

Impact of COVID-19 Pandemic on Indian Agriculture: A Review

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Abstract

The rise and spread of Covid-19 pandemic affected all parts of the human society by creating massive socio-economic panic across all the sectors including agriculture, tourism, commerce, shipping, manufacturing and tertiary sectors across the world. The agricultural and food sector were considered as the most crucial part of the developing economics across the globe, which was completely exposed during the Covid-19 pandemic. It has an undesirable and prominent influence on agriculture and allied sectors in India. The pandemic lockdown has resulted in the agrarian crisis across the nation by influencing and disrupting the food demand, food supply and value chain of various agricultural goods and commodities. In the country like India where majority of the population, approximately 140 million, depends directly or indirectly on agriculture and food sectors as the primary source of their income the impact due to the Covid-19 pandemic created an imbalance and affected the economy of the nation. Containing an analysis and detailed review based on articles, scientific reports, publications, organizational statements, and press releases, this review article addresses an inclusive assessment and highlights the effects of Covid-19 pandemic on agriculture and food systems. An effort has been made to understand its impact on food supply, food demand, food prices, food security and national economy. The need of the hour is to promote effective solutions in order to control critical factors such as food production, food supply, food demand, price hikes, food security and supply chain resilience. Since the urbanization and population will have tremendous growth in the coming decades, epidemics may be more frequent and we need to ensure contingency plans and mitigation strategies, especially for agricultural and food systems.

Keywords

Covid-19; Agriculture; Food supply chain; Food security

Introduction

In China, the first confirmed case of SARSCoV-2 (Covid-19), chronic respiratory infection, was reported in Wuhan, the capital of Hubei Province, in December 2019 (Singhal, 2020). On January 12, 2020, WHO named this new virus as the 2019 novel corona virus (2019-nCoV) (Lu, Stratton and Tang, 2020; Lu *et al.*, 2020). On confirming SARS-CoV-2 cases in Wuhan, Chinese authorities declared a lockdown in the city to constrain the spread of the disease to other cities and countries (Lv *et al.*, 2020). The spread of viral infection to other countries and states was caused by immigration and emigration of various infected people from China to other countries and provinces (Steffens, 2020). The Corona virus disease (Covid-19) is a relatively new strain that was reported in 2019 and was not previously recognized by humans on Earth. As of 7 April 2020, the Covid-19 had infected more than 1.2 million people, killed more than 72,000 and spread across the world (WHO, 2020). The World Health Organization (WHO) on 30 January 2020 declared the Covid-19 spread as a Public Health Emergency of International Concern (Team, 2020). The recent outbreak of the virus rapidly spread across the world, and the World Health Organization (WHO) declared it as global pandemic in March 2020 (Cucinotta and Vanelli, 2020). Compared to the various previous epidemics that the world has suffered from, Covid-19 has been viewed with alarming conditions seriously affecting public health and quarantine recommendations for its detrimental effects on human enterprises and productivity, disrupting national and global economies (Hanashima and Tomobe, 2012). The Covid-19 pandemic is often referred to as the “Black Swan Event”, which happens as a miracle incident not considered occurring normally and these events were distinguished from its previous incidents of greatest incompatibility and acute illnesses (Trevino, 1986). The rapid rise and spread of Covid-19 along with its several detrimental consequences induced pandemic control through territory lockdowns, travel and tourism bans, social distancing and many other restrictions that are imposed on the people’s movements and migrations affecting adversely the economy of all countries across the globe. Worldwide, the pandemic has prominently affected food systems, food supply particularly agricultural inputs and output markets, food processing, food value chains, food demand, consumer economy (Mehroliya, Alagarsamy and Solaikutty, 2021) and unemployment, in return, aggravating poverty, and food and nutrition insecurity. The FAO report, “State of Food Security and Nutrition in the World”, estimates that the Covid-19 pandemic could add about 130 million people worldwide suffering from chronic hunger and malnutrition in 2020 (FAO *et al.*, 2020). The main aim of the lockdown was to restrain social interaction and mobility of individuals. The restricted ability for movements also limits the ability to gather a large mass of individuals in an area with a relative high density of consumers and retailers such as shopping centers, malls, town centers, etc., preventing unprecedented public health concern leading to social and economic crises (Kraemer *et al.*, 2020). When there is an outbreak of contagious disease, it results into starvation and famine at a higher rate (Burgui, 2020). The Covid-19 pandemic would almost certainly have a global economic effect unlike anything seen since the Great Depression of the 1930s (He and Harris, 2020).

India is a diversified country having high population density of more than one billion, contributing 18 per cent to the world’s population, which makes it second most populous country in the world. The adverse impact of communicable disease such as

Covid-19 is severe in India as compared with other countries. The first Covid-19 positive case was identified in Kerala in India on 27 January 2020. Since then, it started spreading at an alarming rate. In order to prevent its spread, the Government of India had announced a nationwide lockdown on 24 March 2020. The lockdown had adversely affected all the segments of the Indian society. Agriculture is one of the priority sectors severely affected by the lockdown. If a nation's agricultural sector is confronted with challenges, the population's well-being will be affected (Tambi *et al.*, 2021). The strict lockdown measures resulted in the restrictions of major economic activities such as production, exports, commerce, logistics, processing, manufacturing, etc., thereby, affecting food supply, food demand, food prices and supply value chain leading to enormous uncertainties with respect to economic growth and socio-economic livelihoods of people.

Methodology

This paper is based on the desk review of recent data on Covid-19 pandemic concerning agriculture, including various published and unpublished literature from different sources along with web-based resources. The method involves reviewing the published and unpublished research articles to determine the impact of Covid-19 pandemic on agriculture and its critical consequences around the world. Google Scholar and Research Gate were the primary databases used for obtaining comprehensive and systematic data from various journals, articles, conference proceedings, scientific reports published by different organizations, and the books. The information collected was systematically analyzed for logical discussion and conclusion.

Results and Discussion

Current Scenario of Indian Agriculture

Agriculture is the prominent sector of the Indian economy. It contributes nearly one-sixth to the Indian national income that is about 17 per cent to the country's GDP and also provides employment opportunities to over 60 per cent of the population directly or indirectly associated to agricultural sector in India. The estimated annual growth (in real terms) from 2014–15 to 2018–19 in agriculture and allied sectors was 2.9% (Government of India, 2020). In terms of the world's agriculture, India produces more than one-fifth of global production of paddy and pulses. Similarly, it contributes to more than 20 per cent of global production of many horticultural crops such as okra, cauliflower, banana, mango and papaya (FICCI, 2020). It acts as the priority sector helping in ensuring food security of the nation along with influencing the growth and development of secondary and tertiary sector of the economy. While the Indian economy contracted by 23.9% in the first quarter of 2020–21, agriculture was the only sector to register a positive growth of 3.4% (ET, 2020). Agricultural growth and development help in enhancing agricultural production and productivity, thereby, reducing poverty directly by raising farm incomes and indirectly by creating employment opportunities, reducing food prices, increasing per capita food availability and ensuring food security (NABARD, 2020). More emphasis on agriculture sector promotes development of the economy. In other words, a flourishing agricultural sector is a boon for most other sectors of the Indian economy.

Impact of Covid-19 on Agriculture Sector of India

The nationwide lockdown across the country has severely affected the production and supply of goods and services that are inadequate to meet the existing demand. Many economic units are on the verge of shutting down; people became unemployed by losing their jobs and wages. When lockdowns are imposed, people are restricted to venture out to purchase various goods and services resulting in reduced consumption along with lower demand (FICCI, 2020). The Covid-19 pandemic has adversely affected the agricultural sector since the farmers had faced a lot of difficulties in every aspect of farming involving production process such as purchase of inputs due to delays in transport and logistics services especially at ports causing smallholders to suffer farm losses (Okolie and Ogundeji, 2022), sowing, accessing labor, harvesting, processing, marketing and exporting of agricultural commodities (NABARD, 2020). The impacts of the pandemic on agriculture and food systems resulting in the instability caused by a shock and related behavioural modifications leading to occasional price spikes, market supply disruptions, and food shortages (Table 1) (FAO, 2020).

Table 1: Impact of Covid-19 Pandemic on Sectors of Agriculture

| <i>Sector</i> | <i>Impact</i> |
|---------------|---|
| Production | Non-availability of raw inputs |
| | Increase in cost of production |
| | Shortage of labor and farm inputs (seeds, fertilizers, agrochemicals, farm equipment, etc.) |
| | Demand deficit |
| | Wastage of food due to improper food management (perishables and semi-perishables) |
| Processing | Shutting down of the units |
| | Lack of adequate supply of raw materials |
| | Low demand due to lockdown |
| | Low income and unemployment of employees |
| | Inflation in price of raw commodities |
| Retailing | Panic buying among consumers |
| | Shortage of food products |
| | Disruptions in demand and supply |
| | Inaccessibility of goods and services |
| | Logistics and storage facilities |
| Consumption | Change in consumer consumption pattern |
| | Food insecurity for lower income groups |
| | Change in consumer behavioral pattern |
| | Low purchasing parity |
| | Change in consumers preference |

The disruptions in the demand and supply chains lead to the shrinking market facilities and falling output prices. With respect to a consumer, it can lead to uneven rise in retail prices. Consumers are adversely affected with the access to adequate quantities of food at reasonable prices. The absence of adequate quantities of food caused by either demand slowdowns or supply shocks resulting in abrupt hikes in retail food

pricing leading to the rise in hunger, malnourishment and nutritional insecurity particularly among the vulnerable groups. In the agriculture and food sector, the various demand and supply factors translated into some types of impacts (Lusk, 2020). The various factors affecting agricultural production such as shifting of consumer demands due to income shocks, reduction in the need for high value food products results into enhancing food insecurity (Amare *et al.*, 2020). The epidemic has affected the livelihood and intensity of farmers' adoption of sustainable agricultural practices (SAP) (Martey *et al.*, 2022). Disruptions in the food supply and value chain are more acute especially for perishable items like fruits and vegetables (Mahajan and Tomar, 2020). The pandemic is severely influencing the food and agricultural supply chain in three big perspectives that include food supply, food demand and food prices (FAO, 2020a). Thus, the impact of Covid-19 pandemic has tremendously affected three major components of agriculture and food sectors that include food supply, food demand and food prices as illustrated in figure 1 and that are closely associated with eradication of poverty, hunger, nutritional security and promoting national food security.

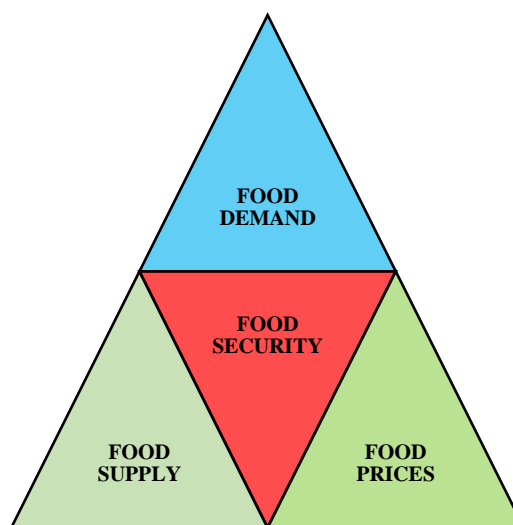


Figure 1: Three major components of food security

Impact of Corona Virus (Covid-19) on Food Supply

The food supply involves certain activities such as farming, harvesting, processing, and its distribution for the purpose of marketing such as whole selling and retailing. Food supply needs a time-bound action and implementation in order to achieve optimum quality of goods and services. In order to optimize production, quality agricultural inputs are required such as seeds, fertilizer, agrochemicals, etc. During the Covid-19 pandemic, the nationwide lockdown resulted in transportation restrictions, closure of industries and international borders affecting input supplies across the nation (Aday and Aday, 2020). The shortage of labour was observed because of their migration to hometowns in order to mitigate the pandemic conditions (Nandi and Swamikannu, 2020). A survey reports that 45% of the migrants returned home during lockdown (Imbert, 2020). The closing of the various national and international borders was a strategy used by many countries in order to control the risk and spread of contaminants. Although various production activities of major staple crops are being

highly mechanized in the developed nations are not affected adversely whereas the more labour-intensive crops such as fruits and vegetables require huge involvement of work force and human labour, thus, being more vulnerable to the effects of Covid-19 (Laborde *et al.*, 2020). Manufacture, reining, distribution and transportation are the various activities which altogether act as the fragments of the food supply associating with the farming landscape to the user's table. Ensuring food supply does not get disrupted and it strives to flourish well (Chen *et al.*, 2020). The Covid-19 pandemic outbreak resulted in enforcement of corresponding preventive lockdowns that acted as a new challenge. During the first and second quarters of 2020, food supply chains were outlined production and transportation fell sharply and household income was adversely affected (FAO, 2020a, 2020b, 2020c, 2020d). Many other worldwide efforts have been made in order to control the pandemic by restraining movement and interactions of people resulting in negative economic effects linked with the functioning of agricultural systems responsible for food supply (Siche, 2020; Timilsina *et al.*, 2020). The international trade of agricultural goods and commodities almost came to a halt whereas the domestic trade networks were severely affected due to the lockdown. Due to the travel restrictions, the movement of goods from the farmer's fields to the nearest market was affected. Thus, the disruptions in food supply and logistics during the pandemic remained acute. As accurate forecasting of food supply became difficult, various firms became risk-averse due to the bullwhip effect where the supplies declined far more than that was necessary.

Impact of Corona Virus (Covid-19) on Food Demand

The demand for the food depends on the mindset of the customers or consumers who further depend on certain attributes such as their socio-economic conditions, patterns of consumption, consumer's attitude, behaviors etc. along with various other environmental conditions, such as drought, flood, ecological disturbances and Covid-19 pandemic affecting significantly the food demand. Food demand can be addressed as consumer's interest and abilities to purchase specific goods and services within a given time frame (Gottheil, 2013). The demand for the food depends on the price of food stuffs, income level of the consumers, socio-demographic situation, consumption pattern, shopping preferences and time constraints (Bakalis *et al.*, 2020; Cranfield, 2020). During the initial phase of Covid-19 pandemic, consumers did resort to panic buying and stockpiling of food items during the lockdown in March 2020. Large-scale stockpiling of foods affected the recurrent stock outs leading to uncertainty over the availability of essential food products in the future as a cause of panic buying (Keane and Neal, 2021). Many consumers hoarded basic food items during the pandemic along with cleaning and sanitary products to ensure the availability of grocery essentials when required (Castelló and Casasnovas, 2021). It has been studied that stockpiling is driven by the expectations over future price fluctuations (Mela, Jedidi and Bowman, 1998). Similarly, at further phase there was steep fall in the demand for food items due to the loss of jobs, accessibility and unemployment. The huge reduction in demand for eatery and commercial food services due to certain factors including handling of foods, production capacity of food along with other agricultural products that have an adverse influence on the farmers output reduction (Brewin, 2020; Ceballos, Cranfield, 2020; Kannan and Kramer., 2020; Poudel and Subedi, 2020). On a general basis there was an uneven distribution of food resulting in shortages of some foods in certain areas and oversupply of certain other foods in

different areas. During the Covid-19 pandemic restrictions many consumers preferred to take away food or use home delivery facilities due to closure of restaurants (Bakalis *et al.*, 2020; Shahidi, 2020). Along the same time, most of the consumers were concerned about the critical effects of Covid-19 on their mental and physical health due to which they look for specific food products and confectionaries to improve their health and mood (Hughes, 2020; Muscogiuri, Barrea and Savastano, 2020). However, keeping the distribution chain alive was necessary by utilization of effective supply management strategies in order to meet the consumer demands (De Sousa Jabbour *et al.*, 2020). Thus, as the consumers play a vital role in food supply chain, changes in consumer's attitude, decision making behaviour and consumption pattern gets strongly affected during Covid-19 pandemic outbreak.

Impact of Corona Virus (Covid-19) on Food Prices

The demand and supply of major agricultural commodities declined in India after the lockdown. The challenges in the food demand and supply chains during the Covid-19 pandemic resulted in the fluctuations in prices of various agricultural goods and commodities. Major studies were done on demand and supply shocks and are analyzed along with price movements in agriculture after the lockdown (Narayanan and Shah, 2020; Rawal and Verma, 2020). The major cause for the price inflation during Covid-19 outbreak involves the demand for food, panic purchase, hoarding and back stocking of goods. Other factors affecting may include shortage of labourers, shutting down of food processing plants, inefficient marketing platforms, disruptions in the global supply chain due to travel restrictions (Sen, 2020). The gap between the wholesale and retail prices of various agricultural commodities increased during the lockdown which may be due to demand collapse or overwhelmed supply shocks. Many consumers may also expect prices to rise in the near future when a supply shock is seen but retail prices are yet adjusted in upward trend (Jaravel and O'Connell, 2020). Fluctuations in food prices are obvious consideration in the underdeveloped and developing countries constituting of both income of farmers and purchasing parity of the consumers (Bellemare, 2015; Barrett, 2020). The selling cost of major agricultural goods and commodities has increased due to constraints in logistics associated with the pandemic (Hahn, 2020). Therefore, various stringent measures such as increase in the communication networks and strengthening logistics facilities are the key factors in establishing efficient food supply chain system, market access and promoting economic stability.

Impact of Corona Virus (Covid-19) on Food Security

Food security can be explained as a process of ensuring the availability and accessibility of optimum quantity of nutrient-rich foods to various communities. It describes about how foods are handled, prepared, and stored following various protocols for effective food control systems, which are essential for protecting consumer's health and safety. The primary goal of food security is to ensure enhancements in food accessibility in order to enable adequate food distribution starting from the households to low-income line. Food security refers to an individual or groups who have unlimited access to healthy food sufficient to improve their living conditions (Rosales and Mercado, 2020). The potential impact of Covid-19 pandemic on food security can be further summarized in the form of distortions in food supply

and demand, uneven hike in food prices, unemployment, poor economic conditions, low investments in the agriculture and food sectors, thereby, affecting government expenditures and financial assistance towards the farmers growth and improvement (Udmale, Pal and Szabo, 2020). According to the Food and Agriculture Organization (FAO), about 135 million people across the world were experiencing extreme levels of food insecurity before the pandemic outbreak (FAO, 2020a). The Covid-19 pandemic outbreak has a detrimental impact on agricultural food systems affecting major food supply chain and disrupting food security in the economically vulnerable region around the world (Alvi and Gupta, 2020; FAO, 2020c; Schmidt, 2020a). In a post-pandemic scenario, the World Food Programme (WFP) has forecasted that the number of individuals facing acute food insecurity may rise from 135 million to 265 million (WFP, 2020). Thus, the food security was adversely affected during the Covid19 pandemic outbreak that can be mitigated through policy reforms, financial growth and nutritional assistance programs. . The government can opt for a staggered procurement and pricing strategy that accounts for the threshold level in cost of storage (Sendhil *et al.*, 2020a). It can also be useful to tackle other crises in the future such as natural disasters, financial recession, global pandemic, etc., thereby, optimizing food security for national growth and economic prosperity.

Conclusion

The Covid-19 pandemic crisis has started a new era in the agriculture and food industry. It has created several challenges in the agriculture and food ecosystem worldwide. It has affected major areas of production, processing, food supply chain, dietary changes, logistics, etc. along with national economy and food security. In order to retain its rise and spread, stringent measures were adopted such as restrictions in movements, social distancing, quarantine measures that posed huge barriers in transportation, disruptions in value supply chains, economic growth and sustainable development in agriculture and food sector. The pandemic has shattered economic prosperity, food securities, government policies, world commerce and financial markets. However, the disruption of the food systems opens up to opportunities to connect local production and consumption (Blay-Palmer *et al.*, 2021). It has created new interventions in the food business, food handling, agriculture and food supply chain network which we have never seen previously (Galanakis, 2020). Furthermore, the Covid-19 pandemic complex vagaries adversely affected economically vulnerable communities across the world in the most impulsive ways requiring an effective understanding along with mitigation and coping strategies to overcome the consequences. The Covid-19 pandemic has created wide havoc in agriculture and food sector by disrupting supply and demand value chain, low inputs, loss of job, reduced household incomes, higher retail prices, etc. In order to tackle the situation, a diverse set of agriculture and food related measures were adopted by governments in response to the agrarian crisis with major concern on agricultural production, functioning of the food chain and consumer demand. The impact of COVID19 on the Indian agricultural system enabled us to arrive at a 10-point strategy for strengthening the sector against the crisis and sustainability issues (Workie *et al.*, 2020). During the peak period local governments were highly vigilant and responded promptly by providing quarantine facilities to the returnees along with distribution of health and ration kits for vulnerable families (Thapa, 2022). The post-2020 context has revealed some transformations which paved the way for agri-food systems to operate (Snow *et al.*,

2021). Along with input subsidies and farm loans, measures such as empowering farmer's access to latest technological interventions can also be taken into account (Demont, Fiamohe and Kinkpé, 2017). Considering farms as micro-systems nested within the larger agricultural systems which can support farmers to deal with uncertainty, being essential in becoming resilient (Slijper *et al.*, 2022). Thus, one of the vital lessons that can be learnt due to the outbreak of the virus would be building a resilient supply chain management and food system. Resilience is about the capacity of a system to live with complexity, uncertainty, and (abrupt or incremental) change, and to ensure continuity in ever-changing environments through adaptation and transformation (Folke *et al.*, 2021). Major reforms in the agricultural marketing and distribution systems along with e-commerce will boost farmers' income. Government efforts are needed to identify gaps and bring desired changes in order to avoid further economic and nutritional disparities. Special, government funds and emergency food rations such as PDS (public distribution system), work guarantee schemes (e.g., MGNREGS¹) and supply of agricultural inputs can play a prominent role if mobility and supply chains are severely disrupted. Additionally, accessibility and functioning of e-National Agricultural Markets, quick and hassle-free direct payment through banks, enabling contract farming, farmer producer companies (FPCs) and logistics like scientific storages at grassroots level along with food, income and job safety net for the poor and needy during lockdown are helpful. On the policy front, facilitating agricultural reforms by promoting transfer of technology directly to the farmers and addressing their grievances supported by the researchers, scientists and farmers together along with new initiatives such as Aatma Nirbhar Krishi (self-reliant agriculture) will enable the economy to transform into a powerhouse of food production and distribution providing sufficient insulation and shock absorption to the vulnerable groups. Innovations such as development and introduction of new products and services, introducing new financial schemes, family farming, community farming, roof top farming, hydroponics, digitalization, etc. will address the modern challenges in agricultural sectors moving a step ahead towards resilience and sustainability.

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¹ https://nrega.nic.in/Nregahome/MGNREGA_new/Nrega_home.aspx

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

| <i>Contribution</i> | <i>Author 1</i> | <i>Author 2</i> | <i>Author 3</i> | <i>Author 4</i> |
|---|-----------------|-----------------|-----------------|-----------------|
| Conceived and designed the research or analysis | Yes | Yes | No | No |
| Collected the data | Yes | No | Yes | Yes |
| Contributed to data analysis & interpretation | Yes | Yes | Yes | Yes |
| Wrote the article/paper | Yes | Yes | No | No |
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Research involving human bodies or organs or tissues (Helsinki Declaration)

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