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# Impact of COVID-19 and Climate Change on Indian Agriculture

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**ABSTRACT**

*Climate change and pandemics both disrupt global food supply chains on their own. Natural and human disasters, such as droughts, cyclones and pandemics, have become more common in the twenty-first century. Their combined effects can result in severe economic stress and malnutrition, especially in developing nations. Understanding how climate change and pandemics interact and developing strategies to address them both together and separately is critical to ensuring a stable global food supply. This paper examines the consequences of these disasters in terms of food and agriculture and then discusses how they are compounded. We discuss the implication of policy and suggest research topics for the future.*

***Keywords:*** *Climate change, Droughts, Cyclones, Pandemics*

## INTRODUCTION

COVID-19, which originated in Wuhan, China – the epicenter – eventually spread around the world and became a pandemic. As of December 6th, 2020, India had already become a hotspot for the virus, infecting 9.6 million (14.6 per cent of global infection), resulting in a 23.9 per cent drop in GDP in quarter one of FY 2020–21. Compared to a weather shock, for example, drought or flood, or a trade embargo, a pandemic shock can have a greater impact on economies due to lost human lives. All of these shocks impact agricultural systems; however, pandemic shocks have an impact on all sectors of an economy. Droughts tend to be localized, affecting only the associated sector or stakeholders, whereas pandemics disrupt food demand and supply, affecting the global supply chain. Similarly, trade embargo shocks affect a specific sector and can be mitigated in the short term with appropriate policy measures. For example, in the event of a supply shortage caused by drought, globally-connected wholesalers and retailers procure from alternative sources to avoid negative consequences (Mishra et al., 2021). Pandemic and climate risks are emerging hazards for agriculture in all over the world.

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Climate change has effects on agriculture's basic foundations by neutering temperature, rainfall, and weather patterns, in addition to increasing the frequency of floods, droughts, and warmth stress. A pandemic, like a temperature change, could be an international threat. Coronavirus (COVID-19) has a light-emitting diode to disruption in numerous agriculture activities and their offer chains. It has created U.S.A. vulnerable to the challenges like food and nutrition security that area unit necessary for sustaining livelihoods. Because of this, farmers face primarily with 2 challenges: addressing the consequences of Climate change and managing the disruption caused by the Covid-19 pandemic. The COVID-19 presents Associate in Nursing unprecedented challenge that necessitates swift and decisive action to confirm food and nutrition security whereas conjointly saving lives and livelihoods. there's a necessity for regional and international cooperation to handle such international problems (Rasul, 2021).

Despite the actual fact that current agriculture and food systems have magnified food production significantly; but, they need to have vital negative environmental consequences that have serious implications for public health (Rockstrom, 2009). Health risks are rising as a result of unsustainable agricultural practices (Ramachandran et al., 2020). Excessive use of agrochemicals, in addition as unsustainable water and energy use, has contributed to lots of international problems, as well as high emissions, pollution, pollution, water deficiency, energy deficiency, diversity loss, and health risks (Pingali, 2012).

In the last 3 decades, Climate change has been manifested by a rise within the mean temperature across Asian countries and an increase within the frequency of utmost rain events. As a result, the assembly of major crops varies from year to year. Underneath the National Innovations in Climate Resilient Agriculture programme (NICRA), the impact of Climate change on Indian agriculture was investigated. In India, the yields of rainfed rice square measure are expected to decrease slightly (2.5 %) in 2050 and 2080, whereas the yield of irrigated rice square measure is expected to extend by seven-membered in 2050 and 100 per cent in 2080 eventualities. Wheat yields square measure expected to visit half dozen to twenty-fifth by 2100, whereas maize yields can visit eighteen to twenty third. The productivity of chickpeas is predicted to rise by 23-25% from future climates. The Indian Council of Agricultural analysis assesses the vulnerability of Indian agriculture to temperature change (ICAR). This was in serious trouble 573 rural districts in Asian country (excluding the Union Territories of Andaman and Nicobar Islands, Lakshadweep). in keeping with the vulnerability analysis, 109 districts out of 573 rural districts (19% of total districts) square measure classified as "very insecure," whereas 201 districts square measure classified as "risk"(Anonymous, 2021).

**Effect of covid-19 on Indian agriculture and rural economy**

The COVID-19 pandemic struck at a time when global and Indian economic growth were both expected to slow. The Indian economy's growth rate has slowed over the last few quarters, with quarterly GVA growth falling from 7.63 per cent in Q4 2017-18 to 3.04 percent in Q4 2019-20. COVID-19 may have exacerbated the downward trend, as evidenced by various factors (Anonymous, 2021). These effects can be discussed as follows-

**Impact on production**

COVID-19 had a negative impact on agriculture production in nearly half of India's states (47 %). Agriculture production (-2.7 %) had not been significantly impacted, owing to the fact that rabi crop harvesting, such as wheat, was nearly finished by the end of April 2020. However, a significant decrease in the production of allied sectors had been seen, particularly in the poultry (-19.5 per cent), followed by the fisheries (-13.6 per cent) and the Sheep/Goat/Pig (S/G/P) sector (-8.5 per cent), owing to a sharp drop in consumer requirement for these products, this could be a result of widespread concern in the aftermath

of COVID 19 about the reliability of non-vegetarian food, mainly poultry meat, as per health reasons. Similarly, due to lesser demand for the products, production in other sub-sectors, *viz.*, dairy (-6.6%) and horticulture (-5.7%) also decreased.

**Impact on farm gate prices**

In the crop sector, the costs of farm gate failed to weaken considerably (-2.2 per cent). On the opposite hand, costs in allied sectors had fallen by 2% to 18%. The poultry sector skilled the best drop (-17.8%), followed by agriculture (-7.6%), dairy (-5.6%), fisheries (-4.8%), and S/G/P (-2.9%), attributable to provide disorder caused by vehicle restrictions.

**Impact on prices of Agri inputs**

An increase in prices up to 9-12 % was observed in agri inputs such as seeds, fertilizers, pesticides, and fodder due to interruptions in the supply chain caused by restrictions on vehicle movement and the shutdown of shops and markets. About 54% of sample districts saw an increase in agri input prices at the national level, which might be due to a lack of supply.

**Impact on agriculture marketing**

Despite the fact that various state governments opened procurement centers at the local level under their authority, restrictions on vehicle movement had a negative impact on the normal operation of marketing of agriculture produce through mandis in about 74% of districts studied as a sample. The impact on the operation of rural haats was more severe, with 87 per cent of them suffering negative consequences. This was mainly due to local governments' complete restriction on the establishment of rural haats in the majority of the country's districts.

**Impact on availability of Agri inputs**

The seeds (-9.2 per cent), fertilizers (-11.2 per cent), pesticides (-9.8 per cent), fodder (-10.8 per cent), and other Agri inputs were all reduced by 9 to 11 per cent due to limitations on movement of materials and shop closures. If we talk about input availability, 58 per cent of people in India were negatively affected.

**Effect of climate change on Indian agriculture**

The vagaries of weather continue to be a threat to Indian agriculture and the looming threat of climate change may exacerbate this vulnerability. Agriculture in India remains vulnerable to weather fluctuations and the looming threat of climate change threatens to exacerbate this vulnerability. Estimating the impact of weather and climate on economic performance is the subject of a small but growing literature. Many of these, however, are either cross-country studies or focus on developed countries for data reasons and thus may not be applicable to a large, climatically diverse country like India.

Between 1970 and 2016, average annual temperatures increased by 0.48 degrees, while average monsoon rainfall decreased by 26 mm (between 1970 and 2016). Temperature extremes have also been steadily increasing. The number of 'extremely hot' days has increased, as has the number of dry days, which is in line with climate change models that predict increased weather variability (International Monetary Fund (IMF), 2017). Changes in temperature and rainfall can have short term and long term impact on agriculture.

**Combating COVID-19 and Climate Change**

Even as climate change continues to have an effect on South Asia, the COVID-19 pandemic has exposed a big threat to human security and prosperity. The coronavirus continues to be spreading, and in Bharat and different South Asian countries, stronger mutant strains have emerged. despite the fact that recent reports of at hand vaccines are encouraging, it's tough to mention once they will be to the many countless folks in South Asia World Health Organization want them, and there is no approach to knowing once the coronavirus is going to be eradicated.

**Developing Agriculture Pandemic-Resilient**

***Enhancing the adaptability of local and regional food systems***

The COVID-19 pandemic has taught us that disasters can strike at any time, laying food supply chains in danger in South Asia.

Because food is essential for human survival, it is critical to prepare for emergencies such as pandemics and other natural disasters, as well as to establish appropriate crisis management structures and protocols (Blay-Palmer et al., 2020). This planning would have to include the integration and coordination of food value chains, from food production and transportation to food processing, marketing, and retailing (Fan et al., 2021). It would entail balancing food supply chains on a local, regional, and global scale. Strengthening local and regional food systems to promote self-sufficiency and shorter supply chains to reduce reliance on global supply chains would be one important strategy. For example, the government of Bhutan has launched an initiative to promote agriculture in urban and peri-urban areas to increase food production and provide employment to those who have lost their jobs as a result of the COVID-19 pandemic. To ensure food security, the government provided various types of assistance to farmers who wanted to use uncultivated land to grow vegetables and other crops (Bhandari, 2020). To prevent disease spread and protect the health of workers involved in the supply chain in the agriculture sector, it is also critical to improve farming's digitalization and inculcate a hygienic working environment, as well as strengthen management systems for food safety and quality standards in manufacturing. Smallholder and family farming, as well as enterprises at small and

medium levels along the food chain must be supported by governments at all levels to ensure their viability and contribute to broader social stability (Darnhofer, 2020).

***Increasing the effectiveness of social programs***

There is a need to strengthen certain vulnerable communities by adopting measures in the direction of social safety. Adequate emergency food aid should be provided, integrating such public distribution with local and regional food procurement wherever possible (Hepburn et al., 2020). Wherever supply chains are severely disrupted, special attention must be paid to the most vulnerable populations, such as children and women. Food assistance programmes that provide adequate access to healthy food rather than just enough calories should be developed (ICIMOD, 2020).

***Adopting Flexible, Smart Approaches***

It is necessary to adopt sensible approaches to make sure that ordinary food production continues. this will be done by maintaining physical distancing and following safety procedures, together with incorporating the required health associate degreed safety measures further as an inflated flexibility in sourcing labor, labor quality, and dealing time (Hepburn et al., 2020). As an example, if attainable, increase the quantity of shifts or amendment the operating hours to scale back the quantity of employees on a farm at a similar time. Agricultural merchandise or inputs might even be transported throughout off-peak hours, like at the hours of darkness or on weekends. Unhealthy foods ought to be discouraged, whereas nutrient and healthy foods ought to be rewarded, so as to enhance health and organic process outcomes. Human employees may well be replaced with machines wherever attainable while not poignant native workers' employment opportunities (van Bodegom and Koopmanschap, 2020). For example, it's been rumored that the govt. of Bangladesh provided subsidies to shop for harvesters so as to alleviate labour shortages throughout paddy harvest home (ICIMOD, 2020). This may scale back overdependence on food imports, as provide disruption throughout a crisis is usually exacerbated by measures to limit exports (van Bodegom and Koopmanschap, 2020). Home gardens and concrete agriculture may be a lot of resilient to shocks and disruptions, making certain that the urban poor have access to a lot of various and nutrient food (Lal, 2020). property fisheries and cultivation are vital sources of nutrition, further as a supply of financial gain and employment (Love et al., 2020).

***Maintaining Open and Functional Supply Chains during the Pandemic***

To keep offer chains open and purposeful throughout an epidemic, authorities should develop special channels and commonplace operational procedures to make sure the movement of food and agricultural inputs (Barrett, 2020). For instance, throughout the paddy gather season, the Bangladeshi government created special arrangements to make sure agricultural workers' transportation (FAO, 2020), As a result, crop injury was reduced. it is vital to strengthen native organizations, establishments, and platforms. Agricultural self-reliance, like home horticulture, ought to be promoted at the native and subnational levels (HLPE, 2020). At the native, regional, and national levels, governments ought to invest in improved territorial market infrastructure, additionally as support additional various and resilient distribution systems, like shorter offer chains and territorial markets. Another necessary strategy for mitigating shocks is to diversify import sources instead of looking forward to one one, so as to cut back fragility within the event of offer disruptions (Henry, 2020).

***Climate Change Resilience***

To reduce the negative effects of temperature change on agriculture and food systems, and applicable adaptation arranged with concrete measures is needed, that should be reciprocally reinforcing. Special attention ought to be paid to public health and therefore the conservation of natural resources very important to food production, likewise as rising farmers' livelihoods and adaptative capacities, once distinguishing adaptation measures (HLPE, 2019). distinguishing integrated choices that make synergies between food systems and public health, likewise as reducing trade-offs between food and climate mitigation, like reducing food loss and waste, are essential (Watts et al., 2020). Governments ought to develop applicable policies and techniques, likewise as give technical and institutional support and incentives to farmers and communities to adopt the proper, long-run solutions, like applicable cropping patterns, scientific discipline management, and resource property, as well as system conservation and fuel reduction (Everard et al., 2020).

***Improving Long-Term Sustainability***

One of the main aspects of food security is property. Non-judicious use of agrochemicals and inefficient use of groundwater have resulted in high GHG emissions, water and pollution, water and energy insufficiency, diverseness loss, and high health consequences (Fan et al., 2021). To minimize gas emissions and optimize the management of various ecosystems, it's important to boost agriculture's property and build stability within the production, process similarly as commercialism of food (Barbier and Burgess, 2020).

***Agriculture and Food System: Improving productivity and resource use efficiency***

The South Asian government ought to increase funding in agriculture and allied systems to boost efficiencies in each facet of the food system, together with resource use potency, so to spice up productivity, shut gaps in yields, and resource conservation (Pretty et al., 2018). Cropping patterns that are acceptable for the situation and correct agronomical measures e.g. crop rotation and multi-cropping practices may result in improved land-use potency and crop productivity whereas reducing reliance on chemical fertilizers (Tenzin et al., 2019).

**Creating a Support Network**

As proved by fast response mechanisms, a positive agricultural policy surroundings is needed for managing shocks and vulnerability. Governments ought to align policies, money investments, and institutional arrangements to form a lot of sanctioning environments. It's necessary to confirm coordinated coming up with and prioritizing activities that support multiple objectives so as to form a tributary surroundings for transformative modification (Rasul, 2020). Policies ought to additionally address risks throughout the food provide chain (including those sweet-faced by small-scale food producers), like storage, post-harvest losses, and food safety considerations (HLPE, 2020). They ought to develop and strengthen food, agriculture, and biological

science policies that improve nutrition whereas additionally serving to mitigate temperature change (Myers et al., 2017). They will do therefore by implementing acceptable practices, making sanctioning policies and establishments, and mobilizing the required resources. The government additionally facilitate worth chain stakeholders to create their capability to stay provide chains running throughout COVID-19 and different pandemics while maintaining safety and security, in order that they will adequately reply to future pandemics and different challenges.

**Advancing Research and Development (R&D)**

Innovation and analysis area unit essential elements of accelerating the potency and responsibleness of food systems; these additionally function as a foundation for long-run agriculture and food security (Henry, 2020). Government organizations ought to invest additional in analysis and innovation in order that the findings may well be wont to develop ways that to strengthen agriculture and food systems that meet organic process wants, improve public health and area unit climate-friendly in terms of resource conservation, system protection. Improved management practices for property intensification in agriculture, inflated crop resilience to environmental condition variability, droughts spells and soil salinity, and identification of acceptable adaptation and mitigation practices that enhance food system productivity while not degrading the surroundings area unit all needed analysis efforts. For instance, farmers area unit supplied with the varieties that area unit drought resistant.

## CONCLUSION

The COVID-19 pandemic scenario has dominated for over 2 years (2020 and 2021) of our life, not solely this however has conjointly light-emitting diode to regarding a pair of million loss of people's life, world-wide. The worldwide challenges of global climate change, best wildfires, floods and rising temperatures have conjointly attended the pandemic. Moreover, the case of pandemic might place a further strain on resources that have already been strained by global climate change, necessitating immediate action to avoid harmful human health risks. Therefore there's associate degree pressing ought to tackle these crises in some ways in addition as there may be a would like of strengthen policy and R&D.

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There is no conflict of interest whatsoever from any institution, journal or individual**.**

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All authors contributed equally.

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