with other farmers, family or neighbours turned out to be complementary patterns of knowledge transmission. It may not occur one or the other, but integration of both, verbal and non-verbal ways of communication, supports best knowledge creation and exchange.

6.3.2. Vocabulary used by farmers

When farmers commented on their try outs and learning processes notes were taken on the expressions used by them (Table 8). One count represents one farmer who applied the expression more than once; no reference is made how often exactly one farmer used

the expression. The field notes of each farm visit served as basis for counting[5]; the phrases of interest had been written down in original citations in the notes. Ex-post, the expressions were grouped in 13 categories.

Table 8: Expressions used by the farmers when commenting on experimental processes, listed to the number of farmers who used it.

Expression used, Spanish	Expression used, translation into English	Number of farmers who used this expression
Probar (una cosa nueva)	To try (a new thing)	22
Inventar / hacer un invento	To invent/to make an invention	14
A ver si da bien / a ver si da resultado	To see if it works well/to see if it gives good results	12
Comprobar / hacer la prueba	To verify, to test	10
Aprendiendo en la practica / aprendiendo trabajando	To learn while practising/ to learn while working	9
Los golpes enseñan / fracasos	To learn from failures	8
Experimentar	To experiment	7
Aprendiendo con el tiempo / cogiendo experiencia	To learn over time/ to gain experience	6
Buscar alternativas / buscar soluciones / buscar maneras de hacer algo	To search for alternatives/ to search for solutions/ to search for ways of doing something	5
Comparar	To compare	3
Investigar	To investigate	2
Evaluar / hacer una evaluación	To evaluate/ to do an evaluation	2
Innovar	To innovate	2

As already indicated in section 6.2.1.1, the word “probar/to try” is a commonly used expression in Cuba and also most farmers used it when commenting on one of their trials. Further, “inventar/invent” is a typically Cuban expression and was used by many farmers, especially when referring to technical solutions to a problem, often in relation with the shortage in material goods and implements. The general criterion for evaluation of a try out was expressed with the phrases “a ver si da bien/to see if it works well”, stating that the results have to be visible to the farmers’ eyes and they have to be good or even better than foregone practices, in comparison with the farmers’ own experiences. Also the expressions “comprobar, hacer la prueba” in the sense of “to verify, to test” were generally used to describe the outcomes of an experiment or trial. Finally, also the phrases “buscar alternativas, soluciones o maneras de hacer algo/to search for alternatives, solutions or ways of doing something” expressed the reasoning behind an experimental process.

Related to learning experiences, farmers used to talk about their practical aspects (*“aprendiendo en la práctica”*), the importance of failures as triggers (*“los golpes enseñan”*) and the source of tradition and experience (*“cogiendo expriencia”*), collected over time (section 6.1.1.2).

[5] The expressions used during the interviews were not taken into account, since there the vocabulary was partly induced by the researcher’s questioning.

The word “experimentar” was used by farmers who were actively involved in the FP-project for several years. While the experienced FP-farmers used it constantly in relation to their farm work, the four farmers in the newly emerging farmer group in La Palma had not adopted it yet. Also the other farmers, outside of the FP-project, used it only in the interview sessions, when induced by the researcher, not in their liberate speech about their farm work.

More elaborate expressions like “comparar/to compare”, “investigar/investigate”, “evaluar/to evaluate” and “innovar/to innovate” were used by a few farmers, also in the context of the FP-movement. The trainings within the project made them more familiar with scientific terms. Farmer LP6 even gave the detailed outline of her experimental design in the crossing of beans talking about the generations she had achieved, up to “F5”.

To conclude, a difference in the used vocabulary between the FP-farmers and non-FP-farmers was noticed. Through their contact to scientists and their research training they were more familiar with scientific terms. Especially the word “experiment” as such was actively adopted by them and used for any new practice introduced as a consequence of the FP-project; whereas non-FP-farmers or starting FP-farmers stuck to general expressions of colloquial language, mostly by talking about “trying out”.

7. Discussion

7.1. Challenges, adjustments and lessons learnt

The experience of conducting this study can be considered as an experiment, performed by the researcher herself. Though it was purposefully selected, consciously developed and explicitly planned; it also gave room for implicit experiences that had to be learnt directly in the field because they could not be anticipated beforehand, even with careful preparation done. The most influencing challenges shall be outlined here; hence they might be of use to a third party planning a similar study.

7.1.1. Cuba as country of investigation

The field work was scheduled from July until October, which are the hottest and wettest months in Cuban climate and prone to hurricanes. Although the research team was lucky and not affected by major storms, it is probably not the best season for travelling to Cuba. The hot and humid climate might weaken a European's physical condition and negatively influence research performance. Further, August is the month of vacation in Cuba which can complicate interactions, meetings or interviews with official representatives and institution staff, because they are not available. In agriculture, summertime is low season too; production is limited to few crops then. High season starts in November. This fact holds the advantage, that farmers have more time available and do not feel hindered in their work by research visits so rapidly. A disadvantage is the fact that many crops and activities farmers are talking about cannot be observed in the fields, which makes it more difficult for the researcher to follow the explanations.

Language skills in Spanish are highly recommendable for a research stay in Cuba, if interaction with local people is planned. Although the researcher provided good speaking and writing skills in Spanish, she had to get used to the Cuban accent, very different from the Spanish spoken in Spain and even differing between the two research areas.

Time management in Cuba is much more flexible than in Europe and changes in schedules, programmes and meetings are more the rule than the exception. Flexibility and patience are worthy skills. Consequently, a tight research programme puts pressure on the researcher and his/her counterparts and might result unachievable.

A functioning transport system is one of the biggest challenges Cuba faces since the crisis of the1990s. Either a big financial budget for rapid private transportation facilities or a big time budget combined with low claims on comfort should to be earmarked.

Internet was only available in tourist internet cafés or at the research institutions, not in the rural areas of research. Further, speed was slow, uploading and downloading of bigger files impossible. It should not be counted on this media in communication and data storage.

7.1.2. Methodology adjustments

As a result of the researcher's personal learning process during her field stay, methodology was redirected several times. First of all, the choice of the research areas was revised. In the beginning, one area in the west and one in the east of the country were scheduled. Since permission for a field stay in the east was not received in time, Batabanó, relatively close to the first research area, was chosen as alternative.

Farm stays of several days at each farm of the sample, originally planned for extended participant and non-participant observation, were not performed in the end. Instead, farm walks were used for non-participant observation and visits at key-informants' places gave chances for participant observation.

Further, it was not possible to collect a complete picture of all implicit experiments on a farm, therefore it comprised a far too complex system of different working processes and visits were too short (section 6.1.1). For that reason, also social and/or economic experiments were completely left out of analysis. Beyond that, Cuban agriculture was generally new to the researcher, which complicated the distinction between "normal" and "individual" practice. As a compromise, she decided to collect examples instead of complete inventories. For a comprehensive study on implicit experiments it is considered useful to focus on just one farm over a season or a year or on one narrow topic of experimentation, e.g. one crop, one management practice or one tool, in order to compare the related implicit experiments between different farmers, farms and/or research areas.

Interaction with respondents was originally thought to occur between just two people, the farmer and the researcher. Sometimes this was the case, sometimes not (section 5.7.1.8). Over time, after building trust and respect for both points of views, individual solutions with each companion were found, like leaving the researcher alone after her introduction or interfering in the conversation only after the interview was closed.

Recording of interviews with farmers was given up after the first field stay (section 5.7.1.6). FP-farmers were used to inquiries by scientists and students but farmers outside of the project seemed less comfortable in the interview session, preferring an informal setting. Finally, the researcher herself did not feel comfortable with the situations encountered and decided not to record anymore. Instead, she trained her abilities in taking meaningful notes and memorizing correctly interview situations. Also knowing the interview guideline by heart with no need to keep a sheet with questions in the hands eased the interaction.

Interview guidelines were adapted in the sense that the questions "What is an innovation for you?" and "What is an invention for you?" were completely left out in the second research area. Both terms are widely used in Cuban language: *"innovación"* more formally in the media and written texts and *"invento"* informally in everyday language as an expression for Cuban creative solutions to all kinds of commodity shortages. As one farmer explained: *"Inventar es innovar. Tiene el mismo sentido."* (To invent is to innovate. It has the same meaning." LP3, 30.07.2007). As most of the farmers were irritated by the amount of abstract questions and their answers did not differ strongly from their definitions of experiments, questions for innovations and inventions were cancelled in the end. One farmer stated: *"Se innova, se inventa y se experimenta a la vez."* ("One innovates, invents and experiments at the same time." LP11, 16.08.2007). Therefore, the answers were not included in data analysis. Also a Likert scale, primarily included to assess a farmer's commitment to farming, was left out in field work because it contradicted the practice of fostering an informal interview situation without formal papers. It was replaced by the questions outlined in section 5.7.2 (SH1.3).

7.2. Critical reflection: limitations and weaknesses

Since this research was not performed in a laboratory but with humans embedded in a social context, it can be prone to several biases. These could be caused by the researcher's performance, by methodological inconsistencies or by the given setting encountered that could not be changed easily. Although it was tried to prevent them in advance as far as possible, this work is not completely free from limitations. At least awareness for possible weaknesses shall be raised.

A "roadside bias" occurs when villages for research are chosen because of having easier access to them, e.g. they are on a main road or close to town. Due to their location, they are often atypically prosperous and populous (Richards, 1985). In this study, choice of respondents depended strongly on the contacts offered by the partner research institutions. Therefore, villages and farms with successful cooperation experiences in the past were presented as counterparts. Also further contacts, provided by the key

informants, gave access to successful and recognized farmers: During field work it turned out that all farmers interviewed were either members of the FP-project and/or accredited by other farmers for their high levels of agricultural production and/or good farming performances. It is beyond the scope of this study to determine, whether such successful farmers do more experiments than "average" Cuban farmers would do.

Cuban families have traditionally been male-dominated (Nieto & Delgado, 2002) which can lead to a bias towards men being seen as the representatives of a farm (Howard, 2003). Indeed, usually male farmers were introduced to the researcher. Only two women in La Palma were referenced as FP-farmers. Women as farm representatives were still the exception rather than the rule. Although farmers' wives, daughters or daughters-in-law confirmed to help with farm work if labour was needed, they referred to their husbands, sons or sons-in-law for information on farm activities. In acknowledging that innovation is gendered (Saad, 2002), also experimentation might be. FP-researchers conducted a gender analysis in their diversity fairs, which showed that variety selection criteria differed between men and women (Montes, 2006). However, in this study, no further investigation of gender roles was performed. Therefore, its outcomes might be biased towards "male" experimentation.

Further, a bias towards elder farmers has to be admitted. Whereas the median age in Cuba is 36.3 years (estimation 2007; CIA, 2008), the median age of the farmers interviewed in this study was 56,5 years. Only six farmers were younger than 50 years (4 FP-farmers), of these three FP-farmers were younger than 40 years. The fact, of elder interview partners, taken together with the described dominance of successful male farmers outlined before, shows parallel characteristics to the public perception of innovative farmers identified by Sumberg and Okali (1997, p.133 ff.)

An "expectation bias" in the interpretation of observed farm life can influence the researcher's judgement on experiments and goes along with the expectancy effect (Rosenthal & Rubin, 1978, cited in Bernard, 2002). The research aim to detect farmers' experiments and classify them into "implicit" and "explicit" guided the researchers view into a certain direction and may have led to misinterpretation of "experiments" which were actually normal farming practice in Cuba. To avoid that "discovering the obvious" (Bernard, 2002, p. 359) and other misinterpretations lead to self-fulfilling prophecies, constant re-reading and reflecting on the observed, cross-checking of experiments with cases of other farmers and discussion of data with research partners was applied. Still, the risk of "false" experiments cannot be eliminated completely except by further in-depth investigations.

Also the assignment of categories such as "implicit" and "explicit" resulted difficult sometimes, since agricultural practices are not black and white but colourful, comprising different characteristics interrelated to human behaviour of the farmer and/or of the researcher (compare Sumberg and Okali, 1997, p. 147). As a result, more than just two categories emerged during data analysis (section 6.1). Although the researcher assessed experimentation contents and interaction with farmers according to her own definitions (sections 3 and 5.7.2) as analytically as possible, her personal perception and subjectivity influenced the decision process. Another researcher might draw upon other categories and criteria. Comparative studies by other parties would have to be conducted to make the influence of the researcher's personality visible.

Finally, the consecutive adjustments in methodology (section 7.1.2) could influence the outcomes. As longer lasting stays on all farms were not performed, data collection relied more strongly on oral information acquisition through semi-structured and unstructured interviewing than on observant data gathering, which might reduce the opportunity to make tacit knowledge of farmers explicit as claimed by Hoffmann et al. (2006). Moreover, first interview sessions were more formal due to the use of a voice recorder and a printed interview guideline, whereas later on settings became more informal, also because the

researcher felt already more familiar with the surroundings. It was tried however to stick to the same wording of questions during the interviews, especially in the questions on farmers' perception of experimental processes.

7.3. Research findings compared to literature findings

7.3.1. Implicit and explicit experimentation

The idea and conceptual outline for this study departed from a basic research approach, as the comprehensive FWF-research-project aimed at the understanding of genuine experimental processes conducted by farmers (Ninio and Vogl, 2006). However, through the field work in Cuba, it was confronted with an applied research approach which was practiced by the FP-project via participatory research (Rios, 2003a). By combining these contrasting approaches, the research objectives were above all based in the comparison of FP-farmers and non-FP-farmers.

It was found that farmers' experimentation, in the sense of implicit experiments, was indeed widespread and present in everyday farming, as already postulated by Johnson (1972) and Sumberg and Okali (1997). Still, for the farmers their experimentation was strongly linked to its outcomes and should be seen within the broader process of agricultural change (Rhoades and Bebbington, 1999). Orientation towards results and/or changes on farm level, measurable and perceivable to the farmers' eyes, was mentioned both by farmers and experts. The outcomes were important as a motive for farmers' experiments but could also serve as a reason in retrospect after the integration of spontaneous experiences, which is also described by Scheuermeier (1997). Nevertheless, they were not entirely geared towards problem solution as identified by Hocdé (1998) although necessity to invent or experiment due to material shortages was often mentioned. Also input savings or adaptation to environmental and economic changes (Bentley, 2006) were important motives. Scientific curiosity as stated by Berkes (1993) was found only in cases of farmers who had well established contacts to the FP-movement and who had developed awareness for their own experimentation processes because of that. The dominance of empirical observation and accumulation of facts by trial-and-error in traditional knowledge creation (Berkes, 1993) is also supported by the research findings as the majority of the farmers mentioned failures as important learning sources. That their learning experiences were ongoing processes over time without clear starting points and sudden ends, was also reported and goes in line with the perception of Rhoades (1989).

However, the experience with the FP-project showed that farmers' experiments can also serve as tool to generate locally adapted alternatives in farming as postulated by Triomphe (1998), here in the concrete case of seed diversity and crop varieties. It is an example where participatory research increases the rates of farmers' experimentation (Saad, 2002). Teaching of small-scale experimentation, as claimed by Bunch (1998) or Ruddell and Beingolea (1995), were actively implemented. This turned out to influence strongly the characteristics of farmers' experiments. FP-farmers experimented explicitly in a planned way following certain steps of methodology similar to scientific experiments, as it was also reported by Sumberg and Okali (1997) of African farmers who had contacts to extension services.

7.3.2. Perception of farmers' experiments

Also in the case of farmers' perception of their own experimental processes, the influence of the FP-project was noticed. While FP-farmers clearly perceived their experiments as such and could express them clearly, most farmers outside the FP-project considered trials, learning experiences or adaptations as normal part of their every day life, as described by Patiño (1990; cited in Saad, 2002). Practices labelled as experiments by the

researcher were considered as experience by the farmers, as reported by Stolzenbach (1997) as well.

The definition of the term “experiment” can be related to the official definition given by Webster’s Online Dictionary (2008). FP-farmers had a clear understanding of experiments, following a scientific perception which goes in line with point 1 of Webster’s definition (*The act of conducting a controlled test or investigation*). The other farmers’ definitions stuck more to the general definition of “trying something new” as declared in point 2 and 3 (*The testing of an idea; A venture at something new or different*) at Webster’s.

Whereas FP-farmers did not see much difference between their experiments and scientists’ experiments, a point of view shared by Sumberg and Okali (1997), farmers outside of the FP-project emphasized the intuitive practical character of their actions as different to scientists’ experiments, as opined by Antweiler (1995) and Hoffmann et al. (2006). Both farmers and experts highlighted differences in experimental methodology, as cited in Hocdé (1998).

7.3.3. Communication patterns

As emphasized by Antweiler (1995), observation and learning in practice turned out to be crucial to knowledge acquisition and transmission in farmers’ experimentation and learning process. Influence of popular storytelling and initiation rites, considered as important for knowledge transmission by Haverkort and Millar (1992) and Mudege (2005), was not detected in the case of farmers’ experiments in Cuba. But farmers highlighted the importance of exchange with other farmers and neighbours. Hence, positive learning spill-over effects from successful neighbours (Foster and Rosenzweig, 1995) were noticed. Also informal communication networks (Wu and Pretty, 2004) played a major role in dissemination of new knowledge and triggers for experimentation.

Again, farmers’ language when commenting on experimentation processes was strongly influenced by the FP-project. The use of the term “experiment/to experiment” and other formal expressions was closely connected to the participation in the project. On general level, the term “probar” (“to try”) was most commonly used by farmers when referring to their try-outs. Also Rhoades and Bebbington (1999) found the expression “prueba” best-fitting in a Peruvian context. Despites, the widely used term “inventar” (“to invent”) seems to be a typical Cuban expression, stemming from the crisis during the 1990s. Further evidence for learning by doing (Antweiler, 1995), for trial-and-error-learning (Berkes, 1993) and for experiential learning over time (Hoffmann, 2006) was also found in the expressions used by farmers when explaining their experimental experiences.

7.4. Evaluation of hypotheses

Hypothesis 1 (H 1): Farmers conduct both explicit experiments, similar to scientific experiments, and implicit experiments, which are part of their everyday farming practice.

This hypothesis has to be negated. Indeed, all farmers performed implicit experiments as part of their everyday farming practice. In contrast, explicit experiments were not conducted by all farmers. Participation in the FP-project for several years showed to increase the number of explicit experiments performed. Whereas implicit experimentation showed to be ubiquitous, explicit experimentation did not.

However, if the definition of explicit experiments is amplified in the sense of “trying something new”, without necessary similarities to scientific experiments, then all farmers were explicitly experimenting.

Sub-Hypothesis 1.1 (SH 1.1): Farmers conduct more implicit experiments than explicit experiments, in number.

As numbers of experiments, especially in the case of implicit experiments, cannot be considered as complete but only as indicators, a definite answer cannot be provided. In all cases evidence for implicit experimentation was found, which was not the case for explicit experimentation. If indicators such as farm changes, learning experiences, future plans and try-outs are taken into account as implicit experiments, then the above stated hypothesis holds true.

SH 1.2: A higher level of education/a non-agricultural background/contact to research staff increases the number of explicit experiments.

Evidence for the positive influence of a higher level of education or a non-agricultural background was not found. But contact to research staff in the case of the FP-project did noticeably increase the number of explicit experiments. The influence of other contacts to scientists could not be determined separately because the concerned farmers in Batabanó were also familiar with the FP-project.

SH 1.3: A strong commitment to farming increases the number of explicit experiments.

Commitment to farming was generally regular to high and farmers interviewed were all in all "successful" farmers (section 7.2). Therefore it is not possible to draw general conclusions of the sample. However, one farmer in La Palma who admitted low commitment to farming did not score worse than other farmers; whereas the three farmers who scored zero in explicit experimentation showed to have a high commitment to farming. One of the farmers being considered especially innovative based his success in his commitment to farming. He scored generally high in experimentation codes but low in explicit experiments (section 6.1).

SH 1.4: The number of implicit experiments is not influenced by the above mentioned variables (higher level of education/a non-agricultural background/contact to research staff, strong commitment to farming).

This hypothesis holds generally true in this sample. No clear evidence for influences can be given. However, commitment to farming seemed to positively affect the performance of innovative farmers. It would have to be determined if the FP-project increased commitment to farming or if farmers were selected for the FP-project because of higher commitment to farming.

H 2: The farmers' perception and labelling of their own experiments is different from what they understand under the term "experiment".

To the FP-farmers, this hypothesis does not apply, to the others it does. FP-farmers labelled and perceived their experiments as experiments. Non-FP-farmers called their experiments try-outs or experience. Further they said either not to experiment at all or to experiment in the sense of implicit experimentation, ex-post understood as ongoing experimentation process during a farmer's work.

Interestingly, the general definition of an experiment was given as "trying something new" and all farmers asked answered the question "do you try out new things?" with yes, as stated in section 6.2.1.1. Therefore, following their own definitions of experiment, all farmers actually did experiments. Nevertheless, only 16 farmers out of 26 stated that they were doing experiments in one way or the other. This might be an indicator that the term "experiment" is still associated more strongly with formal science, especially when asked by a university student, and keeps farmers from using it for their own activities. Also the wife of one FP-farmer outlined that "inventar" and "experimentar" meant more or less the same but "inventar" is more commonly used whereas "experimentar" is more related to science.

SH 2.1: Farmers perceive their experiments different from "scientific experiments" conducted by researchers.

Explicitly this was only asked to eight FP-farmers and two non-FP-farmers. As major difference in methodology was mentioned, which was considered to be more sophisticated when applied by scientists. Apart from that, FP-farmers did not see much difference since they learnt to conduct experiments from scientists. One non-FP-farmer mentioned the intuitive character of farmers' experiments as difference to scientists' experiments which was also acknowledged by the experts interviewed.

Considerations on the implicit association of the term "experiment" with formal science see above (H.2).

SH 2.2: A higher level of education/a non-agricultural background/contact to research staff increase the use of formal vocabulary, such as the term "experiment".

The two non-FP-farmers who had completed five years of higher education gave a clearer definition of the term "experiment" and seemed to be more familiar with such formal vocabulary than other non-FP-farmers. However, they did not use the expressions for their own farming experiences.

No influence of a non-agricultural background was noticed.

In the case of FP-farmers, their contact to the project staff increased the use of formal vocabulary on experimentation, since such expressions were commonly used in project language.

SH 2.3: Farmers communicate orally deliberately about their explicit experiments whereas their implicit experiments are "mute", usually invisible to their owners.

This hypothesis holds true as far as explicit experiments are concerned. Implicit experiments were "mute" in the sense that they were not labelled as experiments by their owners. However, also oral explanation could be obtained on them by using indicator questions or asking specifically on an encountered experiment in the field. Often they were not invisible to their owners but simply not considered as experiments. Instead they were understood as learning experiences, adaptations, solutions to problems or try-outs.

SH 2.4: Demonstration and "learning by observation" play a key role in the transmission of knowledge on implicit experiments.

Demonstration and learning by observation turned out to be important in knowledge transmission, also in the farmers' eyes, supplemented by the notion on learning by doing. Also conversations with other farmers and neighbours received emphasis in the role of learning and receiving new inputs for experimentation. Often, the different ways of knowledge transmission, verbal and non-verbal, went together.

7.5. Final considerations

This study was a first introduction to farmers' perceptions of implicit and explicit experimentation processes. The sample was small and purposefully selected so that only qualitative analysis could be performed and no generalized conclusions could be drawn. Therefore, all hypotheses could receive further attention and detailed analysis in proceeding studies. Especially the influence of sociodemographic characteristics was only poorly investigated due to sample composition.

A gender approach could reveal further insight on male and female experimentation in agricultural settings, as well as age seemed to influence rates of experimentation. The researcher gained the impression that higher age decreases the willingness to experiment. Comparing groups of farmers with a traditional farming background and groups of farmers newly engaged in agriculture also might result insightful since several "traditional" farmers opined negatively on their "new" colleagues. In such a comparison

also the influence of education and/or work experience outside agriculture might become determinable. Further, this study was limited to farmers who were private land owners, organized in CCS. Cuba would offer the opportunity to compare experimentation processes in different land tenure systems, as it is the case in state farms, CPAs, UBPCs or individual usufruct lands. Finally, the exploration of commitment to farming deserves closer attention. More precise indicators on how to measure commitment to farming would have to be developed first. Also the influence of further contacts to science, especially cases of non-participatory formal science, might reveal patterns different from the FP-experience.

Last but not least, the challenge of definition and category building during scientific procedure shall be emphasized: Where does explicit experimentation start and where does implicit experimentation end? Is a farm change that has been experienced an implicit experiment? Can a learning experience be considered as an implicit experiment? Which criteria must be fulfilled by an explicit experiment? What is the difference between a single experiment and an experimentation process? Are farm-life-experiences, in retrospective understood as experiments, also experiments? Where to draw the line?

In this study, explicit experiments were narrowly defined whereas implicit experiments covered a wide range of possible individual performances. This supports on the one hand the notion that experimentation is an ever-present phenomenon in human behaviour; on the other hand it weakens the significance of the expression as such. An expression that comprises everything says little in the end because its contents become blurred.

This study revealed that farmers don’t care too much about labelling, categorising and defining. For them, the actual work performance is important. As a scientist in contrast, clear definitions and prior awareness of their implicit assumptions are prerequisite. Final analysis and results cannot be seen independently of the mindset they are embedded in.

8. Conclusion

Farmers' experiments in Cuba offer a broad field of applications, reaching from small mechanic adaptations in farm equipment due to a lack of material resources up to complicate crosses in crop varieties. They may be discovered by default after a conversation with a neighbour or implemented on purpose after having received training in agro-ecological practices. They may be labelled experiment or experience. They may be simple in their dimensioning including only minor changes in daily farming routine or they may use detailed designs and controlled measurements similar to experiments conducted by research institutions.

Ranges between these extremes are wide and farmers' experiments may cover all spaces in between. In fact, only scientists care about building categories. This study showed that farmers in Cuba do diverse kinds of undertakings that can be considered as experiments from a scientific point of view. This study also showed that farmers usually do not consider their individual activities as experiments in the moment of performance, unless they are involved in a programme that actively enhances farmers' experiments and labels them as such.

Participation in the FP-project showed to increase the amounts of explicit experiments as well as the awareness of farmers for their own experimentation processes. Many participatory research projects around the world, especially in development contexts, use farmers' experiments as a tool for technology development and adaptation. They might also influence the farmers' perception of experimentation processes and by that foster farmers' willingness to experiment actively.

Active experimentation, in the sense of purposefully conducting an undertaking following a prior determined explicit idea and process, seems to be strongly linked to awareness creation. If an aware perception of a farmer's own action process is not present, experimentation stays implicit, performed unconsciously as intuitive response to challenges of daily life. But even if a scientific logic is introduced to farmer's thinking, as it was the case in the FP-project, it might not change their intuitive actions but supplement them with a rational backup, triggering further learning experiences. It can be one way to make their tacit local knowledge explicit, accessible to outsiders and to themselves.

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10. List of Figures

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12. Annex

12.1. Glossary of agricultural crops and livestock

Table 9: English expressions, scientific denominations and Cuban names of the agricultural crops and livestock mentioned in this paper.

English name, used in this paper	Scientific name	Spanish name, used in Cuba
Avocado	*Persea americana*	Aguacate
Banana	*Musa spp.*	Plátano
Bean	*Phaseolus spp., Vigna ssp.*	Frijol
Cassava	*Manihot esculenta*	Yucca
Coffee	*Coffea arabica*	Café
Cow Pea	*Vigna unguiculata*	Frijol caupí
Guava	*Psidium guayava*	Guayaba
Maize	*Zea mays*	Maíz
Okra	*Abelmoschus esculentus*	Quimbombó
Orange	*Citrus sinensis*	Naranja
Papaya	*Carica papaya*	Fruta bomba
Pineapple	*Ananas comosus*	Piña
Potato	*Solanum tuberosum*	Papa
Pumpkin	*Cucurbita spp.*	Calabaza
Rice	*Oryza sativa*	Arroz
Sorghum	*Sorghum spp.*	Sorgo
Soybean	*Glycine max*	Soya
Sugar cane	*Saccharum officinarum*	Caña de azúcar
Sunflower	*Helianthus annuus*	Girasol
Sweet Potato	*Ipomoea batatas*	Boniato
Taro	*Colocasia esculenta*	Malanga
Tobacco	*Nicotiana spp.*	Tabaco
Tomato	*Solanum lycopersicum*	Tomate
Triticale	*x Triticosecale*	Triticale
Wheat	*Triticum spp.*	Trigo
Cattle / Cow	*Bos taurus*	Ganado / Vaca
Chicken	*Gallus gallus*	Gallina
Horse	*Equus caballus*	Caballo
Pig	*Sus spp.*	Puerco / Cerdo
Sheep	*Ovis spp.*	Carnero

12.2. Guideline for interviews with farmers (English version)

Personal data:

Name Code:_____ Start time_____ End time_____ Date:_____

First name: _____Last name:_____

Address:_____

Tel.:_____

Sex: Female / Male

Birth year:_____

Birth place:_____

Married / partnership / divorced / Widow/er / single

Children: How many:_____Children living at home:_____

Experimentation:

Can you tell me a little bit about your farm? Are there any major changes that occurred on your farm during the last years or decades?

Do you have any future plans for your farm? If yes, which ones?

How did you learn the craft of agriculture? For example, how did you learn to grow [a crop present on the farm]?

Do you try out new things? What kind of new things?

What problems do you encounter in your work? How do you deal with them?

Do you try new things/ideas other people suggested to you/brought to your farm? What kind of new things/ideas?

- Neighbours
- Friends
- Family
- Researchers
- Extensionists

Do you do experiments? If yes, which ones?

How do you do them?

What do they look like?

Why do you do them?

Do you have expectations on the outcomes?

Do you take notes on them?

Do you follow certain steps?

Dou you repeat them and try it again?

What are the outcomes?

Would you do it again?

Did you change your working manner because of the outcomes?

What does “experiment” mean to you?

What does “innovation” mean to you?

What does “invention” mean to you?

Do you think your experiments are similar to experiments done by researchers?

What are the differences in your opinion?

What are the most important challenges in agriculture that should be addressed via experiments in your opinion?

On farm level

On general agricultural level in Cuba

What is most interesting / attractive to you to conduct an experiment on?

Level of education:

Type of education:

Years of education:_____

Additional education (courses…)_____

Formal education in agriculture:

Professional background:

How long are you farming?

What did you do before you started farming?

Is farming your main occupation? Yes No

Which profession do you have else?

Did you grow up on a farm?

Have you been involved in farming activities as a child?

Contact to research staff:

Have researchers visited your farm? How often?

Do you work together with researchers? In what way?

Did you work together with researchers in former times? In what way?

Do you work together with extension services?

Are you part of a farmers’ association? Which one? Since when?

Commitment to farming:

Do you like your work in agriculture?

Would you prefer to work in another field of work? If you would get offered another job now/your former job again, would you accept it?

Farm description:

How many people are working in the farm (including the farmer)?

Constant: Family and Relatives:_____Employed:_____

Seasonal:Family and Relatives:_____Employed:_____

What is the size of your land?

Arable land:

Pasture

Forest:

Others:

Number of animals: Kind: _____ Number: _____

Number of animals: Kind: _____ Number: _____

Number of animals: Kind: _____ Number: _____

Number of animals: Kind: _____ Number: _____

Which branch is the most important for your farm income?

Which branch do you like most?

What do you produce? Which of these products do you sell?

How do you sell/distribute your products?

Inclination: flat / flat with slopes / hilly / steep slopes

How would you describe the quality of your soils?

Which types of fertilizer do you use?

Special characteristics (next to the sea,…)

Distance house to farm

Means of transport: foot/horse/oxen/tractor/car

Draft resources: Tractor/Oxen

Energy_____

Water _____

Is there any special characteristic in this area, which was not mentioned yet?

What are the main constraints in your farm/area?

How long do you live here?_____

How long do you farm here?_____

Did you have a farm in other area before?

Where was your farm?_____

How long did you farm there?_____

To which farmers association do you belong?

Do you participate in any informal or formal forum connected to agriculture?

When you want to know something connected to your work, where will you look for information?

Feedback of the interviewee

How did you feel during the interview?

Did any questions made you feel uncomfortable?

Do you suggest to change something?

Would you like to have a copy of photos and records?

Thank you for your contribution!

Questions for the researcher after the interview

Where was the interview done?

Who was present?

General impression from the farm / Specific observations about the farm

General impression from the interview: openness/comfortableness of interviewee interviewer/interview / Specific observations about the interview

Main subjective impression about the farmer

Short summary

Which phrases did the farmer used to define the learning process?

Did the farmer talk about experimentation alone?

Did the farmer talk about methodology?

New hypotheses

Circumstances influencing the interview

12.3. Guideline for interviews with experts (English version)

Personal data:

Name Code:_____ Start time_____ End time_____ Date:_____

First name: _____Last name:_____

Address:_____

Tel.:_____

E-mail:_____

Webpage:_____

Sex: Female / Male

Age:_____

Institution:

Position in Institution:

Working in institution since:

Institutional data:

Name of Institution:

Adress:

Tel:

What is your institution doing related to agriculture?

Where is your institution situated within the Cuban agricultural sector?

Does your institution work directly together with farmers? If yes, in what way?

Experimentation:

In your opinion, which words can you use in Cuban Spanish to refer to any type of experiments or trials?

What are formal terms?

What are colloquial terms?

What does “experiment” mean to you?

What does “innovation” mean to you?

What does “invention” mean to you?

Does your institution perform experiments?

If yes, which ones? Which topics? Where?

Does your institution perform experiments together with farmers?

If yes, which ones? Which topics? Where?

Does your institution encourage farmers to experiment?

Does your institution support farmers' experiments?

Do you think farmers do experiments also on their own?

Do you think it is important for agricultural development that farmers do experiments on their own?

Do you have personal experience with farmers doing experiments? If yes, which ones?

Do you think farmers' experiments are similar to experiments done by researchers?

What are the differences in your opinion?

What are the most important challenges in agriculture that should be addressed via experiments in your opinion?

On farm level

On general agricultural level in Cuba

Thank you for your time and contribution!

12.4. Guideline for interviews with farmers (Spanish version)

Datos personales:

Codificación de nombre:_____ Hora de comienzo:_____ Hora de finalización:_____ Date:_____

Nombre: _____Apellidos:_____

Dirección:_____

Tel.:_____

Sexo: Hombre / Mujer

Anyo de nacimiento:_____

Lugar de nacimiento:_____

Estado familiar: Casado/Divorciado/Soltero/Viudo

Hijos: Cuantos:_____ Hijos que viven en casa:_____

Edad:_____

Experimentación:

¿Me puede contar un poco de su finca? ¿Hubo cambios dentro de su finca?

¿Como aprendió Usted la agricultura? Por ejemplo, ¿como sabe como sembrar [un cultivo presente en la finca]?

¿Que planes tiene para el futuro en su finca?

¿Usted intenta cosas nuevas? ¿Que tipo de cosas nuevas intenta?

¿Cuáles son los problemas principales de su granja? ¿Cómo trata usted los problemas de su granja?

¿Prueba usted cosas nuevas que otra gente le recomendo/trajo a su granja? Que tipos de cosas/ideas nuevas?

- Vecinos
- Amigos
- Familia
- Cientificos
- Consejeros

¿Usted hace experimentos en su finca? ¿Cuales?

¿Como los hace?

¿Que los parecen? What do they look alike?

¿Porque los hace?

¿Que expectaciones tiene usted en punto de los resultados?

¿Toma usted notas de sus experimentos?

¿Sigue usted ciertos pasos (de metodologia) cuando intenta algo nuevo?

¿Repite usted aquello que está intentando, y lo intenta otra vez?

¿Qué son los resultados de este proceso?

¿Lo intentarìa otra vez?

¿Cambió su manera de trabajar debido a otras pruebas/experimentos que usted hizo antes?

¿Cuál es el significado que tiene para usted “un experimento”?

¿Cuál es el significado que tiene para usted “una innovación”

¿Cuál es el significado que tiene para usted “una invención”?

¿Cree usted que los experimentos que hace son parecidos a los experimentos realizados por científicos?

¿Cuales son las diferencias en su opinion?

¿En su opinion, cuales son los retos mas importantes en la agricultura contemporanea que deberían ser adresados por experimentos?

A nivel de una finca

A nivel de agricultura cubana en general

¿Para usted, que es el assunto mas interesante/atractivo para experimentar en eso?

Eduación:

Tipo de educación: Primaria/Secundaria/Preuniversitaria/Universitaria

Anyos de educación:_____

Educación adicional (cursos…):_____

Educación formal en agricultura:

Formación profesional:

¿Cuánto tiempo está usted en la agricultura?

¿Qué hizo usted antes de comenzar a cultivar la tierra?

¿Es la agricultura su ocupación principal? Si No

¿Además de agricultor, qué profesión tiene usted más?

¿Creció usted en una granja?

¿Tenía que trabajar en las actividades de la granja cuando era niño?

Contacto con científicos:

¿Visitaron científicos a su finca? Cuantas veces? ¿Cuando?

¿Usted trabaja juntos con científicos? ¿De qué forma?

¿Usted trabajaba juntos con científicos anteriormente? ¿De qué forma?

¿Usted trabaja juntos con consejeros?

¿Pertenece usted a una associacion de agricultures? ¿Cual? ¿Desde cuando?

“Commitment” a la agricultura:

¿A Usted le gusta ser agricultor?

¿Preferiría trabajar en otra cosa? Si le ofrecerían otro trabajo/su trabajo anterior, fuera de su finca, ¿lo aceptaría?

Descripción de la finca:

¿Cuánta gente estan trabajando en la granja (incluido el agricultor)?

Constante: Familia y Parientes:_____Empleados:_____

Estacional: Familia y Parientes:_____Empleados:_____

¿Qué tamaño tiene su terreno?

Inclinación: llano/ llano con pendiente / colinas/ terrazas

¿Cómo podría describir la calidad de sus suelos?

¿Qué tipos de fertilizante usa?

Tierra arable:

Pastizales:

Monte/Forestales?:

Otros:

Número de animales:Tipo: _____ Número: _____

Número de animales:Tipo: _____ Número: _____

Número de animales:Tipo: _____ Número: _____

Número de animales:Tipo: _____ Número: _____

¿Cuál es la rama más importante para los ingresos de la granja?

¿Qué rama le gusta a usted más?

¿Qué es lo que usted produce? ¿Cuáles son los productos que vende?

¿Cómo distribuye sus productos?

¿Cómo vende en el mercado sus productos?

Características especiales (cerca del mar,…)

Infraestructura Si/No ¿De qué clase?

Energía _____

Agua _____

Distancia entre la casa y la finca:

Medios de transporte: andando, en caballo, con buey, tractor, carro

Recursos de tracción: bueyes, tractor

¿Existe alguna característica especial en su área que aún no se haya mencionado?

¿Cuáles son las principales obligaciones de su granja?

¿Cuánto tiempo hace que vive usted aquí?_____

¿Cuánto tiempo hace que practica la agricultura aquí?_____

¿Tenía usted antes una granja en otra área?

¿Dónde estaba su granja anterior?_____

¿Cuánto tiempo cultivó la tierra en la anterior granja?_____

¿A qué asociación de agricultores pertenece usted?

¿Participan en algún foro informal o formal relacionado con la agricultura?

Cuando usted quiere saber algo relacionado con su trabajo, ¿dónde buscará usted la información?

Feedback al entrevistado:

¿Cómo se sintió usted durante la entrevista?

¿Alguna pregunta le hizo sentirse incómodo?

¿Sugiere usted cambiar algo?

¿Quisiera usted tener una copia de fotos y archivos?

Gracias por su participación!

Cuestiones después de la entrevista

¿Dónde ha sido realizada la entrevista?

¿Quién estaba presente?

Impresión general de la grana. Observaciones específicas de la granja.

Impresión general de la entrevista: sinceridad/comodidad del entrevistado/entrevistador/entrevista. Observaciones específicas de la entrevista

Principal impresión subjetiva de la granja

Pequeño resumen

¿Cuáles son las frases que el agricultor ha utilizado para definir el proceso de aprendizaje?

¿Habló el agricultor del experimento solo?

¿Ha hablado el agricultor sobre la metodología?

Nuevas hipótesis

Circunstancias que han influenciado a la entrevista

12.5. Guideline for interviews with experts (Spanish version)

Datos personales:

Codificación de nombre:_____ Hora de comienzo:_____ Hora de finalización:_____ Date:_____

Nombre: _____Apellidos:_____

Dirección:_____

Tel.:_____

E-mail:_____

Pagina web:_____

Sexo: Hombre / Mujer

Edad:

Institucíon:

Posicíon en la Institucíon:

Empleado/a en la institución desde:

Datos de la institución:

Nombre de la institución:

Dirección:

Tel:

¿Que esta haciendo su institución relacionado con la agricultura?

¿Donde esta situada su insitución dentro del sector agrario de Cuba?

¿Trabaja su institución directamente juntos con agricultures? De que forma?

Experimentación:

¿En su opinion, que palabras se puede usar en Espanyol cubano para referirse a cualquier tipo de experimentos o pruebas?

¿Que palabras son más formales?

¿Que palabras son más coloquiales?

¿Cuál es el significado que tiene para usted “un experimento”?

¿Cuál es el significado que tiene para usted “una innovación”

¿Cuál es el significado que tiene para usted “una invención”?

¿Realiza su institución experimentos agronomicos?

¿En caso de sì, cuales? De que assuntos? Donde?

¿Realiza su institución experimentos juntos con agricultures?

¿En caso de sì, cuales? De que assuntos? Donde?

¿Promociona su institución experimentos de agricultures?

¿Apoya su institución experimentos de agricultures?

¿Que piensa usted: Realizan agricultores tambien experimentos a su propia cuenta?

¿Usted lo considera importante para el desarollo agronomico que agricultores realizen experimentos a su propia cuenta?

¿Usted tiene experiencia personal con agricultores experimentatores? En caso de sì, cuales?

¿Cree usted que los experimentos que hacen los agricultores son parecidos a los experimentos realizados por científicos/por su institución?

¿Cuales son las diferencias en su opinion?

¿En su opinion, cuales son los retos mas importantes en la agricultura contemporanea que deberían ser adresados por experimentos?

A nivel de una granja

A nivel de agricultura cubana en general

Feedback of the interviewee

¿Cómo se sintió usted durante la entrevista?

¿Alguna pregunta le hizo sentirse incómodo?

¿Sugiere usted cambiar algo?

¿Quisiera usted tener una copia de fotos y archivos?

Muchas gracias por su tiempo y participación!

12.6. Codes-frequency-table

Table 10: Codes used in the programme Atlas.ti for field data analysis.

Code	Description	Frequency (all documents)
ADAPTATION	Adaptations of common techniques/solutions	10
ADOPTION	Adoption without changes of techniques, received from outside	12
Age	Age of respondent	26
BACKGR_agr	Agricultural background of respondent	36
BACKGR_job	Professional background of respondent	35
CHANGE	Changes on farm level	61
CHEM	Use of synthetic fertilizers and/or pesticides	36
Children	Number of children of respondent	19
CIT	Original citation of respondent	112
CivilStatus	Civil status of respondent	19
COMMIT	Commitment to farming of respondent	25
COMPARISON	Comparison mechanisms in experimenting	27
CONTACTS	Contacts to institutions	11
Cooperative	Cooperative respondent belongs to	16
CRIT	Criteria of selection and/or evaluation	36
CUBAN_AGR	Cuban agriculture	36
DEDICATION	Role of dedication to agriculture	9
DEF_Exp	Definition of the term “experiment”	53
DEF_innovation	Definition of the term “innovation”	11
DEF_invento	Definition of the term “invention”	12
DIFF_science vs campesino	Difference between scientific experiments and farmers’ experiments	23
Do you do Experiments?	Answer to question “Do you do experiments?”	39
EDUCATION	Level of education of respondent	24
EVAL	Evaluation mechanisms in experimenting	57
EXCHANGE	Exchange of material or information with farmers, neighbours, family, scientists,…	43
Experts_Institution	Institution of expert respondents	14
EXPL_Example	Example of explicit experiments	95
FAILURE	Example for failures as learning sources	49
FARM	Data on farm	24
FARM_animals	Data on farm animals	23
FARM_crops	Data on farm crops	70
FARM_history	Data on farm history	60

FARM_size	Data on farm size	26
FARM_Soil	Data on farm soil	4
FARM_workers	Data on farm workers	30
First Visit -> Second Visit	Examples of comparison between first visit and second visit	8
FP	Linkages to the FP-project	133
FUTURE	Future plans of respondents concerning farm work	47
GOOD_FARMER_IND	Indicators for good farming performances (recognized by other farmers)	24
GUAYABA	Experiments in guava crop	7
IMPL	Example of implicit experiments	126
LEARN	Learning experiences mentioned by respondent	85
MOON	Farm practices according to moon phases	12
My Impression	Personal impression of researcher after a visit/interview	15
NOTES	Information on taking of notes on experiments	12
PartObs	Participant Observation performed by the researcher	3
PlaceOfBirth	Place of birth of respondent	13
PLatano	Experiments in guava crop	24
PREF	Personal preferences in farm work of respondent	10
Probar	Examples linked to expression “probar” (to try)	47
PROBLEM	Problems influencing farm work	143
REASON	Reasons for doing something, e.g. an experiment	129
REGION_Bat	Regional characteristics of Batabanó	20
REGION_LP	Regional characteristics of La Palma	8
SCIENCE	Contacts to scientists/scientific institutions	30
SMALL->LARGE SCALE	Evidence for trials on small scale first and large scale afterwards	12
SOURCE	Sources for information, inputs, ideas to experiment	183
Spontaneity	Spontaneity as a source	25
TECHNIQUE	Agricultural production techniques	43
TOPIC	Topic of experiment	1
TRADITION	Tradition as a source	29
VOC	Vocabulary used by farmer when commenting on possible experiments	86

12.7. Interview citations

Table 11: Answers of the farmers interviewed in original full-text citations to the questions “Do you do experiments?” and “Do you try new things?” The column of “Scie.” represents the farmer’s contact to scientists, the column “FP” his/her contacts to the FP-project (“-“ no contact; “+” contact; “([number])” number of years the contact exists; “+/-“ acquaintance with FP-project but no interest in participation).

	Scie.	FP	Usted hace experimentos? (Do you do experiments?)	Usted prueba cosas nuevas? (Do you try new things?)
LP1	-	+ (7)	Sí, en el 2002 comencé a hacer experimentos en la finca.	Bueno, estamos sembrando leguminosas y plantas que sirven para el ganado, ir incrementando la siembra de arboles frutales...
LP2	-	+ (7)	Sí, de todo tipo hago experimento. [...] Antes del proyecto no hacía experimentos.	Tambien lo hago.
LP3	-	+ (7)	Sí, experimentamos con frijol, con pinya, platano y papa...	Siempre estoy inventando tratando de sembrar cosas nuevas. Por ejemplo, yo no sembraba nunca mas que una mata de aji. Ya siembro mas. No sembrabamos mas de dos montones de plantano, mira cuantos tengo.
LP4	-	+/-	No.	Cada rato hay que probar cosas nuevas. [...] De momento probamos girasol para ver como da.
LP5	-	+ (5)	Sí, en arroz y platano.	Estamos siempre probando. Por ejemplo esta planta de maiz aqui, para probar para ver si funciona aqui tambien.
LP6	-	+ (7)	Hemos hecho muchos, ya yo no te puediera decir en que experimentamos porque han sido tantas las cosas que hemos hecho...	Si, constantemente hago pruebas en mi vega. Hago pruebas con la naturaleza, con los cultivos, con los animales.
LP7	-	-	Bueno, no le voy a decir que realmente hago experimentos. Pero sí tengo ideas de eso. Estoy probando donde se da mejor, en que mes,...	Bueno, estoy probando, si. Estoy probando la piña, es la primera vez que se siembra.
LP8	-	-	Nosotros no hacemos experimentos. Los experimentos los hacen en La Habana, o en San Juan hay una escuela experimental de tabacco.	Bueno, para probar cosas, hay que experimentar con cosas nuevas. Yo quisiera poder experimentar con cosas nuevas, como, por ejemplo, me gustaria sembrar la soybean.
LP9	-	-	No. Ya lo que tengo es eso y estoy trabajando en eso.	Ahora estoy sembrando un poco de naranja dulce pa probar.[...] Y aguacate, tambien siembro mucho aguacate. Ya hace dos años que empeze a sembrar aguacate.

LP10	-	-	No hago muchos experimentos pero...siempre intento cojer lo mejor que se ve en todas las partes.	Bueno, cuando viene semilla de platano y eso...[...] Claro, cada vez cuando haya algo nuevo, lo siembro y lo hago la prueba.
LP11	-	+ (1)	Sí, soy campesino experimentador.	Sí, de momento hago una prueba en malanga...
LP12	-	+ (0)	En papa y en maiz.	Probé papa el año pasado y dio buen resultado.
LP13	-	+ (0)	No.	[not explicitely asked]
LP14	-	+ (0)	No.	Sí, soybean y sorgo para el consumo animal.
LP15	-	+ (0)	A ver lo que trae [farmer LP11].	Voy a probar a sembrar frijol ahora en este pedazo de tierra, que estaba con Marabou hace poco. A ver como da.
Bat1	-	-	Es tan cotidiano que lo haces sin darte cuenta.	[not explicitely asked]
Bat2	+	(+)	Si, como no. A veces se aprende casualmente.	[not explicitly asked]
Bat3	-	-	Mira, al final experimentamos siempre. Probamos y preguntamos a gente que tiene más experiencia que nosotros.	[not explicitely asked, see answer on the left]
Bat4	+	+ (3)	Nosotros siempre estamos experimentando.	[not explicitely asked]
Bat5	-	+/-	Yo personalmente no, pero dentro de la CCSF sì hay.	En este momento no. Ya no hay el espiritu de la juventud, aqui hay que trabajar.
Bat6	-	-	Yo experimentaba con todos los cultivos.	Estaba probando muchos cultivos, toda mi vida, llevo ya 50 años trabajando en el campo. Pero esta [la guayaba] es mi ultima prueba, ya no voy a probar nada.
Bat7	-	+ (4)	No he hecho ningun experimento hasta ahora porque no soy científico. Pero quiero hacer un cruzamiento de frijol este año.	[not explicitely asked]
Bat8	+	+ (4)	No, solamente en arroz con lo que me traigan. Pero estoy probando muchas cosas.	Sí, estoy probando todo el rato, por ejemplo el coco y platano, empezé este año.
Bat9	-	+/-	Aqui no hay experimentos. Los experimentos hacen las empresas.	Si pruebas un cultivo nuevo, tienes que preguntar a alguien que ya tiene experiencia en eso.
Bat10	-	-	No, el abono organico y las cosas del CREE serían cosas así.	[not explicitely asked]
Bat11	+	+ (7)	Siempre se está experimentando. Cuando pruebas una nueva siembra experimentas.	[not explicitely asked, see answer on the left.]

Table 12: Answers of the farmers interviewed in original full-text citations to the question “What is an experiment for you?” The column of “Scie.” represents the farmer’s contact to scientists, the column “FP” his/her contacts to the FP-project (“-“ no contact; “+” contact; “([number])” number of years the contact exists; “+/-“ acquaintance with FP-project but no interest in participation).

	Scie.	FP	Que es un experimento para Usted? (What is an experiment for you?)
LP1	-	+ (7)	En si mismo, un experimento es, por ejemplo en las variedades, tienes que basarte en que son los factores para seleccionar. Producción, lo que antes viene es la producción, el consumo, la resistencia a plagas y enfermedades y a la sequía. Estas factores tienes que tener.
LP2	-	+ (7)	Las caracteristicas que usted le gusta probar, hacer el experimento con las caracteristicas de cualquier planta, a sacarles resultados.
LP3	-	+ (7)	Para mi un experimento es, cuando siembro dos plantas. Y comparo lo que es una y la otra con el mismo tratamiento, el sistema de siembra, que sean dos plantas, un frijol que sea negro a un frijol colorado o rojo, como le dicen ustedes. Veo que el rojo tiene mas vigor que el negro que tiene mas vaina por planta y que es mas resistente a plagas, a sequía, a enfermedades. Ya alli sabemos seleccionar, lo que es una seleccion buena, a la hora de la cosecha seleccionar tambien la mejor planta a guardar la semilla para la proxima siembra. Eso hemos aprendido todo ahora de nuevo.
LP4	-	+/-	Por ejemplo, experimentando en varios colores, eso sería un experimento. [en flores]
LP5	-	+ (5)	-
LP6	-	+ (7)	Para mi, experimentar es la posibilidad de ver, de realizar, de no se..., de comparar las actidudes de determinadas semillas.
LP7	-	-	Experimento seria probar algo nuevo, hacer algo, quiza una innovación. Algo, y despues ver. Comparar los resultados, ver que los resultados.
LP8	-	-	Para mi un experimento es hacer una cosa y estudiarla atraves del tiempo y ver el resultado que da. Eso es hacer un experimento y nosotros no hacemos esas cosas. Y para hacer los experimentos hay que saber lo que uno quiere experimentar. [...] Y esos experimentos los hacen tecnicos, especializados en eso. Pero yo, yo como tal, yo no hago experimentos. Sabes, un experimento es cuando quieres lograr una cosa nueva.
LP9	-	-	Una cosa nueva que uno va a crear, a ver como da.
LP10	-	-	Un experimento es cualquier cosa que se hace, una cosa nueva para experimentar a ver como se da. Eso pueden ser experimentos en cualquier cosa. Todo nuevo es experimentar. Todo nuevo que se hace que no se ha hecho otras veces, es un experimento.
LP11	-	+ (1)	Para mi, un experimento no es mas que llevar algo que una esta haciendo, a introducirle algo nuevo. [...] Y puede ser un experimento tambien, introducir algo nuevo en el conocimiento que uno tiene y aplicarlo en la tierra. [...] Pa mi entiendo como un experimento la insertion del abono organico en substitucion del abono quimico [...]

LP12	-	+ (0)	Sembrar una mata que no tenías antes y ver como da, ver en el terreno si me da.
LP13	-	+ (0)	Probar una planta que no se ha sembrado hasta ahora.
LP14	-	+ (0)	Es parecido a una innovación, innovar algo, por ejemplo sembrar algo donde no habías sembrado nunca y ver como da.
LP15	-	+ (0)	
Bat1	-	-	Es una cosa nueva, por ejemplo crear una variedad nueva.
Bat2	+	(+)	-
Bat3	-	-	Estamos experimentando en la practica.
Bat4	+	+ (3)	Es algo nuevo, probar algo y ver los resultados, por ejemplo en plantas, maquinaria o animales.
Bat5	-	+/-	Significa hacer una innovacion, solucionar alguna cuestion.
Bat6	-	-	[Evasive answer, didn't answer in the end]
Bat7	-	+ (4)	Significa darme la posibilidad de descubrir algo nuevo.
Bat8	+	+ (4)	Es algo bueno, siempre hay que probar.
Bat9	-	+/-	Siempre uno esta conociendo cosas nuevas, hay que experimentar a ver como dan los productos.
Bat10	-	-	El abono organico y cosas del CREE serían cosas así.
Bat11	+	+ (7)	Para mí es sembrar cosas nuevas que se desconoce. Todo lo que hagas de nuevo.

Table 13: Answers of the farmers interviewed in original full-text citations to the question “What is the difference between farmers’ experiments and scientists’ experiments?“ The column of “Scie.” represents the farmer’s contact to scientists, the column “FP” his/her contacts to the FP-project (“-“ no contact; “+” contact; “([number])” number of years the contact exists; “+/-“ acquaintance with FP-project but no interest in participation).

	Scie.	FP	Que es la diferencia entre los experimentos campesinos y experimentos de los científicos? (What is the difference between farmers’ experiments and scientists’ experiments?)
LP1	-	+ (7)	Bueno, tienen bastante similitud. Porque ellos para hacer un experimento tienen tambien que sembrarlo. Ellos los sembraran entre gente, entre obreros y cosas d eso porque ellos no tienen hasta que preparar la tierra y en eso tienen poca experiencia. Pero es la misma...tiene una similitud tremenda. Tienen que evaluarla a la parcela, tienen que evaluarlo que hay, luego escribiendo, un par de años como minimo. Sino no pueden sacar unas conclusiones.
LP2	-	+ (7)	Se parecen bastante. Los experimentos de los cientificos es el estudio que tienen que tienen un nivel de cultivo, de lo que esta en la materia que esta estudiando, muy avanzado. Y nosotros queremos llegar tambien a algo de ellos.
LP3	-	+ (7)	Yo creo que son parecidos. Siempre la agricultura es de aprender siempre algo nuevo. Y un cientifico, eso es lo que busca siempre. Y viene en la practica, el objectivo de lo que tu buscas. Eso tambien seria... Igual que un cientifico. Buscas saber.
LP6	-	+ (7)	Supongo que no tendran la misma calidad pero tienen que ser iguales, supongo. No se. Pienso que lleva el mismo manejo, que lleva el mismo cuidado, la misma observacion, creo que si. Quiza que ellos tengan mas detalle, mas cultura o otras cosas que las pueden aplicar que yo no las veo no las puedo. Pero de modo general es la misma base, pienso.
LP9	-	-	Los tecnicos y los cientificos son los que saben mas de eso. Nosotros sabemos poco, nosotros sembramos una mata de platano y vemos eso pero...hay los tecnicos y los cientificos que pueden experimentar de verdad en cualquier cosa. *Y experimentar de verdad, que quiere decir? Como se experimenta de verdad?* Bueno, la ciencia....hacer un proyecto de cualquier cosa y ver como sale. O ponerlo en funcion.
LP11	-	+ (1)	Yo entendia como experimento cientifico aquello que se hacia desde detras de un buro. Que lo hace un hombre que tiene muchos conocimientos teoricos y prollevaba la practica a traves de un libro. Se lo bajaba al campesino. Antes, los conocimientos cientificos se imponian, no se ensenyaban. Se imponian. Este producto hay que sembrarlo asi porque lo dice tal cientifico. Y ahora no se impone. Ahora se dice, si el campesino quiere lo acepta o no lo acepta.
Bat3	-	-	Nosotros hacemos experimentos practicas. Vamos viendo en la practica, sobre todo via el fracaso.
Bat4	+	+ (3)	Los laboratorios de nosotros son más rusticos, más practicos. Los de los científicos son más de eproveta, de largo plazo.
Bat7	-	+ (4)	No son diferentes pero los experimentos de los campesinos te dan la posibilidad de verlo tu mismo, para ver si es mentira o verdad. Y los científicos los hacen en condiciones diferentes, más sofisticados.
Bat11	+	+ (7)	Cuando pruebas una nueva siembra experimentas, igual no como los científicos en un cultivo pero sí experimentas.

Table 14: Answers of the experts interviewed in original full-text citations to the questions “Does your institution do experiments?” and “Do you think farmers do experiments? Also on their own, outside the FP-project?” The column “FP” describes the interaction of the expert with the FP-project.

	FP	Usted/Su institución hace experimentos? (Do you/Does your institution do experiments?)	Usted cree que campesinos hacen experimentos? Tambien por su propia cuenta, fuera del FP? (Do you think farmers do experiments? Also on their own, outside the FP-project?)
Exp1	Direct	Yes [not explicitely asked because obvious, research center]	Por supuesto. Lo que hace la investigacion participativa es reconocerla y reforzarla. Fortalezerla. Y eso ha sido parte de la historia de este programa.
Exp2	Direct	Yes [not explicitely asked because obvious, university]	Si tu no dices que eso es un problema, tal vez no todos salgan a experimentar. Algunos, los mas curiosos, los mas necesitados, los mas interesados. Pero no todos lo hacen.
Exp3	Invited as expert in one event	Sí; claro. Por ejemplo en aguacate hice experimentos para combatir diversos enfermedades.	No. Hay que enseñarles mucho y son muy repetitivos.
Exp4	Participating in events	La organisacion como tal no hace experimentos, sino los propios campesinos son los que hacen experimentos y luego los llevan a diferentes eventos, a eventos de ciencia y tecnica, a los eventos en el municipio o a la provincia.	Si si. Eso si creo que es cubano. El cubano como tal siempre ve ocupado de experimentar dentro de su propia vega, se usa mucho la experiencia de sus padres, su abuelos.
Exp5	Participating in events	No [not explicitely asked because obvious, not role of institution]	Si, hay muchas cosas que ellos se lo ponen que lo ponen adelante porque tienen algo muy importante: la tradicion. Son experiencias acumuladas por generaciones a generaciones que la van a poner en la practica. Por ejemplo la epoca del tiempo a partir de la luna, la epoca del tiempo a partir del calendario, si es invierno, si hay sequía, la forma de preparar la tierra. Hay cosas que ellos saben y no se los dice ningun cientifico. Porque lo han generado de sus generaciones antecestrales.
Exp6	Direct	Yes [not explicitely asked because obvious, research center]	Sí, sí, hacen experimentos también por su propia cuenta. Pero hay que empujar siempre y ensenyarles a investigar en su finca.
Exp7	Participating in events	Muchos, nosotros normalmente siempre hemos presentado trabajos a diferentes niveles. Nosotros tenemos aqui un	El campesino es un experimentador que esta constantemente experimentando. [...]Ellos primero, tienen una cosa que es la

		movimiento que se llama el movimiento del foro. Donde por año y año se hace trabajos y se presenta alli. Incluso nosotros hemos generalizado trabajos al nivel nacional. Por ejemplo, la produccion de Bacillus thuringensis en estado solido, eso nacío aquí.	cultura, lo que traen de sus ancestros.
Exp8	Participating in events	No [not explicitely asked because obvious, not role of institution; see answer Exp. 4]	Si, si. Hay campesinos que cuando tu llegas a su finca y tu dices “y esto no, esto es...”, entonces ellos mismos lo hacen. Entonces que es la tarea de nosotros? Que eso se divulga y eso entra en nuestro papel fundamental.

Table 15: Answers of the experts interviewed in original full-text citations to the question “What is an experiment for you?” The column “FP” describes the interaction of the expert with the FP-project.

	FP	Que es un experimento para Usted? (What is an experiment for you?)
Exp1	Direct	Es la capacidad que tienen los agricultores de introducir nuevas variantes, sistematizar y diseminar lo que estan haciendo.
Exp2	Direct	Para mi un experimento no es mas que una validacion de una sospecha. [...]Un experimento para ellos [los campesinos] es eso, la busqueda de soluciones a sus problemas.
Exp3	Invited as expert in one event	Es algo que haga para tener un resultado.
Exp4	Participating in events	Un experimento es buscar lo no conocido, es utilizar experiencias de varios compañeros, llevarlo a los demas. Buscar resultados.
Exp5	Participating in events	Para mi un experimento es la accion de poner en practica determinadas implicaciones apartir de los resultados de los investigadores.
Exp6	Direct	Se va a comparar y evaluar…en el campo o en el laboratorio.
Exp7	Participating in events	-
Exp8	Participating in events	Tuvimos experimentos en cultivos que no se sembraba ni el trigo, ni el garbanzo, se sembraba muy poquita soybean. Una sola variedad de soybean y ahora ya estamos sembrando alrededor de 7, 8 variedades de soybean.

Table 16: Answers of the experts interviewed in original full-text citations to the question “What is the difference between farmers’ experiments and scientists’ experiments?“ The column “FP” describes the interaction of the expert with the FP-project.

	FP	Que es la diferencia entre los experimentos campesinos y experimentos de los científicos? (What is the difference between farmers’ experiments and scientists’ experiments?)
Exp1	Direct	la diferencia fundamental es que los experimentos de los cientificos para comprobar que una variante es mejor que otra utilizan un sistema estatistico para demostrar que....utilizan un grupo de herramientas estatisticas para demostrar que hay diferentes indicativas o no. y tienen un concepto my exquisito de disenyo de experimento. Para tratar de separar las variantes o sea la influencia del ambiente con la influencia de otros factores. Sea, los experimentos de los cientificos tratan de identificar cuales son los factores basicos que estan influyiendo su hipotesis. Los experimentos de los campesinos van mas alla que alli. Los experimentos de los campesinos yo me he dado cuenta que ellos no importa tanto separar la influencia de la variedad con la influencia del ambiente. Sino les interesa es la integracion de todo eso. Tienen un concepto mucho mas de sistema, mucho mas holistico de los resultados. Y no necesitan herramientas estatisticas porque lo que no les funciona con los ojos, es que sencillamente no les puede funcionar con los ojos. Y el mercado no lo va a ver con metodos estatisticos. El mercado, y la cadena de valores, de su produccion lo va a ver practicamente....lo va a mirar con sus mismos espejuelos. Si se pone a mirar con los ojos de un cientifico, no le interesa porque eso, la sensibilidad de la gente no esta por alli.
Exp4	Participating in events	Pueden existir diferencias en cuanto los métodos que se aplicen, pero en general para nosotros, los campesinos, este método nos ha dado resultado. Incluso quiza si el campesino le llevas muy cerrado asi hacer experimentos atraves de laboratorios y atraves de muestra, no se, quiza alli se descubra poco.
Exp5	Participating in events	No...quiza el cientifico tenga una valor institucionalizado. El campesino, como se ha aislado, no esta reconocido. Es la diferencia. Sin embargo, un logro cientifico a pesar por determinados requisitos, es valorado por su institucion. Mientras el campesino no siempre esta valorado. Porque si no lo lleva hasta alli, al instituto, no va a ganar aunque tenga buen resultado. Esa es la diferencia. Pero es muy valiosa. La experiencia campesina es necesaria en el proceso productivo.
Exp7	Participating in events	Que la experimentacion cientifica se basa en un grupo de modelos estatisticos. Ellos lo hacen mas bien cualitativa mientras la experimentacion cientifica es mas cuantitativa. Utilizan diseños experimentales, por ejemplo bloque al hazard, no se que. Del punto de vista del campesino no. El campesino experimenta de un punto de vista ligado al proceso productivo y a la observacion diaria. Pero no quiere decir que uno es inferior o no...yo le doy tanta importancia a uno como al otro. Y que deben complementerse.

13. Summary

Farming has been part of human culture since the Neolithic Revolution and its practices have been constantly developed by the farming population. Although this process of agricultural evolution has occurred for centuries without contributions of formal science, solely based on farmers' own experimentation, adaptation and innovation, scientific attention to farmers' experiments is growing only slowly.

Farmers' experimental processes are embedded in their local knowledge on specific farming sites, conditions and practices. In scientific literature, two different approaches towards farmers' experiments can be distinguished: While a basic research approach is oriented towards the genuine understanding of farmers' experimental processes, an applied research approach seeks to promote farmers' experiments as a means to drive forward agricultural development. This currently cumulates in vast literature on participatory research projects, often linked to a development context. While several scientists stress the analytic nature of farmers' experiments, oriented towards problem-solutions, others highlight that farmers' experiments go beyond a rational perspective, including spontaneous, creative actions, triggered by simple observation, curiosity or personal interest, which can be even conducted unconsciously. The farmers' view points on their own experimental processes are hardly explored. However, some authors mention that farmers usually do not consider their experiments as experiments but as experience or day-to-day practice. Therefore, knowledge transmission on these experiments occurs often implicitly via observation and learning by doing. Further, informal communication networks, relying on family, neighbours, kinship and friends, play an important role.

Based on these literature findings, the concepts of implicit and explicit experiments were developed for this study. Implicit experiments are part of the daily farming practice, resulting from continuous adaptations to dynamic circumstances. Since they are embedded in an ongoing process, they are unconsciously performed and not considered as experiments by the farmers. Explicit experiments on the contrary are purposeful undertakings, following a clear intention to "try something new" and show similarities to scientific experiments (e.g. repetition, trial plots, control groups, documentation and evaluation). A better understanding of the character of farmers' experiments, if they are actively planned and purposefully conducted or they are unconsciously performed by the farmers, by focussing on the farmers' perspective, is the overall goal of this study. The resulting research objectives are:

- The variety and number of experiments in the observed farms, classified in explicit and implicit, shall be pointed out.
- The farmers' perception and understanding of their own experiments relatively to scientific experiments shall be presented.
- The communication patterns and vocabulary used by farmers when commenting on their experiments shall be outlined.
- The impact of socioeconomic factors, including the level of education, a non-agricultural background, contact to research staff and commitment to farming, on the above stated goals shall be highlighted.

Cuba as country of investigation offers a fertile ground of innovativeness in search for new methods of farming due to the economic crisis it suffered after the fall of the Soviet Union block. Because of the lack of import of food stuff as well as chemical agricultural inputs, Cuban food security became severely threatened and its agricultural system encountered great challenges. By necessity, farmers and also people with non-agricultural background had to innovate in order to secure their food and income. Alternative technologies, geared towards an agro-ecological production system, emerged. Also a programme of Participatory Plant Breeding (Fitomejoramiento Participativo, FP) has been implemented

by the National Institute of Agricultural Sciences (INCA), which provided the basis for research contacts for this study. Two differing study areas, the municipality La Palma (province Pinar del Rio) hosting rather traditional Cuban agriculture and the municipality Batabanó (province Havana) located in an industrialized agricultural production zone, were selected. In total, a field study for four months was conducted in Cuba; each study area was visited twice.

With the help of key informants, belonging to the FP-project, a snowball sample was taken. It included 15 farmers (two women) in La Palma. Of these six farmers were involved in the FP-project for several years (including the two women) and four farmers were starting in a newly-emerging FP-farmer-group. In Batabanó eleven farmers (all men) were visited, including four members of the FP-project. Further, eight men were interviewed as experts, stemming from scientific or administrational agricultural institutions, with relations to at least one study area. All of them cooperated with the FP-project.

Data were collected via participant and non-participant observation, during farm walks and in unstructured and semi-structured interviews. Field notes and pictures were taken; interviews were additionally recorded in the beginning. In Batabanó recording was stopped because it was considered inappropriate to the interview situation with farmers. Field notes were digitalized the same day; recorded interviews were transcribed (ExpressScribe) and qualitively analysed in the programme Atlas.ti back in Austria. Confidentiality was assured and anonymity warranted.

Detected experiments were classified in explicit experiments and implicit experiments, including farm changes, future plans, learning experiences and try-outs. Implicit experiments were detected above all in the spheres of new crops, new crop varieties, crop management practices, livestock management practices and farm equipment. Concerning methodology aspects, farmers highlighted to try out small quantities first and to ask experienced farmers for advice if specific information was needed. Homegardens and plots assigned to self-subsistence turned out to be the experimental fields for farmers because there crop diversity was usually higher than in their fields. Failures were mentioned as important triggers for new learning experiences. Also discoveries of new things by chance were reported to be spontaneously incorporated into farm work. Adaptations to new circumstances were found as well. The number of explicit experiments depended strongly on the farmers' involvement in the FP-project. Above all, experiments that were learnt within the project were mentioned, e.g. comparison and selection of different crop varieties in trial plots, trials with new crops, plant crosses or agro-ecological fertilization techniques (compost, earthworm humus, green manure plants). Outside the FP-project fewer examples were given, e.g. experiments with crop rotations, changing planting distances, pruning and grafting of fruit trees or changes in fertilizer application. During the second visit of each study area the development of some experiments could be monitored. This showed the constantly flexible working manner of farmers, since many had to redirect their plans due to their highly dynamic working environment.

The perception of farmers' own experiments (directly asked "Do you do experiments?") was classified in three categories. Ten farmers (two FP-farmers) negated to experiment at all (Category NO); eight farmers (all FP-farmers) said to experiment in relation to the FP-project (Category YES_FP); and eight farmers (four FP-farmers) stated to experiment constantly (Category YES). It turned out that farmers were more familiar with the term "to try (probar)" since 18 farmers asked "Do you try out new things?" all answered with yes. While FP-farmers, who were already experienced in the FP-project-work, and two farmers, who had completed five years of higher education, had a clear understanding and definition of the term experiment, other farmers related the term experiment more generally to the characteristics of trying something out (*probar algo*), implementing a new thing one did not have before (*una cosa nueva*) and evaluating the visible results (*a ver*

como da). Commonly, the most important difference between experiments by farmers and experiments by scientists was seen in the different methodology applied. However, FP-farmers did not see much difference between these two types since they had learnt to experiment from scientists. It turned out that the FP-project strongly influenced the perception of experimental processes of their members. It created awareness for farmers' experiments and by that enhanced the farmers' willingness to conduct explicit experiments. All experts, except one, acknowledged farmers' propensity to experiment implicitly as part of the farming performance, stemming from their traditional knowledge and working experience. Further, all experts were familiar with the experiments conducted within the FP-project. As major differences between farmers' and scientists' experimentation also methodological aspects were mentioned.

Concerning knowledge transmission, the importance of both verbal and non-verbal communication patterns was outlined. On the one hand, farmers emphasized to learn in practice via action and observation. On the other hand, they stressed the important role of exchange with other farmers and neighbours. When commenting on their experimental processes, only experienced FP-farmers used the term "to experiment" deliberately. By the other farmers, more colloquial expressions such as "to try", "to invent", "to see if something gives good results" or "to test" were used.

Finally, some limitations of this study shall be clarified. As Cuba was visited for the first time by the researcher, challenges like climate influences, language peculiarities, time management and transport difficulties affected the field work. Further, methodology adjustments were made during the research process, e.g. changes in the interview guideline or the decision not to record interview sessions. The sample composition was biased towards elder male successful farmers. Further, category building and assignment of implicit and explicit statuses to experiments resulted sometimes difficult and reflected the researcher's personal mindset.

All in all, the study confirmed the literature findings that both implicit experimentation as part of daily farming life and explicit experimentation, here implemented via the project of participatory plant breeding (FP), exist. Problem-orientation and purposeful undertakings were found as well as spontaneous acts and experiments out of personal interest and curiosity. Whereas FP-farmers perceived their experiments as experiments, non-FP-farmers saw them as experience and normal part of their farming life, as found in literature. In relation to communication patterns, also the role of observation, learning by doing and via trial-and-error as well as exchange via informal communication networks was confirmed. Further, the influence of the FP-project showed to be a way to create consciousness among farmers for their own experimental processes and make their tacit knowledge explicit.

This study was a first introduction to farmers' perceptions of implicit and explicit experimentation processes and offers starting points for further investigation, for example in the determination of the influence of sociodemographic factors. Further, a comparative study reflecting the role of farmers' contacts to science, e.g. in cases of non-participatory formal science, might reveal patterns different from the FP-experience.

To conclude, farmers in the Cuban study areas showed to perform diverse kinds of undertakings that can be considered as experiments although they themselves often do not perceive them as such. The involvement in the participatory research project (FP) strongly influenced farmers' awareness for their own experimental processes and increased their explicit experimentation. Without this influence, farmers' experiments stay mostly implicit, performed unconsciously as intuitive response to challenges of daily life.

Zusammenfassung

Seit der Jungsteinzeitlichen Revolution ist die Landwirtschaft ist ein wesentlicher Teil der menschlichen Kultur, deren Praktiken von der bäuerlichen Bevölkerung ständig weiterentwickelt wurden. Obwohl dieser Prozess einer agrarischen Evolution über Jahrhunderte ohne den Einfluss formaler Wissenschaft stattfand und allein von bäuerlichem Experimentieren, Anpassungen und Innovationen getragen wurde, erwacht das wissenschaftliche Interesse an bäuerlichen Experimenten nur langsam.

Die experimentellen Prozesse von BäuerInnen sind eingebettet in deren lokales Wissen über spezifische landwirtschaftliche Regionen, Bedingungen und Praktiken. In der wissenschaftlichen Literatur können zwei verschiedene Zugangsweisen zu bäuerlichen Experimenten gefunden werden: Ein grundlagenwissenschaftlicher Ansatz bemüht sich um das Verständnis der genuinen bäuerlichen Experimentationsprozesse; ein angewandter wissenschaftlicher Ansatz versucht bäuerliche Experimente bewusst zu fördern, um die landwirtschaftliche Entwicklung voranzutreiben. Dieses Bestreben findet derzeit seinen Niederschlag in breit gestreuter Literatur über partizipative Forschungsprojekte, meist innerhalb der Entwicklungszusammenarbeit. Während einige Wissenschafter den analytischen, problem-lösungsorientierten Charakter bäuerlicher Experimente herausstreichen, betonen andere, dass bäuerliche Experimente über einen rein rationalen Ansatz hinausgehen und spontane, kreative Handlungen beinhalten können, die durch Beobachtung, Neugier oder persönliches Interesse ausgelöst und manchmal sogar unbewusst durchgeführt werden. Die bäuerliche Sichtweise ihrer eigenen Experimentationsprozesse ist kaum erforscht. Einige Autoren jedoch berichten, dass BäuerInnen ihre eigenen Experimente meist nicht als solche sehen sondern als Erfahrungswerte und Teil ihrer täglichen Praxis. Daher passiert Wissensaustausch über solche Experimente oft stillschweigend durch Beobachtung und Learning-by-doing. Weiters spielen informelle Kommunikationsnetzwerke innerhalb der Familie sowie des Nachbarn- und Bekanntenkreises eine wesentliche Rolle.

Basierend auf diesen Literaturergebnissen wurden in dieser Diplomarbeit die Konzepte impliziter und expliziter Experimente entwickelt. Implizite Experimente sind Teil der täglichen landwirtschaftlichen Arbeit, beruhend auf der ständigen Anpassung an dynamische Arbeitsbedingungen. Durch ihre Einbindung in den kontinuierlichen Arbeitsprozess werden sie unbewusst durchgeführt und von den BäuerInnen nicht als Experimente verstanden. Explizite Experimente hingegen werden bewusst unternommen, mit der klaren Absicht „etwas auszuprobieren“, und weisen Ähnlichkeiten mit wissenschaftlichen Experimenten auf (z.B. Wiederholungen, Versuchsparzellen, Kontrollgruppen, Dokumentation und Evaluierung). Ein besseres Verständnis bäuerlicher Experimente, ob sie nun aktiv geplant und bewusst durchgeführt werden oder ob sie unbewusst ablaufen, unter Einbindung der bäuerlichen Sichtweisen, ist das übergeordnete Ziel dieser Diplomarbeit. Die Forschungsziele lauten:

- Die Vielfalt und Anzahl an Experimenten auf den besuchten Betrieben, unterteilt in explizite und implizite Experimente, soll dargestellt werden.
- Die Wahrnehmung der BäuerInnen von ihren eigenen Experimenten verglichen mit deren Verständnis von wissenschaftlichen Experimenten soll beschrieben werden.
- Die Kommunikationsmuster und die Begriffe, die von BäuerInnen benutzt werden, wenn sie über ihre eigenen Experimente Auskunft geben, sollen präsentiert werden.
- Der Einfluss soziodemographischer Daten, insbesondere des Bildungsniveaus, eines nicht-landwirtschaftlichen Hintergrunds, des Kontakts zu Wissenschaftern und der Hingabe zur landwirtschaftlichen Arbeit, auf die oben genannten Ziele soll bestimmt werden.

Kuba bietet als Forschungsland viel Innovationspotential auf der Suche nach neuen landwirtschaftlichen Bewirtschaftungsmethoden aufgrund der erlittenen wirtschaftlichen

Krise nach dem Ende der Sowjetunion. Durch den plötzlichen Wegfall von Importen, einerseits von Lebensmitteln, andererseits von synthetischen landwirtschaftlichen Produktionsmitteln, war die kubanische Ernährungssicherheit bedroht und das nationale Landwirtschaft großen Herausforderungen ausgesetzt. Aus Notwendigkeit sah sich die kubanische Bevölkerung, BäuerInnen sowie Nicht-BäuerInnen, gezwungen, innovative Lösungen zu finden, um ihre persönliche Ernährungs- und Einkommenssituation zu sichern. Alternative Technologien in Richtung eines agro-ökologischen Produktionssystems entstanden. Dabei wurde auch ein partizipatives Pflanzenzucht-Forschungsprojekt (Fitomejoramiento Participativo, FP-Projekt) im Nationalinstitut für Agrarwissenschaften (INCA) entwickelt, das die ersten Kontakte zu den Forschungspartnern für diese Diplomarbeit bereitstellte. Zwei Forschungsregionen, die Gemeinde La Palma (Provinz Pinar del Rio) mit eher traditioneller kubanischer Landwirtschaft und die Gemeinde Batabanó (Provinz Havanna), Teil einer industrialisierten Landwirtschaftszone, wurden ausgewählt. Vier Monate wurden für Feldforschung in Kuba genutzt, jede Forschungsregion wurde zweimal besucht.

Mithilfe der Kontakte von Schlüssel-Informanten wurden die Interviewpartner anhand eines Schneeball-Systems ausgewählt. 15 BäuerInnen (darunter zwei Frauen) wurden in La Palma interviewt. Davon waren sechs BäuerInnen langjährige Mitglieder des FP-Projekts, vier Bauern waren Mitglieder einer in Entstehung begriffenen FP-Bauern-Gruppe. In Batabanó wurden elf Bauern (alle Männer) ausgewählt, davon waren vier langjährige Mitglieder im FP-Projekt. Zusätzlich wurden acht Experten (alle Männer) von wissenschaftlichen oder administrativen landwirtschaftlichen Institutionen interviewt. Diese Experten standen mit zumindest mit einer der beiden Forschungsregionen direkt in Verbindung und kooperierten mit dem FP-Projekt.

Daten wurden mithilfe von teilnehmender und nicht-teilnehmender Beobachtung, Betriebsbegehungen sowie unstrukturierten und semi-strukturierten Interviews erhoben. Notizen und Fotos wurden zur Dokumentation gemacht, Interviews wurden zu Beginn aufgenommen. In Batabanó wurde jedoch das Aufzeichnen von Interviews mit Bauern gestoppt, da es die Gesprächssituation zu behindern schien. Die Notizen wurden am selben Tag digitalisiert, die Interviews wurden in Österreich transkribiert (mit ExpressScribe) und qualitativ ausgewertet mithilfe des Kodierungs-Programms Atlas-ti. Die vertrauliche Behandlung der Daten und die Anonymität der Interviewpartner wurde gewährleistet.

Vorgefundene Experimente wurden in explizite Experimente und implizite Experimente, einschließlich Betriebsveränderungen, Zukunftsplänen, Lernerfahrungen und Erprobungen, klassifiziert. Implizite Experimente wurden vor allem in den Bereichen der Einführung neuer Kulturen oder neuer Kultursorten, Pflanzenbau- und Tierhaltungspraktiken sowie in Betriebsausstattungen und Maschinerie erfasst. In methodologischer Hinsicht betonten die BäuerInnen die Wichtigkeit, Versuche zuerst mit kleinen Mengen/im kleinen Rahmen zu starten und erfahrene BäuerInnen um Rat zu fragen, wenn weitere Information nötig war. Hausgärten und Anbauflächen für die Selbstversorgung bildeten dabei die Experimentierflächen für BäuerInnen, weil dort die Vielfalt an Kulturarten größer war als auf den Feldern. Weiters wurden Fehler und Misserfolge als wichtige Auslöser für Lernerfahrungen genannt. Außerdem wurde von zufälligen Entdeckungen neuer Erkenntnisse berichtet, die spontan in den Arbeitsablauf integriert wurden. Adaptierungen an neue Gegebenheiten wurden ebenso vorgefunden. Die Anzahl an expliziten Experimenten hing stark von der Teilnahme der BäuerInnen am FP-Projekt ab. Vor allem Experimente, die im Rahmen des Projektes gelernt wurden wie z.B. Vergleiche und Selektionen verschiedener Kultursorten in Versuchsparzellen, Versuche mit neuen Kulturarten, Kreuzungen in Kulturarten oder agro-ökologische Düngungstechniken (Kompost, Regenwurm-Humus, Gründüngungs-Pflanzen), wurden angegeben. Außerhalb des FP-Projekts wurden weniger Beispiele berichtet, z.B. Experimente mit Fruchtfolgen, mit verschiedenen Pflanzabständen, im Obstbaumschnitt

und deren Veredelung oder verschiedene Düngungsanwendungen. Während des zweiten Besuchs jeder Forschungsregion konnte die Entwicklung einiger Experimente weiterverfolgt werden. Dabei wurde die andauernd flexible Arbeitsweise der BäuerInnen sichtbar. Viele hatten ihre Vorhaben abgeändert aufgrund ihres dynamischen Arbeitsumfeldes.

Der Wahrnehmung ihrer eigenen Experimente durch BäuerInnen (direkt gefragt durch „Machen Sie Experimente?“) wurden drei Kategorien zugeordnet. Zehn BäuerInnen (zwei FP-Bauern) verneinten die Frage (Kategorie NO); acht BäuerInnen (alle FP-BäuerInnen) gaben an, im Rahmen des FP-Projekts Experimente durchzuführen (Kategorie YES_FP); und acht BäuerInnen (vier FP-BäuerInnen) antworteten, ständig zu experimentieren (Kategorie YES). Es stellte sich heraus, dass die BäuerInnen mit dem Begriff „probieren (probar)“ besser vertraut waren. 18 BäuerInnen wurden gefragt „Probieren Sie neue Dinge aus?“ und beantworteten dieses mit ja. FP-BäuerInnen mit mehrjähriger Mitarbeit im FP-Projekt und zwei Bauern mit fünfjähriger Hochschulausbildung hatten ein klares Verständnis des Begriffs „Experiment“ und konnten eine detaillierte Definition davon geben. Die übrigen BäuerInnen definierten den Begriff „Experiment“ allgemeiner mit den Merkmalen etwas Ausprobieren (*probar algo*), eine neue Sache Einführen, die man zuvor nicht hatte (*una cosa nueva*), und die sichtbaren Ergebnisse beurteilen (*a ver como da*). Generell wurde der größte Unterschied zwischen Experimenten von BäuerInnen und Experimenten von WissenschafterInnen in der unterschiedlichen Methodik gesehen. FP-BäuerInnen hingegen nahmen diese zwei Arten von Experimenten nicht als sehr unterschiedlich wahr, nachdem sie ihre Experimente von WissenschafterInnen gelernt hatten. Es zeigte sich, dass das FP-Projekt die Wahrnehmung experimenteller Prozesse bei ihren Mitgliedern wesentlich beeinflusste. Es schuf Bewusstsein für bäuerliche Experimente and erhöhte die Bereitschaft der BäuerInnen explizit zu experimentieren. Auch alle Experten außer einem bestätigten die Fähigkeit der BäuerInnen implizit zu experimentieren als Teil ihrer täglichen Arbeit, basierend auf ihrem traditionellen Wissen und ihrer Erfahrung. Außerdem waren alle Experten mit den Experimenten des FP-Projekts vertraut. Auch sie betonten methodische Aspekte als wesentlichste Unterschiede zwischen bäuerlicher und wissenschaftlicher Experimentation.

Bezüglich des Wissensaustauschs wurde die Bedeutung sowohl verbaler als auch nicht-verbaler Kommunikationsmuster unterstrichen. Einerseits betonten die BäuerInnen durch ihre Arbeit in der Praxis und deren Beobachtung zu lernen. Andererseits empfanden sie den Austausch mit anderen BäuerInnen und Nachbarn als sehr wesentlich. Nur die langjährigen FP-BäuerInnen benutzten den Ausdruck „experimentieren“, wenn sie von ihren eigenen experimentellen Tätigkeiten sprachen. Die übrigen BäuerInnen verwendeten umgangssprachlichere Ausdrücke wie „probieren“, „erfinden“, „sehen, ob etwas gute Ergebnisse bringt“ oder „testen“.

Schließlich müssen einige Einschränkungen dieser Arbeit offen gelegt werden. Die Diplomandin bereiste im Rahmen ihrer Feldforschung Kuba zum ersten Mal und Klimaeinflüsse, Sprachbesonderheiten, Zeitmanagement und Transportschwierigkeiten beeinträchtigten den Arbeitsablauf. Außerdem wurden methodische Anpassungen im Laufe der Feldforschung vorgenommen, wie z.B. Änderungen im Interview-Leitfaden oder der Entschluss, Interviews nicht mehr aufzuzeichnen. Die Auswahl der Interviewpartner war dominiert von älteren, männlichen, erfolgreichen Bauern. Außerdem war die Kategorisierung in explizite und implizite Experimente nicht immer einfach und wurde durch die persönliche Wahrnehmung der Diplomandin beeinflusst.

Zusammenfassend bestätigte diese Diplomarbeit die Literaturergebnisse, dass sowohl implizite Experimentation als Teil der täglichen landwirtschaftlichen Arbeit als auch explizite Experimentation, in diesem Fall durch das FP-Projekt, existieren. Problem-lösungs-orientierte Ansätze und geplante Versuche wurden ebenso gefunden wie spontane Einfälle und Experimente aufgrund von persönlicher Neugier und Interesse.

Während FP-BäuerInnen ihre Experimente als solche sahen, bezeichneten nicht-FP-BäuerInnen sie als Erfahrung und Teil ihrer Arbeit, wie in der Literatur beschrieben. Auch in Hinblick auf verwendete Kommunikationsmuster wurden die Einflüsse von Beobachtung, Learning-by-doing und Lernen aus Fehlern ebenso wie von informellen Kommunikationsnetzwerken bestätigt. Weiters war das FP-Projekt eine Möglichkeit, Bewusstsein unter den BäuerInnen für ihre eigenen Experimente zu schaffen und so ihr „stilles“ Wissen explizit zu machen.

Diese Diplomarbeit war ein erster Einblick in die bäuerliche Wahrnehmung impliziter und expliziter Experimentationsprozesse. Anknüpfungspunkte für weitere Forschung ergeben sich z.B. in der genaueren Untersuchung der Einflüsse soziodemographischer Faktoren oder durch eine Vergleichsstudie mit BäuerInnen, die über andere Kontakte zu wissenschaftlichen Einrichtungen, z.B. mit nicht-partizipativer Forschung, verfügen.

Abschließend kann gesagt werden, dass die BäuerInnen in den kubanischen Forschungsregionen verschiedenste Tätigkeiten durchführten, die als Experimente gesehen werden können, auch wenn ihre Besitzer diese meist nicht als solche wahrnahmen. Die Teilnahme an dem partizipativen Forschungsprojekt (FP) beeinflusste wesentlich das Bewusstsein der BäuerInnen für ihre eigenen Experimentierprozesse und erhöhte deren explizite Experimentation. Ohne diesen Einfluss blieben die bäuerlichen Experimente meist implizit, als unbewusste und intuitive Antworten auf die Herausforderungen des täglichen landwirtschaftlichen Lebens.

Resumen

Desde la Revolución Neolítica la agricultura es una parte fundamental de la cultura humana y sus prácticas fueron desarolladas constantemente por la población campesina. Este proceso de la evolución agraria ocurrió durante siglos sin influencia de cualquier ciencia formal, solamente basado en la experimentación, adaptación e innovación campesina. Sin embargo, la valoración científica de los experimentos campesinos está surgiendo sólo lentamente.

Los procesos experimentales de campesinos[6] forman parte de su conocimiento local sobre regiones, condiciones y prácticas agrarias. En la literatura científica dos acercamientos a los experimentos campesinos pueden ser distinguidos: el acercamiento por la ciencia básica busca a entender los procesos genuinos de la experimentación campesina, mientras el acercamiento científico aplicado intenta a reforzarla activamente para estimular el desarollo agrícola. Este empeño resulta en amplia literatura sobre proyectos de investigación participativa, sobre todo en contextos de cooperación al desarollo. Algunos científicos destacan el carácter analítico, orientado hacia la solución de problemas en los experimentos campesinos. Otros subrayan que los experimentos campesinos van más allá de la base racional y que incluyen acciónes espontaneas creativas que surgen de observación, curiosidad o interés personal. Experimentos campesinos pueden ser realizados conscientemente o inconscientemente. La percepción de los campesinos de sus propios procesos experimentales es poco investigada. Algunos autores mencionan que los campesinos no consideran sus experimentos como experimentos pero como experiencias y parte de su trabajo diario. Por tanto, la transferencia de conocimiento sobre estos experimentos pasa por observación y aprendizaje en la práctica. Además, redes informales de comunicación dentro del círculo familiar, vecino y conocido desempeñan un papel importante.

Basado en estos resultados bibliográficos, los conceptos de experimentos implícitos y explícitos fueron desarollados en esta tésis. Experimentos implícitos forman parte del trabajo diario en el campo y de la adaptación constante a condiciones dinámicas de trabajo. Como son integrados en un proceso contínuo de trabajo, ocurren inconscientemente y no son entendidos como experimentos por los campesinos. En cambio los experimentos explícitos son realizados conscientemente con la clara intención de “probar algo” y tienen similitudes a experimentos científicos (por ejemplo repeticiones, parcelas de ensayo, grupos de control, documentación y evaluación). Un entendimiento mejor de los experimentos campesinos, si son activamente implementados o inconscientemente realizados, enfocando en el punto de vista campesino, es objetivo principal de esta tésis. Los objetivos de investigación son:

- Describir la diversidad y cantidad de experimentos encontrados en las fincas visitadas y clasificados en experimentos implícitos y explícitos.
- Presentar la percepción de los propios experimentos por los campesinos en comparación a su percepción de experimentos de científicos.
- Revelar los procesos de comunicación y el vocabulario usado por campesinos cuando comentan sus propios procesos experimentales.
- Analizar la influencia de las características socio-demográficas, sobre todo del nivel de educación, de una base de fondo agrícola/no-agrícola, de contacto con científicos y del compromiso a la agricultura a los objetivos mencionados arriba.

Cuba como país de investigación ofrece mucho potencial innovadoro en la búsqueda de nuevas prácticas agrarias por la crisis económica que sufrió después del derumbe de la Unión Soviética. La suspensión abrupta de importes soviéticos, por una parte de comestíbles y por otra parte de insumos agrícolas sintéticas, arriesgó la seguridad

[6] En este texto, la expresión „campesinos“ incluye mujeres campesinas y hombres campesinos.

alimentaria del país. La agricultura nacional se vió enfrentado a desafíos grandes. Por necesidad la población cubana, campesinos como no-campesinos, tuvo que encontrar soluciones innovadoras para asegurar su base alimentaria personal. Tecnologías alternativas orientado hacía un sistema de producción agro-ecológico surgieron. Entre otros, un proyecto de investigación participativa sobre mejora genética de plantas (Fitomejoramiento Participativo, proyecto FP) fue desarollado en el Instituto Nacional de Ciencias Agrícolas (INCA). Este instituto facilitó los primeros contactos a contrapartes de investigación para esta tésis. Como áreas de investigación el municipio La Palma (provincia Pinar del Rio), caracterizado por una agricultura cubana tradicional, y el municipio Batabanó (provincia Habana), situado en una zona de producción agrícola industrializada, fueron elegidos. Una estancia de cuatro meses en Cuba fue aprovechada para recoger datos. Cada área de investigación fue visitada dos veces.

Con la ayuda de informantes claves la muestra de entrevistados fue tomado através del método “bola de nieve”. 15 campesinos (incluyendo dos mujeres) fueron entrevistados en La Palma. De ellos, seis campesinos fueron miembros del proyecto FP durante varios años y cuatro campesinos estaban constituyéndose en un nuevo grupo de campesinos FP. En Batabanó, once campesinos (todos hombres) constituyeron la muestra, entre ellos cuatro miembros en el FP por varios años. Además, ocho expertos (todos hombres) de instituciones científicas o administrativas fueron entrevistados. Estos expertos estaban relacionados por lo menos con una área de investigación y cooperaron con el proyecto FP.

Datos fueron recogidos a través de observación participativa y non-participativa, visitas de campo y entrevistas non-estructuradas y semi-estructuradas. Notas y fotos fueron tomados, entrevistas fueron grabadas en un principio. En Batabanó la grabación de entrevistas con campesinos fue abandonada porque parecía dificultar la conversación. Las notas fueron digitalizadas el mismo día, las entrevistas grabadas fueron transcritas (con ExpressScribe) y analizadas cualitativamente con el programa de codificación Atlas.ti. La confidencialidad en el manejo de los datos y la anonimidad de los entrevistados fue asegurado.

Los experimentos encontrados fueron clasificados en experimentos explícitos e implícitos, incluyendo cambios en la finca, planes para el futuro, experiencias de aprendizaje y pruebas. Experimentos implícitos fueron registrados sobre todo en la introducción de nuevos cultivos y nuevas varieadades de cultivos, en el manejo de cultivos y animales y en la maquinária y las herramientas utilizadas. Concernando pasos metodológicos, los campesinos acentuaron la importancia de hacer pruebas primero con cantidades pequeñas y de pedir información a campesinos versados si uno desconoce una cosa nueva. Las huertas para el consumo familiar formaron las parcelas de experimentación para los campesinos porque allí la diversidad de cultivos fue más alta que en los campos dedicados a la comercialización. Además, fracasos fueron nombrados como causas importantes para experiencias de aprendizaje. Encima, descubrimientos por casualidad fueron reportados de ser espontaneamente integrados en el proceso de trabajo. Adaptaciones a nuevas condiciones también fueron destacados. La cantidad de experimentos explícitos dependió fundamentalmente de la participación de los campesinos en el proyecto FP. Sobre todo experimentos aprendidos por el proyecto FP fueron denominados, por ejemplo comparaciones y selecciones de variedades en parcelas experimentales, pruebas con nuevos cultivos, cruzamientos en cultivos o comparaciones de diferentes fertilizantes agro-ecológicos (compost, humus de lombriz, plantas en función de abono verde). Fuera del proyecto FP menos ejemplos fueron mencionados, por ejemplo experimentos con rotaciones de cultivos, con diferentes marcos de siembra, en la poda y los injertos en los frutales o en la applicación de diferentes fertilizantes. En cada área de investigación una segunda visita fue realizado. De este modo, el desarollo de ciertos experimentos y la manera flexible de trabajar de los

campesinos fueron visibles. Muchos de ellos tuvieron que modificar sus planes por las condiciones dinámicas de su trabajo.

La percepción de sus propios experimentos por los campesinos (preguntado en directo “Usted hace experimentos?”) fue clasificada en tres categorías. Diez campesinos (dos campesinos FP) negaron la pregunta (categoría NO), ocho campesinos (todos campesinos FP) respondieron de experimentar dentro de las actividades del proyecto FP (categoría YES_FP) y ocho campesinos (cuatro campesinos FP) presumieron de experimentar constantemente (categoría YES). Resultó que los campesinos fueron más familiares con la expresión “probar”. 18 campesinos fueron preguntados “Usted prueba cosas nuevas?” y todos respondieron que sí. Miembros en el proyecto FP de largo plazo y dos campesinos con cinco años de educación superior tuvieron un concepto aclarado y dieron una definición detallada del termino “experimento”. Los demás campesinos lo relacionaron más generalmente con las caracteristicas de “probar algo”, que sea “una cosa nueva” y evaluar los resultados visibles “a ver como da”. Por lo general, la diferencia más importante entre los experimentos de campesinos y de científicos fue percibida en la metodología diferente. Por lo tanto los campesinos FP no vieron mucha diferencia como ellos aprendieron a experimentar de científicos. Resultó que el proyecto FP influyó la percepción por sus miembros de sus propios procesos experimentales. Creó consciencia para los experimentos campesinos y aumentó la disposición de los campesinos a experimentar explícitamente. También todos los expertos a parte de uno reconocieron las capacidades de los campesinos de experimentar implícitamente dentro de su trabajo diario, basado en su conocimiento tradicional y su experiencia en el campo. Ellos también eran familiares con los experimentos introducidos por el proyecto FP y mencionaron aspectos metodológicos como diferencia más importante entre la experimentación campesina y científica.

Referente la transferencia de conocimiento sobre experimentos tanto la comunicación verbal como non-verbal fue subrayado. Por una parte los campesinos acentuaron de aprender en la práctica y por observación diaria. Por otra parte el intercambio con otros campesinos y vecinos les pareció fundamental. Solamente campesinos cooperando por varios años con el proyecto FP usaron la palabra “experimentar” cuando comentaron sus actividades experimentales. Los demás campesinos utilizaron expresiones más coloquiales como “probar”, “inventar”, “ver si algo da resultados” o “hacer la prueba”.

Después de todo algunas limitaciones de esta tésis deben ser clarificados. La autora viajaba la primera vez a Cuba para esta investigación, por eso influencias climaticas, peculiaridades linguisticas, manejo de tiempo y dificultades en el transporte complicaron el trabajo. También adaptaciones metodológicas fueron realizadas durante el proceso de investigación, por ejemplo cambios en los guías de las entrevistas o la decisión de dejar de grabar las entrevistas con campesinos. Además la selección de los entrevistados fue desequilibrado hacía hombres mayores que fueron campesinos exitosos y reconocidos por los demás. Después de todo, la clasificación de los experimentos en explícitos e implícitos a veces no fue facil y fue influenciada por la percepción de la autora.

En resumen, esta tésis confirmó los resultados bibliográficos que tanto la experimentación implícita formando parte del trabajo diario en el campo como la experimentación explícita en este caso reforzado por el proyecto FP, existen. Orientación hacía la solución de problemas y una planificación racional fueron encontrados del mismo modo como acciones espontaneas y experimentos por curiosidad o interés personal. Mientras campesinos del proyecto FP entendieron sus experimentos como experimentos, los campesinos fuera del FP consideraron sus experimentos como experiencias de práctica diaria en su trabajo, como descrito en la literatura. Concerniente los procesos de comunicación varias influencias, como la observación, aprendizaje en la práctica, aprendizaje de fracasos y redes informales de comunicación, fueron confirmados. Finalmente, el proyecto FP pareció ser una oportunidad para crear consciencia entre los

campesinos para sus propios experimentos y con eso hacer sus “mudos” conocimientos explícitos.

Esta tésis fue una primera introducción a la percepción campesina de procesos experimentales explícitos e implícitos. Investigaciones consecutivos pueden salir por ejemplo de un análysis profundizado de la influencia de los factores socio-demográficos o de una comparación con campesinos con contactos a instituciones científicas sin investigación participativa.

Para concluir se puede decir que los campesinos cubanos en las áreas de investigación realizaron diversas actividades que pueden ser entendidos como experimentos desde un punto de vista científco, aunque los campesinos generalmente no los vieron así. La participación en el proyecto de investigación participativa FP influyó considerablemente la consciencia de los campesinos para sus propios procesos experimentales y reforzó su experimentación explícita. Sin esta influencia los experimentos campesinos se quedaron la mayoría de las veces implícitos, como reacción intuitiva a los desafíos de la vida diaria en el campo.

14. Abstract

Farmers' Experiments - The Farmers' View. Farmers' perceptions of implicit and explicit experimentation, exemplified on two research areas in rural Cuba.

Farming practices have been constantly developed since the Neolithic Revolution, based on farmers' experiments and innovations. Farmers' experiments can be conducted purposefully with similarities to scientific experiments (explicit experiments) or unconsciously as part of the daily farming practice (implicit experiments). This study focussed on the farmers' perception of their own experimental processes, comparing the view points of farmers with and without contact to a participatory plant breeding research project (FP-project) in two research areas in rural Cuba. Farmers' definitions of experiments, their communication patterns and examples for implicit and explicit experiments were assessed via participant and non-participant observation, farm walks and unstructured and semi-structured interviews with 26 farmers (14 FP-farmers) and eight experts, during a field stay in Cuba for four months. Qualitative data analysis was performed.

While evidence for implicit experiments was found in all farmers' cases, the existence of explicit experiments was fostered by the FP-project. Also farmers' perceptions of their own experimental processes were influenced by the involvement in the FP-project. While FP-farmers considered their experiments as such and used the expression "to experiment", non-FP-farmers labelled their experiments as experience or day-to-day practice and used colloquial expressions such as "to try" or "to invent". While FP-farmers and farmers with five years of higher education had a clear definition of the term "experiment", other farmers related its concept generally to "try something new". FP-farmers were conscious of their own experimental processes; without contact to the FP-project, farmers' experiments stayed mostly implicit, performed as intuitive response to challenges of daily life. The FP-project was found to make parts of the implicit experimental knowledge of farmers explicit.

Key words: Farmers' experiments, Cuba, perception, communication, participatory research

Kurzzusammenfassung

Bäuerliche Experimente – Die Perspektive der BäuerInnen. Bäuerliche Wahrnehmung von impliziter und expliziter Experimentation, dargestellt anhand zweier Forschungsregionen im ländlichen Kuba.

Seit der Neolithischen Revolution wird die Landwirtschaft durch Experimente und Innovationen von BäuerInnen weiterentwickelt. Bäuerliche Experimente können gezielt mit Ähnlichkeiten zu wissenschaftlichen Experimenten durchgeführt werden (explizite Experimente) oder unbewusst als Teil des täglichen Arbeitsablaufs (implizite Experimente). Diese Diplomarbeit untersucht die bäuerliche Wahrnehmung der eigenen experimentellen Prozesse anhand der Sichtweisen von BäuerInnen mit und ohne Kontakt zu einem partizipativen Pflanzenzucht-Forschungsprojekt (FP-Projekt) in zwei ländlichen Regionen Kubas. Die bäuerlichen Definitionen eines Experiments, Kommunikationsmuster und Beispiele für implizite und explizite Experimente wurden durch Beobachtung, Betriebs-Begehungen und Interviews mit 26 BäuerInnen (14 FP-BäuerInnen) und acht Experten während einer viermonatigen Feldforschung in Kuba erhoben. Qualitative Datenanalyse wurde durchgeführt.

Während implizite Experimente bei allen BäuerInnen gefunden wurden, wurden explizite Experimente durch die Teilnahme am FP-Projekt verstärkt. Auch die bäuerliche Wahrnehmung der eigenen Experimente wurde durch das FP-Projekt beeinflusst. Während FP-BäuerInnen ihre Experimente auch als solche bezeichneten und den Ausdruck „experimentieren“ verwendeten, nannten andere BäuerInnen ihre Experimente Erfahrung/Teil ihrer Arbeit und verwendeten umgangssprachliche Ausdrücke wie „probieren“ oder „erfinden“. FP-BäuerInnen und BäuerInnen mit akademischer Ausbildung gaben eine klare Definition des Begriffs „Experiment“, während die übrigen BäuerInnen den Begriff allgemein mit „etwas Neues probieren“ assoziierten. FP-BäuerInnen waren sich ihrer Experimente bewusst. Ohne Kontakt zum FP-Projekt blieben bäuerliche Experimente zumeist implizit als intuitive Reaktionen auf die Anforderungen des täglichen Lebens. Das FP-Projekt machte Teile des impliziten experimentellen Wissens von BäuerInnen explizit.

Schlagwörter: Bäuerliche Experimente, Kuba, Wahrnehmung, Kommunikation, partizipative Forschung

Abstract (Spanish version)

Experimentos campesinos – El punto de vista campesino. La percepción campesina de la experimentación implícita y explícita, investigada en dos áreas rurales de Cuba.

La agricultura fue desarollada desde la revolución neolítica basado en la experimentación e innovación de la población campesina. Experimentos de campesinos pueden ser realizados intencionádamente con similitudes a experimentos científicos (experimentos explícitos) o ocurridos inconscientemente como parte del trabajo diaro en el campo (experimentos implícitos). Esta tésis enfoca en la percepción de campesinos de sus propios procesos experimentales, comparando los puntos de vista de campesinos con contacto y sin contacto a un proyecto de investigación participativa (Fitomejoramiento Participativo, proyecto FP) en dos áreas de investigación en la parte rural de Cuba. Las definiciones de experimentos por los campesinos, sus procesos de communicación y ejemplos de experimentos implícitos y explícitos fueron recogidos aplicando métodos de observación participativa y non-participativa, visitas de campo y entrevistas non-estrucuturadas y semi-estructuradas. 26 campesinos (dos mujeres; 14 campesinos FP) y ocho expertos fueron entrevistados durante una investigación de campo de cuatro meses en Cuba. Un análisis cualitativo de los datos fue aplicado después.

Evidencia para experimentos implícitos fue encontrado con cada campesino mientras la existencia de experimentos explícitos fue reforzado por la participación de los campesinos en el proyecto FP. La percepción de los propios procesos experimentales de los campesinos fue influido por la afiliación al proyecto FP. Mientras campesinos FP consideraron sus experimentos como experimentos y usaron la expresión “experimentar” constantemente, campesinos fuera del proyecto FP entendieron sus experimentos como experiencia o práctica diaria e usaron palabras coloquiales como “probar” o “inventar”. Campesinos FP y campesinos con cinco años de educación superior dieron una definición diferenciada de la expresión “experimento”. Los demás campesinos relacionaron el término “experimento” más generalmente a “probar algo nuevo”. Los campesinos FP fueron conscientes de su propia experimentación. Sin contacto al proyecto FP, los experimentos de los campesinos quedaron implícitos, ejecutados inconscientemente como respuesta intuitiva a los desafíos de la vida diaria. El proyecto FP contribuyó a volver conocimiento experimental implícito de campesinos en conocimiento explícito.

Palabras claves: Experimentos campesinos, Cuba, percepción, communicación, investigación participativa