Evaluating
Home Garden Projects

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EVALUATING HOME GARDEN PROJECTS

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Summary

Objective

The main objective of this paper is to describe a method of determining the cost effectiveness of home garden projects. For comparative analyses, evaluations must use consistent indicators. Donors need "proof" that home gardening projects are cost-effective interventions. Implementors need better information on what works and what doesn't. By outlining the steps in evaluation and identifying specific quantifiable indicators, this paper provides an evaluation protocol that can be tested, assessed and revised over time.

Approach

In the past, home garden evaluations were often based on unstructured and anecdotal information Although unstructured evaluations are often insightful, they rarely provide systematic data for comparison or application to other locations. The methods described in this paper include quantitative indicators that permit comparative analyses of the benefits and costs of home garden projects.

To prepare this paper, the author reviewed relevant literature from around the world, met with home garden practitioners from international organizations and observed home garden research and evaluation efforts. The following steps in evaluation and the suggested indicators of cost effectiveness synthesize this experience.

Steps in Evaluating Home Garden Projects

The first step in any project evaluation is to **define the project and the criteria for evaluation.** Specific criteria selected will depend on the goals of the project, but for home garden projects will generally include the following:

- Economic criteria;
- Nutritional criteria;
- Project operations criteria.

A second step is to **choose indicators that reflect project status on these criteria.** For example, an indicator of economic benefits is the market value of food produced; an indicator of nutritional benefits is the nutritional content of food produced; an indicator of program operations is the availability of inputs or extension services. To assess this information, data on socioeconomic characteristics, food habits and preferences of household members are helpful.

Third, **develop a plan for evaluation.** Ideally, the plan will include data collection both before project interventions begin and during implementation so that "before" and "after" comparisons can be made. Methods of data collection chosen will depend on the time available for data collection, the level of literacy (record keeping ability) of participants, and the funds available for evaluation.

Baseline data needs include information on:

- Project participants—socioeconomic status, food habits and preferences, purpose of gardening;
- Project plans and costs;
- Macroenvironment—physical and climatic environment, agricultural policies, transportation, storage facilities.

Data to be collected during implementation include measures of:

- output (production);
- input (costs);
- local market prices and transport cost;
- project operations.

For data on output, garden production must be either weighed or estimated. Options include: 1) collecting detailed production data on a few gardens and extrapolating to the rest; 2) visiting several farms in turn once a week and multiplying the result by seven; 3) estimating typical yields by crop from a small sample of plots and gathering information on area devoted to selected crops in other participating gardens so that total yield can be estimated.

Inputs include both time (labor) and physical inputs, such as seeds, fertilizer and water. The value of time spent in the garden or fetching water for the garden can be calculated using a relevant wage rate per hour. The quantity and price of other inputs can be recorded to provide cost information for the garden.

To attach value to the home production, local market prices and any transport costs can be gathered a few times during the growing season, either directly in the market, or indirectly from household recall.

To assess project implementation, data can be collected on: 1) the delivery and availability of inputs provided under the project; 2) the availability and timeliness of technical assistance on garden methods; 3) the timeliness of demonstration garden plots, and other indicators of project operations.

Indicators that Evaluate Home Garden Projects

Economic Indicators

Two economic indicators can be calculated: benefit-cost ratios and cost effectiveness ratios. The **benefit-cost ratio** of a home garden project is the value of food output per dollar spent on the project. Benefits are the produce of the garden valued at local market prices. Costs include operational expenditures such as salaries and rent, variable costs such as fuel and inputs provided by the project, and household costs such as labor or inputs provided by households. A benefit-cost ratio that is greater than one is excellent. Projects with ratios between .3 and .9 are probably cost effective in the long run. Projects with lower ratios are probably not cost effective.

Cost effectiveness ratios also require data on costs, but use a quantifiable nonmonetary indicator of benefits. Possible benefit indicators include: 1) the number of participants; 2) kilograms of food produced; 3) nutrients produced: 4) reduction in the numbers of malnourished children (as defined by a chosen standard). Cost effectiveness ratios only have meaning if they are compared over time within a given project or compared with other known factors or alternative approaches. For example, the cost effectiveness of providing a particular nutrient through home gardens can be compared with the cost of providing the nutrient through fortification of food products or distribution through health services.

Nutritional Indicators

A direct method of calculating the nutritional impact of a home garden project is to gather **anthropometric data** (heights, weights, ages) on participants before and after the intervention. Since nutritional status is affected by many factors, only one of which is diet, this method has obvious shortcomings.

Nutritional indicators can also be derived indirectly, for example, in a **cost effectiveness ratio** using nutrients produced as a measure of benefits. Over time, the increase in nutrients produced and consumed by households can be calculated.

Other indicators combine nutrition and economics, these include: 1) **relative nutrient cost,** calculated by dividing present food expenditure by the quantity of a particular nutrient consumed; 2) **nutrient production cost,** calculated by dividing total production cost by the amount of a particular nutrient produced; 3) **nutritional value for a commodity,** calculated by multiplying relative nutrient cost by the units of nutrient per kilogram of food; 4) **nutritional yield,** calculated by multiplying nutritional value for a commodity by average yield per square meter. The latter two indicators can be used to derive the **total nutritional value** or **yield** of a garden; which can in turn be used to approximate "benefits" for benefit-cost ratios.

Indicators of Project Operations

One measure of the cost effectiveness of project operations is to calculate the cost per participant in proportion to local resources and incomes. If the annual costs of the project (less start-up and expatriate costs) are proportionately lower than in-country expenditures, the project is likely to continue after donors depart.

Other less structured indicators can also indicate project "success," for example, gardens that are initiated without project support, or the replacement of project inputs with locally available inputs.

Conclusions

Evaluation is a necessary adjunct to good project work, enabling both donors and implementors to learn from project mistakes and successes. By outlining the steps in evaluating home garden projects and describing several indicators of cost effectiveness, this paper shows how home garden projects can be evaluated quantitatively. Although other issues exist, this summary provides a starting point for an evaluation protocol that can be tested by private voluntary organizations and revised, as necessary, to improve the techniques for evaluating home garden projects.

Foreword

In a September 1984 meeting, a number of donors assessed their investments in home garden projects and expressed concern with the inadequacy of evaluations. They simply didn't know whether their investments paid off. Given the Agency for International Development's (AID) interest in garden projects, the Office of Nutrition in AID decided to take the lead in improving evaluations of garden projects. This paper is the result of the initial efforts to increase economic evaluation and comparability of evaluation data across home garden projects (and components) as sponsored by AID and Private Voluntary Organizations (PVOs). This paper is seen as a first step in developing an evaluation protocol which could be tested by the PVOs, revised as necessary, and eventually applied to all home garden projects.

The Nutrition Economics Group (NEG) was created in 1977 with funding from AID's Office of Nutrition. The NEG staff of economists help AID implement a program of applied research and technical assistance designed to assist developing countries integrate food consumption and nutrition concerns into their agricultural planning, programming and policy making processes. Located within the Technical Assistance Division of the Office of International Cooperation and Devlopment (OICD) within the Department of Agriculture, the Group can draw on a wide variety of other specialists from within the Department as well as the U.S. land grant university system to complement its work. The Group has been concerned with improving the cost effectiveness of nutrition interventions as well as the consumption effects of agricultural policies, programs and projects.

Dr. Patricia M. O'Brien-Place, the author, is an agricultural economist on the NEG staff. She has previous experience with the evaluation of nutrition interventions for the World Bank and interest in farming systems work including gardens. To assist in the preparation of this report, O'Brien-Place: (1) discussed the reasons for improved evaluations with AID personnel and others in Washington, D.C.; (2) attended the XIII International Nutrition Congress in Brighton, England, August 1985, in order to participate in the session on home gardens and to meet with home garden practitioners from the international organizations; (3) visited the Asian Vegetable Research and Development Center (AVRDC) in Taiwan to observe their home garden research program, their outreach efforts in Thailand, and their evaluation efforts for both.

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List of Abbreviations

AID	United States Agency for International Development
AVRDC	Asian Vegetable Research and Development Center, Taiwan
kg	kilogram
LIFE	League for International Food Education, Washington, D.C. (partially supported by AID)
m^2	square meters
N	total of a nutrient from a garden
NEG	Nutrition Economics Group, OICD/USDA
NPC	Nutrient production cost
NV	Nutritional value
NY	Nutritional yield
OICD	Organization for International Cooperation and Development
PVO	Private voluntary organization
RDA	Recommended Dietary Allowance
RNC	Relative nutrient cost
TNV	Total nutritional value
TNY	Total nutritional yield
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USDA	United States Department of Agriculture

I. BACKGROUND AND OBJECTIVES

Recent reviews of the home garden project literature indicate the need for a consistent method for evaluating the benefits and costs of home garden projects [5, 21]. Most evaluations have occurred **ex post facto** and have varied from highly technical and thorough reviews [16, 39] to descriptive accounts [44, 47]. Although the evaluations provide a wealth of information, inconsistencies between them make comparative analysis difficult or impossible. Thus, no clear assessment of the benefits and costs of home garden projects can be drawn.

Donors need a clear accounting of the benefits and costs of home garden projects. As Brownrigg notes:

> *. . . as long as potential donors cannot clearly see what benefits they are 'buying' if they support home gardening projects, and thus whether they are cost-effective compared to other interventions, they are likely to remain unwilling to invest heavily in them." [5, p. IX].*

Implementors of projects need evaluations also for better information on what successes and problems are occurring. This information can be used to replicate successes intentionally.

The main objective of this paper is to provide a method for documenting the benefits and cost efficiency of home garden projects. The steps in developing this method will be to:

- Define a framework for evaluating home garden projects;
- Describe the data needed for evaluation;
- Provide alternative methods of analyzing the data including suggesting a limited number of indicators which should be derived for all home garden projects to provide cross-project comparisons;
- Discuss the limitations inherent in the evaluation methods suggested by this paper.

II. DEFINING A FRAMEWORK FOR EVALUATION

Evaluation has different definitions depending on the type of project being evaluated, the stage of the project, and the professional background of the evaluator. This section will discuss evaluation theoretically from the perspective of nutrition evaluation specialists and define the term evaluation as it will be used in this paper.

A. Evaluation in Theory

In any evaluation the first two steps are to define the project and decide on the criteria against which the project is to be evaluated. Defining a project consists of expressing the plan for the project. The major objectives of the project (explicit and implicit) provide the criteria for evaluation.

After these preliminary tasks are accomplished, several additional stages of evaluation need to be addressed before the net outcome of the project can be determined [19, p.26]. These stages are:

- Evaluating the plan for the project, for example, are the objectives fully and clearly specified and are inputs compatible with objectives?
- Evaluating the implementation of the project, for example, is the intended target group being reached and are objectives being met?
- Evaluating gross outcome of the project, from measurements based on available data;
- Evaluating net outcome of the project, by comparing gross outcome with costs [19, pp. 29-41].

The above stages should be performed in the order indicated, either in full or in part, before an evaluator moves to evaluating the net outcomes of the project. If a project fails at any stage, then one should not attempt the next stage for the results will be necessarily based on insufficient or contradictory data. For instance, trying to evaluate the implementation of a project when there were no clear objectives in the plan of the project will necessitate guessing the original objectives or providing objectives after the fact.

B. Evaluation for Home Garden Projects

Home garden project evaluation can determine the effectiveness of a home garden project in improving the diet and/or the income of households, while keeping the costs of the project within limits. Costs should be consistent with the project area's income level. The first steps in evaluation are to define the "project" and to decide on the criteria it will be evaluated against. The next two subsections deal with these issues.

1. Defining Home Garden Projects

Simply put, gardening is a very intensive form of agriculture [2, 5, 21]. It usually involves the use of high levels of inputs per unit of land area as compared to inputs used for field crops. The resulting garden output per unit area is "high". Gardens are generally located near the household to ease transport of inputs and outputs, and to ensure the produce is not stolen or injured by animals. To provide further security for the produce, gardens are often inside the homestead (for example, African compound farms) or fences. Home gardens are usually multifunctional (producing items for food, utensils, and fuel) and multistoried (including tree crops as well as ground crops). Home Gardens usually use mixed cropping systems which have varying levels of adaptation to the ecological environment. In addition, gardens can range from the Western version with its rows of vegetables and high use of purchased inputs, to the Asian version which looks like a slightly tamed jungle and utilizes few purchased inputs.

Therefore, "gardening" as the term is used in this paper, can include vegetables, perennial food crops (e.g. taro), fruit bushes and trees, fish ponds, and small livestock, when these are used together in a systematic way to ensure home food supplies. For the purposes of this paper home (or school or community) gardens will be defined as **the intensive use of land and other resources** (household wastes, fertilizer, seed, livestock, etc.) **near the household** (or school or community) **for the production of food, largely intended for use by the household** (or school or community) **members.**

In order to define home garden projects, one must first clarify the difference between projects and programs. A "program" is a well-defined set of activities designed collectively to accomplish certain broadly stated goals and objectives. A program may be composed of several sub-programs or "projects" . For example, a country may have an extension program designed to encourage the adoption of more productive technology and methods by farmers with the objective of increasing the agricultural output for the country. A home garden project could be a part of this program with the objective of increasing the productivity of home gardens in order to improve rural food consumption through training of rural people. Such a project could be financed by a private voluntary organization (PVO) or an expatriate development agency (e.g. AID). The distinction between "program" and "project" needs to be made, so that the objectives of the program do not become confused with those of the project.

2. Criteria for Evaluating Home Garden Projects

The wide variation in home garden projects and in their intended objectives, along with the large number of organizations performing them, results in different goals and objectives for home garden projects. These goals and objectives in turn result in different criteria for evaluating the projects.

From a review of the home garden literature and from interviews with people working with or interested in home gardens (see Appendix A) two major approaches to evaluation are drawn: 1) the general, unstructured gathering of data; and 2) a detailed economic evaluation. Most evaluations are unstructured; economic evaluations have been most fully developed and practiced by the Asian Vegetable Research and Development Center (AVRDC) in Taiwan and Thailand [9, 11, 16]. Appendix A presents a theoretical amalgam of these approaches illustrating the different sets of criteria inherent in the two approaches.

Criteria in any actual case necessarily follow from answering the questions: Who is doing the evaluation? For whom? For what purpose? [19, p. 27]. On most garden projects the evaluators are likely to be project staff who are not professionally trained in evaluation with the evaluation report being used by both the implementing agency and the donor (or funding agency). The purpose of the evaluation, from the perspective of the implementing agency, is to ensure the successful operation of the project. From a more general perspective (e.g. a donor agency), the purpose of the evaluation is to determine whether home gardens are a cost effective mechanism of increasing incomes, increasing food consumption, or improving nutrition. Information derived during the evaluation can be used for both purposes. The difference is more in the timing of evaluation reports and the type of detail necessary on any question. For example, program personnel probably prefer information more frequently such as detail on questions of input availability (why or why not, what are the bottlenecks, etc.), whereas the donor agency would prefer less frequent reports with information on costs and amounts of inputs used.

Although both donors and implementing agencies can use data collected for evaluation, this paper focuses on criteria of interest to donors and provides a method for determining the cost effectiveness of home garden projects. Questions related to improving project operations are addressed as they fit within the context of questions asked by donor agencies, e.g. which programs are the most successful and where?

The criteria to be emphasized in this paper are:

- Economic—to provide evidence of the cost effectiveness of home garden projects given the implicit objective in any project of utilizing resources efficiently;
- Nutritional—to provide evidence of nutritional (nonmonetary) benefits from a project;
- Project operations—to provide evidence of cost effectiveness and sustainability.

The rest of this paper will describe data needed to obtain gross outcomes and indicators that can be used to determine net outcomes of home garden projects.

III. DATA NEEDS

This section describes the data necessary to evaluate home garden projects. Data are often collected without having a plan to utilize the information effectively. To avoid this, the data discussed here are directly related to the outcome indicators derived in section IV. Not all of these data are necessary in every evaluation. The choices are dependent on the evaluation criteria and data collection and analysis capabilities of the evaluators.

A. Baseline Data

Baseline data are descriptive of conditions at the start of a project. Baseline data are also useful in planning project interventions because they provide implementors with information on the participants' gardening (or small livestock) activities prior to the inception of the project.

The baseline data should include three major categories of information—information on participants' households, on project plans and costs, and on the larger environment of the project area.

The household information should include:

- Socioeconomic factors, for example background information such as number of household members, education levels, age-sex distribution, size of land holdings;
- Food habits and preferences, for example vegetables, fruits, and other possible garden produce eaten, food preferences, food purchased;
- Gardening, for example descriptions of present gardens or small livestock and purposes of gardening.

These data are listed in more detail in Table I along with justifications for their use.

The project information should include;

- Objectives of the project, implicit and explicit
- Project implementation plans
- Expected costs of the project to the implementing agency, to the host government, and to the participating households.

The larger environment of the project, or macro-environment, can have a very significant effect on whether the project succeeds or not. The factors which should be accounted for at the outset of the project and updated when evaluations are made include:

- Availability of water, fertilizer and other inputs;
- Significant variations in weather patterns, for example a drought;
- Agricultural policy changes affecting the project area;
- Major political disruptions;
- The project area's transportation, credit resources, storage facilities, marketing system, and extension services [14, p. 9];
- The project area's public health, education and food aid systems;
- Existence of monetary or technical assistance form the world donor community in addition to the particular garden project.

B. Background Data Collection During Implementation

Once the baseline data are collected and analyzed, a subset of the baseline data questions should be chosen to provide continuing background information which would be gathered throughout the project cycle. These would include:

TABLE I: Household Background Data for Baseline

DATA	USE
1. Soci. economic factors	Provide a general description of the household for classification
- size of household	- used to index other data
- age and sex of each member	- necessary for deriving consumption needs of the household
- education level of the head of household and oldest child	- indicator of knowledge level and abilities to self-collect evaluation data
- size of farm	- economic base of household
- availability of water for drinking and other uses	- economic and health indicator
2. Food habits and preferences	Indicator of possible crops to suggest or avoid
- present consumption of typical garden produce (e.g. vegetables and fruits) type and amount	- indicates present preferences
- where produce obtained and at what cost?	- indicates dependence (or lack of) on markets
- what would they like more of? less of?	- provides information for crops to suggest for the garden
- is there any garden produce which is taboo? or only given to certain types of people?	- suggests food to avoid trying to introduce (or emphasize if they go primarily to a nutritionally vulnerable group)
- what small livestock do they consume? where is it obtained?	- indicates possibility for encouraging small livestock production
3. Gardening (before project)	Basis from which to design new or improved gardens
- why do they (do they not) garden?	- knowledge of incentives (or constraints) to gardening
- what is being produced now?	- provides indicator of present garden knowledge
- do they raise small livestock?	- indicates present level of knowledge of livestock practices
- how much land do they (or could they) have available to garden?	- use to plan possible cropping patterns
- where is the land located?	- indicates time costs to household in getting to and from garden
- what type and where is water source?	- time costs in watering
- what is done with what is grown now?	- indicates present selling or home consumption habits

- Socioeconomic information, for example number and type of households participating and age-sex distribution of household members;
- Food habits, for example any significant changes in food preferences, such as, acceptance of a "new" vegetable, fruit, or other garden produce;
- Project costs;
- Environment, for example the occurrence (time and event) of any major changes in the project environment.

C. Garden Output and Input Data

The most basic information to be collected throughout the project cycle will be on the output (production) and inputs (costs) of the garden activity. Although it is difficult to obtain valid data on these factors, it is necessary to make the attempt, to be able to say even with reservation, what is the likely relation between your project efforts and any observable outcome. In the following discussion, two levels of costs and benefits are being discussed: the household level and the project level.

Basic to any economic or nutritional measure of outcome is the data on total garden production (note that in the case of a garden project in an area where gardens already existed, the relevant production for evaluation purposes will be the **increase** in production from the baseline period **not** the total production). A method for either weighing or estimating the garden produce will have to be instituted to provide this data. Since a garden produces continuously over a long period of time, output is not as easily estimated as for field crops which are usually harvested all at one time. The choice of method for gathering output data depends on three constraints:

- Time available for the data collection
- Level of literacy of the project participants
- Funds available.

The options include: 1) collecting detailed production data on a few gardens and extrapolating to the rest (least time consuming); 2) visiting several farms in turn once a week and multiplying the result by seven. If a member of the household is literate and able to weigh the produce daily, all the data collector needs to do is give an initial lesson in weighing and recording, then monitor the situation. This latter method is used quite successfully by the AVRDC Outreach Program in Thailand. [Personal observation, 9/85]. A third method is to estimate typical yields by crop from a small sample of plots and only gather area information on the rest of the participating gardens by crop. Estimated total yields for the gardens can then be calculated by multiplying yield per crop by area of crop, then summing these products for all crops to get total yield.

Costs to the household of the garden project fall in two categories: time (labor) and physical inputs (e.g. seeds, fertilizer, water). The cost of time in a rigorous cost-benefit analysis would generally be set at the relevant wage rate per hour. In the case of home gardens, the labor utilized (other than start-up labor) is often children, who would not otherwise be employed, or spare moments by the adults, which would not necessarily be productively employed elsewhere. In these cases, the "relevant" wage rate for alternative uses of that labor is zero, and thus need not be considered. In a case where there are alternative uses for the labor, the wage in the alternative employment should be used. In either case, the time spent on the garden, preferably by whom, should be collected.

Physical inputs might be purchased or "free" from the household point-of-view. If purchased, the quantity and price of the input should be recorded to provide cost information for the garden. If free, the quantity should be kept at the household level, and the price information at the project level (assuming the project is the source of the free input).

Water seldom has a price, but may entail a cost, e.g. labor to fetch it. Given that the time involved in watering the garden should be collected under the time (labor) data discussed above, any costs associated with water will be recorded as labor costs.

D. Prices and Transport Cost

Market prices for the garden produce will be needed to value the home production. These should be local prices preferably for the season in which production occurs. In addition, if significant transport costs (i.e. large in comparison to the value of the products or transport costs not already being incurred for other purposes) are incurred in marketing the vegetables, these should be gathered. Transport costs for purchase or collection (from project office) of inputs should also be gathered if significant. Market prices and transport costs will only need to be gathered a few times over the growing season either directly in the market or indirectly from household recall. These can then be averaged and used for all project participants.

E. Project Operations Information

Data on project operations will have to be collected throughout the life of the project in order to evaluate project activities. Background data will also assist in evaluating the implementation of the project. The main issues include:

- Delivery and availability of inputs provided under the project;
- Availability and timeliness of technical assistance on garden methods;
- Timeliness of demonstration garden plots.

These data should be gathered on a routine basis throughout the project and analyzed regularly to improve management.

IV. ANALYSIS AND SYNTHESIS

This section will utilize the data described above to develop indicators of project performance in three categories: economics, program implementation, and nutrition.

A. Economic Indicators

Within economic terminology, two evaluation indicators are used: cost effectiveness and benefit-cost ratios. Depending on the intended use of the indicator, evaluation of home garden projects may require one or both of these ratios. Benefit-cost ratios are most appropriate to projects which have largely monetary outputs or with benefits which can be monetized. For example, benefit-cost ratios are preferable when income is the major objective or benefit of the garden. Cost effectiveness ratios are more appropriate when nutrition (nonmonetary) benefits are expected to be high or are the main objective of the project. The interpretation of the ratios is the most important aspect of their use; misinterpretation can lead to funding the wrong project.

1. Benefit-cost Ratio

Table II presents steps for calculating an approximation of the benefit-cost ratio for a project. This is only an approximation since it does not use discounted streams of benefits and costs over the whole life of the project, but as an abridged version of the benefit-cost ratio, it minimizes the data collection process and helps simplify the analysis.

TABLE II: Computing an Approximate Benefit-Cost Ratio

1.	Number of project participants for current year (sum of individuals over households)	_____
2.	Outside funding received to date (investment costs)	_____
3.	Gross value of garden produce[A] (before subtraction of costs) for the most recent year (or those projected to a 12-month period)	_____
4.	Gross benefits per participant (line 3 ÷ line 1)	_____
5.	Recurring and variable costs of the project for current year (operational expenditures, plus expenses incurred by participants and not covered by project)	_____
6.	Annual cost per participant (line 5 ÷ line 1)	_____
7.	Net benefits per participant (line 4 − line 6)	_____
8.	Ratio of benefits to cost (line 7 ÷ line 2)	_____

[A]Garden production is defined here as additional food produced as a result of the project. If at all possible this should be calculated as the difference between what was produced before the project and what is produced as a result of the project. This increased production would be valued at current market prices to provide the gross value of garden produce.

In the case of home garden projects, the gross benefits received (on a monetary basis) are the value of produce of the garden at local market prices. To make this calculation requires estimates of production and the collection of market prices. Gross benefits to the household are the sum, over all crops, of production by crop multiplied by market price by crop. One way to simplify the estimation is to use average annual production over groups of similar households and average prices, then multiply by the number of households in that group. These group estimates can then be added to obtain total gross benefits. Use of this process allows evaluators to avoid figuring gross benefits on a garden-by-garden basis.

Recurrent costs of the project will include

- Operational expenditures for the current year, for example, salaries and wages, maintenance of equipment, rent, and other costs which will reoccur year-to-year;
- Variable costs to the project, for example, fuel for extension vehicles, inputs for gardens provided by the project, and other costs which vary by the number of participants;
- Costs incurred by the households, for example, inputs supplied by participants, labor cost, and transport cost (or savings) if significant.

In most cases, the transport cost (or savings) will be zero. If, however, significant transport costs are saved by the household not having to buy produce or are incurred by marketing home produce, these should be estimated. A transport cost savings will be a positive cost, thus reducing total costs to the household. Whether transport is significant will depend on: 1) the distance to markets (the farther the market the higher the cost in time or fares); and 2) the frequency of market trips for other reasons (if the trip to market would occur anyway, the cost or savings is irrelevant).

The benefit-cost ratio of a home garden project is the value of food output per dollar spent on the project. The benefit-cost ratio can be interpreted with the help of Table III, given the cautions listed in Table IV. In essence, the benefit-cost ratio is a simplified annual rate of return on investment, i.e. it estimates how long it will be before the original investment will be repaid. For example, if the ratio is 0.50 then it will take two years (1 divided by 0.50) for the original investment to be repaid.

TABLE III: Interpreting Ratios of Benefits to Costs

Ratio Value	Interpretation
Ratios greater than 1.0:	The project is an excellent one. Full benefits, if they continue for several years, are more than adequate to cover outside funding.
Ratios from 0.31 to 0.99:	The project is probably cost effective. The more years that the project is able to generate full benefits without additional infusion of outside funds, the better the project looks.
Ratios from 0.0 to 0.30:	The project is probably not cost-effective in an economic sense when the impact of inflation and the value of time are taken into account. It would require many years of full benefits to cover outside funding.
Ratios less than 0.0:	The project is not cost-effective. The benefits can not even pay for local operating costs.

Source: 30, p. 32.

2. Cost Effectiveness

Cost effectiveness ratios require data on costs and on quantifiable, nonmonetary indicators of benefits. The benefit indicator should be chosen to illustrate the major benefit of the project and to compare with known ratios or factors. For home garden projects possible benefit indicators are

- Number of participants (households or individuals)
- Food produced (kg)
- Nutrient(s) produced (for a specific nutrient known to be low in supply)
- Reduction in number of malnourished children (as defined by a chosen standard).

TABLE IV: Checklist of Considerations for Interpreting the Ratio of Net Benefits to Costs

Question	Interpretation
Benefits	
1. Was the project evaluated in a year when benefits had reached their full level?	If projects in early stages of implementation are compared with mature projects which have reached full benefits, a newer project may appear relatively less favorable than it really is.
2. Will benefits continue at a similar level for a substantial number of years?	To the extent that a given project's benefits continue considerably longer than for other projects, the project's current ratio will understate its true relative value.
3. Were benefits larger in years prior to the evaluation?	If the project returned larger benefits in earlier years it may have already reached the break even point and the ratio may understate the level of benefits relative to other projects with similar ratios.
Costs	
1. Have all outside contributions to the project been completed at the time of the evaluation?	If this is not the case, the ratio may overstate the relative cost effectiveness of the project since total outside costs are not included in the calculation.
2. Are the outside contributions large in the first year and gradually reduced?	If this is not the case, the ratio may overstate the relative real benefits in an economic sense when considering the time value of money.

Source: 30, p. 34.

The first two of these will be the most generally applicable given the data available and the ease of their use and interpretation. The latter two should be considered if nutrition improvement is expected to be the major observable benefit of the project or as additional information to the other ratios. Table V presents steps for computing various cost effectiveness ratios. Note as per Table VI that it is important to have the annualized investment and fixed costs as well as recurrent and variable costs when figuring cost effectiveness ratios [for detailed instructions on depreciation, inflation and foreign exchange ratios, see 32, pp. 38-47].

Cost effectiveness ratios cannot stand alone. Unlike the benefit-cost ratio which has an interpretation by itself, cost effectiveness ratios only have meaning as they are compared:

- With other known factors;
- Over time within a given project;
- With alternative approaches within a given project;
- With other projects [32, pp. 49-50].

For home garden projects, all of these comparisons are possible. In fact comparison across projects, once this method is consistently applied, is one of the intentions of this paper. However, from the point of view of any one project, a comparison with "other known factors" is likely to be the most informative. Table VII lists some of the possible factors to be compared with the respective cost effectiveness ratios for home garden projects.

B. Nutritional Indicators

Nutritional indicators can be derived 1) directly through the use of nutritional status data; 2) indirectly through translating food production or consumption data to nutrients; 3) indirectly through using the nutrients (produced or consumed) along with economic data. Nutritional status data have two problems: they are usually not being gathered at present and they require special training to collect. Since data on food production will be collected and data on food consumption can be collected more readily, indirect nutrition indicators are more available.

1. Direct Nutritional Indicators

The direct method for calculating the nutritional impact of a home garden project is to gather anthropometric data (heights, weights, and ages) on the households before and after the intervention. The evaluator also has to gather background data on other factors (e.g. sanitation) which can influence nutritional status. Since nutritional status is effected by many factors, only one of which is diet, these data are necessary to assess the change in anthropometric status from before to after the project while taking account of these possibly confounding variables. Although the indirect methods may seem crude from a nutritional status standpoint, they are perhaps closer to capturing the true project effects given that the immediate impact of the project is on food consumption with nutritional status being influenced secondarily.

2. Indirect Nutritional Indicators

An indirect indicator of nutritional benefit is calculated by converting the food produced by the garden into the relevant **nutrient(s) provided on a daily basis** using the conversion factor of units of nutrient j per kilogram (kg) of food i:

$$\underset{\text{(units)}}{\text{Total nutrient } j \text{ produced}} = N_j = \underset{\text{(kg)}}{\text{food}_i \text{ produced}} \times \underset{\text{(units/kg)}}{C_{ij}}$$

where units are the units typical to nutrient j, such as, milligrams (mgs). **Total nutrient produced** (N_j) can be indexed per capita, by household, or by project cost (see Table V, line 8). The cost effectiveness ratios which use benefit indicators of nutrients produced (see above) are examples of indirectly derived nutritional indicators.

Since each food item contains multiple nutrients, a decision needs to be made as to what nutrient (or nutrients) is appropriate as an indicator of project benefits. Although gardens are not likely to be a major source of calories or protein (exceptions to this exist), these "general" nutrients can indicate the overall adequacy of the diet. In addition, total calories and protein from the garden are useful as a comparison with the amount of calories and protein from other sources. The garden is likely to be a major source of vitamins A and C, and to a lesser degree, iron.

A more precise indicator of nutritional benefits is calculated by limiting the nutrient conversion to the **food consumed** by the household from the garden. An even finer indicator of nutritional benefits limits the conversion to

TABLE V: Computing Indicators of Cost Effectiveness

Note: compute on annual basis for each year of project.

1.	Number of households	_____
2.	Number of participants (individuals) (either line 1 × average household size or actual sum)	_____
3.	Food production[A], kg (either line 1 × average production or actual sum)	_____
4.	Food production per capita (line 3 ÷ line 2)	_____
5.	Value of food production (Table II, line 3)	_____
6.	Value of food production per capita (line 5 ÷ line 2)	_____
7.	Project costs (from Table VI, Total Annual Budget)	_____
8.	Food production converted to nutrient content for a nutrient "N" [sum of (kg of food by crop × units of nutrient "N" per kg by crop) over all crops]	_____
9.	Cost of providing home gardens to each household, $/household (line 7 ÷ line 1)	_____
10.	Cost of providing home gardens by individual reached, $/individual (line 7 ÷ line 2)	_____
11.	Cost of increasing home food supply by 1 kg of food, $/kg (line 7 ÷ line 3)	_____
12.	Cost of providing nutrient "N", $/unit of "N" (line 7 ÷ line 8)	_____

[A]Food production is defined here as additional food produced as a result of the project. If at all possible this should be calculated as the difference between what was produced before the project and what is produced as a result of the project.

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the **increase in food consumed** by the household (or individual) due to the garden. This latter indicator requires baseline data on food consumption by the household (or individual) prior to the project in order to calculate the change in food consumed.

The nutrients produced by, or consumed from, the garden can be converted to a **percentage contribution of the garden to the diet** (N_i) by dividing the total nutrients by the Recommended Dietary Allowance (RDA) for the nutrient:

$$\text{Percentage of } RDA_i \text{ from garden} = N_i \text{ (units)} \div RDA_i \text{ (units)}$$

The RDA can be used at the household or individual level.

TABLE VI: Annual Project Costs

Item	(Units of Currency)
INVESTMENT COSTS[A]	
Land	_____
Buildings	_____
Vehicles	_____
Labor	_____
Training	_____
ANNUAL OPERATING COSTS	
Fixed Costs	_____
Administrative salaries	_____
Other labor	_____
Supplies	_____
Utilities	_____
Variable Costs	_____
Garden inputs	_____
Fuel	_____
Labor	_____
Maintenance	_____
TOTAL ANNUAL BUDGET	_____

[A]Use depreciated values to get investment costs on an annual basis.

Source: Derived from 32, p. 12.

TABLE VII: Comparison Factors for Cost Effectiveness Ratios

Ratio of Cost Effectiveness of . . .	Factors to Compare
Providing home gardens to households[A] ($/individual)	Standard % of Cost/person in relation to income/person e.g. government expenditure for health and nutrition as percent of GNP[B]
Increasing home food supply ($/kg)	Average price of food/kg, if available or price of a major staple or vegetable per kg.
Providing nutrient "N" ($/unit of "N")	Cost of providing nutrient "N" through fortification of food products or distribution through health services
Food production per capita (kg/person)	Average annual kg of food in adequate diet
Annual food value per capita ($ food produced/person)	Average (or average for low-income group) annual food expenditure per capita

[A]Divide line 4 Table V by per capita income for low-income households in order to standardize it for comparison (See Appendix C, Table C-I)

[B]See Appendix C, Table C-II.

3. Nutritional Economics Indicators

Additional indirect methods for describing the contribution of a garden to the household diet combine nutrition and economics. These methods are based on the concept of **relative nutrient cost** (RNC) [40, pp. 181-182]. A "cost" for nutrients is derived from the present consumption of nutrients and the present food expenditures:

$$\underset{(\$/\text{unit})}{\text{Relative Nutrient cost}} = RNC_j = \underset{(\$)}{\text{food expenditure}} \div \underset{(\text{units})}{\text{intake of nutrient j}}.$$

The RNC can be estimated for any population group on which the data is available, for example, a household. The most easily available data will be at the national level: national average food expenditures per capita used along with nutrient consumption per capita as estimated by FAO food balance sheets. If data is available for the garden project area, that would provide the most pertinent RNC. The RNC can be compared with the **nutrient production cost** which is an estimate of the cost of producing nutrient j in the garden:

$$\underset{(\$/\text{unit})}{\text{Nutrient Production cost}} = NPC_j = \underset{(\$)}{\text{Total production cost}} \div \underset{(\text{units})}{N_j}$$

If the RNC of a nutrient is greater than the NPC, then it would be cost effective to grow a garden to provide that nutrient. Table VIII presents some data on Taiwan which illustrates these ratios. The data indicates that gardens in Taiwan would be cost effective in producing calcium, iron, vitamin A and vitamin C.

TABLE VIII: Relative Nutrient Cost (RNC) of Selected Nutrients in Taiwan (June 1981 - May 1982)

Nutrient	NT$/Unit[A]	RNC	NPC
Protein	100g	62	65.5
Calcium	100mg	10	0.89
Iron	100mg	358	39.83
Vitamin A	100R.E.	7.68	0.28
Vitamin C	100mg	37	3.25

[A]NT$ = Taiwanese Dollars, unit = the appropriate unit for that nutrient.

Source: 40, p. 181.

Since nutrients cannot be added together due to their different uses and units, an alternative method for looking at total nutrition is used: the garden ouput is converted to monetary units (e.g. dollars) using the RNC_j. Given the RNC for each nutrient, the **nutritional value** (NV_i) of any commodity i can be derived by using the conversion factor for food into nutrients (C_{ji})

$$\underset{(\$/\text{kg})}{\text{Nutritional value of commodity i}} = NVi = \underset{j}{SUM} \left(\underset{(\$/\text{unit})}{RNC_j} \times \underset{(\text{units/kg})}{C_{ji}} \right).$$

The NV_i can in turn be used in conjunction with yield data (available from AVRDC or in-country) to provide **nutritional yields** per square meter:

$$\underset{(\$/m^2)}{\text{Nutritional yield}} = NY_i = \underset{(kg/m^2)}{\text{yield}_i} \times \underset{(\$/kg)}{NV_i}$$

The NV_i and NY_i for each commodity i can be used to choose which crops should be grown in a project area: the commodities with the highest NV_i and NY_i will be chosen. Additional variations of these ratios can be derived incorporating production costs of each commodity (see Appendix D).

Both the nutritional value and yield ratios are summed together over all commodities being produced in the garden, in order to use these as indicators of the overall garden contribution to nutrition. These calculations provide two estimates of the nutritional benefit of the garden translated into dollars: 1) the **total nutritional value**; 2) the **total nutritional yield**.

$$\underset{(\$)}{\text{Total Nutritional Value}} = TNV = \underset{i}{SUM} \; (\underset{(\$/kg)}{NV_i} \; X \; \underset{(kg)}{\text{production of } i}) ,$$

$$\underset{(\$)}{\text{Total Nutritional Yield}} = TNY = \underset{i}{SUM} \; (\underset{(\$/m^2)}{NY_i} \; X \; \underset{(m^2)}{\text{production of } i}) .$$

These totals should be equal, but depending on how yield and production are calculated (or estimated) for the gardens, these derived indicators may vary. The choice between these indicators should be based on which data are more readily available: production by weight (kg) or production by area (m^2). These total nutritional indicators provide a monetary measure of the nutritional benefits of the project which can be used instead of the value of food production (calculated in Table II, line 3) to derive the benefit-cost ratio (Table II, line 8).

All of the measures based on RNC should be used with caution until they are applied on several examples. The RNC concept has not been widely tested as yet, and a clearer understanding of their possibilities and limitations is needed.

C. Project Evaluation Indicators

Evaluation of the overall project entails two steps

- Is the project functioning optimally? for example, are inputs appropriate and timely?
- Is the project cost effective?

Certain aspects of project functioning are basic to home garden project monitoring and evaluation. Seed supply has at times been cited as a major problem in home garden projects. If seeds are in low supply, then any discussion of the garden output is likely to be useless or misleading.

Issues of cost effectiveness can best be addressed through a "Checklist" procedure developed by Robert Nathan Associates [30, 31, 32] for use by private voluntary organizations (PVOs) and is presented in Table IX. Table IX also provides less structured (or indirect) indicators of what might be termed project "success" . "Success" is defined as changes in the way people (the beneficiaries or end clients) are producing food or obtain "better" results. These indicators would vary with the project area and its objectives, but for the most part some or all of the indicators in Table IX would provide a basis for considering the project a success whether or not more quantitative indicators could be derived.

The **per capita income indicator** ("cost per participant proportional to local resources and incomes," Item 3 in Table IX) is calculated using Table X. If the per capita income indicator is positive the project is probably sustainable; if negative the project is probably not sustainable. This indicator is based on the assumption that donors plan to eventually turn the operation of the project over to the local people to support. If the annual costs of the project (less start-up and expatriate costs) are proportionately lower than what is being spent in the country on such efforts, the project is likely to continue after the donors depart.

V. CONCLUSIONS

This paper has presented methods for evaluating home garden projects with the main emphasis on economic issues and secondary emphasis on nutrition. Given the complexities of home garden projects and the diverse audience for evaluation reports, not every view or issue could be included in the methods outlined here. In particular the view of gardens as an all inclusive metaphor for home production of food in all its forms is not addressed by this paper. The author has intentionally abstracted from the real world those variables for which estimates can possibly be derived, in order to provide decision makers with a starting point for the evaluation of home gardens. As with all abstractions, this method can be misused if accompanying knowledge of local conditions and habits

TABLE IX: Checklist of Indicators of Cost Effectiveness of Home Garden Projects

Direct Indicators of Success with the Participants

1. Gardeners assisted by the project are investing their own funds in the garden enterprise, and this investment is increasing each year.
2. Households feel they can continue (or actually do continue) the gardens without project support, i.e., the earnings are greater than the operating expense.
3. Costs per participant for the garden project are proportionate to the incomes and resources of the participants and their communities.

Indirect Indicators of a "Successful" Project

1. Gardens start next to project area without project support.
2. A greater variety (or volume) of food is available which fills nutritional gaps which may be seasonal or target group oriented gaps.
3. Some "surplus" garden produce is available for sale or barter.
4. Inputs are (or will be) available after the project at affordable prices in the local markets, or will be replaced with locally available inputs.
5. Individuals have learned skills and/or gained resources sufficient to expand production beyond family needs.
6. Crop rotations and other learned techniques prevent pest and disease build up and maintain soil fertility with minimum of purchased inputs.
7. Individuals continue to seek guidance as to how to further "improve" their garden enterprises.
8. Participants encourage others to adopt the new crops or methods.

Source: Partially based on 30, p. III-3 and 32, p. 13; along with personal communication from Donald Ferguson, see Appendix B.

TABLE X: Per Capita Income Indicator

Calculations:

1. Annual per participant cost of the project (Table V, line 10) _____
2. Average per capita income of participants (Appendix C, Table I) _____
3. Annual per participant cost as a percent of per capita income (line 1 ÷ line 2 × 100) _____
4. Percent of government expenditures in project sector (Appendix C, Table II) _____
5. Per capita income indicator (line 4 – line 3) _____

Interpretation of Results:

If line 5 is positive, the project is probably sustainable.

If line 5 is negative, the project is probably not sustainable

Source: 32, p. III-5.

are not gathered and analyzed (as suggested in the baseline data section) along with this largely economic and numerical approach. The limitations of the paper's approach and questions to answer in future efforts are addressed more fully in Appendix E.

The reasons households will perform a home garden activity need to be investigated rigorously. The evaluation methods above could provide valuable data for such an analysis. Although the level of effort to be placed in evaluations will vary according to resources, an effort must be made, or home garden projects will continue to be limited in their scope and applicability.

In conclusion, evaluation is a necessary adjunct to good project work, enabling both donors and implementors to learn from project mistakes and successes. Without evaluations a project cannot learn from its mistakes and successes, and is limited in its growth. By outlining the steps in evaluating home garden projects and describing several indicators of cost effectiveness, this paper shows how home garden projects can be evaluated quantitatively. The emphasis in future home garden project evaluations should be on the use of the economic, nutritional, and project indicators so as to further refine and standardize these concepts. Although other issues exist, this paper provides a starting point for an evaluation protocol that can be tested by private voluntary organizations and revised, as necessary, to improve the techniques for evaluating home garden projects.

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Comment: Excellent example of home gardens in Asia. Good discussion of garden characteristics and their relation to the socioeconomics of the household.

39. Swift, J.

"Agro-Forestry Garden in Morobe Province: Agronomic Results and Observations after Five Years of Continuous Production" Wau Ecology Institute, Papua New Guinea, 1981 (unpublished).

Comment: Example garden from Papua New Guinea, data collected on yield, minutes per land area spent in preparation, and reasons for having (or not having) a garden.

40. Tsou, S., et.al.

"Promoting Household Gardens for Nutrition Improvement" *Household Gardens and Vitamin A Deficiency* pp 179-185, 198?.

Comment: Presents Relative Nutrient Cost (RNC) with examples for Taiwan

41. UNICEF

The UNICEF Home Gardens Handbook: for People Promoting Mixed Gardening in the Humid Tropics New York: United Nations, 1981.

Comment: Good on design of Projects.

42. Utaipatanacheep, A. and J. Gershon

Nutritional Aspect of Gardens in Farming/Family Living System in Thailand Department of Home Economics, Faculty of Agriculture, Kasetsart University, Bangkok, Thailand, March 1985.

Comment: Report on nutrition output of AVRDC outreach gardens in Thailand. Existence of gardens compared with food expenditures, incomes, and other socioeconomic variables.

43. Utzinger, J. and H. Connolly

"Economic Value of a Home Vegetable Garden" *HortScience* 13(2), pp 148, 1978.

Comment: U.S. example of returns to labor in home gardens.

44. van Eijnatten, C.

"Home Gardens: Principles and Experiences" *Small Vegetable Gardens Resource Packet,* Part-C, Peace Corps, Washington, D.C., 1978.

Comment: General article on African and Asian home gardens.

45. WHO/UNICEF Joint Nutrition Support Programme

Gardening for Food in the Semi-Arid Tropics: A Handbook for Programme Planners UNICEF, 1985.

Comment: Good discussion of the trade-off between nutrition and income as household goals.

46. Wishnetsky, T. and J. Cash,

"Home Gardening and Canning vs. Buying Canned Goods" *Extension Bulletin* E936/MSU Ag Fact No. 74. East Lansing, Michigan: Cooperative Extension Service, Michigan State University, May 1976.

Comment: U.S. example of costs of gardens and preserving produce.

47. Yoon, S.

"Women's Garden Groups in Casamance, Senegal: *Assignment: Children,* 63/64, pp 133-153, 1983.

Comment: Excellent, successful example of gardens in Africa.

APPENDIX A: Illustration Of Past Evaluation Approaches

TABLE A-I: Criteria and Alternatives

CRITERIA (data required)	ALTERNATIVES (data collected)	
	Unstructured Information	Structured Evaluation
Economic benefits:		
amount of food produced	estimates for season by crop and household	production recorded by period
market value of food produced	none	market prices obtained
amount of produce sold or bartered	estimates of total sales for crops as a group	weekly sales recorded
value of time saved in not going to market for food	none	round trip time and shopping time recorded
Economic costs:		
cost of inputs (seed, etc.)	intended cost to participants estimated **a priori**	measured weekly
labor time and/or cost	none	weekly accounting
alternative uses of labor or market wage	none	weekly estimates
project costs	original estimates plus updates	original estimates

CRITERIA (data required)	ALTERNATIVES (data collected)	
	Unstructured Information	Structured Evaluation
Nutritional benefits:		
nutritional content of food produced	general estimates of a few nutrients for the total crop	specific estimates of calories, protein, & vitamin A by crop (and sometimes by variety)
household nutritional needs	anecdotal information based on other studies	per capita requirements based on household structure
Promote community development:		
participation levels in other community activities	anecdotal information	none
households not in project area that are adopting methods	estimates by project staff	none
Project operations:		
availability of inputs	anecdotal information	none
coverage of extension	self-reports by participants	none
sources of inputs after the project is over	none	none
choice of crops by households (which and why)	anecdotal information	reasons can be derived from data gathered
variety choice and why	none	can be derived from data gathered

TABLE A-2: Additional Data and Issues

DATA & ISSUES (data required)	ALTERNATIVES (data collected)	
	Unstructured Information	Structured Evaluation
Household background data:		
households participating	number on annual basis	number on weekly basis
family composition	none	age-sex distribution
socioeconomic information	anecdotal information	income and farm data
Baseline data:		
type of gardening activities	anecdotal information	none
number of households participating	anecdotal information	none
nutritional status of households	information based on previous studies	none
evidence of labor availability	anecdotal information	none
constraints to gardening	usually collected	some information
Audience for evaluation:		
convince Donors that home garden projects have a benefit-cost ratio > 1	not effective to date	too complicated to be applied in non-experimental context
provide information to improve programming efforts	found insufficient for explaining what does and doesn't work or why	can provide partial information
Costs of evaluation:		
low-cost preferred	low to zero additional cost	high cost
can be done with a minimum of training	already being done by PVOs	requires professionals

APPENDIX B: Persons Contacted

NAME	TITLE / AFFILIATION
Washington, D.C., 1985	
Ms. Denise Conley-Lionetti	Coordinator, League for International Food Education
Ms. Calvina Dupre	Agricultural Research Advisor, USDA/OICD
Dr. Don Ferguson	Natural Resource Development Officer, USDA/OICD
Ms. Maura Mack	Nutrition Officer, Office of Nutrition, S&T Bureau, AID
Mr. Al Meisel	Executive Director, League for International Food Education
Dr. John McKigney	Nutrition Officer, Office of Nutrition, S&T Bureau, AID
Dr. Hal Rice	Nutrition Advisor, Asia Bureau, AID
Mr. Tom Wilson	Agricultural Economist, Asia Bureau, AID
XIII International Nutrition Congress, Brighton, England, August 18-23, 1985	
Mr. Alan Berg	Nutrition Advisor, World Bank
Dr. Peter Greaves	Joint Nutrition Support Program, UNICEF
Dr. Jane Kusin	Medical Doctor, Tropical Institute, Amsterdam
Dr. Richard Longhurst	Economist, Institute for Development Studies, Sussex, England
Ms. Vera Ninez	Researcher, International Potato Center, Peru
Dr. Per Pinstrup-Andersen	Agricultural Economist, International Food Policy Research Institute
Dr. Barry Popkin	Agricultural Economist, School of Public Health University of North Carolina
Mr. Irwin Shor	Nutrition Survey Consultant, UNICEF
Mr. Paul Sommers	Home Garden Advisor, UNICEF/UNDP, Fiji
Dr. Leonard Teply	Nutrition Advisor, UNICEF, New York
Dr. Barbara Underwood	Senior Scientist, National Eye Institute, National Institutes of Health
Dr. Marianne Zeitlin	Nutritionist, Tufts University
AVRDC, Taiwan, September 1985	
Dr. Diosado Castro	Training and Development, Head
Dr. Jack Gershon	Consulting Nutritionist, Small-Scale Food Production
Dr. Sylvia Green	Plant Pathology
Dr. George Kuo	Plant Physiologist, Head
Miss Jen-Fong Kuo	Home Garden Research, Assistant
Mr. Hsin-fa Lin	Home Garden Field, Assistant
Mr. Bruce McLean	Office of Information Services, Head
Dr. Paul Sun	Acting Director General
Dr. Arnold Tschanz	Plant Pathology, Head
Dr. Samson Tsou	Chemistry (Nutritional), Head

AVRDC Outreach Program, Thailand, September 1985

Dr. Chamnien Boonma	Director, Center for Applied Economic Research, Faculty of Econ. and Bus. Admin., Kasetsart University
Dr. Apisith Issariyanukula	Agricultural Economist
Dr. Thavat Lavapaurya	Horticulturalist
Mrs. Napaporn Promchana	Lecturer in Agricultural Economics
Dr. Anchanee Utaipatanacheep	Home Economist and Nutritionist
Extension Agents	Don Yai, Bangpae district, Ratchaburi province

APPENDIX C: Income and Government Expenditures in Selected Countries

The representative government expenditure levels given in Table C-II are not in categories which directly relate to home garden projects. These categories are given as representative of expenditures with similar goals because the data was available for them. They should be considered as the general range of acceptable expenditures for comparative purposes not as strict limits.

TABLE C-I: Average Per Capita Income (1983 Dollars)

Country	Average Per Capita Income
Bangladesh	104
Benin	232
Bolivia	408
Burkina Faso	144
Burma	144
Burundi	192
Cameroon	656
Central African Republic	224
Chad	64[A]
Congo	984
Costa Rica	816
Dominican Republic	1,096
Ecuador	1,136
Egypt	560
El Salvador	568
Ethiopia	96
Ghana	248
Guatemala	896
Guinea	240
Haiti	240
Honduras	536
India	208
Indonesia	448
Ivory Coast	568
Jamaica	1,040
Jordan	1,312
Kenya	272
Lesotho	368
Liberia	384
Madagascar	248
Malawi	168
Malaysia	1,488
Mali	128
Mauritania	384
Morocco	608
Nepal	128
Nicaragua	704
Niger	192
Nigeria	616
Pakistan	312
Papua New Guinea	608
Peru	832
Philippines	608

Country	Average Per Capita Income
Rwanda	216
Senegal	352
Sierra Leone	264
Somalia	200
Sri Lanka	264
Sudan	320
Tanzania	192
Thailand	656
Togo	224
Tunisia	1,032
Uganda	176
Yemen (YAR)	440
Zaire	136
Zambia	464
Zimbabwe	592

[A] 1982 dollars from 1984 report.

Source: The World Bank, **World Development Report: 1985** (Oxford University Press: New York), 1985. Calculated from Table 1 by multiplying 0.8 X GNP per capita [30, p. 18].

TABLE C-II: Government Expenditures on Education, Health, and Housing and Community Services

Sector/country category	Percent of government expenditures	Decription of expenditures
Education		
Low income countries[A]	10.6	Public expenditures for the provisions, management, inspection, and support of pre-primary and secondary schools; of university and colleges; and of vocational, technical and other training institutions
Middle income countries[B]	11.6	
Health		
Low income countries[A]	4.0	Public expenditures on hospitals, medical and dental centers, clinics, family plannings, and preventive care
Middle income countries[B]	4.7	
Housing and Community Services		
Low income countries[A]	6.0	Public expenditures on housing; on provision and support of housing and slum clearance activities; on community development; on sanitary services; and on cost of welfare services such as care of aged, disabled, and children
Middle income countries[B]	17.7	

[A]Countries with per capita income less than $320.

[B]Countries with per capita income greater than $320.

Source: Data from the World Bank, **World Development Report: 1985** (Oxford University Press: New York), 1985, Table 26; format from 32, p.III-7.

APPENDIX D: Additional Methods for Expressing Nutritional Economics of Gardens

Following on the discussion in the text of indicators which combine nutrition and economics, there are additional indicators which are useful in determining a choice of crops for garden projects given there is a nutritional objective. In particular, given estimates of **production costs** by commodity i, the trade offs between nutritional benefits and costs can be summarized in a **cost-to-value ratio** (CVR) or a **relative nutrient production cost ratio** (RNP). If production costs are in terms of $\$/m^2$.:

$$\text{Cost-to-value ratio} = CVR_i = \underset{(\$/m^2)}{\text{production costs}_i} \div \underset{(\$/m^2)}{NV_i},$$

[Note: if production costs are available only in \$/kg, convert this to $\$/m^2$, by multiplying by yield (kg/m^2)]. If a vegetable is both low in production costs and high in nutrient value, the CR will be less than 1. If the CVR is greater than 1, the commodity is likely to be too costly given its low nutritional value. These data can be used to suggest crops which would be the most cost effective for improving the nutrition of households by using home gardens.

The second method, relative nutrient production cost of each commodity i for a specific nutrient j is derived by calculating:

$$\underset{(\$/\text{unit})}{\text{Relative nutrient production cost}} = RNP_{ij} = \underset{(\$/kg)}{\text{production costs}_i} \div \underset{(\text{units}/kg)}{C_{ji}}$$

The RNP ratio allows a comparison across commodities, as to which commodity is most cost effective at providing a **particular** nutrient. Whereas, the CVR provides a way to rank commodities from the most cost effective at providing nutrients overall, to the least nutritionally cost effective (given the NV_i).

APPENDIX E: Limitations of this Evaluation Method

The limitations of the evaluation method discussed in this paper are of two types: 1) issues which should be considered in future efforts; 2) issues which need further discussion within the home garden project community.

Other issues that might be considered include:

- How do gardens fit into the larger farm enterprise?
- How is the food grown in the gardens distributed within the household?
- What role do small livestock play in home gardens?
- What is the relation between perennial (usually fruit) crops and annual (usually vegetable) crops?

These and other issues of concern can be considered in part by using rapid appraisal techniques and focussed questions to obtain qualitative answers during the baseline and monitoring surveys.

Home garden project practitioners have not reached agreement on two important questions:

- Will (or do) households have home gardens for nutritional reasons? or must there be a clear income benefit before households will garden?
- How much effort (if any) should be put into evaluations?