The UNICEF Home Gardens Handbook: For People Promoting Mixed Gardening in the Humid Tropics

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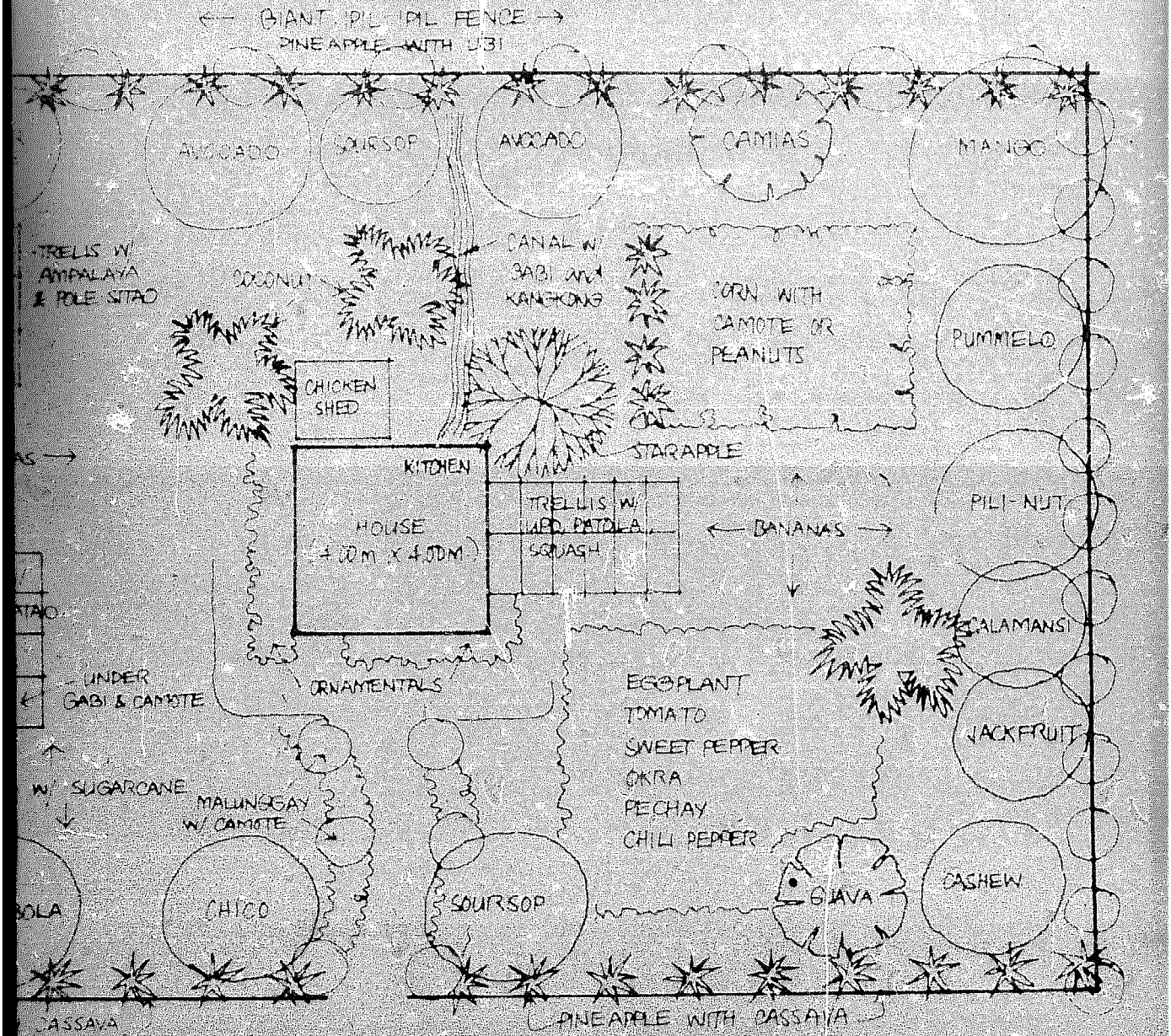

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❛ It seems that virtually everyone agrees that 'local food production' is very important for alleviation of food shortages and hunger. This includes the role of the small farmer but also the small-plot, family production commonly referred to as gardening. There is evidence that the contribution this can make, not only to providing more food and a better balanced diet but to providing some cash income as well as certain non-food household necessities, has been considerably underestimated.

"We must put greater efforts into this important area, which lends itself so readily to popular participation. ❜

James P. Grant
Executive Director
UNICEF

FOREWORD

This Handbook is intended to introduce the reader to time-tested systems of family food production and to help programme officers and community workers develop appropriate home garden programmes.

Much recent emphasis in agricultural development has been given to the production of staple crops and crops for export—while the importance and benefits of home gardens has been relatively ignored. Yet there is every indication that local food production will be increasingly important in providing adequate food and nutrition, especially for a large proportion of the world's neediest people.

Home gardens are, of course, not without their constraints: shortage of available land, inadequate water supply, lack of seeds or a seedling supply system, and the threat of theft, etc. On the other hand, they can and do provide food to those who need it, and they can provide income (sometimes more income for less investment than is needed for a family's field crops) as well as fuel, medicinals and materials for household articles.

Equally important, they offer opportunities for families and communities to improve their daily lives by building on traditional gardening practices developed through long experience of their own environments.

It is hoped, therefore, that the contents of this Handbook will prove useful and adaptable to all those undertaking and promoting home gardening programmes.

The Handbook has been written for UNICEF by Paul Sommers, who holds a B.S. in Agricultural Sciences from California State University and a M.S. in Human Nutritition from the University of the Philippines at Los Banos. He has extensive practical experiences of family food production techniques in rural Southeast Asia.

UNICEF is grateful to the numerous individuals who have helped Mr. Sommers with this Handbook and we would welcome comments on how it might be improved in the future.

L.J. Teply
Senior Nutritionist
UNICEF

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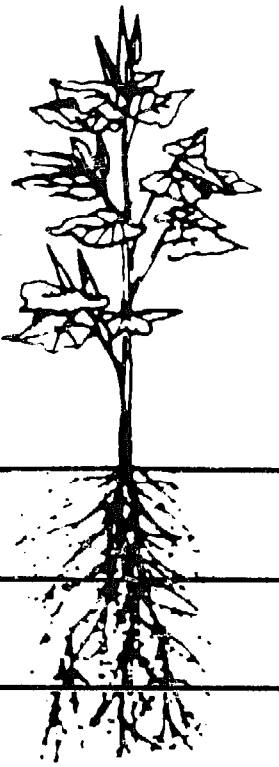
INTRODUCTION

Home gardening has been practiced for centuries throughout the tropical world. A house surrounded by various fruit trees and vegetables is a frequent sight throughout the lowland humid tropics. Yet despite the economic gains in many lesser developed nations, most of their householders continue to spend as much as 75 per cent of their income on food. Home gardens therefore represent the most viable method whereby a rural family can hope to meet its daily nutritional needs.

Any programme of rural development must take into account the importance of the home garden in rural life. A framework for introducing home gardens or modifying those that already exist must be planned very carefully so that it truly meets the needs of the local population. Past programmes have emphasized the physical/technical problems inherent in promoting home gardens or increasing their outputs. It was assumed that the people lacked skills in gardening and that through the adoption of Western gardening techniques, accompanied by advice and support, gardens would abound and flourish. However, research has shown that success cannot be achieved if only the technical aspects are considered. Social and economic factors are vital, and people embarking on a home garden programme must recognize their importance if the programme is to be effective.

The overall objective of this handbook is to introduce the reader to a traditional system of family food production that has proved itself over the centuries, and to provide guidelines to assist programme officers in devising and implementing an appropriate home garden programme. The information is presented in two parts: first, a general explanation of the home garden, its importance, its structure and its uses; and second, a more detailed set of guidelines for establishing a home garden programme, together with practical suggestions for putting the programme into effect at the village level.

For two years, the author observed and worked with indigenous home garden systems thoughout rural Southeast Asia, and especially in the Philippines. However, the techniques and objectives discussed here could be equally applicable to programmes for nutrition improvement in all countries of the lowland humid tropics.



THE MIXED GARDEN

I

A. COMMON CHARACTERISTICS

As one travels through the lowland tropical countryside, a familiar scene repeats itself, that of a dark green mass of plants with a staple crop growing around it. This diverse group of plantings which surrounds so many houses is a mixed garden, and a cornerstone of rural life. Such gardens are found throughout the world, and called by various names; dooryard gardens, kitchen gardens, courtyard gardens, homestead gardens, pekarangan and mixed gardens. Despite the different names, they are similar in basic structure and function. The term "mixed gardens" will be used in this text. As the term implies, the gardens are not designed according to the Western model, with straight rows of single crops, but instead contain an ecologically balanced mixture of annuals and perennials in a multi-story arrangement which yields vertical crops. Mixed gardens are the result of centuries of trial and error and have evolved into a self-sustaining system that can provide rural households with most of their basic dietary needs and perform many other useful functions.

A typical garden in the lowland humid tropics resembles a tropical forest. Dominating the first canopy level there are coconut trees giving only light shade, and rising beneath them is a second canopy of various fruit trees. Bananas, papayas, and a sugarcane are usually planted among these taller fruit trees. Bamboo is there also. Annual and perennial vines, as well as orchids, may grow on the trunks of the fruit trees. The ground level is reserved for low and trailing plants such as sweet potato and herbs. Climbing vines may completely engulf the household's sides and thatched roof, making the house and garden indistinguishable from one another.

B. USES AND IMPORTANCE

Past village and home garden programmes have tended to stress vegetables as the main component of the system. Vegetables have the potential to yield the best results in the shortest period of time, but their usefulness is limited since they cannot form the basis of a permanent, self-regenerating, self-contained ecosystem. Thus, a vegetable garden is one component of a home garden.

A typical Philippine mixed garden averages 300-500 square metres around the house and usually contains 25-40 different edible plant species at one time, a mixture of annuals and perennials, with edible shrubs and trees as well as ornamentals carefully integrated into the garden. Companion planting helps to ensure the permanent self-regeneration. Unlike the static vegetable garden that requires replanting several times per year, the mixed garden uses fruit trees as its basic skeleton. These trees bring up nutrients located deep in the subsoil and deposit them on the soil surface through the decaying of plant residue. The fruit trees and vegetables provide a continuous source of nutritious food for the household, while ornamental plants and flowers provide beauty and also attract bees for making honey and for pollination. This plant diversity creates one of the most environmentally sound cropping systems operating in the tropics today.

Home gardens are much more than a place for raising food. The trees provide shade, a windbreak and firewood. The gardens also supply building materials, fibre, cooking oil, spices and condiments, cooking utensils, material for making mats, baskets, furniture, hats, etc. Small domesticated livestock such as chicken and ducks are sources of excellent dietary nutrients and also fertilizer. Medicinal herbs are crucial to the health of rural families who may not be able to afford or obtain reliable drugs. In addition, the gardens serve to demarcate boundaries, and they offer protection and privacy. Their owners have the opportunity to supplement their income by selling surplus produce. They may also use the garden for social purposes—and religious ones. Often the observer will notice a family temple or religious statuary.

C. VARIETIES

Home gardens vary according to climate. In areas that have distinct wet and dry seasons, food production is directly related to the availablity of water. In the seasonally dry regions where water is in extremely short supply, fewer crops are found in the home garden, especially annual vegetables. However, certain drought-tolerant legume perennials, woody shrubs and fruit trees continue to produce during part of the dry season. In order for gardens in semi-arid areas to flourish, there must be a water supply (which can come from a small-scale irrigation project and/or rain catchment tanks).

In regions with rainfall year-round, a wider range of fruits and vegetables is evident, especially leafy vegetables. In general, the lowland tropics with even rainfall have the steadiest supply of fruits and vegetables from the home garden.

It is important to distinguish between mixed home gardens and those that are intended primarily for commercial use. Commercial gardens may be modelled on the Western "market garden". Raising a few varieties of produce in quantities larger than the family can consume means that the produce can be sold. The mixed garden, however, is diverse; its crops are generally non-commercial and grown primarily for home consumption. In periods of staple crop shortages, the diversity of the home garden's produce helps to supply the family with staple food while at the same time limiting the household's need to borrow money for food. However, when surpluses occur, households will sell or trade the produce. Fruit trees, for example, bear such a large quantity of fruit over a period of weeks or months that households can sell some of the yield and still have enough left for home consumption. Often the garden produce sold is exchanged for food that is not grown in the garden. Nutritional objectives are perfectly compatible with economic objectives.

Most of the nutrition programmes to which UNICEF provides support are concerned primarily with mother and child welfare. The importance of home gardens for nutrition improvement (with a possible economic spin-off) should be stressed, as it is in this handbook. Mixed home gardens are an outstanding example of "appropriate technology," functioning in harmony with local social and economic traditions and with the climate.

D. BENEFITS

Ecological

Small mixed gardens are perhaps the most environmentally appropriate farming system operating in the humid tropics today. By recreating natural forest conditions on a basis of edible plants, they stimulate nutrient cycles and sustain structurally complex and diverse plant communities.

Commercial gardens require cultural management: pest control, fertilization, irrigation, and so on. The mixed garden, however, utilizes different light levels and root zones to establish a stable recycling pattern. The deep-rooted trees absorb water and nutrients from the deeper soil layers and also provide rich organic matter on the soil surface through the decomposition of leaves and other plant parts. The soil surface in the garden is almost completely shaded by the plant canopy, which protects the soil from heavy tropical rain and intense solar heat and allows for an even temperature and high humidity inside the canopy. Weed growth is limited because there is so little direct sunlight and because the weeds must compete with shade-tolerant, edible trailing plants. Companion planting creates synergistic relationships: legumes, for example, may provide nitrogen indirectly to an associated crop through biological nitrogen fixation. In addition, most plants used in the home garden are indigenous and are genetically adapted to the micro-climate.

The accumulation of organic matter and plants on the soil surface prevents erosion, leaching and loss of nutrients. Pesticides and synthetic fertilizers are not required. The gardens fertilize themselves through the steady incorporation of organic matter from the plants, the organic materials discarded in the course of the harvesting and processing activities that occur around the house, the manure from small domesticated farm animals, sweepings from the kitchen, and from the garden plants themselves. Table 1 lists some materials that can be used as fertilizer and mulching material.

Livestock are an important component of the system. They provide food and valuable organic waste material for fertilizer and they often feed off the excess or unusable plant refuse of the household, such as rice hulls, corn stalk leaves and weeds. Ducks, rabbits, pigs and chickens scavenge for food and yet provide high

quality nutrition for households in the form of eggs and meat. Fish ponds can also be a part of the system, and so can bees, which are cultured to produce honey and also transmit pollen for plant fertilization.

Insect and disease problems are usually minimal because many of the plant species repel insects. Chickens also act as pest managers, since they eat harmful, as well as beneficial, crawling insects. Many home gardens contain herbs which act as natural insect repellents as well as ingredients in the diet. Because the gardens do not contain a high concentration of any one species, a major pest build-up is unlikely. The combination of different plant heights serves to trap certain airborne diseases and prevent them from inflicting serious damage on susceptible species. Table 2 lists plants that may repel certain insects and some household sprays for plant protection.

In sum, the ecology of the mixed garden represents a dynamic blending of plants and animals that provides an excellent and diverse source of nutrition for the household.

Nutritional

The low-input high-output cropping system of a mixed garden puts the potential for nutritional improvement within the means of most of the rural poor. In the past, home garden projects have relied on imported vegetable seeds that have been commercially hybridized. These seeds, in order to produce economically, require expensive petrochemical fertilizers, insecticides, and fungicides. However, the traditional mixed garden uses local plant materials and plant and animal residues as fertilizer, thereby limiting the cost of raising food.

Table 3 illustrates in detail the amount of daily nutrients a mixed garden can provide all year round for a family. Produce that is harvested from the garden just before meal preparation retains nearly all its nutrients, unlike produce that is bought at the market and may have travelled some distance. The mixed garden can counteract the inadequate supply of quantity and quality foods that is the major cause of malnutrition in the tropics. It can help safeguard the health of the family and ensure a varied and high quality diet for all. Table 4 is a basic food guide for adults using crops from the home garden.

E. A TYPICAL HOME GARDEN

Mr. and Mrs. Valeriano Suyat are Ilocanos and live on a three-hectare rice farm approximately seven kilometres from Narra on Palawan Island, in the Philippines. Palawan has rugged mountains running its entire length. Along the east and west coasts are heavily forested rolling plains. Rivers and streams are numerous. Narra is classified as a "Type three" climate with seasons that are not very pronounced. The average annual rainfall is 160 cm, and ranges from 21.8 cm from August to October to 3 cm in February. The average daily temperature is 31 °C. Typhoons are infrequent.

Most of the arable lands are underutilized, and so Palawan is in the lowest rank of commercial crop producers. Palay coconut and banana are the main crops. A majority of the crops produced are for subsistence.

Mr. Suyat's annual income comes from his two crops of rice and is between 3,000 and 4,000 pesos (US$430-570). His income is seasonal, with the peaks occurring in the harvest months of May and December, and the period of lowest income between September and November. Two of his three hectares of rice are planted to long-season varieties which mature in six months and on which Mr. Suyat uses no pesticides. The family uses most of this rice at home, preferring its taste over the short-season IRRI varieties. Mr. Suyat does use pesticide on the IRRI rice varieties that are sold to the National Grains Authority. Fish are encouraged in the family rice paddy and harvested during the six-month growing period of the long-season rice.

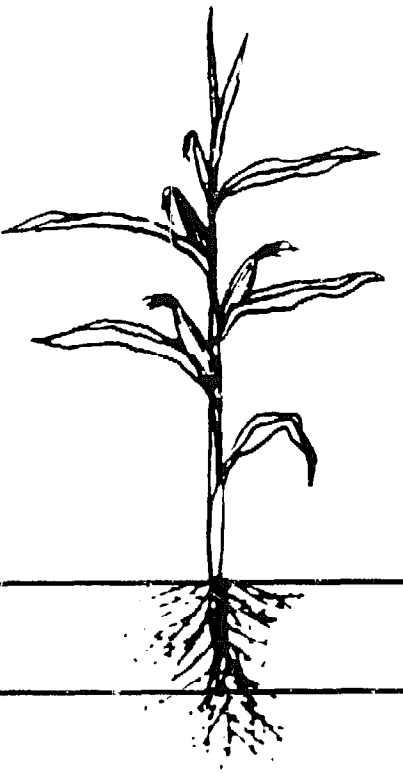
The Suyats go shopping twice a week in the Narra market. Transportation is infrequent, overcrowded, and because the road is in need of repair, it may take them up to an hour to reach the market. The jeepney fare is 50 centavos (7 US cents) each way. Food expenditures average 20 pesos (US$3) per week, for cooking oil, salt, sugar, coffee, kerosene, dried fish (except when Mr. Suyat has caught fish) and sometimes meat. The typical daily diet of the Suyats consists of duck eggs, vegetables, fish and rice. Most of these items come from the home garden and rice paddy.

The Suyats decided on the plants to grow in their garden according to their preference and the plants' nutritional and

economic value. The location of each plant was carefully chosen. Fruit trees were planted in front of the house for shade; *gabi* (cocoyam, taro) and *kangkong* (swamp cabbage) were grown next to the water faucet because they can tolerate continuous watering. Vegetables were planted close to the water pump to facilitate irrigation. Mushrooms were grown inside a banana hill because the bananas provided a moist, shaded atmosphere conducive to mushroom growth. Mangoes were planted in the well-drained higher ground to minimize waterlogging.

Both husband and wife share in the home garden tasks, which include attending to 41 species of plants, 15 chickens, six ducks, two carabaos, and one pig. The eggs from the ducks and chickens are used for home consumption and the pig is reserved for fiestas. The Suyats spend one hour in the garden in the early morning and one hour in the late afternoon. In the dry season there is usually a surplus of eggplant, *ampalaya* (bitter melon), okra, *upo* (calabash gourd), *sitao* (long beans) and *guyabano* (soursop). They are taken on market day and sold to buy other food items. The Suyats' home garden exceeds the Recommended Daily Allowance (RDA) in every nutrient calculated.

Mr. Suyat sums up the importance of his home garden thus: "We are poor. My income is not steady. I depend on my garden to help my family eat through periods of little work. It is our means of survival."



DESIGNING AND ESTABLISHING A MIXED GARDEN PROGRAMME

II

A. PROBLEMS OF THE PAST

Home gardens as part of applied nutrition programmes have received UNICEF support for more than two decades. Past programmes have tended to promote vegetable gardening in a system similar to Western row crop gardening. Large sums of money have been spent on the promotion of this type of home gardening, but with few tangible results. Why?

First, most least developed countries (LDCs) have concentrated on basic grains and have allocated funds for research and education accordingly. As a result, horticulture has suffered, with few trained horticulturalists to be found in most LDCs. Second, gardens have a very low priority in most development plans. They are usually an afterthought. There is great competitition for government resources of money and personnel, therefore the few personnel assigned to home gardens are generally not top government people, nor are they properly trained.

Third, home gardens have been considered the domain of ministries of agriculture and their personnel are, for the most part, concerned not with subsistence but with the commercial production aspects of agriculture, which, as we have seen, requires a totally different approach. Personnel from the ministries of agriculture may be inadequately educated in the wide variety of problems encountered in home gardening, yet they tend to control national networks of information dissemination.

There are also a number of serious constraints within the village that may limit home gardening. Some of these include: tightly clustered houses with little space between them (a common characteristic of coastal fishing villages), theft of garden crops, animals wandering unattended and lack of land or house ownership. In recent years there has been a dramatic increase in the number of landless persons who cannot establish home gardens.

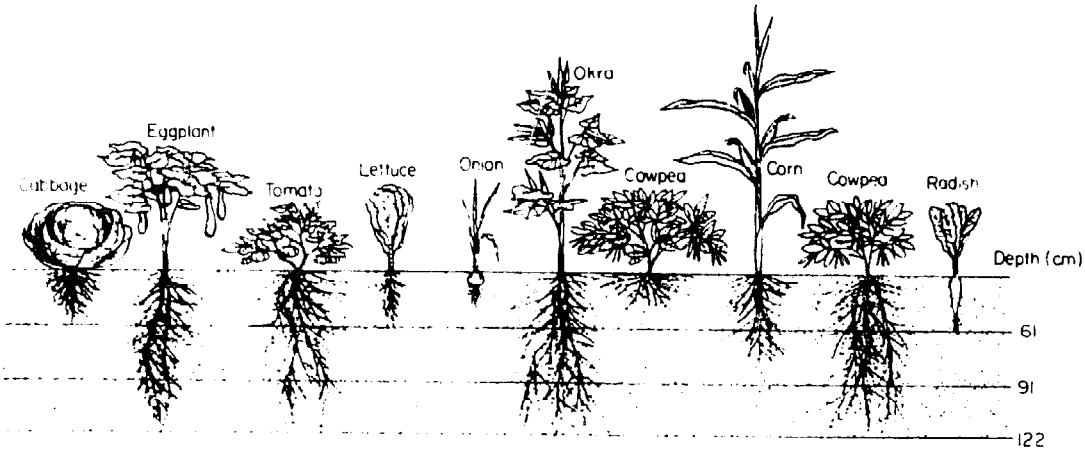
However, the emphasis development agencies have placed on establishing Western row crop gardening has had the most harmful effect. Most have brought their models from their respective temperate climate countries. Assuming that the people of the lowland tropics did not know how to garden effectively, development agencies have tended to fund and promote a type of garden with

which they feel comfortable—the "market garden," which consists of neatly prepared raised beds of vegetables. This type of garden has its advantages in commercial production but, as explained earlier, it is labour-intensive and requires fertilizer and pesticides to produce a satisfactory crop.

Some projects also started with the premise that the local population "did not eat vegetables" and therefore needed to be educated about their benefits. This ethnocentric view of "gardens" and "vegetables" led to serious programming problems.

It has been assumed that once households are informed about the nutritional benefits a home garden can bring, they will enthusiastically establish or develop their gardens. Unfortunately, this has not been the case. For although households would undoubtedly prefer to be well-fed, they have other priorities which may rank higher in importance than nutrition, especially income. While there is little argument as to the nutritional benefits of home gardens, they should not be promoted solely on that basis.

To sum up, home garden programmes have suffered primarily because few persons have taken the time to study their positive and/or negative impacts. Few, if any, projects have attempted to adopt and build on the traditional gardening practices consistent in structure and function throughout the lowland tropics. Many of the problems that face national home garden programmes could be reduced if sufficient resources were allocated *to study the existing system*. In almost every village there is at least one person who is using a garden intensively, and a great deal can be learned from that person. Training programmes that blend technical with social aspects of gardening will have a far greater impact than those that stress technical aspects alone.



B. CHOOSING AND TRAINING PERSONNEL

i) At the national level

Government has a role to play in home gardens. It has the infrastructure in its institutional network and personnel, but the infrastructure has not yet been used to elevate home gardens to their proper place of importance because of a critical lack of trained personnel, and of accurate information on which to base a programme.

Ideally, any project should be designed and operated by the government agencies familiar with the technical and social aspects of home gardens. Such collaboration is not easy to achieve. This is where the programme officer of the development agency can play an important role, by encouraging government agencies to meet and discuss a course outline. The training course will probably be the main channel through which the government will promote home gardening. The information presented and the ideas formulated by the trainees can be the critical factor in success or failure. The agent being trained need not come from the agriculture ministry. Any agency that might be connected with home gardening should use the training programme.

In most LDCs a cadre of non-governmental organizations (NGOs) is involved in research and action programmes, from the national to the village level. Many representatives of these organizations have had years of experience of the social and cultural characteristics of the particular country. A programme officer would be wise to tap this valuable resource as well as the government agencies. Often NGOs have a more practical insight into the various problems of community life than government officials. Many NGOs are eager to co-operate and become involved, and UNICEF could help to accomplish this.

ii) At the village level

Any of the following centres may be found in or near a village and can be used as the focus for a home gardening programme: a school garden, a food-for-work programme, a women's centre, a health centre, a university.

School gardens

Several countries have established school garden programmes, but tend to emphasize the "market garden" concept. However, schools could be used to demonstrate both an economic and a subsistence garden. Materials and technology for the school gardens should be gathered from local people. The school could act as a community nursery as well as a demonstration site. Better food storage, preservation, and preparation could be taught. School feeding programmes could be supplied, in part, from the garden's produce. There are potential problems that would have to be recognized at the outset: inadequate teacher time and interest; availability of land, water, fencing, guards; vacation periods.

Food-for-work programmes

This is an area that has yet to be fully explored, but many countries are involved in resettlement programmes. One of the common problems faced has been a lack of food and economic opportunities in the resettlement areas. A food-for-work programme could be used constructively, in helping to establish home gardens. Households could be provided with food for a specified period of time if they were to plant a home garden according to the guidelines drawn up by the resettlement authority. As the fruits and vegetables began to appear, the food-for-work programme could be phased out. Perhaps a small-scale marketing or processing co-operative could be established as an outlet for surplus produce.

Village women's centre

In many families the cultivation of plants around the home is the wife's responsibility. Therefore women could be actively involved in nutrition education through home gardening. A garden plot could be established at the women's centre using crops grown locally. New recipes and cooking demonstrations could be initiated by the village women and the community nutritionist.

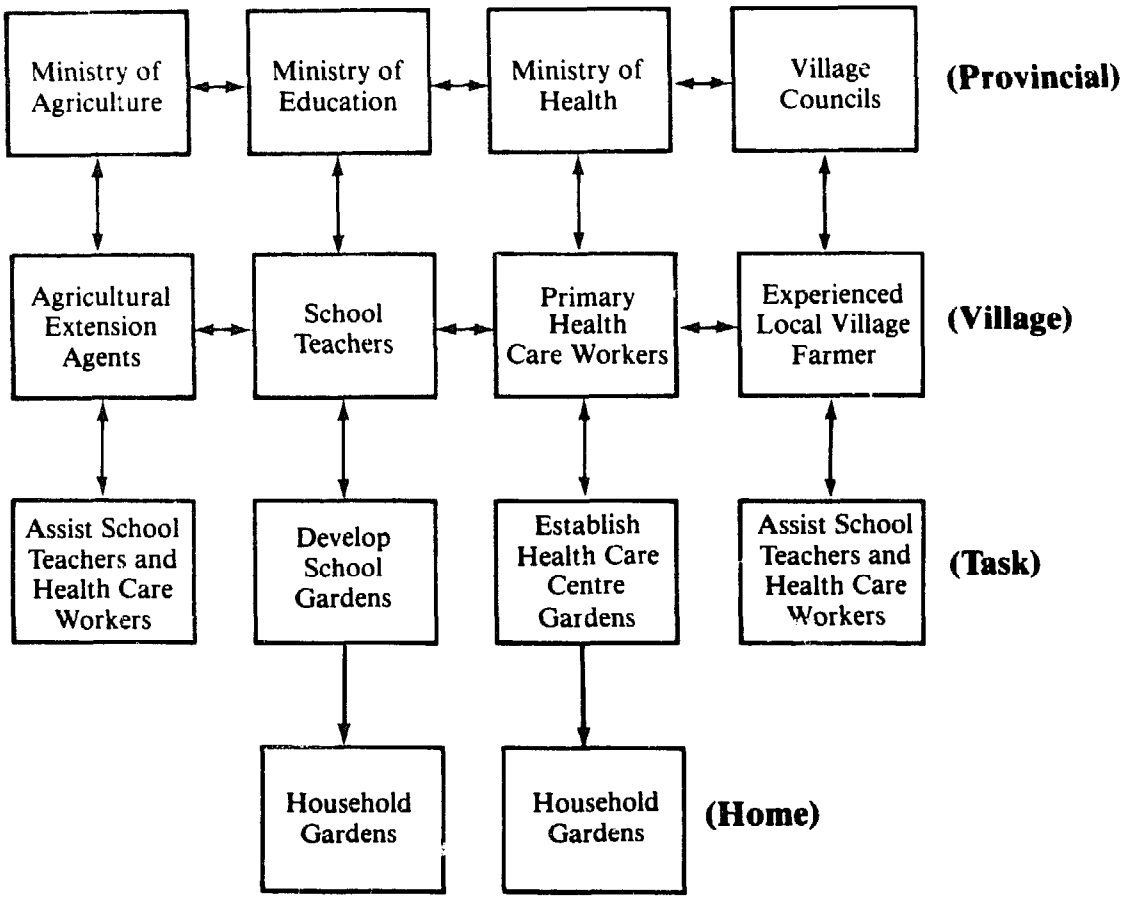
Rural health centres

Health centres can improve community health through prevention as well as cure. Since many illnessess are related to nutrition or diet, a demonstration of a home garden might be presented as an illustration of plants that a family could grow to help prevent illness. Health centres could also dispense information on plant materials and technical matters.

Universities

University staff and students are, in many cases, valuable resources, especially in research. They may have ongoing projects in community development with pilot projects located throughout the country. Since home gardens are a basic part of rural life, some university departments should be interested in researching their structure and functions. An integrated approach from the schools of anthropology and agriculture might be very successful.

The following chart illustrates the various routes by which a programme can be established:



C. INFORMATION

i. How to evaluate it

A common method of designing national projects is to make a survey, pilot study or experiment in one location, and extrapolate the findings for use in formulating a national policy. This method has been applied to home gardens, with no success. Another typical mistake is to issue technical information for home garden programmes based on a single experiment or, worse yet, estimated commercial production yields and practices. What is appropriate for one section of the country is assumed to be appropriate for every other section. But the needs of the population vary from one section of a country to another and this will influence the structure and function of the garden.

In some places, households do not have gardens. But rural people know how to survive. If no home garden has been planted there is probably a good explanation other than indolence or lack of technical skills. Programme officers should remember that economics plays an important role in the utilization of the land around the home. Perhaps grain drying or a cottage industry takes place where a garden might otherwise be. The household may derive more benefit from such activities than from the growing of a nutritious garden. Gardens would be nice to see throughout a village, but they are not appropriate for every household.

It is important to recognize the difference between a home garden programme to intensify garden crop production—which may range from the simple introduction of new plants to modifying cultural practices—and one that is designed to introduce and establish gardens—i.e. one which explains the nutritional, economic and other benefits. These differences in emphasis require entirely different programming.

ii. How to gather it: checklists

If home gardens are planned according to the social, economic, and climatic environment of the particular region, they can be of great value to rural families. The first step in successful planning is to obtain adequate baseline information on existing practices, and

this will provide the foundation for an appropriate programme. The ability to evaluate is critical because the garden that contains the greatest number of desirable characteristics should be the one chosen for use as a demonstration/model garden. The following checklist is intended to assist field personnel in their evaluation.

1. The garden provides a variety of food, medicinal, and building materials. (The greater the diversity, the greater the chance for adaptation by the local people.)
2. The plant canopy is multi-storied, making efficient use of solar energy. (A large number of crops can be grown in a limited space without significantly competing with one another.)
3. The garden provides better use of soil water and soil nutrients through its various root zone levels. (A large numbr of crops can be grown in a limited space without significantly competing with one another.)
4. Weed growth is controlled through shading by the upper canopy level and by trailing edible vines. (Controlling undesirable growth gives the desired plants a good opportunity for growth.)
5. Mixed-crop planting arrangements are such that a high plant density is achieved. (Makes maximum use of a limited growing area.)
6. Plant material is available locally and can be easily propagated. (Lessens dependence on non-local resources.)
7. Plant has the capacity for identical parental regeneration. (Reduces the chance of losing desired qualities.)
8. Crops grown require little or no commercial pesticides and fertilizers. (No necessity to spend severely limited funds on food promotion.)
9. Crop combinations have biological crop protection and synergistic relationships for nutrients. (Companion planting increases crop production efficiency.)
10. Organic matter is allowed to remain in the garden and additional nutrient sources, from farm animals, the family and threshing, are applied to the plants. (Using on-site materials removes the need for fertilizer expenditures.)
11. A steady supply of crops is harvested throughout the year. (Provides food and other essentials during staple crop shortages.)

12. Labour requirements are minimal and do not interfere with the major income activity. (Essential in integrating into daily activities.)

13. The garden provides a variety of quality nutrients throughout the year to ameliorate deficiencies in the diet. (Provides the opportunity for a good dietary intake throughout the year.)

14. The garden is unlikely to create conditions that will damage the ecosystem.

In a national home garden training programme, the staff at the local level can use their training to discover existing home gardens that meet the criteria for development. The owners of the gardens are, in most cases, sources of valuable information. Consideration should be given not only to technical matters, but, more importantly, to social, economic and cultural factors. Questions of motivation, the household's needs, people's perceptions about gardening and the availability of community resources are critical.

The following questions have been designed to provide information about the financial status of households and how it relates to nutritional intake. It will not always be possible to get complete information, even from a sampling of households. It is worth remembering that if the home garden programme is seen to be integrated into an economic benefit package, the chances for motivating families to respond and participate will increase.

Financial Information

1. **Name, age, sex and occupation of family members currently residing in the household.**

(The family composition will determine the nutritional needs of the household. Occupation will indicate the potential income available to the household. Refer to the host government's food composition table, if available, to determine the food/nutrition needs for the household.)

2. **What is the approximate annual income of the family?**

(Household income will provide an indication of disposable income and purchasing power.)

3. **Is income seasonal or steady throughout the year?**

(Fluctuating incomes have a direct influence on nutritional intake. It is important to determine the peak and the difficult months so that the home garden may be designed to meet the household's economic and nutritional needs.)

4. **How much money is spent on food per week?**
(Expenditures for food compared with income provide an approximate percentage spent on food.)

5. **Which items are usually purchased?**
(Examine items purchased to determine which could possibly be produced in the home garden.)

6. **Determine the approximate frequency of shopping and distance to the market place (in time and distance).**
(Perhaps a home garden could be designed to reduce the number of trips and the amount of time spent in marketing.)

7. **Does the amount spent on food vary according to season?**
(If expenditures vary according to season, then it would be appropriate to design a home garden for the months when the family need for garden produce is the greatest.)

Dietary Information

Information about local diet patterns, in terms of availability, preference, and taboos should be collected in order to develop a programme which the local people may be able to accept and assimilate into their lives.

1. **Twenty-four-hour recall of food consumed. (*Meal, amount* and *source*)**
(Obtaining data on daily food intake, in terms of quality, quantity and source should reveal dietary deficiencies, and indicate the major sources of daily food, i.e. own field crops, market, garden, friends, etc.)

2. **Which is the most common method of food preparation? (*Mixed* and *unmixed*)**
(Understanding how food is prepared will help to determine the nutritional value of the meal. This data can be incorporated into a nutrition education programme.)

3. **Which foods are in demand but are not purchased because of the high cost?**
(A solution to the problem may be discovered by analysing the factors involved in the high cost.)

4. **Are dietary intakes different among members of the household?**
(Food consumption patterns and taboos may be obstacles to

improving nutritional status. Analysing these obstacles may lead to their elimination, with the aid of local community leaders.)

Home Garden Information

Traditional home gardening practices were developed to meet basic human needs. As we have seen, a home garden project will be more likely to succeed if local technology is incorporated. Observing the structure and function of the home garden will provide insight into how members of the household perceive their garden in relation to their daily routines.

1. **What is the major staple produced by the household, and when? (*Area* and *quantity*)**
   (The main staple crop is usually the focal point of family and village activities. A home garden project can be designed to complement the staple crop in terms of time allocation and nutrition.)

2. **Why was a home garden constructed? (*Income, home consumption,* or *other*)**
   (The answer may lead to a further understanding of the various activities that take place in the garden.)

3. **How was the design of the home garden decided?**
   (This will provide an insight into the garden's structure and function. A garden which is primarily for income will most probably show a distinctive "market garden" appearance. On the other hand, a subsistence garden generally will appear to have a great variety of plants mixed together in a limited space.)

4. **How was the home garden location decided?**
   (This will provide information as to whether or not garden plants were grown in a certain place for a particular reason.)

5. **How was the choice of plants made? (*Family preference, climate, income, nutritional value,* or *other.*)**
   (The answer will indicate the family's major considerations. The garden may have other functions beside the production of food.)

6. **Major sources of plant materials. (*Markets, friends, relatives, farms,* or *other.*)**
   (This knowledge will help in developing the seed distribution phase of the project.)

7. How many family members work in the garden?

	Seldom	Often
All		
Head of household		
Wife/spouse		
Other		

(The home garden programme must be tailored for the target group.)

8. How many hours are spent working in the garden per day?

Less than half an hour / Between a half and one hour / Between one and two hours / More than two hours / Other

(Time spent in the garden may be an indication of its importance as opposed to that of other household activities. Factors that determine time spent in the garden include type of crop, size of the garden, intensity of the planting, season of the year, major labour involving the staple crop.)

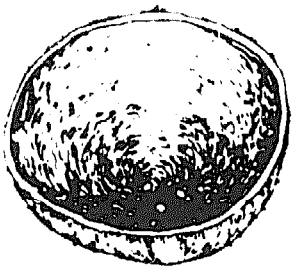
9. Approximate size of the garden

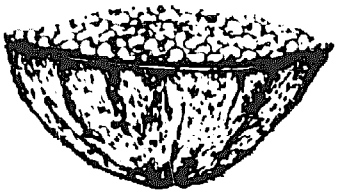
(It is important to appreciate that even if some space may appear available or unused, it may well be in use in an alternative non-food-related capacity.)

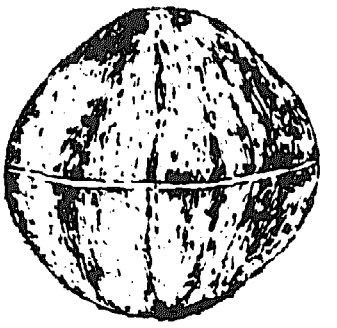
10. a. What tools are used in the garden?
b. Where are most of the tools obtained?

Made by household / Purchased in the market place / Donor group / Other

(A knowledge of tools most commonly used in the home garden will assist programme planners in deciding which tools are necessary, and also if they can be produced locally.)







11. What cultural management practices are used?

Activity	Season	Crops
Watering		
Weeding		
Cultivation		
Staking		
Fencing		
Pest Control		
Chemical		
Biological		
Fertilizer		
Commercial		
Natural organic		

(This information will reveal the degree of technical skill used on the crops. Programme planners could design seminars on the use of locally available material for crop improvement.)

12. Which crops require the most time and care?

(If the answer shows that imported seed requires the most attention, promotion of locally adapted plant materials may be in order.)

13. a. Is there a surplus of crops? (If yes, during which season?) **b. Is there a shortage of crops?** (If yes, during which season?)

(This knowledge may assist in programming for home garden crops that are adapted to the climate at the time of shortage.)

14. Are crops traded from one household to another?

(Findings may indicate that trading is commonplace, and imply that money is not always necessary in order to obtain food.)

15. From what sources is food obtained on a daily basis?

	Most	Some	None
Market			
Garden			
Friends			
Relatives			
Other			

(This answer will have major policy implications, indicating how the family obtains food for its survival. Without a clear understanding of the major food source a home garden programme could not succeed.)

16. Are farm animals raised in the home garden?
If yes,

Kind	Number	Use	Source of Feed
Fish	☐	☐ Income ☐ Home consumption	☐ Market ☐ Farm/garden
Chicken	☐	☐ Income ☐ Home consumption	☐ Market ☐ Farm/garden
Duck	☐	☐ Income ☐ Home consumption	☐ Market ☐ Farm/garden
Pig	☐	☐ Income ☐ Home consumption	☐ Market ☐ Farm/garden
Goat	☐	☐ Income ☐ Home consumption	☐ Market ☐ Farm/garden
Other	☐	☐ Income ☐ Home consumption	☐ Market ☐ Farm/garden

17. What are the problems of this home garden?

Lack of space / Lack of planting materials / Lack of water /
Insects and disease / Stray animals / Lack of time / Theft / Other

(Through a real understanding of the problems, possible solutions can be developed.)

18. List of crops and their uses

Name of crop	Amount	Use

Key: 1. Food / 2. Fibre / 3. Firewood / 4. Building materials / 5. Animal feed
6. Medicinal / 7. Spice / 8. Ornamental / 9. Other

(This classification of plant and animal species and their uses will provide the basis for a self-sustaining home garden.)

D. ESTABLISHING THE MIXED GARDEN

i. Design

A number of preliminary questions are necessary if the garden is to be appropriate for the individual household:

- What will be the primary use of the garden?
- Is it principally for home consumption, or for additional income, or a combination of both?
- Will domesticated animals be permitted to roam freely through the garden?
- Will the garden serve a multipurpose role, supplying not only food for the family but also animal feed, building materials, firewood, and medicinal plants?
- Is the head of the household the landowner, a share tenant, or a leasor of the land?
- How much land is available?
- Is water available all year?
- What is the character of the climate? Prevailing wind direction?
- How much time will the members of the household have to spend on the garden?
- Do they own or have rights to the property?
- What, if any, are the nutritional deficiencies of the household members?

A plan should be drawn, showing the present location of the house and any other permanent fixtures. The drawing of the yard can then be filled in, showing the proposed location of the fruits, vegetables, fencing and livestock areas. Drawing will help to place crops that might otherwise be overlooked. The garden plan should indicate the space that will be needed by each tree in ten years. This is to prevent overcrowding and ensure proper spacing and arrangement.

The size of the mixed garden depends upon the available space, the amount and type of plants, and the time available to work on the garden. It is possible to produce nearly all of a family's non-cereal nutritional needs in an area of 500 square metres or even less. Table 5 suggests an ideal vegetable garden with the approximate number of plants to raise and square metres needed.

The amount of fruit trees and vegetables to plant will depend on the size and purpose of the garden and needs of the family. When the garden is for home consumption, at least one variety of

each fruit tree that the family desires should be included (if space permits). Generally, crops rich in calories (corn, millet) and protein (soybean, peanut) require more space than those rich in vitamins and minerals (drumstick tree, squash).

The special requirements of each plant should be considered. Each plant has its own, but they vary from climate to climate and season to season. Certain plants, especially fruit-producing vegetables, require full sun; others, such as leaf crops, can tolerate slight shade. Some can withstand long dry periods (legumes); others are very susceptible to wilting. Some plants are heavy feeders (corn); others are releasers of nutrients (legumes). Certain plants are climbers; others stand erect. The time from planting to harvest varies. All these factors help determine which crops to grow and where and how to grow them. See Table 6 for some suggested crop locations.

Given the generally favourable year-round climate of the humid tropics, the mixed garden can be designed to yield a continuous flow of produce if it is planted with a variety of fruit trees and vegetables that mature at different seasons of the year.

ii. Implementation

Preparation: Before any planting takes place, the area for the mixed garden should be cleared of weeds and debris. Next, organic matter should be spread over the entire area, if possible. Then the ground should be ploughed or spaded by hand and harrowed or raked level and smooth. The beginning of the rainy season is the ideal time for land preparation as the ground will be much easier to work and the crops will have a constant supply of natural irrigation to help them survive. Now the garden is ready to plant.

Basic framework: The garden plan should be consulted in order to place the plants in their proper location. A temporary fence should be constructed from local building materials while the live fence, a hedge made of trees, has a chance to develop. The fruit trees should form the skeleton of the mixed garden, its permanent framework, so their proper placement is essential. They should receive some form of protection from the rain and sun until they become established. Construction of a trellis for the climbing plants can also be done at this time. After the permanent trees are in place and the trellises are constructed, the annuals can be planted.

Early growth: During the first few years of the garden's development, there can be a high density of annual vegetables, because the trees (except for papaya and banana) are still young

and do not require a lot of space. As the trees develop, the space available for annuals will decrease. With careful planning, vegetables should still contribute greatly to the family's daily diet. However, the types of crop will have to change. Plants that are slightly shade-tolerant will play a more important role, as will climbing plants that will have natural poles on which to climb, in the form of tree trunks. As the mixed garden matures over the years, the rising tree canopy will block high levels of sunlight from reaching the ground.

Special requirements: Weed control will be a major task in the first few years until the canopy blocks out the sun and eliminates the weeds. It can be done by hand weeding or through mulching. Organic matter will also have to be supplied during the early stages until a natural cycle can be generated from the fruit trees (see Table 7).

The need for irrigation may be critical in the early years, but this will depend on the type of plants chosen. Watering by hand will probably be necessary during most of the dry season. Plants can be protected from animals by live fences of pineapples and other repellent crops, and by placing bamboo sticks around delicate plants. If animals continue to be a serious pest, the householder might concentrate on plants grown on trellises made from local materials.

iii. Selecting Plants

Choose plants that require minimum labour in return for a high production of nutrients. Indigenous plants are usually a safe crop because after centuries in that particular environment they have genetically adapted to its conditions and do not require a great deal of labour or materials to give a good yield. Plant materials should also be chosen for their ease of reproduction. If new seeds must be planted regularly and these seeds are only available from outside resources, it may be inconvenient to raise such crops.

Plants should be chosen on the basis of family preference. However, if the community nutritionist finds that members of the household are suffering from nutritional deficiencies, the plants that could reduce these deficiencies should be planted and consumed.

For home consumption, a wide variety of vegetables and fruit is desirable to ensure that the family obtains the necessary balance all the year round. If the home garden programme emphasizes annual vegetables to the exclusion of perennials the outcome may be disappointing. Most annuals are "market garden" vegetables, which are perishable and must be harvested when mature. Space for storing them is limited, and their seeds require transplanting and replanting.

However, if perennials are an integral part of the home garden, income and nutrition complement one another.

When deciding which trees grow best together, it is important to know:

1. Their fruiting habits. Do not plant trees together that flower and produce fruit at the same time. Their requirements for water and soil nutrients will be high and they will compete for limited resources.
2. Where the fruit will bear on the trees. For example, mango, citrus, avocado, star apple and rambutan bear fruits on the outside branches. You might not want to plant them together because they will compete for sunlight. Select a tree that bears fruit on the inside and plant it next to one that bears on the outside.
3. The structure (morphology) of the trees: Are they umbrella-shaped, like mango and jackfruit or open like guava, sugar apple, and breadfruit? Generally, umbrella-like trees produce a lot of shade, preventing many crops from growing below them. They usually require a lot of space to grow.
4. Which tree can produce fruit in partial shade. (Lanzones, durian, jackfruit, and papaya can grow underneath taller trees and may not require full sun to produce fruits.)
5. The height of each tree at maturity (e.g. annonas three metres, mango ten metres). This is useful to know when deciding a tree's location and space requirement. Generally, smaller trees are better adapted to the home garden.
6. Whether they are drought resistant (tamarind, mango, cashew, guava) or need constant moisture (rambutan, durian, papaya, avocado).

Table 8 lists the agronomic characteristics of some tropical fruit trees. Most trees take several years to produce and will require more space than vegetables.

iv. Companion Planting

Companion planting of crops that complement each other is the foundation of a mixed garden. Most homes have limited space to produce crops and rely on this system, which uses every inch of available space for crop production. The mixed garden is intensively cropped vertically as well as horizontally. For the garden to produce

continuously, it rarely depends upon outside resources once it has been established, regenerating itself in order to survive. Some common planting arrangements found in Southeast Asian home gardens are:

1. Multi-story tree crops: coconut - top layer; santol, jackfruit and avocado - middle layer; banana, papaya and coffee - next layer; ubi, wingbean, and other edible vines growing on the tree trunks; pineapple and taro - lowest layer.
2. Climbing legumes: yardlong beans, wingbean and or/lima beans planted to one ipil-ipil stake or one untrimmed piece of bamboo.
3. Planting in a circle: banana in the middle surrounded by cassava and tomato; wingbean growing on the banana; camote trailing on the ground.
4. Water canal from the kitchen and/or water pump: banana, sugarcane, kangkong, taro.
5. Trellis over an irrigation canal: bittergourd, squash, climbing legumes.
6. Trellis over livestock pen for pigs and/or chickens: yam, squash, beans.
7. Mushrooms growing inside a hill of bananas.
8. Climbing vines on a palm-leaf house with or without trellis.

See Table 9 for a detailed list.

v. Seed Storage

The power of seeds to germinate reduces rapidly in the high temperatures and humidity of the tropics. The higher the moisture content of seeds during storage the more rapid their loss of ability to germinate.

Good germination will depend upon:

1. Maturity at harvest. An early harvest before the fruit has matured may result in low germination of the seeds.
2. Processing. Seeds may be dried by placing them over or mixing them with desiccants, such as calcium oxide, ash and charcoal.
3. A short period of storage. A general guide to the life of seeds can be seen in the thickness of the seed coat. For example, seeds from the annona family (soursop, custard apple, sugar apple) have a thicker seed coat and will remain viable longer than seeds from the citrus family (lime, orange, pumelo).

Corn husks with seed kernels can be stored above the wood stove because the smoke will keep away insects and diseases. Containers for storing seeds should be airtight to prevent insect and disease attack. The best container is a glass jar or sealed tin. Tin foil is very suitable when sealed inside a plastic bag. However, if these storage materials are not available, bamboo or coconut hulls from the home garden can be utilized (see Table 10).

The easiest way to obtain new seeds for planting when no commercial seed dealer is located nearby is to buy crops from the local market. In the case of fruit, eat the food and save the seeds. Legumes or seed pods should be placed in the sun and, when dried, the pod can be removed and the seed stored.

When selecting seeds, look for mature plants that have vigour, resistance to insects and disease, high yield and good eating quality. Most dead seeds will float on water. Good seeds appear to have a glossy seed coat while old seeds will have a dull colour.

vi. Harvesting

Fruits and vegetables have distinctly different stages of maturity and this fact must be considered before harvesting.

Some fruits and vegetables will continue to ripen after harvesting; others stop once they have been picked. Muskmelon, caimito, guava, chico, sweet pepper and santol are some crops that should not be harvested before they reach maturity. Some leafy vegetables and fruits can be harvested continually. Generally, as a fruit or vegetable matures, the vitamin C content decreases. However, there is a corresponding increase in vitamin A.

The best time of day for harvest depends on the type of plant. In general, it is best to harvest leaf vegetables, fruit vegetables and tree fruits in the early morning and root crops in the late afternoon. However, the best course is to pick the plant just before the meal. This will help to increase vitamin retention and thus aid the family's nutrition. Table 11 lists the sources of nutrients from the home garden and ways to preserve them in cooking.

vii. Storage and Preservation of Fruits and Vegetables

Home Preservation: Root crops can be stored in a pit under shade for up to three months. Wax gourds and pumpkins can be stored on a shelf for three months. Generally, leafy vegetables cannot be stored for more than a day without refrigeration. Legumes can be stored for longer periods of time.

Dehydration of Root Crops and Fruits: Dehydration, or the removal of moisture from food, is a simple and inexpensive method of food processing by which a crop can be stored for a long period of time. This technique can be used when surplus crops occur. The stored products can be used during periods of low crop production from the home garden. Crops high in starch—sweet potato, yams, cassava, taro and arrowroot—are easily processed.

The process consists essentially of peeling and slicing the crops, blanching them for a few minutes, and placing them on bamboo slat trays for drying in the sun. Finally, the dried product is ground into powder and stored in an airtight container. Most powdered root crops can be stored up to six months.

Some fruits are also good candidates for dehydration. These may include the cooking variety of banana, mango and pineapple. The process is similar to that used for root crops, except that blanching is not necessary. The fruits are washed, peeled, sliced, and placed on trays to dry in the sun. Usually, the fruits will be dry in three days if there are no clouds or rain. The dried fruits can be sealed and stored for up to six months.

Table 1. Some tropical materials for use as organic fertilizer and mulching material

	Nitrogen	Phosphorous	Potash
Corn cobs	x	x	xxx
Corn silage	x	x	x
Corn stalks	x	x	x
Rice straw	xx	x	x
Rice bran	xx	x	x
Rice hulls			
Wheat straw	xx	x	x
Wheat bran	xx	x	x
Peanut shells	x	x	x
Egg shells	x	x	x
Feathers	xxx	x	x
Sugar by-product	x	xxx	x
Coffee grounds	x	x	x
Tea grounds	xx	x	x
Seaweed	xx	x	x
Fish bones	xx	xx	xx
Banana stalk	x	xx	xxx
Banana skins	x	xx	xxx
Banana leaves	x	xx	xxx
Tobacco leaves	xx	x	xx
Tobacco stalk	xx	x	xx
Fresh manure:			
cattle	x	x	x
chicken	xx	x	x
horse	x	x	x
human	x	x	x
swine	x	x	x
bat	x	xxx	x
duck	x	x	x

xxx - Good source xx - Fair source x - Poor source

Table 2. Plants that may help repel insects, and some household sprays

Plant	Insects
Tomato	Flea beetles
Hot Peppers	Chewing insects
Garlic	Cabbage butterfly
Marigold	Aphids, weevils
Mint	Nematode, corn zarworms
Petunias	Aphid
Wood ashes	Ants, aphid, beetles, crawling insects

Formula for spraying

1. If an ordinary house sprayer is available, certain plant parts can be used as insect repellents.

Materials: Mint, tobacco leaves, hot peppers, garlic, onions, tomato leaves.

Procedure: Grind the plant parts to extract the juice and mix with water in a 1:1 ratio.

Another spray can be made of soap, kerosene, and water.

Procedure: (For one litre of mixture)
Quarter-cup laundry soap
Quarter-tablespoon kerosene
One litre water

Mix and apply.

2. Contact poison (for sucking insects)

Materials: One pack of cigarettes
Two eggs
Eight tablespoons oil
Two cups water
Three glass jars
Pinch of detergent soap
Two empty cans

Procedure: Remove the paper from the cigarettes and put the tobacco in the empty can. Add two cups of water and boil for 15 minutes. Strain the solution by pouring it through filter paper into one of the glass jars. Then put eight tablespoons of oil and two tablespoons of vinegar in the other can, add two eggs, and beat together until they emulsify. Combine with the nicotine and put them together in the glass jars. Finally, add a pinch of detergent soap for ease of spraying.

Table 3.
Nutrients[1] in serving portions of foods available in the Philippines

Food and description	weight AP[2]	weight EP[3]	calories	protein
	gm	gm	%	%
FRUITS				
Avocado, ½ pc., 7 x 13 cm	217	174	5.9	4.0
Apple, med., 7 cm dia.	150	132	3.1	0.6
Apricots, 3 pcs.	114	107	2.4	2.4
Atis, 1 pc., 7 cm dia.	143	74	3.0	2.2
Banana, latundan, 2.5 x 12 cm	71	47	1.9	1.3
Calamansi, 3 pcs. 2.5 cm dia.	42	15	*	0.1
Cashew (kasoy) fruit, 1 med., 2 x ½ x 1 cm	60	54	1.4	0.9
Grapes, 1 bunch, 7.5 x 9 cm	103	100	2.4	2.4
Guava, 1 pc., 4.5 cm dia.	41.5	41	2.2	0.9
Jackfruit (Langka) 1 cup		70	3.0	2.0
Mabolo, 1 pc. 7.5 cm dia.	200	120	4.1	1.6
Papaya, 1 slice		100	2.1	1.3
Pomelo (suba), ¼ pc 13 cm. dia.		83	2.1	0.9
Soursop (guayabano), 1 sl., 10 x 5 x 3 cm		106	2.9	2.7
Watermelon (Pakwan) 1 cup diced		155	1.9	0.4
VEGETABLES				
Beans, yardlong (sitaw) 19 pcs., ½ cup cooked	79	75	1.2	4.9
Bittermelon (ampalaya) leaves, ½ cup cooked	90	60	1.2	6.7
Carrots, ½ cup cooked	100	75	1.8	1.3
Eggplant, ½ cup cooked	92	85	0.8	1.9
Horseradish tree leaves (malunggay) ½ cup cooked	81	60	1.6	8.7

[1] Expressed in per cent of the recommended daily allowance a moderately active Filipino woman who weighs 45 kilos.

[2] As purchased

[3] Edible portion

* Negligible

calcium	iron	vit. A	thiamine	riboflavin	niacin	ascorbic acid
%	%	%	%	%	%	%
4.4	16.0	5.8	5.0	9.1	12.9	27.3
1.1	4.0	1.3	2.8	2.7	0.9	3.7
2.6	5.1	72.2	2.1	3.6	4.3	15.2
4.3	7.0	*	5.0	5.4	5.0	45.4
0.6	3.0	0.3	0.6	0.9	2.0	10.7
0.4	1.2	0	0.2	*	0.2	9.4
0.3	3.0	0.4	0.7	*	1.4	151.4
1.9	5.0	1.5	3.6	2.7	1.4	4.3
0.2	2.0	1.1	1.4	1.8	6.4	73.3
2.3	8.0	3.0	4.3	3.6	4.3	5.7
7.9	7.0	1.0	1.4	3.6	2.8	27.1
3.3	7.0	10.9	2.1	2.7	2.9	127.1
3.6	5.8	*	1.8	0.9	0.6	49.8
2.4	6.0	0	7.1	6.4	7.1	44.3
1.7	3.0	6.6	2.1	3.6	2.1	12.8
5.9	5.0	8.5	5.7	7.3	5.0	20.3
6.2	1.0	104.0	3.6	12.7	5.7	56.6
7.5	19.0	364.7	1.4	1.8	2.1	6.4
3.6	4.2	2.8	4.3	3.1	3.0	*
25.9	18.0	147.7	3.9	16.4	7.8	114.8

Table 3. (cont'd)

Food and description	weight AP[1/]	weight EP[1/]	calories	protein
	gm	gm	%	%
VEGETABLES				
Mung bean (munggo) green ½ cup cooked	75	75	0.9	5.3
Okra, ½ cup cooked	92	85	1.1	2.2
Squash fruit ½ cup cooked	109	85	1.3	3.1
Squash leaves 12 stalks 1 cup cooked	65	60	0.6	4.0
Sweet potato (camote) leaves 21 stalks ½ cup cooked	123	60	1.3	3.6
Swamp cabbage (kangkong) ½ cup cooked	73	60	0.8	4.4
FAT-RICH FOODS				
Butter, 1 tbsp.	15	15	4.7	0.2
Margarine, 1 tbsp.	15	15	5.3	0
PROTEIN-RICH FOODS				
Beef lean, broiled matchbox-size		30	2.5	25.8
Pork lean, cooked matchbox-size		30	3.2	11.0
Port liver, cooked matchbox-size		30	1.7	11.8
Dilis	40	30	1.7	13.3
Galonggong	78	30	1.2	12.4
Egg 1 medium	56	50	3.8	15.3
CARBOHYDRATE-RICH FOODS				
Rice, white, ½ cup raw 1 cup cooked	100	200	11.8	9.8
Rice, enriched, ½ cup raw 1 cup cooked	100	200	11.8	9.8
Sweet potato (camote) yellow, 1 pc. = 280 gm	88	85	4.7	1.9
Sweet potato, white 1 pc. = 280 gm	88	85	5.5	1.1
Panotsa, 1 tbsp.		10	1.7	*
Sugar, white, 1 tbsp.		12	2.0	0

calcium	iron	vit. A	thiamine	riboflavin	niacin	ascorbic acid
%	%	%	%	%	%	%
1.8	7.0	0.4	5.0	7.3	3.6	6.4
14.5	4.0	3.7	2.9	5.5	5.0	15.7
2.3	4.0	20.9	3.6	4.5	6.1	21.9
18.7	4.0	43.0	5.0	8.2	3.6	7.1
8.0	9.0	50.1	2.9	6.4	2.1	4.3
5.5	8.4	63.7	2.9	7.3	4.3	15.4
0.3	2.0	8.1	*	*	*	0
0.3	*	10.9	6.0	6.4	0	0
0.4	15.0	0.4	5.7	9.1	13.6	0
0.6	4.5	0	15.0	8.2	11.4	0
0.4	32.0	111.8	1.4	10.9	11.4	9.4
21.4	3.0	0	*	1.8	5.7	0
3.1	3.0	0.9	2.8	5.4	18.6	0
5.1	18.0	26.5	2.9	20.9	*	0
3.1	12.0	0	2.9	3.6	7.1	0
3.1	40.0	0	20.0	3.6	18.6	0
8.0	6.8	21.8	5.4	2.7	3.6	37.7
8.7	6.0	0.2	3.6	2.3	2.9	57.1
0.4	4.0	0	*	*	*	0
0	0	0	*	*	*	0

Table 4. Basic daily food guide for adults using crops from the home garden

Protective foods (for good eyes, teeth and shiny skin)

(a) One or more servings of green leafy and yellow vegetables daily:
one cup raw or half a cup cooked

(b) One or more servings of fruits rich in vitamin C:
one medium fruit or one slice of a big fruit (papaya)

Energy foods

Three or more servings daily:
one cup mashed or one medium-sized root crop

Protein foods (to give strength and protect against disease)

Three or more servings daily:

1. eggs six times per week
2. legumes, half a cup cooked, or
3. nuts, quarter of a cup roasted

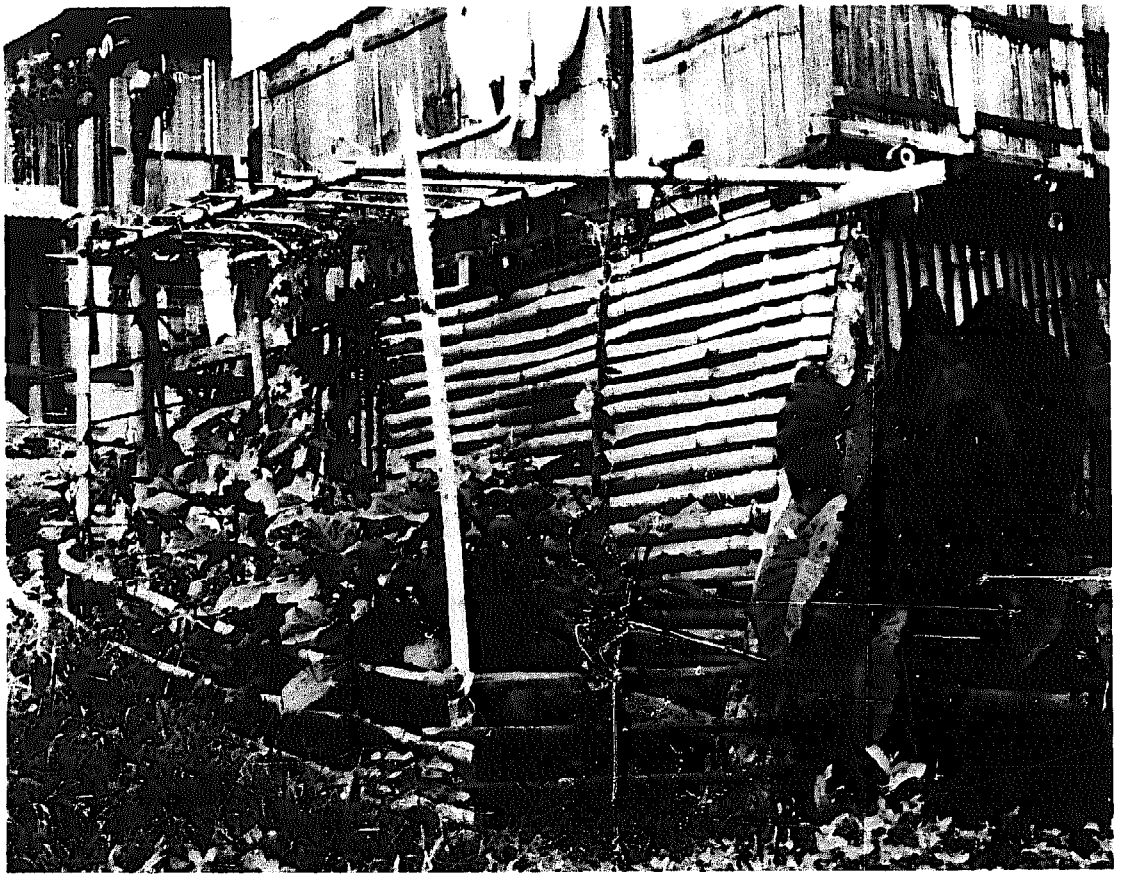


Table 5. Approximate number of plants to raise, amount consumed in kg, and square metres needed per adult per year

Crop	*planting season	kg/ person	no. of plants	sq. m/ person
Fruit vegetables				
Ampalaya	A	1	1	1
Squash	A	3.5	1	1
Okra	A	2	6	3
Tomato	D	10	15	7.5
Eggplant	A	6	6	3.5
Patola	A	5	1	1
Upo	D	5	1	1
Sweet pepper	D	5	5	2.5
Cucumber	A	2.5	5	
Muskmelon	D	7	1	2
Corn	A	15	75	35
Roots and tubers				
Sweet potato	A	50	85	2.5
Cassava	W	25	25	5.5
Taro	W	25	20	6
Yam	W	25	25	7.5
Tugue	W	25	25	7.5
Legumes				
Wingbean	W	8	8	4
Patani	W	8	8	4
Batao	W	8	8	4
Kadios	W	8	8	4
Sitao	A	8	8	4
Tapilan	A	8	8	4
Sincamas	D	8	8	4
Leafy vegetables				
Sweet potato leaves	A	5	15	3
Swamp cabbage	W	5	15	3
Alugbati	W	5	5	1
Hot chili pepper leaves	A	1	2	1
Malunggay	W	2	2	2
Chinese cabbage	A	3	15	3
Lettuce	A	3	15	5
Amaranth	W	5	3	1.5
Mustard	A	3	15	5
Spinach	A	3	15	5

160 sq. m/adult/year (approximate)

*Planting season = A = Any time D = Beginning of the dry season
W = Beginning of the wet season

Table 6.
Crop locations in the home garden

Plants for wet area (near water pump)
Taro
Swamp cabbage
Sugarcane
Banana

Plants for trellis

(a) climbing legumes
- String beans
- Lima bean
- Yardlong beans
- Wing Bean
- Sincamas (Yam beans)

(b) climbing fruit vegetables
- Squash
- Gourd
- Cucumber
- Condol
- Ampalaya

Plants for under the trellis
Taro
Alugbati
Kangkong
Sweet potato
Amaranth
Mustard

Plants for dry areas

Legumes	Jackfruit
Cassava	Grapes
Pineapple	Cashew
Tamarind	Guava
Mango	Soursop
Sugar apple	

Plants that make good live fences
Giant Ipil-ipil
Madre de cacao
Drumstick plant
Casarina
Bamboo
Hibiscus
Pineapple
Cassava
Cactus

Plants that suppress weed growth
Sweet potato
Swamp cabbage
Alugbati
Squash
Yam
Ampalaya

Table 7.
Making liquid fertilizer from animal manure

Materials:
one empty rice or sugar sack (50 kg)
any type of animal manure
a watertight pit or drum barrel
a few rocks or bricks
water

Procedure:

Place the manure inside the bag and tie it. Then place the bag in a watertight pit or drum barrel and fill the container until the water is just covering the top of the bag. Place a weight over the top of the bag. Cover the container. In three weeks remove the bag. The liquid is then ready to be applied around mature fruit trees and well established vegetable plants.

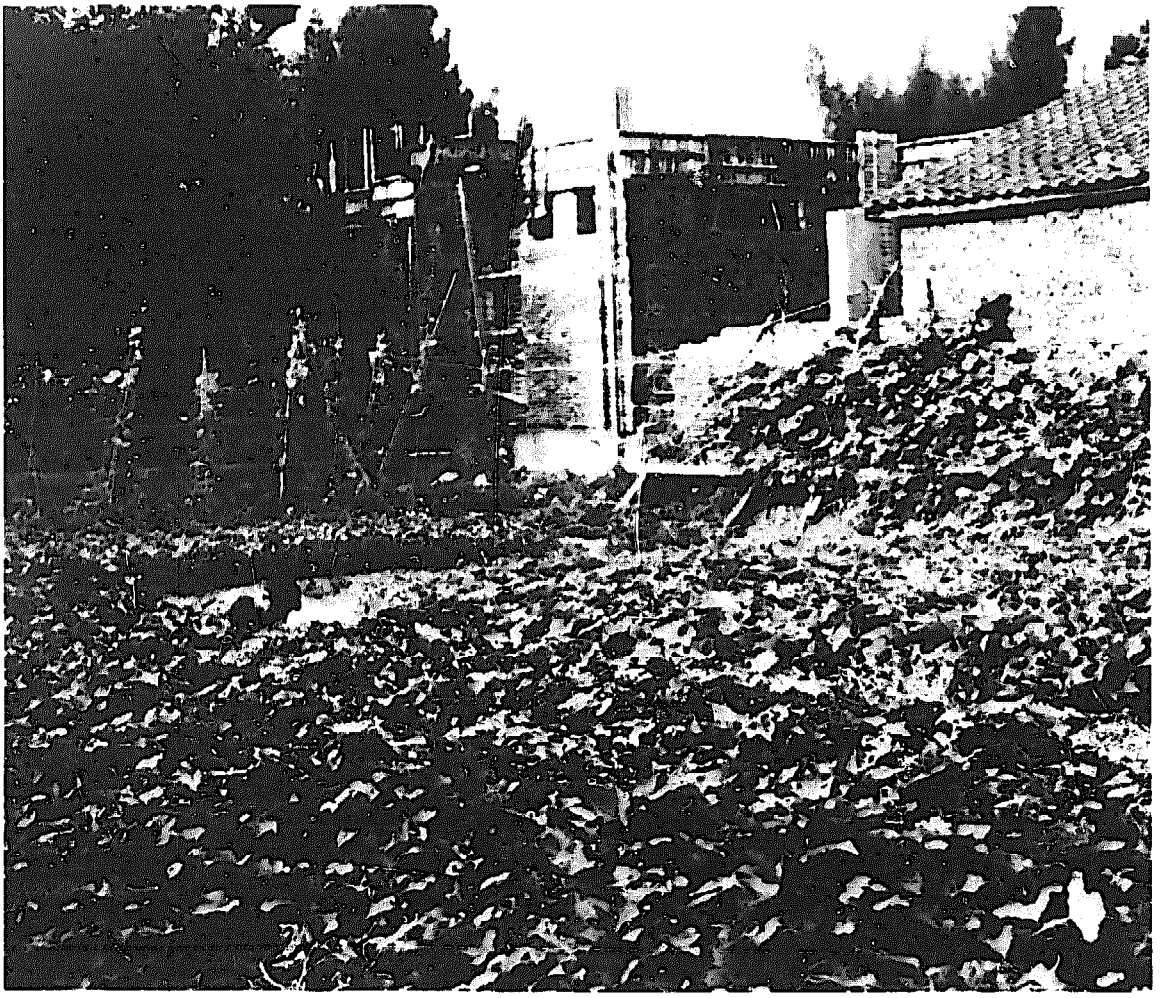


Table 8.
Agronomic characteristics of tropical fruit trees

Crop	plant height (metre)	space between plants (metre)	climate require-ment[1]	altitude (metre)	maturity (years)	intercrop[2]	seed storage	kg/ tree
Atis	5	5	D/W	1000	3	1,2,10	dry	10
Avocado	8	10	W	2500	5	3,4,9,10	moist	40
Balimbing	6	7	W	1000	3	1,5,10	dry	10
Breadfruit	15	12	D/W	1500	5	3,4,6,7,9	moist	20
Caimito	20	10	D/W	1500	5	3,4,6,7,9	dry	32
Chico	8	10	D/W	1500	5	2,6,10	dry	25
Calamansi	5	5	D/W	1500	4	1,10	moist	30
Duhat	20	15	D/W	300	7	3,4,7,9	moist	30
Durian	30	15	W	2500	5	4,7,9	moist	30
Guava	10	6	D	1500	3	1,4,9,10	dry	20
Guyabano	7	6	D	300	3	1,4,9,10	dry	15
Jackfruit	10	8	W/D	1500	4	1,2,4,9,10	moist	65
Lanzones	15	8	W	200	10	1,2,4,9,10	moist	30
Mabolo	20	12	W/D	600	12		dry	30
Mango	30	15	D	500	6		moist	100
Orange	5	8	W/D	5000	5	1,10	moist	30
Papaya	4	2	W	900		1,10	dry	18
Pili	20	14	W	1500	14	1,3,7	dry	25
Pumelo	5	8	W/D	1500	5	1,10	moist	55
Rambutan	13	10	W	1000	10	1,10	moist	50
Santol	15	12	W/D	1500	12		moist	35
Tamarind	25	16	D	500	16		dry	15
Tiesa	10	6	W/D	1000	4	1,2,3,4,7,9	moist	20
Pineapple	1.5	1	W	1000	1.5	3,4,5,9,10	dry	1.5
Banana	4	3	W	1000	4	4,8,10	moist	30
Cashew	3	8	D	1000	3	2,3,4,9,10	dry	10

[1] D = dry, W = wet

[2] Intercrops: (1) Pineapple (2) Calamansi (3) Banana (4) Coffee (5) Ipil-ipil
(6) Annona Specie (7) Lanzones (8) Avocado (9) Cacao (10) Coconut

Table 9.
Companion plant combinations

Camote	Corn, Pigeon pea, Cassava
Sweet Potato	Okra, Eggplant, Tomato, Chili, Pole yardlong bean, Wingbean, Lima Bean, Rice Bean, Jute, Amaranth
Cassava	Camote, Kangkong, Pechay, Nightshade, Lettuce, Garlic, Vine squash, Peanut
Taro	Camote, Kangkong, and underneath any crop grown on a trellis
Tomato) Eggplant) Okra)	Camote, Kangkong, Vine squash, Pechay, Radish
Corn	Okra, Tomato, Camote, Bush beans, Pole beans, Cabbage, Peanut, Vine squash
Vine squash) Bottle gourd) Sponge gourd)	on trellis: Bottle gourd, Sponge gourd, Cucumber, Bittermelon
Ampalaya	on trellis: Legumes, Lima bean, Yardlong bean, Hyacinth bean, Wing bean
Kangkong	Taro, Camote, Cassava, Tomatoes, Okra, Corn, Eggplant, any crop on trellis, Amaranth
Vine/Legumes	on trellis: Ampalaya on corn stalk, on banana stalk
Yam	on fruit trees or trellis
Cucumber	Corn, Pole beans, Radishes, Okra, Eggplant
Tomatoes	Camote, Radishes, Lettuce
Malunggay (Drumstick tree)	Camote, Kangkong, Pechay, Nightshade, Jute, Lettuce, Bush squash, Yam, Amaranth

Table 10.
Directions for preparation of seed storage containers

Bamboo

Materials: One bolo knife or saw and paraffin wax.

Procedure: Cut two nodes from a mature bamboo shoot, then saw six inches off one end of the bamboo piece; shave a good portion of the bamboo wood off the short piece and from inside the container; the short piece should then fit over the long piece, forming a container with a lid. Place ash or charcoal in the bottom of the container; then place the dried seed inside. Put on the bamboo lid and seal with hot wax.

Coconut

Materials: One dried coconut cut in half and paraffin wax. Place ash in the bottom of one of the coconut halves. Place the seed inside. Join the halves by sealing with hot paraffin wax.

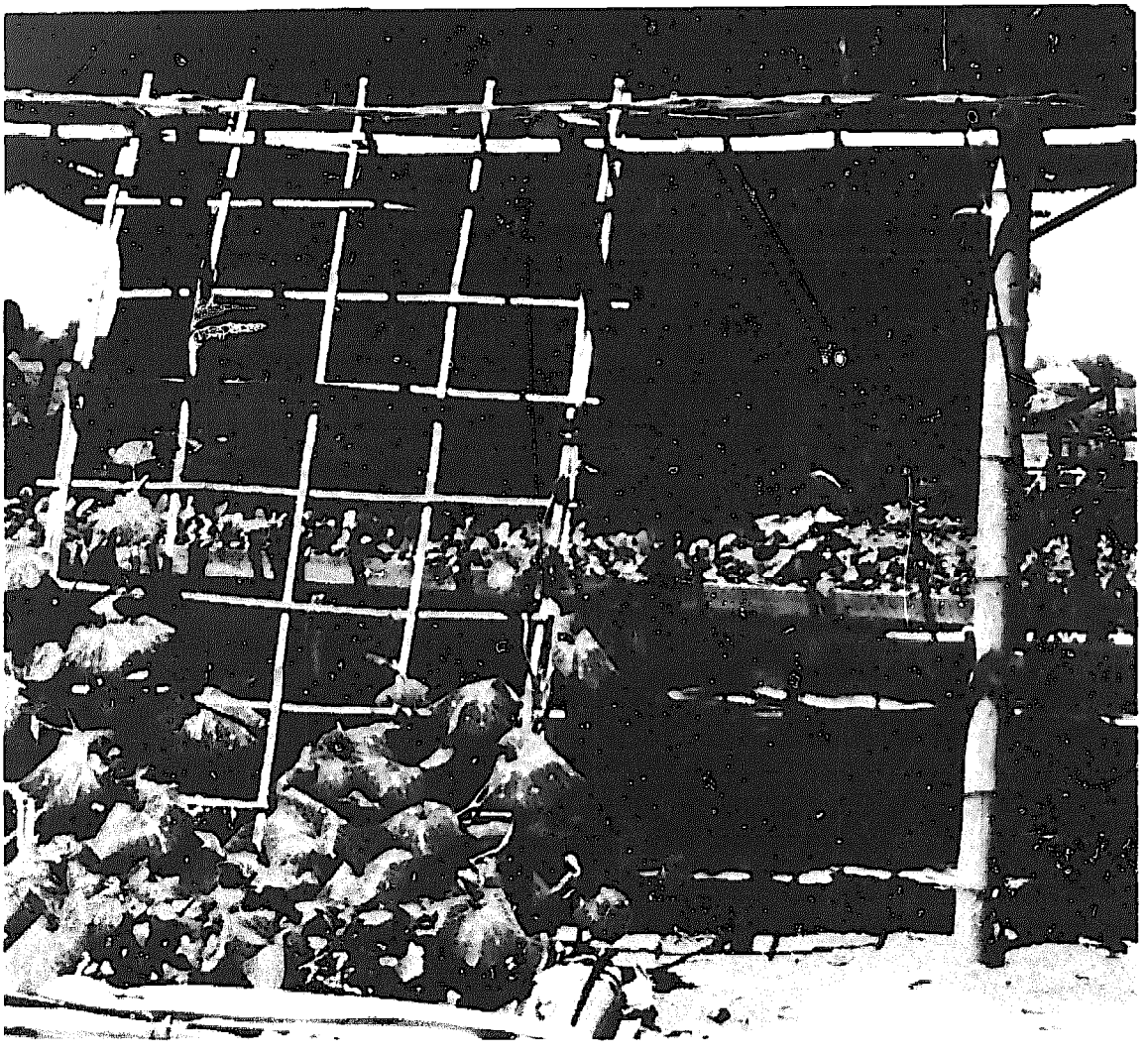


Table 11.
Sources of nutrition from the home garden

Vitamin A

Taro leaves
Drumstick leaves
Ampalaya fruits and leaves
Sweet potato leaves
Cassava leaves
Squash leaves
Hot chili pepper leaves
Swamp cabbage
Chinese cabbage
Spinach
Amaranth leaves
Alugbati
Carrot
Parsley
Mango (ripe)
Banana (tundok)
Papaya (ripe)
Tiesa

Vitamin C

Papaya (uncooked)
Muskmelon
Citrus
Sugar apple
Soursop
Pineapple
Guava
Anc .a
Mango
Tiesa
Tomato
Strawberry
Cashew (fruit)
Sweet pepper

Protein

Peanut
Peas
Cowpea
Mung bean
Pigeon pea
Soybean
Lima bean
Yardlong bean
Wing bean
Sincamas (Yam bean)
Cacao bean
Chick pea
Watermelon seed
Banana tuber
Cashew nut
Pili nut
Tapilan

Energy

Rice
Corn
Sweet potato
Taro
Yam
Potato
Tugui
Cassava
Avocado
Coconut (mature)
Banana
Jackfruit
Breadfruit
Sugarcane

Fats and Oils

Avocado
Coconut milk
Pili nut
Peanut
Cacao bean
Cashew nut
Soybean
Rice bran

Iron

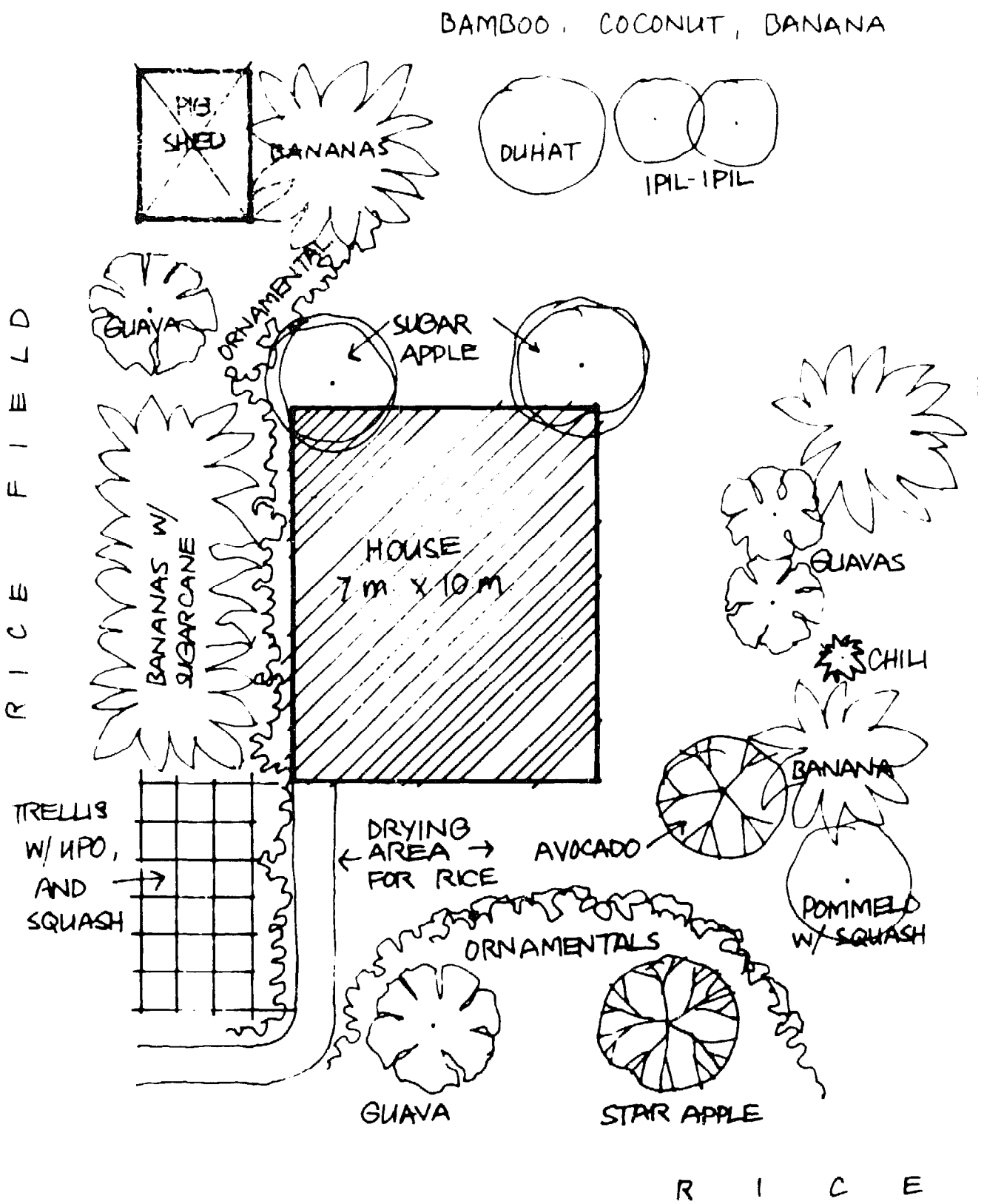
Mustard
Amaranth
Green onion
Pechay
Spinach
Banana heart
Tapilan
Drumstick leaves
Cassava leaves
Sweet potato leaves
Swamp cabbage
Dried fruits
Dried beans

Remember that:

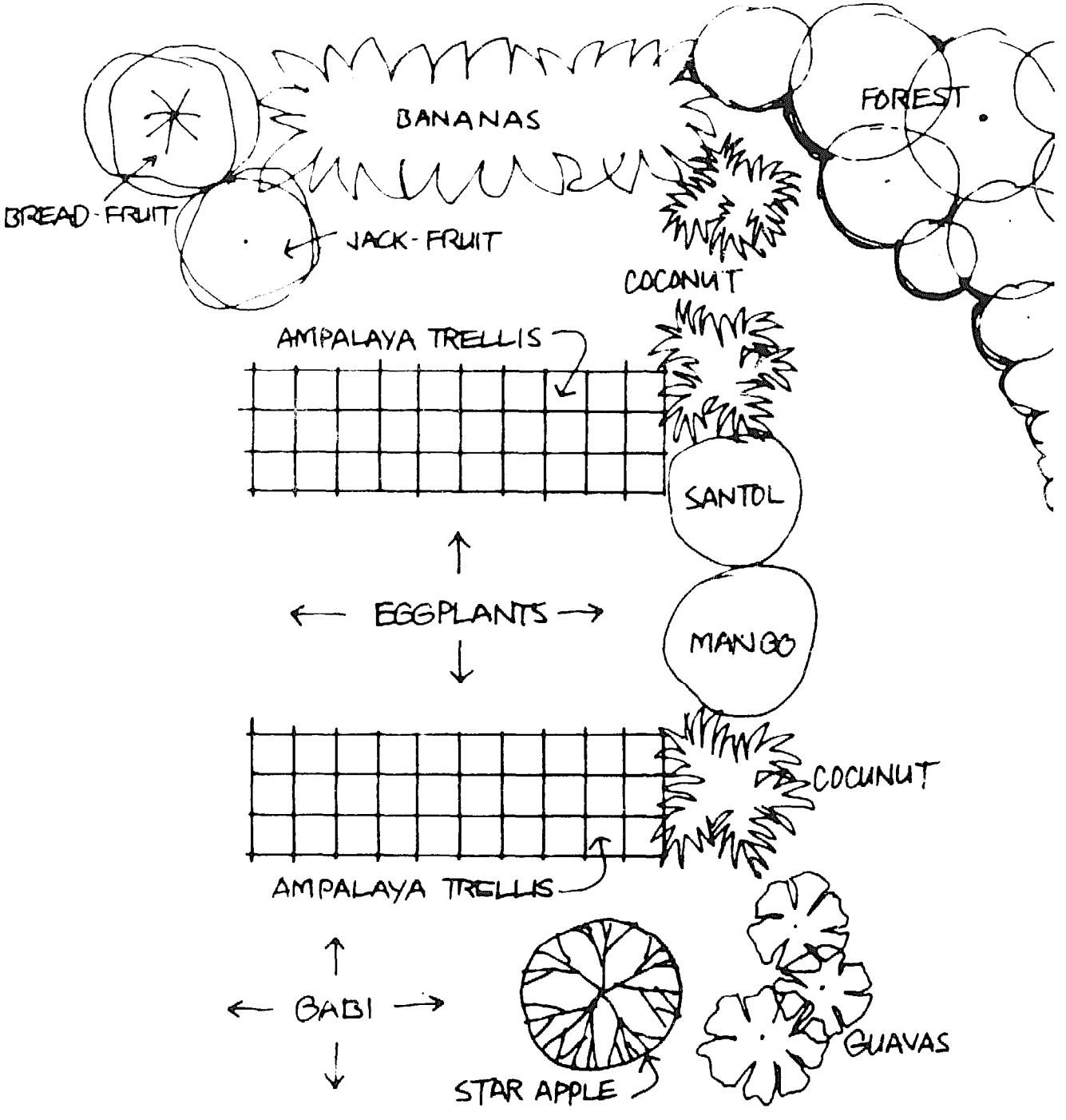
Fat-soluble plant vitamins (A) found in green leafy vegetables are lost during frying.

Water-soluble vitamins (B complex and C) found in green leafy vegetables are reduced during prolonged water soaking, boiling, and oxidation, early preparation and long periods before cooking or serving.

Vegetables should be cooked for just a few minutes and served with the cooking water to retain nutrients.


BAMBOO, COCONUT, BANANA
PIG SHED
BANANAS
DUHAT
IPIL-IPIL
ORNAMENTAL
GUAVA
SUGAR APPLE
RICE FIELD
BANANAS W/ SUGARCANE
HOUSE 7m x 10m
GUAVAS
CHILI
BANANA
AVOCADO
POMMELO W/ SQUASH
TRELLIS W/ UPO, AND SQUASH
DRYING AREA → FOR RICE
ORNAMENTALS
GUAVA
STAR APPLE
RICE

F O R E S T



MANDIOMA FARM

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F I E L D