Impact of COVID-19 on the production of farmers in Raipur district of Chhattisgarh

ABSTRACT

Background: The backbone of the Indian financial system, and the main source of income in rural India, is agriculture. The COVID-19 illness significantly impacted the agricultural supply chain, from the industrial hub to the final consumer. This article begins by analyzing the many strategies that have a bearing on farmer's production. the overall impact while throwing a bit of challenge across in all the sectors but in terms of production it was seen as positive.

Methods: The agricultural years 2019–20 & 2020–21 serve as the study's reference period. By selecting sample villages, the study's data were gathered from 300 households and 50 migrant and non-migrant workers in the Chhattisgarh district of Raipur.

Result: We found that the maize crop had the highest yield loss mostly -5.13 per cent which is due to untimely harvest and unavailability of labours. Also, lak/teora crop yield decreased by -2.83 per cent. Also, we can see from the table that the yield of paddy, vegetables (Bitter guard, brinjal ladies finger and bottle guard), and Arhar had increased by 16.18, 60.76, 61.39, 39.87, 59.74 and 14.28 per cent respectively from previous years yield. The real impact in the case of crop production was seen in the prices of farm produce. The return of migrant workers also increased production; it was found from the study that agriculture was the only source of income for every household during the lockdown. Farmers experienced a shortage of agricultural inputs like seeds, fertilizers, and pesticides as a result of world trade disruption.

Keywords: COVID-19, Coronavirus, Production, Crop yield, Pandemic.

1. Introduction

Since that various pandemics have occurred on multiple occasions, global pandemics are not a new phenomenon for humanity (Table 1). Every pandemic has had an effect on human activity and economic growth around the world. COVID-19 is what we are presently dealing with (corona virus disease of 2019). The virus COVID-19 is caused by the severe acute respiratory syndrome-causing coronavirus 2 (COVID-2) (SARS-CoV-2). The rare infectious respiratory disease known as COVID-19, which initially surfaced in Wuhan, Hubei province, China, in December

2019, was given that name by the World Health Organization. 2020 (Chakraborty et al.). The COVID-19 pandemic is the greatest humanitarian threat to humanity since World War II.

Agriculture and food security are two of the most important sectors for human development (Abdelhedi and Zouari, 2018; Lopez-Ridauraet al., 2019). Agriculture and allied businesses are crucial for the sustained sustainable growth and development of the Indian economy. It significantly contributes to meeting the 1.3 billion Indians' nutritional and food demands, which are closely related to production, employment, and demand generation (GoI, 2016). A lot of focus has been placed on agriculture, food, and nutrition as a result of the COVID-19 problem in India. Agriculture, forestry, and fisheries are expected to have a -1.3 percent decline between April and June 2020. (The Statistica, 2020).

The agriculture industry accounts for 17% of the Indian economy, which is larger than the manufacturing sector. Approximately 263 million people engage in the agriculture industry in India, more than half of them are agricultural labourers who do not own their own farms but instead work for pay on those of others. The COVID-19 pandemic first impacted this population group very hard. The worst aspect of the oppressive social restriction used to be that it fell during the height of the nation's seasonal crop harvest. Fruits and vegetables had reached their peak of ripeness, and rice and tiwda (lakhdi) crops were ready for harvest, which might have a detrimental effect on a farmer's revenue.

Table 1 Main pandemics from the 20th century

Name	Time period	Type	Death toll	Reference
Spanish Flu	1918-1919	H1N1	More than 50M	Farmer (2019)
Asian Flu	1957-1958	H2N2 virus	1.15M	Du et al. (2009)
Hong Kong Flu	1968-1970	H3N2 virus	700,000 and 1M	Wang-Shick (2017)
HIV/AIDS	1981-present	Virus	32M (estimate, March 2020)	WHO (2020b)
COVID-19	2019-Present	Coronavirus	More than 63 million (June 2022)	WHO (2020c)

(M:Million)

Research hypothesis:

Null (H_0): There is no significant relationship between happenings of COVID-19 and production in the study area

Alternative (H_1): There is a significant relationship between the happenings of COVID-19 and production in the study area.

2. Materials and methods

In Chhattisgarh's Raipur area, this study was designed to examine the effects of the coronavirus (COVID-19) on agricultural output. Both primary and secondary data were used to inform this study. Primary data was collected from the farmers using a personal interview method, a well-planned schedule, and a questionnaire. Secondary data was gathered from Census reports, the Labor Bureau, Chhattisgarh, the Government of Chhattisgarh, the Directorate of Economics and Statistics, and various reputable journals, articles, and books. The agricultural years 2019–20 & 2020–21 serve as the study's reference period. By selecting sample villages, the study's data were gathered from 100 (Marginal farmers), 120 (Small farmers), 50 (Medium farmers) and 30 (Large farmers) a total of 300 households in the Chhattisgarh district of Raipur.

Tabular and Percentage analysis were used to find out the impact of COVID-19 on production, Agricultural production (crop type, harvest, what was done with the harvest, and sowing), harvest cost, transport cost, and government support programmes were summarized using descriptive statistics. We used chi-square tests to look for differences in these parameters based on farm size (for binary and categorical variables). A Paired sample t-test has been used to explore the difference in crop yield before and after COVID19 pandemic. *P* values less than 0.05 were considered statistically significant.

3. Results and Discussion

3.1 Impact of COVID-19 on production

The impact of COVID-19 on agricultural production is discussed under table 2. A majority of the sampled farmers 58.33 per cent were able to harvest their crop during lockdown period. Majority of respondents had harvested paddy 62.57 per cent followed by vegetables 23.97 per cent, pulses 8.77 per cent, maize 6.43 per cent and a significant difference were found according to farm size ($\chi2$=25.38, df =9, p-value <0.05). For those who did harvest, the majority of respondents 58.06 per cent were able to sell their crop; 11.29 per cent stored it due to lockdown-related problems, such as a low market price; 4.3 per cent said their produce was wasted since they were unable to sell it, and in few ,instances 18.27 and 1.61 per cent were still attempting to sell their crops. A significant difference was found between these percentages ($\chi2$=24.15, df=12, p-value <0.05). In terms of change in area harvested majority of respondents 66.09 per cent did not find any change in area harvested, 27.01 per cent of respondents harvested area had increased and only 6.89 per cent of respondents harvest area decreased and no significant difference was found according to farm sizes ($\chi2$=5.50, df=6, p-value 0.46). A majority of the sampled farmers 82.18 per cent reported no yield loss due to COVID-19 pandemic but according to farm sizes, no significant difference was found ($\chi2$=1.81, df=3, p-value 0.61). Out of total sampled farmers, 59.88 per cent reported higher cost to harvest, 24.41 per cent of sampled farmers cost to harvest remained the same as the previous year's cost and 15.69 per cent reported lower cost to harvest crops and a significant difference was found in the cost of harvesting according to farm sizes ($\chi2$=18.93, df=6, p-value <0.05). Also, 57.77 per cent of sampled farmers faced higher transportation costs, 41.66 per cent found no change in transportation costs and only 0.55 per cent had reported a lower cost of transportation and a significant difference was found in transportation costs according to farm sizes ($\chi2$=31.96, df=6, p-value <0.05). Additionally, 60 per cent of respondents expressed concern about how the lockdown affected their ability to sow for the future season, and substantial differences were not discovered based on farm sizes ($\chi2$=5.23, df=3, p-value=0.15

Table: 2 Impact of COVID-19 pandemic on agricultural production, according to farm size.

S.N.	Characteristics	Marginal (n=100)	Small (n=120)	Medium (n=50)	Large (n=30)	Overall	P value
1.	Able to harvest crop						
	a. Out of season	46 (46.00)	35 (29.16)	9 (18.00)	2 (6.66)	23 (30.66)	<0.00001
	b. Yes	47 (47.00)	76 (63.33)	27 (54.00)	25 (83.33)	43.75 (58.33)	
	c. No	7 (7.00)	9 (7.50)	14 (28.00)	3 (10.00)	8.25 (11.00)	

2.	Primary crop harvest						
	a. Paddy	33 (71.73)	50 (65.78)	14 (51.85)	10 (40.00)	26.75 (62.57)	<.05
	b. Maize	0 (0.00)	4 (5.26)	0 (0.00)	7 (28.00)	2.75 (6.43)	
	c. Vegetables	13 (28.26)	18 (23.68)	5 (18.51)	5 (20.00)	10.25 (23.97)	
	d. Pulses	0 (0.00)	4 (5.26)	8 (29.62)	3 (12.00)	3.75 (8.77)	
3.	What was done with the crop harvested:						
	a. Sold it	26 (56.52)	52 (68.42)	14 (51.85)	16 (64.00)	27 (58.06)	<.05
	b. Stored it	0 (0.00)	4 (5.26)	8 (29.62)	9 (36.00)	5.25 (11.29)	
	c. Trying to sell it	14 (30.43)	16 (21.05)	4 (14.81)	0 (0.00)	8.5 (18.27)	
	d. Not yet decided	0 (0.00)	2 (2.63)	1 (3.70)	0 (0.00)	0.75 (1.61)	
	e. Wasted	6 (13.04)	2 (2.63)	0 (0.00)	0 (0.00)	2 (4.30)	
4.	Change in area harvested						
	a. Decreased	0 (0.00)	12 (15.78)	0 (0.00)	0 (0.00)	3 (6.89)	0.46
	b. Increased	12 (26.08)	20 (26.31)	9 (33.33)	6 (24.00)	11.75 (27.01)	
	c. No change	34 (73.91)	44 (57.89)	18 (66.66)	19 (76.00)	28.75 (66.09)	
5.	Yield loss						
	a. Yes	7 (15.21)	23 (30.26)	1 (3.70)	0 (00.00)	7.75 (17.81)	0.61
	b. No	39 (84.78)	53 (69.73)	26 (96.29)	25 (100.00)	35.75 (82.18)	
6.	Change in cost of harvest						
	a. Higher	21 (45.65)	45 (59.21)	18 (46.00)	19 (50.00)	25.75 (59.88)	<.05
	b. Lower	11 (23.91)	15 (19.73)	1 (18.00)	0 (20.00)	6.75 (15.69)	
	c. Remained same	12 (26.08)	16 (21.05)	8 (36.00)	6 30.00)	10.5 (24.41)	
6.	Change in transport cost						
	a. Higher	35 (76.08)	46 (60.52)	6 (42.00)	9 (43.33)	26 (57.77)	<.05
	b. Lower	0 (0.00)	0 (0.00)	0 (4.00)	1 (13.33)	0.25 (0.55)	
	c. Remained same	9 (19.56)	30 (39.47)	21 (54.00)	15 (43.33)	18.75 (41.66)	
7.	Lockdown impacted the potential to sow for the upcoming season						
	a. Yes	69 (69.00)	62 (51.66)	29 (58.00)	20 (66.66)	45 (60.00)	<.05
	b. No	31 (31.00)	58 (48.33)	21 (42.00)	10 (33.33)	30 (40.00)	

Note: Figures in the parenthesis indicates percentage to the total farm sizes

3.2 Impact of COVID-19 pandemic on crop yield

Average crop yield is represented in table 3 from the table we can see that the maize crop had the highest yield loss mostly -5.13 per cent which is due to untimely harvest and unavailability of labours. Also, lak/teora crop yield decreased by -2.83 per cent. Also, we can see from the table that the yield of paddy, vegetables (Bitter guard, brinjal ladies finger and bottle guard), and Arhar had increased by 16.18, 60.76, 61.39, 39.87, 59.74 and 14.28 per cent respectively from previous years yield. A dependent t-test revealed there was a significant difference in yield before and after COVID-19 (t value= 2.43, df= 7, p-value 0.045). The result was significant at $p<0.05$. The follow-up question revealed that the lockdown allowed growers to spend more time in the crop fields, which contributed to the rise in crop yield. The return of migrant workers also increased production; it was found from the study that agriculture was the only source of income for every household during the lockdown.

Table: 3 Average crop production before and after COVID-19 pandemic.

Crops	**Yield in quintal before COVID-19**	**Yield in quintal after COVID-19**	**Difference**	**Difference percent**	**Dev (Diff-M)**
Paddy	45.59	52.97	7.38	4.75	4.75
Maize	35.26	32.76	-2.5	-5.13	-5.13
Bitter guard	7.08	11.99	4.91	2.28	2.28
Brinjal	4.87	7.86	2.99	0.36	0.36
Ladies finger	6.42	8.98	2.56	-0.07	-0.07
Bottle guard	2.81	6.98	4.17	1.54	1.54
Arhar	11.18	12.92	1.74	-0.89	-0.89
Lak/Tiwra	7.88	7.68	-0.2	-2.83	-2.83
Mean of difference			2.63		

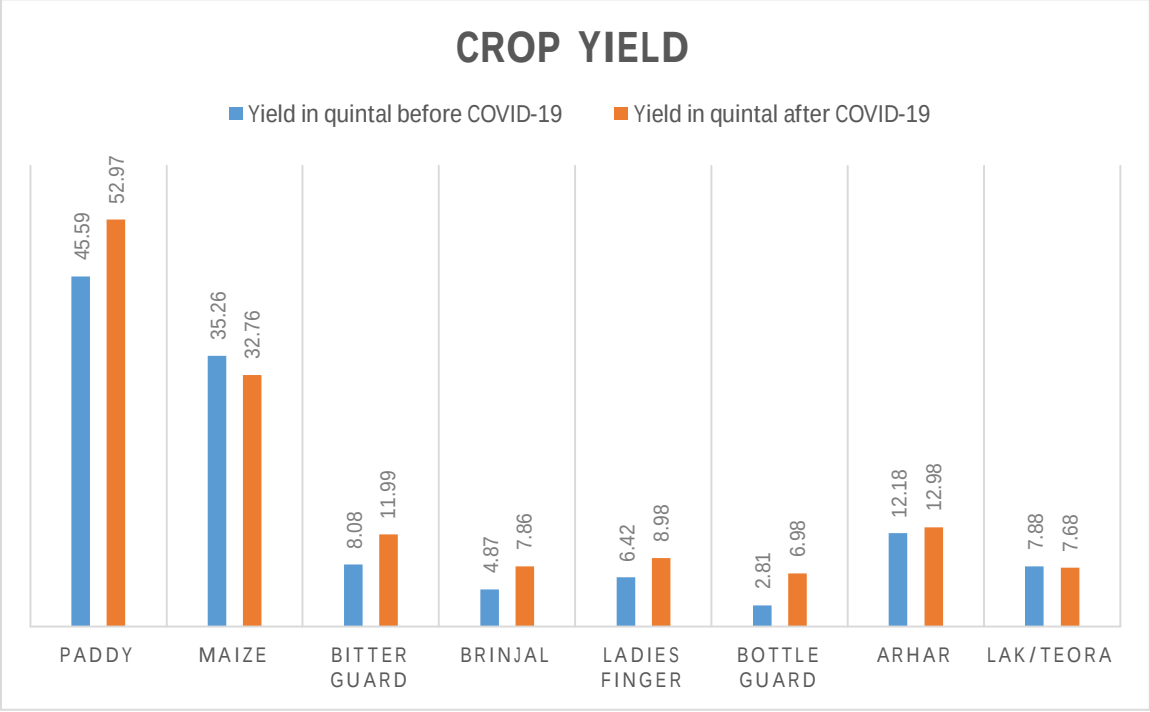

Fig.1 Average crop yield before and after COVID-19 pandemic

3.3 Perception of sampled farmers on impact of COVID-19 on availability of agricultural inputs

Table: 4 Perception of farmers on impact on availability of agricultural inputs and prices of inputs

S.N.	Characteristics	Marginal (n=100)	Small (n=120)	Medium (n=50)	Large (n=30)	Overall	P value
1.	Availability of inputs during lockdown						
	a. Increased	26 (26.00)	24 (20.00)	20 (40.00)	19 (63.33)	22.25 (29.66)	<0.05
	b. Decreased	43 (43.00)	48 (40.00)	17 (34.00)	7 (23.33)	28.75 (38.33)	
	c. No change	31 (32.00)	48 (40.00)	13 (26.00)	4 (13.33)	24.00 (32.00)	
2.	Price of agricultural inputs during lockdown						
	a. Increased	52 (53.00)	59 (48.73)	28 (56.00)	20 (66.66)	39.75 (53.00)	<0.05
	b. decreased	13 (13.00)	8 (7.61)	9 (18.00)	6 (20.00)	9 (12.00)	
	c. Remained same	35 (35.00)	53 (43.65)	13 (26.00)	4 (13.33)	26.25 (35.00)	

Farmers experienced a shortage of agricultural inputs like seeds, fertilizers, and pesticides as a result of world trade disruption. The impact on agricultural inputs and prices of inputs is represented in table 4. Overall majority of respondents 28.75 per cent reported the availability of agricultural inputs had decreased, followed by 24.00 per cent who reported no change and about 22.25 per cent reported an increase in agricultural input availability and the availability of agricultural inputs was significantly higher in large farmers according to farm sizes ($\chi 2=27.64$, df=6, p-value <0.05). Out of all sampled farmers, 39.75 per cent reported an increase in input prices, 26.25 per cent reported no change in price, and the remaining 9.00 per cent reported decrease in input prices. The price of agricultural inputs also showed a significant difference (2=16.94, df=6, p-value 0.05). In order to produce crops in the Kharif season, Singh estimated that India alone needs 250 lakh quintals of seed. If the pandemic persisted, this would likely have an impact on the sowing of crops in the zaid and Kharif seasons. Thus, import relying countries are believed to be particularly affected by the pandemic

3.4 Perception of sampled farmers on impact of COVID-19 on availability of agricultural labour

Table: 5 Impact of COVID-19 on availability of agricultural labours it shows out of total 47.25 per cent used own labour for field operations, followed by 19.66 per cent used hired labour and 17.33 per cent used both own and hired labours for farm operations, landless and marginal/small farmers significantly used more own labour ($\chi 2=68$, df=6, p-value <0.00001). 20.53 per cent reported an increase in the availability of agricultural labour, while 57.57 per cent reported a decline in labour availability. Also, 21.88 per cent reported no changes in availability of labours. There was no evident difference in labour availability according to farm sizes (2=9.23, df=6, p-value 0.16).

Additionally, 41.66 per cent reported a rise in labour pay, 31.33 per cent reported the same pay as the prior year, and 27.00 per cent reported a fall in labour pay and a significant difference in labour pay according to farm sizes was discovered (p-value = 0.05, df = 6, $\chi^2=26.12$). The agriculture industry in India relies on migrant labours for several tasks, from planting seeds to harvesting and threshing, whether in the form of expert or unskilled farm labour.

Table 5 Impact on availability of labours during COVID-19 pandemic.

S.N.	Characteristics	Marginal (n=100)	Small (n=120)	Medium (n=50)	Large (n=30)	Overall	P value
1.	Labour used						

	a. Own	79 (79.00)	79 (65.83)	31 (62.00)	3 (6.66)	47.25 (63.00)	<0.00001
	b. Hired	13 (13.00)	14 (11.66)	17 (34.00)	19 (63.33)	14.75 (19.66)	
	c. Both	8 (8.00)	27 (22.50)	2 (4.00)	8 (26.66)	13 (17.33)	
2.	Availability of labours						
	a. Increased	21 (21.00)	33 (27.50)	3 (6.00)	4 (13.33)	15.25 (20.53)	0.16
	b. Decreased	48 (48.00)	80 (66.66)	26 (52.00)	17 (56.66)	42.75 (57.57)	
	c. No change	30 (30.00)	5 (4.16)	21 (42.00)	9 (30.00)	16.25 (21.88)	
3.	Wages of agricultural labours						
	a. Increased	44 (44.00)	48 (40.00)	17 (34.00)	16 (53.33)	31.25 (41.66)	<0.05
	b. Decreased	30 (30.00)	26 (21.66)	14 (28.00)	11 (36.66)	20.25 (27.00)	
	c. No change	26 (26.00)	46 (38.33)	19 (38.00)	3 (10.00)	23.5 (31.33)	

Note: Figures in the parenthesis indicates percentage to the total farm sizes

4. Difficulties experienced by sampled households during lockdown

Results revealed that overall, 3.68 per cent of respondents permanently migrated back to their original home place. A majority of 54.09 per cent of respondents spent their savings to cover living expenses, also, 23.77 per cent borrowed money to cover living expenses. Out of the total overall 5.5 per cent sold their assets to cover living expenses, 4.91 per cent of respondents reported a change in job/earning occupation, 4.09 per cent changed crop grown on the farm and 0.40 per cent left their farm fellow. Although the free distribution of rations was a great aid to many, families, only enough rice was provided. For other food items, households were still reliant on the market. During the lockdown, households that lost their income survived on their savings or money borrowed. According to the study's findings, most respondents used their funds or borrowed money to endure the lockout. During this time, government support was mostly used to distribute rations, which were primarily made of rice. Only a small portion of the remaining households had enough funds to last longer than a month, and the bulk of homes had already used all their resources. In this context, the state of vulnerable groups was extremely concerning. Many of these households were able to escape the lockdown by borrowing (sometimes at exorbitant interest rates), so they can currently afford to borrow more. These individuals can slip into extreme poverty if the government does not provide for their primary requirements.

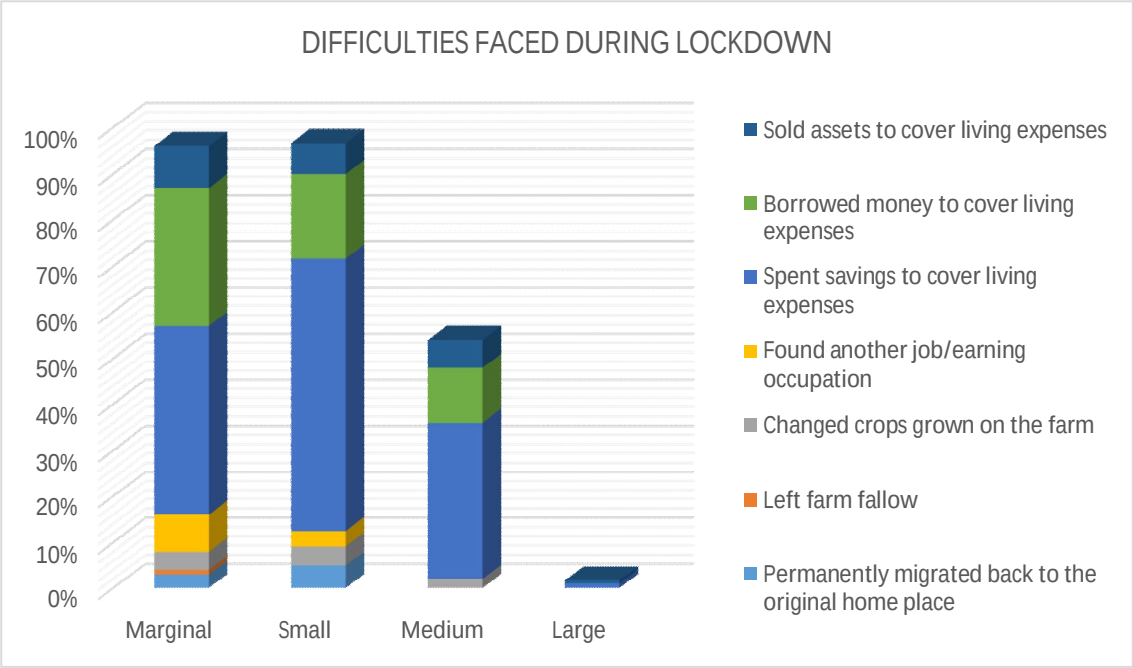

Fig. 2 Difficulties faced during Lockdown

5. Conclusion and Policy implications

Farmers output was greatly impacted by the inadequate supply of agricultural inputs, including fertilizer, insecticides, and most critically, agricultural labours, during the height of harvest in the first phase of lockdown. Due to exorbitant expenditures, an increase in debt, an inability to sell their produce at fair rates, and crop losses, the lockdown's interruption has placed a significant financial burden on farmers. Due to market disruptions, many farmers, particularly those who grow vegetables, pulses, have been compelled to sell their products to local dealers for poor rates. A majority of respondents 58.06 per cent were able to sell their crop, 11.29 per cent stored their crop because of lockdown-related issues such as market price was too low, 2 per cent of respondents reported that their harvest was wasted because they could not sell it, and, in a small number of cases 0.75 and 1.61 per cent were still trying to sell their crops. A majority of the sampled farmers 82.18 per cent reported no yield loss due to COVID-19 pandemic. Maize crop had the highest yield loss mostly -5.13 per cent which is due to untimely harvest and unavailability of labours. 28.75 per cent reported availability of agricultural inputs decreased in the pandemic crisis and 39.75 per cent reported price of agricultural inputs increased during the COVID-19 pandemic. 57.57 per cent said that the availability of labour decreased during the lockdown period.

There was sufficient evidence to support the claim hence, we reject the null hypothesis at the 5% significance level.

Investments in vital logistics must be increased if the demand for agricultural commodities is to continue. Additionally, start-ups and e-commerce businesses need to be supported with the right policies and incentives. With supportive policies, India's agricultural exports, which were worth 38 billion US dollars in 2018–19, might increase even more. It would be in the long-term best interests of farmers to increase their revenue if private sector investments and support were made in the development of export-supportive infrastructure and logistics.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Funding

The research, writing, and/or publication of this work were all done without any financial assistance from the authors.

Acknowledgments

The farmers, migrant and non-migrant workers in the Raipur district were all acknowledged by the authors for their helpful responses, fast information, and respect during data collection.

References

Sapbamrer, R.; Chittrakul, J.; Sirikul, W.; Kitro, A.; Chaiut, W.; Panya, P.; Amput, P.; Chaipin, E.; Sutalangka, C.; Sidthilaw, S.; et al. Impact of COVID-19 Pandemic on Daily Lives, Agricultural Working Lives, and Mental Health of Farmers in Northern Thailand. Sustainability 2022, 14, 1189. https://doi.org/ 10.3390/su14031189.

Meskerem Abebe, Alemayehu Legesse, Fekadu Gadisa, and Munira Hussen (2022) Challenges and Opportunities for the Agricultural Producers in Sinana District in Reflection of COVID-19 Pandemic Advances in Agriculture Volume 2022, Article ID 4511995, 10 pages https://doi.org/10.1155/2022/4511995.

Lindsay M. Jaacks & Divya Veluguri& Rajesh Serupally & Aditi Roy & Poornima Prabhakaran & GV Ramanjaneyulu Impact of the COVID-19 pandemic on agricultural production, livelihoods, and food security in India: baseline results of a phone survey Food Security https://doi.org/10.1007/s12571-021-01164-w.

Duncan Boughton, Joseph Goeb, Isabel Lambrecht, Derek Headey, Hiroyuki Takeshima, Kristi Mahrt, Ian Masias, Sophie Goudet, Catherine Ragasa, Mywish, Maredia, Bart Minten, Xinshen Diao Impacts of COVID-19 on agricultural production and food systems in late transforming Southeast Asia: The case of Myanmar Agricultural Systems 188 (2021) 103026

A Velmurugan, Jayakumara Varadan, T.P. Swarnam, S.K.Zamir Ahmed, T. Subramani, T.K. Biswas, I. Jaisankar and P. Perumal Impact of COVID-19 Pandemic on Agricultural Production and Marketing Systems of Andaman and Nicobar Islands journal of Andaman science association Vol. 25(2):217-225(2020)

Arumugam, Dr. G. Kanagavalli & M. Manida (2020)**,** impact of agriculture in India, Aegaeum journal, Issue May 2020, Karaikudi, ISSN NO: 0776-3808.

DU Zhi-xiong , LAI Xiao-dong , LONG Wen-jin & GAO Liang-liang (2020), The short- and long-term impacts of the COVID-19 pandemic on family farms in China-Evidence from a survey of 2 324 farms, Journal of Integrative Agriculture 2020, 19(12): 2877–2890.

A Velmurugan, Jayakumara Varadan, T.P. Swarnam, S.K.Zamir Ahmed, T. Subramani, T.K. Biswas, I. Jaisankar and P. Perumal Impact of COVID-19 Pandemic on Agricultural Production and Marketing Systems of Andaman and Nicobar Islands journal of Andaman science association Vol. 25(2):217-225(2020).

James Hammond, Kim Siegal, Daniel Milne, Emmanuel Elimu, Taylor Vail, Paul Cathala, Arsene Gatera, Azfar Karim, Ja-Eun Lee, Sabine Douxchamps, Mai Thanh Tu, Emily Ouma, Ben Lukuyu, Pius Lutakome, Sonja Leitner, Ibrahim Wanyama, Trang Pham Thi, Phan Thi Hong Phuc, Mario Herrero, Mark van Wijk Perceived effects of COVID-19 restrictions on smallholder farmers: Evidence from seven lower- and middle-income countries Agricultural Systems 198 (2022) 103367

A.K. Singh, L. Singh & Sunil Kumar (2020), Impact of covid-19 on agriculture and allied sector, Journal of community mobilization and sustainable development, Vol. 15, No. 1, January-April, 2020, ISSN NO: 2230 – 9047.

Jabir Ali & Waseem Khan (2020), Impact of COVID-19 pandemic on agricultural wholesale prices in India: A comparative analysis across the phases of the lockdown, J Public Affairs. 2020; 20: e2402. https://doi.org/10.1002/pa.2402

Khan et al. (2021), Drastic impacts of COVID-19 on food, agriculture and economy, http://dx.doi.org/10.19045/bspab.2021.100008

Narayanan S. & Saha, S. (2020), Urban food markets and the lockdown in India. Working Paper No.2020-017, Indira Gandhi Institute of Development Research.

Niranjan Singh, D.P. Sharma, and D.D. Sharma, Effect of covid-19 pandemic on Indian agriculture, KRISHI SCIENCE – e-Magazine for Agricultural Science.

World Economic Outlook, April 2021 https://www.imf.org/en/Publications/WEO.

Ministry of Home Affairs, April 29, 2020, Order No. 40-3/2020-DM-I (A), https://prsindia.org/files/covid19/notifications/4233.IND_Movement_of_Persons_April_29.pdf.

Wan Nor Arifin (2014), Calculating standard deviation of difference for determination of sample size for planned paired t-test analysis, https://www.researchgate.net/publication/272729859