

### DOES ORGANIC FARMING ENSURE FOOD SECURITY? AN ANALYSIS OF DEVELOPING COUNTRIES

#### ABSTRACT

Food insecurity is a major challenge in front of developing countries. Food and Agricultural Organization of the United Nation (FAO) (2020) reported that 2 billion people face moderate or severe food insecurity, of which 1.02 billion are found in Asia, 674.5 million in Africa, and 205.3 million in Latin America and the Caribbean in 2019. Inadequate food creates serious health issues among people, especially children worst affected by it. Food insecurity among children leads to serious health-related diseases like anaemia, poor health, birth defects, lower nutrient intake, etc. The situation further deteriorates in developing countries where poverty and population rates are high. Moreover, the current agriculture model uses more fertilizers and pesticides to increase productivity. This overconsumption of fertilizers in agriculture leads to environmental degradation and severe human illness. The unsustainability of the current agriculture model has raised many concerns about the future demand for food for an ever-growing population. The alternative method as suggested by many experts is Organic farming. The positive externalities attached to organic farming have enormous potential and it plays a very significant role in protecting the environment, providing safe food, and eventually sustainability. Further, linking the goal of food security with organic farming can help developing countries provide nutritious food and help in protecting the environment. The paper explores the situation of food insecurity worldwide and the current agriculture model performance and failure to achieve food security in many developing countries. The paper also analyses the role of organic farming to attain food security, ~~The present paper also~~ tries to elaborate on the limitations of organic farming to ensure food security and provides alternative models for improvement in current situations. Authors should add (Material and Methodology ??Results??, Conclusions?? and recommendations??).

**Keywords:** *Organic, Agriculture, Food security, Environment, Development*

#### 1. INTRODUCTION

The popularity of organic farming is gaining day by day due to its enormous benefits to the environment. According to Willer et al. (2021), the growth of organic farming is constantly rising, from 11 million hectares of organic area in 1999, increasing to 72.3 million hectares in 2019. In the two decades from 1999 to 2019, the organic farming area recorded 555 percent of growth. Apart from this, organic farming is also gaining momentum in developing countries of Asia and Africa. The growth of organic farming in the African region was significant. From a negligible, 0.02 million hectares of organic land in 1999, increased to 2.0 million hectares. While, total organic producers in the African region stood at 8,50,000 from which Uganda (over 2,10,000) has the highest number of organic producers, followed by Ethiopia (2,04,000) and Tanzania (1,49,000). The same pattern of organic farming growth is shown in the Asia region. In 2019, Asia represents 8 percent or 5.9 million hectares

of total organic farming land in the world. In two decades, Asia has increased its organic farming land fourteen times. In 2019, Asia consists of 1.6 million producers' organic producers, of which almost 1.4 million belong to India, followed by Thailand with 119,000 producers. However, the area under organic farming is still meagre compared to the current model of agriculture i.e., conventional farming. The current food production system helps countries, especially developing countries, to secure food for their population and supply raw materials to food and fuel industries.

Today Malthus's theory is closely related to the situation which many developing countries refer to as food insecurity. According to Food and Agriculture Organization (2010), "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". Contrary to food security, "food insecurity exists when people do not have adequate physical, social or economic access to food." While food accessibility is directly associated with the performance of the agriculture sector which helps countries to secure minimum food for their people, especially in developing countries. The rapid growth in the agriculture sector and enhanced technology help farmers to increase agriculture production. According to World Food and Agriculture (2021), production of primary crops stood at 9.4 billion tonnes in 2019, 53 percent more than in 2000. Even with the tremendous production of food grain, the situation of food insecurity in many developing countries persists. The reason for persistent food insecurity, according to Sen (1981), is not due to inadequate food, there is enough food for everyone, but food insecurity situation arises due to unfair public distribution and profit hoarding by traders. Sen's argument makes sense as the current food production is enough to feed the population but due to leakages in the system, food insecurity persists especially in many developing countries.

## **2. IMPORTANCE OF CONVENTIONAL FARMING AND EMERGENCE OF ALTERNATE**

The current model of agriculture production is a package of new practices of using high-yielding varieties (HYVs), improved farm equipment, and inputs like chemical fertilizers and insecticides (Ladejinsky, 1973). This package helps agriculture to increase food production significantly. One of the foremost pessimists was Thomas Malthus, famous for his theory of population. The theory states that, the growth rate of the population increases at a geometric rate while the food production grows at an arithmetic rate, an imbalance between these growth rates will ultimately lead countries to fall into a low-level equilibrium trap (Thrillwall, 1999, pp. 86). However, Malthus's theory was refuted because the agriculture sector grows at a rapid pace which led the food production rate to grow more than the population growth rate. However, a new challenge arises in the food production method. The intensive use of chemical fertilizers causes various environmental degradation, harming public health and economically not feasible (FAO, 2021; Ladejinsky, 1973; Narayanan, 2005; Pimentel, 1996; Randive et al., 2021). Thus, an alternative is required to meet the food demand, income of farmers and concerns of environmental degradation. In this direction, literature favours organic farming from various alternate methods of food production. Organic farming plays a crucial role in every aspect of agriculture from environment conservation to providing nutritious and chemical-free food for public health, improving soil fertility and biodiversity, and being economically feasible for small and marginal farmers (Reganold & Wachter, 2016). Further, organic farming also meets the criteria of sustainable

development and helps tremendously in targets of Sustainable Development Goals (SDGs)(Šeremešić et al., 2021; Setboonsarng & Gregorio, 2017).The optimistic scholars favour organic farming and will contribute significantly to food security. However, the complexity involves in food insecurity makes it hard for developing countries to ensure minimum food for everyone.

There are various dimensions a play for food security (accessibility, affordability, utilization, and stability). And even with tremendous food production, the food insecurity situation prevails. In this direction how organic farming performs in food security is a matter of debate. Even literature also tries to answer the most debatable question: Can organic farming replace fully conventional farming to ensure food security(Eyhorn et al., 2019).Thus, the objective of the paper is to review and advance the debate on organic farming in the context of food security in developing countries. This study analyzes the current food production in Asia and Africa region using conventional farming. Further, the study assesses the current status of organic farming and food security in developing countries and provides insights into whether the current status of organic is sufficient to meet food security in developing countries.

### 3. RESEARCH METHODOLOGY

The current study analyses??(Is this study analytical or reviewing the production of wheat and rice) the production of wheat and rice production in the Asia and Africa region. This will help in understanding the food security situation in these regions. Further, the study uses secondary data from the Food and Agriculture Organization (FAO) on wheat and rice. (However, rising literature suggests the negative impact of chemical-intensive food production) It is suggested to move this sentence to results. The study also reviews the negative externalities of current food production and the status of organic farming in these regions. For this purpose, various research articles, FAO documents and reports were accessed using Google Scholar, Journals, and Government Websites.

### 4. STATUS OF FOOD SECURITY IN DEVELOPING COUNTRIES

According to the estimates given by Food and Agriculture (2020), nearly 690 million people were hungry, or 8.9 percent world's population. The estimates also categorize food insecurity into two levels, severe and moderate food insecurity. Severe food insecurity is defined as a person not being able to acquire food for one or more than one day, whereas moderate-level food insecurity is a person who goes out of food occasionally or does not have enough resources to acquire healthy food. The estimates showed that about 750 million people were categorized as having severe food insecurity, while 2 billion people fall under moderate food insecurity. The numbers of food-insecure people mainly belong to developing countries of Asia and Africa region. According to FAO (2020), 1027.4 million people who remain food insecure belong to the Asia region, while 674.5 million people from Africa in 2019. The inflated food insecure peoples belong to Asia because it is the most populated region of the world. The prevalence of severe and moderate levels of food insecurity is the main

reason for the spreading undernourishment<sup>1</sup> in developing countries. FAO (2020) reported Asia and the Pacific region was the hub of 51 percent of the global total of undernourished people, and mostly belongs to the highly populated countries of Southern Asia (257.3 million), followed by South-Eastern Asia (64.7 million). Africa reported 250.3 million undernourished people in 2019 and the situation of food security has been deteriorating since 2014. Moreover, linking poverty and high population with food insecurity further deteriorates the situation of developing countries.

Poverty and high population are other issues that most developing countries face. Global Multidimensional Poverty Index (MPI) Report 2020, estimated 558 and 530 million poor people belong to sub-Saharan Africa and South Asia, respectively. The high poverty rate in these regions with fast-growing populations affects the situation of food entitlement for its population. This leads to nutritional insecurity. The concept of food security and nutrition security are interlinked (FAO, 2020). Food security means access to food all the time, while nutrition intake refers to the minimum intake of nutrition from various food. A country that can be food secure does not guarantee proper nutrition intake. In developing countries, malnutrition, child stunting<sup>2</sup>, and child wasting<sup>3</sup> are the outcomes of inadequate food consumption. In 2019, 47 million children who were under the age of five were reported as suffering from severe and moderate child wasting, from which 12.7 and 31.5 million children are reported from Africa and Asia region, respectively. An estimated 74.5 million children were suffering from stunting in Asia and the Pacific in 2019, while Africa reported 57.5 million stunted children. Furthermore, food insecurity hurt every age group of people, especially the poor section of society. There are many life-long and mild diseases associated with insufficient calorie intake. A U.S.-based study by Gundersen & Ziliak (2015) showed food insecurity among children was associated with diseases like anaemia, poor health among children, noncognitive performance, asthma, depression, and anxiety. While adults and seniors face issues like mental health issues, oral health problems, iron deficiency among pregnant women, and limited daily activities among seniors.

India is the second most populated country in the world and also amongst the largest food producer country in the world. Besides, India is the hub for the food-insecure population in the world. Kadiyala (2012) showed, "In India, almost one in two children are stunted and 40% are underweight. One-third of all Indian women are underweight. Rates of micronutrient deficiency are extremely high, with almost 80 percent of children and 56 percent of women being anaemic". ~~This quote, showing the nutrition insecurity among Indian children and women, that continued to be alarming till 2020. Moreover, the condition of nutrition insecurity in 2020 is still alarming.~~ FAO (2020), estimated that about 53 percent of children under age five are not growing well. Further, India also lies into the very high category of child stunting and child wasting. The link between food security and poverty was examined by Pandey and Gautam (2014). They showed backward states like Bihar, Jharkhand, Chhattisgarh, Odisha, and Assam, where poverty is high also score low on the food security index created by them. Moreover, the condition of the prevalence of undernourishment in India, a study

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<sup>1</sup>Food and Agriculture Organisation (2010), defined "undernourishment exists when calorie intake is below the minimum dietary energy requirement"

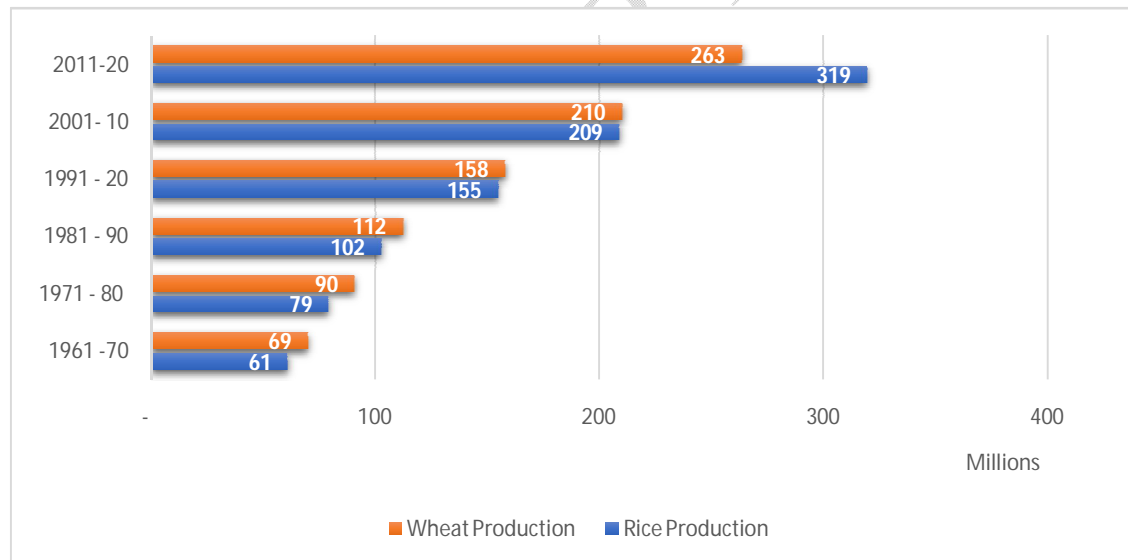
<sup>2</sup>measures the shorter height than their potential for their age.

<sup>3</sup>measures the low-weight-for-height.

conducted by Rawal et al. (2019) showed a different picture of food insecurity in India. They modified the estimation methodology and added new variables like the age and sex of household members and meals consumed outside the home. The result was 12 percent ~~points~~ higher prevalence of undernourishment than reported by the State of Food Insecurity in the World 2015. Thus, even with the tremendous production of food in India, also exporting food to other countries, the situation of food insecurity in India persists.

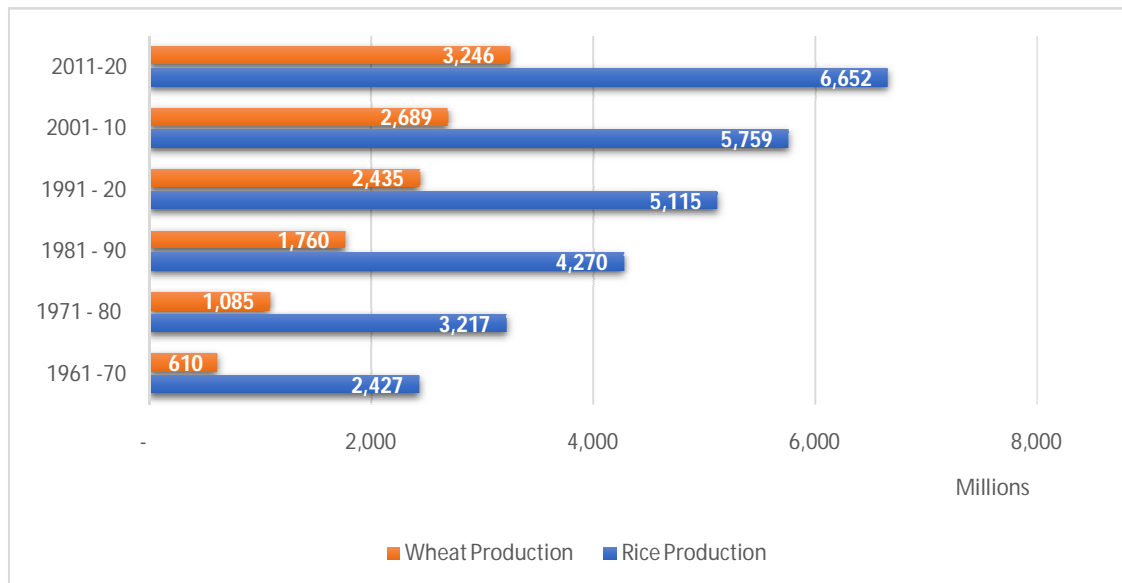
## 5. PERFORMANCE OF FOOD PRODUCTION IN THE DEVELOPING COUNTRIES

Swaminathan (1983) addressed the Third World Prize, in which he said agriculture can be the key to prosperity in third-world countries (Wei, 2010). Further, food production is the base for food security (Swaminathan & Bhavani, 2013). The performance of agriculture will help countries to secure minimum food for their people and support economic activity. Currently, the agriculture model that is used by developed and developing countries is the use of chemical fertilizers and modern machines to increase food productivity on fixed land. The current agriculture model helps developing countries reduce the scarcity of food and also assures ~~that~~ food for all in the ~~whole~~ country. Proper food access and availability can minimize the risk associated with food insecurity. India, for example, using chemical fertilizers achieved new peaks in food production in the country and become a net exporter. The same pattern is also reported by many other developing countries.



**Figure 1: Africa Region Food Production (in tonnes) Since 1961**

**Source: FAO (2021)**



**Figure 2: Asia Region Food Production (in tonnes) Since 1961**

**Source: FAO (2021)**

Figure 1 shows the production of wheat and rice in the region of Africa. As the by-product of the green revolution, food production in Asia and Africa region grows tremendously. The production of wheat and rice in the African region shows a rising trend. The wheat and rice in 1961 stood at 69 and 60 million tonnes respectively, which has grown to 263 and 319 million tonnes in 2020. A similar pattern of growth was reported in the Asia region. Figure 2 shows the wheat and rice production in Asian countries. The growth of wheat and rice production in the Asian region is even more than in the African region. Wheat and rice production grew from 6,10 and 2,427 million tonnes of production in 1961 to 3,246 and 6,652 million tonnes respectively in 2020. The contribution to this food production growth in the Asia region is from developing countries like China, India, Indonesia, etc.

The agriculture sector is very crucial for any developing country, to secure food, reduce rural poverty, and increase the standard of living of farmers. However, agriculture production has become more complicated than ever before due to ~~rising literature indicating~~ the ill side of the current agriculture model. The agriculture production model that is used in most developing countries is a package of high-yielding varieties of seed, chemical fertilizers as an agent of growth, and mechanization for productivity. The unchecked use of pesticides in agriculture caused severe environmental concerns like domestic animals poisoned by pesticides, depredation of natural predators and parasites, further reducing the pollination of vegetables, fruits, and other crops, ground and surface water contamination, loss of biodiversity, soil infertility (Narayanan, 2005; Pimentel, 1996; Randive et al., 2021; Singh et al., 2020; Srivastav, 2020). The less productivity on land forces farmers to use more expensive fertilizers to maintain the productivity of the field. This costs farmers more from their income and rise the inequality between rich and poor farmers (Bowonder, 1979; Ladejinsky, 1973; Narayanan, 2005). The socio-economic factors also made the situation worse for the farmers.

Mariappan & Zhou (2019) found out the major concern for the high suicide rate is due to low returns from cultivation, higher input costs, drought, climate change, and socio-economic problems. Further consumers as well as producers both are affected by chemical fertilizers. Donthi (2021), studied the cases of farmers unintentionally consuming chemicals used in agriculture. The study revealed 7,437 deaths (an increase from 6,962 deaths in 2019) from “accidental intake of pesticides/insecticides”. Chemical-induced food contamination harms public health at large. The results of pesticides and fertilizers residues in daily food intake can cause a series of severe diseases like cancer, diabetes, autism etc. (Owens et al., 2010). Despite the ill side of the current agriculture model, developing countries continuously use this conventional method. Food production with a conventional agriculture model will degrade soil fertility and leads to lower food production.

## **6. THE ALTERNATIVE MODEL OF AGRICULTURE**

However, the unsustainability of conventional farming is also not a suitable option for food production. An alternative production system i.e. organic farming is recommended by many experts. This approach abstains from the use of chemical fertilizers, instead in this farming organic fertilizers, green manure, vermicompost, and bio-fertilizers are used. Using these fertilizers has no risk or trivial contamination of soil or water (Reganold, 2016). However, organic farming is not risk-free as it is still developing. The constraints that are associated with organic farming such as low yield, niche market, conversion period, low-scale production, etc. Yield is a crucial factor in the situation of food security. The proponent of conventional farming Norman Borlaug quoted in an interview that “Producing food for 6.2 billion people (now 7.4 billion) ... is not simple.” He added, “[Organic approaches] can only feed four billion—I don’t see two billion volunteers disappear” as cited in the post by Pollack (2007). Literature also supports the low-yield argument in the case of organic farming. Globally, the organic yield was 10% less when compared to conventional farming (MacRae et al. 2007). According to Seufert (2011), a meta-analysis study compares the yield of organic and conventional farming. The study reveals that organic farming grows lower yield, ranging from 5%, 13%, and 34% when rain-fed regions, best practice is used under organic farming and both techniques are most comparable respectively. Similar results are found in a study by Forster (2013) where yield in the case of wheat is less than 27% in the first crop cycle additional crops like soybean and cotton was also found to be a larger yield gap compared to conventional farming. Singh & Grover (2011) conducted a study to examine the organic farming viability in Punjab revealing that organic wheat yield is lower when organic farming is undertaken as comparing it to conventional wheat (compensated by the premium prices). Manjunathan and Puttaswamiah’s (2021) reported lower yields for both crops in the case of organic yield compared with conventional farming yield. Another constraint that drags backwards organic farming is the conversion period. In the shift from conventional farming to organic farming, the conversion period usually lies between 1-4 years as mentioned by Singh & Grover (2011). In this period, the yield from the farm is very low as compared to conventional farming (Reddy, 2010). This infers that the farmer has to sacrifice years of income or earns less income in between this period. Bachmann (2011) analyzed the potential of organic cotton farming, in which he finds out that during the conversion period of the first two years, the yield is lower in organic cotton. Another area of organic farming that needs attention large scale organic production. Panneerselvam (2014) analyzed

the impact of large-scale organic conversion of food production in the states of Tamil Nadu and Madhya Pradesh, India. And reported that converting organic as the only food production system will reduce by 3-5% food production. This will further aggravate the situation of food insecurity in the country. However, optimistic scholar favours organic farming in the long run.

Badgley et al., (2007) estimated that organic farming could produce sufficient food on a global per capita basis. Further, developing countries have more potential to grow organic food than developed countries. But on the contrary, Connor (2008) criticized Badgley and does not support the analysis. Another study by Ehyhorn et al. (2018) showed a comparable yield in organic and conventional farming. Hulsebusch's (2007) as cited in Schoonbeek et al., (2013) view on organic farming is optimistic, and the reason this with "in the long run, organic farming will save natural resources and no cultivation is a loss". Thus, in the long run, organic farming can significantly help to meet food security. The long-run perspective of organic farming is that it has the potential to meet the challenge of food security within the framework of sustainability (Schoonbeek et al., 2013; Thakur & Sharma, 2005; Azadi et al. 2011; Setboonsarng and Gregorio, 2017).

## **7. CONCLUSION**

Today the world needs a food production system that is sustainable and also able to meet the requirement of food for the world population. However, the current model of agriculture only ensures food security at the cost of sustainability. The data on food production in Asia and Africa regions shows the tremendous food production from the advent of the green revolution. Many developing countries ensure food security because of the success of the green revolution. However, new challenges arise as extensive use of chemical fertilizers and pesticides degrade the environment, harms public health, and becomes infeasible for farmers. The present agriculture model for food production is harming the climate and is unsustainable in the long run. The alternative approach i.e., organic farming which is sustainable and environment-friendly. Rapid growth in organic farming all over the world implies the importance and points to the alternative to the current agriculture model. However, the achievement of the current agriculture model is tremendous and helps developing countries affirm the food security in the country but to ensure sustainable food security, an alternative approach is required. The study found that even with the benefits associated with organic farming, there are many constraints like lower yield, niche market, and conversion period, associated with organic farming. Thus, for developing countries, the large-scale adoption of organic farming can also provide a long-lasting solution, not the selective one. In conclusion, despite the benefits associated with organic farming, it is difficult to ensure food security in developing countries.

## **ETHICAL APPROVAL**

I/We declare that the manuscript was prepared following the protocols of the Helsinki Declaration or similar ethical statements.

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