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USAID'S INFANT & YOUNG CHILD NUTRITION PROJECT

# Nutrition and Food Security Impacts of Agriculture Projects

A REVIEW OF EXPERIENCE

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**IYCN** USAID's Infant  
& Young Child  
Nutrition Project

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## Introduction

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This review summarizes the findings of studies undertaken over the past 30 years to examine the food security or the nutrition impacts of agricultural projects in low-income countries. The studies come primarily from (1) the Consumption Effects of Agricultural Policies program of the Nutrition Economics Group (United States Department of Agriculture [USDA] and United States Agency for International Development [USAID]) in the 1970s and 1980s; (2) a series of studies carried out by the International Food Policy Research Institute; and (3) review articles discussing multiple studies by Rogers (1989), Bonnard (2001), Berti, Krusevec, and FitzGerald (2004), and Leroy and Frongillo (2007).

Agricultural projects are often justified on the grounds that the food produced will accomplish some combination of improving household food security and improving nutrition. Rarely, however, do agricultural projects actually measure these effects. In fact, even in retrospect, it is not always clear whether a given project had a positive or negative effect on food security and nutrition levels of food-insecure households and undernourished individuals.

Of these two effects, food security—the access to adequate food—is the more likely to be affected by an agricultural intervention. Nutrition impacts, normally evaluated by anthropometric measurements of young children and sometimes by dietary intake, are further removed from agricultural interventions, depending on—in most but not all cases—in addition to accessible food:

- The distribution of that food within the family.
- Positive care and feeding practices.
- Control of infectious disease.

This review looks at food security and nutrition impacts separately, and then integrates the two in a concluding discussion.



Nutrition impacts depend on more than access to food, like appropriate intra-household distribution of food and appropriate feeding practices for young children.

Photo: Evelyn Hockstein

## Food security impacts

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It is clear that agricultural projects and policies have the capacity to have major effects on household food security. These effects take place through employment and incomes, and through market prices, with these, in turn, affected by crop selection and choice of agricultural technology. Each of these, plus the important effects of women's roles in agricultural production processes, is discussed below.

### Increasing farmer incomes

Agricultural projects increasing production generally have the effect of increasing farmer incomes.

In each of the six agricultural production promotion projects examined by Leroy and Frongillo, which increased production and measured income or expenditure effects, income or expenditure was found to increase as a result of the project.<sup>1</sup>

In Ethiopia, the incomes of households that adopted market-oriented dairies were 72 percent higher than those of non-adopting households, with income increasing both food and non-food expenditures.<sup>2</sup>

But where the inputs in an agricultural project involve significantly higher farmer costs (e.g., improved seed varieties requiring fertilizer and irrigation), the intervention may have the effect of excluding small producers and thus have no positive effect on their food security.

An analysis of green revolution effects on small farmers in Uganda found that farmers seldom had the means or the capacity to put in place this technology, a particularly unfortunate phenomenon since small farms were generally found to have more labor at their disposal per hectare, with increased production more frequently translating into improved local food consumption than was the case with larger farms.<sup>3</sup>



The higher costs of new technologies may prevent small farmers from adopting them.

Photo: Evelyn Hockstein



Generally more important in reducing household food insecurity than increasing incomes of landed farm households is the employment of unemployed or under-employed individuals from agricultural laboring households through an agricultural intervention. Since food insecurity is often high in such households, and since on average 60 percent to 80 percent of income is spent on food in low-income rural households, the income earned from this employment is likely to translate well into improved food security.

Where an agricultural intervention has the effect of improving agricultural productivity, the demand for agricultural wage labor often increases.

In the Gambia, a shift to a new rice production technology (involving mechanized pump irrigation and improved drainage) had the effect of increasing the employment of agricultural labor. While real incomes on average increased by 13 percent per household, income increases among poorer agricultural laboring households were proportionately greater.<sup>4</sup>

Not surprisingly, however, agricultural interventions that increase agricultural mechanization often have the effect of reducing the demand for labor even when productivity increases. While the issue is complex given the secondary employment sometimes generated from increased food production, rice production-related evidence from Bangladesh on tiller introduction,<sup>5</sup> from the Philippines,<sup>6</sup> and from West Java<sup>7</sup> indicates the general displacement in labor and the benefit of larger farmers at the expense of smaller and more marginal producers. At the same time, this often is not the case with lighter mechanization, such as mini-tractors in Indonesia.<sup>8</sup>



Increasing mechanization can reduce the demand for labor despite productivity increases.

Photo: © 2006 Fotodan, Courtesy of Photoshare

## Interventions affecting prices

In general, the effect of changes in food prices on the food security of a household depends on whether that household is a net seller or a net purchaser of food. Where a farming household over the course of a year sells more of a particular food commodity than it buys, an increase in the price of that food will be a net plus for the family, sometimes translating into improved food

security. For households, normally poorer ones, that over the course of a year have to purchase more of the commodity than they are able to sell, the effect on income, and in turn on food security, will be the opposite.

Increased agricultural production sometimes has at least the short-term effect of reducing market prices of food commodities and thus benefiting net purchasers of food. Where demand for the food commodity has been exceeding supply, these production increases may stabilize prices, although this is unlikely to be the explicit intent of producers. However, if the food produced is marketed outside the area where it is produced, or is exported, this increased production may have no effect on local prices.

Producer price subsidies or price supports (designed to encourage production) may therefore function as both a plus and a minus to producers who are both sellers and purchasers of food. Here is an example of an analytical effort to sort this out:

In Cameroon, it was calculated that a 10 percent food price increase would, in the short run, raise incomes of farmers by 3 percent through the sale of higher-priced food, and thus increase consumption by 0.5 percent, not nearly enough, however, to compensate for the 11.6 percent direct reduction in consumption that would result from the fact that these farmers were also food purchasers. (In the longer run, this negative consumption effect could be reduced or even transformed into a positive effect if the farmers would increase production and sales of agricultural produce, encouraged by the higher food prices.)<sup>9</sup>

Such price supports often affect land-owning agricultural-producing families differently depending on farm size.

In Honduras, price supports for maize benefited larger land-owning families, while smaller farmers who were net purchasers of maize suffered from the higher maize prices.<sup>10</sup>

The same was found with sugar price supports in Jamaica, where higher prices outweighed the effects of increased employment generated by the policy.<sup>11</sup>

By contrast, in Egypt, where beef is produced primarily on small farms, price supports on meat had a disproportionately positive effect on poorer farming families.<sup>12</sup>

## High-value and export crop production

Overall, the effect of cash crop production on local food consumption depends importantly on whether the land and labor utilized are in surplus and on the extent of variability in the supply prices of basic food crops.

Food-insecure households dependent on land for subsistence crops may be deprived of these foods or see the prices for these foods rise if land is shifted to high-value or export-oriented commercial farming. But this is not always the case.

Evidence from the South Nwanza district of Kenya found that farmers shifting from maize to sugarcane production increased their food intake by 360 calories per household per day. Wages of agricultural laborers producing sugarcane were three times higher than for maize producers. These income and caloric intake improvements did not, however, translate into improved nutritional status of young children, which was more significantly affected by caring practices and morbidity.<sup>13</sup>

Recognizing, however, the potential negative household food security impacts of high-value or export crop production, a Uganda project, with assistance from USAID, addressed this problem by introducing agricultural technologies and inputs common both to pre-existing food crops and exports. The project introduced agricultural inputs, through the establishment and support of input suppliers, that resulted in increases in both local food crops (maize, beans, cassava, and oilseeds) and agricultural exports (these same food commodities plus fruits, vegetables, vanilla, and cut flowers).<sup>14</sup>

### Other agricultural intervention effects

Agricultural projects often include components that increase the likelihood that food security impacts will be positive. Among them:

- Intercropping, if done with food crops disproportionately consumed by the poor.
- Small-scale agricultural processing, which increases employment (in some cases, of women).

Similarly, agricultural projects seeking to increase production of foods disproportionately produced by the poor on lower-quality land and often without irrigation (which are often the same foods that are disproportionately consumed by the poor: millet, sorghum, other coarse grains, cassava, and sweet potatoes) are likely to increase food consumption by food-insecure households.

However, food consumption by food-insecure households depends not only on availability and price but also on the time and labor required to prepare the foods and on perceptions of satiety. A study in Mali found that even with lower market prices for millet and sorghum than for rice, there was less than expected substitution of these coarse grains for rice because of their increased cooking time, and hence, fuel needs. Additionally, rice is considered more filling than millet and sorghum, so smaller amounts are prepared per person.<sup>15</sup> In projects where these issues might potentially arise, or where less commonly consumed foods are being introduced, formative research on the issues would be warranted.

Agricultural interventions that include food processing not only may create jobs that generate income for unemployed and under-employed individuals, but also may have the effect of making the food available for longer periods of the year, thus stabilizing food prices.

Agricultural interventions that involve women (who often are more concerned than men with family health and food consumption) are more likely to lead to an improved translation of household income increases into improved household food security.<sup>16</sup>



Indirect support for this was found in a study carried out in Egypt, which found that female-headed households consumed more calories than male-headed households at the same income level.<sup>12</sup>

Women involved in poultry production in Bangladesh were reported, as a result, to have gained influence in the allocation of household income.<sup>17</sup>



Agriculture projects that actively engage women are more likely to lead to improved food security.

Photo: Evelyn Hockstein

This suggests that more focus on assistance to women in the agricultural work that they do (often weeding, harvesting, processing, and preservation) may be warranted, along with efforts to maximize women's time vis-à-vis both agricultural tasks and family care.

### Design issues and effects of other policies

Even with the best of intentions, agricultural interventions seeking to improve household food security levels can be counteracted by other policies unrelated to agriculture; for example, by deficit spending that leads to food price inflation, and thus reduces the purchasing power of those who are net purchasers of food. Even low-income small land-owning households are usually net purchasers rather than net sellers of food.<sup>10</sup>

In Peru, such price inflation resulting from deficit spending more than offset the benefits of price stabilization efforts in the food sector.<sup>18</sup>

In Tanzania, inflation from deficit spending reduced the real income of agricultural producers despite agricultural subsidies that were also in place.<sup>19</sup>

It is also important to note that both the design of a project and its implementation are likely to affect consumption.

An Asian Development Bank-assisted project that introduced high-value crops in northwest Bangladesh failed to produce any positive effect on food security of landless laboring families because<sup>20</sup>:

- On the small landholdings involved, there was little hiring of additional labor.
- No processing took place, the result of inadequate local electrical power.

Another Bangladesh study that examined the impact of both vegetable and polyculture fish production suggested that the sometimes unpredictable effects of these interventions on incomes and well-being may be explainable in part by the ease or difficulty of technology dissemination (easier for improved vegetables, more difficult for fish ponds). The study found, in turn, substantial differences in short-term and longer-term economic benefits. In the case of individual fish ponds, long-term income gains resulted despite negative short-term effects. (The difficulty of disseminating the polyculture fish technology limited the number of households competing with the innovators.) With vegetable production, the opposite was true. In the short run, innovating families registered significant increases in monthly expenditures (a proxy for income). However, given the ease of disseminating vegetable technologies, the larger number of producers over time erased these gains in the long run. Not surprisingly, early adopters tended to have higher economic status.<sup>21</sup>

## Summary of food security impacts

This review of the effects of agricultural interventions on household food security suggests that:

1. These effects are often unclear at the outset and require explicit modeling and/or measurement. Such measurement is most useful if it assesses the effects of the intervention on the food security of population groups found to be food insecure at the outset of the project. (Further improving the food security levels of households already relatively food secure should be given lower priority.)
2. Increasing employment of unemployed and under-employed population groups is likely to translate into reduced food insecurity.
3. The effects on food security of agricultural policies or interventions that affect food prices are likely to depend on whether rural households are net sellers or net purchasers of those food commodities.
4. The effect on food security of cash crop production is likely to depend on whether the land and labor utilized are in surplus and on the extent of variability in the supply prices of basic food crops.
5. The effect of agricultural interventions on food security is likely to be more positive if the interventions focus on those agricultural tasks normally undertaken by women, if they increase intercropping, increase small-scale agricultural processing, and increase the production of food disproportionately consumed by food-insecure households.
6. Agricultural interventions that displace labor through large-scale mechanization are more likely to have negative food security effects.

## Nutrition impacts

As suggested above, while the effects of most agricultural policy and interventions on household food security are often substantial, the measurable effects on measurable nutritional status—often evaluated as the nutritional or micronutrient status of young children, and in some cases, the dietary diversity of vulnerable family members—are likely to be less significant. Studies of the determinants of nutritional status generally indicate that while young children in economically more advantaged households have better nutritional status than children in poorer households, the short-term effect of increased household income or of increased household food availability translates poorly into nutritional status.

In order for this translation to be more significant for these younger children, the increased food availability normally would have to be accompanied by some combination of improved caring and feeding patterns, better access to health services, and reduced morbidity—sometimes affected, in turn, by improved hygiene and sanitation.



Improvements in hygiene and sanitation can increase the nutritional benefits of improved food availability for younger children.

Photo: PATH

In Rwanda, it was calculated that even a doubling of household calorie consumption, from 1,500 to 3,000 calories per adult-equivalent—an extreme change—would reduce nutritional stunting of young children by about one-quarter of a standard deviation (or 17 percent of the z-score mean), whereas deworming would have the same effect, and a clean latrine would have twice this impact on nutritional status.<sup>22</sup>

In the Philippines, it was found that providing landless households with land resulted in some improvement in preschooler nutritional status. But for households that already owned land, the nutritional status of young children did not improve with income increases.<sup>23</sup>

There are, however, particular agricultural interventions that are likely to affect the nutritional well-being of young children and other nutritionally vulnerable groups.

In the case of certain agricultural production programs, regardless of their effects on income, and even when production is primarily commercial rather than for home consumption, some amount of the food is likely to be consumed at home, thus often improving dietary intake.

This was found to be the case in multiple studies of polyculture fish, dairy, and poultry production examined by Leroy and Frongillo.<sup>1</sup>

Increased egg production also led to increased egg consumption by children and reproductive-age women in the Bangladesh Integrated Nutrition Project (in part, it should be noted, because poultry-producing families were counseled on the importance of egg consumption by these individuals).<sup>24</sup>

In the Bangladesh vegetable and polyculture fish production study referred to earlier, the improved vegetable program resulted in increased vitamin A consumption, improvements in weight-for-age z-scores for children, a decrease in stunting (height-for-age z-score <-2) by 28 percentage points among girls and 43 percentage points among boys, and increases in body mass index for women, despite the absence of long-term income effects.<sup>21</sup>

When vulnerable group members also increase their dietary intake of these foods, their nutritional status also may increase.

In Egypt, the prevalence of iron deficiency anemia was reduced among school-aged children whose families were engaged in the production of animal-source foods.<sup>25</sup>

A 2004 review by Berti, Krasevec, and FitzGerald found no conclusive evidence on the effects on nutritional status of agricultural interventions in general, but did find that 11 of 13 home gardening interventions examined had a positive effect on dietary intake and anthropometric, biochemical, and/or morbidity indicators.<sup>26</sup> Importantly, of all the agricultural interventions examined, only these home garden projects had improving nutrition as an explicit project objective. Also, importantly, each of these projects included nutrition counseling and often other public health interventions, and most incorporated gender considerations into the project.

In one case, where the effects on dietary intake of vulnerable family members were examined in an agricultural project with and without nutrition counseling, the effects were significantly greater in the former.<sup>27</sup>

The 2007 review by Leroy and Frongillo of multiple studies came to a similar conclusion: The animal production projects having clear effects on improved dietary intake or nutritional status were likely to be those in which either women played a critical role in the intervention, or the intervention included a nutrition counseling component.<sup>1</sup> A 2001 review by Ruel reinforced the nutrition counseling conclusion.<sup>28</sup>

Clearly, however, the potential for nutrition counseling in agricultural projects is not limited to garden projects. Agricultural extension workers, particularly those advising women, can provide

counseling on nutrition as well as on processing and preservation options for the foods being cultivated, and can provide linkages to other nutrition and health services.



Nutrition counseling increases the dietary impact of agriculture projects.

Photo: Evelyn Hockstein

Garden projects have been more likely to result in improved dietary intake, particularly in vitamin A intake, rather than in improvements in anthropometry. Helen Keller International, however, found that in Bangladesh, when home garden production increases were substantial and led to the sale of some portion of this production, with the proceeds used in part to purchase additional rice, the caloric intake of children also increased, leading also to improvements in anthropometry.<sup>29</sup>

In addition to home gardens and to projects that include nutrition-related counseling, agricultural projects that utilize micronutrient-rich plant varieties have major potential for improving nutritional well-being.

The introduction of orange-fleshed sweet potatoes in Mozambique coupled with nutrition counseling had the effect of significantly increasing vitamin A intake and serum retinol levels among children, and providing itself with more than one-third of the vitamin A consumed by these children.<sup>30</sup>

A new variety of maize, expected to be made available in Zambia in 2012, appears to provide an 18-fold increase in beta-carotene content.<sup>31</sup>

It is important to note that agricultural interventions may have unintended negative effects on nutrition beyond those mitigated through their effects on food security:

- Newly irrigated land may increase the concentration of mosquitoes, and in turn, the incidence of malaria.<sup>32</sup>
- Animal production may lead to the spread of zoonosis, infectious disease spread by animals.<sup>33</sup>



- Changes in agricultural interventions designed to increase production and employ women may increase women's agricultural workloads, and in turn, have negative effects on time available for child caretaking. In Kenya, intensification of dairy technology resulted in a greater workload for women.<sup>34</sup>
- Healthier populations with increased consumption of animal-source foods (high in saturated fat and cholesterol) as a result of agricultural interventions may increase their risk of chronic disease.<sup>35</sup>

### **Summary of nutrition impacts**

The review suggests that positive and significant nutrition impacts are most likely to occur from agricultural interventions when (1) household members regularly consume the food commodity being produced, (2) the intervention includes explicit nutrition counseling, (3) the intervention includes home gardens, and/or (4) the project introduces micronutrient-rich plant varieties.

## Conclusion

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Although food security and nutrition are often used to justify agricultural interventions, there has been relatively little intentionality in the design of such interventions to ensure that food security and nutrition impacts are positive and significant. The studies discussed in this paper, however, indicate that such impacts can often be anticipated, and that agricultural projects can be oriented in ways that maximize positive impacts. While reducing household food insecurity may be a more direct result of such an intentional orientation, reduced malnutrition may also be possible in some projects. Efforts are therefore needed to sensitize those responsible for the design of agricultural projects, and to increase awareness among senior agriculture officials in governments and international assistance organizations.

As part of this sensitization, it should be noted that while it is clear that agricultural interventions can significantly affect food security and sometimes nutrition, there is also evidence that a healthier, better-nourished work force can help to increase agricultural productivity where labor is one of the limiting factors in the production process.

### About the Infant & Young Child Nutrition Project

The IYCN Project is the flagship project on infant and young child nutrition of the United States Agency for International Development (USAID). Begun in 2006, the five-year project aims to improve nutrition for mothers, infants, and young children and prevent the transmission of HIV to infants and children. IYCN builds on 25 years of USAID leadership in maternal, infant, and young child nutrition. Our focus is on proven interventions that are effective during pregnancy through the first two years of life.

### For more information

Please visit [iycn.org/agriculture](http://iycn.org/agriculture) for additional IYCN resources developed to help agriculture project designers achieve improved nutrition and food security for women and children around the world.

- Achieving Nutritional Impact and Food Security through Agriculture (fact sheet)
- Integrating Household Nutrition and Food Security Objectives into Proposed Agriculture Projects: Illustrative Guidance
- Nutritional Impact Assessment Tool

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