Evidence on Interventions and Field Experiences


How Can Agricultural Interventions Contribute in Improving Nutrition Health and Achieving the MDGs in Least-Developed Countries?

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Abstract

There are strong conceptual linkages between agricultural development and nutrition improvements which may be categorized into three main pathways: the development, own-production and market pathways. Evidence on the efficacy of these pathways is mixed with some strong, some negative and some weak impacts. These findings reflect both the importance of agriculture for nutrition and the conditionality of that importance on contextual factors. They are also the result of insufficient high-quality empirical research investigating these linkages. The most effective ‘pathways’ and interventions linking agricultural change to improved nutritional outcomes change with economic growth and development, with declining importance of the development and own-production pathways and increasing importance of the market pathway. Substantial challenges in operationalizing agricultural-nutrition linkages need to be overcome to better exploit potential opportunities.

Introduction

This chapter discusses ways in which agricultural interventions can contribute to improving nutrition health and to achieving the Millennium Development Goals (MDGs) in least-developed countries. After this introduction, the chapter briefly details the main nutrition- and agriculture-related MDGs and progress on their achievement. The following section then considers processes by which
agriculture may contribute to improved nutrition and to progress on nutrition-related MDGs. This is followed by an examination of evidence on the impact of agricultural development and development interventions on nutrition. This leads on to a discussion of agricultural interventions that can promote improved nutrition – sometimes referred to as nutrition-sensitive agriculture.

**What Are the Nutrition/Health Issues in the MDGs That Are Most Closely Linked to Agriculture?**

The MDGs, a set of eight goals with associated targets and indicators, were originally specified in United Nations [1]. A small number of further targets and indicators were added subsequently.

The principle goal and target that is the focus of this paper is Goal 1 (eradicate extreme poverty and hunger) and within that target 1C (halve, between 1990 and 2015, the proportion of people who suffer from hunger). Two indicators are specified for this target:

- Indicator 1.8: prevalence of underweight children younger than 5 years
- Indicator 1.9: proportion of population below minimum level of dietary energy consumption

The most recent information on progress and likely achievement or non-achievement of MDG targets is found in United Nations [2]. Substantial gains have been made on indicator 1.8 in some regions (notably Western Asia, Eastern Asia, Caucasus and Central Asia and Latin America and the Caribbean, and to a lesser extent in North Africa and South Eastern Asia). However, progress has been slower in Sub-Saharan Africa and South Asia, and the overall target of halving the prevalence of under-nourishment is unlikely to be met by 2015.¹

There have been considerable concerns about the validity of measures for indicators used for indicator 1.9. Revised estimates of the numbers and proportions of undernourished people are provided in [5]. These show that prior to 2007, falls in the prevalence of undernourished people were not quite on track to meet the MDG target, and food price increases in 2008 and subsequent years then further slowed down the rate of fall in incidence. However, absolute numbers of undernourished people have hardly fallen, meaning that the World Food Summit global target of halving the number of hungry people from 1990–1992

¹This discussion of MDG achievements does not address widely voiced concerns about differences between changes in incidence and absolute numbers or about greater challenges in meeting relative rather than absolute reductions where countries or regions have initially high incidences of disadvantage [3].
to 2015 will be missed by a wide margin. However, the revised estimates of prevalence of undernourishment show a decline rather than the previously estimated reversal in falling global prevalence of undernourishment following food price rises in 2008, as also reported by Headey [4].

As with other MDG targets, there are wide variations between regions as regards changes in prevalence and numbers of undernourished people. FAO, WFP and IFAD [5] estimate that absolute numbers of undernourished people have been falling in Asia and in the Latin America-Caribbean areas, with falls in prevalence on track to meet the MDG target. In both Near East/North Africa and Sub-Saharan Africa, however, absolute numbers of undernourished people have been rising, with lower falls in prevalence in Sub-Saharan Africa, but actual increases in prevalence in Near East and North Africa – although this is from a much lower 1990–1992 starting point than the other regions (7% as compared with 15% in Latin America/Caribbean, 25% in Asia and 35% in Sub-Saharan Africa). Within Asia, there has been a remarkable fall in prevalence in South Eastern Asia from 30 to 11% from 1990–1992 to 2010, with a slightly lower but still remarkable fall in Eastern Asia from 21 to 12% over the same period. South Asia achieved a lower fall in prevalence, however, which if continued will not be enough to achieve the target. Prevalence in Western Asia increased.

FAO, WFP and IFAD [5] recommend that although undernourishment and hunger should be monitored with a wide range of indicators of food availability, access and utilization, data are not available on an annual regional basis for many critical indicators, such as stunting and wasting.

**How Can Agriculture Contribute to Improvements in Nutrition?**

Links between agriculture and food security have long been recognized, but agriculture is only one contributor to food security. The Committee on World Food Security defines food security as follows [6]:

*Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability. The nutritional dimension is integral to the concept of food security.*

This recognizes that food availability is a necessary but not sufficient condition for food security – access is also necessary through entitlements (allowing local unavailability to be overcome by purchases), and once accessed food needs to be utilized. Utilization depends upon food storage and processing and upon physiological processes of nutrient absorption. Stability is then needed in ex-
pected food access – and hence stability in availability, access and utilization and in their determinants. Food security also has different dimensions as regards types of nutrient.

A number of authors have provided overviews and conceptualizations of links between agriculture and nutrition or, more widely, health [7–12]. It is helpful to distinguish between three broad pathways by which agriculture impacts on nutrition: a general development pathway, a market pathway, and an own-production pathway.\(^2\) We consider these in turn.

There is a longstanding literature on the role of agricultural development in wider development processes [14–16] supported by more recent empirical work [17]. This may be summarized as a process whereby new agricultural technologies and resources increase both agricultural production and food availability per worker [18]. This lowers the cost and price of food relative to worker incomes and increases real incomes and other discretionary spending. It also releases agricultural labor from food production to production of other goods and services. Industrial, service and knowledge revolutions can then build on this with further increases in labor productivity and in goods and services supply and demand, with falling relative importance of agriculture. Expected food security and nutritional benefits from this arise from increased food production (improving food availability), lower food prices and increased real incomes (improving food access, both for staples and more diverse nutrient rich foods) and more diverse incomes (improving food stability). Increased individual and public incomes should also lead to improved individual and public educational, health, sanitation and other investments which should lead to improved food utilization. These development processes should therefore lead to improvements in all four ‘pillars’ of food security.

These arguments suggest that despite its challenges there is a special role for smallholder agricultural development in poor agrarian economies with large numbers of poor farmers: such development leads to simultaneous expansion of labor supply to and demand for initially nonstaple and then nonfarm production with simultaneous food security and nutritional gains for poor smallholder populations. The effectiveness and efficiency of smallholder development policies and investments are, however, questioned by some, who suggest that faster growth may be achieved by focusing on nonagricultural growth and/or large-scale agricultural development [19]. These arguments rely on prior or current agricultural development that has already raised agricultural productivity outside the poor agrarian economy to deliver cheap food (from imports or from

\(^2\)This builds on the distinction between market and own-production pathways [13] and on four out of five pathways identified in World Bank [12].
rapid increases in net value-added labor productivity in large-scale agricultural development) with simultaneous nonagricultural development to absorb smallholder labor and raise its productivity outside the agricultural sector. This in turn requires competitive access to markets serving populations with sufficiently high incomes to demand the new goods and services produced. Both these alternatives face substantial challenges as regards large-scale requirements for improved access to food markets and for labor-absorbing nonagricultural development. Large-scale social protection policies may address some of these challenges (as in Brazil) as policy makers try to produce the same coordinated processes with taxes and subsidies transferring income to large numbers of poor rural people from smaller numbers of skilled workers and owners of capital. This approach, however, faces governance and political economy challenges and needs a large and rapidly growing capital-intensive sector to support these transfers.

There are also questions about the availability of cheap food. International food price spikes from 2008 have led to renewed interest in food prices and challenged the widespread observation of a steady fall in long-term real food prices [20]. Prices have subsequently fluctuated above a base somewhat higher than pre-2008 prices. More fundamentally, however, conventional measures of ‘real’ food prices compare food prices with US consumer prices or the prices of manufactures, prices that are largely determined in richer economies by the demand of richer consumers and societies (with relative falls in food prices an inevitable result of increasing incomes with economic growth [18, 21]). A more meaningful measure of real food prices is to compare them with incomes, which vary between rich and poor individuals and societies. Unsurprisingly, real international food prices measured in this way have not declined for poor people in the way that they have for the less poor [18].

The market and own-production pathways are shown in figure 1. Both these pathways postulate the effects of agricultural interventions (on the left) which, if taken up, lead to agricultural product changes. Under the market pathway (see the upper part of fig. 1), these product changes then lead to changes in the supply to the food market, with possible subsequent impacts on food prices, consumer real incomes and food demand and consumption, with possible subsequent impacts on nutrition intakes, food utilization and nutritional status. There are strong parallels between the market pathway and some of the processes outlined under the agricultural development pathway. However, the market pathway is not restricted to economies with large numbers of poor farmers, and focusses more on impacts on the nutrition of food buyers.

The own-production pathway (in the lower part of fig. 1) focusses more on food consumption and nutritional status impacts for agricultural producers –
allowing for the effects of increased incomes from food or nonfood sales and/or own changes in consumption of own-produced foods. Both pathways are affected by wider socioeconomic context (shown at the top and bottom of fig. 1) and by impacts of health, water and sanitation interventions (in the middle of fig. 1).

This discussion may appear to suggest that these three pathways can be considered relatively distinct from each other. There are, however, considerable overlaps between them – for example the development pathway depends upon processes that are very similar to those involved in the market pathway, and there are also linkages between the market and own-production pathways. The pathways are therefore both distinct and overlapping, as shown in figure 2 (which also shows important nonagricultural and contextual influences on nutritional status).
How Has Agriculture Contributed to Improvements in Nutrition?

We now consider evidence for agriculture's actual impacts on nutrition through these three pathways. As one would expect, there are considerable overlaps in evidence across the three pathways, but also considerable gaps and difficulties in clearly establishing patterns of causality.

Evidence on the first pathway is derived from two main types of study: those that analyze patterns of change across countries with different growth paths [9, 22], and those that look at growth paths in more detail within particular countries [23, 24]. Evenson and Gollin [25] also use a simulation approach to investigate the impact of the green revolution food production, prices and malnutrition.

A number of recent studies have investigated the relationship between income growth and nutrition, generally measured in terms of stunting, height-for-age or underweight [7, 9, 22, 23]. These generally find that increasing income leads to reduced malnutrition, although estimates of the strength of the relationship vary. Some studies provide some explanation of this variation, with stronger effects in longer-term analysis, from agricultural growth (except in India), and at lower income levels. Effects are also commonly stronger when malnutrition is measured by hunger or dietary intake than when it is measured by anthropometric variables. Nutritional status is also affected by the type of agricul-

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**Fig. 2.** Overlaps between development, market and own-production pathways for agricultural impacts on nutrition.
ture and by a range of conditioning factors including women’s education and status, distribution of growth, dietary quality, land distribution, access to medical care, fertility, infrastructure, and specific nutrition programs. Headey [9] concludes that ‘economic growth is nutrition-sensitive if it increases food production (especially when food insecurity is high), reduces poverty, increases female education, improves health access, and reduces fertility rates (...) for low-income countries at least, economic growth is a necessary but insufficient condition for reducing malnutrition’.

Data and estimation difficulties and the many influences on growth impacts on malnutrition mean that estimates of the scale of these impacts should be treated with care. It is nevertheless instructive to note the scale of the different estimates of an author who considers in some detail the variability and reliability in his estimates [9]. His regression estimates suggest that with a per capita growth rate of 5% per year, stunting prevalence would be reduced by around 0.9 percentage points per year. Outside India, agricultural growth per total capita of 5% per year would reduce stunting prevalence by 4 or 2 percentage points depending on the way that the sectors are weighted. No significant effect of agricultural growth on stunting prevalence is found in the Indian states. As regards impacts of agricultural growth on estimated calorie availability, a 5% increase in agricultural GDP per total capita leads to a 2.5–4% increase in energy supply, declining sharply as agricultural population shares fall and calorie consumption rises. A 10% increase in energy supply is then associated with a reduction in stunting of 3.3 percentage points. Increases in food production have similar impact for the group of countries with initial food production below the sample mean, but are very low and not significant for the group of countries with initial food production above the mean. Evenson and Gollin [25], using a simulation, estimate that without the Green Revolution the incidence of stunting would have been 12–15 percentage points higher in South Asia and 6–8 percentage points higher in developing countries overall.

The studies reported above are relevant to all three pathways by which agriculture can impact on nutrition – and emphasize the relationship and overlap between them. All three pathways can involve impacts from price changes and from changes in product composition, although the balance between them is likely to differ. There can also be significant complementarity, as between the development and own-production pathways, as the nutritional impacts of economic development tend to be greater in economies with greater relative importance of the agricultural sector. There is then a larger share of the workforce working in agriculture and getting a double benefit as both producers and consumers from increases in real incomes and in access to improved diets.
It is also useful, however, to distinguish between them:

- Market pathways generally involve more direct and immediate impacts of changes in food prices and food composition and less extensive processes of change. The development pathway, however, involves wider, medium- to long-term processes including effects of structural change, changes in agricultural and nonagricultural productivity, and impacts on individual and public resources and investments.

- Development pathway impacts are more important in poorer, low- and middle-income countries, but market pathways can also be important in high-income countries.

In the market pathway, we focus on two main mechanisms: changes in food prices and in food composition, noting first that if these changes are to be driven by changes in domestic agriculture, then this requires that food markets are not dominated by imports.

Some evidence on the impacts of short-term falls in food prices has been discussed earlier under the development pathway. Further evidence of short-term impacts is provided by examination of the negative impacts of food price rises. As discussed earlier, initial estimates of very large and damaging increases in the incidence of undernourishment and hunger following the 2008 global food price spike [26–28] have been moderated by the countervailing effects of economic growth benefiting poor people mainly in Asia [4, 5]. Medium-term damaging effects of higher food prices on the urban poor are universally recognized, but there is more debate on the effects of higher food prices on the rural poor. Some argue that the rural poor gain long-term benefits from higher food prices stimulating increased production and labor demand. Others, however, argue that the evidence for this is limited and that there are a number of structural constraints and considerations that make this unlikely for most poor rural people, particularly in Africa [29].

There is also some evidence of the negative effects of recent food price rises on nutritional status [28, 30]. Earlier studies of the effects of high rice prices also found increased malnutrition rates as a result of price rises in Indonesia and Bangladesh [31, 32]. Increases in rice prices may also lead to households reducing consumption of important micronutrients but not of calories as they try to maintain calorie consumption by reallocating spending to a less diverse diet with a higher proportion of staples.

Changes in dietary composition may result from changes in the mix of foods accessed by consumers or by changes in particular foods’ nutrient composition as, for example, with the growth in the market demand for and consumption of orange flesh sweet potato and hence of vitamin A in rural Mozambique following its introduction to and cultivation by smallholder farmers [33, cited by 34]. ‘Nutrition value chain’ interventions have also promoted increased crop diversity in
production and in consumer food intake, in both developing and developed economies [34].

Agricultural interventions’ nutritional impacts via the own-production pathway have been the subject of a number of reviews [12, 35–37]. These draw similar conclusions, that the evidence base is too weak to draw any robust conclusions regarding the nutritional impacts on producers of the limited number of agricultural interventions investigated. Weaknesses in evidence arose as a result of poor study designs with limited counterfactuals, small sample sizes, and heterogeneous use of variables for measuring nutrition (including measures of dietary changes but relatively few measures of nutritional outcomes). However, all studies also report promising indications and examples of agricultural interventions impacting on nutritional status, and conclude that more and better quality studies are needed. It should be noted that these reviews did not cover agricultural interventions undertaken without specific nutritional objectives. Nevertheless, informative examples of such studies exist [38], and more systematic examination of them could be instructive.

In this context, a recent review identifies gaps in current and planned research on agriculture for nutrition [8]. Areas relevant to this paper and addressed by only a limited number of (or no) projects included: whole supply and nutrition impact chains and policy influences on them; the development pathway; the market pathway; governance, policy processes and political economy influences; cost-effectiveness, and development of research and evaluation methods and metrics. They did not, however, attempt to assess the quality of the research projects reviewed.

**What Agricultural Interventions Can Promote Improved Nutrition Health and Achievement of the MDGs in Least Developed Countries?**

In this section, we build on earlier discussion and the work of other authors to identify strategic principles, practical principles and practical options for ‘nutrition-sensitive agriculture’, agricultural interventions aiming to promote improved nutrition.

Discussion in the sections above shows that the effectiveness of agricultural development in promoting improved nutrition is generally highest in poorer agrarian economies, and declines with development, as does the proportion of agricultural workers and rural inhabitants. This suggests declining importance of the development and own-production pathways. The importance of the market pathway, on the other hand, increases with development, as food buyers and purchases increase and subsistence production and consumption decline. Referring back to
figure 2, these patterns suggest that agri-nutrition interventions in the least developed, poor agrarian economies are likely to be most effective if they work in the overlap of the development and own-production pathways (intersection C). As development proceeds, the focus should shift towards areas A and D, before concentrating on the market pathway – although there will still be some disadvantaged producers who merit specific attention through own-production pathways, as well as poor consumers whose nutrition could benefit from some engagement in own production of particular foods (such as vegetables, fruit or small livestock). Agri-nutrition interventions will also need to be supported and complemented by other services and interventions and a supportive environment as shown in figure 2, particularly where there are substantial food imports. This pattern of changing pathways has parallels with changing roles for governments in promoting agriculture [39] (establishing the basics, kick starting markets, facilitating markets) and in promoting agricultural nutrition links [40], with provision of core public goods in stage one (energy- and nutrient-deficient) countries, targeted service delivery in stage two (energy-sufficient but nutrient-deficient) countries, and private sector regulation in stage three (excessive calorie) countries.

It must also be recognized that as important players in the value chain, producers’ interests will be important in any intervention that seeks to change agricultural practices, even if improvement of their nutrition is not an objective driving that intervention.

These broad strategic principles are supported by and match more practical principles for nutrition-sensitive agriculture. Hawkes and Ruel [34] outline nine principles for what they term a ‘nutrition value chain’ approach – which has wider relevance beyond interventions within the market pathway (as almost all agricultural development involves markets, even if nutrition objectives are not pursued through food markets). The following principles are suggested [34, pp. 35–38]:

1. Start with explicit nutrition goals.
2. Clearly define the nutrition problem.
3. Create and capture value for nutrition.
4. Be expansive in the search for solutions, but tailor to context.
5. Focus on the functioning and coordination of the whole chain in order to create sustainable solutions.
6. Add value not only for nutrition (and consumers), but also for other chain actors.
7. Take a broader view of adding value for producers and consumers.
8. Focus on meeting, growing, and creating demand.
9. Create a policy environment in which better nutrition is valued.

Herforth et al. [41] also suggest principles for nutrition-sensitive agriculture, focusing on guiding principles for operational investments that prioritize nutri-
tion in agriculture and rural development. They reiterate the first of Hawkes and Ruel's principles and suggest the targeting of nutritionally vulnerable groups, investment in women, and a focus on increasing all-year access to diverse, nutrient-dense foods. They also argue for creation of enabling environments for good nutrition through knowledge and incentives for staff, and active search for opportunities to work across sectors. These points demand active involvement of different specialists in agriculture, nutrition and other development sectors and new cross-sectoral thinking and disciplines to address these issues. World Bank [12] note the need for investment in human capacity and behavioral change alongside agricultural intervention if such interventions are to have nutritional impacts.

Fan et al. [42] set out wider principles for promoting beneficial linkages of both health and nutrition with agriculture. These focus on filling knowledge gaps (through research, evaluation and education across disciplines and sectors), doing no harm (addressing health risks along agricultural value chains right through to consumers and seeking to promote health and nutrition interventions that contribute to the productivity of agricultural labor), seeking out and scaling up innovative solutions in sectoral programs with cross-sectoral benefits, and creating an environment in which cooperation can thrive (through cross-sectoral partnerships with mutual accountability mechanisms, attention to market failures and advocacy). These are particularly useful in also emphasizing the importance of feedbacks from nutrition to agriculture and health: these feedbacks have not been a focus of this paper but are nevertheless important.

Finally, we consider practical options for nutrition-sensitive agriculture. Figure 1 includes some examples of the types of agricultural intervention that may be useful in nutrition sensitive agriculture. Hawkes and Ruel [34] also outline five 'categories of action' within the value chain approach they espouse: information and education for behavior change; research and technology change (for example through breeding, genetic modification, fertilization, or agronomy to increase production or change product composition); organizational change, within and among organizations, to promote coordination or change power relations; changes in costs and incentives (through new systems or public or private investments), and development of policies and standards (such as procurement policies and systems or market or food safety standards). To these might be added, from a wider perspective, changes in national policies (for example on trade, input or product subsidies).

We now briefly discuss food contamination, an issue spanning the market and own-production pathways in figure 1. We focus on mycotoxin contamination, specifically aflatoxin, which is produced by *Aspergillus flavus* and *A. parasiticus* infecting maize grain through insect attack in the field and/or in poor
storage conditions. High concentrations of aflatoxin are found in maize in southern, eastern and west Africa as well as in parts of Asia and Latin America. Aflatoxins’ effects in inducing liver cancer have long been recognized, but there is a growing body of evidence of immune system disorders and stunted growth with exposure to aflatoxin and fumonisin (another common mycotoxin). These effects are particularly important in poor populations where maize is a staple food often produced under stress and then stored in poor conditions (groundnuts, rice, dried cassava, and sorghum, and millet are also affected). They are also particularly serious in the first 1,000 days of life. Given the widespread poor storage and consumption of (particularly) maize and the high incidence of communicable diseases to which these mycotoxins may suppress immunity, this is a major issue with strong links between agriculture and nutrition. Possible measures include improved crop pest control, changes in storage practices to reduce insect infestation/damage and moisture content, infection of grain with competing and harmless fungal species, rejection of affected grain, mineral or yeast-based binder additives, and market standards and regulations. Interventions must however take account of the poverty and food insecurity of many affected households, the importance of dispersed and informal markets with small transactions in areas with very poor market infrastructure, and the importance of subsistence production and consumption which never enters the market [43–45].

**Conclusions**

This review has shown that achievement of the nutrition-related MDGs is unlikely in large populations of poor people mainly in South Asia and Sub-Saharan Africa, but that agricultural development can promote nutrition improvements through three main pathways (the development, own production and market pathways). Evidence on the efficacy of these pathways is mixed with some strong and some weak or negative impacts, reflecting varied processes and contexts as well as insufficient high-quality empirical research. It is clear, however, that there is significant potential for improving the nutritional status of poor people through a range of agricultural interventions alongside complementary social and nutritional interventions – with particular attention to the status of women.

We conclude with a brief discussion of the major challenges to implementing agricultural interventions to achieve improved nutrition outcome. These may be broadly categorized into challenges in coordinated action across agriculture and nutrition, in achievement of required improvements in agricultural production and food security, and in translating agricultural improvements into nutritional improvement.
A number of challenges to coordinated action across agriculture and nutrition are implicitly set out in the previous section. There are fundamental challenges in working effectively across traditionally separate disciplines and sectors which are enshrined in often competing government, research and other organizations, in different bodies of knowledge and world views, in different career and incentive structures, and in sectoral funding allocations [46, 47]. There are major challenges in getting policy and political commitment to bridge the two disciplines and sectors at all levels of work, from policy formulation and implementation to field operations. These challenges need to be specifically addressed as proposed by Fan et al. [42], with a search for clear ‘win-win’ opportunities across the divides (such as local sourcing for school feeding schemes) and with ‘policy champions’, ‘civil society advocacy coalitions’ and community and other decentralized efforts [46]. An underlying difficulty is the lack of sufficient good-quality research on agriculture-nutrition interactions and the lack of common metrics across the disciplinary and sectoral interfaces. Another core challenge is the achievement of greater gender empowerment – women play critical roles in agriculture and the integrated management of household resources for nutrition (as well as other goals).

Challenges in increasing agricultural production and improving food security have become increasingly apparent since the 2008 food spike, which results from a ‘perfect storm’ of interacting factors involving declining or stagnant productivity (as a result of low investment, increasing environmental pressures and increasing fossil fuel costs), increasing demand (from rising incomes and populations) and increasing instability (from environmental shocks, reduced stocks, and financial and physical speculation) [20, 48, 49]. Further rises in fuel prices, the negative effects of climate change on agriculture, and continuing population and dietary change with growing incomes pose further challenges to agricultural labor productivity and prices, particularly in poorer agrarian economies in the tropics – with both a general tightening of food availability and prices and increasing instability in both availability and market access. Unfortunately, these challenges strike at all three agriculture-nutrition pathways. Addressing them requires approaches that again cross disciplines and sectors in building resilience, diversity and nutritional effectiveness [50].

Finally, and drawing together the two previous sets of challenges, there are challenges in getting agricultural development to actually impact nutrition. These challenges arise for multiple reasons (and are well illustrated by the nutritional challenges in India) – for example the lack of gender empowerment in agricultural fora, challenges in getting changes in food security systems that impact the critical 1,000 days from conception, or limits to benefits from biofortification of staples where infants do not consume enough to get sufficient nutri-
ent benefits even after biofortification, as well as the disciplinary and sectoral disconnects discussed earlier.

The challenges of improving agricultural-nutrition linkages to address the scandal of acute undernutrition are therefore very substantial. There is, however, considerable potential for gain with emerging new opportunities and, even with a marked lack of attention in the past, a strong record of achievement to build on. Increasing recognition of the importance of nutrition for human welfare and of the potential for nutritional measures to provide proxy measures for well-being is also likely to increase the importance of agriculture-nutrition linkages in agricultural policies. There is much to play for.

**Disclosure Statement**

The author declares that no financial or other conflict of interest exists in relation to the content of the chapter.

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