



Available Online at EScience Press

# International Journal of Agricultural Extension

ISSN: 2311-6110 (Online), 2311-8547 (Print)

<https://esciencepress.net/journals/IJAE>

## COVID-19 OUTBREAK: CHALLENGES AND OPPORTUNITIES TOWARDS AGRICULTURE SECTOR

Rizwan A. Memon\*, Kamleshwer Lohana

Mehran University, Institute of Science and Technology Jamshoro, Sindh, Pakistan.

### ARTICLE INFO

#### Article History

Received: May 30, 2021

Revised: October 30, 2021

Accepted: September 11, 2021

#### Keywords

Covid-19 outbreak

Agriculture sector

Challenges

Policies

Farmers

### ABSTRACT

This study underscores the impact of Covid-19 outbreak on agriculture sector and highlights some sound practices to promote the agriculture growth, which are essential amid Covid-19. The primary aim of this research is to add the knowledge already available on the topic and sustain the agriculture growth amid of Covid-19 outbreak. The study revolves around its twin research question; what are the challenges to agriculture sector in amid of Covid-19 and how challenges may transmute into opportunities? The qualitative methodology is used with content analysis technique to collect the data collection. Content available in diverse formats related with neighbouring characteristics of impact of Covid-19 outbreak on agriculture. The results of this document enable us to wrap up the purpose of the research. There is need to improve, promote and digitalize agriculture sector in all dimensions, that can face and overcome the challenges, which are profound due to enforcement of lockdown after the Covid-19 outbreak. Government policy/role is an important factor to develop any type of strategy or development in this sector especially in value addition process. Local government can sustain local food commodity in domestic markets that will directly motivate farmers to focus on their production. No doubt, Covid-19 ascertains so many challenges for every business but right strategy on right time transform challenges into opportunities. Strategy refers some interest and priorities from government side to promote agriculture sector. This is the need of the time and essential for agriculturalists to stay in business.

Corresponding Author: Rizwan A. Memon

Email: [rizwanmuistd@gmail.com](mailto:rizwanmuistd@gmail.com)

© The Author(s) 2021.

### INTRODUCTION

A novel corona virus (Covid-19) originated from Wuhan, China in late December, 2019 has now affected almost all countries worldwide (Mackenzie and Smith, 2020). The world imposed smarmy lockdown on all social and economic activities of the countries Lockdown is showed quite effective for slow down the spread of corona virus but its impact on socio-economic lives of the people is remained long lasting (Shafi *et al.*, 2020). Majority of world's rural population belongs to agriculture sector in both perspective employment and income. Focusing on

developing countries, frequently falling of natural disasters and increasing pressure of climate change amid the outbreak of Covid-19 is posing serious challenges for the growth of agriculture sector (Stephens *et al.*, 2020; Memon, 2021). This pandemic is more vulnerable for underdeveloped countries, where majority of population labeled with rural framework and their living standard is not up to the basic<sup>1</sup> standard

<sup>1</sup> Basic standard refers food security is attained "when all people, at all times, have physical, social and

(Chazovachii, 2020; Ebrahim and Buheji, 2020). Generally, Asia region has a high crop intensity ratio 1.1 as compared to 0.7 in Americas and Europe (Jat *et al.*, 2016). A union of 20 Asian countries, namely Asian Productivity Organization (APO) established in 1961. APO is devoted to raise socioeconomic development and promote productivity in the Asia region. Pakistan is also one of the founding members of APO. In Asia region, agriculture sector has a massive importance in multidimensional reasons. It meets the basic consumer domestic needs, a source of foreign exchange earnings; it provides the inputs for manufacture industrial goods and catering a large number of employments (Tagar and Panhwar, 2010). This study is designed to bring out some sound strategies in attention to readers to make amendment in policies and implication approaches in order to oblige agriculture sector.

Since then, the epidemic has influenced hardly on the socio-economic nature of the world and agriculture sector is not except to influence. The aim of this research is to put knowledge from the existence documents on the topic and find out the answer of twin research question Amid of Covid-19 what are the challenges to agriculture sector and how challenges may translate into opportunities? Challenges refer some sudden change, those are ascertained by lockdown in agro food supply chain, agro food distribution structure, lack of labor availability, lack of raw material accessibility and food security management and production systems that weigh pressure on agriculture sector. Whereas, opportunities refer some sound state policies and right time state intervention resultant in rise of overall agro-goods productivity amid of Covid-19.

The world is experienced of multiple policy interventions amid pandemic, sometime open and close facets of the economy, governments are trying to maintain the balance of economic activity and spread of disease. The initial shock of pandemic outbreak disrupt agriculture sector in all magnitudes (Sharma *et al.*, 2020). In reality, agriculture has a great importance in all major economy purposes; it is the mainly contribute in economic growth, poverty reduction and food security of the country. Key resources of agriculture sector;

---

economic access to adequate and nutritious food that congregates their nutritional needs for an active and healthy life" (Kent *et al.*, 2020).

include soil and water assets, which are mainly responsible for agricultural productivity. Corona virus (Covid-19) pandemic has a negative impact on both lives and livelihoods of the people (Lauer *et al.*, 2020).

#### **Data sources and evidences from the literature**

The food is the basic necessity of human being and is a primary necessitate of life. Covid-19 epidemic hit hardly on demand of food, with a collapse of demand from catering, hotels, restaurants and closure of open markets. The necessary adjustment is required to tackle the food crisis. The Covid-19 epidemic contains big impact on consumption behavior of the people (Baker *et al.*, 2020; Naja and Hamadeh, 2020). Literature demonstrates the majority of smallholder farmers need cash handouts, while the concern ministry needs to provide subsidies on tariff and non-tariff agro-commodities (McGuire and Sperling, 2016; Cui *et al.*, 2018; Ceballos *et al.*, 2020). From the global, researchers pointed out the numerous approaches, and state intervention at domestic level is considered a primary obligation to sustain agriculture sector from the bottom surface. Some researchers' also sparse evidences for appropriate policy, reduction of cost and improvement in efficiency may play a vital role in growth of agriculture sector (Javaid and Nawaz, 2018; Chandio *et al.*, 2017).

The literature predicted the grain yield in wheat by utilizing a Normalized Difference Vegetation Index (NDVI) and carry out field experiments for reaction of NDVI for diverse wheat cultivars as well as for fertilizing of nitrogen by captivating data from 2008 to 2009 and from 2009 to 2010 and originated a significant correlation among NDVI booting, of grain filling, and for maturity stages with grain yield (Afghan *et al.*, 2013). The condition of food security via dietary intake method analyzed one fourth of the households as it was food insecure and by using the logistic regression analysis, they found size of family, monthly income, prices of food, expenses of health and debt as the main factors that had a great influence on the status of food security in rural households (Yousaf *et al.*, 2018; Ishaq *et al.*, 2018).

Existing literature suggests the role for donor fund or state is positively impact on all businesses then the business role emerges into a CSR corporate social responsibility by taking a case study for Sialkot football-manufacturing cluster in Pakistan and found the donor-

funded support of CSR had potential for facilitating joint access for SMEs of demanding consumers markets of developing countries. Then CSR in practical ultimately perform the activities to promote education at local district union council level, abundance of clean water in area and proper road infrastructure. India has always been known as greatest agriculture-based countries of the world. Many Indian researchers conducted their scholarly work on agro-product value addition and its quality that is much needed in this pandemic situation. Value addition is a practice of enchanting of a raw commodity into supplementary high quality end products; such an example from sub-continent tomato rate is low farmers are demolishing their tomato product rather than selling at very low rates in local markets. Government should take intervention; their tomato product is could be much useful, if it is used in producing tomato catch up. Farmers may get their value of their products. This is essential for future production. In other aspect the Covid-19 fears reduce the availability of labor for farming and cultivation process, it leads in reduction of agriculture commodities. Disruptions of food supply in markets may mean disruption of future productivity but positive intention of local market consumers/whole sellers and state intentions in terms

of policy may transform this challenge into opportunity. In terms of value added is figure out what the consumers want? Then transform product and make it as per prerequisite. This paper is designed to bring out some sound strategies in attention to readers to oblige agriculture sector.

**MATERIALS AND METHODS**

Study seeks to identify and value the consequences of the Covid-19 pandemic specifically in agriculture context. Documentary compilation was based on the available data and qualitatively, content analysis technique used. Available data sources include presented literature, books and book chapters formed by different scholars and scientists in the field of agriculture science. All are considered essential in understanding of Covid-19 outbreak is an opportunity to persuade sustainable development in agriculture sector. The bibliographic search was conducted on Google Scholar, B-ON, Science direct and SCILIT databases. The article search followed the expressions in the title and abstract: “Covid-19”, “Agriculture”, “Public Policies”, “Challenges” “State intervention” and “Sustainability”. Table 1 shows the number of documents collected and analyzed and the year of publication.

Table 1. Documents analyzed and year of Publication.

Type of Document				Year of Publications			
Report	Theoretical	Opinion/View point	Empirical	2021	2020	2019	Prior to 2019
2	21	2	24	6	34	2	10
<b>Total publications=51</b>							
<b>Sources: Author’s own compilation</b>							

All selected documents were fully read to carry out the objective of analyzing the consequences of Covid-19 pandemic on agriculture sector.

**RESULTS**

The Covid-19 pandemic changes world flourishing economies into recession. The countries either developed or under developed had to take urgent and influential measures to lessen the longer impact of pandemic on their country’s economy. In this paper, authors first analyze the impact of Covid-19 on agriculture sector and then underline the best practices of the world to promote the sustainable development in agriculture sector. In response the first part of the

research question.

“What are the challenges to agriculture sector amid of Covid-19 outbreak?”

**COVID-19 outbreak: Food distributional system**

The rises in population demand rise in food, still agriculture sector has potential to provide but right strategy from state and right value addition of food items is initial obligation to face the pandemic challenges. The Covid-19 outbreak extensively dislocates food supply chains athwart all main agro-products all over the world. It also expected a considerable pressure on agriculture sector. Food supply chain refers a process by which consumers supplied food products through

agro-food supply chain. Normally, food is produced in rural parts of the countries and distributed to cities to meet urban needs dietary necessities. The impact of Covid-19 on distributional channel, ban on local national and international transportations creates fear in farmers to produce the food (Pu and Zhong, 2020).

The distributional channels of food are under risk as never before. China mitigates this challenge with an unprecedented scale of safety control measures across the country, the national emergency food supply system (NEFSS) takes this responsibility and successfully delivered the supply of food all over the country. In addition, the China successfully run initiatives "Cereal Bag Provincial Governor Responsibility Mechanism (CBPGRM) and another related approach "Food Basket Mayor Responsibility Mechanism (FBMRM) in response to build more sustainable food system to protect domestic agricultural production (Zhan and Chen, 2021). To establish flourishing Food Distributional System required some serious intention and strategies from the all agro-end users.

#### **COVID-19 Outbreak: Food safety and security**

Since Corona virus appearance in December, 2019, it is

being spreading on accelerating pace. According to Food Agriculture Organization (FAO, 2020), the corona virus is a global crisis and has a great impact on food and agriculture sector. The pandemic has created a disruption in food security of billion people on the risk rope (Mouloudj *et al.*, 2020). The developing countries of Asia Pacific region are facing worse situation regarding the food security and safety. Food insecurity refers less economic access to the people, transportation constraints, low purchasing power, lack of awareness, lack of understanding of tools and techniques of food safety and shortage of labor (Huss *et al.*, 2021). Several food protective measures are undertaken by various countries around the globe. Hazard analysis and critical control point (HACCP) approach widely practiced and succeeded in mitigating the challenge of food insecurity amid of Covid-19 pandemic. Researchers also suggest some government interventions to keep international trade on line such as; fertilizers, grains, pesticides and other agro-food import and export to stays alive in agro-business (Clapp and Moseley, 2020). Moreover, Global Food Security Index used different indicator to measure in between 113 countries food quality and safety as defined in Table 2.

Table 2. Global Food Security Index (GFSI) rankings among some same level countries (The Economist, 2020).

Global Ranking	Country Name	Overall Score (0-100)	Quality and Safety
62	Indonesia	62.6	47.1
64	Philippines	61	50.3
66	Sri Lanka	60.8	52.4
72	India	58.9	47
78	Pakistan	56.8	43.6
79	Nepal	56.4	53.7
83	Bangladesh	53.2	30.6

This report shows food security is deteriorating in countries before the maturity hit of the Covid-19. This report released in March, 2020. It was an initial time of pandemic. The overall score plus quality and safety of food was reduced hardly after the mature period Covid-19 (Worstell, 2020).

#### **COVID-19 Outbreak: Labor availability**

Labor is a necessary component in agriculture perspective, from farm to fork. However, the effect of pandemic on labor place on limiting labor movement.

The Covid-19 pandemic has become the sharper focus for labor unavailability. Taking the example of restaurants, hotels and bars struggles to sale their foods, which ultimately reduce the demand of labor. Similarly, food growers stressed to produce product which is going to less in demand amidst in this pandemic (Luckstead *et al.*, 2021). Labor is essential in all aspect of agro-production to process to distribution to delivery. In addition, sudden closures of all food manufacturers industries, hotels and restaurants caused substantial disruptions in demand of food and labor. Good practices

considered, US government add additional measures to ensure strong labor force, potential hindering quality control with the support of their federal food safety inspectors (Coibion *et al.*, 2020). US government also eased H-2A visa rule (waived in-person interview) to promote contingency visitor workers (Flocks, 2020).

### **COVID-19 outbreak: Agri-production capacity and sustainability**

The hammering in harvest would decline production deal for the following and upcoming seasons. On one hand the demand of food products decreases that lay down their prices and on other hand the costs of products increase during the pandemic. In China, a survey was conducted with grain producers; results reveal 20 percent of increase in prices of seeds, pesticides and fertilizers (Pu and Zhong, 2020). Australia is a developed country with proficiency in food production, but despite this, it has been projected 4.5% loss in economy prior to the Covid-19 epidemic (Neef, 2020; Seleiman *et al.*, 2020). In many countries, the measure of epidemic put in place since the virus outbreak, resultant to disrupt the supply of agro-food commodities to international, national and local markets and restriction and response from the consumers, both within and across the borders (Stanciu *et al.*, 2020).

Productivity falls down due to limited market availability and agro-processors could not access raw materials (Adam *et al.*, 2020). Food growers have not any fix incentives and capacity to carry on farming without the earnings. Chinese government taken this issue seriously, the government issued 16 importunate notices to ensure sufficient supply of food, operative and efficient logistics for distribution agricultural inputs and supply chain from local to national balance. The notices main focus was on to sustain agriculture production and focus on transportation (Fei *et al.*, 2020).

In response to second part of research question. How challenges may translate into opportunities amid of Covid-19 outbreak?

The African countries dealt with COVID-19 pandemic to unlock its agricultural potential through the commitment to harmonizing food trade rules and policies and rationalize tariff and non-tariff hurdles via the coordination of policies and practices across the Africa's Regional Economic Communities (RECs) in somehow and in some regions proved a game changer in this epidemic (Morsy *et al.*, 2020). The African

Continental Free Trade Agreement (AfCFTA) defined trade with neighbor countries would help the region enhance its scale production capacity and enhance competitiveness through domestic market enlargement (Banga *et al.*, 2020).

Australian government has taken some good measures to facilitate its agriculture sector. Especially grant permission for agriculture workers to travel between regions. Extension of visas, for the overseas' agricultural workers in Australia, ultimately encourage farmers to offer maximum time and focus on their field work. In addition, accelerated deployment of improved crop varieties using emerging genetic technologies could contribute significantly to the delivery of the productivity gains required to ensure food security (Henry, 2020).

The Indonesian Bureau of Logistic (BULOG) a well-known government agency that manages food distribution, food prices and food stock across the country. The agency is relevant especially monitoring agro-food progress is proved essential part in mitigating the influence of pandemic (Rozaki, 2020). In Asia region some innovative crops have been cultivated by farmers in this year including pulses, oilseeds and vegetables. Provincial government subsidy and fairly distribution of local government has been considered a positive impact on innovative agriculture development. The approach to innovative food idea, a genotype term comes in mind. Some developed countries are builds smart cities and develop controlled environment (genetic type) of smart agro-cultivation for sustainable agriculture development, despite the consequences of pandemic or any natural disaster. These all actions are mainly concerned to promote the agriculture business, challenges laid down into opportunities. Food growers may remain afloat amid of crisis time (Covid-19 outbreak).

### **CONCLUSION AND RECOMMENDATIONS**

The Covid-19 outbreak is having a profound influence on agriculture. Future food corridors of adjustment are not easier to detect. States need to make a farmer friendly policy and develop better strategy to promote the agriculture result from their respective regions (Barrett, 2020). Large or small regions need to act together, under their respective unions so called trade unions to negotiate their goods at city and district level (Laborde *et al.*, 2020). A national or provincial department should take responsibility of accountability and monitor the

progress of agriculture production. If appropriate strategies are not taken at the time, it is expected that some farmers may switch crop type and some may close farming completely.

Covid-19 ascertains a great impact on the actions and behaviors of humanity; agriculture sector is not the exterior from this impact. No doubt, pandemic make certain many challenges for every business but right strategy on right time transforms challenges into opportunities. Strategy refers some interest and efforts of state side towards the agriculture development. Such practices, US government eased in H-2A visa policy for guest farmers.

Time to act, it is recognized and the Covid-19 outbreak creates some serious challenges for agriculture sector, although it also indicates towards the significant opportunities such as; focus on the trade communication within the closer local markets, friendly state policy encapsulates innovative growth in agriculture sector and local administration's focus on the availability of goods in local market is another easy way to sustain development in agriculture sector at local district and provincial level.

## REFERENCES

- Adam, C., M. Henstridge and S. Lee. 2020. After the lockdown: macroeconomic adjustment to the COVID-19 pandemic in sub-Saharan Africa. *Oxford Review of Economic Policy*, 36: S338-S58.
- Afghan, S., Z. Hussnain, K. Ali and A. Shahzad. 2013. Performance of promising sugarcane clones developed from imported fuzzi (true seed) in Pakistan. Place Published.
- Baker, S. R., R. A. Farrokhnia, S. Meyer, M. Pagel and C. Yannelis. 2020. How does household spending respond to an epidemic? Consumption during the 2020 COVID-19 pandemic. *The Review of Asset Pricing Studies*, 10: 834-62.
- Banga, K., J. Keane, M. Mendez-Parra, L. Pettinotti and L. Sommer. 2020. Africa trade and Covid-19.
- Barrett, C. B. 2020. Actions now can curb food systems fallout from COVID-19. *Nature Food*, 1: 319-20.
- Ceballos, F., S. Kannan and B. Kramer. 2020. Impacts of a national lockdown on smallholder farmers' income and food security: Empirical evidence from two states in India. *World Development*, 136: 105069.
- Chandio, A. A., H. Magsi, A. Rehman and J. G. M. Sahito. 2017. Types, sources and importance of agricultural credits in Pakistan. *Journal of Applied Environmental and Biological Sciences*, 7: 144-49.
- Chazovachii, B. 2020. Understanding Strategies for Resilient Livelihoods by Masvingo Urban's Vulnerable Groups During the Covid-19 Pandemic in Zimbabwe. *African Journal of Governance & Development*, 9: 139-59.
- Clapp, J. and W. G. Moseley. 2020. This food crisis is different: COVID-19 and the fragility of the neoliberal food security order. *The Journal of Peasant Studies*, 47: 1393-417.
- Coibion, O., Y. Gorodnichenko and M. Weber. 2020. Labor markets during the COVID-19 crisis: A preliminary view. National Bureau of Economic Research. Place Published.
- Cui, Z., H. Zhang, X. Chen, C. Zhang, W. Ma, C. Huang, W. Zhang, G. Mi, Y. Miao and X. Li. 2018. Pursuing sustainable productivity with millions of smallholder farmers. *Nature*, 555: 363-66.
- Ebrahim, A. H. and M. Buheji. 2020. A Pursuit for A 'Holistic Social Responsibility Strategic Framework' Addressing COVID-19 Pandemic Needs. *American Journal of Economic*, 10: 293-304.
- Fei, S., J. Ni and G. Santini. 2020. Local food systems and COVID-19: an insight from China. *Resources, Conservation, and Recycling*.
- Flocks, J. 2020. The potential impact of COVID-19 on H-2A agricultural workers. *Journal of agromedicine*: 1-3.
- Henry, R. 2020. Innovations in agriculture and food supply in response to the COVID-19 pandemic. *Molecular plant*, 13: 1095-97.
- Huss, M., M. Brander, M. Kassie, U. Ehlert and T. Bernauer. 2021. Improved storage mitigates vulnerability to food-supply shocks in smallholder agriculture during the COVID-19 pandemic. *Global Food Security*, 28: 100468.
- Ishaq, A., M. Khalid and E. Ahmad. 2018. Food Insecurity in Pakistan: A Region-Wise Analysis of Trends. Pakistan Institute of Development Economics (PIDE) Working Papers, 157.
- Jat, M. L., J. C. Dagar, T. B. Sapkota, B. Govaerts, S. Ridaura, Y. S. Saharawat, R. K. Sharma, J. Tetarwal, R. K. Jat and H. Hobbs. 2016. Climate change and agriculture: adaptation strategies and mitigation opportunities for food security in South Asia and

- Latin America. *Advances in agronomy*, 137: 127-235.
- Javaid, A. and S. Nawaz. 2018. Review analysis on Agricultural Sector in Pakistan. *International Journal of Research and Innovation in Social Sciences*, 2: 93-94.
- Kent, K., S. Murray, B. Penrose, S. Auckland, D. Visentin, S. Godrich and E. Lester. 2020. Prevalence and socio-demographic predictors of food insecurity in Australia during the COVID-19 pandemic. *Nutrients*, 12: 2682.
- Laborde, D., W. Martin, J. Swinnen and R. Vos. 2020. COVID-19 risks to global food security. *Science*, 369: 500-02.
- Lauer, S. A., K. H. Grantz, Q. Bi, F. K. Jones, Q. Zheng, H. R. Meredith, A. S. Azman, N. G. Reich and J. Lessler. 2020. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. *Annals of internal medicine*, 172: 577-82.
- Luckstead, J., R. M. Nayga Jr and H. A. Snell. 2021. Labor Issues in the Food Supply Chain Amid the COVID-19 Pandemic. *Applied Economic Perspectives and Policy*, 43: 382-400.
- Mackenzie, J. S. and D. W. Smith. 2020. COVID-19: a novel zoonotic disease caused by a coronavirus from China: what we know and what we don't. *Microbiology Australia*, 41: 45-50.
- McGuire, S. and L. Sperling. 2016. Seed systems smallholder farmers use. *Food Security*, 8: 179-95.
- Memon, R. A. 2021. A Comparative Study on Women Perception and Condition In the Event of Natural Disaster and Migration: A Qualitative Study from Sindh–Pakistan Flood 2010. *Journal of Governance Risk Management Compliance and Sustainability*, 1: 50-61.
- Morsy, H., A. Salami and A. N. Mukasa. 2020. Opportunities amid COVID-19: Advancing intra-African food integration. *World Development*, 139: 105308.
- Mouloudj, K., A. C. Bouarar and H. Fehit. 2020. The impact of COVID-19 pandemic on food security. *Les cahiers du CREAD*, 36: 159-84.
- Naja, F. and R. Hamadeh. 2020. Nutrition amid the COVID-19 pandemic: a multi-level framework for action. *European journal of clinical nutrition*, 74: 1117-21.
- Neef, A. 2020. Legal and social protection for migrant farm workers: lessons from COVID-19. *Agriculture and Human Values*, 37: 641-42.
- Pu, M. and Y. Zhong. 2020. Rising concerns over agricultural production as COVID-19 spreads: Lessons from China. *Global Food Security*, 26: 100409.
- Rozaki, Z. 2020. COVID-19, agriculture, and food security in Indonesia. *Reviews in Agricultural Science*, 8: 243-60.
- Seleiman, M. F., S. Selim, B. A. Alhammad, B. M. Alharbi and F. C. Juliatti. 2020. Will novel coronavirus (Covid-19) pandemic impact agriculture, food security and animal sectors? *Bioscience Journal*, 36.
- Shafi, M., J. Liu and W. Ren. 2020. Impact of COVID-19 pandemic on micro, small, and medium-sized Enterprises operating in Pakistan. *Research in Globalization*, 2: 100018.
- Sharma, R., A. Shishodia, S. Kamble, A. Gunasekaran and A. Belhadi. 2020. Agriculture supply chain risks and COVID-19: mitigation strategies and implications for the practitioners. *International Journal of Logistics Research and Applications*: 1-27.
- Stanciu, S., R. I. Radu, V. Sapira, B. D. Bratoveanu and A. M. Florea. 2020. Consumer Behavior in Crisis Situations. *Research on the Effects of COVID-19 in Romania. Annals of the University Dunarea de Jos of Galati: Fascicle: I, Economics & Applied Informatics*, 26.
- Stephens, E. C., G. Martin, M. van Wijk, J. Timsina and V. Snow. 2020. Impacts of COVID-19 on agricultural and food systems worldwide and on progress to the sustainable development goals. *Agricultural Systems*, 183: 102873.
- Tagar, H. K. and I. Panhwar. 2010. Agricultural credit in Sindh: issues and recommendations. *Australian Journal of Basic and Applied Sciences*, 4: 4099-106.
- Worstell, J. 2020. Ecological resilience of food systems in response to the COVID-19 crisis. *Journal of Agriculture, Food Systems, and Community Development*, 9: 23-30.
- Yousaf, H., M. I. Zafar, F. Anjum and S. A. Adil. 2018. Food security status and its determinants: a case of farmer and non-farmer rural households of the Punjab, Pakistan. *Pakistan Journal of Agricultural Sciences*, 55.

Zhan, Y. and K. Z. Chen. 2021. Building resilient food system amidst COVID-19: Responses and lessons

from China. *Agricultural Systems*, 190: 103102.

**Publisher's note:** EScience Press remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made. The images or other third-party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.