

Impact of Corona Virus on Indian Agriculture and its Management Strategies

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ABSTRACT

COVID-19 pandemic disrupted the Indian Agriculture System. The fourth wave of corona in some countries has rung the alarm to become concerned about the spread of delta-omicron variant. In this review, attempt has been made to highlight the consequences of COVID-19 in Indian Agriculture System and the possible management strategies. Although the effect of COVID-19 on the production of cereal, fruit, vegetable and flower crops was not much severe but there was a problem in marketing of the produce as lockdown disrupted the marketing channel, which plagued both the demand and supply chain of the agricultural commodities in the market. Based on the experience, some strategies have been highlighted in this review to recover the post-pandemic effect.

Key word: COVID-19, Indian agriculture, Marketing, Strategies, Pandemic

Introduction

The cases of novel coronavirus (2019-nCoV) were first time reported on December 31, 2019 in Wuhan state of China where from the virus generated, which was later known as COVID-19 (Wang, 2020, WHO, 2020a), which was different from SARS-CoV and MERS-CoV. The reports from the globe confirmed the cases of infection due to this new virus, which had tremendous alarming growth, now being the main global health problem affecting the normal development of the society and all its components. There is always a risk of developing a new infectious disease (Burnet and White, 1972) from the Spanish flu of 1918 to AIDS, which still has no definitive treatment. Similarly, Covid-19 was also the contagious disease, threatening and disturbing the humanity. From the past pandemics (Table 1) that

the world has experienced, it has been shown that quarantines and panic have an impact on the environment, human activities such as livestock, agriculture, tourism, transport, education, health, fishing, mining, industry, commerce, *etc.* and economic growth too (Hanashima and Tomobe, 2012; Bermejo, 2004; Arndt and Lewis, 2001, Siche, 2020). In India, a large country with 1.3 billion people, the disease was first time detected in Kerala on 30th January 2020 in a student returning from Wuhan. When there was an outbreak of infectious disease, there was also an increase in hunger, malnutrition and unemployment (Burgui, 2020; Sar *et al.*, 2010). The situation became worst as the disease progressed, making the public movement restrictions more and more stringent, causing labour shortages for the harvesting of crops and difficulties for the farmers to bring their fresh produce to the market. Agriculture

is one of the most important sectors in human development and is related to food security (Abdelhedi and Zouari, 2020; Kogo *et al.*, 2020; Lopez-Ridaura *et al.*, 2019). The changes in agriculture due to COVID-19 have had a larger effect on the overall US economy than the share of agriculture in the economy at the beginning of COVID-19 but the non-agricultural shocks still outweigh the impacts from agriculture by a magnitude of 3 (Beckman and Countryman, 2021). India has agriculture-based economy since more than 50% of the people are belonging to farming community. Strategies imposed by the Government to prevent the spread of COVID hampered the farm production and productivity. There is a cycle of events associated with farm produce, *i.e.*, from land preparation, sowing to harvesting, threshing and marketing. Hence, the objective of this review is to analyze the relationship between agriculture and impact of corona virus and how this relationship was affected by the events related to the disease of COVID.

Food demand

Every pandemic caused increment in the demand of food around the world, *e.g.*, the demand for new bread, biscuits and packed food enlarged by 76% and vegetables by 52% in a week when the COVID-19 was declared but the interest for alcoholic items did not increase. Moreover, the demand for alcoholic products increased after few months of the pandemic announcement (Crisp, 2020). Closure of

the food stores also influenced in the food supply chain. Higher customer demand resulted in empty racks in shops, and a decline in supply originated an increment in the cost of meat items (Barman *et al.*, 2021). The COVID-19 pandemic guaranteed the utilization of systems intended for crisis and influenced the legally bound exchanges in the food supply chain. Simultaneously, there was difficulty in making adjustment in the supply-demand equalization, and both the farmers and businessmen were in great trouble (FAO, 2020). Because of economic loss and allocating their assets concentrating on economic motivation and public help programs, the governments of the various countries were confronting financial crunch. During COVID-19, it was also observed that insufficient finance with the people decreased the demand for agriculture produce in the market. In China during pandemic period, there was an increase in online demand in food and beverage sector due to some quarantine policies (FAO, 2020a). In situations where a virus spreads by contact, contactless delivery services such as drone system came in vogue, which were preferred by the consumers (Fig. 4).

Food supply

The food supply network joints the agriculture system with customers performing the production processes, bundling, conveyance and capacity (Chen *et al.*, 2020). COVID-19 pandemic did not directly affect the food production like other diseases such as

Table 1. Main pandemics from the 20th century

Sr. No.	Name	Time period	Type	Death toll (in Million)	Infected age of human	Reference
1.	Spanish flu	1918-1919	H1N1	More than 50 million	Adults from the age group of 20 to 50	Farmer (2019)
2.	Asian flu	1957-1958	H2N2 virus	1.15 million	School children, young adult and pregnant women	Duet <i>al.</i> (2009)
3.	Hong Kong flu	1968-1970	H3N2 virus	1-4 million	Children and their families	Wang-Shick (2017)
4.	Russian flu threat	1977	A/H2N2	7 million deaths	Children and young adults (<23 years)	Kilbourne (2006)
5.	1997: Avian flu Threat to present	1997-1999	A/H5N1A/H9N2	(Approximately 1.5 million) Chickens were infected	Thousands of human infected	WHO (2022)
6.	HIV/AIDS	1981 to date	Virus	32 million (estimate, March 2020)	Younger and elder people	WHO (2020b)
7.	COVID-19	2019 to date	Corona virus	5.24 million (10 May 2022)	Children, youngsters and elder people	WHO (2020c)

bird flu, *E. coli*, mouth disease, *Listeria*, etc. The farmers were enforced to abolish the food essentials or commodities on the field due to the restrictions imposed by the governments during pandemic periods, *e.g.*, every day, several liters of milk were thrown on roads by the dairymen or livestock's farmers due to hindrance in the supply chain (Fig.1). Thousand tonnes of tomato were also thrown by the farmers on the road or destroyed in the field due to the hindrance in transport system. At the time of global disaster, the basic element of the food industry is the maintenance of logistic coherence, as the tea plants were damaged due to some logistical challenges. The greatest issue in the food supply chain was to get resources from the suppliers and to guarantee the progression of food movement from producers to the buyers (Alonso *et al.*, 2007). Pandemic lockdown has aggravated the agrarian crisis in the country by disrupting both demand and supply chain of agricultural commodities in the market (Balamurugan, 2021). The effect of pandemic issues on supply chain of agricultural or horticultural fresh produce generally depends on the composition and intensity of legal frameworks and availability of inputs.

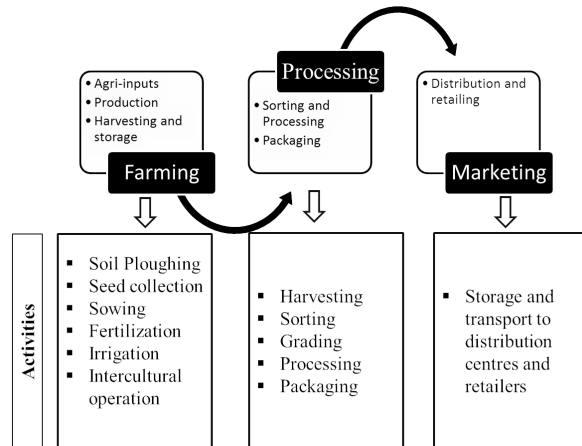


Fig. 1. Agricultural supply chains (Sharma *et al.*, 2020)

Lack of labor availability

The labor-intensive works in certain areas such as animal production, agriculture, planting, harvesting and preparations of the produce for marketing were extremely interrupted due to shortage of labour because of COVID-19 emergency (Stephens *et al.*, 2020). The lack of farm workers or labourers was a significant problem during the COVID-19 pan-

dem. Because of the lack of work force, sickness and physical distance to be kept up during production, the crisis reduced the capacity of firms and agri-business to work. These conditions slowed down the transportation of food and horticultural sources and made issues in giving non-stop food supply to business sectors. The time-dependent nature of the farming activities and higher efficiency requirements over time may prompt the agricultural change to be characterized as mechanical progression and up-scaling of the work power.

Food security

Food security implies that everyone has unrestricted access to food that allows them to satisfy their basic needs. Not taking quick action implies an imminent food crisis, with a greater effect on the most vulnerable population. Measures should focus on keeping global food supply chains active and mitigating the impacts of the pandemic across the food system. Social programs act as an umbrella, which minimizes the effect of short-term crises. The first vulnerable group, *i.e.*, people who experience chronic hunger and do not consume enough caloric energy to live a normal life, which is about 820 million people (FAO, 2020a). The people of this group cannot afford any possible interruption in their livelihoods or access to food under a situation of COVID-19. If the virus spreads in countries where such people live, with health system with limited capacity, the consequences could be serious. A second vulnerable groups, *i.e.*, small farmers, who may be prevented from working on their land and accessing markets to sell their fresh produce or buy seeds and other essential inputs. The third vulnerable group, *i.e.*, children from low-income families, who are mainly nourished by food provided by social programs, the interruption of these programs due to the pandemic puts food security and nutrition at risk, and as a consequence, the existence of children with limited capacity to cope with diseases (FAO, 2020d). Thus, each country must direct its actions to maintain social food programs, taking the necessary precautions to avoid transmission of the virus.

Cost and availability of agricultural inputs

Agriculture sector is not only dependant on climate resilience but also on market resilience. The price gap between inputs and marketable produce might cause heavy loss to farmers. Seeds, fertilizers and land are three primary inputs of agriculture. The

other necessary inputs are large machineries, small implements and pesticides. During and after the onset of COVID-19, the availability of the agricultural-inputs became low due to improper transportation facilities, which disrupted the proper supply of the materials from market to field. Another reason for unavailability of resources is closure of markets and shops due to lockdown. Reductions in availability of agricultural-inputs have been found for all subsectors across the country at post COVID period. The peak declination across the country was observed in the availability of fertilizers, rental farm machineries, cattle feed, seeds and pesticides by 11.2, 10.6, 10.8, 9.1 and 9.8%, respectively (NABARD, 2020). The maximum quantity of unavailable seeds has been reported from Nagaland followed by Jharkhand, West Bengal, Bihar and Tamil Nadu (27.5, 16.7, 15.0, 14.7 and 12.5%, respectively), while increasing rate (2.8%) of seed availability was reported from Arunachal Pradesh. Similarly, the availability of fertilizers also decreased in almost all the states excluding Arunachal Pradesh and Uttarakhand. The largest fall in the availability of fertilizers was reported from Nagaland followed by Jharkhand, Punjab, Andhra Pradesh and West Bengal. Largest unavailability of pesticides has been reported from Nagaland (35%) and lowest from West Bengal (18.1%). The maximum Indian farmers are small and marginal, lacking their ability to buy heavy implements for ploughing, irrigation, intercultural operations and harvesting. Unavailability of rental implements during post-COVID and lockdown period fallen them into trouble (Fig.2). Decline of availability of rental machinery was observed in the states of Nagaland, Jharkhand, Assam and Gujarat with declination rate of 45, 18.6, 17 and 17%, respectively. Unavailability of cattle feed was reported from Manipur, West Bengal, Bihar and Jharkhand. Surplus production and prices of the

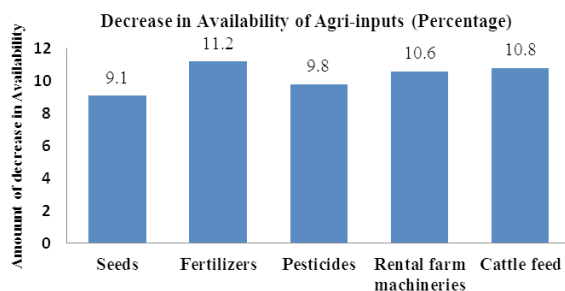


Fig. 2. Depletion of availability of agricultural inputs (NABARD, 2020)

products in the market correlated negatively with each other. As supply of agricultural-inputs got low at the time of COVID, the price of available agricultural-inputs has increased across the country (Fig.3). The reason might be closure of shops and markets. The prices of different agricultural-inputs like seeds, fertilisers, pesticides, fodder, *etc.* usually increased by 9-12%. Increased prices of agricultural-inputs were observed in 54% districts of India. Shortage in supply of insecticides and pesticides disturbed the farmers to take protective measures, which have been resulted in reduced yield in the year 2021.

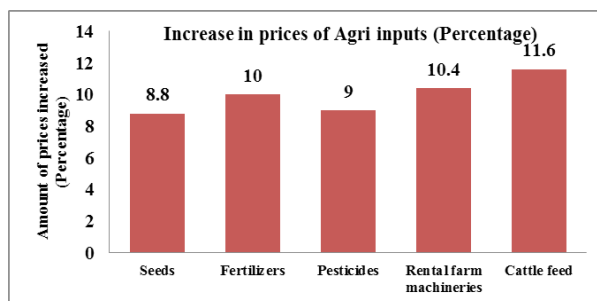


Fig. 3. Increasing price of agricultural inputs during COVID-19 (NABARD, 2020)

Agriculture Production

India is the leading producer of some of the agricultural and horticultural crops but yield of major food grains and other important crops are less than average global yield. The yield of such major crops in the country is very low as compared to world's highest yield. The pandemic situation imposed by COVID 19 had adverse effect on agriculture sector of the world as well as in India. The main reasons for the reduction in agricultural production in India included unavailability of labour, machineries, restriction on movement of people, social distancing, *etc.* Overall production of agriculture and allied sectors had affected almost all the states of India due to the effect of COVID 19. There was no report for significant losses on production of *Rabi* crops, only 2.7% decline has been reported. Harvesting of wheat by end of April saved the countries overall of the total losses of *Rabi* crops (potato, mustard, gram and wheat). However, significant reduction in the production of allied sectors has been reported. People had stopped the consumption of non-vegetarian food in the wake of COVID 19 infection. Especially the production of poultry, fishery, and domestic animals, *i.e.*, pig, goat and sheep has been reduced

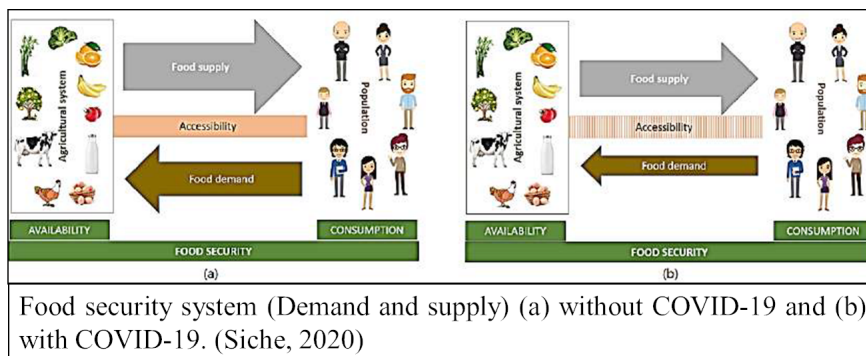


Fig. 4. Food security system (Demand and supply) (a) without COVID-19 and (b) with COVID-19 (Siche, 2020).

by -8.5, -13.6 and -19.5%, respectively due to the dropping of public's demand to strengthen the barrier for spreading of COVID 19 (NABARD, 2020). Yield reduction in horticulture and dairy sector by -5.7 and -6.6%, respectively has also been reported (Fig.5). Market demand for fresh or packaged milk did not decline, however, the market demand for processed products like chocolates, cream, khoya, paneer and sweets reduced due to the drop down of the demand. The closing of hotels, parlours, restaurants, stalls and sweet corners reduced the demand for processed milk products.

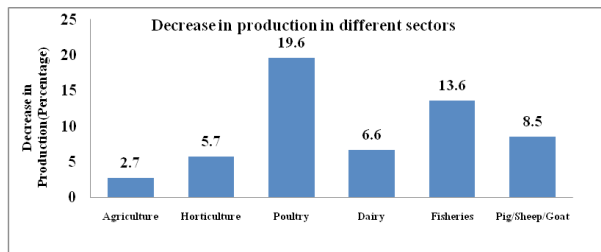


Fig. 5. Reduction in production in different agricultural sectors (NABARD, 2020)

Marketing

COVID19 persuaded lockdown was shocking news to the small farmers. A significant bad impact on marketing of agricultural fresh produce has been reflected. It has affected the Indian agriculture system in many ways. Occurrence of COVID19 pandemic followed by sudden lockdown broke the marketing channel. Interruptions in supply and demand of farm produce affected the farmer's income. Transportation of goods was arrested, which in turn resulted into rotting of soft, tender, perishable vegetables and farmers also faced problems in marketing of those produce. Farmers were unable to carry

the produce up to main centres and were compelled to sell their produce at low price in the local markets. Global agriculture trade was also faced a huge loss. Because of continuous global lockdown, the agricultural fresh produce of ~\$40 billion was not exported (<https://www.consultancy.asia/news>, 2020). The impacts on local *haats* were more severe than the main marketing centres like *mandis*. Though the operational work was continued in the main *mandis* and procurement centres under the jurisdiction of state and central government but complete ban on opening of local *haats* and markets by the government to reduce crowding and spreading of deadly disease had heavy impact on marketing of fresh farm produce. However, there was considerable variation across the states for the marketing of fresh farm produce. Lockdown imposed severe losses to the floriculture sector of India (Workieet *al.*, 2020) due to the break on social, religious and cultural gatherings.

Mitigation strategies of COVID19 impacts

There are the pathways to be found to manage the COVID-19 impact. The announcement about occurrence of fourth wave by delta-cron, a hybrid between omicron and delta variant of corona in China has ringed the bell to be aware of the spread and infection of it. Impact of first wave in India is still alive in different sector of the society. However, the Government of India and the citizen of it together can manage the effect of next wave if it will arise in severe form. Various strategies such as adoption of industry 4.0 technologies, supply chain collaboration and shared responsibility is identified for sustainable future. Theoretical and managerial implications are provided based on the outcomes of the

study (Sharma *et al.*, 2020). From a policy perspective, there is an apparent need for (a) continued supply chain monitoring and industry engagement, (b) the proactive development of strategies to deal with absenteeism and other potential threats to the supply chain and (c) an assessment of the economic and health merits of providing additional public resources to provide greater access to grocery pickup and delivery services (Gray, 2020). Home gardening, *i.e.*, local community gardens, indoor and rooftop gardens, vertical farming, etc. could play an important role in advancing food and nutritional security during and after the COVID-19 pandemic, while also strengthening the provisioning of numerous ecosystem services, *i.e.*, plant biodiversity, microclimate, water runoff, water quality, human health, however, risks of soil contamination by heavy metals must be addressed (Lal, 2020). Cariappa *et al.* (2021) proposed a 10-points strategy ranging from social safety nets, family farming, monetizing buffer stock, staggered procurement to secondary agriculture to revive and prosper post-pandemic.

Emphasizing of secondary agriculture

Sudden lockdown in the whole country witnessed the number of migrant labourers. About 45% migrant labourers returned home after announcement of lockdown (Imbert, 2020). Then, the reverse migration of labour was resulted in difficulty in harvesting of *Rabi* crops like pulses and wheat of the year 2020 in the north-west plain of the country (Dev, 2020). Small farming sectors can be converted into enterprises to promote secondary agriculture, where primary farm produce and farm wastes (by-products and crop residues) will be used as raw material (Dey, 2019), *e.g.*, the left-over part of cotton after harvesting can be used as preparation of paper, hard board and soft board (Chengappa, 2013). Further, novel innovations in value addition of harvested produce of aromatic and medicinal plants, which supply raw materials for the preparation of cosmetics, food essence, pharmaceuticals and medicines could create employment and enhance the export potential.

Group farming

Group farming practices may reduce the cost of production. Farmers in rural area could work together as cooperative farming groups or farmer producer companies and organizations. They can work together as a network for the exportation in the in-

ternational market.

Government investment in Research and Development sector of agriculture

Government as well as private sectors should take a step forward for the improvement of agriculture sector. Agriculture sector was the only sector, which showed positive growth during COVID period (the first quarter of 2020-21), while total Indian economic growth was stunted by 23.9% (ET, 2020) and other sectors failed to rise. The Government should invest in the research and development of agriculture, better insurance and finance policy, digital marketing and procurement, and storage infrastructure development like cold storage. The impact of Covid-19 in agriculture sector was not severe as much as in the manufacturing sectors, however, the lockdown had significant impact on the agriculture and allied sectors in the country, as majority of population approximately 140 million households depend on agriculture sector (Balamurugan, 2021).

Monetizing of surplus produce

The Food Corporation of India stored two times more-buffer stock every year than the norms and this stock has worth of Rs. 1.5 crore (<https://indianexpress.com/gulati-6469970/>). Monetizing the surplus stock could be the best pathway for revenue generation of the government. It will also reduce the storage and maintenance costs. This can be invested for promoting the small enterprises of rural area, development of storage buildings, *etc.*

Procurement policy of government

During and after the onset of pandemic circumstances, which discontinued the marketing and storage facility, the government could provide opportunity of astounded pricing and procurement policy, which will give a baseline or threshold in storage cost, especially for staple food grains like wheat and rice (Cariappa *et al.*, 2021). This would boost the farmers to store the fresh produce at farm level.

Price and revenue risk management

At the beginning of every crop season, the Government of India announced the minimum support price for some specific crops. The Government should cover more crops and stabilize their market price. Impact of COVID-19 on food prices except vegetables was less or negligible. Farmers have faced price risk at post-COVID 19 period. Crop in-

insurance scheme only covers the yield risk. Government should produce a scheme for both price and yield risk (revenue) to farmers (Cariappa *et al.*, 2021).

Conclusion

Both Indian and global agricultural system have impaired disaster due to COVID-19 pandemic. Global food insecurity is a potential looming threat, which can be prompted by fourth wave of corona. Understanding of the COVID-19 impacts on the agricultural system in developing countries is necessary to secure food for the people of this country. A domestic supply chain in India was interrupted by restriction on transportation, movement and migration of labour, which in turn led to an increased market price of the commodities like flour, pulses, fruits, vegetables, milk, medicines and other commodities in daily use. India has witnessed a sharp decline in the consumption of chicken and poultry meat due to similar reason, which caused massive loss in the income of the farmers. As the fourth wave of pandemic has begun to threaten some of the countries and their food system, suitable mitigation tactics for pandemic stress should be implemented by the producers' organisations and government of the developing countries like India. In order to secure country's food system and livelihood of the common people, the role of each state becomes much more relevant. Therefore, the state should enhance the social safety network immediately and implement some short-term strategies.

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