Home Gardens in Less Developed Countries

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Home gardens are an ancient and widespread agricultural system. Today in the United States and other developed countries (DCs), the home garden remains as a popular hobby. Horticulture departments in the United States work with home gardeners as one of their land grant university responsibilities. What is the status of home gardens in the less developed countries (LDCs) of Africa, Asia, and Latin America? Are home gardens simply hobbies there as well? Can home gardens contribute to the nutritional and household needs of poor families in LDCs? What is the record of past home garden projects in these countries? Is there a state-of-the-art strategy to improve home gardens? Is there a role for the horticultural scientist? These questions are addressed in this review of home gardens in LDCs, their crops and role in meeting nutritional and other needs of poor families. The design and results of past home garden projects and 2 strategies for improving home gardens are evaluated. Recent initiatives by international agencies, e.g., UNICEF and USAID, and the challenge these present to horticultural scientists also are discussed.

Major conclusions are that home gardens make significant contributions to the nutritional and economic well-being of families in LDCs. However, quantitative methods are necessary for detailed and reliable information on the productivity and impact of home gardens or home garden projects on the family’s nutritional and economic status. Even without further quantification, a “farming systems research and extension” (FSR/E) methodology would improve the design and implementation of home garden projects. Predetermined or fixed models, whether small or large, lack adaptability by definition, especially when advocated without prior analysis of the knowledge and needs of the family. A fixed model therefore may increase the risk to families attempting to implement the recommended changes in their current garden or when starting a garden for the first time. FSR/E methodology applied to home gardens projects would include initial characterization of the community—identifying and grouping potential clientele according to their current gardening practices, nutritional problems, perceived constraints and goals; planning a garden research program that starts with the community’s knowledge and problems; conducting research in gardens involving the community’s participation and evaluation of results; and dissemination of technology developed within gardens to other members of the community.

HOME GARDENS IN LDCs

Any discussion of LDC home gardens must acknowledge the lack of comprehensive and reliable statistical information on home production and consumption of vegetables and fruit as compared to the United States or other DCs. Consumption of vegetables in DCs is much higher than in LDCs, even though our diets are considered to be high in meat and fats. Daily per capita consumption of vegetables in DCs is estimated to be 220 g compared to 70 g in Africa, 60 g in Latin America, 160 g in South Asia, and 70 g in Southeast Asia excluding roots, tubers, or dry legumes (12). The same study estimates that 87% of the vegetables in DCs are produced commercially vs. 47% in LDCs. Observations of others (4, 11), however, suggest that consumption is underestimated and production overestimated. Consumption and production of fruit in LDCs, with the exception of bananas and coconut for export, are unreliable for the same reasons. Therefore, a discussion of home gardens in LDCs must rely upon field studies by anthropologists, geographers, and ecologists.

Horticulturists trained in the United States or Europe view vegetable and flower gardens and lawns with shrubs, fruit, and shade trees as separate components of the overall landscape or yard. These standards are too limiting for LDCs where the home garden should be defined as a family-managed food, fiber, ornamental and medicinal production system, usually located near the family dwelling producing primarily for the family’s consumption and secondarily for sale. Other characteristics are a large number of locally popular vegetable, fruit, and starchy crops including annual and perennial species intercropped for maximizing vertical and horizontal space, and receiving little or no daily maintenance, mechanization, purchased inputs, or government assistance. Gardens are frequently hand-irrigated, fenced to prevent predation by animals and people, harvested over long periods, sometimes year-round, and smaller than the family’s fields (personal communication, Vera Ninez, International Potato Center, Lima, Peru, 1984). Home gardens and their functions in Africa, the Caribbean, Peru, and Asia are described below.

Africa

The compound garden in tropical Africa has been described as the most permanent and intensively cultivated part of the traditional shifting or bush-fallow farming system. Surrounding the dwelling, the garden receives nutrients from household refuse and human and animal wastes. Annual vegetables are intercropped with staple and tree crops in the garden. Fields further from the garden contain fewer vegetables and a higher proportion of staple and cash crops intercropped with protected tree species such as kola nut [Cola nitida (Ventenat) Schott and Endl. and C. acuminata (Beauv.) Schott and Endl.], oil palm (Elaeis guineensis Jacq.), and wine palm (Raphia vinifera Beauv.) (23).

A plant inventory of gardens in East Central State, Nigeria, listed an average of 50–60 species within 5000 m². Predominant species included okra, Amaranthus spp., bitter-leaf (Vernonia amygdalina Dal.), Celosia argentea L., fluted gourd (Telfairia occidentalis Hook.), tomato, eggplant, and other Solanum spp., pumpkin, lime bean, vegetable jute (Corchorus olitorius L.), yams (Dioscorea spp. L.), cocoyams [Colocasia esculenta (L.) Schott and Xanthosoma sagittifolium (L.) Schott], cassava (Manihot esculenta Crantz), maize, African breadfruit [Treculia africana Dence. ex Trerul.], Gnetum spp., Parkia biglobosa (Jacq.) Benth., Pterocarpus spp., orange, guava, coconut, mango, plantain, banana, and pineapple (23).

Studies in southern and eastern Africa indicate that a change from staple crops intercropped with vegetables to cash crops and increased population densities reduced the area in gardens, reducing vegetables and fruit in the diet, and increasing subsequent malnutrition. The Zulus, for example, changed from their traditional diet of grain porridges accompanied by sauces and relishes prepared from garden or gathered produce to one consisting primarily of grain porridge resulting in pellagra, a niacin deficiency (7).
Caribbean

Extensive geographic studies in this region reveal that gardens respond to social changes. Puerto Rican gardens can be classified based on spatial patterns defined by the house or other structures, bare ground, trees, shrubs, and annuals related to the social and economic status of the family. Six types have been described: “jibaro”, traditional, vernacular, contemporary ideal, house-and-garden ideal, and manor garden, with the traditional and vernacular being the most common in rural areas. The ground cover to bare ground ratio increases on a continuum from the “jibaro” to the manor garden, with the ratio of volunteer to planted species decreases from 20 to less than 1, and the ratio of food to ornamental crops both in terms of species and area occupied decreases (17). Gardens of the rural poor on Grenada have not changed much in style, composition, or size since emancipation of the slaves in 1834. These gardens average 2000 m² and include tall crops like banana and pigeon pea [Cajanhus cajan (L.) Mills.] planted as a visual barrier to prevent theft of valuable fruit and vegetables (5).

The diversity of flora throughout the Caribbean clearly demonstrates the direct effects of different cultures, where crops are associated with the indigenous Arawak and Caribs, with the African slaves and with the European planters who introduced Polynesian cultigens, such as breadfruit [Artocarpus altilis (Park.) Fosberg] and many others (5). Analysis of gardens on Martinique indicate that 56 species are food crops, 35 for ornament, 11 for construction, 5 for medicine, and 3 for fiber (16). Garden composition, although varying from family to family in response to ecological constraints and needs, typically would contain these crops in order of popularity: banana, plantain, pigeon pea, cocoa, coconut, mango, Citrus spp., sweet potato, yams, taro, cassava, peanut, Amaranthus spp., okra, chili pepper, tomato, cabbage, cowpea [Vigna unguiculata (L.) Walp.], cucumber, and eggplant (5).

Few studies have attempted to quantify the contribution of gardens to the nutritional well being of the rural poor. One such study of families on food stamps in Naranjito, southwest of San Juan, Puerto Rico, indicated that children’s intake of calories, protein, Ca, Fe, Vitamins A (as beta carotene), C and riboflavin was higher in families with gardens than in families without gardens (13).

Peru

A recent study of home gardens in the Amazonian lowlands, Andean highlands, the arid coastal and urban areas of Peru identified 5 major socio-economic types: gardens which complement the food produced by families engaged in subsistence agriculture and so called ‘budget gardens’ grown by landless rural and urban families to supplement their incomes. Gardens contributed 10% of the total family income by reducing the need for purchased food and from sales. Staple crops, roots, tubers, maize, bananas and plantains, occupy over one-third of the garden area. Recently introduced species associated with commercial production are absent in home gardens due to their low survival rate under harsh conditions and need for purchased inputs (22).

Asia

Villages surrounded by trees are a common sight throughout rural Asia. These trees are part of the traditional home garden system known in Indonesia as the “pekaran-gan” (9, 31, 33, 34), occupy as much as 45% of the arable land on the island of Java (32). These gardens vary from 20 to 2000 m² and contain 30 to 50 species approximating the rain forest in diversity. The high ratio of perennial to annual species results in multiple canopies with a wide range of height and rooting depth enhancing exploitation of sunlight, nutrients and water. This system effectively reduces leaching and erosion nutrient loss compared to a monocrop of annual species (28). Trees and shrubs, such as bamboo, breadfruit, coconut, Gnetum gnemon L., horseradish tree (Moringa oleifera Lam.), jackfruit (Artocarpus heterophyllus Lam.), mango, papaya, Pithecellobium jiringa (Jack) Prain ex King, “katuk” (Saururus andegynous Merr.), and tamarind (Tamarindus indica L.) are grown for fruit, leaves, and wood. Climbing species grown for leaves, fruit, and seeds are sword bean [Canavalia gladiata (Jacq.) DC.], hyacinth bean [Dolichos lablab (L.), bottlegourd [Lagenaria siceraria (Molina) Standl.], sponge gourd [Luffa cylindrica (L.) M.J. Roem.], bitter melon (Momordica charantia L.), winged bean [Psophocarpus tetragonolobus (L.) DC.], chayote [Sechium edule (Jacq.) Swartz], and yardlong bean [Vigna unguiculata var. sesquipedalis (L.) Verde.] Ground level crops grown for leaves, fruit, roots, and seeds are “sintron” [Erectichis valerianifolia (Wolw.) DC.], water spinach (Ipomoea aquatica Forsk.), ming aralia [Polycycis fruticosus (L.) Harms], various Solanum spp and the rice bean [Vigna umbellata (Thumb.) Ohwi and Ohashi] (26). In addition, may pantropical trees, vines, low perennials, and annual crops noted for Africa and the Caribbean are common as well (29, 31).

The productivity of home gardens in Asia is better documented than elsewhere in LDCs. In rural China, private family gardens, established on 8% of the arable land and limited to 45 m² per person, produce 21% of the country’s vegetables, poultry, and swine (19). Even with rural immigrants rapidly increasing the urban areas of Indonesia, 11% of the families in urban areas produce 17% of their food in home gardens (9). In the less populated provinces of Indonesia, such as East Kalimantan, a rapid shift from subsistence agriculture plus high rates of immigration from Java has occurred, when off-farm employment is available from mining and lumbering. People in these areas have diverse ethnic backgrounds and diets but continue to obtain 50% of their vegetables and fruit throughout the year from home gardens (26). A massive highland to lowland migration has taken place in Nepal. Highland immigrant families are forced to reduce their normal year-round garden cycle to a few months in the cool, dry season because highland crops are not adapted to the lowland environment. Vitamin A deficiencies are now a concern (4).

One of the most thorough studies of garden productivity was made by Stoler (33) in rural central Java. Home gardens produced $250 to $820/ha/year, which were the highest returns to nonfarm labor available to their owners. Garden management required only 8% of men’s time and less of women’s. The portion of family income from home gardens ranged from 22% to 27% and was the largest source of income for the poor, who sell garden produce to purchase rice. These families also consumed more vegetables as a substitute for rice, which reduced Vitamin A deficiency among their children. However, intensifying production from gardens by growing more high value fruit and vegetables was too risky for poor families with the greatest dependence on gardens. Thus only households with substantial income or more secure land tenure could afford to make long term, investments in their gardens with increased return but higher risk.

Home garden projects to improve family nutrition

Home garden projects frequently are designed to improve the nutritional quality of family diets during economic crisis. One of the earliest examples in the United States was a garden program for the unemployed which distributed garden plots during the severe food shortage of Detroit’s Panic of 1893. Since then, Liberty, War, and Victory gardens have been organized to produce vegetables and staples (21).

Designing home garden projects for LDCs to improve family nutrition presents several problems. Vegetable species, i.e., roots, tubers, legumes, and other annuals and perennials, are at least 100 times more numerous than cereal species (13). Nutrient content and yield potential of traditional and exotic species grown under local conditions; the ability to propagate or purchase new planting stock locally, dietary preferences, the nutritional value of food normally consumed and nutritional deficiencies of the local population must all be considered by project organizers, who often lack this information. A review of 3 home garden projects over the past 35 years reveals the evolution of project strategies.

Mexico

R.W. Richardson (Rockefeller Foundation Agricultural Program in Mexico) during the early 1950s initiated one of the first large scale home garden projects (31). When the Rockefeller program began in 1943, it dealt primarily with maize, wheat, and beans and eventually became the International Maize and Wheat Center (CIMMYT). Richardson identified United States cultivars of beet, cabbage, carrot, chickpea, lettuce, lima bean, mustard, onion, spinach, green bean, swiss
chard, and tomato adapted to Mexico for year-round production in elevated areas and for winter production at low elevations. He then developed seed production methods for cabbage, onion, and tomato. Near the conclusion of the project, he initiated genetic improvement of 3 traditional vegetables — tomato, chili pepper, and squash. Ten years later, the number of home gardens had increased in the project area, the quality of commercial produce in the markets had improved, and large number of Mexican scientists had been trained.

Richardson's approach to improving home gardens characterizes many of the American missionary programs before the 1980s. The general strategy was to introduce vegetables popular in the United States to LDCs for trial without regard to adaptability, nutritional value, or acceptability and to ignore local crops. The success of his project in terms of improving the nutritional quality of local diets is unknown; however, it probably contributed to the development of Mexico's multimillion dollar export of winter vegetables to the United States.

**Haiti**

Almost 20 years later, King (18) advocated a different approach to home garden projects by proposing crop selection based on the specific needs of different groups. His goal was maximum nutrients/m² for gardeners, maximum nutrients/dollar for the urban consumer, and maximum dollars/ha for the commercial grower. This model was applied to Haiti assuming protein and Vitamin A and B₃ to be the most critical nutrients lacking in the local diet. King recommended cabbage, carrot, onion, pumpkin, and Swiss chard for the home garden; beet, cucumber, green peas, green pepper, lettuce, and shallots for the commercial grower; and cabbage, eggplant, okra, pumpkin, and yellow sweet potato for the urban consumer. The lack of regard for the local diet as evidenced by the absence of tropical crops (especially leafy vegetables) in the recommendations and the use of United States yields to calculate the production of nutritional constituents, unfortunately reduced the relevance of the model. Without diet information, the selection of crops which will improve rural and urban diets is likely to fail.

**Nigeria**

The FAO/Nigeria Home Gardens for Improved Human Nutrition Project, initiated in the mid 1960s, was probably the best documented and most expensive garden project in Africa (8). Horticulturists, nutritionists, and sociologists worked in cooperation with the Ministries of Agriculture and Economic Planning, the Univ. of Ibadan, and several area hospitals. Horticulturists sought to combine Indonesian and Nigerian concepts and species. Activities at the project headquarters included collection of both exotic and traditional, annual and perennial vegetables and fruit crops to determine their growth and reproduction requirements, their yield potential, pests, and nutritional value. Local home gardens and diets were studied. Mothers were taught to recognize nutritional problems and the role of vegetables and fruit in a well balanced diet. Research focused on the development of gardens for the family’s nutritional needs using minimal labor and purchased-input technology.

The project was considered a successful joint effort of health and food production education programs. Over 600 gardens, averaging 26 m² were established after 6 years with an annual survival rate of 85%. Households with gardens obtained 70% of their vegetables from the garden, doubled the number of meals with vegetables and increased the amount of vegetables served at each meal by 50%. Households without gardens obtained 32% of their vegetables from markets and 60% gathered from fields, compared to 10% and 20% for households with gardens.

The project, however, was criticized for lack of attention to the public’s ideas and attitudes. The cost of each garden established based on the overall project budget exceeded several thousand dollars! Its extension programs failed to integrate the project with other local institutions. The nutritional status of families if improved was not reported. The residual effect of the project in the community today is not known.

Oxfam (a private British-based famine relief and development organization) recently reviewed 28 of its health and nutrition projects involving gardening. Successful projects contained these components: crop selection and production for nutritional rather than market value, small garden size, extension activities oriented to the family’s primary food producer (frequently women), and an integration of activities with agricultural, health and social education programs in the community (24).

**CURRENT HOME GARDEN PROJECT STRATEGIES**

Two new strategies for home garden projects are currently advocated by international agencies to replace the former practice which rejected local crops while encouraging Western or exotic crops produced as monocrops in rows or beds. These 2 strategies are described as the intensive, fixed model, and the mixed garden or ‘farming systems research’ method.

**Intensive, fixed models**

Horticulturists and nutritionists for several years have been seeking the perfect garden for LDCs. The solution to the problem has been sought by applying crop production and human nutrition theory to the development of models on experiment stations which can then be extended to the public. These model gardens come in various shapes and sizes. A 29 m² round garden irrigated with an overhead sprinkler and divided into 8 wedge-shaped beds in which nutritious, locally adapted vegetables would be grown in a rotation system, was designed for Puerto Rico (20).

In Hawaii the productivity of two 27 m² gardens were compared. In one, typical Western vegetables such as cucumber, eggplant, lettuce, and snap bean were grown. The 2nd included dark green leafy vegetables such as water spinach, amaranth and ‘pak-choi’ [Brassica campestris Group Chinensis (L.) Makino], noted for their nutritional value (6). The 2nd garden produced 6 times more protein, 5 times more iron, 11 times more Vitamin A equivalents (as beta carotene), and 13 times more Vitamin C than the first garden (35).

The model used in Hawaii has been refined further by the Asian Vegetable Research and Development Center (AVRDC), Taiwan, by designing gardens for Thailand, Indonesia, and the Philippines based on popular nutritious vegetables from each country (2). These 18.5 m² gardens tested during the hot rainy season at AVRDC, produced on the average 16% of the protein, 43% of the Ca, 58% of the Fe, 84% of the Vitamin A equivalents and 330% of the Vitamin C of the recommended dietary allowances for a family of 5 per day.

The success of this project in improving the nutritional status of participating family is unknown, as field testing only began in Thailand in 1984. The project will be evaluated in 1985 (personal communication, Henry Munger, Cornell Univ., Ithaca, NY, 1985). However a similarly designed project in the Philippines had mixed results. The efficacy of extending nutrition and garden education and planting stock of locally popular vegetables to increase the levels of Vitamin A in the blood of children was compared to injections of Vitamin A or monosodium glutamate (MSG, a common cooking ingredient) fortified with Vitamin A. The garden program was more expensive and less effective in increasing Vitamin A levels in children than the fortified MSG, but the incidence of severe malnutrition decreased, and the overall health of the population was significantly improved compared to the other treatments (30).

A variation on the intensive, fixed model is a larger version incorporating the concepts of agroforestry, a production system described and refined in Indonesia which intercrops annuals and woody perennials (34). A 2000 m² garden was designed for Sri Lanka which would produce vegetables for family consumption and tree crops, e.g., avocado, banana, black pepper, breadfruit, clove, coconut, coffee, jackfruit, mango, nutmeg, and papaya for market. A family utilizing the proper spacing, management practices, and limited purchased inputs could earn an estimated $600 annually when the garden reached full production in 20 years (3).

Intensive, fixed model garden projects lack flexibility. This inherent weakness can result in the attempted implementation of a project unresponsive to the local reality. Consider the common problem of transferring technology to small farmers in LDCs, where all too frequently the technology is not adapted the farmer’s production environment (14). If we assume that in most situations the garden is of secondary importance to the family's
fields, then any innovation offered to improve their garden production and possibly the family’s nutritional status must not increase the demand for additional skills or production inputs including labor in competition with farming. Furthermore, if the fixed model is implemented at the exclusion of the traditional garden and is unsuccessful, the family will be at greater risk than before, perhaps even greater than if they had no garden at all (25).

Mixed gardening, a farming systems approach

Agricultural development research for LDCs gradually has adopted FSR/E as it is a family-oriented strategy for improving the productivity of the farm. FSR/E is essentially a management tool for prioritizing research, which relies upon the farm family to aid scientists in understanding their major farming problems and the interrelationships of inputs, crops, animals, and land in family decision-making. In theory, by understanding the family’s needs and knowledge about farming, it is possible to design and implement experiments on the farm to rapidly identify new technologies that are feasible and acceptable to the family’s biological, physical, economic, and social environment (10, 28).

The essence of mixed gardening, a term introduced by Paul Sommers based upon his home garden research in the Philippines is the traditional home garden of Southeast Asia, the “pekaran” described earlier, which produces not only food but construction materials, fuel, animal fodder, medicinals and ornamentals (MS Thesis, Univ. of the Philippines, Los Banos, 1978, 31). A mixed gardening project to improve or establish home gardens follows a several basic steps common to FSR/E (28).

A request by a community or government agency is necessary to initiate the project. The project team using social survey techniques and previously published information must gain an understanding of the community’s garden practices, crops, diet, health, and nutritional status. Examples of suitable survey techniques, called “sondeos” or rapid, informal surveys for this task, are available (24, 27, 31, 35). Ideally, a project team would include anthropologists, extension specialists, health specialists, home economists, horticulturists, microeconomists, and nutritionists. In reality, these tasks would be accomplished by small teams, e.g., a nutrition-oriented horticulturist and home economist.

The 2nd step is planning garden research. The research strategy should build upon local knowledge and address the needs identified during the initial characterization of the community. The strategy may include small intensive vegetable gardens, large traditional gardens as described previously, market gardens, or any number of combinations. The key is to let the community’s knowledge and situation set the direction for research.

The 3rd step is garden research and analysis. New cultivars, crops, or techniques may be tested in existing gardens; however, incorporating garden techniques and crops used by the best local gardeners may be all that is necessary to get started (31). Research should involve cooperating families, hospitals, health clinics, experiment stations, schools, markets and other appropriate community and government institutions. Community evaluation of objectives, research, results, and recommendations is essential to maintain community support.

The final step is extension of results. The success of the project is reflected in the acceptance by families of the recommendations developed for their expressed needs. The use of in-garden experiments evaluated by families and incorporated into their garden initiates the extension process.

INTERNATIONAL AGENCIES AND HOME GARDENS

The home garden as a means to improve the nutritional well-being of families in LDCs has enjoyed renewed interest in the 1980s. This is partially due to the high level of interest in FSR/E by agricultural development specialists in the United States and elsewhere, that places a high value on understanding the family’s needs. There also is strong local support by private citizens in the United States and other DCs for religious and nongovernmental volunteer programs to help alleviate hunger in LDCs.

Beginning in 1980, various international agencies began to reevaluate their position on home gardens. The United Nations Children’s Fund (UNICEF) published Paul Sommers’ home garden handbook on mixed gardening concepts (31). The United Nations Univ. commissioned a study of home gardens in LDCs (personal communication, Dr. Vera Ninez., CIP, Lima, Peru, 1983). The U.S. Agency for International Development’s (USAID) nutrition program awarded a grant to the League for International Food Education (L.I.F.E.) to conduct a state-of-the-art study of home gardens with emphasis on projects in LDCs and to convene a conference in 1985. The author serves on the study’s advisory panel. L.I.F.E., USAID, and the Peace Corps sponsored a 2-week course in 1984 taught by Paul Sommers to train teachers in mixed gardening. The Peace Corps has sponsored mixed gardening training programs in Honduras and Fiji, and more are planned for 1985 (personal communication, Albert Meisel, Director, L.I.F.E., Washington, DC, 1984).

However, this renewed interest requires several key questions to be answered. Do traditional home gardens make significant, cost effective contributions to the nutritional and economic well-being of the poor in less developed countries? Can home garden projects be organized, implemented, and evaluated that make significant contributions to family nutritional and economic well-being, and still be feasible, acceptable, self sustaining, and cost effective? Can hundreds of years gardening experience be coupled with horticultural and nutrition science to realize these objectives? The garden is a special horticultural system; therefore this is a unique challenge to horticulturists around the world.

Literature Cited


