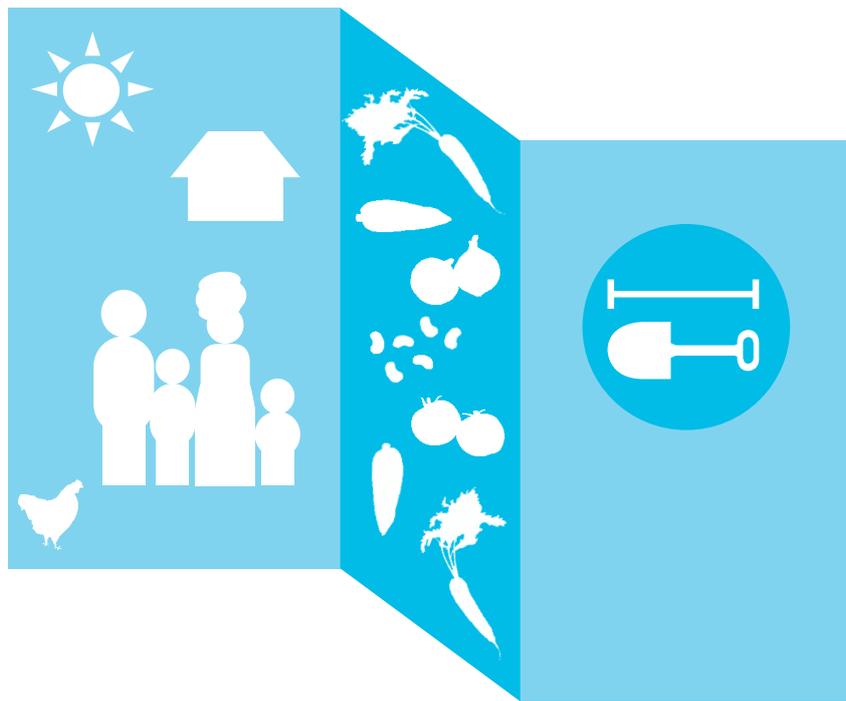


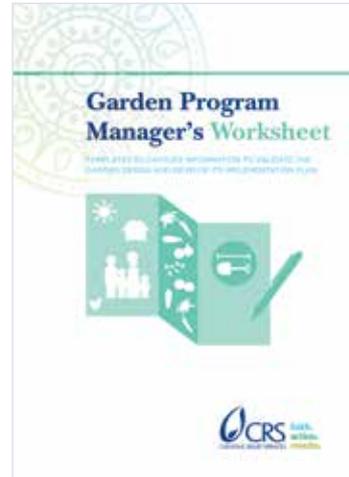
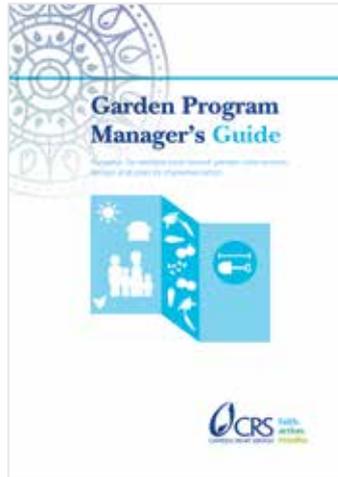
# Garden Program Manager's Guide

Purpose: To validate post-award garden intervention design and plan its implementation





This document is based on the *Garden Resource Guide* where all references are cited. Use the *Garden Program Manager's Guide* alongside the *Garden Program Manager's Worksheet*.



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# Acronyms

<b>CRS</b>	Catholic Relief Services
<b>DiNER</b>	Diversity for Nutrition and Resilience
<b>FA</b>	Field Agent
<b>IP</b>	Implementation Plan
<b>IPM</b>	Integrated Pest Management
<b>MEAL</b>	Monitoring, Evaluation, Accountability and Learning
<b>NGO</b>	Nongovernmental Organization
<b>PERSUAP</b>	Pesticide Evaluation Report and Safe Use Action Plan
<b>PM</b>	Program Manager
<b>PWD</b>	People With Disabilities
<b>HIV</b>	Human Immunodeficiency Virus
<b>SBC</b>	Social Behavior Change
<b>SMART</b>	Skills for Marketing and Rural Transformation
<b>USAID</b>	United States Agency for International Development
<b>WASH</b>	Water, Sanitation and Hygiene

# Contents

Introduction .....	1
1. Validate the Garden Design.....	1
2. Develop the Garden Implementation Plan .....	2
3. Garden Type Selection and Rollout .....	3
4. Crop Selection .....	10
5. Gender Integration .....	11
6. Nutrition .....	13
7. Seed .....	14
8. Integrated Soil Health Management.....	16
9. Pest and Disease Managementt.....	17
10. Water Resources.....	17
11. Postharvest Handling .....	19
12. Marketing.....	20
13. Behavior Change for Gardens.....	23
14. Performance Monitoring .....	25
Annex: Factors affecting crops.....	26

## Introduction

Garden projects are widely implemented interventions in nongovernmental organization programming and can deliver positive results in the areas of nutrition, agricultural income and women's empowerment—if planned and implemented using a multi-sectoral approach.

This guide supports program managers in validating the garden design and in planning its implementation. It encourages cross-sectoral discussions among colleagues with different areas of expertise: agriculture, nutrition, behavior change, gender, postharvest handling, marketing, and monitoring and evaluation. This manual should be used with the *Garden Program Manager's Worksheet* and the *Garden Resource Guide*. The PM is encouraged to review the completed *Project Design Worksheet*, if completed during the proposal process.

**This guide encourages cross-sectoral discussions among colleagues with different areas of expertise.**



## 1. Validate the garden design

### Garden-related outcomes

- Improved nutrition
- Increased income
- Women's empowerment

Each context is different, so consulting with the direct implementer(s) and key male and female decision-makers of the targeted households is important to ensure that the garden design is appropriate for the 1) context, 2) beneficiary stage of change, and 3) expected outcome of the garden intervention.

A set of questions is available in Chapter 2 of the *Garden Resource Guide* to support this assessment. The analysis of this data should confirm whether the proposed garden intervention is aligned with the local context. If adjustments are needed, the PM should 1) document the needed adjustments, 2) explain why they are needed, and 3) identify any changes to technical and financial requirements in Table 1 of the Worksheet.

The PM can use data from the project baseline or the previous project's endline, if in the same communities. When validating, the PM should verify the nutrient deficiencies and dietary diversity levels of the targeted end users of the garden produce, as well as the market availability of nutrient-rich foods that can contribute to preventing these deficiencies. See guidance in the *Garden Resource Guide* on verifying the nutrient deficiency, dietary diversity, and market availability. The PM and team should then validate the rest of the design considering the targeted audience that will build and maintain the gardens and those who will benefit from the produce. The later chapters of this guide will help you make decisions and identify next steps that you will capture in Table 1 in the *Garden Program Manager's Worksheet*.



**An analysis of key data should confirm whether the proposed garden intervention is aligned with the local context.**

## 2. Develop the garden implementation plan

To guide implementation, the PM should develop a garden implementation plan that is based on the [agricultural calendar](#) for the crops being promoted in each agro-ecological zone. The steps for developing this plan are:

1. Develop a combined agricultural calendar for garden and main crops, including planting and harvest season(s) as well as weather conditions (e.g. rain, and air and soil temperature).
2. Based on the agricultural calendar, develop an implementation plan that considers the following:
  - a. Adapt training materials to reflect local context, existing competencies, stage of change of beneficiaries, crops to be promoted, project restrictions/approach, and the donor's approved environmental assessment reports.
  - b. Identify all inputs (seed, compost, watering cans, wheelbarrows, irrigation equipment, recipe books, etc.) needed for the first garden season, confirm how gardeners will access them, and develop plan for inputs to be available (unsubsidized or subsidized).
  - c. Prepare training schedule for staff and field agents (FAs)/volunteers with the selected garden lesson plans.
  - d. Plan support activities/interventions that will be conducted (e.g., meeting with input suppliers and product buyers, DiNER/seed fairs, irrigation development, gender intervention, and cooking demonstration).
  - e. Plan initial meetings with key stakeholders.
  - f. Schedule rollout of lesson plan to community members.
  - g. Plan to collect data and monitor performance.

Use Tables 2 and 3 in the worksheet to help develop the implementation plan.

### 3. Garden type selection and rollout

There are numerous types of gardens. This guide describes the key aspects of seven types of gardens: container gardens, conventional row gardens, keyhole gardens, permagardens, raised beds, sunken beds, and vertical/multi-level gardens. See Chapter 3 of the *Garden Resource Guide* for additional resources on each garden type to help you validate the garden selection. The *Garden Lesson Plans* provide detailed guidance on how to build each garden type. After validating the garden, the PM with the field agents should:

1. Determine the process for community members to make the final decision on what type of garden(s) to learn about
2. Finalize the selection of gardens to demonstrate based on discussions with community members
3. Adapt the garden-type lesson plans given the local context and available resources
4. Identify demonstration sites in each community
5. Determine with community members how to gather inputs and equipment for building the community's demonstration gardens

The PM should work with select FAs to field test the garden type lesson plans. A checklist for monitoring the implementation quality of each type of garden is also available in Chapter 3 of the *Garden Resource Guide*.

Use Table 4 in the *Garden Program Manager's Worksheet* to capture the above information.

**Chapter 3 of the *Garden Resource Guide* has additional resources on each garden type.**



### Descriptions of garden types

#### Container gardens



A hanging garden and a sack garden.  
*Photos by Anza Muenchow for CRS*

Container gardens are simply containers filled with high-quality soil and compost. This type of garden can increase the area available for planting, and can be used in constrained spaces, including urban or peri-urban areas. Containers must have proper drainage, should be placed where they can receive adequate sunlight and water, and where they will not be damaged by heavy winds or rains.

## Conventional row gardens



Conventional row garden.  
*Photo courtesy of [Paulo O](#),  
licenced under [CC BY 2.0](#).*

These are larger gardens that often use irrigation. Plants are more widely spaced than in sunken or raised beds, and therefore compete less for nutrients and sunlight. But given the wider spacing, weeds are more of a concern than in other garden types. The soil is subject to compaction due to movement around the garden. These gardens permit the use of larger tools, equipment or animal traction.

## Keyhole gardens



Keyhole gardens.  
*Photo by CRS staff*

Keyhole gardens are compact raised bed gardens, often waist high, constructed with layers of organic material inside stone walls to improve water retention and soil fertility. Keyhole gardens were designed to be used by people with limited mobility (e.g., the elderly, people with disabilities or people living with HIV), because once they are constructed, they are easy to manage—no bending over and relatively minimal maintenance is needed. If promoting keyhole gardens to PWD, consider adaptation of the garden design to accommodate the disability, such as a wider keyhole or lower walls if the gardener is in a wheelchair.

## Permagardens



Permagarden.  
*Photo by Thomas Cole*

Permagardens consist of raised or sunken beds that are surrounded by swales and berms to improve soil health and water management. They are designed to optimize the use of available resources and build resilience to environmental stresses.

## Raised beds



Raised beds.  
*Photo by CRS staff*

The raised bed garden is the most common type of small garden. It is a flat-topped garden bed created by simply mounding soil, compost and rotted manure into a rectangular shape that is generally 3 to 4 square yards/meters. This bed type is useful in wet climates or during the rainy season because it allows for good drainage and prevents plants from being damaged by waterlogging. These beds permit deep root growth and increased plant density and are highly productive. Because the soil in the bed is not disturbed by equipment or trampling, there is reduced risk of soil compaction. Raised beds can be framed or unframed. If framed beds are promoted, make sure that materials used for frames are non-toxic.

## Sunken beds



Sunken beds.  
*Photo courtesy of [Terrie Schweitzer](#), licenced under [CC BY-NC-SA 2.0](#)*

Sunken beds are dug into the ground and therefore lower than the surrounding area. This is done to maximize water use. They are generally used in dry, arid climates or for use during the dry season because they conserve or divert water, alleviate water runoff, and create a microclimate that helps keep plants moist and cool and protected from winds. When preparing these beds, it is important that the soil is prepared and amended in a loose manner (aerated) to allow for greater pore space. Sunken beds are often the preference for plant nurseries that will later be transplanted to raised beds in the rainy season.

### Vertical/multi-level gardens



Vertical garden. Photo by Anza Muenchow for CRS

Vertical gardens are especially good for maximizing constrained spaces, since plants can grow vertically, not just horizontally. This garden type uses trellises, nets, strings, cages or poles to support growing plants as well as plants grown in suspended mediums. Suspending plants can also help avoid potential animal damage.

**Figure 1: Land needs per garden type**

#### Large parcel

Conventional row garden



#### Medium parcel

Raised beds  
Sunken beds  
Permagarden



#### Small parcel

Container garden  
Vertical garden  
Keyhole garden



**Table 1: Types of gardens**

Type	Land size	Climate/location/use	Labor requirements	Water resources	Suitable crops	Materials (besides basic tools)	Advantages	Constraints
<b>Container</b>	Small	Urban area/landless.	Minimal effort to establish and maintain. Requires regular attention to water needs.	Requires close attention to soil moisture.	Any crop is suitable as long as it has ample space. Ensure containers of appropriate size are used.	Non-toxic containers; soil mixture consisting of sand or gravel, soil and generous amounts of compost	Use where there is limited space or soils are unsuitable or not cultivable (rocky, infertile, contaminated, rooftops, bricked areas, etc.); requires little labor or purchased resources, and recycled materials can be used for containers	Limited production so may not produce sufficient vegetables to meet household needs. May require frequent watering, especially if placed inside, or on verandas or other covered places.
<b>Conventional row</b>	Medium/large	Rural.	Minimum effort to establish. More difficult to maintain as garden is larger and there will be more weeds.	Varies depending on soil quality and type. Large area may require significant time for watering.	Suitable for most crops and can be integrated with agroforestry systems (e.g., fruit trees).	Best used with mechanization, such as pump or drip irrigation, motorized tillers, animal traction and others.	Larger fields allow for staggered planting. Greater production may permit surplus to be sold for income generation.	Not intensive so requires more land to produce same volume as intensive production. Because of greater distance between plants, needs weed management.
<b>Keyhole</b>	Small	Semi-arid climates; dry season; location with rocky, difficult-to-cultivate or infertile soils; limited space.	Medium effort/difficult to establish, as many materials are required. Easy to maintain.	Designed for moisture retention. Uses greywater.	Suitable for root crops, leafy crops/greens, carrots, beets, garlic, herbs. Unsuitable for peppers, eggplant, maize and large/vining plants.	Stones, manure, ash, rotting logs, dry and green grass or leaves, other available organic materials, woven basket.	May be physically appropriate for those with disabilities.	May need to establish multiple keyhole gardens to meet household consumption needs. Some materials may be difficult to access.

Type	Land size	Climate/ location/use	Labor requirements	Water resources	Suitable crops	Materials (besides basic tools)	Advantages	Constraints
<b>Permagarden</b>	Medium/large	All seasons, but support dry-season gardens.	Medium effort/difficult to establish as careful attention must be given to the construction. Medium maintenance effort as it requires close attention.	Designed for moisture retention and flood control.	Suitable for all crops.	Hoes, pangas/machetes; 4 watering cans; containers to carry manure, ash, etc.; 4 empty maize seed bags (100 kg); manure, wood ash, charcoal dust; 6-8 jerry cans for water; vessel to hold a bag of manure or chopped leaf material suspended in water; fencing material; nails (1 kg); hammer; twine; bamboo or sticks used to make an A-frame.	Designed to address soil and water constraints. If designed correctly, will optimize use of water and soil nutrients even in the face of drought or other climate shocks.	Uses primarily perennial crops (bushes and trees) and fewer annual crops. The design stage is more intensive than some of the other gardens described. Maintenance will likewise require more time, care and attention from the gardener.
<b>Raised bed</b>	Small/medium	Moist climates or during the rainy season.	Medium effort required to construct the garden. Easy to maintain. Weeds are minimal.	Good drainage, but may need frequent watering in the dry season.	Most plants grow well, but shallow-rooted plants are preferred, such as vegetables, herbs and berry bushes. Large vining plants will take up space. Stake/trellis may be used to reduce space needs.	Frames are not required. If using frames, they can be made out of concrete blocks, bricks, stone, nylon sacks, etc. Wood is not recommended because it rots easily. Tires should not be used as they may be toxic.	Size is determined by gardener to accommodate available labor, space and food needs.	In arid, dry climates, the soil may get too hot and dry out.

Type	Land size	Climate/ location/use	Labor requirements	Water resources	Suitable crops	Materials (besides basic tools)	Advantages	Constraints
<b>Sunken bed</b>	Small/medium	Dry areas, dry season, nursery.	Medium effort to establish given double digging. May be more difficult to maintain for those with disabilities or chronic illness as crouching is required.	Designed for moisture retention as it limits water runoff and serves as a water catchment system. Maximizes use of available water found deeper in the soil.	Suitable for all crops, except roots and tubers due to the depth required for optimal growth.	Organic matter/compost.	Supports rebuilding soil health and keeps roots cool in hot climates.	Not suitable for areas prone to flooding or heavy rains, or for soils with poor drainage. Nearby erosion may fill in the bed.
<b>Vertical/Multi-level garden</b>	Small	Urban area/landless.	Minimal effort to establish and maintain. Requires regular attention to water needs.	Because garden is compact with less soil, frequent watering is likely needed. Water needs to be distributed evenly. Simple drip irrigation is needed if garden is larger.	Trellises are suitable for vining and sprawling plants, such as cucumbers, peas, tomatoes, melons and pole beans. Suspended containers or poles may be used to support leafy greens or herbs.	Can be made of trellises, nets, strings, cages, poles, suspended containers, sacks, bamboo, etc. Nutrient-rich soil needed.	Maximizes constrained space and permits gardening in areas with unsuitable soils (rocky, unfertile, hilly, etc.). Can help prevent crop damage by animals if hung out of their reach.	Limited production to meet homestead needs. Because of the limited amount of soil used, it must be very fertile to meet plant needs. Plants need to be closely monitored for nutrient stress, and compost should be added regularly. If containers are elevated, irrigation can be difficult when lifting is required.



**The right crop mix and varieties will improve productivity and soil health, and manage pests and disease.**

## 4. Crop selection

The right crop mix and varieties will improve productivity and soil health, and help manage pests and disease. It will result in produce that will be consumed, processed, or sold on the market and may support women's empowerment. Crop selection is influenced by the garden intervention outcome, garden type, gender dynamics, productivity, seeds, soils, water requirements, and perishability. The table in the annex provides information on factors for a selection of crops that the PM should consult in finalizing crop selection. Factors that are based on local context—such as food preference, gender preferences, and market demand—are not specified in this table. A brief description of selected factors is provided below (more details on all the factors are available in Chapter 4 of the *Garden Resource Guide*). Note that the design team was encouraged to use the TOPS Program's [A Tool For Framing A Discussion Between Nutrition and Agriculture Specialists](#) for selecting crops. Inquire from management whether this completed tool is available as an information source.

**Nutrition objective:** If nutrition is important, the PM needs to ensure the selected crops reduce the nutrient deficiencies identified during the validation process. This may include crops that are nutrient-dense in vitamin A, protein, iron, vitamin C and/or zinc. This presents an opportunity to explore indigenous vegetables, which often have superior nutrition profiles to similar non-native species and are more adapted to the local climate. Catholic Relief Services has an Indigenous Vegetable Assessment [tool](#) available for use. Biofortified crop varieties can also be considered.

**Marketing objective:** The PM needs to consider both household consumption and market demand. Typically, market vendors want a mix of vegetables—not just one product. The market assessment conducted as part of the design phase or the validation process will help determine the best crop mix, the most valued varieties, volume needs, and sale prices.

**Small business opportunity outcome:** The PM should consider crops using the Market Opportunity Identification tool that could lead to a niche market for entrepreneurs starting small- or medium-size businesses.

**Food preferences:** The PM should understand what food (crop/variety) the end consumer likes to eat to ensure the food is consumed or sold. If a non-traditional crop is promoted, the PM needs to ensure there are activities to change the behavior of the gardener to grow it and the consumer to eat it.

**Gender preferences:** The PM should consider male/female preferences for crop types and varieties to ensure adoption and use. The PM needs to understand the gender dynamics around each crop to ensure 1) the target audience benefits, 2) there is no shift in control from women to men if the crop becomes profitable, and 3) there is no harm done.

**Seed selection:** The PM needs to confirm the availability, accessibility and affordability of seed, and the ease of saving it between production seasons. The [Seed System Security Assessment](#), if available, may provide information on what seed varieties are available and how gardeners access specific varieties. The PM may want to consider seed varieties that are drought- and/or disease-resistant as well as being appropriate for fresh consumption or processing.

For nutrition and marketing reasons, varieties with a short maturity, different harvest times, and staggered ripening should be considered. Furthermore, indigenous vegetables should be considered as they often address seed scarcity/quality issues. For more details on indigenous vegetables, see the *Garden Resource Guide* chapters on Nutrition (Chapter 6) and Seed (Chapter 7).

**Garden type:** As seen in the previous sections, certain crops are suitable for different types of gardens. The PM should ensure that selected crops align with the garden type(s) the project will promote.

After the crop selection is validated, the PM should identify any behaviors that need to be changed to ensure the promoted crops are grown, eaten and/or sold. Adjust the project design to accommodate the behaviors to be changed.

Use Table 5 in the *Garden Program Manager's Worksheet* to capture notes and actions to take regarding crop selection. Update the tables in Step 1 and 2 appropriately.

## 5. Gender integration

Gender can be integrated into intervention along a continuum from gender blind to gender responsive to gender transformative. According to CRS' gender strategy, all projects must put in place activities that are, at a minimum, gender responsive, with a goal of incorporating transformative programming that more directly influences change in norms and systems to facilitate equality. For more information on the different levels of gender integration, see Chapter 5 in the *Garden Resource Guide*.



All projects must put in place activities that are, at a minimum, gender responsive

### Figure 2: Levels of gender equality integration

Adapted from the Interagency Gender Working Group [Gender Equality Continuum Tool](#)



Goal: Gender equality and better development outcomes

The process for integrating gender into an intervention begins with a gender analysis, which practitioners then use to design their interventions. A suggested list of steps for completing this process is outlined below.

**Step 1: Assess the gender dynamics of the project context.** If a gender analysis has not been conducted, the PM should work with appropriate colleagues to collect gender-related data on gardens that help to assess, analyze, and attempt to understand the following six gender domains:

- Roles, responsibilities and time use
- Access to and control of assets and resources
- Power relations and decision-making
- Participation and leadership
- Knowledge, beliefs and perception, including cultural practices
- Legal environment

To learn more about these domains, read Chapter 5 on Gender Integration in the *Garden Resource Guide*.

**Step 2: Use the results to design program interventions:** Table 2 illustrates potential gender-responsive and gender-transformative adaptations or interventions based on gender analysis findings.

**Table 2. Selected gender-responsive and gender-transformative adaptations to garden interventions**

Gender dynamic	How can the program respond to this dynamic?	How can the program transform the situation to facilitate equality?
<p>Women manage household gardens but do not have access to very many inputs. Men in the same household manage larger plots for cash crops, and they access inputs through farmers' groups and input dealers in the cities. Women are not members of these groups and rarely travel to the cities because of their household responsibilities.</p>	<ul style="list-style-type: none"> <li>■ Hold forums with men to engage them on why they should buy and share inputs with women for the household garden.</li> <li>■ Hold voucher fairs in the villages to bring vendors to women who are unable to travel to the cities, and prioritize women receiving vouchers for gardening inputs.</li> </ul>	<ul style="list-style-type: none"> <li>■ Build up a community-based input distribution network of enterprises and help women farmers become owners of these enterprises. Engage men in the process.</li> </ul>
<p>Men are the ultimate authorities in the household. Women have some autonomy about what foods from the garden the family will eat and what to sell in the local market. But their male partners own the land, so they have ultimate decision-making authority.</p>	<ul style="list-style-type: none"> <li>■ Integrate appropriate nutrition- and gender-relevant messages into agriculture lesson plans (e.g., Zambia integrated field agents and volunteer lesson plans).</li> <li>■ Monitor for changes in men's and women's decision-making, roles and responsibilities, particularly if men begin to take over responsibility of gardens from women.</li> </ul>	<ul style="list-style-type: none"> <li>■ Use couple communication approaches such as the CRS <a href="#">SMART Couples</a> approach to strengthen joint decision-making.</li> <li>■ Use community approaches for building knowledge of gender issues such as inequitable decision-making.</li> <li>■ Mobilize and train women in groups to learn about and advocate for their rights. Work with male gender champions to support changes in gender dynamics.</li> </ul>
<p>Married women are primarily responsible for gardens but are rarely official members of farmers' cooperatives. Some cooperatives have women's groups for members and members' wives. Some women are members of separate savings groups or Savings and Internal Lending Communities (SILC).</p>	<ul style="list-style-type: none"> <li>■ Meet with cooperative members and explain the importance of reaching female gardeners with information and resources for their gardens and suggest trainings be held for the women's groups (or separate trainings held for female members of existing cooperatives). Also, reach out to women through the SILCs.</li> <li>■ Form new women-only groups or cooperatives where they do not currently exist.</li> </ul>	<ul style="list-style-type: none"> <li>■ Work with women to use home gardening as an entry point for new goals and opportunities for themselves and their families, such as leadership opportunities in the cooperative or value-added enterprise opportunities.</li> <li>■ Work with cooperatives to review and revise their constitutions accordingly to encourage active female participation and leadership.</li> </ul>

**Step 3: Prioritize interventions.** The PM should review the table created in Step 2 for any overlaps or contradictions, and then prioritize gender adaptation or interventions that will have the greatest impact on gender equality. It is important to be responsive to the gender dynamics, scope and limitations of the program.

**Step 4: Check for generalizations and assumptions.** It is easy to generalize gender dynamics and make personal assumptions about the program context. The PM should review the proposed activities to make sure the program is not designing activities that assume women’s circumstances are all the same.

*Note:* Gender identity is one of the most common systems of marginalization, but there are other social identities that intersect with gender that multiply marginalization a person may face, such as ethnicity, tribe, religion and/or class affiliation, disability, age and marital status.

For more information on the gender domains and examples as shown in Step 2 above, read Chapter 5 on Gender Integration in the *Garden Resources Guide*.

## 6. Nutrition

### Nutrition and disabilities

When assessing the nutrition situation, it is important to understand different nutrient needs and access to nutritious foods by those with disabilities (who are often overlooked) ([Global Partnership on Children with Disabilities](#)).

In addition to verifying that the garden design aligns with the nutrition outcome and that the crop selection aligns with nutrient needs and food preferences, the PM should verify the agricultural pathway the project plans to use to improve nutrition. **The three pathways are listed below, and more details are available in Chapter 6 of the *Garden Resource Guide*.**

1. Food Production Pathway
2. Agricultural Income Pathway
3. Women’s Empowerment Pathway

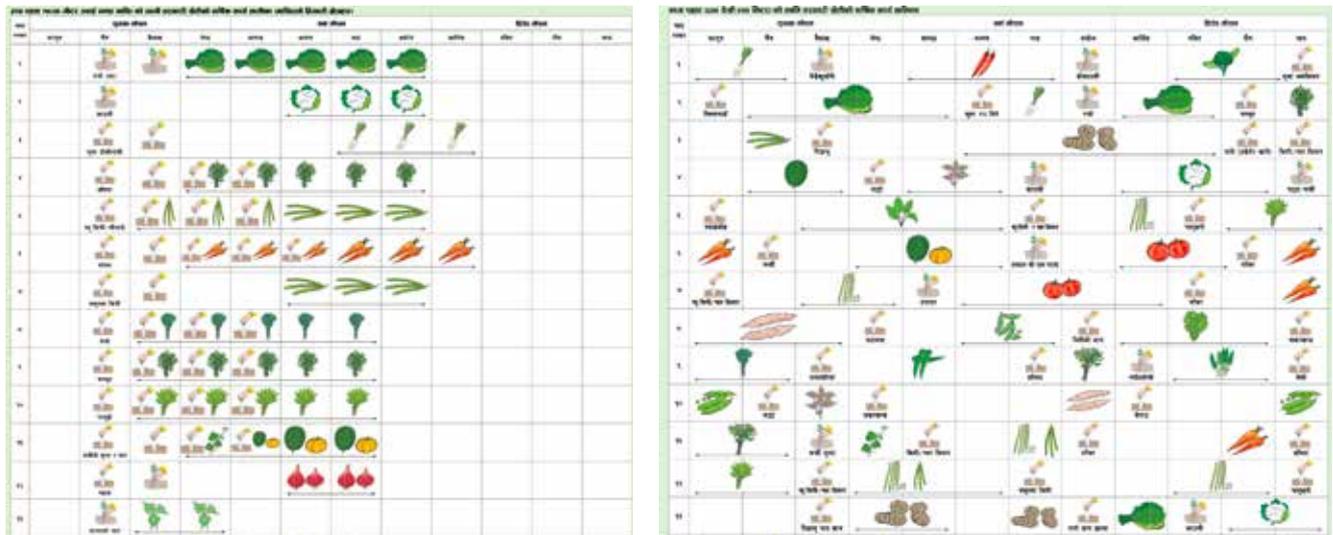
When validating the pathway, the PM should consider whether all components of that pathway are being addressed by the project and whether the different interventions within these components are targeted to the same households of the garden intervention.

The PM needs to verify the seasonal calendar and seasonal gaps when food is not available. The PM should work with the FAs to support gardeners to plan for seasonality and to plan staggering of crops within a season (Figure 3). See Chapter 6 in the *Garden Resource Guide* for more information on seasonality and production staggering.



**Verify the agricultural pathway the project plans to use to improve nutrition.**

**Figure 3: Seasonal calendar for diversifying and staggering crops**



Typical planting calendar

Diversified vegetables and harvest times

Source. *Suaahara Homestead Food Production Seasonal Crop Calendars*. 2014. Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs. [Click here](#) for more examples of crop calendars.

Another way to address seasonal gaps and the hunger season is for the PM to support FAs in training gardeners on basic food storage and preservation methods. For more information, see Chapters 6 and 11 of the *Garden Resource Guide* that share information on Nutrition and on Postharvest Activities.

The PM also needs to promote the consumption of garden crops based on the local context. This could include social behavior change communication, cooking demonstrations and recipe books. For more guidance, Chapter 6 of the *Garden Resource Guide* includes information on cooking demonstration standard operating procedures, descriptions of ways in which nutrients can be lost during preparation, and guidance on designing successful recipe books, including CRS examples.

## 7. Seed

In addition to verifying seed availability and affordability, the PM needs to determine the type and variety of seeds to promote, verify the seed access strategy, and support FAs in delivering this strategy.

There are five types of seed varieties: open-pollinated, hybrid, wild sourced, landrace, and genetically modified. When considering what type of seed variety to promote, the PM needs to consider the appropriateness for seed saving, anticipate production level in the first season and post season, seed cost, cultural context, transport and storage. Please note there is a growing emphasis on promoting indigenous vegetables in gardens. If the PM wants to know more about the different seed varieties and indigenous vegetables in particular, see the *Garden Resource Guide* Chapters 6 and 7.



**There is a growing emphasis on promoting indigenous vegetables in gardens.**

## Wild-sourced plants and transplants

A CRS Niger project carried out a week-long assessment of indigenous vegetables with agricultural field staff, followed by a two-day training that included interaction with female elders in the surrounding community on gathering wild seed and identifying wild vegetables. The training led to the development of two indigenous vegetable demonstration gardens that included vegetables from wild-sourced plants and wild transplants.



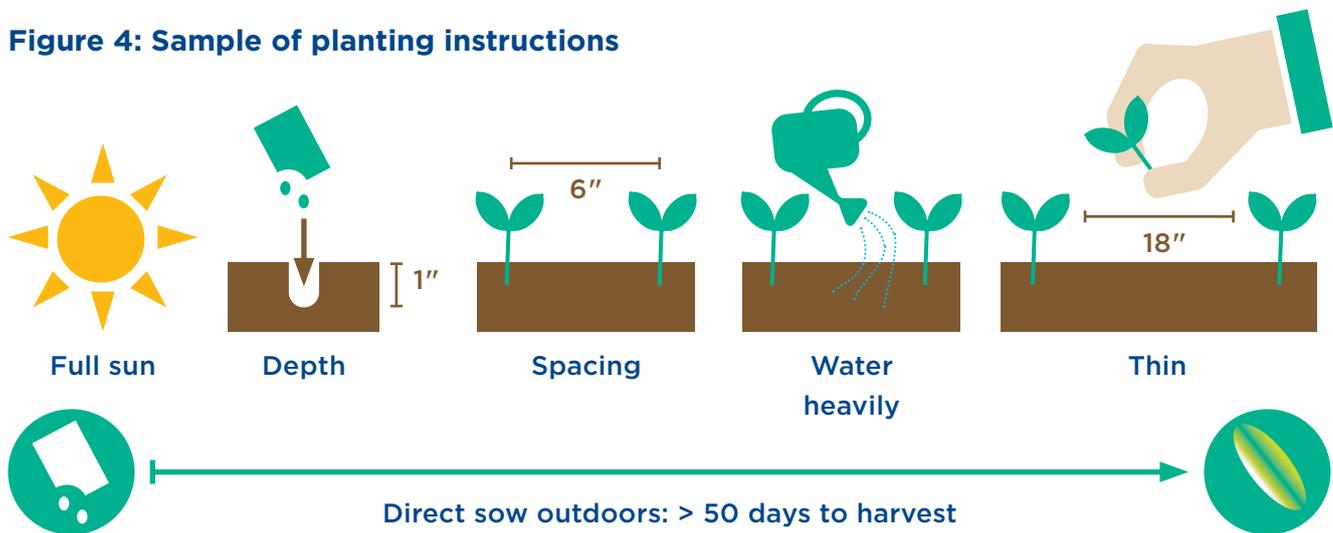
The PM needs to make sure issues related to seed access by male and female gardeners are addressed in the project's interventions, e.g., seed is available at a reasonable distance from the targeted community and is affordable. Seed access is critical to a sustainable garden intervention, so the PM needs to ensure that the seed access strategy leads to sustainable seed access after the project ends. There are a number of seed access strategies, with most of them supporting the development of the seed supply system such as DiNERS, seed and voucher fairs, ledgers, training and demonstrations, and direct partnership with the seed private sector. Additionally, the project may want to promote seed saving, and there are times when direct seed distribution may be needed. Please note that direct seed distribution is likely to lead to unsustainable gardens post-intervention. The PM needs to weigh the costs, benefits and risks of focusing on each strategy given the local context. To learn more about these seed access strategies, see Chapter 7 of the *Garden Resource Guide*.

If the project promotes local seed saving and production, the PM needs to consider the additional labor required, especially in crisis situations when gardener resources might already be stretched or when engaging women and girls. The PM needs to ensure they promote crops that facilitate easy seed saving (see table in Annex) and provide training to FAs to support this effort. See Chapter 7 in the *Garden Resource Guide* for more guidance on seed saving, such as isolation distance, production technique and competing priorities.

If the seed strategy engages with the commercial vegetable seed sector, the PM should work with the private sector partner (if already identified) or identify local private sector partners to work with for commercial vegetable seeds. To help identify appropriate partners and negotiate a cost-share approach, the PM can engage with the impact assessment team or the private sector agriculture advisor. The PM should work with the private sector vendors to negotiate what is appropriate for the project context.

Engage with private seed vendors to adjust their approach or business model to reach the targeted vulnerable groups. Areas to consider are seed packet size, planting instructions for those with low literacy levels (Figure 4 below), packet material, etc.

**Figure 4: Sample of planting instructions**



To maintain the quality of locally and commercially sourced seeds, the PM should make sure the interventions include seed storage training that includes rodent-proof containers, moisture control, cool storage, and purchase timing. The PM should also ensure that this training includes guidance on what information gardeners should collect if sourcing local seed. If the PM and staff are not convinced of the expected viable lifespan of the seed, seed testing may need to be conducted. For more information on seed quality and conducting seed germination tests, see Chapter 7 of the *Garden Resource Guide*.

## 8. Integrated soil health management

### **Healthy soils = Healthy plants = Healthy people**

The PM needs to ensure the FA can support gardeners to understand their soil and how to manage it to grow healthy vegetables, fruit and herbs in spite of moderate weather problems. The PM can train FAs on a number of observations and simple tests to use to understand soil properties. For more information on these soil properties and associated do-it-yourself tests, consult Chapter 8 on Soil in the *Garden Resource Guide* and the garden lesson plans.

If the garden's soil needs improvement, the PM should train FAs on the "rule of three": 1) minimum tillage, 2) adding organic matter (e.g., composting, green manure/cover crops, and commercial inorganic fertilizer), and 3) crop or vegetable diversification and rotation. Special considerations are needed for gardens on slopes and gardens with heavy clay soil in areas with heavy rains. For details on soil amendments and these special considerations, see Chapter 8 on Soil in the *Garden Resource Guide*.

**Rule of 3**  
Gardeners can transform poor soil by engaging in minimum tillage, adding organic matter, and diversifying and rotating crops.

## 9. Pest and disease management

Integrated pest management (IPM) is a broad crop management approach that stresses the importance of monitoring and correctly identifying pests or disease. The approach integrates cultural, biological, mechanical or physical control and chemical practices to control pest populations below established thresholds. The main steps in this approach include 1) prevention, 2) monitoring, 3) identifying, 4) assessing, 5) taking action, and 6) evaluating results. It is important for the PM to train FAs on the pest and disease management strategies the project promotes. See the checklist for implementers in the box below. The PM should consult the *Garden Resource Guide* for information on IPM steps, beneficial insects, specific diseases, bio-pesticides, and guidance on safe and proper use of agro-chemicals.

### IPM checklist for implementers

- Learn what pests and disease are common
- Identify key control methods
- Know what additional resources exist in the project area for IPM support
- If part of a United States Agency for International Development (USAID) initiative, communicate with the local environmental compliance officer regarding any planned use of agro-chemicals

Ensure that any project activities, especially those related to use or promotion of chemical pesticides, comply with donor regulations and the approved Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP).

**Integrated pest management integrates cultural, biological, mechanical or physical control and chemical practices to control pests.**



## 10. Water resources

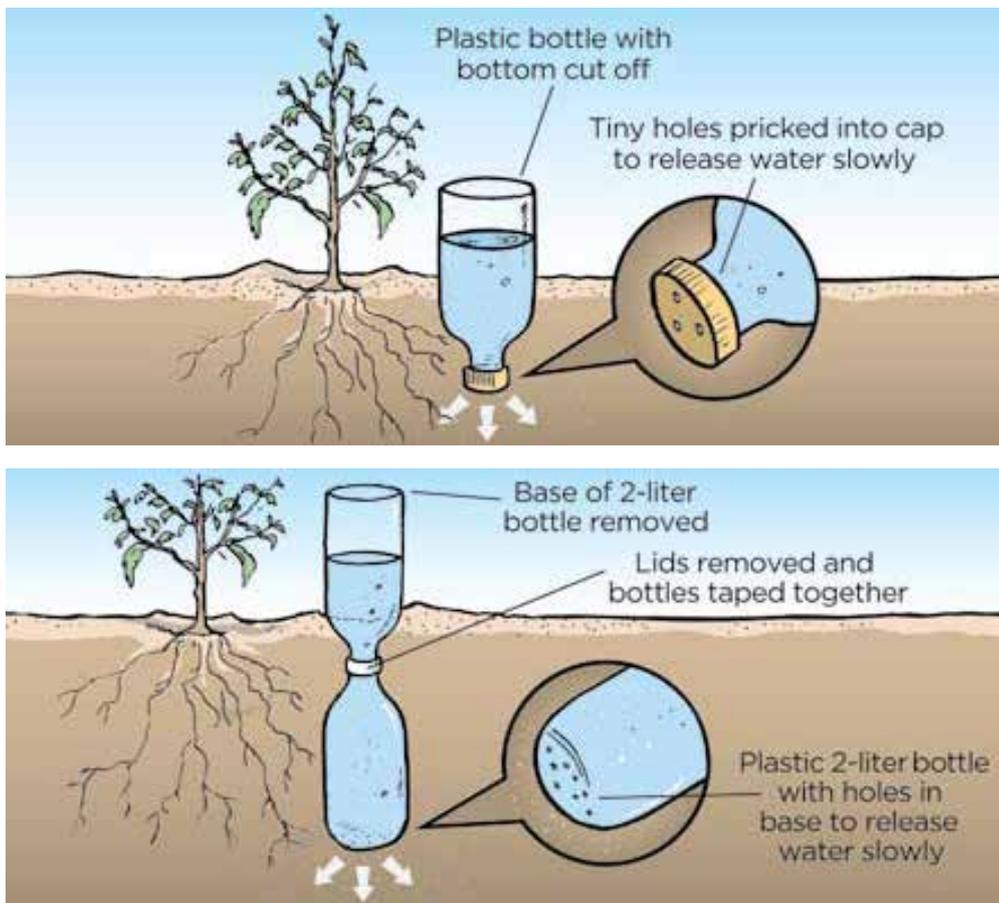
Water is a critical element in designing and sustaining any garden. Improved water resource management can dramatically increase garden production. With climate change significantly impacting water resources spatially (*where* rain falls) and temporally (*when* rain falls), FAs need to support gardeners to adapt to these changing rainfall patterns to ensure water is available and accessible for their gardens.

The PM should check whether the design is dependent on rainwater, groundwater, surface water and/or reclaimed water. The project's approach must then be validated for increasing access to water for gardens through wells, rainwater catchment systems, protective berm-and-swale systems or greywater. Details of each system are listed in Chapter 10 of the *Garden Resource Guide*. In addition to these water access strategies, the PM should validate or determine the approaches to watering gardens, such as hand watering, clay pot/pitcher irrigation, bottle irrigation, and low-cost drip irrigation. The *Garden Resource Guide* provides more details on soil moisture management, such as garden types that retain water, and the soil and water conservation practices for adapting to climate change, such as mulching, minimum tillage and cover crops.

**Climate change significantly impacts *where* and *when* rain falls.**

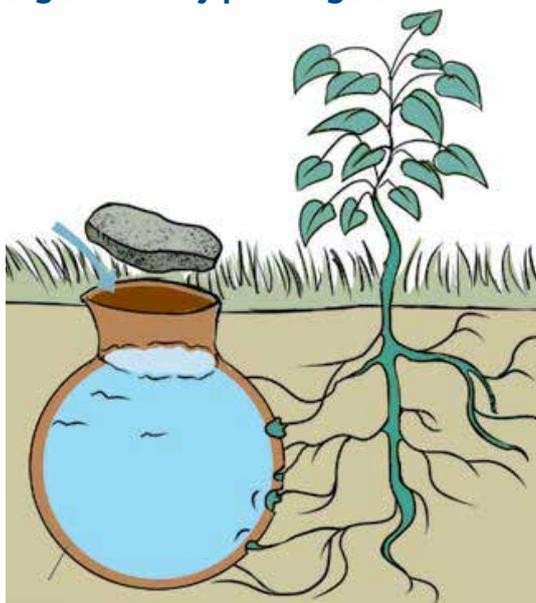


**Figure 5: Bottle irrigation**



Source: Burpee et al. 2015

**Figure 6: Clay pot irrigation**



Source: Burpee et al. 2015

## 11. Postharvest handling

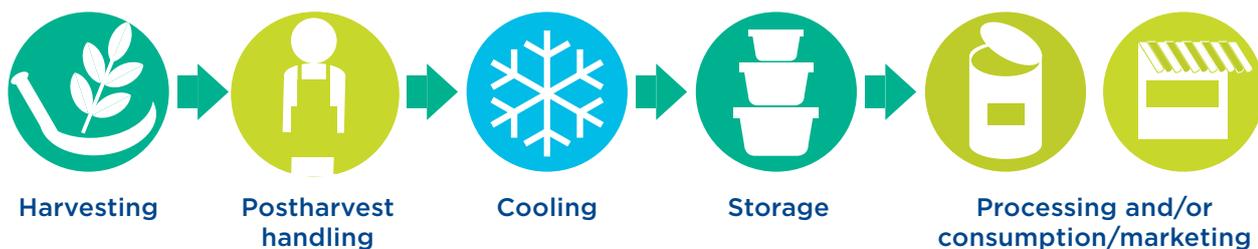
The postharvest handling of vegetables is important for:

1. Maintaining quality (appearance, texture, flavor and nutritive value)
2. Ensuring food safety
3. Reducing postharvest losses between harvest and consumption
4. Increasing storage life
5. Maintaining and/or adding market value

**Postharvest handling, storage and home-scale processing can be simple and low cost.**

Gardeners have many options for the use or destination of their harvested vegetables, so the PM needs to understand the management considerations for these different options. The first option is to consume the vegetables immediately after harvesting. The second is to store vegetables for later home consumption or sale. A third is to process vegetables for later home consumption or sale. When gardeners produce vegetables for sale to others, they can market directly from the garden or they can harvest and store their fresh vegetables or preserve their vegetables by processing and packaging the food products for later sale. Figure 7 illustrates the postharvest chain for garden produce for home consumption and marketing.

**Figure 7: Postharvest chain for garden produce**



When supporting post-harvest practices for garden produce, the PM should support the FAs to understand each crop's perishability and storage life in order to give guidance for staggered planting and post-harvest practices. The PM should train FAs on postharvest problems and their causes, as well as harvest and postharvest practices and technologies, for the purpose of reducing food losses and ensuring that food safety is promoted. Recommended harvest practices will help gardeners determine the appropriate maturity (for ensuring quality and shelf life), when to harvest (at the appropriate time of the day), and how to be gentle when harvesting.

### Wearable picking bags

These harvesting aids can be made by sewing bags with openings on both ends and adding shoulder straps, fitting fabric over the open bottom of a ready-made bucket, fitting bags with adjustable harnesses, or by simply adding an open pouch to an apron. Picking bags should be kept clean and washed between uses.

Right: Wearable picking bags being demonstrated in Tanzania.  
*Photo courtesy of Lisa Kitinoja/Postharvest Education Foundation*



Proper storage includes these practices:

- Store high-quality produce; do not store with damaged or diseased produce
- Keep cool after the harvest
- Maintain temperature control
- Provide relative humidity (RH) control, e.g., keep onions/garlic at low RH (60–70%) and other vegetables at high RH (85–95%)
- Ensure adequate ventilation and air circulation between containers
- Avoid incompatible product mixes, e.g., storing ripe fruit in the same room as green vegetables
- Make sure certain crops stored together can tolerate the same temperature, RH and level of ethylene in the storage environment

Some inexpensive evaporative cool storage (ECS) systems that can be used for most fresh vegetable crops are not appropriate for onions or garlic.

These include the pot-in-pot, the zero energy cool chamber, and the desert cool storage cabinet. To learn more about these systems, read Chapter 11 on Postharvest Handling in the *Garden Resource Guide*.

For small-scale food processing, the PM validates the form of processing given the local context. Simple methods for home processing of vegetables include 1) drying (via shade, solar, electric or fossil fuel heat sources), 2) canning (in whole form, or chopped, pureed, or juiced), and 3) fermenting, pickling or preserving in sugar (jams, jellies, or candies). Of the three preservation types, drying foods typically costs the least. Although canning and bottling are useful forms of preservation, they require time, labor, equipment, supplies, fuel and safe handling practices. Most importantly, they require clean water. Lastly, the PM needs to train FAs on food safety practices. The typical causes and sources of food safety problems during production and postharvest handling fall into the following three major categories: physical hazards, chemical hazards and human pathogens. There are four principles the PM should ensure the FAs provide as guidance to gardeners: 1) clean soil, 2) clean water, 3) clean surfaces, and 4) clean hands. The PM can read Chapter 11 in the *Garden Resource Guide* for more information.

## 12. Marketing

Although better nutrition is often the priority for garden interventions, gardens can also help the targeted audience generate income. Families can either sell their surplus production—which will also increase access to nutritious food among the wider community—or they can market their produce or added-value product from the start (and only use small amounts for household consumption). Earnings from selling surplus or marketing most of the production can improve nutrition if used for purchases that further contribute to their nutrition. They can also use the income they earn to improve their garden.



## Literacy and numeracy skills

Some of the gardeners you work with may have low levels of literacy and numeracy. Recording information in notebooks may therefore pose problems for these families. Preparing learning materials that use drawings will help. Ideally, when embarking on projects that promote the sale of products, you should support families to improve their literacy and numeracy. This will increase the probability that their market venture will be a success.

As gardeners move from occasionally selling their surplus produce to neighbors to selling regularly to buyers, they will be starting a small business. Running a garden as a business requires some basic knowledge about producing and selling vegetables, herbs and fruit that customers want to buy. It also requires knowing about how to cover costs, count income, make a profit, and protect a business against risks.

It is good if the PM and FA make it clear to gardeners that there is a difference between selling produce and marketing produce. The PM will need to ensure that the FA has the necessary skills to support this entrepreneurship endeavor. FAs should be able to identify and encourage male and female entrepreneurs who have the capacity and willingness to take on/manage risk and have the ability to learn how to develop a business. FAs need knowledge to support gardeners in making thorough business plans that address supply and demand during seasonality and price fluctuation, and that include cost-benefit analysis or economic feasibility analysis.

The FA needs skills to help gardeners identify what to grow, when to sell, and who the customers and buyers are. The gardener will need guidance on how to narrow down the options of what to produce to a shortlist of between two and five crops based on seed availability and affordability, soil and climate conditions, local knowledge and information on productivity, seasonal or yearly viability, crop maturity, production needs, nutrition content, and gender implications. This information may lead to some crops being eliminated because of challenges that will be difficult to overcome. The PM needs to support FAs in understanding the differences between selling informally to families in the community and to market stallholders. Table 3 describes some of these differences.

**Table 3. Purchase factors based on buyer priorities**

Purchase factors	Selling to families in the community	Selling to local market stallholders
<b>Seller-buyer relationships</b>	The gardener selling the garden produce may know many other families that reside in the community or that are related to them. Trust between the seller and buyers may already be established and transactions between them will be informal. In this situation, the buyer will largely accept the conditions of purchase set by the seller. Buyers will return to buy more produce if they are happy with the quality and the value for money.	The gardener may or may not know the stallholders personally, some of whom may come from other communities. The agreement between the gardener and the buyer will be informal—with no contract—but with the conditions of purchase clearly defined by the buyer. The relationship will flourish to the extent that trust between the gardener and the buyer is built. That is, the gardener providing the produce that the buyer needs and the buyer paying on time and at a fair price.
<b>Quantity</b>	The amount of produce that individual families buy will depend on the number of adults and children who make up a family, how much of these items they grow themselves, and income available for purchase.	A market stallholder will likely want to buy only an amount that they can sell in a day. This will be particularly true for itinerant stallholders who move from one community to another. The gardener needs to find out what the minimum and maximum amount of produce is that the stallholder requires.
<b>Frequency</b>	For perishable produce, such as leafy vegetables, frequency of purchase may be high with families buying two or three times a week. For less perishable products, such as carrots, purchase frequency will be lower, perhaps once a week.	Local markets may be held daily, two or three days a week or just once a week. The gardener should negotiate with the stallholder the days that they will deliver produce, which will depend on how much they have to sell and the minimum and maximum amounts that the buyer is prepared to buy.
<b>Quality</b>	Families will be attracted by fresh produce and knowing that it has been grown locally. Produce that has been grown without the use of agrochemicals to control pests and disease is also sought after.	Market stallholders may buy all of a producer’s crop regardless of quality, sort the produce themselves, and sell different quality produce at different prices. Alternatively, they may specify quite precise conditions in terms of freshness, color, size, shape and agrochemicals used.
<b>Price</b>	If families are confident about the quality of the produce, they are likely to pay the same or more than they might pay at the market for the same product.	Stallholders pay at prices that will allow them to cover their costs and make a profit. The prices will fluctuate throughout the year depending on the supply and demand.
<b>Location</b>	Sale to families in the community is usually from the homestead. There are cases where the local authorities make space available in the market for households that produce vegetables to sell on certain days. There is usually a cost associated with the use of the space.	In only exceptional cases are market stallholders likely to collect produce from the homestead. It is more likely that the gardener producing for sale will take their produce to the market stallholder. If the amount of produce is large, the seller may have to hire someone to help them transport the produce to market.

For more formal market engagement with the sale of garden outputs, the PM should refer to the CRS value chain toolkit, starting with the market opportunity identification process.

To support the farmer with marketing garden produce, a *Garden Business Workbook* is available; the PM should train FAs on how to use this workbook if a marketing approach for gardens is planned. The workbook is included in the *Garden Resource Guide* along with further explanation of the concepts above.

### Applying a gender lens

When it comes to marketing produce that entails travel away from the home, the PM will need to consider gender issues that may impede women's equitable participation or benefit. In some cultures, it is not seen as appropriate for women to engage with male buyers or travel long distances. The PM may also have to pay attention to building women's negotiation skills.

### How to facilitate inclusive household decisions about marketing

Commercialization of gardens can have significant effects on household gender roles and power relations. These effects can be positive but there is also a risk that they damage rather than improve relations. When a crop that has been typically managed by women is marketed and becomes profitable, it is possible that her husband—as the one often with more bargaining power in the household—might take over management of that crop. Approaches that can be effective to empower both men and women of the household to enter jointly made decisions about what food should be grown, eaten and sold, and how the money should be spent in a way that will have the maximum benefit for themselves and their families include [SMART Couples](#) and the [Area Association Model](#). Other publicly available training toolkits include the International Fund for Agricultural Development (IFAD) [Household Methodologies Toolkit](#) and the Hivos [Sustainable Coffee as a Family Business Toolkit](#). For more information, read Chapter 5 of the *Garden Resource Guide*.

## 13. Behavior change for gardens

### Five tenets of behavior change

1. Know exactly who the target group is and look at everything from *their* point of view.
2. The *action* is what counts, not the knowledge or intent to change.
3. People take action when it *benefits* them. *Constraints or barriers* keep them from acting.
4. Social norms matter to most people.
5. Decisions to change a behavior or adopt a practice are not necessarily rational nor linear.

**Knowledge does not equal behavior change; it is action by the target group that counts.**

Gardening is comprised of several practices and many behaviors within these practices. Therefore, it is important for the PM to confirm which behaviors need to change so the garden can be sustainable and successful. The PM needs to ask: Who is the target audience and influencers of the behavior? What formative research has been conducted and/or should be done? At what stage of change is the target audience?

When validating the behavior change (BC) aspects, the PM should remember that change is behavioral, social, economic and cultural. Behavior change includes not only communication (often expressed as BCC, i.e., behavior change communication), but also actions to create an enabling environment for sustained change. The actions may include provision of needed systems (ongoing technical support from agricultural extension workers), services or infrastructure (sustainable sources of seeds, tools or irrigation materials), formulation of supportive policy (local government rescinds market tax for garden products), or measures to sway social norms (events to make gardening a fun, profitable and acceptable use of time). If formative research is needed to help guide the intervention, there are several tools available for agriculture-related programming: positive deviance, doer/non-doer methodology, focus group discussions, and participatory rural appraisal.

Not everyone is going to adopt gardening, and many will adopt it only after they see the success and benefits of others. In adopting new practices, individuals go through stages of change with each stage requiring different BC activities to move them to the next stage. The five stages are: 1) pre-contemplation, 2) contemplation, 3) preparation, 4) action, and 5) maintenance. In gardening terms, stages of change might look like this:

- 1. Pre-contemplation:** Aisha and her neighbors plant in furrows and have not heard of raised beds.
- 2. Contemplation:** Aisha has seen the model garden with raised beds and watched a video on how to construct one. The video explained all the advantages of preventing waterlogging and compacted soil.
- 3. Preparation:** Aisha talks to women from a neighboring village about the time required to prepare the ground, maintain the garden, and the expected yield of vegetables.
- 4. Action:** Aisha and her husband prepare a small plot with raised beds; she plants and harvests it.
- 5. Maintenance:** Aisha continues planting, harvesting, and caring for the raised bed garden for many years.

See Chapter 13 on Behavior Change in the *Garden Resource Guide* for additional information on behavior change and gardening.

## 14. Performance monitoring

Performance monitoring is important for ensuring that the project is on the right track to achieving its objectives as it gives real-time information on outputs, behaviors being changed, and associated results. This allows the PM to make informed changes to the project design. The PM needs to verify whether the suggested indicators in the proposal are appropriate given any changes to the design based on the validation process and identify whether additional indicators need to be added to the MEAL plan.

Example indicators for use in garden programs are listed in Chapter 14 of the *Garden Resource Guide*. Given the multi-sectoral nature of gardens, the indicators measure outcomes related to agriculture, nutrition and gender. **Once indicators are selected, meaningful targets for these indicators must be set.** The PM, along with the project's monitoring, evaluation, accountability and learning (MEAL) advisor, should develop a schedule table to clearly define responsibilities and deadlines for collecting and analyzing data. Program managers should work closely with their respective MEAL staff to ensure they are collecting, analyzing and reporting data appropriately and using a gender lens. The PM and MEAL staff should come up with a localized learning system that makes sense to staff and communities. For more information, see Chapter 14 in the *Garden Resource Guide*.

Performance monitoring allows the PM to make informed changes to the project design.



## Annex: Factors affecting crops

Crop	Ease of saving seed	Soil type best for the crop <sup>1</sup>	pH level preferred by the crop	Average crop water needs (mm/total growing season)	Contains high levels of the following nutrients	Non-compatible crops	Perishability (very high: <2; high: 2-4; moderate: 4-8; low: 8-16; very low: >16)
<b>Amaranth</b>	Easy	Many soils	5.5-7.5	-	Vitamin A, iron, zinc	-	Very high
<b>Avocado</b>	N/A	Many soils if well drained	Tolerates 5.0-7.0 Prefers 6.0-6.5	-	Folate, zinc	-	High
<b>Banana</b>	-	Many soils if deep, well drained	5.5-6.5	1200-2200	-	-	Very high
<b>Beet</b>	Difficult	Loam or sandy soils, not clay soil	6.0-7.5	-	-	Mustard, pole beans	Moderate
<b>Broccoli</b>	Difficult	Many soils if well drained	6.0-7.0	-	Vitamin C	Cabbage, cauliflower, lettuce, pole beans, tomatoes	Very high
<b>Cabbage</b>	Difficult	Sandy loam to clay soil	6.0-7.0	350-500	Vitamin C	Broccoli, cauliflower, strawberries, tomatoes	Low
<b>Carrot</b>	Difficult	Sandy soil	5.5-7.0	-	Vitamin A	Dill, parsley	Moderate
<b>Cassava</b>	Vegetative propagated crops (VPC)	Sandy soil	5.0-8.0	-	Iron (leaves)	-	Very high
<b>Chickpea</b>	Easy	Well-drained loam and clay loam soils	5.0-9.0	-	Protein	-	Very low (dried)
<b>Chili pepper</b>	Easy	Sandy soil	5.0-6.5	-	Vitamin C	-	High
<b>Chinese cabbage</b>	Difficult	Sandy loam	6.0-7.5	-	-	-	Moderate
<b>Citrus</b>	Tree	Loam, sandy loam or sandy soils	Tolerates 4-8 Prefers 5.5-7.0	900-1200	Vitamin C, folate	-	Moderate
<b>Common beans</b>	Easy	Sandy loams or silty loams are best; can grow in any soil except clay	Tolerates 5.5-7.5 Prefers 6.0-6.5	-	Protein	Garlic, onions, peppers, sunflowers	Very high
<b>Cowpea</b>	Easy	Many soils, but does best in sandy or sandy loam soils	5.5-7.0 Does not do well at 7.5 or higher	-	Protein	-	Very low (dried)
<b>Cucumber</b>	Easy	Loam soils are best	Tolerates 5.5-7.6 Prefers 6.0-7.0	-	-	Herbs, melons, potatoes	Very high

1. The best soil for most vegetables is a loam.

Crop	Ease of saving seed	Soil type best for the crop <sup>1</sup>	pH level preferred by the crop	Average crop water needs (mm/total growing season)	Contains high levels of the following nutrients	Non-compatible crops	Perishability (very high: <2; high: 2-4; moderate: 4-8; low: 8-16; very low: >16)
<b>Eggplant</b>	Difficult or moderate with training	Sandy soils, not clay soil	Tolerates 5.5-7.0 Prefers 6.3-6.8	-	-	-	High
<b>Garbanzo beans</b>	Easy	Well-drained loam or clay loam	6.0-9.0	-	-	-	Chickpeas
<b>Garlic</b>	VPC	Sandy soil	5.5-8.0	-	-	Peas and beans	Low
<b>Gourd</b>	Easy	Many soils, but loams are best	5.5-7.5	-	Vitamin C	-	Very low
<b>Guava</b>	N/A	Many soils	4.5-8.2	-	Vitamin C (ripe)	-	High
<b>Groundnut</b>	Easy	Sandy soil	6.0-6.5	-	Protein, iron	-	Very low (dried)
<b>Kale</b>	Moderate or difficult	Many soils if well drained; prefers loam soils	Tolerates 6.0-7.5 Prefers 6.5-6.8	-	Vitamin A	Strawberry, tomatoes	High
<b>Lablab bean</b>	Easy	Many soils if well drained	4.5-7.5	-	Protein	-	-
<b>Lettuce</b>	Moderate	Sandy soil	6.0-7.0	-	-	Broccoli	Very high
<b>Lentils</b>	Easy	Deep, sandy loams; needs good drainage	Tolerates 6.0-8.0 Prefers 7.0	-	Folate, protein	-	Very low (dried)
<b>Mango</b>	N/A	Many soils	-	-	Vitamin A (ripe)	-	High
<b>Melon</b>	Easy	Sandy soil	> 5.0	400-600	-	Cucumbers, potatoes	High
<b>Moringa</b>	-	Sandy loam to loam	Tolerates 5.0-9.0 Prefers 6.5-7.5	-	Protein, vitamin C, vitamin A	-	Leaves very high, seeds very low
<b>Mung bean</b>	Easy	Sandy loam	6.2-7.2	-	Protein, folate	-	Very low (dried)
<b>Mustard</b>	Easy	Sandy or sandy loam	5.5-6.8	-	Vitamin A, vitamin C	-	Seeds very low
<b>Okra</b>	Easy	Sandy soil	6.5-7.6	-	Folate	-	High
<b>Onion</b>	Difficult	Sandy soil	5.5-6.8	350-550	Vitamin C	Beans, peas, sage	Low (dry)
<b>Papaya</b>	-	Many soils	5.5-6.6	-	Vitamin A (ripe), folate	-	High

Crop	Ease of saving seed	Soil type best for the crop <sup>1</sup>	pH level preferred by the crop	Average crop water needs (mm/total growing season)	Contains high levels of the following nutrients	Non-compatible crops	Perishability (very high: <2; high: 2-4; moderate: 4-8; low: 8-16; very low: >16)
<b>Pea</b>	Easy	Clay soil	6.0-7.5	350-500	Vitamin K, manganese, thiamin, copper, vitamin C, phosphorous, folate	Garlic, onions	Very high
<b>Pepper</b>	Easy	Medium clay soil	5.5-7.0	-		Beans	High
<b>Pigeon pea</b>	Easy	Sandy soil	5.5-6.5	-	Protein	-	Very low (dried)
<b>Pineapple</b>	VPC	Sandy soil or loams	4.5-6.5	-	Vitamin C	-	High
<b>Plantain</b>	VPC	Loams	4.6-7.8	-		-	High
<b>Potato</b>	VPC	Sandy or well-drained soils	4.8-6.5	500-700		Cucumbers, melons, squash, sunflowers, tomatoes, turnips	Moderate (immature), low (mature)
<b>Pumpkin</b>	Easy	Sandy soil	5.5-7.5	-	Vitamin A, zinc (seeds)	Potato	Low
<b>Radish</b>	Easy	Sandy soil	6.0-7.0	-		Potato, hyssop	Moderate
<b>Regionally important/traditional greens</b>	Easy	-	-	-	-	-	Very high
<b>Soybean</b>	Easy	Well-drained soil, but not sandy soils	6.0-7.0 Ideal 6.3-6.5	450-700	Protein, zinc	-	Very low (dried)
<b>Spinach</b>	Moderate; some varieties need long days to produce seed	Many soils, but prefers sandy loam	Tolerates 6.0-7.5 Prefers 6.4-6.8	-	Zinc	-	Very high

Crop	Ease of saving seed	Soil type best for the crop <sup>1</sup>	pH level preferred by the crop	Average crop water needs (mm/total growing season)	Contains high levels of the following nutrients	Non-compatible crops	Perishability (very high: <2; high: 2-4; moderate: 4-8; low: 8-16; very low: >16)
<b>Squash</b>	Easy	Sandy soil	5.5-7.0	-	-	-	High (summer); low (winter)
<b>Sweet potato (orange)</b>	VPC	Many soils; prefers fine sandy loam or well-drained clay loams	Tolerates 4.5-7.5 Prefers 5.8-6.2	-	Vitamin A	-	Low
<b>Taro</b>	VPC	Clay oil	?	-	-	-	Low
<b>Tomato</b>	Difficult or moderate with training	Loams and sandy loams; not clay soil	Tolerates 5.5-7.5 Prefers 6.0-6.8	400-800	Vitamin C	Broccoli, Brussels sprouts, cabbage, cauliflower, corn, kale, potatoes	Very high (ripe); high (partially ripe)
<b>Watermelon</b>	Easy	Many soils, but prefers sandy loams	5.5-6.5	-	-	-	High
<b>Yam</b>	VPC	Many soils, but prefers a sandy clay loam	5.5-7.0	-	-	-	Low

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