



Nutrition-sensitive agriculture programming

A nutrition-sensitive approach
for market-based agricultural projects

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Authors

Sandrine Chetail

Director, Agriculture
schetail@hq.mercycorps.org

Cathy Bergman

Food Security Initiative Lead
cbergman@mercycorps.org

Andrea Mottram

Senior Specialist, Agriculture
amottram@hq.mercycorps.org

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Mercy Corps.

Mercy Corps

45 SW Ankeny Street
Portland
Oregon 97204

The guidance is for non-nutrition specialists.

It has been designed to help agriculturalists working in market-based programs avoid harming the nutritional status of target households unintentionally and to boost nutrition whenever possible.

It includes:

- an overview of nutrition-related issues
- a step-by-step guide for the design, implementation and evaluation of nutrition-sensitive agriculture programs
- a number of annexes providing background information, and practical tools to use when applying the step-by-step approach.

This is the first edition of the guidance and is intended to be a living document. As we continue to learn more about effective nutrition-sensitive programming, the guidance will evolve to reflect our increased understanding.

Please share your experience, results, and thoughts with us, to help develop this guidance further:

Sandrine Chetail

Director, Agriculture
schetail@hq.mercycorps.org

Cathy Bergman

Food Security Initiative Lead
cbergman@mercycorps.org

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What is 'nutrition-sensitive' development work?

Nutrition is crucial to global development. It is essential to every individual's physical and cognitive growth, resistance to disease and lifetime productivity. Well-nourished children are a third more likely to break the cycle of poverty as adults than malnourished children.¹

To be nutrition sensitive is to recognize this huge significance, and to embed nutrition-related issues in the planning, implementation and evaluation of our development work. Looking at our projects through a 'nutrition lens' in this way is similar to the integration of gender in our programs.

In recent years, international development professionals have become particularly interested in making links between nutrition and agriculture. Research is in progress globally within the development community, to identify:

- what these links might be at program level
- how best to develop and implement them
- what results we can expect from them.

While research continues, Mercy Corps offers this guidance to help market-based agriculture programs become more nutrition-sensitive.

Why should agriculture programs be nutrition sensitive?

Agriculture and nutrition have great potential to influence each other. Agriculture provides the foods that can improve nutrition, and nutrition supports agricultural labor by providing the energy and health farmers need to maximize productivity.

As a sector, agriculture:

- has a central role in supplying food systems from community to national markets
- often employs the poorest and most vulnerable households, including women and youth
- has the potential to grow, and increase opportunities for the most vulnerable people.

"There is a growing understanding that agricultural development is an entry point for improving human nutrition, while at the same time, agricultural investments targeted toward smallholder farmers are more likely to succeed if they address human capital constraints due to malnutrition."

Mercy Corps' Agricultural Approach

Malnutrition is a major barrier to development

Under-nutrition affects 805 million people in the world. Two billion more live with critical micronutrient deficiencies.² A large majority of these people live in the countries where we work.

- Malnutrition causes poor physical and cognitive development and growth, increases vulnerability to disease, and limits productivity over a lifetime.
- Malnutrition can prevent a child from adequately growing into adulthood. UNICEF estimates that between a third and a half of deaths among children under five worldwide are attributable to malnutrition, largely because malnutrition reduces resistance to disease and infection.
- Malnutrition has lifelong impact. A one percent reduction in the height of a child based on age as a result of chronic malnutrition in childhood leads to a 1.4 percent reduction in lifetime productivity, making malnutrition a critical component to ongoing poverty.³
- Malnourished women face increased risks during pregnancy and are more likely to deliver malnourished babies, so perpetuating the problem into the next generation.
- Children under two years of age and women of reproductive age are most vulnerable to malnutrition.
- At a population level, under-nutrition and micronutrient deficiencies cause losses in GDP of two to three percent in affected countries.⁴
- The SUN Movement estimates that eliminating malnutrition could boost GNP by 11 percent in Africa and Asia and increase wages by 5-50% over a lifetime.

The Mercy Corps nutrition-sensitive approach to agriculture

The Mercy Corps *Agricultural Approach* includes a substantial focus on agriculture's ability to provide the means of accessing a diversified, nutrient-rich diet, both for farming households and their larger communities.⁵

The Mercy Corps **theory of change** is that if agriculture programs:

- support the **production** of more nutritious food
- help maintain their nutrient content along the **value chain**
- increase households' **purchasing power**
- empower women and households to make appropriate **nutritional decisions**

then agriculture programs will have positive impacts on the nutrition of children under two and women of reproductive age.

This means that:

- We must avoid unintended negative consequences. Our programs must not impact negatively on nutrition. We must do no harm.
- We need to improve the availability of nutritious foods. Agriculture produces the food communities eat, direct from farm or processed.
- We need to boost households' purchasing power to help people buy nutritious food. With higher income and behavior change, people will be more likely to buy diverse and healthy food.

- We can advance our Mission of enabling secure, productive and just communities as healthy people will be better able to co-create, lead and ultimately own the solutions to their problems.

We aim to embed nutrition considerations at each stage of our market-based agriculture programs, to contribute to reduce the nutritional gap of the target population.

This is based on four key principles:

- **Understand the nutritional gaps.** Based on available secondary research, determine which micro or macro nutrients are missing in the diet of your program's geographical target population, with a specific focus on women of reproductive age and children under two.
- **Seek opportunities to boost nutrition.** Use nutrients as criteria when selecting value chains, educate household and agriculture actors in dietary needs and where to find nutritious food, and avoid nutritional losses along the chain.
- **Check for potentially negative program impacts on nutrition.** For example prevent the displacement of crops critical to community consumption, and seek solutions to ensure that women and other caregivers are able to spend more time caring for their children.
- **Include an explicit, nutrition-related objective and monitoring indicators.** You can aim to increase dietary diversity and/or decrease a particular nutrient gap known to exist in the programming context, specifically for women of reproductive age and children under two.⁶

How can a market-based agricultural program become nutrition sensitive?

It's easy to do! Integrating a nutrition-sensitive approach does not require a drastic change.

In fact, many nutrition-sensitive approaches are already incorporated in what we do.

Nutrition-sensitive approaches include:

- diversifying production with nutritionally rich crops or animals
- focusing on value chains of nutrient-dense foods that meet local nutrient deficiencies⁷
- incorporating biofortified crops⁸
- improving storage and processing in ways that maintain the nutritional content of food⁹

We need a basic understanding of the nutritional context of our work and to intentionally incorporate that knowledge into program choices.

- streamlining nutrition education through multiple stakeholders¹⁰
- empowering women as producers and participants in household decision making
- increasing demand for locally produced nutritious foods.

Step-by-step nutrition-sensitive market-based agriculture programming

1 Assess the nutritional context

During your agriculture assessment, identify:

- the target population's **nutritional gaps** (calories, iron, vitamin A and protein)
- local varieties and seasons of **nutrient-rich products** (crops, livestock and fish)
- **gender roles and responsibilities** in production and decision making.

2 Select priority subsectors/products

Shortlist products:

- with the most **economic potential**
- with economic potential that are rich in the right nutrients to **fill nutritional gaps**
- with economic potential for which **biofortified** varieties exist that can fill nutritional gaps.

3 Assess options for change

✓ **If shortlisted products will fill nutritional gaps**, or there are biofortified varieties available to fill gaps, focus on the value chain and determine:

- the ways in which nutrients may be lost during each stage of the value chain
- key constraints and enablers for the value chain.
- the availability of biofortified inputs (such as improved seeds and livestock breeds)

✗ **If shortlisted products won't fill the gaps**, focus on alternatives and determine:

- the availability, affordability and seasonality of products in nearby markets that can fill the gaps
- whether the income that can be expected from the shortlisted products will be enough for a household to buy a diverse food basket all year round
- what the potential is to diversify products.

Whether shortlisted products will or won't fill nutritional gaps, strengthen your understanding of the roles and responsibilities in households for income management, food purchase, storage, preservation and preparation.

4 Plan essential interventions



✓ **If shortlisted products will fill nutritional gaps**, or there are biofortified varieties, follow a **value-chain** pathway:

- strengthen the input supply chain
- improve all stages of the value chain to reduce nutrient loss and increase year-round availability (production, harvesting, storage, transport, processing, and marketing).

✗ **If shortlisted products won't fill the gaps, but alternative and affordable products are available locally**, follow an **economic** pathway:

- promote the importance of buying a diverse food basket year round, and changing behaviors to allow women and children to consume it.

✗ **If shortlisted products won't fill the gaps, and alternatives aren't available or affordable**, follow the **product diversification** pathway:

- support the diversification of on-farm production to help fill some nutritional gaps.

Whatever the options for change are, you must:

- sensitize all stakeholders in your program to nutrition
- promote gender-balanced decision making in household income management
- support improvements in food storage, processing and preservation in households.

5 Plan complementary interventions

- Increasing women's control of resources.
- Supporting off-farm revenue generation.
- Improving access to cash or food safety nets.

6 Plan monitoring and evaluation

Define nutrition objectives and indicators.

7 Ensure you do no harm

Check that no program activities could unintentionally affect nutrition negatively.

Step-by-step nutrition sensitivity explained

The overview opposite shows how to incorporate nutrition sensitivity into market-based agriculture programs with a sequence of logical and systematic steps, each strengthening nutritional outcomes.

The explanations for each step are as follows.

1 Assess the nutritional context



This step accompanies the preliminary assessment phase before project design, when you define the existing constraints and opportunities in agricultural markets in your target area.

Alongside traditional agriculture and market-related information, assess the nutritional context of your pre-defined geographical area, and answer the following questions:

- **What are the nutritional gaps among children under two and women of reproductive age (15 to 40 years old)?** Using secondary data, establish the typical diet of the target population (see **Annex 3** for sample questions and data sources).

Work with nutrition staff or outside experts to identify any deficiencies in calorie, iron, vitamin A, and protein intake.¹¹ While deficiencies in other micronutrients such as zinc are also important, levels of calories, iron, vitamin A and protein are fundamental for the physical and cognitive development of the child.

- **Which indigenous crops are rich in these nutrients, and are livestock or fish being produced or available?** Promoting these crops and/or livestock and fish within your program could contribute to filling nutritional gaps.
- **Who in the household has control and decision-making power over the production and/or purchase of food?** When mothers have control over resources, their children are more likely to be well nourished. Your assessment will determine how to strengthen mothers' decision-making power.

The 1,000-day approach

There are about 1,000 days from the start of a woman's pregnancy to her child's second birthday.

The quality of nutrition during this period affects a person for a lifetime; in terms of brain development, immunity, and physical growth, limiting the capacity to learn, generate income, and ability to withstand diseases. The 1,000-day period is a time of vulnerability, but more importantly a window of opportunity to break the cycle of hunger and poverty.

Research has shown that:

- Adults who were well-nourished in childhood increased their workload capacity by nearly 50% over their malnourished peers.¹²
- Adults who were well-nourished in childhood tend to earn about 22% more than their stunted peers, even when they come from the same economic background.¹³ There are examples of adults in Guatemala, well nourished in childhood, earning as much as 45% more than those who were not.¹⁴

Taking a 1,000 day approach means focusing on the needs of pregnant and lactating women and children under 24 months.

Since it can take several weeks before a pregnancy is identified, a more general focus on women of reproductive age is increasingly common.

2 Select priority subsectors/products



This step builds on your preliminary assessment and starts with you shortlisting the subsectors or products (crops, livestock and fish) that have the most economic potential.

From your shortlist of products with the most economic potential, determine which are rich in the nutrients needed to fill the gaps identified in **Step 1**.

This can make a difference in the nutritional status of your target populations, and help narrow down your target markets.

- ✓ **If shortlisted products will fill nutritional gaps, or biofortified varieties exist,** you will need to ensure that:
 - nutrient loss is limited at each step of the value chain
 - those who need them the most (women of reproductive age and children under two) are able to consume them on a regular basis.

- ✗ **If shortlisted products won't fill nutritional gaps,** you will need to add interventions that will diversify your target population's consumption.

Be careful of inappropriate interventions. If you find a deficiency in vitamin A or iron in your target population, staples like millet or maize will not be good choices to contribute towards filling these gaps. The same would be true of pure cash crops such as coffee or spices.

You need to complete another level of assessment (**Step 3**) to understand the appropriate interventions in either case.

Foods rich in nutrients include:

- **Iron** Legumes (beans, lentils, cowpeas, soybeans), animal products (eggs, meat, fish), dark leafy greens (spinach, kale), sesame.
- **Vitamin A** Orange sweet potatoes or orange cassava, cowpeas, carrots and pumpkins, fish, oil, eggs and milk, papaya mangoes and tomatoes, red palm oil, dark leafy greens (spinach, kale).
- **Protein** All legumes (including groundnuts), all animal products, sesame.

Foods rich in these important nutrients typically supply the body with high-quality calories. The quality of calories is critical, as well as the quantity. An individual can consume enough calories, but still be deficient in micronutrients or macronutrients because they are eating too few nutritious foods. You must promote diversified agriculture and diets which include foods providing both calories and nutrients.

Complementary nutrients promote absorption of other nutrients, but **antinutrients** inhibit the absorption of other nutrients (see **Annex 9**).

Micronutrients and macronutrients

Macronutrients are substances required in large amounts while micronutrients are substances required in small amounts for normal growth and development.

A deficiency in... leads to...

calories	loss of energy, extreme fatigue, weight loss, and failure of the immune system
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iron (a micronutrient)	anemia and subsequently can cause problems like fast or irregular heartbeat, complications during pregnancy, and delayed growth in infants and children
----------------------------------	---

vitamin A (a micronutrient)	blindness in children and increases the risk of disease and death from severe infections
---------------------------------------	--

protein (a macronutrient)	extreme fatigue, loss of weight, and general dysfunction of the body
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There are two other important micronutrients that should be in healthy diets; **zinc** and **iodine**.

Very few data sources will indicate the level of deficiency in these micronutrients, which is why they are not included specifically in this guidance. However, it is good practice to promote their consumption.

A deficiency in **zinc** can hinder normal growth, development, and immune function, and is especially important during pregnancy. Sources of zinc include meat, fish, whole-grain cereals, and legumes.

A deficiency in **iodine** can lead to brain damage, physical development problems, and mental/cognitive impairment. The best source of iodine is iodized salt, which can be added to foods.

3 Assess options for change (including value-chain assessments)



This step is ideally completed before you finalize the design of your project, or at project inception when you need to assess further to define the gaps and opportunities within your selected markets.

The assessments you will need to complete, and the choices you will make in response to those, depend on the results of your shortlists in **Step 2**.

✓ **If shortlisted products will fill nutritional gaps, or there are biofortified varieties available:**

Although selected products can contribute to filling the nutritional gap, if not properly handled, the nutritional value can decrease at each step of the value chain. For example, nutrients are lost when products are stored in a humid place, or transported in the sun. The norms and regulations of the market, as well as supporting functions for this market, may also hinder the promotion and reinforcement of the nutritional value of the products.

You will need to assess:

- where nutrients are lost in the market system and at each step of the value chain
- opportunities to either maintain or enhance nutritional value
- the norms and regulations of the market, and supporting market functions that need to be strengthened or influenced.

This will enable you to design interventions that make the most of any possibilities to add nutritional value at key points along the value chain and promote nutrition sensitivity among key actors.

Include in your assessment:

- **The availability, quality, and affordability of inputs that could offer increased nutritional value** These include improved fortified seeds, seeds that are stored properly so as not to lose their nutritional value, improved livestock breeds (for example, breeds that produce more milk and richer milk or eggs), storage bags and containers.
- **Handling of the produce at each step of the value chain** Overleaf are examples of conditions or actions that may have a negative impact on the nutrient content at each step of the chain.

- **The norms and regulations, or absence of them, that limit the promotion of nutrition**

These could include the absence of food safety regulations or sanitary controls, a certification process for improved inputs, grading system, or labelling of nutrient content on processed food.

- **The missing supporting market functions and actors**

Key supporting functions such as research and development, or information dissemination, may not take nutrition into consideration. Many key actors, such as the chambers of commerce, consumer associations, government extension agents, regulatory bodies, and agriculture private providers, may also not be aware of the basics of nutrition and the simple steps they can take to be nutrition sensitive in their work.

You will also need to assess:

- The potential for using biofortified crops, if they are available, as alternatives to your selected products (see **Annex 4**).

If there is potential, then your primary product acquires nutritional value and can fill nutritional gaps.

Biofortification

Biofortification is a process by which crops are bred to have a higher amount of micronutrients.

This is either through conventional selective breeding, or through genetic engineering.

The process is used in some crops such as rice, millet (iron rich pearl millet), cassava (vitamin A rich variety), sweet potato (orange flesh) and beans.

However, at times, biofortification changes the color, texture, or cooking characteristics of products. It is important to check if biofortified varieties are acceptable to local households, and if there is potential to increase demand.

Causes of nutrient loss along the value chain

Input supply

- Inputs of nutrient-rich crops/animals/fish not available or of poor quality
- Storage containers not available or expensive



Production and harvest

- Water pollution, for example from overuse of inputs or contamination by animal manure
- Incorrect moisture content at harvest, which will affect storage
- Incorrect levels of soil nitrogen, potassium, phosphorus and calcium
- Pests and diseases
- Infection with *aspergillus* leading to high levels of aflatoxins (this affects storage too)



Storage and processing

- Light and heat damage
- Non-hygienic milk cans
- Milling and polishing removing nutrients or contaminating products



Transport

- Light and heat damage
- Physical damage to products during handling



Marketing and sales

- Light, heat, and physical damage in open-air market displays
- Lack of cold chain access
- False advertising (such as package falsely indicating high iodine or vitamin content)



Preparation and consumption

- Cooking time too long
- Frying and fermentation
- Peeling

Note These examples are context specific. For example, although peeling reduces vitamin content, this may also avoid water-borne diseases. It is important to choose the lesser risk and understand the factors that influence this.

✘ If shortlisted products won't fill the gaps

When products won't fill the nutritional gaps, it is important to consider how these gaps can be filled.

You will need to assess:

- the availability of nutrient-rich products in local markets and whether households can afford them
- the potential for households to diversify production with nutrient-rich products for their own consumption.

Include in your assessment:

- **Products in the markets that are rich in missing nutrients** This is either as raw products or processed. Markets should be those usually visited by target households to ensure easy access. Pay particular attention to price fluctuations throughout the year to assess the affordability of such products.
- **Revenues generated by households** This is to confirm if they are sufficient to purchase a balanced basket of products year round.

If you get positive results for these first two, your interventions should focus on ensuring households understand the value of purchasing this basket of products year round, and change their behaviors to let women and children to consume them.
- **The potential for households to diversify production to include more nutritious crops, animals or fish using current production systems.** This can be done with intercropping, off-season production, home gardens, or livestock and fish production (including eggs and milk). Make sure you identify:
 - Which crops can be intercropped with the primary crop and the benefits they bring.
 - The primary product's seasonality given the agro-ecological context and the potential for off-season production, specifically access to water.
 - The feasibility of home gardens, including women's access to small plots by the homestead, access to water, and general interest.
 - The resources available to produce livestock or fish (land, water, and food), interest, processing and storage materials (for milk for instance), and compatibility with other agricultural activities.

Product diversification

Intercropping the right crops can improve both nutritional and economic outcomes.¹⁵

- Intercropping staples like maize or millet with legumes (for example beans or lentils) can increase soil fertility (fixing nitrogen into the soil and increasing productivity of the primary crop) and provide a source of protein and iron (see **Annex 7** for the nutrient content of crops).
- Tree crops such as papaya and mango can provide shade and retain soil moisture while being a good source of vitamin A.
- Integrating livestock can provide manure for the primary crops while being a source of protein.

Off-season production allows for expanding the production of complementary crops on land that would otherwise remain fallow outside the main production season(s) of the primary crop(s).

- Off-season production requires a good knowledge of products' seasonality and access to water for supplementary irrigation.
- Off-season production can be further advantageous when it contributes to soil regeneration.

Home gardens or the production on small plots around the home for consumption, have the triple advantage of providing diverse food for consumption, providing food all year-round, and usually being under the control of women.

- It is proven that women who control access to food are more likely to better nourish their children and their household as a whole.
- To be successful, home gardens ideally include a large variety of fruit, vegetables and legumes providing the necessary nutrients, as well as animals for proteins (see **Annex 5**).

Livestock and fish production (including eggs and milk) has the advantage of providing food year-round while providing women and children with more varied diets.

- Animal-source foods are a great source of many important nutrients (e.g. protein and iron).
- They also contain nutrients that are more easily absorbed by the body than plant-based foods (see **Annex 7**).
- Livestock can also provide economic resources to families as they reproduce and fertilize the soil.

Whether shortlisted products will or won't fill nutritional gaps, strengthen your understanding of the roles and responsibilities in households related to buying, storing and preparing food.

This is critical to determine your target audience for nutrition sensitization, and to ensure that the income generated by your program is carefully used for nutritional purposes (see **Annex 3** for examples of questions to include).

4 Plan essential interventions



In this step, you decide on the interventions appropriate to your assessments in Step 3.

- ✓ **If shortlisted products will fill nutritional gaps, or there are biofortified varieties, follow a value-chain pathway:**

Design your interventions to address nutritional loss at each step of the value chain, involving all stakeholders, to maintain or enhance the nutritional value of your selected products.

- Strengthen the input supply chain.
- Improve all stages of the value chain to reduce nutrient loss (production, harvesting, storage, transport, processing, and marketing).
- Increase year-round availability.

- ✗ **If shortlisted products won't fill the gaps, but alternative and affordable products are available locally, follow an economic pathway.**

- Promote the importance of buying a diverse food basket year round, and changing behaviors to allow women and children to consume it.

- ✗ **If shortlisted products won't fill the gaps, and alternatives aren't available or affordable, follow the product diversification pathway.**

Your assessment in **Step 3** will confirm (or not) the feasibility and advantages of:

- intercropping
- off season production
- home gardens.

Support to at least one of these interventions will contribute to improving food consumption.

Whatever options for change you identify in Step 3, and whatever specific interventions you decide on as a result, these simple interventions must be embedded in your agriculture project.

- **Sensitizing all agriculture stakeholders to nutrition to achieve behavior change** including male and female household members, agriculture extension services, private suppliers and traders, and food processors, with a specific emphasis on the decision-makers of food purchase and preparation.
- **Promoting shared decision making for the use of income** to ensure that women participate and have a say on how income is used, specifically for nutrition purposes.
- **Supporting improvements in food storage, processing and preservation capacities** in households.

Including these interventions systematically will contribute to ensuring that:

- income generated by agriculture is used to purchase nutritious food
- this food is actually consumed appropriately by children and women of reproductive age
- the food produced or purchased is correctly stored and preserved to maintain nutrients throughout the year, even during the lean season.

Sensitizing all agriculture stakeholders to nutrition to achieve behavior change

Building on existing local knowledge, attitudes and practices, sensitize all stakeholders, placing emphasis on those with influence on household nutrition.

Focus your sensitization efforts on the nutritional value of each local crop or processed food, the importance of a balanced diet, and the steps to take to preserve nutritional value (see **Annex 8** for nutrition sensitization training modules).

The purpose of sensitizing all household members to the importance of nutrition is to ensure the decision-makers support and/or adopt production diversification, agree to allocate part of the household income for purchasing more nutritious food, and/or support a more balanced food allocation within the household.¹⁶

Your target groups for nutrition sensitization include:

- husbands and fathers as they are usually the main decision makers in terms of production and sometimes food purchase
- grandmothers and mothers-in-law, as in some cultures, they have great influence on food preparation and eating habits
- mothers, caregivers, and girls of reproductive age.

This last target group is the primary audience for your nutritional sensitization. It is important for your program to encourage and support them to purchase and/or grow nutrient-rich food, prepare it the appropriate way without losing the nutrient content, and conserve it for times during the year when these nutrients are not available.

Your program can also include nutrient supplementation at critical phases, breastfeeding, and appropriate hygiene and sanitation. It is also critical that the program educates caregivers about the importance of sticking to infant and young child feeding recommendations targeted at specific age groups (see recommendations on page 13).

Finally, sensitize other market actors (extension services, traders, input suppliers, transporters, and processors) to ensure they promote nutrient-rich crops and adapt practices that maintain and/or enhance nutrient content.

Promoting shared decision making for the use of income

Discuss financial management and priorities with household members.

Promote a gender balance in decision making and ensure that they all understand the benefits of growing and purchasing nutritious foods.

Supporting improvements in food storage, processing and preservation capacities

Women and producers need to:

- improve their access to good storage
- increase their processing and preserving capacity to reduce seasonality and post-harvest losses
- contribute to making healthy foods convenient to prepare.

This will enable:

- improved nutrient content of crops stored
- increased shelf life for increased availability of nutrient-rich crops year round, even during the lean season
- more appropriate food handling to increase food safety.

That completes the three essential interventions of nutrition sensitization, shared decision making and food storage, processing and preservation.

Food storage, processing and preservation

Household storage

The way harvested crops, or milk and meat, are stored will influence the nutrient content of those crops. For example:

- if crops are stored in a dry and cool area, away from animal or pest contamination, they will be less likely to be affected by bacteria such as aflatoxin, and so will maintain their nutrient content (see **Annex 10** on food safety and aflatoxin)
- if milk is stored in a cool or refrigerated area, in metal cans instead of plastic cans, it is less likely to get spoiled and remains more hygienic.

Household processing and preservation

Simple methods of conservation and transformation at household level can maintain nutrients and increase shelf life. For example:

- solar drying vegetables with appropriate technology, keeping food in sealed and dark containers, or making cheese (see **Annex 9** on processing methods).

Infant and young child feeding

Feeding practices for children under age five are particularly important and the first 1,000 days are a critical window for optimal growth, health, and development.

Complementary feeding takes place when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and other foods and liquids are needed. Insufficient or inadequate complementary feeding can negatively impact health and growth.

Feeding recommendations to promote optimal nutrition:

- | | |
|----------------------------|--|
| 0-6 months | Exclusively breastfeed
(child should not consume any foods or liquids aside from breast milk) |
| 6-12 months | Start complementary feeding
but breast milk should contribute to half or more of child's nutritional needs |
| 12-24 months | Continue complementary feeding
but breast milk should contribute to a third or more of child's nutritional needs |
| 24 months and older | Nutritional needs can be met from foods aside from breast milk
but breastfeeding can still be practiced |

Examples of interventions along the value-chain pathway

Market function	Possible Interventions
Input supply	<ul style="list-style-type: none"> ● Increase supply and demand of appropriate (potentially biofortified) and diverse seeds, micronutrient fertilizers, improved breeds, and storage containers. ● Sensitize input suppliers on nutritional products and processes. ● Introduce labour-saving technologies e.g. mulch and improved water management.
Production	<ul style="list-style-type: none"> ● Support cooperation between agriculture and health extension agents to promote appropriate solutions. ● Sensitize producers and processors on the nutritional risks linked to the environment (for example pollution with livestock manure or fish ponds leading to breeding malaria mosquitoes). ● Encourage the separation of animals from human habitat. ● Establish an animal disease surveillance. ● Support production diversification and intercropping. ● Decrease the prevalence of aflatoxins at production, drying, harvest and storage.
Harvest	<ul style="list-style-type: none"> ● Sensitize producers on pre-harvest and during-harvest moisture.
Storage	<ul style="list-style-type: none"> ● Train producers and extension agents on proper storage techniques. ● Encourage systematic aflatoxin testing for commercial farmers. ● Spur demand for appropriate storage equipment.
Transport	<ul style="list-style-type: none"> ● Sensitize transporters on appropriate transport methods.
Processing	<ul style="list-style-type: none"> ● Increase capacities in appropriate processing practices such as solar drying or partial cooking. ● Explore the potential for nutrient fortification (for example soy flour).
Marketing and sales	<ul style="list-style-type: none"> ● Facilitate the access to information and technology for traders and farmers. ● Improve packaging to retain nutrients. ● Increase retail marketing and promotion of nutritious foods. ● Engage in cold chain analyses and improvements. ● Engage in social marketing campaign to improve consumption of nutrient-rich food.
Preparation and consumption	<ul style="list-style-type: none"> ● Sensitize on simple ways to preserve nutrient content (see Annex 9): <ul style="list-style-type: none"> • Germinate and soak grains¹⁷ • Avoid frying foods • Cook vegetables in boiling water or steam and re-use the liquid for soup or cereal¹⁸ • Store raw fruit and vegetables intact, keep storage time short, cool or refrigerated • Avoid peeling fruit and vegetables when peel is edible • Wash/scrub fruit and vegetable before peeling or cutting, not after • Consume or cook fruit and vegetables immediately after peeling, cutting, chopping or pulping • Promote at-home fortification
Norms and regulation	<ul style="list-style-type: none"> ● Encourage and/or disseminate food safety regulations for industrialized processing or public eating places. ● Encourage collaboration between the agriculture and health services to avoid water borne diseases related to irrigation; water pollution; or animal-related diseases. ● Advocate for improved phyto-sanitary control of livestock and livestock products. ● Support testing and certification for innovative products that support nutrition.
Key actors and supporting functions	<ul style="list-style-type: none"> ● Raise awareness among public, private and civil society actors on the importance of good nutrition. ● Identify and engage key associations in advocating for better nutrition. ● Engage with R&D to develop, test, and disseminate nutrient-rich crops and technologies.

5 Plan complementary interventions



Depending on your program budget, donors' flexibility, and feasibility, complementary interventions can enable your program to contribute further to improved nutrition.

These include:

Women's control and decision making

Women are often the primary caregivers of their children, husbands, and themselves. It is important that they are allowed to take the decisions necessary to improve their nutrition and that of their children.

To do so, they need money and time:

- **Revenue-generating activities for women**

This is critical if your selected crops are controlled by men. Women who generate their own revenues will have more control on how their revenues are spent. You can support women, both on and off farm, to increase their capacities to develop revenue generation activities.

- **Time-saving technologies for the production, processing, or preparation of food**

This will enable women to spend more time in the care of their children. You can consider a broad range of time-saving technologies, including those designed to improve water access, ease food preparation, or reduce the need for cooking fuel.

Households' off-farm revenues

Given the high seasonality of certain agricultural regions, ensuring an additional off-farm income is more likely to contribute to the regular purchase and consumption of nutritious food year round.

You should ensure that sources of revenues are designed to target women and do not conflict with the timing and need for labor of farming activities.

Access to safety nets

As with off-farm revenues, improving access to safety nets, whether informal, government-led, or from remittances, will ensure gains in nutrition are not compromised in times of crises, and people continue to eat a diversified diet throughout. Your interventions can include savings plans, community safety nets, cash-for-work schemes, improved money transfers, or advocacy to local governments.

6 Plan monitoring and evaluation



Traditional agriculture sector goals may have potential to yield nutrition improvements, but we have very little evidence of this.

Experience shows that explicit **nutrition objectives** are necessary to guide specific activities, and **nutrition indicators** help track positive nutritional effects and attribute them to the intervention.

Even so, it is important not to burden your agricultural program with heavy nutritional monitoring and evaluation. We propose that you focus on two nutrition objectives and two indicators. They have been selected for their relevance to agricultural market development, and relative ease of monitoring and measurement. Both indicators specifically look for nutrient gaps in what individuals actually eat.

Nutrition objectives and indicators

Objectives	Indicators
Pregnant and lactating women, and children under five, have diversified their diet year round	Women's Dietary Diversity Score (WDDS) This looks at food groups that contribute to a healthy diet for women of reproductive age.
Pregnant and lactating women, and/or children under five, have reduced their deficiency in nutrients¹⁹	Minimum Diet Diversity for Children This looks at different food groups consumed by a child aged 6-23 months.

See **Annex 11**

7 Ensure you do no harm



After designing your program, ensure that project activities do not contribute negatively to nutrition.

Avoid unintended negative consequences (such as those highlighted in *Causes of nutrient loss along the value chain* on page 10) by identifying issues that are potentially harmful, developing a mitigation plan, and establishing a well-functioning monitoring system for timely detection of negative effects (see **Annex 12** for some questions extracted from Mercy Corps' *Do No Harm* screening).²⁰

Annex 1 Nutrition glossary

Acute malnutrition Rapid reduction in nutritional status over a short time period. Acute malnutrition can be moderate or severe. Also known as wasting (low weight-for-height). (UNICEF)

Anemia Condition in which red blood cells or hemoglobin levels are reduced impairing the body's ability to supply oxygen to the body's tissues. Anemia is caused by the inadequate intake or poor absorption of iron, folate, vitamin B12 and other nutrients. It is also caused by infectious diseases such as malaria, worms, and schistosomiasis (bilharzia), and genetics. Women and children are at high risk. Signs of anemia include tiredness, pale skin, and headaches. (UNICEF)

Carotene Orange or red pigment in some foods that the body uses to create vitamin A (-carotene).

Chronic undernutrition Delayed growth that develops over a long time (especially in infants and young children). It is caused by inadequate nutrition over long periods of time (including poor maternal nutrition and poor infant and young child feeding practices) and/or repeated infections. Also known as stunting (low height-for-age). (UNICEF)

Complementary feeding The use of age-appropriate, adequate, and safe food in addition to breast milk or a breast-milk substitute. The process starts when breast milk alone is no longer sufficient to meet the nutritional requirements of an infant. **Note** It is not recommended to provide any solid, semi-solid, or soft foods to children less than six months of age. The target range for complementary feeding is generally six to 23 months. (UNICEF)

Complementary foods Foods given to infants in addition to breast milk after they have reached six months of age.

CTC (community-based therapeutic care)

Management of acute malnutrition in the home rather than in therapeutic feeding centers with an added community focus, often involving referral by, or follow-up from, community health workers. (IRIN)

Exclusive breastfeeding When an infant receives only breast milk and no other liquids or solids (not even water), with the exception of oral rehydration salts (ORS) or drops or syrups of vitamins, minerals, or medicines. It is recommended that exclusive breastfeeding takes place for infants aged 0-6 months. (UNICEF)

Food security When all people at all times have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 1996). The four components of food security are food availability,

economic and physical access to food, food utilization, and stability over time.

Fortification The addition of micronutrients to a food during or after processing to amounts greater than were present in the original food product. (UNICEF)

GAM (global acute malnutrition) The total number of children between six and 59 months in a given population who have moderate acute malnutrition and those who have severe acute malnutrition. (The word "global" has no geographic meaning.) When GAM is greater than or equal to 15% of the population, the nutrition situation is "critical" as defined by the World Health Organization. (UNICEF)

Height-for-age A measurement of chronic malnutrition (stunting) in children. (UNICEF)

HINI (high-impact nutrition interventions) A comprehensive package of nutrition interventions including improved practices, micronutrient supplementation, and management of malnutrition, which have proven impact on mortality and morbidity. (IRIN)

Home-based care Care and/or nutrition interventions given to individuals in their homes.

Infant and young child feeding (IYCF) The feeding of infants (less than 12 months old) and young children (12-23 months old). IYCF programs focus on the protection, promotion, and support of exclusive breastfeeding for the first six months, timely introduction of complementary feeding, and on continued breastfeeding for two years or beyond.

Iodine deficiency disorders Range of abnormalities resulting from iodine deficiency, including reduction in IQ (lowered intelligence), goiter, and cretinism (severe physical and mental disability that occurs from deficiency during the first trimester of pregnancy).

Kwashiorkor Form of acute malnutrition resulting from protein-energy deficiency (deficiency of protein and energy/calories) characterized by oedema (swelling). Signs of kwashiorkor in addition to oedema include reduced fat and muscle tissue, skin lesions, frequent skin infections, tiredness, shiny skin, and light hair. (UNICEF, IRIN)

Low birth weight (LBW) Babies born weighing less than 2,500 grams (2.5 kg) are considered to be of low birth weight.

Macronutrients Fat, protein, and carbohydrates that are needed for a wide range of body functions and processes. (UNICEF)

Malnutrition An abnormal physiological condition caused by inadequate, unbalanced or excessive consumption of macronutrients and/or micronutrients. Malnutrition includes undernutrition, overnutrition, and micronutrient deficiencies. (FAO, State of Food Insecurity 2013)

Marasmus Clinical form of acute malnutrition characterized by severe weight loss or wasting. Marasmic children are extremely thin and typically have grossly reduced fat and muscle with thin loose skin, and are irritable. (UNICEF)

MCH (maternal and child health) An interdisciplinary approach to the factors that influence the health and healthcare of women and children. (IRIN)

Micronutrients Essential vitamins and minerals needed by the body in very small amounts. Examples include vitamin A, iron, and zinc.

Micronutrient malnutrition Suboptimal nutritional status caused by lack of intake, absorption, or utilization of one or more vitamins or minerals. Excessive intake of some micronutrients may also result in adverse effects.

Middle upper-arm circumference (MUAC) The circumference of the mid upper arm is measured on a straight arm midway between the tip of the shoulder and the tip of the elbow. This measures acute malnutrition or wasting in children age 6-59 months. MUAC tape is used to make the measurement. This is a plastic strip marked with measurements in millimeters. It can indicate whether a child is moderately or severely malnourished. (UNICEF)

Moderate acute malnutrition (MAM) Also known as moderate wasting. When a child's weight-for-height is below the standard reference population (between -2 and -3 standard deviations from the median weight-for-height for the reference population. (UNICEF)

Nutrition Strictly speaking, the provision of the various food substances required to maintain life. In the broader context of humanitarian interventions, good nutrition is the result of adequate food security, health and care. It encompasses a diet of sufficient quantity and (particularly in the case of children) variety, as well as the availability of clean water and decent sanitation and hygiene. Health is a component of nutrition because sickness can suppress appetite and reduce the absorption and retention of key micronutrients. Nutrition responses prioritize the most vulnerable people in a population: infants, children, pregnant women and breastfeeding mothers because it is very young children whom malnutrition adversely affects most severely and long-lastingly. (IRIN)

Oedema/Edema Swelling due to accumulation of water in body tissues, most commonly in the feet and legs. If a depression caused by applying a finger to a swollen area persists for some time then oedema is present. It is a clinical sign of severe acute malnutrition. It can be mild, moderate, or severe. (IRIN, UNICEF)

Overnutrition A result of excessive food intake relative to dietary nutrient requirements. (FAO, State of Food Insecurity, 2013)

Protein-energy malnutrition The lack of sufficient energy or protein to meet the body's metabolic demands, as a result of an inadequate dietary intake of protein, intake of poor quality dietary protein, and increased energy and/or protein demands due to disease or increased nutrient losses. (World Bank)

R&D Research and development.

Recommended daily allowance The average daily dietary intake of nutrients that is sufficient to meet the nutrient requirements of nearly all healthy individuals in a given population. (UNICEF)

Severe acute malnutrition (SAM) Results from recent short-term deficiency of protein, energy, and minerals and vitamins leading to loss of body fats and muscle tissues. Acute malnutrition presents with wasting (low weight-for-height) and/or the presence of oedema. (UNICEF)

Stunting Reduced height or length due to slow growth. A condition that usually results from extended periods of inadequate food intake, and/or chronic infection especially during the years of rapid growth for children. An indicator of chronic malnutrition measured by height-for-age. (World Bank)

Undernutrition An insufficient intake and/or inadequate absorption of energy, protein, or micronutrients that in turn leads to nutritional deficiency. (UNICEF)

Underweight A condition measured by weight-for-age that can also act as a composite measure of stunting and wasting. (World Bank)

Wasting A condition measured by weight-for-height that results from the loss of both tissue and fat in a body. A condition that usually reflects severely inadequate food intake or infectious processes happening at present. An indicator of acute malnutrition. (World Bank)

Weight-for-age A measure of underweight (or wasting and stunting combined). An indicator of acute malnutrition. (UNICEF)

Weight-for-height An indicator of acute malnutrition/weight-loss, also known as wasting. Additionally used to evaluate responses to food crises. (IRIN, UNICEF)

Annex 2 Basic facts about nutrients

The foods we eat, and that nourish us, consist of three macronutrients as well as many micronutrients.

Each of these nutrients performs essential functions that support human growth and maintain good health, but no food contains all the nutrients that the human body requires. For this reason, the regular consumption of a variety of foods rich in these nutrients is essential. Dietary diversity is important.

Macronutrients

Macronutrients make up most of what we eat and are needed in large amounts to maintain good nutritional status. There are three kinds of macronutrients:

Carbohydrates Carbohydrates contribute the most calories (energy) in most human diets. The body uses them to fuel human activity, and they are especially important in maintaining the function of the heart, brain and central nervous system. Carbohydrates are available in high amounts in staple cereals (such as rice, maize, wheat, and sorghum) as well as the flours made from these cereals. Carbohydrates are also available in smaller quantities in fruit, vegetables, and dairy products.

Protein Protein is important to form muscle tissue, organs, blood, enzymes, and neurotransmitters. Protein also helps regulate biochemical reactions in the body, such as metabolism. Protein is available in high amounts in animal products such as meat (including poultry and fish), eggs and milk. Protein is also available in important amounts in legumes (such as beans, peas, lentils and nuts). Some cereals, especially sorghum and millet, are also good sources of protein.

Fat Fat provides the body with important amounts of calories (energy). It also plays an important role in promoting growth in children, keeping skin and hair healthy, protecting organs, maintaining body temperature, as well as ensuring that the body makes efficient use of certain micronutrients (such as vitamin A, see below). Fat is found in all varieties of cooking oil, as well as dairy products, meat, fish, nuts, and groundnuts.

Micronutrients

Micronutrients are vitamins and minerals that the human body requires in small amounts, but are essential to good health.

They do not provide any energy, but play an important role in many body functions, including growth, brain function, and immune function. Diets that provide insufficient

amounts of micronutrients can cause serious health problems. There are many kinds of micronutrients, but many public health problems in developing countries arise from insufficient intake of vitamin A and iron.

Vitamin A Vitamin A is important for child growth and development, maintaining the immune system, and supporting good eye health. Insufficient vitamin A consumption can result in night blindness, impaired immune responses, and faltered growth and development in children. Vitamin A is available in meat, fish, poultry, and dairy in addition to orange-colored fruit and vegetables (such as papaya, mangos, carrots and orange-flesh sweet potatoes), and dark-green leafy vegetables (such as spinach, collard and cassava leaves). The body absorbs vitamin A easier when consumed in animal-source foods.

Iron Iron carries out several critical roles in the body, including carrying oxygen from the lungs to each cell, maintaining brain function and muscle activity, and helps the body digest food. Diets that do not contain enough iron can cause increased vulnerability to disease and infection, decreased work performance, and can hinder mental function. Iron deficiency during pregnancy can result in small babies that are more vulnerable to early death. Foods that contain iron include eggs and meats, dark-green leafy vegetables (such as spinach, collard and cassava leaves), and legumes (such as beans and lentils). The body absorbs iron easier when consumed in animal-source foods. The requirement for iron in pregnant women is so high that it is almost impossible to fully meet needs with a good diet. Iron supplementation is therefore strongly recommended.

Two other micronutrients that are important for public health in developing countries are iodine and zinc.

Iodine Iodine is important for child growth and development, particularly for physical development, brain (mental and cognitive) functioning. The best source of iodine is iodized salt, which can be added to foods.

Zinc Zinc is important for child growth and development, and immune system functioning. It is especially important during pregnancy for the child. Sources of zinc include meat, fish, whole-grain cereals, and legumes.

Breast milk's nutrients

Breast milk has many macronutrients and micronutrients necessary for a child's growth and development.

For the first six months of a child's life, breast milk contains all of the macronutrients and micronutrients a child needs. Therefore, during this time it is recommended children only consume breast milk (not even other liquids like water). From six to 24 months of age or beyond, it is recommended that children continue to consume breast milk alongside nutritious complementary foods as, during this time, breast milk does not provide enough macronutrients and micronutrients. Regardless, it is important to continue to breastfeed as breast milk still provides children with critical nutrients.

Breast milk contains carbohydrates, protein, and fat. Micronutrients in breast milk can vary, depending on the nutrient and mother's diet. Micronutrients in breast milk include vitamin A, iron, and vitamin D.

The effects of malnutrition

Malnutrition is a large category of conditions caused by insufficient access to food, poor mother and child caring practices, disease, poor water quality and sanitation, and insufficient access to health services.

There are many symptoms of malnutrition, including poor growth and development, incidence of specific disease and increased vulnerability to other diseases.

UNICEF estimates that malnutrition is responsible for a third to a half of the deaths of children under five worldwide.

Indications of malnutrition:

Stunting Stunting is a slowing of growth that results in reduced height. It is a condition that usually results from extended periods of inadequate food intake, especially insufficient intake of protein and calories. Repeated or chronic infection during early childhood can also cause stunting. It is often referred to as "chronic" malnutrition. Stunted children are too short for their age and can have delayed cognitive development. It is an irreversible condition if it occurs during the time between conception and when a child is 24 months old, and remains a critical cause of vulnerability throughout childhood and into adulthood.

Wasting Wasting is a short-term result of severely reduced food intake or disease. Both children and adults can be affected by wasting. It reflects an immediate problem, often referred to as "acute" malnutrition. At an individual level, it indicates a dangerous level of vulnerability. At the population level, it indicates the onset of a food-security emergency. Wasted children weigh too little for their height. It is a condition that can be reversed with improved diet (sometimes with specialized foods) and the treatment of any underlying illness.

Underweight Underweight is a short-term result of severely reduced food intake or disease and is a sign of malnutrition. It means an individual's weight is too low for their age.

Anemia Anemia is a decrease in the number of red blood cells caused by insufficient iron intake. It causes weakness, fatigue and inability to concentrate. Newborns, young children and women of reproductive age have high iron requirements and are therefore vulnerable to anemia. Anemia during pregnancy can result in small babies with a higher risk of death.

Obesity Obesity is caused by excessive food intake and/or insufficient physical activity. Obesity, long a public health problem in the developed world, is growing as a significant problem in the developing world as well. Obese individuals weigh too much for their height. It is a major risk factor for many non-infectious diseases, such as diabetes, asthma, cardiovascular disease and arthritis.

Vitamin A deficiency Lack of vitamin A in the diet leads to blindness and increases the risk of disease and death from severe infections. Women and children are at greatest risk. For children, vitamin A deficiency causes severe visual impairment and blindness, and significantly increases the risk of severe illness and even death from common childhood infections like diarrheal disease and measles. For pregnant women, vitamin A deficiency occurs especially during the last trimester when demand by the unborn child and mother is highest. Maternal deficiency can lead to night blindness.

Iodine deficiency disorders Lack of iodine in the diet leads to brain damage and impaired cognitive development. Iodine deficiency during pregnancy can increase risk of stillbirth, abortion, abnormalities, and mental problems.

Malnutrition is not only due to the insufficient intake of food or certain foods, but can also be caused by illness and infections (e.g. diarrhea causes the loss of nutrients) and poor sanitation, hygiene, and water use (which can cause illness and infections).

Annex 3 Assessing nutritional gaps

What

This annex offers a sample list of questions to help agriculture-program staff identify the most important, unmet nutritional needs among their target population. These questions should be included within the preliminary agriculture assessment designed to scope the agriculture market.

Why

To be nutritionally sensitive, an agricultural intervention needs to incorporate the specific nutrition priorities that exist among the targeted population. Four nutrition deficiencies are both most prevalent in developing countries and most debilitating to human health and productivity, specifically:

- insufficient energy (caloric) consumption
- insufficient protein consumption
- insufficient vitamin A consumption
- insufficient iron consumption (anemia).

This guide will help you identify which of these problems concern your target population so that appropriate interventions can be embedded within your agriculture program to achieve nutritional outcome.

Note The results of this assessment will by no means be sufficient to inform nutrition-specific activities, which require a much deeper inquiry with significant nutritional technical input.

How

Sources of information do probably already exist. A combination of conversations with local, first-hand experts and a desk review of online resources (see reference list below) can provide national-level data, and in some cases, local information as well.

The worksheet below outlines key questions to investigate during your agriculture assessment. While you may not be able to answer all questions, the picture you can obtain of the local nutritional context will ensure your agricultural activities are designed and implemented to respond to local nutritional needs.

Online data sources

- Core Group www.coregroup.org
- UNICEF www.childinfo.org
- Demographic and Health Survey Program <http://dhsprogram.com/Data/>
- Multi Indicator Cluster Surveys (MICS) http://www.childinfo.org/mics4_surveys.html
- WHO Nutrition Landscape Information System <http://www.who.int/nutrition/nlis/en/>
- WHO Vitamin and Mineral Nutrition Information System <http://who.int/vmnis/database/en/>

Local data sources

- Ministry of Health representatives
- Public health officials, nutritionists, and/or medical staff at local healthcare facilities
- Official government, UN or NGO reports
- Heads of local administration
- District officers of health, rural development, women's affairs, statistics, community welfare/development, agriculture (including livestock), and other sectors, as relevant/available
- UN delegates
- Local and international NGOs

Examples of questions

Nutrition context for agriculture programs

General nutritional context

What percentage of children aged from six to 59 months are stunted within your target population? (stunting is defined as being too short for a child's age – *height-for-age*)

Stunting provides an indication of the level of chronic (long term) malnutrition within a population. It can be caused by many factors, but is useful information to understand the scale of the problem that your target communities face.

Stunting is measured by height-for-age.

What percentage of children aged from six to 59 months are wasted within your target population? (wasting is defined as weighing too little for a child's height – *weight-for-height*)

Wasting provides an indication of the level of acute (short term) malnutrition within a population. As with stunting, wasting can be caused by many factors, but again, it is useful information to understand the nutritional context within your target communities. High levels could be indicative of a need for emergency programming in the area.

Wasting is measured by weight-for-height.

What percentage of children aged from six to 59 months are underweight within your target population? (underweight is defined as a child weighing too little for their age – *weight-for-age*)

Underweight is a composite measure of both stunting and wasting. It will not tell you whether the malnutrition it measures is a long-term or short-term problem, but lacking information about either stunting or wasting, it does provide some idea of the scale of malnutrition in your context.

Underweight is measured as weight-for-age.

Identify the main kinds of food eaten by your target population.

Identify seasonality in the food consumed.

Have nutrition experts identified insufficient dietary diversity as a key cause of malnutrition? If so, which food groups are commonly missing from the typical local diet?

Food groups:

Grains, roots, and tubers, legumes and nuts, dairy products, flesh animal foods, eggs, vitamin-A-rich fruit and vegetables, other fruit and vegetables.

What key nutrients are not sufficiently consumed among the target population?

Calories

Yes No Background

Have nutrition or health experts identified insufficient food consumption generally or by certain groups (especially young children and women of reproductive age) as a key cause of malnutrition?

For adults, 2,000 kcal is required daily to support a minimally active and healthy life. Those engaged in agricultural activity are very likely to require more. Caloric requirements for children vary by age and gender. See the table in **Annex 7** for agricultural products that provide energy.

Are pregnant and lactating women and/or chronically sick individuals consuming fewer than 2,500 kcal?

These individuals require higher energy intake to support a minimally active life and promote the healthy development of infants, breast-milk production, and recovery from illness.

Is there a predictable hunger season during which the amount people eat generally decreases?

Protein

Yes No Background

Have nutrition or health experts identified insufficient protein consumption, either generally or by certain groups as a key cause of malnutrition?

See the table in **Annex 7** for agricultural products that provide protein.

Examples of questions *continued*

Vitamin A	Yes	No	Background
Have nutrition or health experts identified insufficient vitamin A consumption, either generally or by certain groups (especially young children and women of reproductive age) as a key cause of malnutrition?			See the table in Annex 7 for agricultural products that provide vitamin A.
Does the Ministry of Health or other agency support regular vitamin A supplementation?			
What is the prevalence of night blindness among children aged under 72 months?			Prevalence indications, according to WHO: Mild > 0 to <1% Moderate ≥1 to <5% Severe ≥5%
Iron	Yes	No	Background
Have nutrition or health experts identified insufficient iron consumption, either generally or by certain groups (especially young children and women of reproductive age) as a key cause of malnutrition?			See the table in Annex 7 for agricultural products that provide iron.
Does the Ministry of Health or other agency support iron supplementation for pregnant women?			Iron requirements are very high for pregnant women to reduce infant and maternal morbidity and mortality. Though agricultural products are very unlikely to meet these requirements, the more that is available in the local food supply, the better.
What is the prevalence of anemia among women and children aged under 60 months?			Prevalence indications, according to WHO: Mild 5 to <20% Moderate 20 to <40% High ≥ 40%
Indigenous crops rich in nutrients and/or processed nutrient-rich food			
What crops/livestock/fish are the most commonly grown in your target area?			
Among those crops, which ones are rich in protein? iron? vitamin A?			
Are there wild foods rich in protein, iron, or vitamin A? If yes, are they seasonal? difficult to find and/or grow?			
Are there processed foods rich in protein, iron, or vitamin A available in the local markets?			

Roles and responsibilities that influence dietary practices

Who decides which crops to plant or livestock to raise? Is there anyone who influences this decision?

Who performs agricultural labor? (specify for each crop/livestock)

Who decides how much agricultural produce is kept for household consumption and how much is sold? Is there anyone who influences this decision?

Are kitchen gardens in common practice? If so, who makes decisions related to them, and who provides the labor?

Who decides how much money will be spent on food purchases? Is there anyone who influences this decision?

Who purchases the food?

Who prepares the food?

Are there practices that determine how much and what types of food different members of a household can access?

Are there agricultural or other responsibilities that prevent women from breastfeeding?

Annex 4 Biofortification

What

This annex presents the different types of crops that can be fortified to ensure better absorption of nutrients. Biofortification is a process of breeding and producing staple food crops with higher micronutrient content to increase their nutritional value. It differs from ordinary fortification as it focuses on making plant foods more nutritious as the plants are growing, rather than having nutrients added to the foods when they are being processed.

Why

Biofortification can be an efficient strategy to increase the absorption of nutrients by rural populations to reduce micronutrient deficiencies among women of reproductive age and children under five.

Biofortification:

- 1 Capitalizes on the regular daily intake of a consistent and large amount of food staples by all family members** Staple foods predominate in the diets of many people in rural parts of developing countries, so this strategy implicitly targets low-income households.
- 2 Is cost-effective** After the one-time investment to develop seeds that fortify themselves, recurrent costs are low, and seeds can be shared.
- 3 Is sustainable** Nutritionally improved varieties will continue to be grown and consumed year after year, even if government attention and international funding for micronutrient issues fade.
- 4 Increases outreach** It provides a means of reaching undernourished populations in relatively remote rural areas, delivering naturally fortified foods to people with limited access to commercially marketed fortified foods that are more readily available in urban areas.

Note

- Biofortified food, especially in vitamin A, may have a different aspect (more “red”) than traditional food. As such, it is important to emphasize the nutritional benefits through nutrition education campaigns, as well as the production and economic benefits, such as the fact that they may have shorter maturity cycles than the traditional ones, thus allowing for earlier profits. The new biofortified food may need to be farmed slightly differently so education and information about best farming practices are critical to disseminate. It is also important to understand that cooking and the

taste of the biofortified food could be slightly different from the original crop. Sensitization on these matters and the importance of the biofortified food can favor adoption.

- It is important to promote biofortification at the same time as diet diversification to avoid the oversimplification of diets already relying heavily on carbohydrates. Animal-source foods, legumes, nuts, fruit, and vegetables are also important to eat regularly.

How

Crops with biofortification options

Vitamin A	Cassava, maize, orange-fleshed sweet potatoes, golden rice
Zinc	Rice, wheat, beans, sweet potatoes, maize
Iron	Beans, pearl millet, rice, sweet potatoes, cassava, legumes
Protein	Sorghum, cassava

To identify the potential for biofortification, the following steps are suggested:

- 1** The first step is to link up with local research institutes and suppliers to identify the availability of such crops on the local market.
- 2** Should these crops be available for sale or only within the research institute, it will be important to work with both the private suppliers and the research institute to identify ways to bring these crops closer to the consumers to increase availability.
- 3** At the same time, it will be important to promote these crops to ensure uptake and purchase by producers.
- 4** Producers should be informed of agricultural techniques and practices for growing the crop effectively as they may not be familiar with the crop or the needs of the biofortified crop may be different than the needs of the original one.
- 5** Finally, these crops may be unknown to consumers. It will be critical to invest in sensitization of these crops to increase purchase and consumption.

Harvest Plus has developed a *Biofortification Prioritization Index* that ranks countries according to their suitability for investment in biofortification interventions, combining indices for production, consumption, and micronutrient deficiency, using country-level crop production and

consumption data primarily from the Food and Agriculture Organization (FAO) of the UN and iron, zinc, and vitamin A deficiency data from the World Health Organization (WHO). This is a useful tool for highlighting those countries that may benefit from significant reductions in micronutrient deficiency through biofortification of staple crops.

Further resources

- <https://www.securenutritionplatform.org/Pages/DisplayResources.aspx?RID=263>
- Harvest Plus <http://www.harvestplus.org/content/faq>
- D Azara Marfo, 'Prioritizing countries for biofortification interventions using country-level data', *HarvestPlus Working Paper*, Oct 2013, p24
- Penelope Nestel, Howarth E Bouis, J V Meenakshi, and Wolfgang Pfeiffer, 'Biofortification of Staple Food Crops', *The Journal of Nutrition*, Vol.136, No.4, 2006, p1066

Biofortification Prioritization Index

Global ranking	Crops rich in vitamin A			Crops rich in iron		Crops rich in zinc	
	Cassava	Maize	Sweet potatoes	Beans	Pearl millet	Rice	Wheat
1	Mozambique	Malawi	Angola	Rwanda	Niger	Cambodia	Tajikistan
2	Angola	Benin	Burundi	Benin	Gambia	Bangladesh	Turkmenistan
3	Ghana	Zambia	Uganda	Tanzania	Burkina Faso	Laos	Azerbaijan
4	Liberia	Kenya	Mozambique	Burundi	Chad	Myanmar	Afghanistan
5	Benin	Mozambique	Rwanda	Myanmar	Senegal	Vietnam	Pakistan
6	CAR	Angola	Tanzania	Togo	Nigeria	Indonesia	Kazakhstan
7	DRC	Burkina Faso	Sierra Leone	Haiti	Namibia	Sierra Leone	Uzbekistan
8	Sierra Leone	Zimbabwe	Madagascar	Uganda	Guinea-Bissau	Madagascar	Turkey
9	Cote d'Ivoire	Timor-Leste	Guinea	Angola	Uganda	Sri Lanka	India
10	Zambia	Mali	Haiti	Kenya	Nepal	Philippines	Iraq
11	Malawi	Togo	Kenya	Brazil	India	Nepal	Nepal
12	Congo	Tanzania	Mali	Cameroon	Ghana	North Korea	Morocco
13	Togo	Ghana	Laos	Nicaragua	Togo	Liberia	Syria
14	Madagascar	Gambia	Benin	Chad	Sierra Leone	Guinea	Egypt
15	Guinea	Lesotho	Timor-Leste	Malawi	Myanmar	Guyana	Iran

Annex 5 Home gardens

What

Also sometimes called kitchen gardens, home gardens are the production of fruit and vegetables next to the home to complement the consumption of staples with more diversified and nutrient-rich food. While home gardens have, as their name suggests, included only vegetables, it is advised to add animals such as chickens or goats to encourage the consumption of animal proteins, including meat, dairy and eggs. The production of animals within home gardens has the double advantage of bringing animal protein closer to home, thus encouraging the consumption by household members who would not otherwise have access to it (such as children and women), and bringing fertilizers to the gardens in the form of animal manure.

Why

Home gardens are a useful alternative when women don't have control over production. They can complement biofortification and/or intercropping. When carefully planned, home gardens produce nutritious food all year round. Advantages include the following.

- They provide sources of nutrients.
- They are close to the consumption location, so are time saving for women.
- They allow for a more diverse diet.
- They are under the control of women. Even if they do not have access to land, women usually have access and control over homestead resources, so home gardens increase women's decision making.
- They ensure year-round availability of food.
- They increase potential family income.

How

These interventions must not be stand-alone but coupled with a series of agriculture and nutrition interventions.

Home gardens interventions should include the following.

- **Developing a model that includes:**
 - sufficient diversity of fruit, vegetables and animals to provide for all necessary micronutrients and protein, focus on vegetable-based proteins during fasting in some communities
 - adaptations for women, for example, crops that are usually produced by women, or that do not require too much water or too much labor for women both during the production and preparation process

- staggered the planting and maturity cycle to ensure all foods do not mature at the same time and provide food all year-round
- intercropping to ensure soil fertility
- medicinal herbs if appropriate.
- Facilitating training on efficient production practices following the model developed above.
- Ensuring access to seeds and tools adapted for women's usage. It will be important to teach women how to collect and re-use vegetable seeds for sustainability purposes.
- Facilitating fencing around the garden to keep animals out, and appropriate habitat for animals.
- Promoting production, harvesting, and storage techniques that allow for high productivity and maintain nutrient content throughout, including compost with kitchen waste.
- Developing more efficient water management including access to water and use of water. Access to water should consider waste water, drip irrigation, or clay-pot watering. Use of water should consider timely supplementary watering, and tree or crop cover to avoid evaporation/loss of water.
- Delivering nutrition education to ensure a correct understanding of the value of such production.

Hydroponics

What

Technique used for growing vegetables without soil whereby nutrients are provided to the plants in liquid form.

How

Plants should be grown near clean water source, in a place with at least six hours of sunlight per day, away from animals, under shelter from excessive rain or sun. More advanced systems can be created with fish ponds operating with the growth of plants.

Advantages

Plants are clean and safe to eat, occupy a small space (e.g. on walls, roofs, or terraces), provide a high yield, are low-cost, and easy to learn and implement.

For more information and details on how to build a hydroponics system, see the FAO guide: <http://www.fao.org/docrep/019/i3556e/i3556e.pdf>

- Developing processing or conservation techniques to ensure that nutrient-rich food remains available all year round and maintains its nutritional value.

It is only when the production reaches a sufficient level to ensure that sales will not interfere with household consumption that interventions can broaden their scope to link women producers to value chains.

Further resources

See **Annex 7** for crop nutrient content

See **Annex 8** for processing and preservation

See **Annex 7** for nutrition sensitization

<http://www.fao.org/docrep/019/i3556e/i3556e.pdf>

FAO Manual: A vegetable garden for all.

<http://factsreports.revues.org/404>

A Talukder, N J Haselow, A K Osei, E Villate, D Reario, H Kroeun, L SokHoing, A Uddin, S Dhunge and V Quinn, *Homestead Food Production Model, lessons learned from scaling-up programs in Asia (Bangladesh, Cambodia, Nepal and Philippines)*, Helen Keller International, 2010

<https://www.spring-nutrition.org/publications/training-materials/farmer-nutrition-school-session-guide>

Farmer Nutrition School Session Guide, SPRING, May 2014

Annex 6 Product diversification

What

Diversification of agricultural production can occur in many forms (for example mixing genetic varieties, or mixing species) and over different scales (crop, field, or landscape level), giving farmers a wide variety of options and combinations. For example, diversification at the crop level refers to associating crops with different plant heights. Diversification at the field level uses a mix of crops within a field, for example by using areas between and around fields where trap crops or natural-enemy habitat can be planted. At the landscape level, diversification may be achieved by integrating multiple production systems, such as mixing agroforestry management with cropping, livestock, and fallow.

Designing for diversity emphasizes the mimicking of natural ecosystems to enable beneficial relationships between microbial communities in the soil, insects, plants and animals, as well as preserving “wild” spaces and ensuring species and genetic diversity. Examples of mimicking natural ecosystems include intentionally designed agroforestry systems (combinations of crops with trees) in areas where natural ecosystems are forests, or planting grain crops that grow and live for many years in areas that were once prairies. Enhancing biodiversity allows natural agroecological processes and the ecosystem as a whole to build soil nutrients and natural resistance to pests and diseases; services typically performed by external inputs in monocrops where these natural processes are removed (Mercy Corps’ discussion paper on leveraging agroecological approaches to build resilient food systems, Greg Scarborough, January 2015).

Why

Production diversity reduces a multitude of risks associated with price volatility for both inputs and outputs and climate change, and thus increases resilience in a variety of ways, by:

- engendering a greater ability to suppress pest outbreaks and dampen pathogen transmission, which may worsen under future climate scenarios, without the need to rely on expensive and often toxic external inputs
- improving soil fertility and thus crop and livestock production through “companion planting,” which heightens the beneficial interactions between plants and livestock
- spreading the economic risks between a diverse basket of crops and livestock products

- making a greater diversity of nutrient-rich foods available.

How

Mixing crops and trees (agroforestry)

This consists of a land-use management system in which trees or shrubs are grown around or among crops or pastureland. Aside from increasing soil fertility through the fixing of nitrogen, avoiding water run-off, and re-constituting soil litter with falling leaves, planting the right kind of tree can supply fodder, fuel, fruit or timber, all having a direct or indirect impact on nutrition.

Trees to plant when designing an agroforestry system:

- Multi-purpose trees which give many benefits such as fodder, timber, firewood, medicine, bee forage, and fruit
- Trees with small leaves that don't overshadow the land, such as lucaena, flemengia, and acacia.
- Trees which drop their leaves in winter, such as mulberry, and melia.
- Trees which don't compete with ground crops.
- Trees which have deep roots that aren't damaged by ploughing, such as most legumes, and melia.
- Nitrogen-fixing trees which increase nitrogen in the soil.
- Trees which do not require a lot of water, or use amounts of water/rain that is available.

Why is agroforestry important for nutrition?

Trees can assist with improving nutrition in many ways, both directly and indirectly.

- Trees can provide nurturing environments for livestock or crops which provide valuable nutrients to households. For example, trees that provide soil fertility or fodder allow for and improve the production of vegetables and milk, and can provide wild-food sources.
- Also, trees that provide timber for fuel decrease the time that women spend on collecting firewood, allowing them to spend more time to care for their children.
- More directly, parts of trees are edible and nutritious (such as leaves, fruit, and nuts).

For more information on links between agroforestry, nutrition, and health, see this IFPRI brief: http://www.ifpri.org/sites/default/files/publications/focus13_11.pdf

Mixing diverse crops (intercropping) or animals

Within-crop mixing takes place where crop rotations are practised over and within years.

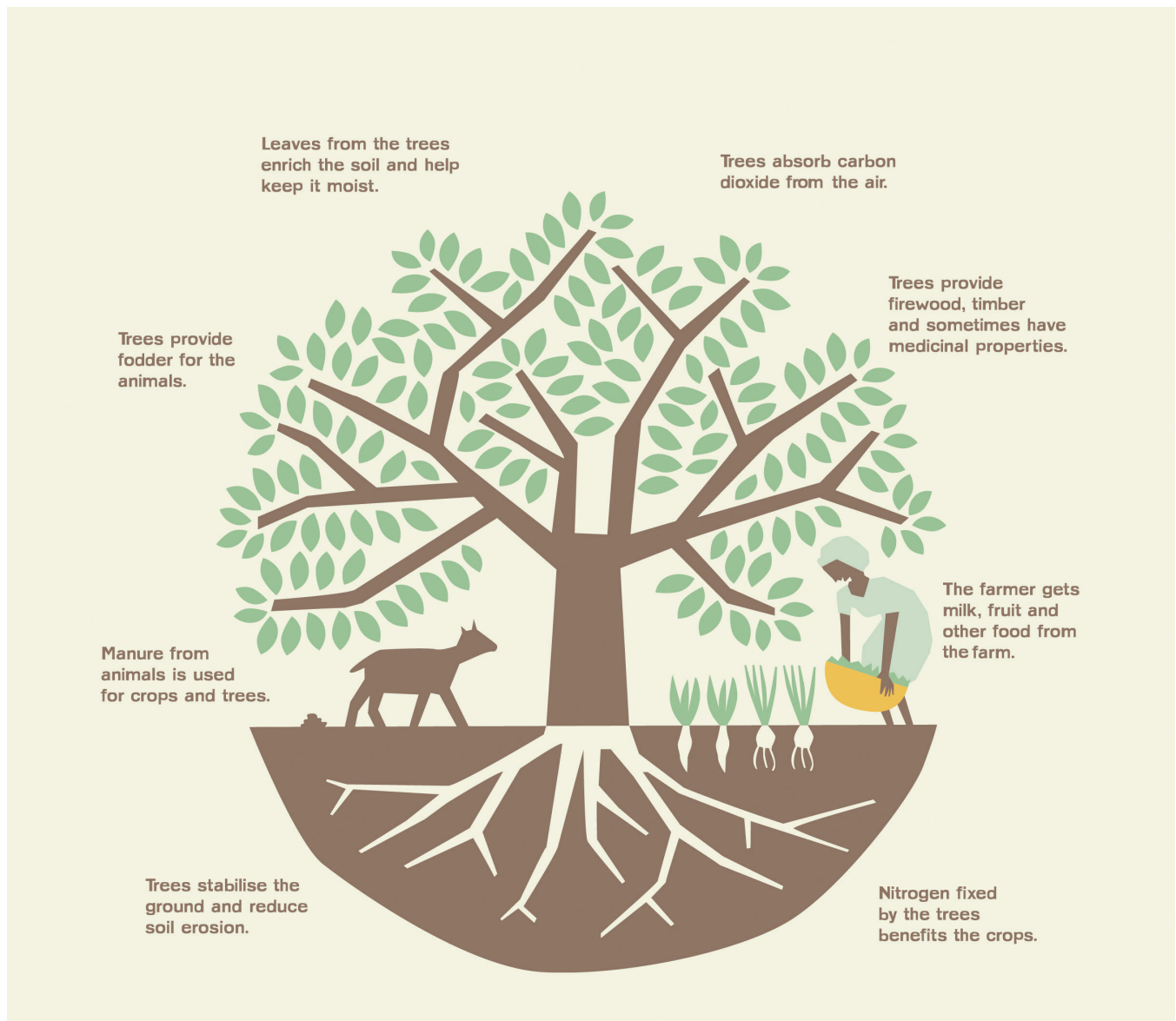
For example, a farmer has a grain-legume rotation to provide the grain with nitrogen or a potato-beet-grain rotation to avoid disease in the potatoes. Plants can also be intercropped to take maximum advantage of light and moisture, to suppress weeds or prevent leaching of nutrients through the use of catch crops. For example, beans will be intercropped with maize in a way that it will both fix nitrogens into the soil for increased productivity, and increase the diversity of available nutrients, as beans are rich in protein and iron, while maize provides the necessary calories.

Examples of mixing between animals are found in chicken-fishpond systems where chicken dung fertilizes the fishpond, in beef-pork systems where pigs eat the

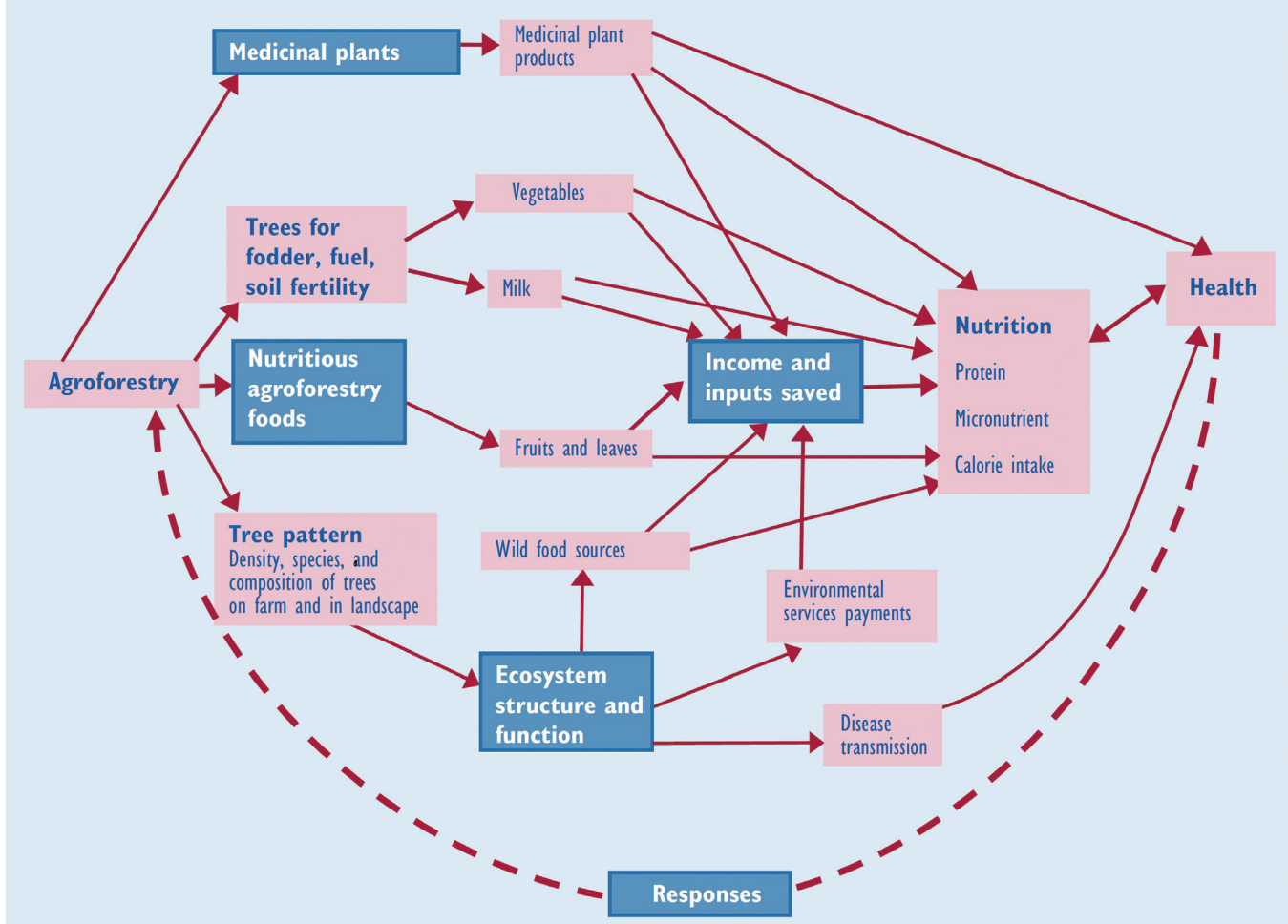
undigested grains from the beef cattle dung, or in mixed grazing such as cow-sheep mixes to maximize biomass utilization or to suppress disease occurrence.

Why is mixing diverse crops (intercropping) or animals important for nutrition?

- Intercropping improves dietary diversity through the production of various crops rather than only one or two staple crops. This in turn improves the variety and quantity of nutrients households are able to consume.
- When intercropped, the nutrient content of crops increases. For example, when groundnuts are intercropped with maize, the iron content of groundnuts can be greater than groundnuts that are monocropped.
- Mixing between animals allows for using the by-products of other animals for feed or fertilization,



Linkages between Agroforestry, Health, and Nutrition



Source: IFPRI 2006 (link in Further resources below).

which can yield more nutritious meats compared to animals that are fed poor diets (e.g. maize-based diets). Animal-source foods contain a large variety of nutrients and nutrients that are often more bioavailable (more easily absorbed by the body) than plant-source foods. Intake of animal-source foods is especially important for infants, young children, and pregnant and lactating women, and provide a year-round source of good nutrition.

Mixing crops and animals in an integrated system

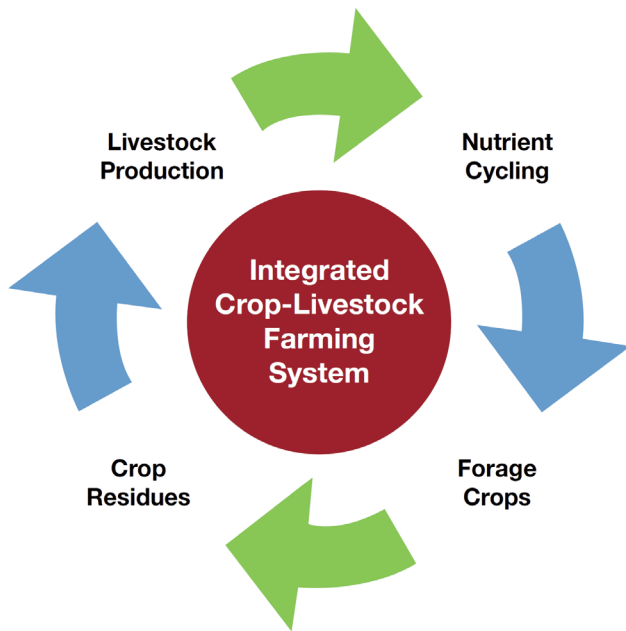
Integration is used to recycle resources efficiently where products or by-products of one component serve as a resource for the other, for instance dung goes to the crops and straw to the animals. In this case the integration serves to make maximum use of the resources.

Why is mixing diverse crops and animals important for nutrition?

- Animal-source foods contain a large variety of nutrients and nutrients that are often more bioavailable

than plant-source foods. Intake of animal-source foods is especially important for infants, young children, and pregnant and lactating women. Animal-source foods are often not seasonal and thus provide a year-round source of good nutrition.

- In an integrated system, the waste products of one component serve as a resource for the other. For instance, manure can be used to enhance crop production, crop residues and by-products feed the animals (often supplementing inadequate feed supplies), which contributes to improved animal nutrition and productivity and finally improved human nutrition.
- In times of need, livestock can be used as a source of cash to access more diverse food.



Note In some cases, there might be competition for crop residue between feeding the animals and leaving the residue on the ground for mulch as part of conservation-agriculture principles. It is important in this case to evaluate what is most important and either limit the number of animals fed through residue or find alternative sources of feed.

Further resources

For agroforestry

http://www.permaculturenews.org/resources_files/farmers_handbook/volume_4/4_agroforestry.pdf

For mixed crop and livestock system

<http://www.accessagriculture.org/category/149/Integrated%20Crop-Livestock%20Management>

For integrated mixed systems

<http://www.fao.org/3/contents/17efb632-9a71-5f97-a8db-c82800640241/Y0501E00.HTM>

<http://www.ifad.org/lrkm/factsheet/integratedcrop.pdf>

Examples of diversification in agricultural systems and the potential benefits for farmers under climate change

Type of diversification	Nature of diversification	Benefit	Examples
Increased structural diversity	Makes crops within the field more structurally diverse	Pest suppression	Strip-cutting alfalfa during harvest allows natural enemies to emigrate from harvested strips to adjacent non-harvested ones (Hossain et al. 2001)
Genetic diversity in monoculture	Growing mixed varieties of a species in a monoculture	Disease suppression	Genetic diversity of rice varieties reduces fungal blast occurrence (Zhu et al. 2000)
		Increased production stability	Increased genetic diversity was positively related to mean income and stability of income (Di Falco and Perrings 2003)
Diversify field with non-crop vegetation	Growing weed strips or vegetation banks in and alongside crops	Pest suppression	Grassland or refugia planted at field margins (beetle banks) were used as overwintering habitat for natural enemies (Thomas et al. 1991)
		Pest suppression	Using white and black mustard on the field margins of sweet corn crops trapped pests and prevented them from entering the cornfield (Rea et al. 2002)
Crop rotations	Temporal diversity through crop rotations	Disease suppression	Alternating cereal crops with broadleaf crops and changing stand densities disrupts the disease cycles (Krupinsky et al. 2002)
		Increased production	Manipulating diversity through crop rotations of greater cover crop and nitrogen-fixing crops increased the yield of the primary crop (Smith et al. 2008)
Polycultures	Growing two or more crop species and wild varieties within the field, spatial and temporal diversity of crops	Disease suppression	Grassland fields with multiple species to decrease disease transmission (Mitchell et al. 2002)
		Climate change buffering	More ecologically complex systems with wild varieties and temporal and spatial diversity of crops were able to grow under climate stress (Tengö and Belfrage 2004)
		Increased production	Grassland plots with greater in-field species diversity led to more stable feed and fodder production (Tilman et al. 2006)
		Increased production	Grassland plots with greater in-field species diversity led to increased production (Picasso et al. 2008)
Agroforestry	Growing crops and trees together, spatial and temporal diversity	Pest suppression	Willow trees grown in natural willow habitats experience lower rates of pest outbreak in the leaf beetle (Dalin et al. 2009)
		Pest suppression	Greater shade diversity increased bird natural-enemy abundance for larval control on crop plant (Perfecto et al. 2004)
		Pest suppression	Coffee berry borer control increased with greater ant diversity and abundance in shade systems (Armbrecht and Gallego 2007)
		Climate change buffering	Greater shade tree cover led to increased buffering of crop to temperature and precipitation variation (Lin 2007)
		Climate change buffering	Greater shade tree cover led to increased buffering from storm events and decreased storm damage (Philpott et al. 2008)
Mixed landscapes	Development of larger-scale diversified landscapes with multiple ecosystems	Pest suppression	Complex landscapes that have areas of woodland and hedgerows interspersed within fields had higher rates of larval parasitism (Marino and Landis 1996)
		Pest suppression	Oilseed rape crops adjacent to complex, structurally rich, and large old fallows had higher rates of parasitism by the rape pollen beetle (Thies and Tschantke 1999)
		Increased production	Mixed land use of organic cropland, crop rotations, and intensive managed grazing led to optimal diversity and profitability strategies (Boody et al. 2009)

Brenda B. Lin BioScience 2011;61:183-193

Annex 7 Global averages on nutrient contents

The specific nutrient content of any agricultural product is highly contextual, depending on climate, soil, variety, production practices, post-harvest handling and

preparation techniques. Processed and packaged foods may also be fortified with nutrients so it is important to check packaging.

Nutrient content based on global averages

	Calories	Protein	Vit A	Iron	Iodine*	Zinc	Notes and source
Cereals							
Rice	●						http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Wheat	●						http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Maize	●						http://www.fao.org/docrep/t0395e/t0395e03.htm
Sorghum	●	●		●			http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://siteresources.worldbank.org/NUTRITION/Resources/Tool2-AnnexC.pdf
Millet	●	●		●			http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://siteresources.worldbank.org/NUTRITION/Resources/Tool2-AnnexC.pdf
Tef	●			●			http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://siteresources.worldbank.org/NUTRITION/Resources/Tool2-AnnexC.pdf
Roots and tubers							
Potato	●				●		http://www.fao.org/docrep/t0207e/t0207e04.htm
Yam	●				●		http://www.fao.org/docrep/t0207e/t0207e04.htm
Orange-fleshed yams	●		●		●		http://www.fao.org/docrep/t0207e/t0207e04.htm
Sweet potato	●				●		http://www.fao.org/docrep/t0207e/t0207e04.htm
Orange-fleshed sweet potatoes	●		●		●		http://www.fao.org/docrep/t0207e/t0207e04.htm
Cassava	●				●		Should not be used for infant weaning foods due to possible toxicity, cyanide is present so foods should be well cooked/processed http://www.fao.org/docrep/t0207e/t0207e04.htm
Orange cassava	●		●		●		Should not be used for infant weaning foods due to possible toxicity, cyanide is present so foods should be well cooked/processed http://www.fao.org/docrep/t0207e/t0207e04.htm
Legumes							
Groundnuts	●	●				●	Groundnuts are especially prone to aflatoxin contamination, which can have dangerous impact on human health. Care should be taken to assure food safety. http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Lentil		●		●		●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://ods.od.nih.gov/factsheets/Iron-HealthProfessional/
Beans		●		●		●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://ods.od.nih.gov/factsheets/Iron-HealthProfessional/
Yellow or green peas		●				●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Cowpeas		●	●	●		●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/ http://ods.od.nih.gov/factsheets/Iron-HealthProfessional/
Pigeon peas		●				●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Soybean	●	●		●		●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 http://ods.od.nih.gov/factsheets/Iron-HealthProfessional/

*Iodine is most commonly consumed from the intake of iodized salt, which can be added to foods and is found in some processed foods. Amounts of iodine in foods like root crops and tubers depends on the iodine content of soil where crops are grown.

Nutrient content based on global averages *continued*

	Calories	Protein	Vit A	Iron	Iodine*	Zinc	Notes and source
Vegetables							
Dark, leafy greens			●	●			From a variety of plants, including kale, collards, chard, and spinach, as well as the leaves from pumpkin, cassava, sweet potato, amaranth, and cowpeas. http://www.fao.org/docrep/w0078e/w0078e08.htm ; http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Carrot			●				http://www.fao.org/docrep/w0078e/w0078e08.htm
Pumpkin (and other orange squash)			●				http://nutritiondata.self.com/facts/vegetables-and-vegetable-products/2601/2
Animal origin products							
Red meat		●		●		●	Contaminated meat represents a risk to human health. Care should be taken to assure food safety. http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864 , and ACDI/VOCA <i>A nutrition primer</i>
White meat		●		●		●	Contaminated meat represents a risk to human health. Care should be taken to assure food safety. http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Organ meat		●		●		●	Contaminated meat represents a risk to human health. Care should be taken to assure food safety. <i>ACDI VOCA, A nutrition primer</i>
Poultry		●				●	Contaminated meat represents a risk to human health. Care should be taken to assure food safety.
Fish		●			●	●	Contaminated fish represents a risk to human health. Care should be taken to assure food safety. http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Fish oil						●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Eggs		●		●		●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Milk		●				●	Contaminated milk represents a risk to human health. Care should be taken to assure food safety. http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Blood		●		●		●	http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Fruit							
Banana	●						http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Plantain	●						http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Papaya			●				http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Mango			●				http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Tomato			●				Vitamin A content of tomatoes is highly variable among different varieties. http://www.fao.org/docrep/w0073e/w0073e06.htm http://nutritiondata.self.com/facts/vegetables-and-vegetable-products/2682/2
Orange melon			●				http://nutritiondata.self.com/facts/fruits-and-fruit-juices/1954/2
Other							
Sesame		●		●			http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864
Red palm oil	●		●				http://www.fao.org/docrep/w0073e/w0073e06.htm#P5431_644864

*Iodine is most commonly consumed from the intake of iodized salt, which can be added to foods and is found in some processed foods. Amounts of iodine in foods like root crops and tubers depends on the iodine content of soil where crops are grown.

● Iodine can be in seafood, but not usually in fresh fish.

Annex 8 Nutrition sensitization training

What you need to prepare before the training

- Determine during the assessment the type of nutritional deficiencies present in the target population (vitamin A, iron, protein and/or calories).
- Determine during the assessment which indigenous crops are rich in vitamin A, iron, or protein.
- Design a model for home gardens integrating low-labor and low-water-demanding nutritious crops and

Sensitizing households on nutrition

Target audience Mothers of children under five, fathers, and grandmothers.

Timing Four hours (can be divided into two separate sessions if needed).

Objective of the training To ensure that mothers of children under five understand the importance of a balanced diet and help them define ways to improve the family diet.

Key themes to address during the training

- 1 The importance of nutrition for the child's development
- 2 How to have a more balanced diet
- 3 Producing complementary nutrient-rich food:
 - on additional land – homegardens or livestock production
 - on current land – biofortification of current crops produced or intercropping
- 4 Purchasing complementary nutrient-rich food
 - Importance of shared decision making
 - Existing supplies of nutrient-rich food
- 5 How to preserve nutrients
- 6 The importance of clean water, sanitation, and hygiene (time permitting)

Key resources

FAO *Family nutrition guide* – detailed nutrition information: <http://www.fao.org/docrep/007/y5740e/y5740e00.htm#Contents>

WHO healthy diet information: <http://www.who.int/mediacentre/factsheets/fs394/en/>

WHO, 2005, *Guiding principles for feeding non-breastfed children 6 – 24 months of age*: http://www.who.int/child_adolescent_health/documents/9241593431/en/index.html

animals that are familiar to the audience and can grow within the target geographical area.

- Design a model for production diversification incorporating livestock rearing or fish production (refer to **Annex 6** on production diversification).
- Determine which biofortified crops are accessible and feasible in the region.
- Determine which fortified foods are available for purchase and at what cost.

WHO, 2003, *Guiding principles for complementary feeding of the breastfed child*:

<http://www.who.int/nutrition/publications/infantfeeding/924154614X/en/index.htm>

Details of the training

1 The importance of nutrition

What We care about nutrition because of the strong links between undernutrition and death. The number of child deaths resulting from undernutrition is around 3.5 million every year (Lancet, 2008), i.e. 35% of deaths are due to a combination of undernutrition and illnesses. Undernutrition not only causes death, but can also make people more likely to get sick or can slow or impair children's growth and development. Proper nutrition also enables adults to be strong and economically productive.

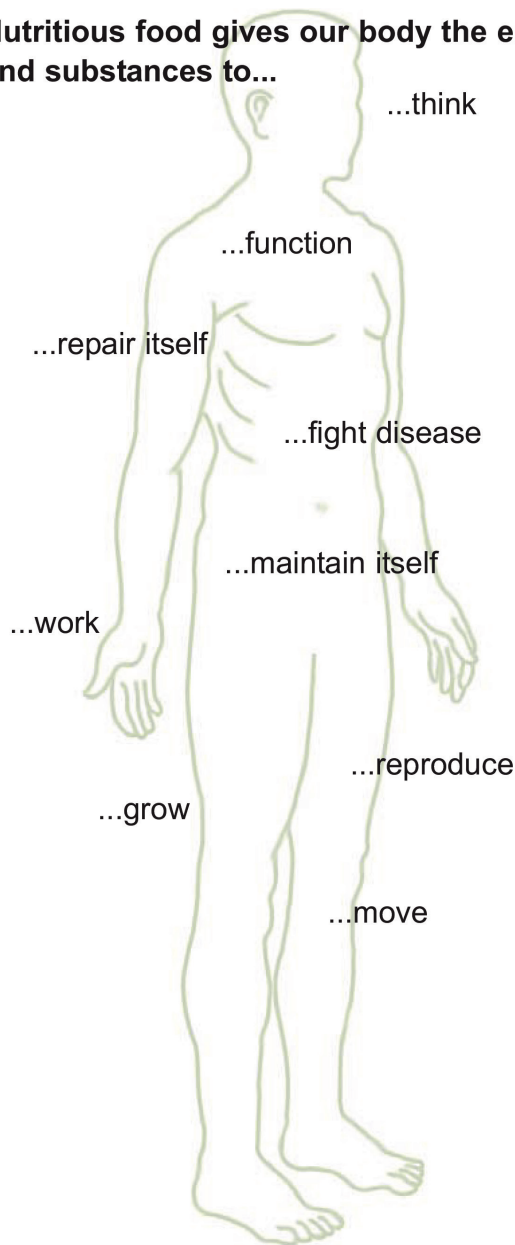
Effects The effects of undernutrition can be seen with the naked eye, for example, children are short for their age, they are thin for their age, they have oedema (swelling), etc. Sometimes the effects are not visible, for example children are more likely to be sick, they are tired and cannot concentrate in school, etc.

For pregnant and lactating women Undernutrition increases the risk of:

- maternal death during childbirth
- giving birth to an underweight or mentally impaired baby. When breastfeeding, undernutrition of the mother leads to the poor health, growth, and development of the child.

For children Undernutrition increases the severity and length of some common diseases such as diarrhea, ARI (acute respiratory infections), or measles, increasing the risks of death. Undernutrition also affects the physical and mental development of the child, which means that he or she will be less able to earn money when they grow up and less able to help you meaningfully in the farm.

Nutritious food gives our body the energy and substances to...



- Most growth faltering occurs between the ages of six and 24 months when the child is no longer protected by exclusive breastfeeding and is more exposed to disease and infection through contaminated food or water. Even a child adequately nourished after 24 months of age is unlikely to recover growth 'lost' in the first two years as a result of malnutrition.
- There are increased nutrient needs during pregnancy. Inadequate food intake during pregnancy can increase the risk of delivering an undernourished baby. When mothers are breastfeeding they require extra energy which they can get from the reserves they have built up during pregnancy and from eating extra food after birth. It is therefore important for pregnant and lactating mothers to increase their food intake and ensure they have a balanced diet.

What to do

- 1 Improve caring and appropriate practices such as breastfeeding, and appropriate complementary feeding, as well as hygiene and health-seeking behaviors.

Infant and young-child feeding

Feeding practices for children under age five are particularly important and the first 1,000 days are a critical window for optimal growth, health, and development. Complementary feeding takes place when breast milk alone is no longer sufficient to meet the nutritional requirements of infants and other foods and liquids are needed. Insufficient or inadequate complementary feeding can negatively impact health and growth.

Feeding recommendations to promote optimal nutrition

0-6 months	Exclusively breastfeed (child should not consume any foods or liquids aside from breast milk)
6-12 months	Start complementary feeding, but breast milk should contribute to half or more of child's nutritional needs
12-24 months	Continue complementary feeding, but breast milk should contribute to a third or more of child's nutritional needs
24 months and older	Nutritional needs can be met from foods aside from breast milk, but breastfeeding can still be practised

Source: Food and Nutrition Council of Zimbabwe, FAO, & UNICEF: *Healthy harvest – A training manual for community workers in growing, preparing, and processing healthy food* <http://motherchildnutrition.org/healthy-nutrition/pdf/mcn-healthy-harvest.pdf>

What does this mean for the family? It means more time and money spent to go to the health facilities. It also means less time and energy to work with you in the field, go to school, and earn money.

Whom To counter undernutrition, one of the important and simple things to do is having a balanced diet. A balanced diet is important for all. It is important for the father, so that he has more energy to work in the field. But it is even more important for children under two, and pregnant and lactating women. Why?

2 Eat more appropriately through a balanced diet (see below).

2 How to have a more balanced diet

This discussion is based on the results of the assessment, which will reveal the type of micronutrient (vitamin A, iron or proteins) and calorie needs within the target population, and which indigenous crops or fortified processed products provide these types of nutrient.

Start the session with a discussion on what infants and young children, and pregnant and lactating women in the community/in the family eat.

a Show the food group diagram for a healthy life, each person should eat some of each of these food groups, everyday, all year round. The food groups are outlined below. The diagram also shows that we need to eat a sufficient amount of:

- carbohydrates (e.g. millet, sorghum, whole grains, yams, potatoes, rice, and maize)
- protein (e.g. fish, meat, beans, nuts, and eggs)
- micronutrients (e.g. fruit and vegetables) every day.

Individuals, especially children over six months and pregnant and lactating women, should consume foods from at least four of the following food groups per day.

- Grains, roots, and tubers: millet, sorghum, whole-grain flour, potatoes, yams, rice
→ Important for energy.
- Legumes and nuts: beans, lentils, cowpeas, soybeans, groundnuts
→ Important for protein and growth.
- Dairy products: milk, yogurt, cheese
→ Important for protein, micronutrients, and growth.
- Flesh animal foods: meat, fish, poultry
→ Important for protein, micronutrients, and growth.
- Eggs
→ Important for protein, micronutrients, and growth.
- Vitamin-A-rich fruit and vegetables: orange sweet potato, papaya, mango, carrots, pumpkin, leafy greens
→ Important for growth and development.
- Other fruit and vegetables: leafy greens (kale, spinach), tomatoes, bananas, peppers, eggplant
→ Important for growth, development, and digestion.



Source: UNICEF

Breastfed, best fed

- Breast milk is the perfect food for babies. It has everything a baby needs to grow and develop for the first six months of life.
- Babies who consume only breast milk during the first six months of their life (exclusively breastfed) tend to grow better, fall sick less, and perform better in school than those who are not exclusively breastfed.
- For the first six months, babies do not need any other foods or liquids aside from breast milk (not even animal milk, water, porridge, or fruit).
- Giving other foods and liquids (including water) to babies during the first six months can be dangerous for their health.
- Human breast milk is perfect for human babies, just as cow's milk is perfect for baby cows and goat's milk is perfect for baby goats. We never see baby goats drinking cow's milk because animal milks are different.
- At six months, the child should start eating other foods, but should continue breastfeeding until at least 24 months.

- b *Briefly summarize the nutritional status of the population nationally and in the target area based on the results of the assessment.*
- c *Explain the possible effects of this lack of nutrients*
The chart below provides examples of the health consequences for each type of nutrient gap.

The health consequences of nutrient gaps

Lack of vitamin A	Visual impairment or blindness
Lack of iron	Anemia – pale conjunctivae (inner eyelid), nail beds, gums, tongue, lips and skin; tiredness; headaches; breathlessness; delayed infant motor function; delayed infant mental function; slow cognitive and social performance; decreased immune function; risk for early births or small babies (pregnant women)
Lack of proteins	Kwashiorkor – oedema, large belly, thinning hair, light skin; tiredness; underweight; short for age
Lack of calories	Thinness, lack of strength

- d *Provide a list of agricultural products that are found locally and that contain the necessary nutrients.*
For example:

Local products containing nutrients

Vitamin A	Orange sweet potatoes or orange cassava, cowpeas, carrots and pumpkins, fish oil, eggs and milk, papaya, mangoes and tomatoes, red palm oil
Iron	Legumes (beans, lentils, cowpeas, soybeans), animal products such as eggs, red meat, blood, dark leafy greens (spinach, kale), sesame
Protein	All legumes (including groundnuts), all animal products, sesame

Iodine and zinc

Iodine and zinc are other micronutrients that are important for proper growth and development. Lack of iodine can lead to brain damage, physical development problems, and mental/cognitive impairment. The best source of iodine is iodized salt, which should be added to foods. Lack of zinc can hinder normal growth, development, and immune function, and is especially important during pregnancy. Sources of zinc include meat, fish, whole-grain cereals, and legumes.

- e *Provide a list of fortified products that can also be found locally* For example: maize flour, rice, porridge, salt, etc. **Note** Not all salt available is fortified with iodine. Check packaging or ask market sellers to be sure you are purchasing/consuming iodized salt.

Fortification

Fortification is a process where micronutrients are added to foods to improve their nutritional quality. Fortified foods are processed so special attention should be paid to the packaging on processed foods that are purchased. Subsistence or small, rural, market purchased foods are often not fortified. Increasingly, maize and wheat flour, porridge mixes, and rice (e.g. *Ultra Rice*) are being fortified with vitamins and minerals like iron and zinc. Vegetable and soybean oils are often fortified with vitamins A and D. Many countries have made the fortification of certain foods (e.g. wheat flour) mandatory while some countries have limited or no fortified products.

f Discuss with the group the reasons why they do not eat these foods and ways for them to consume these foods more regularly. See examples in table below.

3 Producing nutrient-rich foods

To have access to all types of food all year round, one of the easiest things to do is to produce them yourself. Below are four simple ways of producing them:

- **Develop your home garden** Close to your home, it provides a good source of additional nutritious food all year round (see **Annex 5** on home gardens). *Show the drawing of an example of home garden.* In your garden, think about including:
 - different types of nutrient-rich food (some green leafy vegetables for iron, some carrots or papaya for vitamin A, etc.)
 - food that is available all year round, or with staggered maturity periods so that you have a good source of nutrients all year round
 - a source of water close by, either kitchen waste water, or a small reservoir for rain water, or a river/lake or a pump/bore hole.
- **Intercrop nutrient-rich crops with your traditional crops** Intercropping is not only good for nutrition purposes, it is also good for the soil. For example, intercropping beans with maize increases the amount of nitrogen in the soil and makes it more fertile, and

beans are a good source of protein (refer to **Annex 6** on production diversification).

- **Continue to produce your crops, but change the variety** This is called biofortification. There are numerous varieties of crops that provide more nutrients than the one we currently produce. For example, orange-flesh sweet potatoes provide more vitamin A than the traditional white varieties (see **Annex 4** on biofortification)
 - **Engage in livestock rearing or fish production.** Small animals, for example poultry, rabbit, guinea pigs, or even goats that will eat the kitchen waste and require little time to take care of. In addition to meat, some of these animals can also provide eggs and milk (see **Annex 6** on production diversification)
- #### 4 Purchasing nutrient-rich foods
- a Start the session with a discussion on who is making decisions within the home:
Who is preparing food? Who is buying food? Who decides what to buy or what to prepare?
 - b Continue the discussion with a discussion on how the money is provided to the one who buys the food. *Insist on the importance of giving the women the necessary financial means to purchase not only grain, but also vegetable, fruit, legumes (beans, lentils), meat, fish, and eggs.*

Reasons people do not eat foods and ways to overcome barriers

Food groups	Possible reasons for not consuming those (provided by the group)	Ways to overcome these barriers (provided by the group)
Fruit and vegetables	Traditional meals consist of cereals in a form of dough with only occasionally some sauce. Vegetables are not part of the traditional meal. Orange-flesh potatoes are not available locally, or we do not like them. Spinach is available only a few months during the year.	We could grow some vegetables next to our home. We could find a way to prepare sweet potatoes so that we can eat them. We could purchase vegetables in the market. Etc.
Dairy	Children are fed cow milk once a day, but during the dry season, due to lack of pasture or because the herd has migrated, they do not have access to the milk.	We could keep a goat or two, feed the goats kitchen waste, and give the milk to our children. Etc.
Eggs	Children do not eat eggs as it is believed they will become introvert.	Eggs are reserved for the father. We could feed them eggs only once a week. Etc.

Gender sensitivity: Importance of women

Women play a vital role in food production and nutrition and therefore it is important to include them in decision making and to educate them about proper nutrition and ways to prepare foods to ensure optimal nutrient gain. It is important to empower women when undertaking nutrition sensitization since they control much of a household's food security and nutrition. It is also important to educate them on proper caregiving and feeding practices so they feel comfortable and prepared to meet infant and young child feeding requirements. Educating and empowering men and boys is also important so they are supportive of women and also understand the importance of nutrition for themselves and their families.

Further information:

FAO and WFP, importance of women in agriculture: <http://www.fao.org/publications/sofa/en/>

IFPRI, gender as a key link between agricultural programs and improved nutrition: <http://ifpri.org/publication/gender-key-dimension-linking-agricultural-programs-improved-nutrition-and-health>

- c *End the discussion with where people purchase their food, in which case what type of food is good to buy. Fortified foods are important to purchase (refer to the list of fortified food available on the market). Animal-sourced foods are also important to consume, but care should be placed on where the food is purchased in terms of safety and hygiene (see **Annex 10** on food safety).*

5 How to preserve nutrients

Food that is nutrient rich can still lose its nutrients if not properly handled, for example, during purchase, transport to the home, harvest, storage, processing, or even during preparation. There are simple ways to ensure that the food that you consume has maintained its nutrients (see **Annex 9** for more detailed information about proper storage, processing, and preparation of foods to ensure the maintenance of nutrients.)

Preparing your food so that it does not lose its nutrient contents is important. You can:

- germinate and soak grains to help your body better absorb the iron and zinc naturally available in the food
- reduce the frying time of foods
- cook vegetables in boiling water or steam, and re-use the liquid for soup or cereal preparation

- store raw fruit and vegetables intact (without cutting or peeling them), keep storage time short and cool or refrigerated
- avoid peeling fruit and vegetables when the peel is edible and you can wash them with safe water
- wash/scrub fruit and vegetables before peeling or cutting, not after
- consume or cook fruit and vegetables immediately after peeling, cutting, chopping or pulping
- fortify your food, especially for children, for example, including soyabean flour in children's porridge will improve the protein and iron content, adding fish powder/dried fish to soups will improve the protein, iron, and vitamin A content, or adding fortified salt with iodine to soups.

Cooking demonstrations and recipes

Cooking demonstrations of ways to increase the nutrient content of local foods/meals are helpful. Demonstrations can include showing families the appropriate amount of cooking time to limit the loss of nutrients, boiling or steaming vegetables that are not peeled, washing foods, in addition to how to fortify foods (i.e. by adding nutrient-rich foods to meals or recipes). Cooking demonstrations can help understand how people perceive changed tastes of new recipes and can help families assess the feasibility and local acceptability of improved complementary feeding options. Demonstrations of drying, fermenting, or germinating foods are also helpful.

During the cooking demonstrations/sharing of new recipes that are locally appropriate (involve foods that are normally eaten and available), consider encouraging households to add the following items to meals.

- Groundnuts (groundnut paste or powder)
- Millet and sorghum vs maize
- Iodized salt
- Leafy green vegetables (can be added to any meal fresh or dried)
- Dried fish/fish powder
- Beans or bean flour

The following foods can be added to porridge given to children to improve its nutritional value.

- Groundnuts (paste or powder)
- Dried fish/fish powder
- Bean flour
- Vegetable oil

For more nutritious recipes: <http://motherchildnutrition.org/healthy-nutrition/pdf/mcn-healthy-harvest.pdf>

Vegetable mixtures and diet quality

Where animal-source foods are limited or unavailable, the quality of protein in the diet can be improved by mixing a variety of vegetable or plant-based products at each meal. Some examples of combinations that can increase nutrient absorption include:

- rice and beans
- maize and beans (and leafy green vegetables)
- sweet potatoes and beans (and peas and leafy green vegetables)
- meals or porridges made from millet, sorghum, cassava, or maize flour served with cowpeas/beans sauce, and tomatoes
- sorghum meals served with bananas and groundnut paste
- millet meals served with onion, yam, peas, and tomato
- potatoes with groundnut soup
- maize meals served with sesame or groundnuts
- maize/millet or rice meals served with vegetable stew (green leaves, tomatoes, beans, onions)
- cassava with beans
- plantains with beans and cabbage.

6 Importance of clean water, sanitation, and hygiene

If time permits, you can share this information on the importance of clean water, sanitation and hygiene.

Clean water, sanitation, and hygiene are important during the production, processing, and consumption of food. Lack of clean water, sanitation, and hygiene can lead to illness from infectious diseases that can be especially dangerous for infants and young children whose immune systems are still developing. Illness related to water, sanitation, and hygiene can also be harmful to pregnant women who also need to be strong for their growing child. Water-borne illness often leads to diarrhea which can contribute to a loss of nutrients so even if diets are adequate, nutrients can be lost if diarrheal diseases are present.

- a Clean water:** Clean water is important for agriculture, agricultural products, consumption, feeding, and drinking. When foods or utensils are cleaned with water that is not safe for consumption, people can become sick, especially those who are more vulnerable to illness like infants and young children, pregnant women, sick adults, the elderly. When cooking, clean water should also be used for porridges, soups, etc. to avoid getting infectious diseases. Locate clean sources of water near your home or ways to purify the water. Discuss what water is used now for producing food, washing and preparing food, and consuming food. Further discuss how this water can be improved and safe. Water that is near animals can be especially dangerous so if livestock live or walk near your water source, make sure it is safe to use.
- b Sanitation:** Having and using sanitation facilities (e.g. latrines, toilets) is important to prevent the spread of infectious diseases that can also lead to diarrhea and the loss of nutrients. Lack of sanitation facilities can lead to feces getting into water systems, or attract flies which can land on food.
- c Hygiene:** Hygiene refers to washing hands after using the toilet and before preparing and consuming food. This is important to prevent diseases from the fecal-oral route and to ensure other bacteria that may be on hands is clear before coming into contact with food. This is especially important when caregivers feed infants or young children and their hands often come into contact with the child's mouth.

Discuss what the main water sources in your community are and what this water is used for (e.g. rain water vs lake water). Discuss what sanitation facilities are available in your community. How can you improve water, sanitation, and hygiene within your household? How will this affect your family's nutrition?

For more information on water, sanitation, and hygiene, refer to this WHO resource: http://www.who.int/elena/titles/bbc/wsh_diarrhoea/en/

Sensitizing agriculture extension services on nutrition

Target audience Providers of agriculture extension services, including local government, and private sector providing embedded services, such as seed suppliers and MFIs. Farmers can also be trained on these themes.

Timing Two hours.

Objective of the training To help agriculture extension service providers understand the importance of nutrition for the population and for the economy (how the loss of nutritional value can affect them as parents and as economic agents), and to generate a discussion on how they can contribute, through their activities, in maintaining or increasing the nutritional value of agricultural products.

Key themes to address during the training

- 1 The importance of nutrition:
Why is nutrition important for you?
- 2 Basics of nutrition
- 3 Nutrient-rich crops and livestock
- 4 How to preserve nutrients
- 5 The importance of engaging in dialogue with health and nutrition extension services

Key resources

Biodiversity International improving nutrition with agricultural biodiversity manual for implementing field projects: http://www.biodiversityinternational.org/uploads/tx_news/Improving_nutrition_with_agricultural_biodiversity_1478.pdf; <https://www.spring-nutrition.org/publications/tool-summaries/improving-nutrition-agricultural-biodiversity>

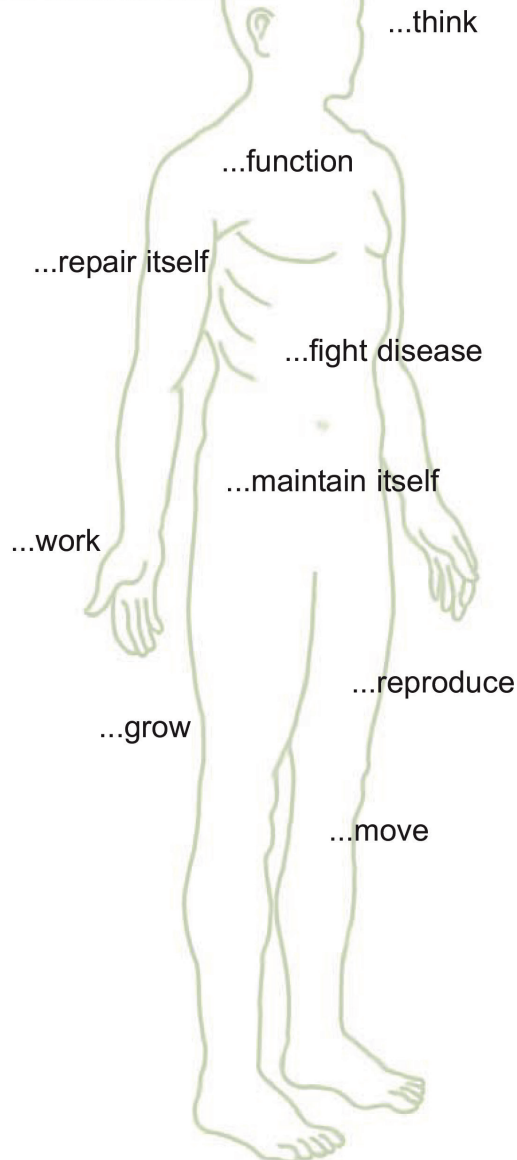
Action Against Hunger Field work manual for maximizing nutrition gains from livelihoods and agriculture: http://www.actionagainsthunger.org/sites/default/files/publications/maximising_the_nutritional_impact_of_fsl_interventions_0.pdf; <https://www.spring-nutrition.org/publications/tool-summaries/maximizing-nutritional-impact-food-security-livelihoods-interventions>

Details of the training

1 The importance of nutrition

What We care about nutrition because of the strong links between undernutrition and death. The number of child deaths resulting from undernutrition is around 3.5 million every year (Lancet, 2008), i.e. 35% of deaths are due to a combination of undernutrition and illnesses. Undernutrition not only causes death, but can also make people more likely to get sick or can slow or impair children's growth

Nutritious food gives our body the energy and substances to...



Source: Food and Nutrition Council of Zimbabwe, FAO, & UNICEF: Healthy Harvest – A training manual for community workers in growing, preparing, and processing healthy food <http://motherchildnutrition.org/healthy-nutrition/pdf/mcn-healthy-harvest.pdf>

and development. Proper nutrition also enables adults to be strong and economically productive.

Effects The effects of undernutrition can be seen with the naked eye, for example, children are short for their age, they are thin for their age, they have oedema (swelling), etc. Sometimes the effects are not visible, for example children are more likely to be sick, they are tired and cannot concentrate in school, etc.

For pregnant and lactating women Undernutrition increases the risk of:

- maternal death during childbirth
- giving birth to an underweight or mentally impaired baby. When breastfeeding, undernutrition of the mother leads to the poor health, growth, and development of the child.

For children Undernutrition increases the severity and length of some common diseases such as diarrhea, ARI (acute respiratory infections), or measles, increasing the risks of death. Undernutrition also affects the physical and mental development of the child, which means that he or she will be less able to earn money when they grow up and less able to help you meaningfully in the farm.

What does this mean for the family? It means more time and money spent to go to the health facilities, it also means less time and energy to work with you in the field, go to school, and earn money.

Whom To counter undernutrition, one of the important and simple things to do is having a balanced diet. A balanced diet is important for all. It is important for the father, so that he has more energy to work in the field. But it is even more important for children under two, and pregnant and lactating women. Why?

- Most growth faltering occurs between the ages of six and 24 months when the child is no longer protected by exclusive breastfeeding and is more exposed to disease and infection through contaminated food or water. Even a child adequately nourished after 24 months of age is unlikely to recover growth 'lost' in the first two years as a result of malnutrition.
- There are increased nutrient needs during pregnancy. Inadequate food intake during pregnancy can increase the risk of delivering an undernourished baby. When mothers are breastfeeding they require extra energy which they can get from the reserves they have built up during pregnancy and from eating extra food after birth. It is therefore important for pregnant and lactating mothers to increase their food intake and ensure they have a balanced diet.

What to do

- 1 Improve caring and appropriate practices such as breastfeeding, and appropriate complementary feeding, as well as hygiene and health-seeking behaviors.
- 2 Eat more appropriately through a balanced diet (see below).

Infant and young child feeding

Feeding practices for children under age five are particularly important and the first 1,000 days are a critical window for optimal growth, health, and development. Complementary feeding takes place when breast milk alone is no longer sufficient to meet the nutritional requirements of infants and other foods and liquids are needed. Insufficient or inadequate complementary feeding can negatively impact health and growth.

Feeding recommendations to promote optimal nutrition

0-6 months	Exclusively breastfeed (child should not consume any foods or liquids aside from breast milk)
6-12 months	Start complementary feeding, but breast milk should contribute to half or more of child's nutritional needs
12-24 months	Continue complementary feeding, but breast milk should contribute to a third or more of child's nutritional needs
24 months and older	Nutritional needs can be met from foods aside from breast milk, but breastfeeding can still be practised

2 How to have a more balanced diet

This discussion is based on the results of the assessment, which will reveal the type of micronutrient (vitamin A, iron or proteins) and calorie needs within the target population, and which indigenous crops or fortified processed products provide these types of nutrient.

Start the session with a discussion on what infants and young children, and pregnant and lactating women in the community/in the family eat.

- a Show the food group diagram for a healthy life, each person should eat some of each of these food groups, everyday, all year round. The food groups are outlined below. The diagram also shows that we need to eat a sufficient amount of:
 - carbohydrates (e.g. millet, sorghum, whole grains, yams, potatoes, rice, and maize)
 - protein (e.g. fish, meat, beans, nuts, and eggs)
 - micronutrients (e.g. fruit and vegetables) every day.

Individuals, especially children over six months and pregnant and lactating women, should consume foods from at least four of the following food groups per day.

- Grains, roots, and tubers: millet, sorghum, whole-grain flour, potatoes, yams, rice
→ Important for energy.
- Legumes and nuts: beans, lentils, cowpeas, soybeans, groundnuts
→ Important for protein and growth.
- Dairy products: milk, yogurt, cheese
→ Important for protein, micronutrients, and growth.
- Flesh animal foods: meat, fish, poultry
→ Important for protein, micronutrients, and growth.
- Eggs
→ Important for protein, micronutrients, and growth.
- Vitamin-A-rich fruit and vegetables: orange sweet potato, papaya, mango, carrots, pumpkin, leafy greens
→ Important for growth and development.
- Other fruit and vegetables: leafy greens (kale, spinach), tomatoes, bananas, peppers, eggplant
→ Important for growth, development, and digestion.

Breastfed, best fed

- Breast milk is the perfect food for babies. It has everything a baby needs to grow and develop for the first six months of life.
- Babies who consume only breast milk during the first six months of their life (exclusively breastfed) tend to grow better, fall sick less, and perform better in school than those who are not exclusively breastfed.
- For the first six months, babies do not need any other foods or liquids aside from breast milk (not even animal milk, water, porridge, or fruit).
- Giving other foods and liquids (including water) to babies during the first six months can be dangerous for their health.
- Human breast milk is perfect for human babies, just as cow's milk is perfect for baby cows and goat's milk is perfect for baby goats. We never see baby goats drinking cow's milk because animal milks are different.
- At six months, the child should start eating other foods, but should continue breastfeeding until at least 24 months.



Source: UNICEF

- b Briefly summarize the nutritional status of the population nationally and in the target area based on the results of the assessment.
- c Explain the possible effects of this lack of nutrients
The chart below provides examples of the health consequences for each type of nutrient gap

The health consequences of nutrient gaps

Lack of vitamin A	Visual impairment or blindness
Lack of iron	Anemia – pale conjunctivae (inner eyelid), nail beds, gums, tongue, lips and skin; tiredness; headaches; breathlessness; delayed infant motor function; delayed infant mental function; slow cognitive and social performance; decreased immune function; risk for early births or small babies (pregnant women)
Lack of proteins	Kwashiorkor – oedema, large belly, thinning hair, light skin; tiredness; underweight; short for age
Lack of calories	Thinness, lack of strength

- d Provide a list of agricultural products that are found locally and that contain the necessary nutrients.
For example:

Local products containing nutrients

Vitamin A	Orange sweet potatoes or orange cassava, cowpeas, carrots and pumpkins, fish oil, eggs and milk, papaya, mangoes and tomatoes, red palm oil
Iron	Legumes (beans, lentils, cowpeas, soybeans), animal products such as eggs, red meat, blood), dark leafy greens (spinach, kale), sesame
Protein	All legumes (including groundnuts), all animal products, sesame

Iodine and zinc

Iodine and zinc are other micronutrients that are important for proper growth and development. Lack of iodine can lead to brain damage, physical development problems, and mental/cognitive impairment. The best source of iodine is iodized salt, which should be added to foods. Lack of zinc can hinder normal growth, development, and immune function, and is especially important during pregnancy. Sources of zinc include meat, fish, whole-grain cereals, and legumes.

- e Provide a list of fortified products that can also be found locally For example: maize flour, rice, porridge, salt, etc. **Note** A lot of salt available is fortified with iodine. Check packaging or ask market sellers to be sure you are purchasing/consuming iodized salt.

Fortification

Fortification is a process where micronutrients are added to foods to improve their nutritional quality. Fortified foods are processed so special attention should be paid to the packaging on processed foods that are purchased. Subsistence or small, rural, market purchased foods are often not fortified. Increasingly, maize and wheat flour, porridge mixes, and rice (e.g. *Ultra Rice*) are being fortified with vitamins and minerals like iron and zinc. Vegetable and soybean oils are often fortified with vitamins A and D. Many countries have made the fortification of certain foods (e.g. wheat flour) mandatory while some countries have limited or no fortified products.

- f Discuss what products the training participants produce and how these can be improved or changed to improve their nutritional status. What steps need to take place for these improvements/changes to be implemented and what resources are needed? How can they ensure the products reach these target populations?

3 Combining nutrient-rich crops and livestock

- a Some crops are naturally rich in nutrients. It is important to know which ones, so that you can better understand their production and harvest conditions, and promote them among producers. Provide a list of agricultural products that are found locally and that contain the necessary nutrients.

For example:

Local products containing nutrients

Vitamin A	Orange sweet potatoes or orange cassava, cowpeas, carrots and pumpkins, fish oil, eggs and milk, papaya, mangoes and tomatoes, red palm oil
Iron	Legumes (beans, lentils, cowpeas, soybeans), animal products such as eggs, red meat, blood), dark leafy greens (spinach, kale), sesame
Protein	All legumes (including groundnuts), all animal products, sesame

- b Some crops can be genetically modified to increase their nutrient contents. These are **biofortified crops**. (see **Annex 4** on biofortification)

Crops with biofortification options

Vitamin A	Cassava, maize, orange-fleshed sweet potatoes, golden rice
Iron	Rice, wheat
Protein	Beans, pearl millet

Note Certain biofortified crops can have a different consistency or color. To ensure acceptance by the producers and consumers, it is important to emphasize their nutritional value, and their economic value in some cases when they have shorter maturity cycles.

- c *Animal-sourced foods* are important for children and pregnant and lactating women to consume as they are good sources of protein and micronutrients (e.g. iron). As such, it is important to promote an integrated agricultural system that combines animals with crop production (see **Annex 6** on production diversification).
- d *How to promote the production of nutrient-rich food*
- **Households (and mainly women) can develop a home garden** Close to their home, it provides a good source of additional nutritious food all year round (see **Annex 5** on home gardens). *Show the drawing of an example of home garden.* In the garden, think about including:
 - different types of nutrient-rich food (some green leafy vegetables for iron, some carrots or papaya for vitamin A, etc.)

- food that is available all year round, or with staggered maturity periods so that you have a good source of nutrients all year round
- a source of water close by, either kitchen waste water, or a small reservoir for rain water, or...

- **Intercrop nutrient-rich crops with traditional crops** Intercropping is not only good for nutrition purposes, it is also good for the soil. For example, intercropping beans with maize increases the amount of nitrogen in the soil and makes it more fertile – and beans are a good source of proteins;
- **Livestock and fish production** (including eggs and milk) This also has the advantage of providing food year round while providing women and children with more varied diets. Animal-source foods are a great source of many important nutrients (e.g. protein and iron). They also contain nutrients that are more easily absorbed by the body than plant-based foods (see **Annex 6** on production diversification). Livestock can also provide economic resources to families as they reproduce and fertilizer for soil. Your assessment and plans for livestock and fish production should consider resources available to produce livestock or fish products (e.g. land, water, food), interest, processing and storage materials (e.g. for milk), and compatibility with other agricultural activities. Chickens, rabbits, guinea pigs, cows, goats, and fish can be useful to work with at a household level or larger scale. Egg and milk production should also be considered.

4 How to preserve nutrients

Food that is nutrient rich can still lose its nutrients if not properly handled, for example, during purchase, transport to the home, harvest, storage, processing, or even during preparation. There are simple ways to ensure that the food that you consume has maintained its nutrients (see **Annex 9** for more detailed information about proper storage, processing, and preparation of foods to ensure the maintenance of nutrients).

Preparing your food so that it does not lose its nutrient contents is important. You can engage in these activities and encourage those you work with to do the same.

- Germinate and soak grains to help your body better absorb the iron and zinc naturally available in the food.
- Reduce the frying time of foods.
- Cook vegetables in boiling water or steam, and re-use the liquid for soup or cereal preparation.
- Store raw fruit and vegetables intact (without cutting or peeling them), keep storage time short and cool or refrigerated.

- Avoid peeling fruit and vegetables when the peel is edible and you can wash them with safe water.
- Wash/scrub fruit and vegetables before peeling or cutting, not after.
- Consume or cook fruit and vegetables immediately after peeling, cutting, chopping or pulping.
- Fortify your food, especially for children, for example, including soyabean flour in children's porridge will improve the protein and iron content, adding fish powder/dried fish to soups will improve the protein, iron, and vitamin A content, or adding fortified salt with iodine to soups.

5 Importance of engaging in dialogue with health and nutrition extension services

- a Why** It is important to work with health and nutrition extension services to understand what the nutritional deficiencies and issues in your population are. These services are also important because they can inform you of what foods are nutritious, the sources and importance of different nutrients, what the needs of the local population are, and what feeding practices and nutrients are important for different people (e.g. children, women, elderly). These services not only have experts with technical knowledge, but also have contact with the community and end users of your agricultural products.
- b Who** Health and nutrition extension services can include government/public and private practitioners at government (e.g. Ministries of Health) or healthcare facilities (e.g. hospitals and clinics). Health instructors or nutrition officers or counselors may also be available in your community for collaboration. Community health workers are also helpful to work with as they have health knowledge, are aware of community needs and issues, and a reliable trusted relationship with community members.
- c Collaborating with health and nutrition extension services will allow you to do the following.**
- *Produce a product that is nutritious and important:* Health and nutrition service providers can inform you of nutritional needs. You can create a product to meet these needs to improve nutrition amongst consumers. Health and nutrition experts can also educate you about the nutritional value of foods you can produce so you can grow/rear foods that are nutritious.
 - *Market and increase demand for your product:* Health and nutrition extension service providers often work within communities and your potential consumers, and can act as a liaison between you

and households. They can advise you on marketing and where most people purchase their food. They can also advise households to consume your product, if it meets their nutritional needs. For instance, if your product is fortified/biofortified, informing health and nutrition extension services of this nutritious property and where it can be purchased can then be shared with community members.

Further resources

ENGINE Project, Save the Children, Dec 2012
Nutrition sensitive agriculture trainer manual
http://www.fsnnetwork.org/sites/default/files/da_trainer_manual_04_jan_2013_final_2.pdf

UNICEF nutrition overview lesson:
<http://www.unicef.org/nutrition/training/2.1/9.html>

FANTA nutrition introduction course:
<http://www.globalhealthlearning.org/course/nutrition-introduction>

UNICEF nutrition training on maternal, infant, and young child nutrition facilitator guide: http://www.unicef.org/nutrition/files/Facilitator_Guide_September_2013.pdf

UNICEF training on nutrition visual cards for nutrition counseling: http://www.unicef.org/nutrition/files/counseling_cards_Oct_2012small.pdf

UNICEF training on nutrition visual aids:
http://www.unicef.org/nutrition/files/TRAINING_AIDSept012small.pdf

FAO designing nutrition-sensitive agriculture activities:
http://www.fao.org/fileadmin/user_upload/agn/pdf/DesigningNut-SensAgriActivities.pdf

USAID, FANTA, FHI360, CORE Group, Save the Children nutrition program design tool: <http://www.coregroup.org/storage/documents/Resources/Tools/NPDA/NPDA-Reference-Guide-April2015.pdf>

CORE Group nutrition program design tool: http://www.coregroup.org/storage/documents/Workingpapers/NPDA_workbook_web.pdf; <https://www.spring-nutrition.org/publications/tool-summaries/nutrition-program-design-assistant>

GAIN and IDS nutritious agriculture program planning tool: <http://nutritiousagriculture-tool1.gainhealth.org/>; <https://www.spring-nutrition.org/publications/tool-summaries/nutritious-agriculture-design-program-planning-tool>

FAO food-based dietary guidelines: <http://www.fao.org/ag/humannutrition/nutritioneducation/fbdg/en/>

Annex 9 Improved storage, preservation, processing and preparation

What

Foods naturally deteriorate as they age. The science of food storage and preservation has evolved from our attempts to slow that deterioration. The prime concern with the quality of foods and the duration they last is preventing spoilage microorganisms from growing, and preventing the loss of nutrients. This is done through appropriate food storage and preservation methods. Proper storage and preservation can increase the shelf life of your foods, making them available all year round or for a longer period of time.

Food processing is the transformation of raw ingredients into edible food, or of food into other forms. Food processing typically takes clean, harvested crops or animal products and uses these to produce attractive, marketable and often long-shelf-life food products. Foods are processed to improve their digestibility, enhance their appeal to the consumer, and extend their shelf life. Processing is thus one step above food storage and preservation.

Why

Storage, preservation and processing all serve to extend the availability of foods beyond the area and season of production, increasing the availability of food, and more specifically nutritious food, throughout the year. Further processing is used during the preparation of food to ensure it is digestible and provides good taste. However, this has to be done carefully, using the right methods to avoid reducing the nutritional value of foods during the process.

How

The information below relates to improving storage, preservation, processing, and preservation to increase the shelf life of foods and decrease nutrient loss (see **Annex 10** on food safety).

Storage

Moisture, temperature, oxygen, light, and cleanliness are all critical factors in optimal food storage.

- *Moisture* The humidity in the storage environment should be low. If dried foods pick up moisture from the storage area, molds and bacteria can grow. This can lead to spoilage and illness.
- *Temperature* The optimal temperature is in the cool-to-

moderate range, approximately 5-20 degrees C. Grain germination rates will decline, and vitamin breakdown rates in all stored foods will increase, as the temperature increases.

- *Oxygen* Oxygen can cause an oxidization process that creates a chemical change in the properties of stored foods. Foods store best when oxygen free.
- *Light* This destroys vitamins A and C during storage. These losses can be prevented by use of a dark-colored or opaque container
- *Cleanliness* Ensure foods (especially grains) are cleaned and dust, straw, insects, other plant parts, etc. are removed from the grains before storage. Also make sure the storage container is clean of such items.

The quality of foods that are put into storage is also important. Foods that are stored should be clean, not damaged, and fruit and vegetables should not be too soft. They can be stored before or after processing as long as the above factors are considered. For some foods, immediate processing upon harvesting can reduce the risk of microorganisms, pests, or of fruit and vegetables going bad. This can also reduce loss of nutrients.

Proper storage will avoid losses, both of the food itself or its nutritional value. Containers and storage facilities that are dark, cool, dry, and sealed will produce the best results. Below are some examples of good containers and storage facilities.

- Above-ground storage containers or rooms can limit the mold, bacteria, pests, and animals that have access to foods. Storage containers can be placed on pallets to keep foods off the ground for best results. Containers can also be hung from roofs (e.g. baskets for vegetables).
- Solid-walled storage areas can help keep pests, animals, and vermin out.
- Metal silos can store grains so that they are not left uncovered, reducing the amount of grain spoiled by rain exposure and pest penetration (Proctor, 1994).
- Metal containers are useful for storing milk as they reduce contamination and spoilage, and can keep milk cooler than plastic or other materials. Keep these containers covered.
- Freezers with good ventilation and air movement are critical for long-term meat and fish storage. Rapid freezing is important as slow freezing can allow ice to form in cracks in the meat, which will reduce the quality of the meat. Meat and fish should not be unfrozen and

refrozen. When transported or being sold, meat and fish should remain frozen.

- PICS (purdue improved crop/cowpea storage) bags or natural fiber bags are good for storing grains and legumes.
- Baskets or dry, open containers with ventilation are good for storing raw fruit and vegetables. These containers should be kept in cool environments. For longer term storage of raw fruit and vegetables, it can be useful to process them first. Dried fruit and vegetables can be kept in cool, well sealed, dry containers (metal containers are often cooler and drier than plastic).
- Underground pits can be used to store root crops like yams and cassava.
- Grain cribs are useful for storing grains and legumes.
 - In humid areas or during the wet/rainy season, it is important to use ventilated structures to keep contents dry and the width of structures should be reduced.
 - In arid areas or during the dry season, solid-walled silos or bins can be used, made with local materials or cement.

Storage containers and facilities:



Above-ground storage of grain sacks (using home-made pallets)



Examples of grain cribs for storage



Metal silo for grain storage



PICS bag for grain storage

Check on foods that are being stored, especially those being stored for a long time, to ensure they are not contaminated, growing mold, becoming spoiled, infested, etc.

Insect repellents

When storing foods long term (e.g. grains or dried fruit and vegetables), it is important that they are protected from insects. Most grains or dry foods are subject to insect contamination which can destroy or reduce their quality. It is important not to use chemical insecticides in large quantities as they can have harmful health effects. There are many natural ways of repelling insects: cow dung can be used on the walls of grain cribs or food storage facilities as it has insect-repellent properties, neem leaves can also be used as an insect repellent (leaves can be soaked and mashed, then the solution can be sprayed on foods). Adding small quantities of palm or groundnut oil to stored grain also gives additional insect protection. Insecticides can be applied to foods themselves and/or storage containers. They can also be reapplied if foods are being stored long term and insects are a problem.

It is also important that foods are properly stored during transportation (especially for large-scale operations). The above factors should be considered when transporting foods and proper containers should be used. Heat accumulation and poor ventilation during transportation should be limited.

Preservation

The most common preservation methods include drying and fermentation. Germinating, blanching, curing, salting, and smoking are other methods of preservation that can be used on crops and animal-source foods.

How to dry Since ancient times, the most common method of preserving fruit and vegetables, as well as meat and fish, has been sun drying. Reducing the moisture in food prevents the growth of microorganisms that cause foods to decay and lose nutrients. At the same time negative biochemical activities are practically stopped or reduced to very low levels. Foods preserved by drying can be kept at ambient temperatures for long periods and provide nutrients when fresh produce is not available.

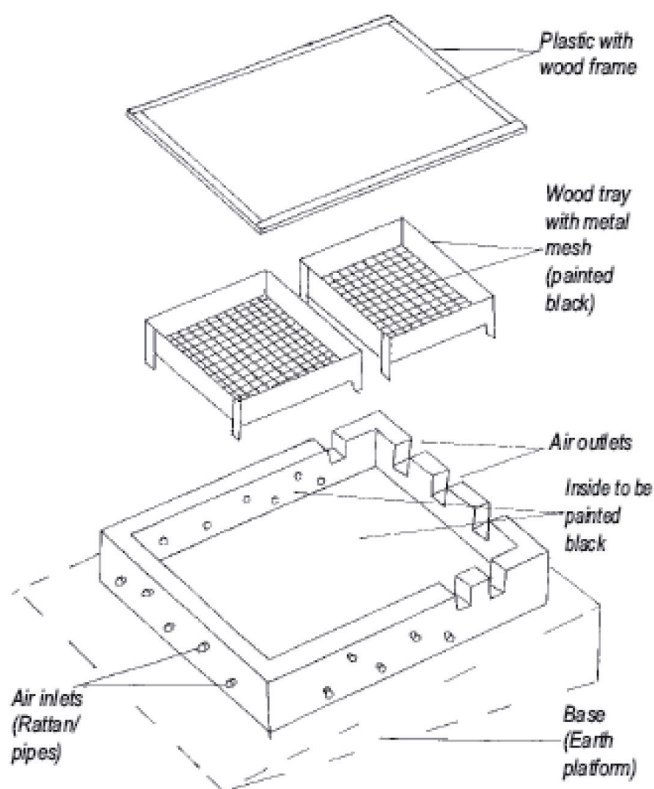
Open-air sun drying has disadvantages, such as infestation by insects, contamination from dirt, rodents and birds, and spoilage from occasional rains. That said,

open-air sun drying can be done if the environment is clean and dry, and it is above ground, away from the reach of animals, children.

Specific instructions on how to dry different foods can be found here: <http://answers.practicalaction.org/our-resources/collection/drying-6>

Solar dryers: The use of solar dryers, an alternative to sun drying, provides the benefits of higher air temperature and continuous air flow which substantially improve drying rates. The solar dryer is based on the absorption of heat using a black surface. The temperature inside a solar dryer can be maintained at 60° to 70°C, which minimizes the damage to vitamins and other nutrients. Solar dryers do not require sophisticated building materials. A family-type solar dryer can be built using local materials inexpensively. For larger-scale productions, larger solar dryers can be built or purchased.

Here is an example of how to build a **basic solar dryer**: <http://answers.practicalaction.org/our-resources/item/a-simple-solar-dryer>



How to ferment Aside from preserving food, fermentation may also enrich food with protein and vitamins, eliminate anti-nutrients, and reduce cooking time and the amount of fuel needed.

Fish fermentation: Fish can be fermented by stacking fresh fish in heaps in the open air for 24 hours.

During this time some fermentation occurs. After stacking, the fish are cleaned and prepared for sale or consumption. The fish meat is then soaked in sea water in wooden buckets. The water is changed weekly when it becomes foul. Finally, the partially fermented fish is spread on straw for two to four days to dry in the sun and wind.

Fermenting vegetables requires a balanced mixture of water, salt and vinegar, while fermenting fruit relies on sugars.

For more information on the fermentation of fruit and vegetables, refer to this FAO resource: <http://www.fao.org/docrep/x0560e/x0560e06.htm>

How to germinate Germination involves soaking foods (mostly grains) in water and can increase the amount of time post-harvest that foods can be eaten. Germination can also increase the digestibility of foods and increase the availability of nutrients in foods. Once germination is complete (typically a few days to a week – you will see grains starting to sprout), foods can be removed from water and dried for optimal preservation.

Note Water may need to be changed daily during germination to ensure proper hygiene is maintained.

How to blanch Blanching involves bringing water to boiling point then dipping fruit or vegetables into the water or steam (steam is best as it results in the loss of fewer nutrients). Dipping should only be for a few minutes, not a long time. Dipping into the boiling water should be shorter for smaller vegetables (i.e. under five minutes) while larger vegetables or fruit can be dipped for a longer time (several minutes, but typically not more than seven). Dipping into boiling water for too long can destroy valuable nutrients. Blanching can be done prior to drying and can help prepare fruit and vegetables for the drying process. It helps foods maintain their color and taste, increasing the amount of time they last, killing bacteria, and preserving the foods.

For more information on blanching and other vegetable preservation techniques, refer to: <http://www.fao.org/docrep/v5030E/v5030E0q.htm>

How to cure Curing entails leaving crops outside to dry in the shade. This is useful for root crops like yams, sweet potatoes, and cassava. It is best done in the dry season or in arid areas. When the outer surface of the root is hard, it is safe to further process or store the food. Additional processing can then follow, such as pounding foods or milling them into flour.

How to salt Salting is a form of curing and involves adding dry edible salt to foods for preservation. This can be used for vegetables (e.g. cabbage), meat, and fish. Salt can help ensure microorganisms do not grow in meats. Salt

is added to foods to dehydrate them and decrease the growth of microorganisms. The amount of salt depends on the food.

Note When salting meat and fish, food safety practices should be followed and cold chains and other processing may be necessary for longer preservation.

How to smoke Smoking is typically done with meat and fish. The surface of the meat or fish needs to be dry prior to the start of smoking. Drying can occur simultaneously with smoking, but this takes longer. If drying is insufficient, there are cracks in part of the meat, or a hard crust forms, smoking is inadequate and meats may not be safe or nutritious to consume. Fish and meat can be smoked by placing the food on a grill over a charcoal fire.

Processing

Village-level processing includes turning foods into flour, oil, paste, or parboiling to ease preparation.

How to parboil The parboiling process involves three stages:

- 1 Soaking or steeping of rice paddy/fruit/vegetables in cold or hot water to increase its moisture content
- 2 Treatment by steaming
- 3 Drying

Parboiling vegetables involves treatment by steaming and is similar to blanching. It partially cooks vegetables for later use in cooking different meals. It can make cooking easier or faster. Parboiling is often used for potatoes and thick, hard vegetables.

Processing by type of produce

Produce	Processing	Note to maintain nutrient content
Cassava	Milling into flour Fermentation and drying	Milling may reduce the amount of fat, protein and fibre and increase the proportion of starch. Milling can improve nutrient digestion.
Grains	Milling Fermentation	Milling may reduce the amount of fat, protein and fibre and increase the proportion of starch. Milling can improve nutrient digestion.
Fish	Salting/smoking/drying Fermentation	Salting/smoking/drying reduces the water content and can increase the nutrient concentrations of fish. Fermentation can increase absorption of iron and other nutrients.
Banana	Fermentation and drying	Fermentation can increase absorption of iron and other nutrients.
Rice Paddy	Parboiling	Paddy that has been parboiled has better nutritional quality because of the migration of nutrients towards the centre of the grain during the process
Fruit	Drying	Drying (dehydrating) fruit concentrates the nutrients. The nutritional content of dried fruit includes protein, carbohydrates (sugars), fiber, little to no fat, vitamins A, B1, B6, and B12, calcium, iron, magnesium, phosphorous, potassium, sodium, copper, and manganese.
Vegetables	Drying, parboiling	Vegetables selected for drying should be sound, fresh, and in the peak of condition: ripe, but still firm and at the right state of maturity. Drying, especially in the sun, reduces the amount of vitamin A and C. Parboiling can be done to vegetables like root crops (e.g. potatoes, yams, cassava) which can make them easier to use later in meals.
Meat	Salting/smoking/drying	Probably the most popular dried meat is jerky. Jerky can be made with almost any type of meat and is prepared through curing in a salt solution or marinade, either as cut strips of meat or as ground meat. It can either be prepared in the salt solution as raw meat or can be cooked before drying.
Beans	Drying	Drying reduces water content and can increase nutrient concentrations.
Groundnuts	Milling/grinding	Heat is not needed for processing. Groundnuts can be placed in the grinding machine to produce paste and oil. The oil can be separated out from the paste by cooling the paste.

How to mill Milling involves converting solid foods (e.g. maize, cassava) into flour. This allows foods to be preserved and used for additional cooking purposes. Foods should be dried and hard prior to milling. Most milling is done using grinding-mill machinery.

How to make oil Nut and seed oils can be simply made by putting the nut/seed into a grinding mill then cooling the paste allowing the oil to separate from the paste. Oil can then be removed and stored. For larger productions, oil extraction machinery or an oil press can be purchased to produce larger quantities of oil efficiently. Hand presses are also available for household or small-scale use. The oil extraction process is different for different foods and can involve the use of chemicals for production (e.g. soybean and vegetable oil).

Preparation

Simple modifications in the way we prepare food can have impact on the amount of nutrients retained.

Most vegetables are peeled or trimmed before cooking to remove the tough skin or outer leaves. Most nutrients, such as vitamins, tend to lie close to the skin surface however, so excessive trimming can mean a huge reduction in nutrient value. You can also keep skin on vegetables for cooking or raw eating, if the skin is edible and if cleaned properly with safe water.

Some vitamins dissolve in water, so vegetables may lose their vitamins to the cooking water. For example, boiling a potato / leafy greens can cause much of the vegetables' B and C vitamins to migrate into the boiling water. It is still possible to benefit from these nutrients if the liquid is consumed, for example, by using the liquid in a soup. Alternative cooking methods such as grilling, roasting, or steaming generally preserve a greater amount of vitamins and other nutrients.

Below is a summary of food preparation methods that are detrimental to the nutrient content.

Some nutrients can promote the absorption of other nutrients (complementary nutrients) and others can inhibit the absorption of other nutrients (antinutrients). Because of this, we need to consume a diversified diet and cook foods in ways that maximize their nutritional value.

Complementary nutrients

When some nutrients are consumed with other nutrients, they can increase the body's absorption of the other nutrient. A diversified diet can help ensure a variety of nutrients are consumed together for maximum absorption.

For instance, vitamin C helps with iron absorption. Consuming foods rich in vitamin C together with those containing iron can improve iron absorption in the body. Foods rich in vitamin C include tomatoes, leafy greens, papaya, oranges, and lemons (see **Annex 7** on the nutrient content of foods). Some foods can be eaten with plant-based protein to give the body complete proteins (e.g. rice and beans, lentils/beans with grains like maize or sorghum).

Antinutrients

Antinutrients interfere with the absorption of other nutrients. Foods with antinutrients should be properly cooked or processed to reduce the amount of antinutrients in them.

Antinutrients occur in many foods. It does not mean these foods should not be consumed, but that they should be adequately cooked or processed to maximize nutrition.

For instance, many foods such as potatoes and cassava have phytates that interfere with iron and zinc absorption. Soaking, germinating, fermenting, sun drying, and cooking can reduce the amount of antinutrients in foods.

Loss of nutrient content in food preparation

Loss of vitamins occurs when food is:

- excessively trimmed or peeled
- chopped into small pieces
- prepared a long time before cooking
- cooked a long time before eating
- boiled for a long time and in contact with air
- fried for a long time or at high temperatures.

Reduce loss of nutrient content by:

- germinating seeds (for example, of legumes), to increase vitamin C
- fermenting and germinating, to increase the absorption of iron and other nutrients
- eating fruit and vegetables with the skin/peel on, to increase vitamin A and C intake
- grilling or steaming vegetables just before eating them.

FAO – adapted from King and Burgess, 1993

Sanitation and hygiene

During the storage, preservation, processing, and preparation of foods, sanitation and hygiene are important.

Hand washing and cleanliness by individuals working with the foods is important.

It is also critical to work in hygienic environments and use clean utensils and processing materials. This can involve using clean water and soap.

Storing and working with food should be far from latrines or toilet facilities and if such facilities are not available, food should be kept away from areas where human or animal feces could be present.

Further resources

FAO: <http://www.fao.org/docrep/w0078e/w0078e02.htm#TopOfPage>

<http://www.fao.org/docrep/s8620e/S8620E00.htm#Contents>

FAO information on proper storage and processing of animals (manual slaughtering): <http://www.fao.org/docrep/003/x6552e/X6552E00.htm#TOC>

FAO information on storage and processing grains: <http://www.fao.org/docrep/w1544e/W1544E03.htm>

Annex 10 Food safety

What

An important element in the food chain is the use of control procedures to ensure that food, whether raw, semi-processed, manufactured or prepared, is safe, of high quality (meeting established official standards and buyers' expectations) and nutritionally sound. Much of the responsibility for food safety lies in the hands of women, who have a major role in food production, procurement, processing, preparation and presentation at both the market and household levels. A substantial proportion of transmission of food-borne disease occurs in the home, so the education of those involved in domestic food preparation is of crucial importance.

Why

Food safety is a public health priority. Millions of people fall ill every year and many die as a result of eating unsafe food. Serious outbreaks of food-borne disease have been documented on every continent in the past decade, and in many countries

rates of illnesses are increasing significantly. Diarrhoeal diseases alone kill an estimated 1.5 million children annually, and most of these illnesses are attributed to contaminated food or water.

About 75% of the new infectious diseases affecting humans over the past 10 years were caused by pathogens that started in animals and animal products. Many of these diseases in people are related to the handling of infected domestic and wild animals during food production; in food markets and at slaughter houses. Bacteria like salmonella (from poultry) and e.coli (from cow meat and leafy greens) are of concern. The H5N1 and ebola outbreaks are recent examples of animal-borne diseases.



Mold and bacteria

Mostly in grains (barley, sorghum, wheat), maize, groundnuts, cotton seeds, yams, cassava (grains and oils), meats, and poultry. Cooking and processing can eliminate mold and bacteria, however foods with visible mold or bacteria should not be consumed. Mold and bacteria can cause diarrhea, cancer, eye/nasal/throat/skin irritation.

Other food safety concerns come from the way we prepare food. Acrylamide, which may cause cancer, is formed from natural ingredients during the cooking of some foods such as fried potatoes and coffee at high temperatures.

Food contaminated by polluted water, or overuse of pesticides and chemical fertilizers also has negative health effects. Polluted water can lead to illness and diarrhea, which contribute to the loss of nutrients and malnutrition. Pesticides and chemical fertilizers that leach into water or foods also cause illness like cancers, skin and eye irritation, and nervous and reproductive system problems.

How

The information below relates to improving food safety to decrease risks from contamination and illness.

See **Annex 9** on food storage, preservation, processing, and preparation for information specific to shelf life and nutrition.

Food can become unsafe in the following conditions:

- 1 Purchase** If the food you buy has been staying in the sun for too long, or if the food is old. This can lead to loss of nutrients over time or the growth of mold or bacteria.
- 2 Transport** If the food has stayed in the heat or sun for too long during transport, or if the food has been exposed to flies or dust during transport (because it is not covered or properly stored). If foods are transported long distances, and for a long time, mold or bacteria can develop if conditions are not dry or cool.
- 3 Production/harvest** If animals have been close to the food, or if the water with which it has been produced is polluted. Pesticides and chemical fertilizers can also cause water and food contamination. When harvesting foods, foods that are exposed to the soil, flies, dust, etc. can become contaminated. If production facilities are not hygienic or clean, or if production takes a long time or harvesting is during a rainy day allowing for mold or bacteria to grow. If produced foods are not packaged properly. If fruit and vegetables are not harvested at the correct stage in their life (e.g. before maturity). If you do not rotate crops or use different grains strains, or if pests persist or are on crops.
- 4 Storage** Have you ever seen some mold on your grain? This means that there is bacteria developing. There are also other bacteria that develop that cannot

be seen with a naked eye, but that are as dangerous to health. To avoid mold and bacteria during storage, you need to ensure the following.

- Where you store your grain is dry, dark, with no pests. It is also proper to store foods in rooms or structures that are built with strong suitable materials in a safe, clean location. Above-ground structures can help ensure pests, rodents, and bacteria do not contaminate stored food.
- You use natural fiber bags, and store these bags on pallets rather than on the floor.
- Store different foods in different containers and/or locations (e.g. animal-sourced foods, fruit and vegetables, grains) to avoid cross-contamination of potential molds or bacteria.
- Foods are not damaged, and fruit and vegetables are not too soft.
- Foods being stored are clean and not growing mold, rotting, or infested.
- You properly dry the grain. You need to minimize the time between harvesting and drying, and use heated drying when it's humid at the time of harvest. You can even roast your grain when appropriate, as with groundnuts for example.
- Root crops like sweet potatoes and cassava stay in the ground until ready to eat, then are eaten immediately, to increase their safety and decrease the likelihood of mold growing on them. Yams and cassava can be stored safely in underground pits.
- Foods are not stored near animals or toilet facilities.

5 Processing Processing foods for a long time or under high temperatures can reduce their nutrient content. Extensive milling of grains also leads to the removal of grain components that have a lot of vitamins. However, some forms of food processing can improve the amount of time foods remain edible and can make them safer for consumption. These practices are especially important for larger-scale activities that have more resources and capacity for food processing. Such food safety practices include:

- **Drying:** This removes water from food allowing it to last for a long time and preserves food by removing the water that allows bacteria and mold to grow. Fruit, vegetables, grains, nuts, and beans can be dried outside or with more advanced technologies.
Note Direct sun drying should be avoided as it can lead to nutrient loss, but solar drying is efficient at creating an environment that does not allow microorganisms to grow.

The special case of aflatoxin

What Aflatoxin is a harmful naturally occurring agent that causes cancer and illness. It is not visible in contaminated foods.

Where We are exposed to it primarily through the consumption of agricultural or animal products. Aflatoxins are present in barley, sorghum, wheat, maize, groundnuts, cotton seeds, yams, and cassava (grains and oil). They can also be found in fresh and sun-dried meats and poultry (animals are affected by aflatoxin from eating contaminated feeds).

Health effects Exposure to aflatoxin can lead to illness, immune suppression, liver problems including cancer, and nutrition-related problems in children like poor growth.

Livestock effects Aflatoxins pose threats to the farming industry and low levels can cause long-term effects in animals and animal products.

Prevention In agriculture use crop rotation, different strains of crops, intercropping and crop variety. Proper drying and processing in addition to storing foods in proper cool, dry, pest-free environments can prevent aflatoxin spread.

Further information:

IFPRI solutions to aflatoxins for improved food safety: <http://www.ifpri.org/event/aflatoxins-finding-solutions-improved-food-safety>

Past and current projects on aflatoxin http://www.aflatoxinpartnership.org/en/Activities_in_Africa.aspx

- **Blanching:** This involves bringing water to boiling point then dipping fruit or vegetables into the water or steam. This process can prepare fruit and vegetables for drying and helps these foods maintain their color and taste, increasing the amount of time they last, killing bacteria, and preserving foods so microorganisms do not grow on foods while being stored.
- **Curing:** This entails leaving crops outside to dry in the shade. This process is useful for safely preserving root crops like yams, sweet potatoes, and cassava. It is best done in the dry season. When the outer surface of the root is hard, it is safe to further process or store the food. Additional processing can involve pounding foods or milling them into flour.
- **Germination and fermentation:** This involves soaking grains in water and often other substances that increases the amount of time a food remains edible,

increases the digestibility of foods, and increases the availability of nutrients in foods.

To ensure the safety of foods during this process, clean water should be used in addition to hygienic facilities and containers.

- Salting, smoking, or drying meat can also preserve it and increase the amount of time it can last before being consumed. These processes make it safe to consume meat days after it has been harvested and processed in these ways.

6 Preparation during preparation, there are a few key principles to remember so that your food does not get contaminated and is safe to eat.

- Keep surfaces clean where preparation takes place.
- Cook your food for the appropriate length of time and at the appropriate temperature to kill pathogens, but avoid overcooking when frying, grilling, or baking. Make sure animal products are not undercooked and vegetables are not overcooked.
- Use safe water.
- Clean hands and cooking equipment with soap before use. Dry utensils on a rack in the sun and cover them with cloth.
- Eat meals as soon as possible after they are cooked, so that bacteria do not have time to breed.
- Keep food covered, especially cooked food and food for children, so that dust cannot fall on it and flies with bacteria on their legs cannot land on it.
- Once cooked, store food in a cold place.
- If you must keep cooked food for another meal, cover it and keep it in a cool place. Then heat the food again just before eating it.
- Separate raw and cooked foods to prevent contaminating the cooked foods.

The importance of food safety for animal-source foods

Food safety during the purchase, transport, production/harvest, storage, processing, and preparation of meat, fish, milk, and eggs is especially important as food-borne diseases are common and more dangerous with animal-source foods.



Cassava and cyanide poisoning

What Cyanide is a toxic substance that can cause a variety of illnesses and naturally occurs in cassava.

Where We are exposed to it primarily through the consumption of raw cassava. Cyanide is naturally in cassava crops, but the quantities of cyanide in cassava vary depending on the variety, environment, and culture. Cassava peels have the highest levels of cyanide.

Health effects Depending on the amount of cyanide an individual is exposed to, the health effects can vary. Short or infrequent exposure can result in vomiting, headaches, collapsing, or death shortly after consumption. If an individual ingests a lot of cyanide, the resulting iodine deficiency caused by cyanide poisoning can lead to goiters, and neurological disorders can occur.

Prevention All cassava that gets consumed should be peeled (peel should never be eaten). Cooking cassava can reduce cyanide below harmful levels, but special attention should be paid to cooking time and methods, as not all cooking will decrease cyanide levels to non-toxic quantities.

Fermentation This can prevent cyanide poisoning if it involves soaking for a long time (days) and then the fermented cassava is dried (it can also then be roasted).

Sun drying or putting cassava on the fire This can reduce cyanide levels, but cassava pieces need to be in the sun or on the fire for a long time (sun dried for days, not hours). For a greater reduction in cyanide, soak the cassava for a long time before sun drying.

Pounding or crushing This decreases cyanide levels in cassava.

Milling Crushing and sun drying cassava that then gets made into flour can remove much of the cyanide in cassava.

Leaves In addition to the root, cassava leaves have cyanide and should not be eaten raw. Pounding and boiling in water can reduce cyanide toxicity.

Note Cassava also has antinutrients and processing can remove these. Fermentation and drying for a long time at high temperatures can remove antinutrients, and sun drying of leaves will help reduce antinutrients as well.

Food safety for large-scale productions is critical, as attention to hygiene and environmental conditions at each phase of production is important.

Purchase Consumers should ensure the animal-source products they buy have not been in the heat or at room temperature for a long time, are not old (typically more than one day since harvest). Consumers should also understand where the livestock or fish came from to ensure the foods are not contaminated (e.g. feed contaminated with bacteria, fertilizers, etc.).

Transport Foods should not be contaminated during transport by contact with flies, dust, etc. Animal-source foods should be kept in a cold chain during transport. While eggs do not need to be kept in a cold chain, they should not be in the heat for too long. Raw meat, fish, and milk should be properly covered and stored during transport to avoid contamination.

Production/harvest When animals are slaughtered or milk is acquired, it should be in a clean environment with clean utensils. Hands should be washed before and after harvesting. Milk, meat, and fish should be placed into clean containers (metal is best as it is more hygienic and can keep products colder longer). By-products of animals that are not being used should be properly disposed of (burned, buried, etc.) in appropriate places to avoid environmental contamination or diseases.

Storage Raw and cooked animal-source foods should be kept in cold environments and not removed from the cold until being cooked or consumed. Long-term storage should be in freezers. Storage containers/facilities should be clean (metal containers are best) and foods should be covered.

Processing Careful attention should be taken in processing meat and milk. Milk should be boiled to avoid the growth of bacteria. Although milk can be made into yogurt and cheese, it should still be kept cold and not allowed to ferment for too long. Meat should be cooked immediately after harvest, unless a very cold refrigerator is available. Meat and fish can be dried, salted, or smoked to increase the duration of time between cooking and eating. However, once processed it should be properly stored to avoid contamination.

Preparation It is important that meat, fish, and eggs are fully cooked. Eating raw animal-sourced foods can contribute to negative health effects. Cooked animal-source foods should not be stored or placed near raw foods or touched by utensils that have been in contact with raw foods.

Regulations and certificates

Many governments have safety regulations and certifications for proper storage, harvesting, and processing of animal-source foods. Such information should be gathered from your area of work.

Collaborations with government officials to understand safety controls and encourage them to put them in place, if lacking, is important.

Health codes for meat and milk production are especially important as bacteria and contamination from animal-source foods can be fatal.

Additional resources

Harvesting and storage tips for different crops:
<http://motherchildnutrition.org/healthy-nutrition/pdf/mcn-healthy-harvest.pdf>

FAO food storage and processing information:
http://www.fao.org/docrep/w0078e/w0078e07.htm#P5183_330479

Safety practices for manual slaughtering/animal production: <http://www.fao.org/docrep/003/x6552e/X6552E00.htm#TOC>

Annex 11 Nutrition-sensitive indicators

Indicator

Prevalence of children six to 23 months old receiving a minimum acceptable diet (MAD)

Definition This indicator measures the percentage of children six to 23 months of age who receive a minimum acceptable diet, apart from breast milk. The MAD indicator measures both the minimum feeding frequency and minimum dietary diversity, as appropriate for various age groups. If a child meets the minimum feeding frequency and minimum dietary diversity for his or her age group and breastfeeding status, then the child is considered to be receiving a minimum acceptable diet. Tabulation of the indicator requires that data on breastfeeding status, dietary diversity, number of semi-solid/solid feeds, and number of milk feeds be collected for children six to 23 months old for the day preceding the survey.

This composite indicator will be calculated from the following two fractions:

- 1 Total number of breastfed children six to 23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day / Total number of breastfed children six to 23 months of age in the survey.
- 2 Total number of non-breastfed children six to 23 months of age who received at least two milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day / Total number of non-breastfed children six to 23 months of age in the survey.

Minimum dietary diversity for breastfed children six to 23 months old is defined as four or more food groups out of the following seven food groups:

- 1 Grains, roots, and tubers
- 2 Legumes and nuts
- 3 Dairy products (milk, yogurt, cheese)
- 4 Flesh foods (meat, fish, poultry, and liver/organ meats)
- 5 Eggs
- 6 Vitamin-A-rich fruit and vegetables
- 7 Other fruit and vegetables

Minimum meal frequency for breastfed children is defined as two or more feedings of solid, semi-solid, or soft food for children six to eight months old and three or more feedings of solid, semi-solid, or soft food for children nine to 23 months old.

For the MAD indicator, minimum dietary diversity for non-breastfed children is defined as four or more food groups out of the following six food groups (during the previous day):

- 1 Grains, roots, and tubers
- 2 Legumes and nuts
- 3 Dairy products (milk, yogurt, cheese)
- 4 Flesh foods (meat, fish, poultry, and liver/organ meats)
- 5 Eggs
- 6 Vitamin-A-rich fruit and vegetables
- 7 Other fruit and vegetables

For the MAD indicator, minimum meal frequency for non-breastfed children is defined as four or more feedings of solid, semi-solid, soft food, or milk feeds for children six to 23 months old, with at least two of these feedings being milk feeds.

Note This indicator cannot be calculated for non-breastfed children.

Unit Percentage of children six to 23 months of age receiving a minimum acceptable diet

- a Overall
- b Male
- c Female

Disaggregate by Sex

Type (outcome/impact) Outcome

Direction of change Higher is better

Data source Population-based survey at baseline and final evaluation

Further guidance

WHO. 2008. *Indicators for assessing infant and young child feeding practices – Part 1: Definitions*. <http://www.who.int/nutrition/publications/infantfeeding/9789241596664/en/index.html>.

WHO. 2010. *Indicators for assessing infant and young child feeding practices – Part 2: Measurement*. <http://www.who.int/nutrition/publications/infantfeeding/9789241599290/en/index.html>.

Indicator

Minimum Dietary Diversity-Women: Mean number of food groups consumed by women of reproductive age (MDD-W)

Definition This indicator aims to measure the micronutrient adequacy of the diet and reports the number of food groups consumed in the previous day by women of reproductive age (15–49 years). To calculate this indicator, ten food groups are used:

- 1 All starchy staple foods
- 2 Beans and peas
- 3 Nuts and seeds
- 4 Dairy
- 5 Flesh foods
- 6 Eggs
- 7 Vitamin-A-rich dark green leafy vegetables
- 8 Other vitamin-A-rich vegetables and fruit
- 9 Other vegetables
- 10 Other fruit

The indicator is tabulated by averaging the number of food groups consumed (out of the ten food groups above) across all women of reproductive age in the sample with data on dietary diversity.

Unit Mean number of food groups consumed by women 15–49 years of age

Disaggregate by None

Type (outcome/impact) Outcome

Direction of change Higher is better

Data source Population-based survey in baseline and final evaluation

Further guidance

FANTA 2014: *Introducing the Minimum Dietary Diversity-Women (MDD-W) Global Dietary Diversity Indicator for Women* <http://www.fantaproject.org/sites/default/files/resources/Introduce-MDD-W-indicator-brief-Sep2014.pdf>

Mary Arimond et al. 2010. 'Developing Simple Measures of Women's Diet Quality in Developing Countries: Methods and Findings.' *Journal of Nutrition* 140(11): Supplement. http://www.fantaproject.org/publications/JofN_Oct2010.shtml.

Annex 12 Potential direct and indirect impacts on human health and nutrition

Extract from the *Agroecological risk and resilience screening tool focusing on potential direct and indirect impacts on human health and nutrition* (http://www.mercycorps.org/sites/default/files/MercyCorps_ARR_Screening%20Tool_V1.0.pdf)

A Usage of assets, including income and land

Income increases may be spent on unessential non-food items or on non-nutritional “status” foods, such as processed food and carbonated beverages. These in turn can worsen food and nutrition security and perpetuate the vulnerability of the very population that we seek to serve. Programs focused on increasing income may also inadvertently limit the availability of a diverse range of foods by promoting a limited number of products that may not meet the nutritional needs of the local population. When this happens, there is a potential to drive up the local prices for nutritious food and thereby negating the impact of increased income and reducing a household's food security. A few questions to ask yourself are:

- 1 Do farmers currently consume a proportion of the food grown on their land? If so, which crops? What proportion of diet is produced on farm?
- 2 Do farmers currently sell a proportion of the food grown on their land? If so, which crops?
Estimate
 - % of landholdings dedicated to producing food consumed in household
 - % of household food needs met by own production for consumption
 - % of landholdings dedicated to crops sold for income
 - % of household food needs met by income generated from farming activities.
[Total income generated over 1 year/12] / Monthly cost of diet for local HHs
- 3 Will the current program shift the proportions or amounts of land allocated and food grown for consumption or sale? If so, how? How is this expected to impact household food security?
- 4 If income gains are expected from the intervention, what are they?
 - What % of household food needs will this increase in income meet?
[Total increase in income generated over 1 year/12] / Monthly cost of diet for HH

- Is this improvement sufficient to significantly improve household food security?
 - Would increasing activities focusing on production for consumption hold more potential for increasing food availability and access at the household level?
- 5 Is there potential that program activities will encourage or incentivize farmers to shift current production patterns in ways which will reduce diversity of pathways to food availability and access for the smallholder household? For example, shifting farmer households to over depend on production either for income or production for consumption, may increase vulnerability by over exposing farmer households to risk to one type of shock (i.e. market shocks, fuel price increases, climate related crop failure and natural disasters).
 - 6 Will the production strategies promoted for income generation provide sufficient net income to ensure year round food access for the household? Do we have evidence of improved food security nutritional outcomes for other local farmers who have already adopted similar strategies being promoted?
 - 7 Will the proposed production strategies result in sufficient combined ‘production for consumption’ and income to cover the dietary needs for average households? If there is a gap, how will it be filled by households? Other livelihoods?

B Time constraints for women

Women are engaged in many competing priorities to care for their households, and children specifically. We need to consider gender-related trade-offs in terms of time spent for lucrative activities versus time for caring for children.

- 1 Are target women beneficiaries required to travel long distances to participate meaningfully in market activities?
- 2 Are promoted agriculture activities more time-consuming than traditional activities? Are there technologies that we can promote to decrease time spent?
- 3 Are promoted agriculture activities physically demanding for women?

C Agriculture technologies and practices may have unintended negative consequences on people's health

Below a non-exhaustive list of these technologies.

- 1** Are the irrigation mechanisms we are promoting potentially damaging people's health? For example, stagnant water can favor the breeding of mosquitoes, potential carriers of malaria or dengue. Also consider other water-borne diseases due to animal feces or pollution by chemicals.
- 2** Ecological Pest and Disease Regulating Mechanisms
 - Have the potential agroecological and human impact of the proposed pest and disease management strategies been assessed –i.e what are the known effects of these pesticides/ fungicides on human health?
 - If pesticides or fungicides are needed, is training sufficient with respect to dosage, protection of water sources and the potential harmful effects to farmers and their families if used/stored/disposed of inappropriately?
- 3** Is there an animal health plan for the new animals and clear identification of animal health services with capacity to deliver the animal health program? Increasing animal populations without adequate animal health prevention and disease control capacity not only risks the loss of the introduced assets with no return on resources consumed but may also support propagation of disease within and beyond the wider community herd/flock.
 - If animals are introduced from outside the existing production-marketing system, has the potential of introducing diseases been considered and mitigation measures put in place?
 - Are milk or other livestock products to be consumed as an intended outcome of the project? If yes, have the food safety risks of milk-borne and other diseases been considered (e.g. brucellosis) and appropriate animal health measures put in place?
 - How is milk and meat handled? Are there basic food hygiene issues which should be addressed to ensure safe animal products?
- 4** How will animal waste be managed?
 - Is there an estimate of the likely amount of animal waste which will be produced? Consider both processing as well as production related waste – most important for mono-gastric species (chickens, ducks, pigs) kept in peri-urban settings)
 - Is there a plan to ensure effective containment of waste if animals are housed/roam in residential areas?

- Is there a risk that animal waste could contaminate water sources? If so, what mitigating actions are proposed to prevent this occurring?
- If abattoirs and/or skins processing is included: what processes are in place to prevent environmental contamination with potentially harmful chemicals/ waste water? (these would generally warrant a specific environmental impact assessment)
- Will animal waste be recycled back into agricultural systems? If so, how?
- Can the waste be used as an organic fertilizer, promoting an integrated approach and re-cycling nutrients? If so, is there a written plan to quantify and appropriately manage likely waste production system to process waste either to generate energy (e.g. biogas) or to compost waste and use as an organic fertilizer? (to reduce potential pathogens and improve bio-availability of nutrients)

D Food safety practices

If not followed properly may have unintended negative consequences on people's health.

- 1** Is clean water available for use for cleaning and cooking? What are the water sources?
- 2** How will the preparation of animal-source foods be handled? (In addition to questions above in section C3)
 - What food hygiene practices are in place?
 - How will animal-source foods be stored?
 - How will animal-source foods be processed?
- 3** How will the harvest and preparation of crops (fruit and vegetables) be handled?
 - How will crops be stored to avoid the growth of mold, bacteria, etc. and pests?
 - How will crops be cleaned for consumption?
 - How will crops be cooked and processed for consumption?
 - How will groundnuts and cassava be processed and stored to avoid aflatoxin and cyanide problems?

Endnotes

- 1 http://scalingupnutrition.org/wp-content/uploads/2013/12/101059_SUN_2pager_English_v4r91_12_17_2013.pdf
- 2 FAO, WFP and IFAD, "The State of Food Insecurity in the World 2014," Rome, FAO.
- 3 GAIN/Behrman and Rozenweig (2001)/Hunt (2005). UNICEF cites that 38 percent of children under five in developing countries have stunted growth as a result of chronic malnutrition.
- 4 IFPRI, Concern Worldwide and Welthungerhilfe, "2010 Global Hunger Index: The Challenge of Hunger, Focus on the Crisis of Child Undernutrition," Bonn, Washington, DC, Dublin, October 2010, p 25.
- 5 For more detail, see Mercy Corps' Agricultural Approach on the Digital Library at <https://mcdl.mercycorps.org/gsd/docs/AgriculturalApproachMC.pdf>
- 6 A diet that consists of a variety of different kinds of foods is more likely to provide the full complement of nutrition that a person requires on a regular basis to support nutritional and health status.
- 7 **Annex 3** includes guidance for assessing local nutrient deficiencies.
Annex 7 provides information about the nutrient content of major agricultural products.
- 8 Biofortification is the process of breeding food crops that are rich in micronutrients, such as vitamin A or iron. See **Annex 4** for more details.
- 9 **Annex 9** provides guidance on nutrition-sensitive improvements to food storage and processing.
- 10 **Annex 8** includes a curriculum for carrying out nutrition sensitization among local stakeholders.
- 11 Iron and vitamin A have been called out specifically given their importance for the development of fetuses and children under two.
- 12 Martorell, R. ed. "The Effects of Improved Nutrition in Early Childhood: The INCAP FollowUp Study." *Journal of Nutrition* 125 (4S) (1995): 1027S-1138S.
- 13 Sally Grantham-McGregor, Yin Bun Cheung, Santiago Cueto, Paul Glewwe, Linda Richter, Barbara Strupp, "Developmental potential in the first 5 years for children in developing countries," *The Lancet*, Volume 369, Issue 9555, 6-12 January 2007, pages 60-70.
- 14 John Hoddinott, John A. Maluccio, Jere R. Behrman, Rafael Flores, Reynaldo Martorell, "Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults", *The Lancet*, Volume 371, Issue 9610, 2-8 February 2008, pages 411-416.
- 15 Not all crops can be intercropped – it is important to check which crop can be intercropped with the selected primary crop.
- 16 In some societies, the most nutritious foods are reserved to the father. Sensitization efforts need to ensure that households, and fathers in particular, understand the importance of providing a balanced diet to children under five and pregnant and lactating mothers.
- 17 For people whose diet is mainly composed of cereals, the presence of phytates in those cereals slows down the absorption of iron and zinc. Soaking or germinating cereals will reduce the presence of these phytates.
- 18 This simple process reduces losses of beta-carotene (which gets converted into vitamin A) and vitamin C. Ascorbic acid is another name for vitamin C, but vitamin C is a more commonly known and understood term.
- 19 Nutrients will refer to the nutritional gap identified during the assessment, and include one of: vitamin A, iron, proteins, or calories.
- 20 Mercy Corps' Agroecological Risk & Resilience Screening Tool, Guidance for considering agroecological impact of agriculture interventions and identifying opportunities to build resilience in food systems, Greg Sacrborough, September 2014.