

Ensuring Food Security for India's Expanding Populations

From 1950 to 2015, India's grain production jumped from 50 million tons to 250 million tons, alleviating hungers of people to some extent. Indeed, in recent decades, the number of stunting children under 5 in India has decreased by 10%. Despite this positive turn of events, about 47 million, or four out of ten children across the country, still suffer from chronic undernutrition and stunting (*Nutrition and food*, n.d.). Considering that India is expected to have 1.52 billion people living in by 2036 (Agarwal, 2020), the dramatic increase in food yields in the past decades is insufficient to support the rapidly expanding India population.

When the number of people to feed surpasses the pace of food production, catastrophic diseases, wars, and starvation will follow. Although this scenario remains yet hypothetical, modern economists are concerned that the calamity is inevitable (*Where does hunger*, 2020). Avoiding the disasters and meeting the increasing demand for food pose a new challenge to India: to guarantee food security to its large population. Defined as the availability of resources in the required quantity and quality where they are needed (Coleman-Jansen et al, 2020), food security can be achieved, in part, by increasing the food supplies on an environmentally sustainable basis and ensuring even the poorest people have food security.

So how can this condition be fulfilled to ensure consistent food production over a long period? Primary solution to produce more food has been the deforestation, clearing or removing trees in rainforests into farming area, and conventional farming that depends on synthetic

chemicals and industrial products such as fertilizer, pesticides, and herbicides to maximize crop yields with limited resources (Cederberg and Werf, 2020). While these agricultural practices supply short-term demand for food, they entail devastating long-term consequences: climate change and global warming. For example, 17% of Amazon forests have been destroyed in the last fifty years, leading to an exponential increase in endangered or extinct wildlife species (*Deforestation and forest*, n.d.). If the practice of traditional agricultural methods continues, the food system will eventually collapse. Therefore, deviating from the conventional methods and moving toward sustainable agriculture are crucial to secure long-term food supplies.

One of the most promising alternatives for conventional farming is vertical farming, or a practice of growing crops in vertically stacked layers (LeBlanc, 2020). Think of conventional farming as a single-floor house and vertical farming as an apartment that supports a multitude of households. Compared with conventional farming, vertical farming far exceeds conventional farming in product quantity while saving up to 97% of water using hydroponics. In this system, nutrition enriched water seeps directly into plant roots, allowing water to be collected and reused (Lagomarsino, 2019). Being applicable even in cities and harsh environments, vertical farming reduces the need to transport food from rural or warmer regions. Local food production alleviates pressure on ecosystems by avoiding food spoilage and minimizing carbon emission caused by transporting products. In addition, because vertical farming grows crops indoors, crops are less vulnerable to disease, pests, pollution, and weather conditions, hence scarcely depending on toxic chemicals to keep plants healthy (Despommier, 2015).

Hundreds of businesses that have experienced success from implementing vertical farming confirm the tremendous benefits of the farming technique. One such market in the United States is the Bowery Farming. Since 2015, the company has consistently met their consumers' rising demand for food, such as vegetables, with vertical farming technologies: through maximizing food yields with minimum natural resources, the company has earned up to 172.5 million dollars. Even throughout Pandemic, the company was able to quickly satisfy demands of panic-buying people. Likewise, a recent start-up Lettuce Grow is becoming a leading market in agricultural industries. Using a hydroponics system, the company allows its customers to grow about 20% of their foods at home, about the same yield as a 40 feet squared farm (D'Antino, 2020). Indeed, vertical farming still has several obstacles to overcome, such as a limited range of arable crops and energy efficiency. Nevertheless, increased investments and research for the technology assures promising return of stable food yields that would enhance India's food security.

Another promising solution to the food shortage is genetically modified organisms (GMO). GMO crops, in comparison to conventional ones, require less pesticides and natural resources. Bananas with increased iron and sweet potatoes enriched with vitamin (Ackerman, 2021) are just a few examples of the GMO crops that can address malnutrition. More specifically, Golden Rice, rich in vitamin A, was a potential provision to address vitamin A deficiencies, which is the major cause of children's death and blindness. Because of vitamin A deficiencies, more than 25,000 children lose their sights annually, and half of them die within a year of turning blind (*GMOs under scrutiny*, 2016). The Golden Rice was expected to stifle vitamin A deficiencies rate had the anti-GMO advocates not overthrown the commercialization of the product.

GMO opponents argue that GMO is detrimental to human health and environments; however, there has been no confirmation of allergen or toxin compounds in GMO. Every new GM crop has been thoroughly scrutinized by its developers, researchers, and large institutions including the U.S. National Academy of sciences, American Medical Association, and World Health Organization. They found that eating GMO is “no riskier than eating conventional food.” In fact, because the transgenic protein concentration in GMO is so low and the GMO testing so rigorous, some scientists argue that it is easier to detect potential allergens in GM crops than conventional crops (*GMOs under scrutiny*, 2016). While the long-term health complications of GMO continue to be disputed, GMO’s potential as a reliable nutritional source far exceeds its unconfirmed drawbacks.

Vertical farming and GMO are both promising solutions to potential food shortages by producing ample food yields continuously. Nevertheless, the increase in food production alone does not guarantee equal food security for all people. In fact, despite the noticeable increase of food production from 20th to 21st century, the estimated number of chronically undernourished and malnourished people in India has been rising, not falling. For example, in some states like Dahod, the number of stunting children under 5 has risen by 11% and severely underweight children by approximately 6% over the past five years (Gagdekar, 2021). To ensure national food security, another condition, guaranteeing food access to the poorest and most vulnerable to adequate nutritious food, needs to be achieved.

Vertical farming and GMO research are conducted to serve “commercial interest of [large corporations],” rather than to address food insecurities of those in need (*GMOs under scrutiny*, 2016). One example of this is “terminator seeds,” or sterile food crops. First invented by the Monsanto company, terminator seeds prevent the farmers from re-planting the seeds after harvest. This forces farmers to continuously purchase commercial seeds that heavily depend on fertilizers and chemical products, benefitting large corporations that sell those products. The expensive costs of seed and agricultural products restrain farmers from cultivating crops, undermining not only the local food security, but also that of the nation (*Monsanto and terminator*, n.d.). Thus, the inappropriate uses of advanced agricultural technologies can corrode food security in India. The technologies should focus on addressing food insecurity around and distributing food supplies more equally between wealthy and deprived.

Ensuring food security to eliminate world’s hunger requires achievement and dedication beyond just increasing the amount of food production. Along with implementing vertical farming and GMO technologies to produce abundant food on sustainable bases, India needs to use them wisely to distribute food equally. Expanding on existing agricultural institutions and working to promote food security can support this process as well as protect people’s access to food. Now is the time for India to face these challenges and address food insecurities across the nation.

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