

## **SIMPLIFIED HYDROPONICS:**

### ***Improvement of Food Security and Nutrition to children aged 0 to 6, a case study from Ecuador***<sup>1</sup>

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#### **1. Background**

Ecuador is located in the northwest of South America (figure 1). It is a country of overwhelming beauties but one which faces serious socio-economic limitations. In 1996, 27% of its urban population had their basic needs unfulfilled, and 34% of poor urban homes were unable to cover the cost of the basic family needs. The diet of poor people in Ecuador consists basically of rice, potatoes, yucca, bread, margarine, a very low proportion of protein and almost no fruit or vegetables. The national vegetable intake per capita in Ecuador is 30 kg./person/year, whilst the average for Latin America is 60 kg.

The Government of Ecuador, conscious of these problems, prioritised nutrition and food security for children aged 0 to 6 from the most vulnerable areas of the country and requested to the Food and Agriculture Organisation of the United Nations (FAO) the formulation and execution of a technical cooperation project to transfer the technology of simplified hydroponics to pilot sites in eight strategic locations of the country. The project was launched in May 2000 and was jointly operated by FAO and the National Institute for the Child and the Family (INNFA). The national institution carries out direct action for 44,000 children in 1,200 Child Development Centres (CDC, figure 2) with the co-participation of their families and the community.

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Furthermore, FAO made an agreement with the Uruguayan Hydroponics Association (ASUDHI), to employ an expert in the production of hydroponics vegetables and social community projects, as an International Consultant.



Figure Nº 1. Location of the 8 model SH modules in Ecuador



Figure Nº 2. INNFA Child Centre

## 2. The project objectives

The main goal of the project was to start the production of high-quality vegetables, through training on simplified hydroponics (SH), on a permanent basis, in order:

- To increase the availability of food for children under 6 years of age attending the INNFA Child Development Centres.
- To help their families organise and run farming mini-enterprises, to improve their income and their living standards, ensuring their food security and income generation.

## 3. Strategy

The strategy was based on the idea of strengthening the local community organizations, through intensive training to monitors and community leaders on :

- Application of the SH technology for the production of fresh vegetables.
- Promotion of a socio-organisational process to allow them to administer the project, focusing in the establishment of hydroponics mini-enterprises, with the support of the community.

## 4. Simplified Hydroponics

Since 1991, the FAO Regional Office for Latin America and the Caribbean (FAO/RLC), has been very active in the development and diffusion of the uses of the SH, as part of a food security strategy for low-resource populations in peri-urban and urban areas. Several training materials ([Annex](#)) are available free of charge on the website of FAO/RLC ([www.rlc.fao.org](http://www.rlc.fao.org)) covering the main issues of the SH system and had allowed numerous training courses to monitors at Chile, Brazil, Peru, Costa Rica and Uruguay.

Conceptually SH is a low input branch of Hydroponics, developed in Latin America. It uses the general concepts of Hydroponics but differs from High Technology Hydroponics (HTH) used in the U.S.A., Europe and Australia as follows:

- **HTH:** it is oriented to the market to maximize the cost/benefit ratio for the enterprise. It uses high technology and little labour. It is located in rural areas.
- **SH:** its main aim is for the family to be able to feed itself and to produce a small income. It is appropriate for low-resource populations. SH uses very low cost, simple technology; requires almost no investment; and uses family labour. SH can be generally located in the urban or peri-urban areas although also is suited to rural conditions.

Advantages of Simplified Hydroponics (SH):

- It is a low cost and easy-to-learn technique. A self-teaching, low-cost, easy to learn training course on popular hydroponics gardens<sup>7</sup> provides the basic technological pack for SH, This has been promoted by FAO/RLC as part of the strategy for urban agriculture to produce vegetable crops on limited urban and peri-urban spaces; do not require any previous knowledge, and their concrete results are easy to see by the local communities within few weeks.
- It allows the production of vegetables "without soil" in containers with water or in low-cost natural substrates (sand, rice skulls, pumice stone, etc.). It allows to grow a wide variety of vegetables, such as lettuce, tomatoes, carrots, garlic, watercress, aubergines, beans, parsley, radish, leek, strawberries, melons, flowers, aromatic and medicinal plants, etc.
- It allows the use of recycled materials to build the containers, thus making low-cost materials such as wood and disposable containers, useful (figure 3).
- It is ideal for food production in urban and suburban areas (*Urban Agriculture*). It offers the advantage of using places that have not previously been thought appropriate for food production (courtyards, small gardens, walls, balconies, rooftops).
- High efficiency of the use of water, but requires uncontaminated water availability.
- Generation of direct income for family or community micro enterprises.



Figure N° 3. Double height container with reusable materials

- It allows the production of high quality, harmless food. The fruits and vegetables have a very high biological and nutritional value. Since they are grown by the family, they are harvested immediately before their use, thus, the products are fresh and they keep their nutritional and medicinal qualities intact. Another advantage for the settlements is that it allows cultivation out of the ground, harmless and uncontaminated. In order to assure the harmlessness of the final product, it is essential to use drinking water and / or clean rainwater.

### **5. Beneficiaries of the Project.**

The activities were carried out in urban, rural and peri-urban areas of Ecuador, with a high percentage of the population living in poverty (60-80%) and indigence (6-60%). The direct beneficiaries of the project were children aged 0 to 6, from low-resourced homes, attending the Child Development Centres (CDC) of INNFA on a daily basis and their families (figure N° 2). The whole community also benefited from them indirectly.

### **6. Project Locations**

The SH modules were located in eight locations distributed in different geographical areas representing contrasting (mountain and coast) environments with very different climates and heights. On the coast, at sea level, the hot climate is humid and dry; on the mountains, at 3,400 m.o.s.l. the climates are temperate with very cold nights. (figure N°1).

### **7. Results and social impact**

7.1 – Hydroponics Modules supplying fresh vegetables to the INNFA CDCs.

- Pilot hydroponics (SH) modules were implemented each near to eight selected Child Centres (CDC) and equipped with 400 – 700 m<sup>2</sup> greenhouses (figure N° 4), basic irrigation setting, rainwater collection tank and water supply. Simple, chlorine water-treatment to guarantee the availability of potable water for irrigation and produce post harvest washing were set following normative from the health national organization.
- Monitors: 2 people per SH module (including women) were chosen by the community and trained by the FAO Project consultants to work in the modules. (figure N° 5). Intense technical follow up during two years allowed to increase the level of the expertise of the monitors to be able to expand and diversify the production focusing on micro-enterprises development
- Farming enterprises: an increasing number of farming micro-enterprises (formed by members of the community) have been established on the basis of the promising productive results.
- Community role and participation: the communal participation in the project was active ensuring follow up and success. In all the cases, the community supplied the land for the module, materials and labour to build the greenhouses.

- 70% of the fresh vegetable crops production resulting from the 8 SH modules was devoted to supply 54 Child Development Centres, comprising 2,567 children. The remaining 30% of the production is being sold among the neighbours of the community or in the market. In this way, the needed income to sustain the Modules is being generated to continue the operation after the starting inputs from the FAO project terminates.



Figure Nº 4. View of a greenhouse with simplified production systems



Figure Nº 5. Women working in the orchard.

#### 7.2 – Module Production Plan.

Each SH module elaborated their own production plan based on:

- Food requirements for the CDC.
- Market studies of the community and its surroundings.
- The potential of production considering vegetable specie and improved cultivars and its adaptation to the area, water quality, climatic conditions, and pest and local diseases.

### 7.3– Nutritional contributions of the SH modules to the CDCs.

#### a) Quality of the Product:

- Delivery of vegetables of excellent nutritional value (fresh, healthy, with no waste, a higher content of vitamins, etc.).
- Uncontaminated by pesticides or microbes.

#### b) Product diversity and continuity:

- The variety of vegetables available for the CDCs has been widened.
- New products have been included in the children's diet, such as watercress soup, rich in Vitamin A, B2, C, D, E and minerals, such as iron, calcium, phosphorus, iodine and manganese.
- All year around fresh high quality vegetable production has been planned and achieved ensuring constant supply to de CDCs.

### 7.4 – Nutritional status of the children at the CDCs.

Although an improvement in the children's nutrition was obtained at the CDCs affected by the FAO project, more recording time is needed to observe significant changes in quantitative growth indexes, such as Weight/Height, Weight/Age and Height/Weight. The short time span of the project (2 years) means that the data cannot be taken as conclusive and further monitoring and evaluation has been strongly recommended.

### 7.5 – Diminution of diseases.

Collateral facts were observed in the children in the eight SH modules:

- Reduction of acute respiratory infections; acute diarrhoeas and skin problems within children in the same CDCs, in relation to the previous years and among children from CDCs with no SH module.
- Improvement in their general appearance, they used to be pale and sad, now they look healthy and happy.
- These improvements are very probably due to increased intake and large diversity of vegetables with better quality and safety resulting in more availability of vitamins and phyto-nutrients in their diet; and to an indirect psychological effect caused by the importance given to the children and their participation in the project together with their families (figure N° 6).



Figure N° 6. Children participating in activities in the greenhouse

#### 7.6 – Great motivation of the children

Participation of children in recreational and educational activities related to the SH modules (planting and harvesting) promoted their motivation, value education and contributed to the development of abilities and skills according to their ages.

#### 7.7 – Generation of knowledge for the different regions of Ecuador.

The great variability, both in terms of climate and elevation over the sea level for the 8 locations of the SH modules (figure N° 1), was an initial difficulty in moving the project forward. Information was collected and consolidated on hydroponics nutrients and other inputs availability; varieties; climatic factors; incidence of plant pest and diseases; water irrigation quality (chemical and microbiological); and community organization to increase the national know-how and to facilitate the validation of the SH technology associated with social projects adapted to the different regions of Ecuador.

In addition to the community level impact, the project developed applied research activities. Due to the fact that a significant part of the coast of Ecuador is affected by very salty ground water (EC : 36 mS/cm) and prolonged droughts. The use of this water for irrigation completely inhibits or makes it difficult to produce vegetables on the ground resulting in the deterioration of the physical and chemical properties of the soil. Thus, these communities have no access to fruits or vegetables. In view of this, and in order to study the feasibility of the hydroponics production with salty water, a small experiment was carried out in the Commune of Tugaduaja, where it rains on average 76 mm per year and the available water has an EC 3,73 mS/cm. Under these conditions, the simplified hydroponics production system was integrated with shading; special varieties, mix with rainwater and the correct disinfection of the water allowed the cultivation of a significant range of optimum quality vegetables.

#### 7.8 – Training

Training courses on SH and follow up to monitors, parents, community members were organized at the different project locations comprising approximately 800 participants. The topics covered the simplified hydroponics systems; nutritional value of vegetables; plant nutrition; , plant pest and diseases integrated management; post harvest management of hydroponics products; water quality and safety; community organization and basic accounting for micro-enterprise establishment. The transfer of the hydroponics technology exceeded the expectations of simplified hydroponics. The monitors have easily incorporated the technique and they are now producing almost at the top of their productive capacity. This could be a starting point, later leading to higher productivity hydroponics techniques, such as NFT. The training component has been crucial to the project and it is expected a natural expansion and transfer to the rest of the community.

#### 7.9 – Positive impact on the communities.

Accordingly to the evaluations, the SH modules and the food they produce have been well accepted by all the communities involved in the project with the following impact: the diminution of diseases in the children; the improvement of the availability and access to food (food security) in the CDCs; and their interest to continue and expand the experience to a larger greenhouse production area under their own costing; introducing new hydroponics technologies (tomatoes-volcanic rock substratum, lettuce-NFT tubes; and consolidating the farming enterprise.

### 8 – Conclusion

**This project demonstrates that the hydroponics system (SH) can be considered an effective alternative to be integrated in food security and nutrition rural and peri-urban development programmes with in low-resource populations living under poverty conditions. The explicit acknowledgement by the local communities of the good quality of the fresh, un-contaminated vegetables obtained by the SH modules, as opposed to the ones they can obtain in bad conditions in local markets, has been a crucial factor for the on-going increased activities. Similar strategies can be used in countries with comparable situations, with the aim of improving their nutrition, food security and general welfare conditions.**