Farmers' experiments in Cuba's urban agriculture

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Abstract: *Urban agriculture in Cuba arose after the collapse of the socialist block in 1989. The subsequent food scarcity came hard on the urban population. As a result, urban dwellers occupied fallow land in the cities and began to produce their own food, mostly without previous experiences in agricultural production. Farmers' experiments and innovations were an integral part of the development of Cuba's urban agriculture movement. This paper is based on four-month fieldwork carried out in summer 2007 for a MSc thesis, consisting in semi-structured interviews with 24 urban farmers. Observation, field notes, a research diary and photographic documentation completed the set of methods used. The Interviews were registered with a digital voice recorder and the qualitative data were transcribed with F4 software, coded and analyzed with the software Atlas.ti. The quantitative data were stored on an Access database. Urban farmers mainly experimented on the areas of crop production, on the introduction of new plants, intercropping, soil fertility, tools/ machinery and produce commercialization. The experiments were either conceived by the farmers themselves or came up from recommendations from colleagues and knowledge exchange with experts. Solving specific problems was the main driver for experimenting. The farmer surveyed usually started experimenting on a small scale, which was enlarged when the results proved promising. They assessed their experiments by comparison and direct observation. The modification of the experimenting methods was a usual way to achieve applicable results. The outcomes reveal the contribution of urban farmers' experiments to an improvement in the resilience of urban areas.*

Keywords: *farmers' experiments; farmers' innovations; urban agriculture; sustainable agriculture; local knowledge*

Introduction

Urbanization is an ongoing process worldwide. Projections estimate that by 2030 about 60% of the world's population will be living in urban areas (United Nations, 2002). Urban areas are highly dependent on external resources like water, food and energy and this dependence makes them vulnerable to unforeseen changes (Shen et al., 2005; Newman, 2006). The collapse of the socialist block, in 1989, was one of these unforeseen changes, at a time when Cuba's economy depended on the trade relation with socialist countries. Thus, the collapse had a dramatic impact on the Cuban national economy, on everyday life and, above all, on food supply of Cubans (Wright, 2009).

Urban agriculture in Cuba emerged as a strategy of urban dwellers to adapt themselves to the new socio-economic conditions. However, most of the people who took up urban agriculture as a livelihood strategy lacked farming experience (Altieri et al., 1999). Therefore, the novice urban farmers saw themselves forced to experiment and innovate in order to establish efficient food production systems in their cities.

Urban farmers' capacity to experiment and innovate is the starting point for this paper. Our hypothesis states that their experiments still remain an integral part of the urban agriculture movement in Cuba and that urban farmers' experiments on environmentally friendly topics and methods help improve towns' sustainability and resilience.

The purpose of this research is to get a better understanding of urban farmers' experiments. In order to reach such purpose we examined the areas of experimentation, sources, reasons, methods and outcomes of urban farmers' experiments.

Farmers' experiments

Farmers' experiments refer to the process of conducting informal trials by which farmers, farm workers or gardeners evaluate innovations (Rajasekaran, 1999, Saad, 2002)). The observation of changes and the assessment of results is an integral part of this process (Stolzenbach, 1999). Farmers experiment on a broad variety of topics, which can be divided into four groups: technical, economic, social and institutional. Technical experiments are the prevailing ones, including such areas as crop production, farm machinery and animal husbandry (Sumberg and Okali, 1997, Nielsen, 2001).

Farmers mainly experiment to solve specific problems, but also out of curiosity. Personal challenges trigger experimentation too (Rhoades and Bebbington, 1991; Bentley, 2006). Farmers start experimenting driven either by their own ideas, by other farmers' advice or by the active promotion of a technology or method by scientists or extension agents (Bunch, 1991; Sumberg and Okali, 1997). They generally start on a small scale to keep the experiment simple, to reduce risk and gain experience (Hocdé, 1997). Once the results proved feasibility, farmers might enlarge and convert the experiment into common practice (Rhoades and Bebbington, 1991). Farmers usually evaluate their experiments by comparison with other plots, with different treatments or with experiences derived from previous years (Scheuermeier, 1997). They draw conclusions based on close observation (Millar, 1994).

Although there are a number of variables influencing – and even altering – farmers' experiments, farmers are able to recognize limiting factors. Some farmers even modify certain variables during the course of the experiments, and even in such cases they are able to determine the validity of the results (Scheuermeier, 1997). Farmers' experiments and innovations are deemed successful when they improve a certain situation. Changing variables to whitewash negative results would mean a waste of time and self-delusion (Critchley and Nyagah, 2000).

Farmers hardly ever use written note to document the experimental process or the results. Farmers consider note taking often redundant since they usually spend enough time working in agriculture, drawing conclusions from their experiences and incorporating such conclusions to their daily working routine (Rhoades and Bebbington, 1991).

Informal experiments are not just limited to rural farming. Many individuals and end users of innovations are involved in grassroots experiments to develop, adapt or modify innovations to specific needs (Gupta et al., 2003; Hippel, 2005). It matters little whether production takes place in rural or urban agriculture. Urban producers also have to meet the challenges which result from daily farming practice. Therefore, informal farmers' experiments are also an integral part of urban agriculture (Vogl et al., 2003).

Urban agriculture in Cuba

Urban agriculture involves all agricultural activities within (intra-urban) or at the fringe (peri-urban) of towns, cities or metropolitan areas. Such activities include crop production, animal breeding, processing and trade of food and non-food produce (Mougeot, 2001).

With the collapse of the socialist countries, in 1989, urban agriculture became a viable option in Cuba to mitigate the upcoming food crisis (Bourque and Cañizares, 2001). So, the urban population began growing vegetables and breeding animals to ensure a minimum food supply (Moskow, 1999). In 1994 the Cuban Ministry of Agriculture (MINAGRI) formally started to set up an organizational structure for the urban agriculture movement in Cuba. Undoubtedly, urban agriculture has played a key role to ensure food security during the toughest years of the crisis (Rosset and Bourque, 2001).

Cuban urban agriculture is based on organic production methods, the use of local resources and the direct distribution to the consumer (Companioni et al., 2001). Furthermore, it is highly institutionalized, including such services as advice, monitoring and evaluation of its development. The administrative structure of urban agriculture allows extension agents and scientists to establish direct and fast contact with urban farmers and facilitates knowledge exchange (GNAU, 2007).

Methods

Field research was done for three months in summer 2007 within the context of a wider research project on "organic farmers' experiments"[1]. The research towns were selected on the recommend-dation of local colleagues who were members of research institutions[2] and farmers' organizations[3]. Another location selection criterion was the degree of urbanization.

The sites chosen were: 1) La Palma, a small town in the Western province of Pinar del Río, with a population of 16,419 inhabitants; 2) Sancti Spiritus, a medium-sized city with 134,810 inhabitants located in the central region of the island, which is known for its permaculture movement, and 3) Havana, the capital, with 2,168,255 inhabitants, the largest and most densely populated of the three research locations, with a strong urban agriculture movement.

The interviewees in each location were selected through snowball sampling. Local colleagues provided the initial contacts and recommended the first interviewees for the survey. Semi-structured interviews with 24 urban farmers were conducted after prior informed consent (Bernard, 2002). Moreover, unstructured and informal interviews were conducted in those cases where semi-structured interviews were not feasible.

All the information was collected either digitally (semi structured interviews) or through field notes (farm walks and direct observation). Photographic documentation and short videos complemented the semi-structured interviews. Additionally, a digital research diary was updated every few days to keep record of the research progress. The recorded interviews were transcribed by using F4 software. Socio-demographic data was stored on a Microsoft Access database. The transcribed interviews were coded with the software Atlas.ti. Content analysis based on deductive coding was combined with a grounded theory approach based on inductive coding (Miles and Huberman, 1994; Bernard, 2002).

Results

Areas of experimentation

All the surveyed individuals carried out activities that can be labeled as farmers' experiments in urban agriculture, though there were differences between such activities in terms of frequency and complexity. All of the interviewees conducted experiments in more than one agricultural area whether simultaneously or at different times. The most active farmers mentioned up to nine different experiments, whereas the least active ones mentioned two experiments. In all, 104 farmers' experiments were identified (fig 1).

The farmers experimented in the different agricultural areas of production run on the farm according to subjective perception of priorities. Sometimes, they even experimented in non-traditional areas of production , trying something completely new.

The most usual areas of experimentation (fig. 1) was crop production, where farmers experimented on i.e. cuttings, pruning, transplanting, biological pest control and seed conservation. Experiments on tools, equipment, and machinery included work on mills, rasps, rakes, wells, dehydrators or biogas. Experiments in edaphology referred to soil protection, borders for added-topsoil plots or selection of adequate production sites. Intercropping included experiments to increase plant diversity and was actively promoted by extension agents. By experimenting respondents assessed also the suitability and feasibility of the new crops or varieties. Experiments related to fertilization included production

[1] The project, which lasted two years, was funded by The Austrian Science Foundation (FWF). The data collection was carried out in Austria, Cuba and Israel by a PhD student in each country. The field work in Cuba was done thanks to a student visa under an official agreement between the University of Natural Resources and Applied Life Sciences (BOKU), the Experimental Station of Pastures and Forages "Indio Hatuey" (EEPFIH) and the National Institute of Agricultural Sciences (INCA). This paper is based on the findings of a MSc thesis.

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and application of worm compost, biofertilizers and liquid humus. Experiments on processing referred to elaboration and conservation of new products such as flower wine, preserved vegetables or fruit juices. Production units with direct sales points were interested in experimenting on lines of commercialization. Irrigation was a common concern in urban agriculture and one experiment even resulted in a patented irrigation system. Experiments on animal nutrition were aimed at optimizing fodder rations. Experiments on paranormal technologies included pyramidal energy and magnetized water. Some respondents also experimented with capacity-building and education methods, i.e. organization of workshops and seminars to improve knowledge exchange. Experiments on pest control, composting toilets and local resource recycling were less often mentioned. Other experiments included the application of liquid smoke for plant protection, recycling of organic waste from the neighborhood, cleaning a greenhouse with an extra-large towel, use of bee propolis as putty, homeopathy for plants and setting-up of a vegetarian snack bar.

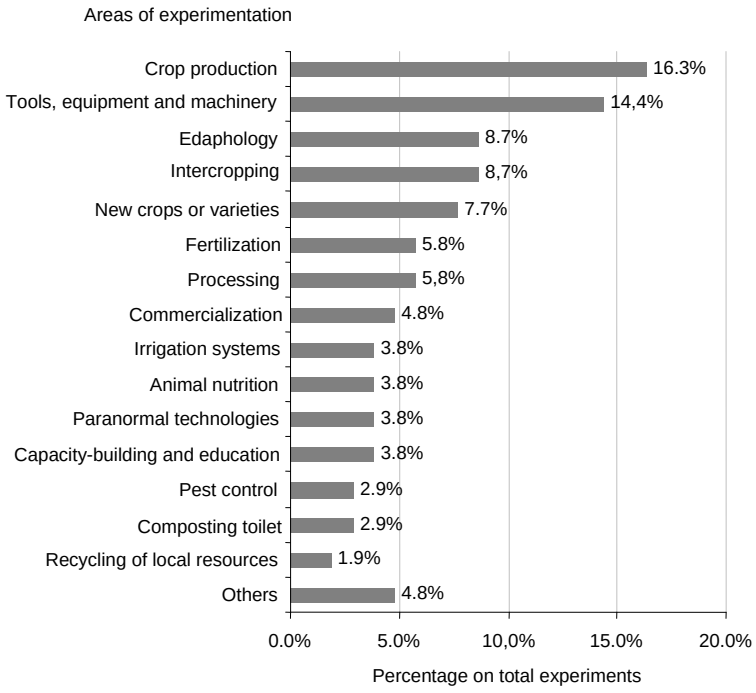

Figure 1. Areas of experimentation (total experiments: 104) and percentage of each area of experimentation in La Palma, Sancti Spiritus and Havana (n = 24 respondents).

Experiments' sources

The initial ideas that eventually led to experimenting and the reasons for conducting a specific experiment were overlapping aspects in the decision-making process. The interviewees' experiments were based either on their own ideas (30 %) or on ideas from external sources (fig. 2). Social networks of urban farmers facilitated the diffusion of knowledge, especially when the relations were based on acquaintance and trust. Respondents usually appreciated personal communication and mutual knowledge exchange with other farmers. Knowledge exchange included the transmission of original ideas from other farmers and eventually led to experimenting.

The institutions dealing with urban agriculture maintained regular contact with urban farmers, and some research institutions conducted on-farm research or invited outstanding farmers to participate in the development and/or assessment of technologies. Furthermore, knowledge exchange between urban farmers and extensionists favored the transmission of ideas and the generation of new ones by the farmers. Hence, knowledge exchange between farmers and scientists or extensionists was also a source for experimenting.

Information from books, newspapers, magazines, TV or radio was another experiments' source. Agricultural institutions used the mass media to broadcast information. Local radio stations cooperated with agricultural institutions and broadcasted programs to inform farmers. Occasionally, programs also included descriptions of farmers' innovations.

Urban and rural agriculture share overlapping knowledge systems, with their own specificity in different areas. Knowledge exchange between systems includes also the transmission of traditional knowledge originating from rural agriculture. Some respondents mentioned such knowledge that was available to them, though not yet put into practice, as the source of experiments. Thus, urban farmers tried practices originated from rural agriculture that were already known long before.

Off-farm experience acquired from field trips to other regions also triggered experiments. Few respondents met experts on permaculture from abroad at field trips or workshops and benefited from the ideas introduced by these visitors.

Although not directly involved in food production, relatives or friends enjoy high reliability. Some interviewees said that they used to discuss agricultural issues with their families and occasionally with friends. The ideas provided by relatives of friends eventually triggered experiments.

Even coincidence could be a source of urban farmers' experiments. According to some respondents, an unforeseen situation triggered farmers' reflection about the past occurrences. These urban farmers then tested something that previously happened by coincidence.

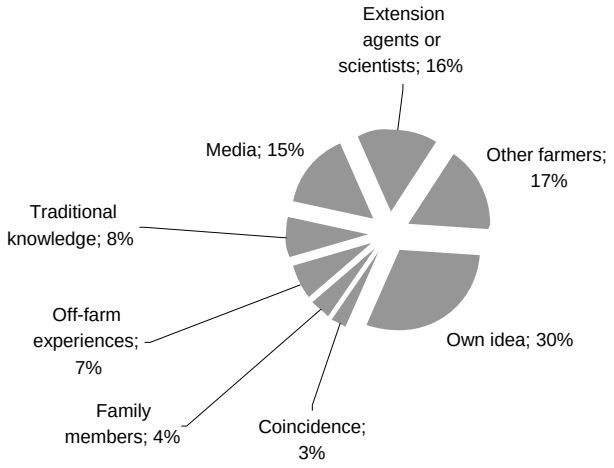

Figure 2. Sources of Cuban urban farmers' experiments (n=24).

Reasons for experimenting

The urban farmers began experimenting when they expected that it would lead to an improvement. Respondents claimed that it rarely would make any sense starting an experiment and expecting negative results. This would mean investing time and resources without getting any benefits in return. Nevertheless, some interviewees said that on occasion they tried something new without really expecting positive results. This was the case when they experimented on something that had been recommended to them, but without really believing in its feasibility.

The need to solve specific problems was the main reason that led to the decision to experiment (fig. 3). The problems that drove urban farmers to search for solutions were related to resource shortage, inefficient on-farm resource management, presence of pests and diseases, increased soil erosion, water management-related problems, unsatisfactory working conditions and problems with time management.

Economic reasons were also drivers for experimenting, though less important. In these cases, the farmers tried to improve their economic situation either by cost saving or by responding to an

emerging market opportunity. Economic reasons were more important to those interviewees relying on the commercialization of their products.

Personal reasons were also mentioned by respondents. Such reasons were related to the traits of farmers' personality, such as creativity, curiosity and penchant for experimenting. Personal reasons also included searching for challenges or increasing knowledge.

Another reason for experimenting was the adaptation of an innovation to the farm's specific conditions. In these cases interviewees experimented with innovations that were developed outside the farm and had to be modified to meet the farmers' needs.

Some farmers started to try innovations because of active promotion from scientists or extension agents who motivated farmers to try a new technology or method. The relationship between farmers and institutions influenced the farmers' attitude towards experimentation and gave rise to the adoption and adaptation of innovations.

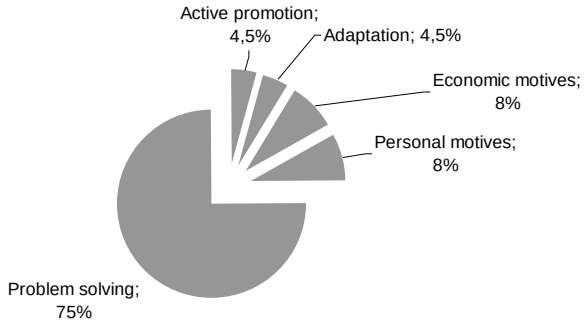

Figure 3. Cuban urban farmers' reasons for experimenting (n=24).

Methods applied by urban farmers

Most of the interviewees preferred starting the experiment step by step without using a written plan or a model, having the experiment design in their minds. The progress of the experiment determined their further decisions. Experimenting by following a plan or a model helped only 33% of the farmers set up the experiment and led them to a better understanding of the whole process. The type of plan depended on the area experimented on.

For 90% of the interviewees, starting on a small scale was a way to keep the experiment manageable at the initial stages, when they were still inexperienced. Some farmers started on a small scale just instinctively and others followed experts' advice.

The farmers said that they usually tried to minimize risks, though a few of them declared that they occasionally dared to take risks and started on a large scale when certain indicators forecast applicable outcomes and economic benefits. For example, one of the interviewees, who had tasted a new salad variety, was convinced that such variety would hit the spot. Therefore, he resolved to start directly on a large scale.

According to 62% of the interviewees, replicating experiments was a possibility to corroborate or improve the outcomes. However, when the evaluation of the results was positive, the experience acquired by the farmers made further experimentation unneeded and the experiment in question became a common practice. Replications helped urban farmers to confirm the results and to guarantee the validity of the results. The decision to carry out replications also depended on the subject experimented on.

Observation was the most important way to evaluate an experiment. In 90% of the cases the farmers assessed the results by observation and comparison to previous results or to the results obtained in a similar plot. Comparison was made either directly, against a comparable group, or indirectly, on the basis of the accumulated experience from previous experiments.

Whereas memorizing the experiences was an empirical way to keep a mental record of an experiment, 62.5% of the farmers interviewed, took written note of the process or of the outcomes of the experiment. As for documentation, it reinforced the validity of the experiments. Interviewees usually took note directly in the field on a sheet or a simple notebook. Those interviewees who did not take written note said that they were able to remember the key aspects of the experiments and that daily observation was the basis for gathering experience and learning.

Outcomes of urban farmers' experiments

The farmers interviewed considered the experiment results to be positive when they noticed an improvement. If the improvement compensated the efforts, the results were considered profitable and could be communicated to others. According to the interviewees, the benefits included resource saving (e.g. time, labor, energy, water), better use of available resources (e.g. land, materials,) and a higher degree of autonomy from external resources. As a result autonomy over production facilities and subsistence of the farming unit increased. Experiments allowed them to make their work easier, streamline farm management practices and increase the production. Successful commercialization of new products and improved costumer loyalty helped increase agricultural incomes. Better hygiene conditions eventually led to an improvement in animal health. Other benefits were better soil protection and the extension of the growing season for specific crops.

Outstanding experiments can be expected to be prized at innovation award forums organized by agricultural institutions. Successful experiments contributed to increase social ties between farmers, since they communicated the outcomes to each other. Interviewees were proud of successful experiments, and 95.8% of the respondents actively communicated the results within their social networks. Although there were unsuccessful experiments, the results generally brought an improvement of farming performance, thus contributed to agricultural development. The outcomes were classified into five categories: 1) farmers adapted an innovation that had previously been introduced to the farm unit. That is, the interviewees tested something that they already knew and modified it to their farm's specific conditions; 2) the experiment resulted in an innovation, which was new to the farm but not necessarily new in general; 3) the farmers claimed that they had never seen anything similar to the innovation in question elsewhere, so they developed something completely new: an invention; 4) the interviewees adopted an innovation, and the experimental process was limited to the period of gaining initial experience during the adoption process; 5) few interviewees were not satisfied with the outcomes and rejected their implementation (fig. 4).

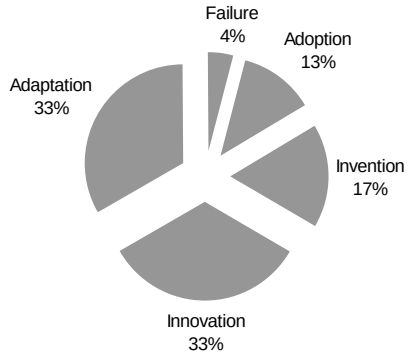

Figure 4. Outcomes of Cuban urban farmers' experiments (n=24).

Discussion

Urban inhabitants' capacity to experiment and innovate made it possible to mitigate the negative consequences of the economic and food crisis arising after the collapse of the socialist block. Cuban people's need to respond to such crisis was the driving force triggering the development of urban agriculture. The example of the Cuban urban agriculture movement shows how urban farmers'

experiments and innovations could soften the impact of an economic change that affected the society as a whole. The need to solve a problem and to improve the situation triggered self determined experiments and innovations.

Most of the results of this study confirm the findings of other authors related to the areas of experimentation (see, for instance, Bunch, 1991; Rhoades and Bebbington, 1991; Reij and Waters-Bayer, 2005; Bentley, 2006). Nevertheless, although the introduction of new crops or varieties prevails in the literature on this subject (Sumberg and Okali, 1997; Nielsen, 2001; Vogl et al., 2003), this was not the most important area of experimentation for the urban farmers interviewed in Cuba. The high proportion of experiments related to tools, equipment and machinery reveals the interviewees' attempts to overcome the shortage of resources through redesign or modification. The experimentation on soil management reflects the characteristics of the farming sites in Cuba's urban agriculture, where most of the plots were established on barren land which was covered with a fertile top soil of about 30 cm. Intercropping experiments were another farmers' strategy to maximize the use of the available area and meet the production plans.

Sumerg and Okali (1997) identified "trying something that has been observed or recommended" as the most important source of experimenting, followed by farmers' ideas of their own and by experiments which have been actively promoted. Most of the Cuban interviewees claimed that their experiments were based on their own ideas. However, the ideas provided by other farmers, relatives, extension agents and off-farm experiences outnumbered farmers' own ideas.

Ensuring food security, increasing income and maintaining soil fertility were the main reasons for experimenting (Nielsen, 2001). The prevailing reason why the Cuban urban farmers interviewed resolved to experiment was the need to solve a perceived problem. Food security was rarely perceived as a problem in Cuba. Instead, the interviewees did perceive the potential for improving both agricultural production and the use of locally available resources.

Comparison was an important strategy to evaluate results. Moreover, the interviewees emphasized the importance of observation for the experimental process. The documentation of the experimental process or outcomes in Cuba seems to contradict the findings of Sumberg and Okali (1997). The high percentage of respondents who took written note reflects compulsory documentation in Cuba's urban agriculture.

Urban farmers' capacity to approach a broad range of topics indicates that they are also able to respond to diverse changes in agricultural production. The areas of experimentation (biological pest control, biogas, worm compost, etc.) are characterized by low environmental impact. So they improve cities' sustainability in terms of both local food supply and closing the energy cycle. The attempts to solve perceived problems indicate that urban farmers experiment to improve production. Although food security was rarely deemed to be a concern by Cuban urban farmers and was not their underlying reason for experimenting, their experiments contributed per se to guarantee long term food security for the urban population.

Urban farmers' experiments led to agricultural development by increasing the efficiency of the system. Their capacity to approach diverse areas and their flexibility in applying the methods makes farmers' experiments a valuable input for strategies aimed at improving the resilience of urban systems.

Farmers' capacity to respond to changes (Kummer et al., 2008) represents an important condition for achieving agricultural sustainability. Nowadays, most of the worlds' cities have become highly unsustainable and, at the same time, vulnerable to changes. Promoting farmers' experiments in urban agriculture is a viable strategy to mitigate vulnerability of urban areas and to improve their resilience and sustainability.

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