

Food and Agriculture Organization of the United Nations

MAXIMIZING NUTRITION IN CROP PRODUCTION USING A FOOD SYSTEMS APPROACH









MAXIMIZING NUTRITION IN CROP PRODUCTION USING A FOOD SYSTEMS APPROACH

AN EVIDENCE-BASED LITERATURE REVIEW

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Context

This literature review is one of a series of four sector-specific reviews aimed at informing the development of guidance notes for the integration of nutrition across the crops, fisheries and aquaculture, forestry and livestock sectors in 12 sub-Saharan African countries. The guidance notes will provide practical suggestions on how to formulate programmes and policies that contribute to sustainable healthy diets and enhanced nutrition. Both the literature reviews and the guidance notes form part of a collaboration by the Food and Agriculture Organization of the United Nations (FAO), Action Against Hunger and World Vision to support national decision-makers and programme implementers in strengthening sector policies, programmes and investments for improved food security and nutrition outcomes, especially for those who currently or could rely on this sector for subsistence and sustenance.¹

The present literature review focuses on mainstreaming nutrition in the crops sector, using a food systems approach. Food systems refer to the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, marketing and advertising, preparation, consumption and disposal of food products that originate from crop and livestock production, forestry, fisheries and aquaculture, as well as the broader economic, societal and natural environments in which these diverse production systems are embedded (FAO *et al.*, 2019).



Figure 1. Food systems for healthy diets

Source: Adapted from the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (FAO, Rome, 2017).

¹ The project covers the following countries: Burkina Faso, Chad, Côte d'Ivoire, the Democratic Republic of the Congo, Eswatini, Ghana, Kenya, Mali, Mauritania, Senegal, Uganda and Zimbabwe.

The review also highlights challenges faced by the most vulnerable groups in this sector, such as small-scale farming communities and the women and youth within them.

Methodology and structure

In developing this review, a desk study of both peer-reviewed scientific literature and grey literature was conducted; the resulting information on the contribution of the crop sector towards food and nutrition security has been organized across the following key questions:

- How does the crop production sector contribute to sustainable healthy diets and prevent malnutrition?
- How is the crops sector organized within the framework of the food system?
- Who are the most vulnerable groups in the crops sector? What are the drivers of malnutrition and/or poverty in these groups?
- What are the main limitations and drivers that affect the crops sector?
- What are the most relevant types of interventions that may enhance the contribution of the crops sector to sustainable healthy diets and improved nutrition, while also addressing the challenges faced by the most vulnerable groups in this sector?

Background

As the largest food sector, crops provide sustenance for all 7.8 billion of the world's population, as well as 1.3 billion out of the 2.5 billion agricultural jobs in the world (FAO, 2017b). Women comprise 43 percent of these 1.3 billion workers (FAO *et al.*, 2019). The crops sector has traditionally focused on providing calories and reducing famine by maximizing productivity, often for economic reasons (Amoroso, 2016). This emphasis on food security and commercial value has come at the cost of production diversity; as a result, many consumers are unable to access the full range of crops, including fruits and vegetables, that are needed to achieve dietary diversity (EAT Initiative, 2015). This imbalance in the crop supply chain is strongly associated with the prevalence of malnutrition, as poor access to fruits and vegetables means poor access to a wide range of vitamins and minerals that are needed for a healthy diet (FAO and WHO, 2019). Due to its broad and critical and comprehensive role in the food system, supporting both the economic and food and nutrition security aspects of the crops sector is essential for achieving the 2030 Agenda for Sustainable Development.

How does the crops sector contribute to sustainable healthy diets and prevent malnutrition?

Crops (staples, fruits and vegetables) provide essential macro- and micronutrients: carbohydrates, proteins, fats, and vitamins and minerals (Schmidhuber *et al.*, 2018). Staples such as maize, rice and wheat are calorie-rich foods that provide energy; fruits do not provide as much protein and mineral content, but are a good source of carbohydrates and water-soluble vitamins; and vegetables provide a significant amount of minerals, vitamins and phytochemicals that can reduce the risk of cardiovascular

disease and obesity, while also functioning as antioxidants and anti-inflammatory agents (FAO and WHO, 2019).

The consumption of whole grains from staple crops is associated with increased health and a 20–25 percent reduction in the risk of mortality (Ross *et al.*, 2017). Likewise, the consumption of up to 400 g of fruits and vegetables per day is also associated with improved health and a 4–10 percent reduction in the risk of mortality (Gehlich *et al.*, 2020). To ensure the crops sector can address these recommendations, the following are critical: 1) a diversified crop production system that pays significant attention to the production of fruits and vegetables; 2) better market access that allows producers and non-producers to sell and buy nutritious food; and 3) biofortification – especially through conventional crop breeding – which adds essential vitamins and micronutrients to targeted crops (FAO and WHO, 2019).

How is the crops sector organized within the framework of the food system?

1. Food supply chain

The crop value chain consists of farmers, agricultural extension workers, food transporters, food processors, and wholesale and retail agricultural input and food dealers (Liverpool-Tasie *et al.*, 2020). Producing and moving food along the supply chain requires multidisciplinary interventions. It is therefore important that actors all along the chain have access to relevant resources, including land rights, agricultural inputs, irrigation services and agronomic training. Of these actors, 28–34 percent are smallholder farmers who manage under 2 hectares of land (Ricciardi *et al.*, 2018).

Crop production covers most of the food groups recommended in a diverse diet (FAO, 2020). As such, there is often a significant positive relationship between farm production diversity and consumer dietary diversity (Ecker, 2018). The more crops farmers produce, the more food they have for their own consumption and the more food they can sell for income to purchase a diverse diet. But despite the strong case for a diversified production system, most crop value chains neglect fruit and vegetable production, thus limiting the supply of essential vitamins and micronutrients required to achieve a healthy diet (Amao, 2018). A more informed approach is thus needed to balance productivity, biodiversity, commercial value and demand within the crop production system (FAO, 2017a).

Better and more streamlined fruit and vegetable value chains require enabling environments that support increased public and private investment for the research, development and commercialization of improved varieties of vegetables and fruits (Rustad and Smith, 2013). One example is through support for the cultivation of African leafy vegetables (Maseko *et al.*, 2019), which contain more minerals and vitamins, require less water to grow, can adapt easily to poor-quality soils, and are more resistant to diseases. These vegetables are however prone to losses as a result of pests and climate change (Himmelstein *et al.*, 2017), and are often associated with economic damage, which in turn discourages producers from cultivating fruits and vegetables. It is therefore essential that appropriate investments are made in interventions such as integrated pest management, biofortification (Jha *et al.*, 2020) and infrastructure projects for capacity building, storage, processing and packaging (Garcia-Cela *et al.*, 2019; Schreinemachers, Simmons and Wopereis, 2018). These investments are needed to encourage the cultivation of fruits and vegetables among both small- and large-scale producers.

2. Food environment

The food environment comprises the physical and non-physical factors that influence the quantity and quality of food crops people buy and eat. This includes wet markets, stores and supermarkets, as well as other social, economic and cultural factors (Obour *et al.*, 2018). In addition to the safety and quality of the food crops themselves, other environmental factors such as advertisements or promotional material, as well as proximity to wet markets (for example, how near or far people are from food sources) can influence the quantity and quality of the food crops people eat (Hawkes *et al.*, 2010).

The two most significant determinants for the quantity and quality of food people eat are price (both absolute and relative) and consumer income (Herforth and Ahmed, 2015). In most cases, micronutrient-rich food crops (such as fruits and vegetables) are more expensive than staple food crops (Alemu *et al.*, 2019). Moreover, staple food crops are easily tradable, due to both demand and ease of storage and transport, while micronutrient-rich foods such as fruits and vegetables (especially those that are highly perishable) are less so, and are generally more influenced by factors such as storage, transportation and safety standards within local supply chains and retail services. Addressing and managing these considerations can be expensive and typically raises the cost of micronutrient-rich crops significantly (Headey and Alderman, 2019).

Safety-net programmes (for example, for cash transfers, cash or food vouchers, etc.) can bypass price/ income hurdles, thereby addressing affordability and increasing access to nutritious food (Global Panel on Agriculture and Food Systems for Nutrition, 2017). In addition, subsidies for micronutrient-rich crops and taxes on unhealthy foods can promote the former while discouraging consumption of the latter (Niebylski *et al.*, 2015). Building and strengthening market infrastructure and facilitating market access for farmers can also improve the general public's access to and consumption of diverse food and of other important vitamins and minerals (FAO, 2017a). For example, farmers linked to input and output markets in Kenya were found to consume a higher amount of vitamin A, iron and zinc (Chege, Andersson and Qaim, 2015). It is therefore essential that governments implement policy initiatives to support the above interventions.

3. Consumer behaviour

There are two groups of consumers in the crop production sector – those who produce and consume crops directly, and those who purchase food from retailers (Joosten *et al.*, 2015). In both cases, consumer behaviour influences the crop value chain through demand for specific types of staple foods or fruits and vegetables. And in both groups, those who purchase, prepare and serve crop produce are often women (Quaidoo, Ohemeng and Amankwah-Poku, 2018).

In the crop food system, understanding consumer behaviour requires understanding how people prepare and store food, and the decisions they make about the quality, quantity, diversity and safety of the food they eat or provide to others in their households (Pellegrini and Fernández, 2018). Nutrition education is a critical factor for such decisions, and for general awareness regarding the preparation and consumption of food crops. A study published in 2013 notes that regular consumption of fruits and vegetables is much more strongly motivated by nutrition education than regular consumption of other food groups (Rustad and Smith, 2013); this was especially true among low-income women and high-school students. Together with income, education is key to increasing the likelihood that consumers will pay a premium for higher-quality fruits and vegetables (Nicolae and Pelau, 2011). Interventions should therefore focus both on educating consumers on the benefits of a healthy diet, and on making fruits and vegetables more affordable.

Who are the most vulnerable groups in the crops sector? What are the drivers of malnutrition and/or poverty in these groups?

Smallholder crop producers are the most vulnerable group in the crops sector (Jayne, Mather and Mghenyi, 2010). These farmers have limited access to land tenure, and lack access to agricultural inputs, agricultural technology, extension services, markets and climate-related information. For most smallholder farmers, production is mostly for subsistence, uses traditional farming methods and involves limited arable land (Ricciardi *et al.*, 2018). In addition, women and youth are more vulnerable compared with their male and older counterparts, due to limited access to agricultural inputs and agricultural profits (Doss, 2014). In general, smallholder crop producers suffer from high rates of poverty and malnutrition; this is due to various factors including low crop productivity, which in turn may be influenced by climate change, the political or economic situation of the region or country, access to financial services, proximity to markets and other sociocultural factors (Morton, 2007; Vermeulen, Campbell and Ingram, 2012). To ensure that vulnerable groups in the crops sector are protected, policies and programmes must therefore address these issues equitably across all demographics, with a particular focus on women and youth."

What are the main limitations and drivers that affect the crops sector?

The following factors have been identified as key limitations and drivers for the crops sector (Béné *et al.*, 2019):

- a) Urbanization and increased consumer income (FAO, 2017a).
- b) Population growth (Ferreira de Sousa et al., 2020).
- c) Intensification and homogenization of the agricultural sector (Pellegrini and Fernández, 2018).
- d) Increased frequency and intensity of extreme events and of soil degradation (García-González *et al.*, 2018).
- e) Improved access to infrastructure and information (FAO and WHO, 2019).
- f) Internationalization of private investments and concerns for food safety (Béné et al., 2019).

What are the key interventions in the crop sector that can contribute to sustainable healthy diets and improved nutrition while addressing social inequity?

Based on the issues identified in this review, there are several key interventions that should be considered when designing and implementing policies and programmes for the crops sector:

- a) Diversifying the crop production system (FAO, 2017a);
- b) Improving productivity and increasing production for a diversified range of fruits and vegetables (including leafy vegetables), in particular locally adapted varieties that are rich in micronutrients and protein, and well-suited to local nutrition issues and dietary preferences (Maseko et al., 2019);

- c) Improving rural markets and enabling smallholders to access high-quality markets (Jayne, Mather and Mghenyi, 2010);
- d) Reducing food loss and waste, improving food quality and ensuring food safety (FAO, 2015);
- e) Increasing the consumers' knowledge on food preparation and nutrition (FAO, 2020); and
- f) Enabling smallholder farmers (especially female farmers) to access agricultural assets, finance, inputs and training (FAO, 2017a).

This literature review informs and complements the development of a guidance note on the crops sector, providing practical suggestions on the formulation of programmes and policies that meet these targets and contribute to better nutritional outcomes while taking environmental, social and economic impacts into account.

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