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Resilience and Economic Growth in the Sahel – Enhanced  
Resilience

## **A Manual for Oasis Gardens**

Principles - Steps - Advice - Experiences



March 2021

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## Contents

List of Abbreviations .....	i
Preface – A Systems Approach .....	1
1. Introduction: The importance of gardening.....	6
2. Establishing an Oasis Garden .....	8
2.1 Conditions for successful Oasis gardens.....	8
2.2 Forming Groups .....	9
2.3 Group networks and access to resources.....	10
3. Site selection and preparation .....	11
3.1 Bio-Reclamation of degraded land .....	12
3.2 Establishing the seedling nursery .....	12
3.3 Planning and preparing beds.....	13
3.4 Compost Production.....	14
3.5 Sowing and Protecting Garden Beds.....	15
3.6 Watering and irrigation .....	17
4. Maintaining the Oasis Garden.....	20
4.1 Rotation .....	20
4.2 Integrated Pest Management.....	21
4.3 Seed sourcing and multiplication .....	23
5. Post-production: Processing and preservation.....	24
6. Nutrition .....	25
6.1 Training suggestions for implementers .....	26
6.2 Training for garden participants .....	26
7. Planning for market.....	27
7.1 Training for market production .....	27
7.2 Linking groups to markets .....	28
8. Monitoring gardens and ongoing support .....	28
Appendix A: Roles of the executive bureau.....	30
Cash management books .....	32
Appendix B: List of resources.....	33

## List of Abbreviations

BDL	Bio-reclamation of degraded lands
CBSP	Community-Based Solution Provider
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
INRAN	National Institute of Agronomical Research of Niger
IPM	Integrated pest management
MFI	Micro-finance institution
OFSP	Orange-fleshed sweet potato
NGO	Non-governmental organization
RISE	Resilience in the Sahel Enhanced
USAID	United States Agency for International Development
VSLA	Village savings and loan association

## Preface – A Systems Approach

This manual presents the proven approaches, best practices, and lessons learned of the gardening activity used to achieve food and nutrition security and enhance community resilience in the intervention zones in Burkina Faso and Niger by the **USAID Resilience and Economic Growth in the Sahel -- Enhanced Resilience (REGIS-ER)** Activity. REGIS-ER implemented various gardening approaches such as Oasis Gardens, homestead gardens, and community gardens.

REGIS-ER was a seven-year activity (2013-20) of the Resilience in the Sahel Enhanced (RISE) portfolio, supported by USAID. It aimed to increase the resilience of chronically vulnerable populations in marginal agro-pastoral areas in Burkina Faso and Niger by strengthening livelihoods, governance and the health and nutritional status of communities. Key interventions include:

- **Sustainable livelihoods:** Diversifying economic opportunities, through agricultural and animal production and marketing, access to financial services.
- **Strengthened governance:** Regional capacity building, planning, natural resource management and land use, disaster and conflict risk management.
- **Improved health and nutrition:** Access to potable water, capacity development of community health workers, training for nutritious local food consumption and gardening, behavior change communications for health actions, and latrine and well construction.

The Oasis Garden approach adopted by REGIS-ER takes a systems approach, working on several aspects of the whole system to ensure that the garden activity is successful and sustainable. The key elements are Working Together, leveraging key entry points, group formation including savings and loans, and ensuring land tenure to justify the investment in building and maintaining soil fertility.

### Working Together

In integrated development programs, such as REGIS-ER, the garden gate offers an entry point to systems around environment, society, and food. While commonly assumed to be an activity for income generation and nutritious diets, the garden can also be used to support multi-stakeholder, multi-dimensional, regenerative interventions at the systems level. Framing gardening activities within a broader set of development goals and systems creates an opportunity to leverage synergies and prevent imbalances that may lead to negative unintended consequences.

NCBA CLUSA adopts a human centered, community-led methodology, Working Together, that engages the whole system and the connections between community, environment, and markets. The Working Together approach starts with analyzing the system. Within the Oasis Garden system, we need to understand the trade-offs between impacts to people, profit and planet, often referred to as the triple-bottom line. When any one goal is pursued out of balance with the others, unintended consequences are likely to result, often out of the sight of implementing organizations. For example, the use of water for growing vegetables may be to the detriment of water users for livestock production. A systems approach for gardening acknowledges the trade-offs between the different goals

#### Working Together

NCBA CLUSA's multi-stakeholder engagement methodology, Working Together, brings local actors together to create a shared vision, identify a common objective, and then execute an action plan to achieve them. This systems approach to development engages all actors within that system to work together. Our facilitative role ensures that the process is led by the community, not dictated by the project. From our first meetings with stakeholders, the Working Together methodology leverages local resources, builds local capacity, and targets strategic leverage points for intervention. When the project ends, the community is left with the skills, resources, will, and power to drive their own development.

within the triple-bottom line and seeks to maximize the benefit to all three – and to do no harm in the process.

As part of a system, horticulture and garden activities involve group governance, capacity strengthening, environmental regeneration, and social and behavior change. Applying the Working Together approach, we can ensure the effective implementation and transfer of ownership that is critical to ensuring the sustainability. The following sections provide some examples of high-level general theories of change that may be used and adapted in the design of garden interventions.

### **Project Entry Points**

**Oasis and/or Community Gardens and Homestead Gardens** are interventions REGIS-ER has implemented to build resilient and sustainable communities. The main aims of the Oasis Garden activity are: 1) training for optimal use of gardens and to provide quality produce (from a nutritional perspective), and 2) tracking performance of project gardens to provide a model for viable approaches. The focus here is on economic, technical, and organizational aspects of gardens. REGIS-ER worked with affinity groups of women, usually women of reproductive age, and linked the gardening activity to other interventions, such as nutrition behavior change or savings and loans. The integrated approach allowed the project to reach women through one platform with multiple resilience building initiatives that reinforced each other.

**Community-Based Solution Providers (CBSPs):** CBSPs are last-mile entrepreneurs who provide products and services to the communities, making both inputs and advice accessible and affordable. For horticulture, these include vegetable seeds, fruit and agroforestry tree seedlings, orange-fleshed sweet potato cuttings, and other inputs or services such as phytosanitary inputs, biological pest control, fertilizer or compost. CBSP strategic actions include:

- Promotion of nursery owners: technical refresher training, technical assistance to develop production plans for each nursery owner.
- Promotion of other horticulture CBSPs: meetings, technical and marketing training, including training by suppliers, training on entrepreneurship, investment support.
- Marketing and tracking of sales: radio, signboards, flyers, client base monitoring.

The last-mile entrepreneurs can facilitate access to markets for garden supplies as well as providing a market outlet for the resulting surplus, creating a win-win scenario.

### **Group Formation**

Community gardens are often used as a program entry point in gardening and broader resilience interventions. Forming a group puts people first, helps build social capital so that they may tap a network, and advocate collectively. As an illustration, in many areas neighbors are often the first stop in times of need. As a common coping mechanism, households experiencing hardship may rely on their neighbors to get to better times by sharing food or lending money or other resources. However, in many instances the shock that has created the hardship may be widespread, affecting the whole community, region or beyond. When the hardship affects a broader swath of society, neighbors are challenged to support neighbors, resulting in a breakdown of customary coping strategies. If effective groups have been established, they may be able to support their members by drawing on saved assets, linking to another group that has not been affected by the shock, or link to the local or regional government authorities to access assistance.

Group formation is foundational to many development outcomes. A successful group can identify and solve problems, link to local and regional networks, and access resources for the continued support of

group activities. Pairing the group formation with gardening activities helps leverage the gardening activity to broader development goals, while contributing to the sustainability of the garden.

Adhering to key principles for group formation (see section 2.2), when combined with a successful gardening platform, can create synergies that are intermediary to several systemic impacts. Cooperation for mutual benefit is most effective when the benefit is tangible. This benefit can come from the garden itself, or through the social capital acquired as a member of the group. The garden is an entry point to broader systemic change that puts people first. However, it is important the garden is a success to ensure trust in the program approach.

### Village Savings and Loan Associations

Group formation in the garden can be complemented with Village Savings and Loan Associations (VSLAs). While VSLAs play an important economic role, they are also valuable for building social capital and cooperation. When a VSLA is formed through the community garden, the revenue from the garden can be set aside by the members. Annual payouts can then support investment in the garden or another economic activity or investment of the individual members' choosing. Short term loans to VSLA members also help them cope with shocks, or meet other household needs, such as school fees. Investing in garden infrastructure, as one example, can improve the success of the garden intervention. These investments also have knock-on effects to the local economy, highlighting the benefits of a systems approach. The group may be targeted to include women, youth or other vulnerable and/or marginalized populations. For example, if the garden is established on a parcel of land provided by the community, it can involve young people or vulnerable women who otherwise have no access to land. The group governs itself and determines how and when payouts or special loans may be made.

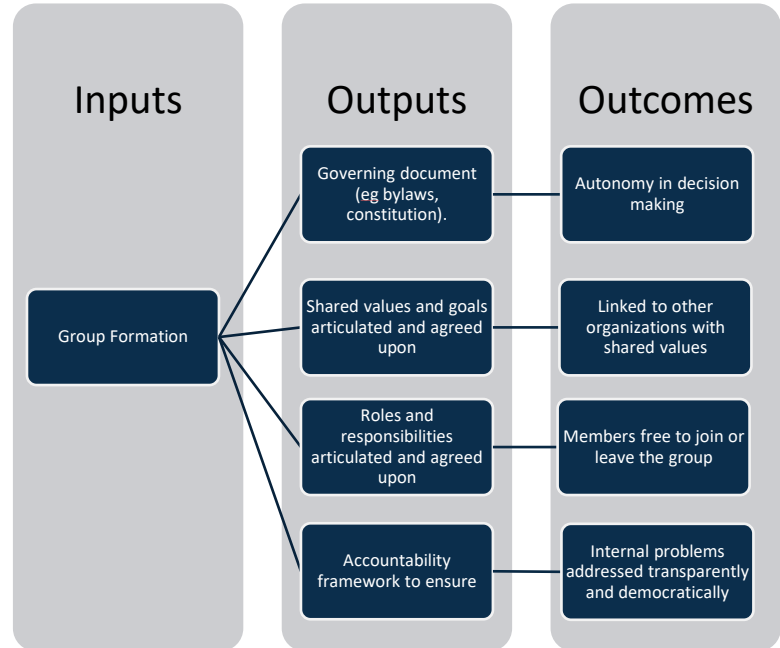


Figure 1. Theory of Change for Group Formation. The outcomes may be linked to a several impacts based on context and the objectives of the program.

The keys to a successful VSLA overlap considerably with successful group formation: democratic governance, transparency, and a shared vision for their activity. Group formation and VSLAs may be easily layered in a program and are often the first activities to begin because they provide immediate tangible benefits.

### Land Tenure and Rehabilitation

A critical component of using gardens as an entry point to community development is that those who work the gardens are stewards of the land. Soils in many developing countries are degraded to the point where agriculture activities are not possible. With investments of time and improved techniques, degraded lands may be restored. However, to justify this investment, garden groups need to be assured that they will continue to maintain access over the land through recognized of tenure.

As discussed in the group formation section, the collective voice of the group can effectively advocate for tenure. The site selection must address the issue of ownership – before the ground is broken. If the land is being offered by the community or an individual member of the community, the attribution must be witnessed and publicly declared. A formal certificate of attribution or title issued by a land commission or local government is a better guarantee. Without solid tenure of some sort, the long-term sustainability of the garden will be at peril. Often an individual or community will be more willing to allocate degraded lands, but without tenure, the own may reclaim the land once its fertility is restored.

Adoption of techniques described in this guide, particularly the bio-reclamation of degraded lands, provide a blueprint to restore productivity

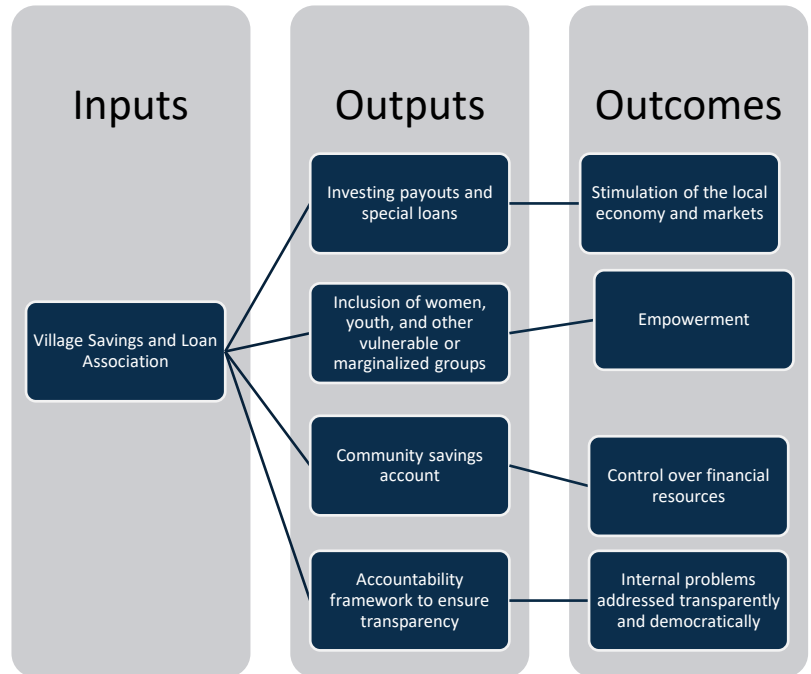


Figure 2. Theory of Change for Village Savings and Loans Associations. The outcomes may be linked to a several impacts based on context and the objectives of the program.

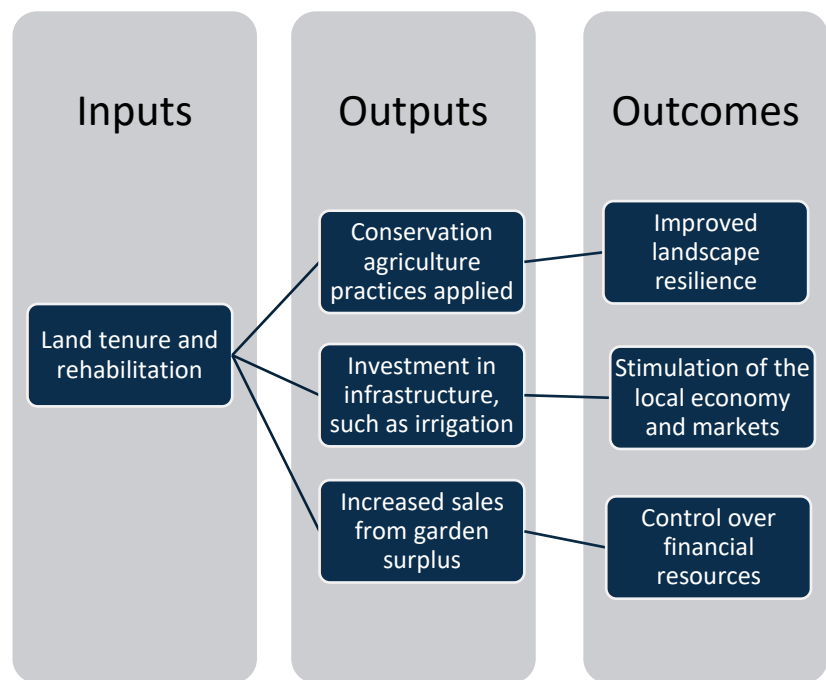


Figure 3. Theory of Change for Land Tenure and Rehabilitation. The outcomes may be linked to a several impacts based on context and the objectives of the program.



of degraded lands. In addition to creating a more resilient landscape, the bio-reclamation practices result in greater and more reliable yields that have greater nutritional content.

### Conclusion

The adoption of the multi-pronged strategies has broad reaching impacts across the system. Resilient landscapes can support economic resilience for agriculture enterprises, while also promoting personal resilience through the production of more nutrient-dense crops. The garden provides an entry point to affect systems level change. The theories of change that have been presented are examples of maps that may be followed. The garden should not be viewed as an end to itself, but rather the catalyst that can help to facilitate numerous outcomes associated with community resilience.

The content of this guide has been honed over the past seven-years in the very challenging Sahel environment. The successes should serve as a model for future development initiatives.

Before launching a collective garden, especially one that is designed to be profitable, it is necessary to meet the following conditions:

- There must be enough, good-quality water near the garden.
- The soil must be suitable for market gardening.
- The crop species must be adapted to the climatic conditions of the area.
- There should be sufficient labor.
- There should be demand for and market outlets for produce.
- The operation must be financially viable, and the group must be able to ensure management with integrity.



## 1. Introduction: The importance of gardening

Horticulture is both an art and science that focuses on creating produce of the highest nutritional and aesthetic value. Gardening and horticulture are often used interchangeably. Horticulture is a scale-neutral pursuit with examples across the world from the smallest small-space container garden to the largest and most sophisticated controlled environment production systems. The goals of horticulture opportunities can be as varied as the production systems themselves, including income generation and economic development, but also to supplement the household food basket, education, mental wellness, and an avocation that helps to build relationships with friends and family. The goals of the pursuit will determine the types of practices that are employed. For example, a garden aiming to maximize the use of a land parcel for a diversified supplement to the household food basket, may integrate different crops, both perennial and annual – and small livestock -- into an agroforestry system. Gardens with the goal of growing for a specific market may clear the soil and grow in a highly controlled system that maximizes the use of resources to achieve economic gain. Each system has its advantages and disadvantages, and it is important to understand the trade-offs to the environment, income, health and nutrition.

Because horticulture may be adapted so easily to varying contexts, it is a good fit for resource-scarce settings. One of many ways in which horticulture is practiced is community gardening, where an organized group of community members garden collectively, sharing responsibility for example for the fencing and source of water while cultivating individual plots. Oasis or community gardening is a critical intervention in tackling food insecurity, malnutrition, and poverty. It helps to create easy access to a diverse range of fresh, nutrient-dense food.

Gardens are commonly assumed to lead to improved nutrition. This assumption has been articulated through an agriculture to nutrition theoretical framework which illustrates how gardens and their complementary interventions may positively influence nutrition.<sup>1</sup> The impact is not only derived through the vegetables produced, but also through the income and the access to diverse foods including animal sourced proteins.

### Production to consumption pathway

Malnutrition continues to be a critical issue faced by many countries worldwide, and it can lead to children's poor physical and cognitive development. Gardens and horticulture crops are thought to more likely result in nutrition impacts than cereal crop production, particularly for women and children.<sup>2</sup> Gardens typically grow nutrient-dense foods such as leafy greens, vegetables, and fruits and when consumed by the household, positively improve diet diversity.

Gardens may also influence an enabling environment for improved household nutrition. Gardening acts as a participatory behavior change opportunity by building interest and awareness of nutrient-rich foods such as fruit and vegetables. If these foods are consumed by the household, particularly women and children, they can directly improve nutritional status. Combined with the promotion of safe preservation

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<sup>1</sup> Herforth, A., & Harris, J. (2014). Understanding and Applying Primary Pathways and Principles. Improving Nutrition through Agriculture. Technical Brief Series Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) Project.

<sup>2</sup> Olney, Deanna K., et al. "A 2-year integrated agriculture and nutrition program targeted to mothers of young children in Burkina Faso reduces underweight among mothers and increases their empowerment: a cluster-randomized controlled trial." *The Journal of Nutrition* 146.5 (2016): 1109-1117.

and storage practices can offset the effects of the lean season when food is less available by smoothing consumption patterns. This leads to not just improved food security, but also nutrition security.

### **Income Pathway**

Households that are successful in their gardening campaign may even produce a surplus, which can be sold for household income. REGIS-ER primary findings, observations and program beneficiaries' testimonies indicates that gardening has been a source of increased income and economic growth for many households. The garden produce is used to feed households and improve the health of families, and the surplus is sold at the market to earn extra money. The income made by selling the surplus can, with appropriate knowledge and budgeting skills, be used to improve household resilience through expenditures on additional nutrient-rich foods, health care, school fees, income generation investment, or saved for future needs.

Despite the risk of environmental shocks such as drought, Oasis Gardens can improve resilience and support communities' economic stability.



Rabi Ousmane is one of many women whose household income has increased significantly from gardening. Rabi grows a variety of crops in the Iguéfane (Niger) Oasis Garden, such as moringa and vegetables. She uses the profits from the sale of these crops to provide other nutritious foods to her family. Rabi used to weave *tangaras*, or straw mats, to sell in the market, but this brought in very little income. She often struggled to meet the needs of her family. *“Now we can take care of our own needs and we can even take care of other’s needs,”* Rabi said. In addition to meeting the needs of her family, Rabi uses her income to reinvest in the garden to ensure that her production continues.

### **Women’s Empowerment Pathway**

Garden activities generally target women. This fits with the traditional role of women in the household economy, in which women are responsible for the non-staple ingredients that go into the stewpot, as well as barriers to access or control of land for staple (i.e., cereals) production. Gardens are often located near households or within the community, making it a convenient activity for women who may have limitations to travel because of domestic responsibilities or restrictive social norms. Gardens are, therefore, a cultural appropriate pathway to empowering women.

Garden interventions are key entry points for complementary activities such as nutrition education, literacy, numeracy and financial skills, business trainings, savings and loan, and addressing gender equity through engagement with both men and women. For women particularly, there is not enough space and time to socialize with peers, or to support and learn from each other when they are in a constant struggle to meet basic needs. Once they start working and spending time together, the garden automatically becomes that space for them to draw knowledge and empower each other.

In addition to providing that much-needed space and time for social interaction, an Oasis Garden will be a source of income. As income earners, women gain the power to be a part of the financial decision-making in their households and actively participate in promoting the wellbeing of family members.

Collective gardening also allows women to exercise leadership skills. They learn to govern and manage their activity, and to speak in public settings and discuss community economic and social issues as a



group. They strategize about how to tackle problems, and claim their right to be agents of a positive change for their households and communities



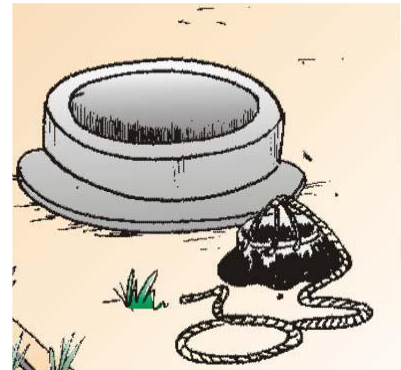
Hassiatou Abdou, a member of Albarka women’s group in Niger, learned about the mother-to-mother group from a friend at the Oasis Garden. At one group meeting, Hassiatou discovered that contaminated water can cause diarrhea, which leads to dehydration and often serious illness or death in infants and children, especially for children under 6 months of age who are supposed to be exclusively breastfed (but often are not). Through her association with the Oasis Garden, she acquired crucial knowledge on how to protect her children.

## 2. Establishing an Oasis Garden

Oasis Gardens are part of an integrated approach to improving nutrition and livelihoods outcomes, particularly for women and children. Oasis Gardens combine participatory behavior change, nutrition knowledge, improved agricultural techniques, access to markets, land tenure and governance. The integrated elements fulfill conditions for sustainability and greater success.

### 2.1 Conditions for successful Oasis gardens

- **Ensure community engagement.** As with all NCBA CLUSA interventions, Oasis Gardens must be selected by the communities as a desired activity, one that the community is willing to invest in. While establishing Oasis Gardens may require a financial or in-kind grant from the project, community cost share is required to ensure local buy-in and ownership.
- **Ensure access to water.** Availability of water is a fundamental requirement for horticulture. Often the project will need to invest in water infrastructure (irrigation, wells or boreholes). A cost-benefit analysis of each potential site is useful to establish whether the financial infrastructure investment makes sense. The cost of maintenance also needs to be factored in, as well as the ease of drawing water. The time and effort burden needs to be considered with respect to other competing responsibility of the women gardeners.
- **Assure land title for women.** The labor and resource investment in an Oasis Garden can be great. On marginal lands, the soil must often be rehabilitated to reach adequate productivity. Long-term arrangements or land title ensures that the land is not taken from the women once the soil productivity is restored.
- **Focus on group governance.** Groups that demonstrate strong governance are more likely to be sustained beyond the project. Having elected leadership, bylaws that stipulate membership dues and the enforcement of those bylaws are signs of good governance. Exercise the cooperative principle of each member having one vote.
- **Integrate with other activities.** Oasis Gardens provide both a place and an interested group for channeling behavior change or organizing other activities. Two common activities are mother-to-mother groups for nutrition and health behavior change, and VSLAs that build economic activities and strengthen resilience.



- **Provide training on planning gardens for market.** In addition to horticulture techniques, provide training on seasonal calendars and when to maximize profits on the marketplace. Seasonal calendars are useful visual aids to support this training and require basic levels of literacy and numeracy. Techniques on how to get crops early or late in the season or how to preserve them can increase profits by getting the produce on the market when they are scarce.
- **Link groups to the private sector.** NCBA CLUSA's network of CBSPs are a good complement to Oasis Gardens to ensure continued access to inputs and services at affordable rates. It is important to build the supply chain for seeds, fertilizer and irrigation. Some CBSPs can help with aggregation for getting produce to markets.

## 2.2 Forming Groups

Before entering a community, it is critical to understand the contexts and relationships. Development practitioners are outsiders, even among national staff, no matter how great they think their idea is. It is critical to get the perspective and opinions of the targeted communities, and it is important to triangulate to ensure that we are not just hearing what beneficiaries think we want to hear. The inequalities that development programs attempt to address have created incredible imbalances in power and privilege that have often been internalized by targeted communities. It is important to acknowledge this, as it can often obscure the ability to understand the context and facilitate appropriate development.

### Participant Engagement

Working Together encourages participatory methods for mapping the system. Two methodologies that help to solicit community members perspective in the planning of gardening activities are [Participatory Learning for Action](#) and community mapping.<sup>3</sup> It is important that everyone is given an opportunity to participate in gardening activities if they want. It is especially important to be inclusive of marginalized segments of the population as they are likely the most vulnerable and in need of support. The NCBA CLUSA Working Together toolkit provides tools and resources for activity co-creation, visioning and participatory planning.

### Group solidarity and leadership

Ensuring group cohesion begins with community engagement around the garden planning. In line with cooperative principles, membership is voluntary and open. Once the group is self-selected, participants should be trained on group governance. **Governance training** covers leadership roles, member responsibilities, decision-making and conflict resolution, developing a vision and mission statement, developing group bylaws, and resource mobilization. Depending in the scale of the activity and geographic range, a trainer-of-trainers model can be adopted with the elected group leaders to cascade training down to group members.

Establishing a group vision and bylaws collectively with all members is an essential step. Members of the group must agree to the membership requirements, the penalties for breaking those requirements, and members need to hold each other accountable.

Autonomy in decision-making is critical to the success of a group. The governance structure should be determined by the group itself, with each member getting one vote. A common model that is often used includes four leadership positions:

- President

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<sup>3</sup> See: <https://www.betterevaluation.org/en/approach/PRA>

- Secretary
- Treasurer
- Lead Gardener

These roles are more fully described in Appendix 9.1.

### Securing Land Tenure

Marginalized and vulnerable populations, particularly women, often face barriers to land access and tenure. The project should support negotiation for land access by women's groups. One strategy that worked particularly well is to target degraded and/or abandoned lands that are not actively used by the owners. Using restorative techniques, such as bio-reclamation of degraded lands (BDL). Through a facilitative approach the project can encourage collaboration between the women's groups, local government, and landowners. This can help the marginalized groups to have greater negotiation power and shift the conditions so that they can reap the benefits of their efforts.

In Niger, a women group's lease was expiring before finishing their activity. REGIS-ER's gender specialist, in collaboration with the project's regional teams and the various Local Development Committees, collaborated to resolve the situation. This exercise led some women's groups to renegotiate (on their own) the remaining duration of their leases, which increased from an average of 5 months to 10 years. Approximately 50 ha (44 sites) were made available to women for long-term use with project support.

### 2.3 Group networks and access to resources

Project grant funding can be used to establish the Oasis Gardens for start-up investments in fencing, irrigation, gardening materials and inputs, but the group will need an internal revenue generating plan to ensure long-term sustainability. As with all grants, even the initial start-up grant should include community contribution (cost share). An internal revenue plan is needed for the following actions:

- A reserve for garden maintenance or repairs.
- A training fund for member education.
- A guarantee fund for bank credit.<sup>4</sup>
- An investment fund for garden upgrades.

Illustrative financial resources:

- Membership dues detailed in the bylaws.
- Member fines for breaking set bylaws.
- Government or NGO grants.
- Reserves from the prior year surplus (e.g., membership dues, contributions from members for inputs or sales of produce).
- Revolving savings and loan fund (see village savings and loans below).

It should be noted that members who cannot contribute financially to the implementation of the action plan because of their level of income can contribute labor or through material (in-kind) support. While the individual share of the financial benefits may be in proportion to the members' contributions, each member shall have one equal vote in decision-making.

In some cultures, particularly those that are influenced by Islamic Law or values, it may be forbidden (haram) to charge interest.

According to a Sharia-compliant VSLA guide, contrary to the debt-based conventional microfinance (charging interest), Islamic microfinance is asset-based and recognizes that money is not an earning asset in and of itself, since money has no intrinsic worth. In other words, it is prohibited (haram) to provide or receive any fixed, predetermined rate of return on financial transactions. Profits and returns should be based on tangible assets or discrete, identifiable services, as opposed to the value of money. The goal of Islamic microfinance principles is to ensure growth with equity for social welfare and justice.

See: [SILC Field Agent Guide 5.1S-Sharia-compliant](#)

<sup>4</sup> Group-based credit should only be considered if the group is formally registered and the credit will be used for group investments in the garden, not for individual group members. When group funds are used to leverage individual member loans, it puts vulnerable group members at risk.

One of the benefits that group members will have by working collectively, rather than individually, is that they will be able to form partnerships with umbrella organizations such as federations or credit unions. This will help the groups to access funding, technical assistance, and be formally recognized. However, any decision must be made by the group through a transparent decision-making process.

### **Linking groups to financial services**

To ensure effective and sustainable implementation of Oasis Garden project, one of the program's goals should be that vulnerable producers, households and gardening groups have access to financial services. Financial services give participants the opportunity to learn how to manage and plan their finances, save, and re-invest in their gardens.

Establishing a VSLA within the group reinforces social cohesion and collaboration. It is the most foolproof and risk-free form of access to credit. Savings groups have been shown to build small enterprise and strengthen resilience, especially during times of shocks and stress such as family illness. Typically, loans are given with a transparent, clearly communicated interest rate.

In addition, the Oasis group may have an account with a local financial service provider (MFI, credit union or bank) for deposits of membership dues. The account offers a secure fund for equipment repairs or other investments needed.

### **Linking groups to suppliers**

Groups need affordable access to inputs for gardening and technical support. One way to ensure local, affordable goods and services are available to communities is through a CBSP network. CBSPs are social entrepreneurs who are identified and trained by the project and based in communities. The Lead Gardener of the Oasis Garden group can be trained as a CBSP to offer a fee-based service, not only to their group, but also to others who may want to start a group or homestead garden or may be engaged in other types of enterprise.

The CBSP approach developed by NCBA CLUSA is a variation of a last-mile entrepreneur. Similar approaches include farmer-to-farmer extension, community knowledge workers, para-vets, community health workers and village agents. A CBSP is a trusted individual, an entrepreneur based in the community who is designated and accepted by the community to facilitate access to products, services and information, and helps find solutions to problems communities face. In contrast with other market-based service provision approaches, which are sector oriented and employ agents with narrow products on offer, the CBSP has a broad focus, responding to demand and looking for opportunities to address the needs of their communities.

CBSPs are often motivated by social outcomes, and women and youth make up a significant proportion of CBSPs in any given area. In addition to making money, CBSPs seek to provide solutions, services and products to their communities. They may sell a range of products and services, including products that only allow them to break even and not make a profit so long as other products they offer are profitable and make up for that margin loss. As "social entrepreneurs", they also provide information to their clients that help solve problems (e.g., demonstrating a new crop variety, explaining the importance of hand washing to prevent COVID 19). See NCBA CLUSA's CBSP Guide for more information.

## **3. Site selection and preparation**

Water and fencing are the two most critical infrastructure needs when establishing a new garden. As we will explore, other factors, while important, can be integrated into the garden strategy. For example, soil fertility is a critical component to achieve an abundant harvest, however, poor quality soils may be rehabilitated through the BDL with immediate benefits. Incorporating trees into the garden will provide

benefits such as soil and water retention, reduction of wind erosion and evaporation, and fruit and leaves. These benefits are usually longer term. Basic fencing materials can be progressively replaced with hedges or live fences, and water and irrigation systems can be upgraded over time.

### 3.1 Bio-Reclamation of degraded land

In many cases the land allocated for communal gardening is degraded and unsuitable for productive use in its current state. Reclamation techniques are needed to rehabilitate the land for production.

Developed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the BDL involves using water-harvesting methods (demi-lune planting pits and zai holes, a technique developed in Burkina Faso); retaining or applying animal and plant residues; and planting high-value fruit trees and indigenous vegetable crops that can tolerate drought conditions.<sup>5</sup> Contour bunds can also help slow down the flow of surface water, reducing erosion and increasing infiltration. The bunds can be reinforced with grasses, and the retained silt will help build soil. These features can generally restore a degraded piece of land, but for gardening, the area of the garden beds will require intensive work to build fertility and soil structure, by digging in organic matter such as straw and compost.

Planting pits, such as zai, are low tillage techniques that allow farmers to concentrate organic or chemical fertilizer around the seed. The hole also concentrates water and enhances infiltration. Together these elements provide a better growing environment and more judicious use of resources. While zai is generally a technique for large fields for staple crop production, they can also work in garden areas of highly degraded land. Rather than beds, the garden consists of zai pockets with a vegetable crop in each pocket. This is suitable for crops such as tomato, eggplant or cassava. Zai is a conservation farming technique: more details about this and conservation farming can be found in the REGIS-ER manual on conservation farming.

Marginal land is land that has little or no agricultural or industrial value. Marginal land has little potential for profit and often has been stripped of vegetation, has poor soil and is too compact for water to infiltrate. This type of land is often a sign of overuse and desertification.

BDL sites should not be located near pasture sites as they are prone to attract grazing livestock. BDL is physically intensive work and should be undertaken as a community project with husbands and other men encouraged to assist with the process.

### 3.2 Establishing the seedling nursery

The seedling nursery is the heart of the garden. It is the space dedicated to the production of healthy and vigorous seedlings before transplanting to beds. These plants will be transplanted into their final location in the garden. The success of the garden will largely depend on the care given to plants in their early stage of development nursery.

Materials and Equipment Needed:

- Watering cans, water storage, such as barrel or cistern.
- Hoes, shovels, wheelbarrows, pickaxes, rakes, machete.
- Construction materials for sowing and transplanting (wooden pole, mats, nets).
- Organic fertilizers and phytosanitary products and treatment devices.

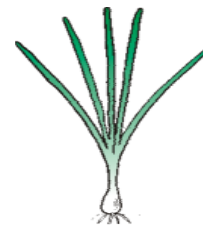


<sup>5</sup> <https://www.icrisat.org/bioreclamation-of-degraded-lands-restoring-roots-rights-and-resilience-in-niger/>



The seedling nursery should be flat, square or rectangular, well-drained soil, in full sunlight protected from wind. It should be in the garden area, near the beds where the seedlings will be transplanted. (The young seedlings are fragile, and they should not be exposed to sunlight and drying winds, or handled too much, between the nursery to the bed.)

Vegetable crops that are usually started in nurseries include tomatoes, eggplant, peppers, onions, garlic and lettuce. These should be sown in the seedling nursery four to six weeks before transplanting. Consider spacing when sowing to avoid disturbing the roots of neighboring seedlings when transplanting. Water regularly (should not be too wet, but not dry either), and cover the surface of the nursery with a net or straw to help keep moisture. In some locations, it is also necessary to protect seedlings from lizards or other pests with mosquito netting.



### 3.3 Planning and preparing beds

Establishing gardens requires knowledge of the site. For example, if the site commonly floods during periods of rain, raised beds may be used to keep the garden from being waterlogged. If the location is arid, the beds should be wide trenches a few centimeters below ground level to prevent drying. The soil should be loosened and worked with organic materials to at least 40cm of depth to give space to grow – especially for root or tuber crops such as carrots or potatoes.

Once the soil has been excavated, mix compost with the soil before filling back in. For raised beds, dig on either side of the planned bed area and pile the soil in the middle, incorporating the compost as you go. Dimensions of beds vary widely but the typical size is about 9 meters long and 1.1 meters wide, with paths between beds of 0.6 meters.



### 3.4 Compost Production

In market gardening, organic or chemical fertilizer helps to maintain the health of the plants. But there are several benefits of using compost:

- Locally produced compost can be less expensive than chemical fertilizer.
- Compost improves the structure of the soil for greater water absorption and retention and better root development.
- It promotes biological activity of the soil that increases the nutritional exchanges between the soil and the plants and reduces the risks of attack by pests.

#### Equipment needed:

Wheelbarrows, shovels, watering cans, pickaxes, hoes, boots, rakes, measuring tape, pitchforks, masks, cutters, black plastic.

Compost is made from plant residues and animal waste. Note only excrement from animals may be used. Meat, bones, or other animal parts are not recommended unless they can be properly ground and dried for proper decomposition.

There are two ways of making compost: pit compost and heap compost.

Pit compost is a technique that uses a pit to facilitate the decomposition of organic debris to which certain mineral materials have been added. Heap composting takes place in the open air. The technique consists of piling successive layers of plant residues, decomposable household waste and manure followed by abundant watering. The National Institute of Agronomical Research of Niger (INRAN) recommends mixing organic debris with successive layers of plant residues, decomposable household waste, and manure on a flat soil surface followed by abundant watering. This method prevents the pile from drying out and helps to encourage quick decomposition.

Compost maintenance is extremely important:

- The first turning of the compost, which takes place 15 to 20 days after its start, ensures that the topmost layer becomes the bottom layer. Turning serves to mix the organic materials initially put in homogeneous layers, to aerate the compost pile, and to provide additional water to facilitate decomposition.
- The second turning will take place one month after the first turning and repeats the same process.

#### Pit Compost

- Locate the pit near a water point, but at least 20m distant to avoid contaminating the water point.
- Dig the pit to a depth of 1m, length 3m and width 2m.
- Lightly water the bottom of the pit and spread a thin layer of ash to protect the pit from termites.
- First spread corn stalks (better if cut into small pieces) forming a layer of 20 to 30 cm, or about 15 wheelbarrows worth of cornstalks. Water heavily (about 150 liters of water or 15 watering cans).
- Spread a layer of easily decomposable materials (cattle manure) 10 to 20 cm thick, or about 10 wheelbarrows, add and turn in the existing soil with a spade or hoe, and water (150 liters of water or 15 watering cans).
- Then place a third layer, 20 to 30 cm thick, of fine plant materials (dry bush straw or millet glumes), water heavily (150 liters of water or 15 watering cans) and turn into the soil.
- Repeat the same process of successive layers 2 to 3 times to fill the pit.

- Cover carefully with old mats, black plastic, or palm fronds to conserve moisture.

Only open the pit to provide water during the first and second turning of the compost. The compost should always be covered to better conserve heat and humidity.

The compost is ready after two to three months and must be used immediately.

### Heap compost

- Collect manure, locally available organic matter (droppings, grasses, tree leaves), loamy soil and organic household waste (no animal wastes).
- Sort by separating household wastes into organic matter and non-organic debris (plastics, pieces of iron glass, etc.). Discard the non-organic waste.
- Crush the organic remains to facilitate decomposition.
- Moisten to facilitate the composting process.
- Let the mixture decompose for four weeks, turning every 10 to 14 days.
- Water the compost after each turning.
- Cover with a tarp, old mats or palm fronds to conserve heat and humidity.
- The compost is ready to be used after two to three months of fermentation.



Compost from pits or heaps can be sifted to remove larger undecomposed bits before adding to the garden bed. Compost is also an excellent soil amendment for staple crop production!

### 3.5 Sowing and Protecting Garden Beds

Provided there is adequate water, gardening is possible year-round. The appropriate crops and varieties must be selected for each season: cool dry season, hot dry season, and rainy season. Crops that are susceptible to heat, such as leafy vegetables, are best grown in the cool dry season. Only hardy crops are suited for the hot dry season, unless the garden beds can be abundantly watered. Rainy season is suited for most crops, but gardening competes with the staple crop production (especially where labor is scarce) and so gardening should only concentrate on high-value vegetables. The choice of crops depends on several factors:

- Food habits and preferences
- The type of target market
- The climatic conditions of the area
- Potential income from products.
- Other goals

**Table 1. Common Garden Crops**

Plant Family	Vegetable
Carrot Family (Apiaceae)	carrot, celery, parsley, parsnip
Goosefoot Family (Chenopodiaceae)	beet, spinach, Swiss chard
Gourd Family (Cucurbitaceae)	cucumber, muskmelon, pumpkin, summer squash, watermelon, winter squash
Grass Family (Poaceae)	ornamental corn, popcorn, sweet corn, (sorghum, millet, rice)
Mallow Family (Malvaceae)	okra, hibiscus, (cotton)

Mustard Family (Brassicaceae)	broccoli, Brussel sprouts, cabbage, cauliflower, Chinese cabbage, collard, kale, kohlrabi, mustard greens, radish, rutabaga, turnip
Nightshade Family (Solanaceae)	eggplant, pepper, potato, tomato
Onion Family (Alliaceae)	chives, garlic, leek, onion
Pea Family (Fabaceae or Leguminosae)	bush bean, kidney bean, lima bean, pea, pole bean, soybean, cowpea/niébé, peanut/groundnut
Sunflower Family (Asteraceae)	endive, lettuce, sunflower

Transplanting or direct-sowing seeds in beds must follow guidelines for spacing. Some crops are sown in rows (in furrows), others in mounds (such as sweet potatoes Cucurbitaceae). The spacing between seeds within a furrow, and between rows or mounds must be sufficient to allow for the plants to develop. Root or tuber crops must be spaced enough to allow the underground growth without constraint from neighbors. Crops that are too close will be competing for sunlight, and they will invest more energy in producing leaves than fruit: they may look lush, but the harvest will be disappointing.

Sowing seeds is simple but here are some tips and tricks to make it easier:

- **Sow at the proper depth.** In general, plant seeds at a depth two times the seed's diameter, no deeper. Some seeds only need to be pressed into the soil surface, as they need more light to germinate. For seeds at two or three times the depth, poke individual holes for seeds or create a furrow.
- **Pay attention to seed spacing.** You can plant lettuce, radishes, carrots, and other small seeds densely, and then thin them to the correct spacing when the seedlings are small. In general plan to sow some extra seeds, since not all seeds germinate.
- **Plant in defined rows;** do not scatter widely. It is easier to keep weeds down between rows and identify seedlings from weedlings. (Weeds do not usually grow in rows!) Often, rows are spaced about a 30 cm apart.
- **Firm the soil** once seeds are sown. This ensures good contact between seed, soil and moisture.
- **Water new seeds gently** or you will wash those seeds away or cause them to drift together. Use a fine, gentle mist to moisten the soil. (An advantage of drip irrigation is that it is gentle.)
- **Prevent soil crusting.** Weak seedlings (such as carrots) can struggle to break through the soil surface if a hard crust forms. After covering seeds with soil, add a thin layer of fine mulch or compost to help prevent crusting.
- **Mound vining plants.** When direct sowing large vining plants such as squash, melon, and cucumber, consider planting them on a hill or mound. Each hill should be spaced 1.3 to 3 meters feet apart. Plant 4 to 6 seeds in a circle in 10 cm intervals on each hill. Thin when seedlings have 2 or 3 leaves. Remove all but 2 to 3 large, healthy, well-spaced plants per hill. More than 3 plants per hill will lead to crowding, greater chance of disease, and lower yields.
- **Mark the spot** where you planted your row of vegetables. It is very easily to forget, especially when you are trying to differentiate between seedlings and weeds. Use a stick with a label or mark the spot with the empty seed packet.

Table 3: Quantity of seeds required per hectare

Crops	Needed seeds in kg/ha	Minimum germination (%)	Germination duration (in days)	Production method and duration in nursery (days)
Okra	5	70	6	Direct sowing
Lettuce	0.6	75	3	Nursery (21)
Onion	5	70	6	Nursery (45)
Watermelon	5	75	6	Direct sowing
Hot pepper	0.35	65	14	Nursery (40)
Sweet pepper	0.3	65	14	Nursery (40)
Tomato	0.35	75	6	Nursery (30)

### Fencing

Fences are an important component of the gardens as they protect the gardens against animals and wind. Fences may be made of local materials such as woven straw, more permanent wire mesh or a living fence (hedge). Some fences are made from thorny branches, which are good at catching debris in the wind and making a denser barrier, but we do not encourage cutting precious thorn trees. The wire mesh fence has a useful life of 5-10 years and is effective after installation. A live fence will be effective indefinitely with some pruning, but it will require time to for establishment. A living fence also has the benefit of acting as a wind break, which will reduce erosion and evaporation. A live fence can be planted when a less durable thatched fence is installed, providing both immediate and long-term protection. Fruit trees or moringa may also be incorporated into the live fence to provide an additional source of food or income.



### 3.6 Watering and irrigation

Water is the essential element for a successful garden. Without water, the garden will not grow. Water that is scarce or hard to obtain (e.g., in very deep wells) will create unsustainable burden for the gardeners, and possibly conflict with other water users (for domestic purposes, brick-making or livestock). The water flow or recharge rate should be estimated before beginning a garden. A 10m<sup>2</sup> bed will require approximately 100 liters of water per day – depending on season and soil conditions. The frequency may be reduced for deeper watering, such as flood irrigation, or during the cool season. But for purposes of calculating water availability, a good rule of thumb is 100 liters per 10m<sup>2</sup> per day.



There are several factors that must be considered when deciding on irrigation infrastructure. For gardens, the soil should remain humid, but not saturated. There should never be standing water in the garden. It will take some practice to determine the frequency and amount of irrigation based on the local soil conditions and technology that has been selected.

#### Manual watering

This irrigation system requires direct application of water via watering cans. This is a lot of work and therefore limits the area that can be cultivated. There is also a lot of water loss, but this technique requires the gardener to visit every bed and spend time looking at the crop. Activities, such as scouting



for pests, weeds or a need for thinning can be done at the same as watering, which may help save time in the long run.

To facilitate manual watering, wells can be equipped with a solar pump to haul water to the surface, or a California system can help distribute the water to cisterns closer to the beds in a large collective garden.

### **Flood irrigation**

Flood irrigation is common in many low-lying areas near a river or pond. For this method, water is brought through canals or pipes to the plots. When one canal is full, the water pours into the next and so on. This method requires significant land development work (pump, pipeline, leveling) and is practiced on heavier soils such as rice paddy fields. Flood irrigation is only recommended in situations that fulfill the conditions: abundant source of water, relatively flat lay of the land, soils with more clay content. This method wastes a lot of water due to evaporation and infiltration into the canals. Additionally, the weight of the water in the garden beds can compact the soil making it difficult for the plants roots to grow. However, the flood irrigation can water large areas with relatively little effort. It is often used for water-thirsty plants such as onions.



### **California Irrigation System (Ségué Bana)**

Distribution by Californian network is based on conveying water via buried PVC pipes to distribution points located around the garden. Its principle is practically the same as that of furrow irrigation; the only difference here is that the distribution passes through PVC pipes, underground, which means that there is less waste. The distribution points can be spigots or direct irrigation into garden beds, fed by a pump from the central source. Another model is to draw water and stock it in a central cistern, linked by the pipe network to other cisterns. Since water finds its level, all the cisterns will fill with the central point. Water can be drawn from a cistern closer to the garden bed and watered with a can. Filling this system can be arduous, and it will be easier with a motor-pump, but the cistern system allows for water to be stocked for use whenever convenient. The California system is relatively inexpensive to install, uses easily available materials. It is easy to maintain and can be installed in a modular layout that can be expanded over time. The buried pipes are protected from sunlight or being stepped on.



*Photo credit: Sheladia Associates*

### **Sprinkler irrigation**

Distribution by pipes instead of open channels offers many advantages, such as saving water (reduced loss from evaporation) and the possibility of covering greater distances between fields and water sources. But the most striking thing is the use of pressure in the pipes to spread the water in the fields. Sprinklers can spray the water evenly, and the direction and distance can be adjusted with pressure nozzles. The irrigation is easy to manage (by opening a simple valve). Sprinkler irrigation requires much less work, but the equipment is much more expensive, and a high-pressure source is a prerequisite. The

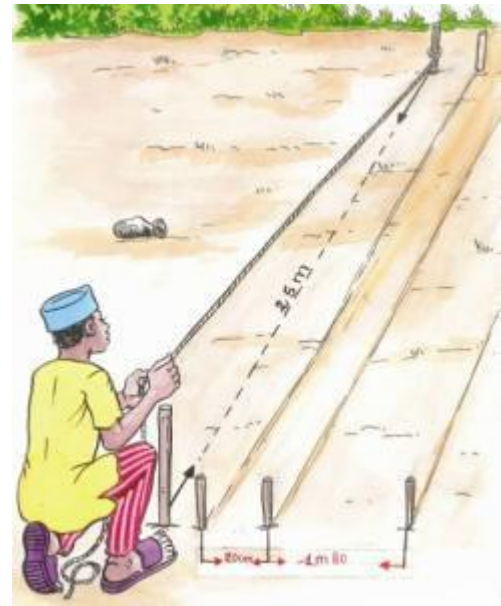
other disadvantage of sprinkler irrigation is loss due to the water aerosol evaporating or taken away by the wind during operation, as well as inefficiency when space between beds is watered unnecessarily. The system can also increase phytosanitary problems caused by damp leaves. This is not the most eco-friendly irrigation technique, but it can enable very large-scale production.



### **Drip irrigation**

The drip irrigation is a piping set-up that delivered droplets of water to the base of the plants. The advantages of drip irrigation are mainly the efficient use of water, providing plants the water they need without spreading water where it is not needed. Water is brought to each plant according to the quantity, duration and location determined by the gardener. Once the tubing is laid down, its operation requires little effort (only monitoring). The cost of a system can be quite high depending on the materials. There are low-cost systems available, but the more durable materials can be costly. The drip irrigation system will not function well if there is silt or sediment in the water, as the pressure heads will clog.

Since water is concentrated at the pressure head, the humidity of the soil gradually decreases towards the periphery. Conversely, the aeration of the soil decreases from the outside towards the center. The salts are continuously leached from the center to its outer edges. Consequently, roots are concentrated where these three parameters are close to their optimal level. Drip irrigation works well for upright plants that bear abundant fruit, such as tomatoes, eggplant or peppers. It also works for potatoes, with tubers around the base of the plant. Drip irrigation is less effective for squashes and other crops that vine out.



Drip irrigation has many advantages over other irrigation methods, leading to a significant improvement in crop performance (yield and quality).

- The distribution of water in the field is uniform.
- Water is brought directly to where it is needed, at the level of the roots.
- The quantity and duration of irrigation are highly controlled to keep the aeration and humidity of the soil at their optimum level.
- Fertilizer application can be easily done by the irrigation system, directly at the roots.
- The risk of leaf diseases is reduced due to the low humidity in the foliage (compared to sprinkler irrigation).
- The efficiency of the system for water use is far superior to other irrigation methods.

**Table 2: Illustrative investment and revenue (US\$) of different models in Niger**

Type of system	Traditional	Market Garden			
	500m <sup>2</sup>	Household 80m <sup>2</sup>	Commercial 500m <sup>2</sup>	Grouped 10x500m <sup>2</sup>	Communal 5000m <sup>2</sup>
Drip irrigation system	\$0	\$24	\$300	\$3,000	\$2,500
Reservoir	50	56	300	560	2,000
Well or borehole	160	30	160	160	160
Pump	335	30	335	335	335
PVC	33	10	33	792	60
Work tools	170	48	173	651	651
Fence	70	25	70	249	226
Start-up cost	818	223	1,371	5,746	5,932
Annual operating cost	665	98	547	5,094	5,094
Gross income per year	\$1,323	\$292	\$1,824	\$18,235	\$18,235
Reimbursement period (year)	1.2	1.2	1.1	0.4	0.5

## 4. Maintaining the Oasis Garden

Soil health is the foundation of productive farming practices. Like children, gardens need good nutrition. Fertile soil provides essential nutrients to plants. Physical characteristics of soil structure and aggregation allow water and air to infiltrate, and roots to explore. Soil quality is the capacity of a specific kind of soil to sustain plant productivity, maintain or enhance water and air quality, and support diverse fauna including human health and habitation. Several factors determine soil quality including fertility, organic matter composition, texture, compaction, water holding capacity, biological activity, and soil conservation. Tilling will break down natural structure and eventually cause compaction, while certain plants will draw nutrients and leave the soil poorer. It is important to restore and preserve soil health through by working in organic materials for structure and nutrients, rotating crops or inter-cropping to ensure that specific nutrients are not over-absorbed and periodically restored, and reducing the reliance on chemical pesticides and fertilizers. Beds should be manually weeded and the crust at the surface should be broken with a hand-spade to facilitate water infiltration aeration.

### 4.1 Rotation

Rotation refers to an agriculture practice that entails changing the planting location of families of crops with the garden every season.

The two fundamental principles of rotation are:

1. Support soil health by rotating crops with different nutrient requirements. For example, certain vegetables such as onion and carrots grow poorly on fertile soils where compost has been recently applied, whereas other crops such as tomatoes, okra, lettuce grow very well after a compost application.
2. Management of pests and diseases: Growing tomatoes or other crops of the Nightshade family season after season can result in diseases or insects to build up in the soils. Rotating other crops in the plot will break the cycle. This is true for onion family crops as well: onions, garlic, leeks, and chives.

Crop rotation makes it possible to reduce by more than half, the use of phytosanitary products whose doses and methods of application are often very poorly controlled by producers. Knowing the families helps to limit the risks and to better manage the operation. It allows producers to have broad information on the succession of different vegetables in the same plot.



- Vegetables from the same family have almost the same diseases.
- Vegetables from the same family should not follow one another on the same plot.
- Vegetables from the same family have almost the same land use patterns.

Deeply rooted crops, such as tomatoes, beets and carrots will break up the soil and draw nutrients from deep in the soil, bringing them to the surface for use by shallow-rooted crops in the following season. Heavy feeders, such as corn, lettuce, tomatoes, and cucumbers use up a lot of nitrogen. Give the soil a rest by planting carrots, potatoes, beets, or onions. Nitrogen can be natural restored by planting legumes which harbor nitrogen fixing bacteria in their roots. (Do not pull up the roots after harvesting but leave them to decay so the nitrogen is available for the next crop.)

According to the Old Farmer's Almanac, rotations should follow this order: Alliaceae, Leguminosae (can be planted with Alliaceae), Brassicaceae, Solanaceae, Umbelliferae, Cucurbitaceae, Chenopodiaceae. Other crops, such as basil, corn, lettuce or okra, can be rotated in at any point in the cycle.<sup>6</sup>

### Companion Planting

There are plenty of good reasons to plant certain crops together:

- **Deterring pests:** Certain plants act as insect repellents. For example, garlic's odor is unappealing to many pests.
- **Attracting beneficials:** Some plants also attract beneficial insects. For example, borage (*Borago officinalis*) attracts pollinating bees and tiny pest-eating wasps.
- **Shade regulation:** Large plants provide shade for smaller plants in need of sun protection. For example, corn shades lettuce.
- **Natural supports:** Tall plants, like corn and sunflowers, can support lower growing, sprawling crops such as cucumbers and peas.
- **Improved plant health:** When one plant absorbs certain substances from the soil, it may change the soil biochemistry in favor of nearby plants.
- **Improving soil fertility:** Some crops, like beans, peas, and other legumes, help to make nitrogen more available in the soil. Similarly, plants with long taproots, like burdock, bring up nutrients from deep in the soil, enriching the topsoil to the benefit of shallow-rooted plants.
- **Weed suppression:** Planting sprawling crops like potatoes with tall, upright plants minimizes open areas, where weeds typically take hold.

## 4.2 Integrated Pest Management

Integrated pest management (IPM) is a holistic set of tools that can be used to solve pest and disease problems in vegetable crops. Using IPM involves both eliminating existing pests and diseases and assessing environmental factors. IPM involves:

- Pest identification
- Monitoring and assessing pest numbers and damage
- Guidelines for when management action is needed
- Preventing pest problems
- Using a combination of biological, cultural, hand or mechanical and chemical management tools
- After action is taken, assessing the effect of pest management.

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<sup>6</sup> <https://www.almanac.com/video/how-rotate-your-vegetable-crops>

It is important to be aware that all crops are prone to pest and diseases. However, their sensitivity varies, which means that they require different level of attention and monitoring. Discussion of common pests and treatment methods can be found in this valuable guide: [Integrated pest management in vegetable production: a guide for extension workers in West Africa.](#)<sup>7</sup>



Prior to beginning any gardening activities, it is important to examine pre-existing and probable pest and diseases and different techniques and materials needed to manage them. Starting with good quality seeds is key to success. To protect vegetables against their enemies, early identification is essential, and the timely use of appropriate control measures will reduce the severity of the damage. Frequent inspection ensures quick detection of pest and rapid application of the appropriate control measures. The inspection should look for the presence of insects on plant leaves, stems, flowers, fruits, or in the soil.

Pest management techniques are divided into four main groups: cultural, mechanical or physical, biological, and chemical.

### **Cultural Controls**

The most important aspect of IPM is to start with healthy plants through the selection of quality planting materials whether it be seed, seedlings, saplings or vines. Quality in this aspect refers to a combination of seed purity, high germination, vigor, and absence of diseases. Once the quality planting material has been sourced, it is important to design the bed and space the plants appropriately.

*Brassica rapa*, a crucifer family crop that includes turnips, mustard greens or bok choy, is effective in combating most soil diseases. Plant *Brassica rapa* in field with soil disease.

Another example of cultural control is performing a rotation cultivation with trap plants (legumes and cereals). Rotation with these species also allows an improvement in fertility and soil structure. There are several means to control vegetable enemies. Taking regular preventive measures can avoid the occurrence of phytosanitary problems and reduce the need for pesticides. Some other practices that may be used for cultural control of pests include:

- Grow varieties adapted to the local conditions.
- Intercrop varieties that offer natural protection to other crops.
- Choose good, well-drained soils for the garden.
- Rotate crops. The same crops should not be planted year after year in the same field plot.
- Use disease and pest tolerant vegetable varieties, and use healthy seeds of good quality (disinfect the seeds if needed).
- Avoid using plants from a nursery which is infected by insects or diseases.
- Follow pest practices in planting, irrigation and fertilizing schedules.
- Manually collect big insects (caterpillars, beetles, etc.) or use simple traps.
- Immediately destroy plants or parts of plant attacked by pests or disease and thoroughly clean the area after harvest.
- Use scarecrows to control attacks from birds.

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<sup>7</sup> Atcha-Ahowe, C.; Baimey, H.; Godonou, I.; Goergen, G.; James, B.; Sikirou, R.; Toko, M. 2010. Integrated pest management in vegetable production: a guide for extension workers in West Africa. IITA, Ibadan, Nigeria.

### Mechanical and physical controls

This is a technique where pests and diseases-causing microorganisms are killed directly or blocked out from the crops. It also involves making the environment unfavorable for pests and harmful microorganisms' growth. For example, the garden bed may be covered with a net while the plants are small and vulnerable to prevent a devastating attack. Inspecting crops and physically picking off the pests can help control for larger, more visible pests, such as beetles or caterpillars.

### Biological Controls

This technique involves using predators, parasites, pathogens and competitors to control pests and diseases. In some cases, the presence of general predators, such as spiders, may be encouraged by limiting the use of synthetic pesticides. In other cases, an organism may be cultivated and intentionally released in the garden space to help keep pest populations low. Companion planting can attract or harbor predators that protect neighboring plants.

### Chemical Controls

In IPM, pesticides are used as a last resort because they tend to kill beneficial organisms as well as the pests, and harming the environment in others ways. Some organic products such as neem oil or crushed chili peppers can provide a measure of protection with little harmful effects. For stronger chemical pesticides, it is best to approach an agriculture extension agent for help in selecting the least harmful appropriate pesticides. Pesticide application should only be done by a professional with proper equipment and protective gear. Never spray on a windy day!

## 4.3 Seed sourcing and multiplication

Seeds are where it all begins. Starting with quality seeds or other planting material is the first step to a successful garden. Additionally, establishing the mechanisms for gardeners to acquire seeds is critical to the sustainability of the garden. There are two important types of seeds: hybrid and open-pollinated varieties.

- **Open-pollinated** seeds refer to seeds that will "breed true." When the plants of an open-pollinated variety self-pollinate or are pollinated by another plant of the same variety, the resulting seeds will produce plants roughly identical to their parents. This contrasts with the seeds produced by plants that are the result of a recent cross (such as an F1 hybrid), which are likely to show a wide variety of differing characteristics originating in one or other of the grandparent varieties. Open-pollinated varieties are also often referred to as standard varieties or, when the seeds have been saved across generations or across several decades, "heirloom" varieties. While heirlooms are usually open-pollinated, open-pollinated seeds are not necessarily heirlooms; open-pollinated varieties are still being developed.
- **Hybrid** varieties are the result of crossing two different breeding lines. They represent the first generation originating from the cross (F1). They differ from pureline varieties and open-pollinated varieties in that the seed they produce should not be saved and replanted the next generation will deteriorate into the characteristics of one or other of the grandparent varieties. To obtain hybrid qualities, the parental lines must be crossed each time to produce new seed.

There are two types of systems that seeds may be sourced, Formal and Informal Systems:

- The **formal seed system** is a deliberately constructed and bounded system, which involves a chain of activities leading to clear products: certified seed of verified varieties. The guiding principles of the formal seed system are to maintain varietal identity and purity, and to produce seed of optimal physical, physiological, and sanitary quality. Seed marketing and distribution often takes place

through a limited number of authorized seed outlets, usually for commercial sale, although seed may also be distributed (free or for sale) by national research programs, universities, or NGOs.<sup>8</sup>

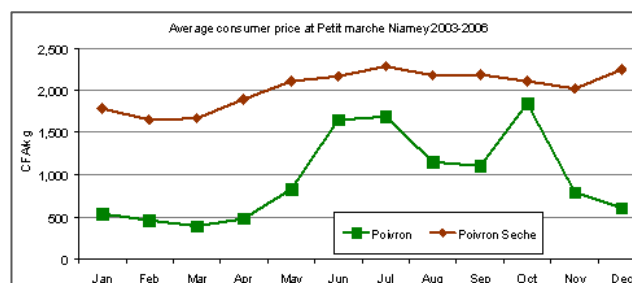
- The **informal seed system** includes most of the other ways in which the farmers themselves produce, disseminate, and access seed: directly from their own harvests; through exchange and barter among friends, neighbors, and relatives; and through local grain markets. What most characterizes the informal system is its diversity. Varieties may be true breed or mixed-race populations. In addition, the seed is of variable quality (of different purity, physical and physiological quality). The same functions of multiplication, selection, dissemination, and storage take place in the informal system as in the formal, but they take place as integral parts of crop production and marketing systems, rather than as discrete activities aimed at producing certified seed.<sup>9</sup>

**Integrated seed systems** imply coordinated actions between the formal and informal seed sectors. The term also conveys the interdependence of such systems, with multiple links between the two, with each reacting to the other and changing over time. Integrating decentralized seed production with formal markets can help to create an inclusive mechanism for economic growth. While fruits and vegetables may be cultivated in the garden, seed production also represents a promising income generating opportunity. This is especially true in the growing season immediately preceding the rainy season because garden groups can produce seed that is immediately distributed for the upcoming cereal crop campaign, reducing the need for prolonged storage.

## 5. Post-production: Processing and preservation

The objective of post-harvest storage is to safely keep a product for weeks or months while keeping their maximum nutrition benefits. Preventing product spoilage helps in preventing food waste, and if there is surplus production, preserving and processing food products keeps them consumable for a long period of time and they can be sold when prices are high. For example, onion prices can be 3-4 times higher 5-6 months after harvesting than at harvest time. The table below shows the overall value added and year-round price stability for dried pepper in Niger, compared to the highly fluctuating – and overall lower – prices for fresh peppers.

In developing economies, advanced food processing and preservation methods are often not accessible. Artisanal methods are therefore key interventions to keeping food safe and nutritious for a long time. One of the safest ways to store and add value to produce is by drying. Drying allows for longer-term storage and gives the producer market power, because he can ask for an increased price when the product becomes scarcer. Properly dried produce retains its nutrient content and is easier to transport. Many vegetables are suitable for drying, including onions, tomatoes, peppers, sweet potato, and beans. Fruits such as mangoes and papaya are also suitable for drying. When sun drying, be sure to place the vegetables on an



<sup>8</sup> Louwaars, N. (1994). Seed supply systems in the tropics: international course on seed production and seed technology. Wageningen, The Netherlands: International Agriculture Centre.

<sup>9</sup> Almekinders, C. J. M., & Louwaars, N. P. (1999). *Farmers' seed production: New approaches and practices*. Intermediate Technology Publications.

aerated tray and cover top and bottom to prevent flies from contaminating the produce. Sweet potatoes can also be made into flour for porridge.

Many fruits can be made into juices, including hibiscus (bissap) and baobab, or jams or jellies, or pickled or conserved in oil (pepper).

It is important to keep dried or process food in clean containers, and stored in a cool dry place. If the vegetables are not completely dry, they may grow mold or fungus, which will ruin the produce and is potentially harmful to humans.

## 6. Nutrition

One of NCBA CLUSA's objectives for the Oasis gardening activity is to address underlying causes of malnutrition. Malnutrition is a general term that includes micronutrient deficiencies, undernutrition and overnutrition. Malnutrition can lead to wasting, stunting, obesity, and various health issues such as diabetes or weak immune systems. Stunting manifests as slow physical growth – and is often not apparent because a child may look healthy (unless compared side by side to a well-developed child the same age). Stunting also affects intellectual development. The impact is lifelong, and can lead to health problems later in life, as well as low birthweight when stunted girls grow to reproductive age. Micronutrient deficiencies contribute to a variety of issues, such as low immunity, anemia, or night blindness. When households experience food insecurity they struggle to consume enough calories, and often sacrifice diverse diets that provide micronutrients and protein, such as fruits, vegetables, eggs, meat, and milk. Acute malnutrition results in wasting, and severe acute malnutrition can be life threatening for infants. Where there are chronic insufficiencies, stunting in children is prevalent.



*The range of heights of this cohort of 4-year-olds is not “normal” but the result of different diets. Photo: Unicef.*

Nutrition status is influenced by many factors and inadequate household resources is an integral one. Gardening is a nutrition-sensitive intervention as it addresses several underlying determinants including food security, income generation, and women’s empowerment. When successful, garden activities can create an enabling environment to diversify diets, especially ones rich in necessary nutrients to prevent and address malnutrition and poor health.

While an improved diet contributes to better health, garden produce alone does not resolve malnutrition and prevent disease. Gardening has the potential to be a source of income which can give access to diverse foods including animal source foods, and in the long-term it can facilitate community development, enable greater access to adequate caregiving resources and health services, and contribute to a more hygienic environment.

The nutrition goals of gardening cannot be achieved without increasing knowledge and promoting behavior change regarding nutritious food and its importance to health and human development. The project should incorporate trainings specifically designed to address knowledge and behavior gaps. If the trainings are consistently employed, they can help gardening practitioners to understand how



gardening and resulting increases in income can improve nutrition through consumption of safe and nutritious foods.

Project implementers should have basic knowledge about nutrition and be comfortable with concepts for nutrition-sensitive agriculture. Prior to beginning the Oasis activities, project staff, including partner staff should be trained. Additionally, gardening participants will require training on nutrition including tailored messaging and participatory activities. It is necessary to identify and incorporate practices that are context-appropriate for the cultures and education levels of communities where the project is implemented.

## 6.1 Training suggestions for implementers

Activity implementers and their implementing partners need to be familiar with key nutrition-specific and nutrition-sensitive concepts to support the intended nutrition outcomes of the Oasis Garden concept. The USAID SPRING project and the USAID Advancing Nutrition project have produced several trainings and tools that can be used for staff training, which are described below. If your project does not have a nutrition specialist on staff or does not have access to HQ technical assistance, these resources can still be used by the project team.

The following training resource *Designing Effective Nutrition-Sensitive Agriculture Activities* provides an overview of essential nutrition concepts, outlines how food produced and consumed, income generated and spent, and use of women's time and energy impact nutrition outcomes, and guides practitioners through the design process.<sup>10</sup>

## 6.2 Training for garden participants

Participants in the Oasis Garden activities will require nutrition-specific and sensitive training to support positive nutrition outcomes. This training will need to match the objectives and goals of the project. For example, if diversifying diets is a desired outcome, training should target participants and household influencers to build knowledge around the importance of consuming a nutritious diet, nutritious foods that are being produced in the garden. If supporting gender equity is an objective, then including training and messaging around equitable household decision-making would be appropriate. If the gardens are to be used to enhance incomes, then training around money management and the use of income towards food and health care would be needed.

Gardening activities frequently fall within a multi-sectoral project. To integrate sectors and collaborate with either partners or co-located health and nutrition projects, explore using those partners who are implementing nutrition-specific activities to lead nutrition training that complements the gardening activities. This could include messaging around using garden production in complementary foods for young children or in cooking demonstrations where gardening participants contribute some ingredients from their gardens.

### Five Ways to Improve Nutrition through Agriculture

1. Increase availability of and access to diverse, nutrition foods.
2. Encourage income use for better diets, health, and hygiene.
3. Recognize the central role of women in agriculture and nutrition.
4. Generate demand for diverse, nutrition foods.
5. Establish policies and programs to support a broad view of nutrition.

See: <https://www.spring-nutrition.org/media/infographics/five-ways-improve-nutrition-through-agriculture>

<sup>10</sup> <https://www.advancingnutrition.org/resources/designing-effective-nutrition-sensitive-agriculture-activities-workshop-facilitators>

## 7. Planning for market

Surplus production can be source of income which contributes to improved nutrition and living standards. For the most gain, links to markets need to be cultivated and the timing of bringing produce to market should aim to take full advantage of market fluctuations. During certain periods of the year, fresh produce is scarce, and prices are high – but the gardens are also empty. At other times, the market is saturated, and prices are very low. As a result, gardeners experience poor sales, and the produce may rot if not properly processed and stored. However, market gardening is possible year-round with proper management, providing seasonal produce for the household diet and a steady income.

### Entrepreneurial Soft Skills:

- Opportunity seeking and pro-active
- Risk taker
- Drive for efficiency
- Respect for commitments made
- Persistence
- Goal-oriented
- Planning and self-management
- Persuasive and effective networker
- Independence and self-confidence

### 7.1 Training for market production

Training for market gardeners should reinforce their capacity for planning and management of market gardening sites.<sup>11</sup> At the end of the training, participants will develop:

- Better planning of vegetable production.
- A crop calendar for each site.
- A cash flow plan for each site.

The training modules cover the soft and technical skills needed for effective market gardening:

**Entrepreneurship:** The aim of the market gardener is to generate economic growth, driven by entrepreneurship. A focus on building a culture of entrepreneurship is important.

**Marketing for Nutrition:** Understanding the nutritional benefits of the crops produced in the garden and passing on this knowledge to consumers can add value and motivate customers to purchase these products. For example, informing a mother that adding leafy greens to her child’s porridge to improve the child’s growth and resilience to disease could influence the mother to buy the greens and act upon this advice.

**Planning:** Strategic decision-making and planning crop cycles is critical. For example: depending on the availability of water, the market gardener may select short-cycle crops over long-cycle crops, or early or late harvesting crops, or she may stagger the sowing over a period of a few weeks to ensure a steady harvest. Planting also depends on favorable sales periods and knowledge of crop cycles so that the gardener can maximize returns.

**Crop Calendars:** The arrangement of different crops in the field facilitates planning. Planning with the IGESPLAM method (see footnote) consists of programming crops according to their growth cycle and the season. A fast growing crop, such as lettuce grown in the cool season, and be followed by another crop that is more heat tolerant, such as okra. The distribution of vegetables over time and space is a key principle for successful production. The trick is to occupy all periods considering factors such as water, market, tolerance to the season and labor. Crops grown during the hot or rainy seasons will command

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<sup>11</sup> See the REGIS-ER manual “Introduction to Market Garden Management and Planning” (known by its French abbreviation IGESPLAM).

higher prices on the market due to scarcity, but they are harder to grow due to heat, pests, lack of water or labor constraints.

**Cash Management:** Proper cash management is facilitated by operations tracking sheets. These include the expenses, and revenue flows (past and forecast). These line items provide information captured on other tracking tools (gross margin, operating account, campaign balance sheet, cashbook, etc.). All these documents are shown in Appendix 9.2.

**Balance Sheets:** Balance sheets are financial statements that facilitate easy tracking of asset, liabilities, and equity of the gardening group, and they provide necessary information to evaluate return on investment and capital structure. Keeping balance sheets is a basis for monitoring the progress the Oasis Garden as a business.

The balance sheet establishes the results of an enterprise at the beginning and end of an exercise, and it tells where the wealth (cash, inventory and infrastructure) of the organization comes from – and what the expenses and debt are. When the balance sheet is established at the beginning, it is said to be the opening balance sheet. It is an inventory of the organization's assets and debts. The end of the fiscal year takes place at the end of the year or timed annually with the end of the agricultural campaign (e.g., every September). In general, the balance sheet shows the overall or partial financial results of an organization. The preparation of the balance sheet consists of carrying out certain preliminary work such as inventories or cash counts, along with a review of total revenue, expenses and debt. A critical part of the balance sheet is depreciation or amortization of fixed investments – such as a well, pump or fencing – in order to set aside funds for making repairs or replacing the infrastructure at the end of its useful life. Amortization is a distinct expense from recurrent costs, such as seeds, fertilizers, labor or water (if it is billed by the municipality). The amortization fund must be kept for the long term.

## 7.2 Linking groups to markets

Small holder farmers often lack selling opportunities, sometimes due to a lack of transportation, time, or links with local agribusinesses. As a result, they opt to sell their production through intermediaries, who buy at a much lower price, thus eating into the farmers' profits. That said, intermediaries can provide a service (e.g., transportation) and will pay a premium if the produce is aggregated – providing them one source for a large supply. This is an advantage of a collective garden. To solve this problem and ensure that gardeners gain the most out of their produce, the project implementers should help establish partnerships with local processors or buyers. There is also a need to link gardeners with local provide sector actors in the value chains for services such as s transportation or inputs. The project should ensure that the linkages are beneficial, strong, effective, and sustainable.

Due to power imbalance between smallholder producers and agribusiness companies, their business partnerships and negotiations might not be straightforward. The project should monitor the partnership to ensure that powerful entrepreneurs or agribusinesses do not exercise undue power over the gardeners.

## 8. Monitoring gardens and ongoing support

### Monitoring Tools

The garden management book is made up of a set of tables that allow market gardeners to record the different information of the garden or site.



This information includes:

- The list of producers.
- Agricultural equipment.
- Crop planning (past and planned).
- The schedule of activities (planned and achieved).
- The forecast and realized cash calendar.
- Gross margin of crops.
- The operating account.

This matrix is an interesting basis for analyzing crop schedules. Once all the indicators have been put together, the market gardener can safely start his production activity. It thus strengthens its chances of seeing its production objective from a positive perspective. The three most essential aspects are: market, money, and water.

The notebook also allows technicians to make recommendations to improve results. Two situations can arise within a collective garden site:

- Joint management (input purchases and product sales are grouped).
- Individual management (input purchases and product sales are individual).

For the first case, all the gardeners will need a common operating account, whereas the second case only requires individual operating accounts. There will always need to have some form of collective management to maintain the fencing and irrigation system.

### **Ongoing Support**

The Oasis Garden's sustainability relies on a supporting network of local government, civil society and private sector which needs to be cultivated from the beginning. This support establishes an enabling environment for the garden's successful implementation and continued access to technical assistance, inputs and markets. While the gardens are initially supported by project staff, this role is gradually transferred to local actors and institutions as their capacity for this role is strengthened. This process graduates project field agents and facilitators who deliver direct support to local resource persons who provide needed support.

**Local Government and Traditional Leaders:** Support from local government and traditional leaders is essential for the establishment of the gardens and for their continuation. This support starts with the allocation of land for the group and facilitates the transfer of land title or long-term loan. Local government technical services, especially the agriculture department, will provide ongoing technical assistance.

**Private Sector:** A network of CBSPs provides the garden group with access to inputs and knowledge on new techniques (pest management, composting). (See CBSP manual.) Other private sector actors include off-takers, transporters, agribusinesses for inputs, and local enterprises that process foods.

## Appendix A: Roles of the executive bureau

Job description of women’s groups’ elected leaders	
<b>President</b>	<ul style="list-style-type: none"> <li>• Leads Association meetings.</li> <li>• Represents the Association whenever it is necessary.</li> <li>• Sees to the solidarity among Association members.</li> <li>• Leads discussions regarding loans to Association members.</li> <li>• Organizes the budget together with the treasurer.</li> <li>• Countersigns the financial documents.</li> <li>• Coordinates activity plans agreed by the Association members.</li> </ul>
<b>Secretary</b>	<ul style="list-style-type: none"> <li>• Writes the Association reports, letters, etc., and communicates with the Site Coordinator and others about Association's matters.</li> <li>• Replaces the President when the President is absent.</li> <li>• Attends all meetings.</li> <li>• Produces the reports for each meeting.</li> <li>• Keeps the Associations records.</li> </ul>
<b>Treasurer</b>	<ul style="list-style-type: none"> <li>• Collects money from Association members.</li> <li>• Opens a savings account in the bank together with the President.</li> <li>• Issues checks (signed by her and the President) to purchase inputs and pay contractors.</li> <li>• Transfers a fixed amount from the Association income to COGES.</li> <li>• Reports to members on a regular basis on the financial situation of the Association.</li> <li>• Issues loans to members of the Association based on the consent of most members.</li> </ul>
<b>Lead Gardener</b>	<ul style="list-style-type: none"> <li>• The Lead Gardener plays a critical role in the success and long-term sustainability of the Association. She should be elected by the Association considering her farming skills and leadership. She should be able to read and write to provide reports. She should be one of the best producers in the team and over time will be accepted as an authority on horticulture.</li> <li>• The Lead Gardener should receive special training from the Horticultural Expert and the Field Technician on agricultural best practices. She should accompany the Field Technician on every site visit, listen to his comments and help the women conduct their activities. The Lead Farmer should report to the Field Technician on any new pest and disease and master the appropriate techniques to treat them.</li> <li>• When the Project leaves the site, the Lead Gardener provides the continuity and technical help to the other women in the Association. The Lead Gardener should participate in creating the annual garden plans, including soil preparation, nursery preparation, crop selection etc.</li> <li>• The Lead Gardener should be compensated by the Association, so she has a monetary incentive to perform her work.</li> </ul>

## Different Methods of Election

Election methods	Descriptions	Benefits	Disadvantages
<b>Consensus</b>	Accredited co-op members or delegates consult and nominate a candidate.	Easy to understand and quick to implement.	May lead to misunderstandings -Not always allows you to choose the right person. Influence of some village leaders.
<b>Vote by Show of Hands</b>	Accredited group members or delegates who are pro-candidate raise their hands and count. In the case of multiple nominations, a voter chooses only once. If the first two candidates have the same number of votes, a second round is held to decide between them.	Makes a wise choice - Easy for members to master.  Quick to implement.	May lead to misunderstandings -Fear of the public or the candidate you have not chosen.  Members who are or are not pro-candidate are indexed from where a grudge arises.  Some members or delegates may vote more than one candidate.
<b>Line-up vote</b>	Accredited group members or delegates line up behind the candidate of their choice.	Easy to understand by members.  Easy to master by members.	May lead to misunderstandings -Fear of the public or the candidate who has not been chosen. Members who are favorable or not to a candidate are indexed, resulting in a grudge.
<b>Vote by Sitting or Standing</b>	Accredited group members or delegates who are pro-candidate stand and count	- Easy for members to understand - Easy for members to master	May lead to misunderstandings. Fear of the public or the candidate you have not chosen.  Members who are or are not pro-candidate are indexed from which a grudge arises -Some members or delegates may vote more than one candidate.
<b>Vote by Secret Ballot</b>	Each candidate chooses a colored paper or symbol of their choice. Then the accredited members or delegates of the co-op, choose the color or symbol of the candidate to whom they are in favor and put it in an urn. At the end of the vote, the votes are counted. If two candidates have the same number of votes, a second round is held.	Keeps the secret of choice.  Allows the choice of the one you want safely.  Save the cohesion between members and candidates.	Relatively complicated.  Requires a little more time and resources (urns, ballots, etc.).

## Cash management books

### 1) Inventory book

Its usefulness: It gives the situation on the physical stock in store at the date of the inspection.

Name:..... Date:.....

Nature product	Amount	Unit price	Total value	Difference between card - stock - indicate + or -	Reason
Total					

Manager's signature      Controllers' signature

### 2) Treasurer's cash book

Utility: It is used to record the inflows and outflows of funds. It gives the following main information: date, coin number, label or designation, entry, exit, balance, report. The cash book is monthly.

The carry-over is made at the end of each page, taking on the second page the totals of the first page (entry, exit, balance). The carry-over is also done at the end of each month, this time taking up the balance from the preceding month before continuing the operations of entry and exit.

Name: ..... Month/Year: ..... N° page: .....

N°	Date	Reference	Wording	Input	Output	Sold
			Report			
Total						

### 3) Cash count: treasurer or cash-treasurer ticketing

This is the first level of control, it shows, the balance of cash-on-hand at the time of the check:

Name:..... Date:.....

Designation	Number	Amount
10,000 banknotes	4	40,000
5,000 banknotes	6	30,000
1,000 banknotes	10	10,000
500 pieces	20	10,000
Total		90,000

### 4) Reconciliation sheet: movement cash book - treasurer

Its usefulness: confrontation cash situation and past entries in the cash book. This is a single sheet per reconciliation.

Previous balance	Entry period	Total	Period output	Real balance	Real balance	Difference
0	200,000	200,000	1,200	198,000	178,000	20,800

## Appendix B: List of resources

### NCBA CLUSA resources:

1. [Techniques d'irrigation et de production améliorée en cultures maraîchères au Sahel.](#)
2. [Formation des APS horticultures.](#)
3. [Guide pour l'atelier de formation des agents de terrain sur la vie associative et Documents de gestion des organisations communautaires de base.](#)
4. [Manuel de formation des formateurs adaptation au changement climatique: focus sur les œuvres CES/DRS.](#)
5. [Farmers of the Future program operation manual.](#)
6. [IGESPLAM manual.](#)
7. [Manuel Compost.](#)
8. [Gestion intégrée des nuisibles cultures maraîchères.](#)
9. [Conservation Farming Manual \(French\).](#)
10. [Manuel de collecte de données des sites maraîchers \(French\).](#)

### Additional Resources:

1. The Organic Farmer: <https://theorganicfarmer.org/Articles/seed-selection-important-during-planting-season>
2. Integrating Seed Systems: <https://seedsystem.org/wp-content/uploads/2017/07/Syngenta-USAID-brief-3-Integrated-Seed-Systems-3-copy.pdf>
3. Integrated pest management in vegetable production: a guide for extension workers in West Africa. <https://cgspace.cgiar.org/handle/10568/63650>
4. USAID SPRING Nutrition-Sensitive Agriculture Training Resources Package (2018). [https://www.spring-nutrition.org/sites/default/files/spring\\_nutr-sens-agri-training-package-guide.pdf](https://www.spring-nutrition.org/sites/default/files/spring_nutr-sens-agri-training-package-guide.pdf)
5. USAID Advancing Nutrition. 2020. Designing Effective Nutrition-Sensitive Agriculture Activities. Facilitator's Guide (2020). <https://www.advancingnutrition.org/resources/designing-effective-nutrition-sensitive-agriculture-activities-workshop-facilitators>