



## Multi-level impacts of the COVID-19 lockdown on agricultural systems in India: The case of Uttar Pradesh

Kumar, Pavan; Singh, S. S.; Pandey, A. K.; Singh, Ram Kumar; Srivastava, Prashant Kumar; Kumar, Manoj; Dubey, Shantanu Kumar; Sah, Uma; Nandan, Rajiv; Singh, Susheel Kumar

Total number of authors:  
15

Published in:  
Agricultural Systems

Link to article, DOI:  
[10.1016/j.agsy.2020.103027](https://doi.org/10.1016/j.agsy.2020.103027)

Publication date:  
2021

Document Version  
Peer reviewed version

[Link back to DTU Orbit](#)

### Citation (APA):

Kumar, P., Singh, S. S., Pandey, A. K., Singh, R. K., Srivastava, P. K., Kumar, M., Dubey, S. K., Sah, U., Nandan, R., Singh, S. K., Agrawal, P., Kushwaha, A., Rani, M., Biswas, J. K., & Drews, M. (2021). Multi-level impacts of the COVID-19 lockdown on agricultural systems in India: The case of Uttar Pradesh. *Agricultural Systems*, 187, Article 103027. <https://doi.org/10.1016/j.agsy.2020.103027>

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1 **Multi-level impacts of the COVID-19 Lockdown on Agricultural Systems in India**

2 Pavan Kumar<sup>a</sup>, S.S. Singh<sup>a</sup>, A. K. Pandey<sup>a</sup>, Ram Kumar Singh<sup>b</sup>, Prashant Kumar Srivastava<sup>c</sup>,  
3 Manoj Kumar<sup>d</sup>, Shantanu Kumar Dubey<sup>e</sup>, Rajiv Nandan<sup>a</sup>, Susheel Kumar Singh<sup>a</sup>, Priyanshi  
4 Agrawal<sup>a</sup>, Akanksha Kushwaha<sup>a</sup>, Meenu Rani<sup>f</sup>, Jayanta Kumar Biswas<sup>g</sup>, and Martin Drews<sup>h\*</sup>

5  
6 <sup>a</sup> Rani Lakshmi Bai Central Agricultural University, Jhansi - 284003, India

7 <sup>b</sup> Department of Natural Resources, TERI School of Advanced Studies, New Delhi – 110070,  
8 India

9 <sup>c</sup> Institute of Environment and Sustainable Development, Banaras Hindu University  
10 Varanasi, U.P. - 221005, India

11 <sup>d</sup> Forest Research Institute, PO: New Forest, Dehradun – 248006, India

12 <sup>e</sup> Indian Council of Agricultural Research, Ministry of Agriculture and Farmers Welfare, GT  
13 Road, Rawatpur, Kanpur (UP), India

14 <sup>f</sup> Department of Geography, Kumaun University, Nainital, Uttarakhand, India

15 <sup>g</sup> Department of Ecological Studies & International Centre for Ecological Engineering,  
16 University of Kalyani, Kalyani, Nadia – 741235, West Bengal, India

17 <sup>h</sup> Department of Technology, Management and Economics, Technical University of Denmark  
18 2800 Kgs. Lyngby, Denmark

19  
20 \*Corresponding author: Martin Drews, mard@dtu.dk, telephone: +45 22 86 33 80

21  
22 **Highlights**

- 23 • The lockdown as a response to COVID-19 has seriously disrupted Indian farms  
24 • Farms have been less profitable amid rising food prices (pressure on food security)  
25 • Lack of migrant labor have led to loss of produce and affected the Spring harvest  
26 • Experience and relief packages may help to sustainably develop Indian agriculture

27

28

29 **Abstract**

30 When the Government of India on March 24, 2020, ordered a complete lockdown of the  
31 country as response to the COVID-19 pandemic, it had serious unwanted implications for  
32 farmers and for the supply chains of agricultural produce. Many of these implications were  
33 magnified by the fact that - as is typical for developing countries - the economy of India is  
34 highly based on farming, and industrialization of the agricultural systems is modest. In this  
35 paper, we report the various consequences of the COVID-19 lockdown on farm systems in  
36 India, including the economy, taking into account the associated emergency response from  
37 the Indian government. Combining quantitative and qualitative sources of information,  
38 including expert elicitation and a survey amongst farmers, the paper identifies and analyzes  
39 different factors that contributed to the severe disruption of farm systems and the agricultural  
40 sector as a whole following the lockdown. Among other issues, our study finds that the lack  
41 of migrant laborers in some regions and surplus of workers in other highly affected the April  
42 harvest, leading both to a decline in agricultural wages, to a critical loss of produce and has  
43 had an effect on the general economy; we also find that the partial closure of rural markets  
44 and procurement options, combined with insufficient supply of products, has led to shortages  
45 of food supplies and dramatically increased prices, which particularly has affected urban  
46 dwellers and the poor. We hypothesize that the lessons learned from the COVID-19 crisis  
47 could fuel the development of new sustainable agro-policies and decision-making in response  
48 not only to future pandemic situations but to sustainable development of agricultural systems  
49 in India and in developing countries in general.

50 **Keywords:** COVID-19, India, Asia, lockdown, farmers, economy

51

52

## 53 **1 Introduction**

54 The recent outbreak of the novel SARS-CoV-2 virus also called the coronavirus disease 2019  
55 (COVID-19) has evolved into one of the most serious pandemic situations in the past 100  
56 years. Worldwide, entire populations have been experiencing lockdown situations aimed at  
57 slowing the spread of this disease with associated disruption of economic activities and  
58 abrupt changes in policies towards the mitigation of the health impacts of COVID-19  
59 (Ayittey et al. 2020; Bhagavathula et al. 2020; Kumar et al. 2020a; Singh et al. 2020a). This  
60 includes India, the world's fifth-largest economy in 2019, which is now facing an  
61 unprecedented economic crisis due to COVID-19. In a recent South Asia Economic Focus  
62 update published by the World Bank (2020), the Indian economy is currently projected to  
63 shrink by 4.8% in 2020 and further by 2.8% in a baseline scenario for 2021 due to COVID-  
64 19.

65 India took early action to limit the spread of COVID-19, ordering a 21-day nationwide  
66 lockdown for its population of 1.3 billion people starting March 24, 2020. The lockdown has  
67 since been prolonged several times. As a result of these initiatives, it is only recently that the  
68 pandemic has spread widely in India compared to other countries (Kumar et al., 2020b).  
69 Hence, as of May 16, 2020, the number of reported infections was still comparatively low,  
70 counting 90,648 accumulated cases with 2871 deaths recorded (Worldometer, accessed May  
71 16, 2020). For comparison, as of September 14, 2020, the number of cumulative reported  
72 infections in India has soared to 4,845,003 cases with 79,754 deaths recorded, placing India  
73 second only to the United States in terms of total infections (Worldometer, accessed  
74 September 14, 2020). The Indian government has generally viewed the pattern of COVID-19  
75 spread as similar to the 2009 H1N1 influenza pandemic and thereby assumed that the spread  
76 of the disease is unlikely to be uniform. After the expiration of the initial 21-day period, it  
77 was therefore originally planned to maintain the full lockdown only in "hotspot" areas and to  
78 relax it in other places.

79 The principal activities of most people in developing countries usually relate to farm level  
80 systems and agricultural production (Singh et al., 2020b), which is intrinsically linked to their  
81 livelihoods, the economy, social systems and the environment. In rural areas, in particular,  
82 agriculture often comprises the dominant source of employment, income, and food for the  
83 local communities. In the developing countries of South-East Asia, the agricultural sector  
84 generally contributes more than 20 percent of the national Gross Domestic Product (GDP)

85 (IMF, 2014) and is a natural focal point for economic activities aimed at fostering more or  
86 less sustainable development in terms of creating growth, jobs, trade, new businesses and for  
87 mitigating poverty. The environmental impacts of the associated agriculture activities,  
88 including the provision of other (natural) ecosystem services (Costanza et al., 1998), depend  
89 on the intensity of the farming, the use of agricultural practices, and locally varying factors  
90 such as soil conditions, climate variability, etc. In the wake of the “green revolution” in Asia,  
91 agricultural activities have increased in most countries and seen the rise of new innovations  
92 and technologies. This has in turn resulted in a general trend of increasing pressures on  
93 forests and other natural ecosystems that seems likely to continue (Porter et al., 2014).

94 Due to extensive COVID-19 mitigating actions at national levels, the economic activities  
95 related not only to Indian farm systems but to farmers all over South-East Asia have faced  
96 several severe hits due to the unusual circumstances that arguably has outweighed the direct  
97 impacts of COVID-19 (Mahendra Dev, 2020). For example, due to the Indian lockdown  
98 transportation has largely been halted thereby stagnating yields and compromising food  
99 security. Hence during the peak of the spring harvest, produces could often not reach the rural  
100 markets - the “mandis” - thus severely disrupting normal supply chains. The unavailability  
101 of migrant laborers has also affected harvest and post-harvest operations. Further, the current  
102 pandemic has given rise to challenges in procurement operations.

103 In this paper, we collect evidence from different sources to identify and present the various  
104 multi-level implications of the COVID-19 lockdown and related efforts on agricultural  
105 systems in India, taking into account the associated emergency response from the Indian  
106 government. When comparing to the implications of similar emergency response taking place  
107 in developed countries, e.g. in Europe, it is evident that many of the consequences reported  
108 herein are characteristic for developing countries with an agro-based economy and an  
109 agricultural sector that is less industrialized. As is, the current situation in India could  
110 potentially stall the development of the agricultural sector for many years to come and/ or  
111 lead it in a direction not aligned with the Sustainable Development Goals (SDGs).

112 Conversely, lessons learned from coping with COVID-19 could also potentially spark the  
113 development of more robust supply chains. On this background, we hypothesize that the  
114 development of sustainable agro-policies and decision-making in response to (the prevention  
115 of) future pandemic situations urgently needs to be rooted in the current lessons learned from  
116 the COVID-19 pandemic.

117 The rest of this paper is organized as follows. The Methods section provides a brief overview  
118 of the concept used for data collection. The Results and Discussion section, which comprises  
119 the main part of the paper, is divided into five subsections. In the first subsection, we outline  
120 the grand challenge of weighting impacts of the national economy (GDP) of India over the  
121 health impacts of COVID-19. The second subsection summarizes some of the abrupt  
122 challenges caused by the pandemic amid the inherent agricultural potential. Thirdly, we  
123 present the emergency response actions taken by the Indian authorities in order to mitigate  
124 the impact on Indian farmers. Fourthly, we identify the economic status of Indian farmers,  
125 whereas the last section investigates overall impacts on farm systems and more broadly the  
126 agricultural sector. Finally, in the Conclusions section, based on lessons learned, we discuss  
127 briefly some possible steps forward for managing agricultural impacts and ensuring  
128 sustainable development of the Indian farm systems in the face of the COVID-19 pandemic.

## 129 **2 Methods**

130 This semi-empirical research combines different quantitative and qualitative sources of  
131 information, including expert elicitation, in order to identify, describe and analyze different  
132 factors affecting Indian farm systems and more broadly the agriculture sector, following the  
133 COVID-19 lockdown initiated in March 2020. Sources of information used for these  
134 descriptive analyses include data from the National Statistical Office of India, scientific  
135 publications, “grey” literature including reports and official information released by the  
136 national and state governments and organizations of India, media articles and finally local  
137 data, e.g., obtained through a telephone survey targeting a random selection of 570 Indian  
138 farmers, as well as personal communication collected and/ or contributed by the  
139 transdisciplinary author team, representing a wide range of views and expertise. Accordingly,  
140 in the ensuing Results and Discussion section, we address the implications on farm systems  
141 from a multi-level perspective, i.e., ranging from a national macro-economic view down to  
142 the local farm level perspective.

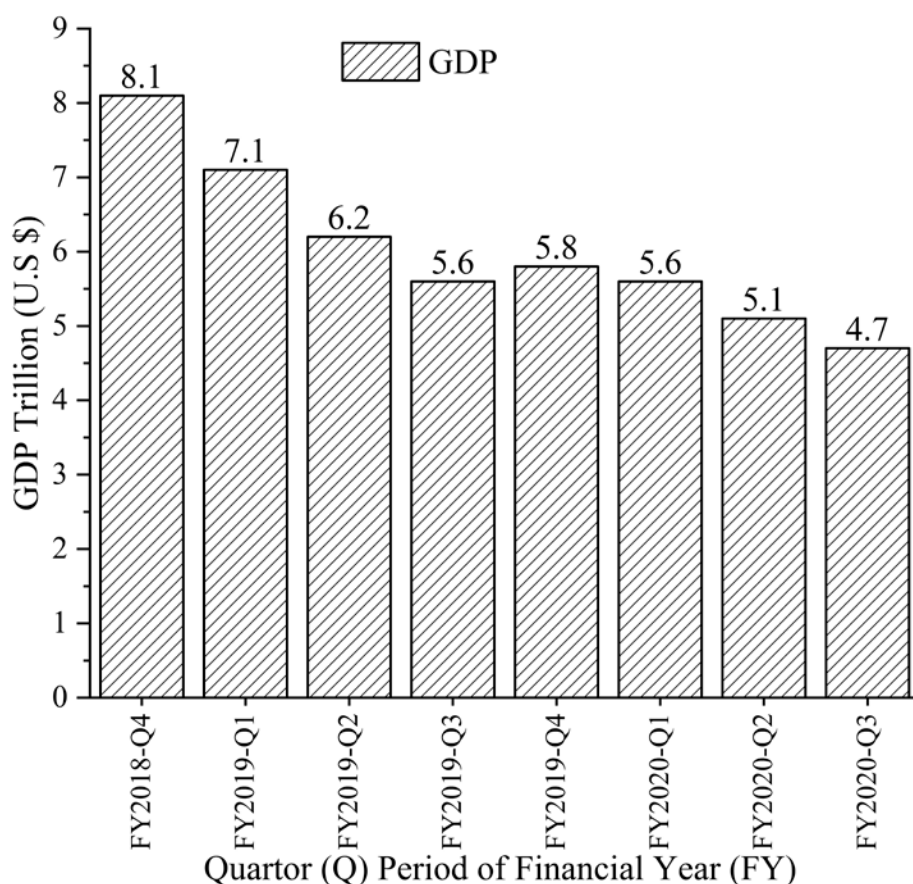
## 143 **3 Results and Discussion**

### 144 *3.1 Impact on the national economy*

145 The situation caused by the COVID-19 crisis and extended lockdown period in India severely  
146 affects not only the supply but also the demand for agro-foods (Mahendra Dev, 2020). This  
147 directly impacts the economy of 140 million Indian farmers, and the share of the GDP

148 associated with agriculture has similarly declined. In India, the agricultural yields for Rabi  
149 (spring crops) cereals get stored in cold storages, food banks and/ or are directly supplied to  
150 the market from local farms. When most of the cereal production cannot get to market, food  
151 prices especially on urban markets therefore soar. This creates a very difficult situation both  
152 for local farmers and for the poor people of India, who are unable to afford the products, and  
153 for the availability of agro-foods and food security in general.

154 To mitigate the immediate challenges related to COVID-19, the Government of India has  
155 provided economic aid (“relief packages”) aimed at many different sectors (see below), but  
156 mainly for farmers, the agricultural and associated sectors. The economic aid supplied by  
157 these relief packages and other measures provided by state governments in support of farmers  
158 and the agricultural sector in general has been critically needed but has also inversely  
159 impacted the national GDP (see Figure 1).



160  
161 Figure 1. Recent and expected developments in the GDP of India since the fourth quarter  
162 (Q4) of the fiscal year 2018 (FY2018). The numbers shown are from the Reserve Bank  
163 (Central Bank) of India (RBI), <https://www.rbi.org.in/>. Accessed 16 May, 2020.

164 As shown in the figure the national GDP was in May 2020 expected to be down about 1  
165 trillion USD in value from Q1 to Q3. A fair part of this drop is expected to be related to the  
166 agricultural sector. For comparison, a novel 5-year scheme worth INR 15,000 *crores* (1 crore  
167 = 10 million) introduced by the Government of India aims to strengthen the national and state  
168 level systems in order to combat the health impacts of COVID-19. This fund will be divided  
169 among all states and union territories. Activities to be funded under this scheme include the  
170 development of dedicated COVID-19 hospitals, intensive care units, and supply of oxygen in  
171 medical centers. The implementation of this COVID-19 Emergency Response and Health  
172 System Preparedness Package is planned by state governments in three phases: from January  
173 2020 to June 2020, July 2020 to March 2021, and April 2021 to March 2024

### 174 *3.2 Abrupt challenges amid agricultural potential*

175 Amongst all of the measures installed in response to the COVID-19 pandemic, it was the  
176 sudden curfew on the transportation of crops (including the additional legal aspects) caused  
177 by the lockdown that initially and seriously impacted agricultural systems in India. In the  
178 Rabi harvest season in India in April, paddy production dominates most fields (Chaddha et  
179 al., 2017). Coinciding with the March lockdown, farms were heavily engaged in beginning to  
180 harvest spring crops all over the country. However, the abrupt change instilled by the  
181 lockdown suddenly caused all transportation of goods to be severely limited, more or less  
182 from one day to the next. Due to the non-availability of sufficient storing services amongst  
183 middle class farmers, in particular, grains and vegetables have continued to ripe during the  
184 lockdown and part of this year's yield is likely to be damaged. Likewise, the lockdown closed  
185 most of the mandis for normal businesses and large procurement operations were  
186 immediately stopped by authorization of the Indian government. Some residential agro-food  
187 markets were still allowed though not every item was being marketed during the current  
188 pandemic times. As a result, supply chains have stopped working and limited availability of  
189 vegetables have become a serious issue for the general population, especially in major cities  
190 (Mahendra Dev, 2020).

191 The critical need for extensive numbers of migrant workers in various Indian states also  
192 caused severe problems during the lockdown and continue to some extent to do so.  
193 Effectively grounded in their native communities, many of the potential migrant workers  
194 have lost their jobs and are currently unable to earn enough money to sustain themselves and  
195 their families. Others have found new work with local farmers at very low wages due to the



196 excessive amount of labor available in some communities. During normal harvest times, a lot  
197 of Indian farms rely on large numbers of migrant agricultural workers to work their fields.  
198 With the current unavailability of such man power and with farm systems in many places not  
199 able to adapt, massive values are therefore at risk of getting ruined in the paddy (Himanshu,  
200 2019).

### 201 *3.3 Government of India, ICAR and Local Government initiatives*

202 The migration of people back to their native rural communities combined with a decline in  
203 market availability for and sale of produce (and the social and economic issues relating to  
204 both) reinforces the importance of having strong policies in place to tackle these challenges.  
205 The Indian Ministry of Finance acted already in the initial stages of the COVID-19 spread in  
206 India. After the immediate announcement of the lockdown, the Indian Finance Minister  
207 proclaimed a financial assistance of INR 1.7 *lakh crore* (1 lakh crore = 1 trillion) as a subsidy  
208 to people below the poverty line, which include 800 million people nationwide. Part of this  
209 will happen through a financial scheme introduced by the Government of India called PM-  
210 KISAN (Pradhan Mantri Kisan Samman Nidhi), which will front load in 2020-21 with a cash  
211 instalment of INR 2000 to all farmers with the first instalment to be paid out by April, 2020.  
212 This scheme will offer amounts of INR 2000 to Indian farmers thrice after every fourth  
213 month. Another help package under the existing Pradhan Mantri Garib Kalyan Yojana  
214 program (the Prime Minister's scheme for the welfare of the poor) specifically targets the  
215 poor to help them fight the battle against COVID-19, to cope with the nationwide lockdown  
216 and it's financial consequences. The rate of wages in India has also been revised and  
217 increased for all those working under the Mahatma Gandhi National Rural Employment  
218 Guarantee Act (MNREGA). This scheme is one of the world's largest wage schemes. Finally,  
219 the Government of India has recently established a program called the PM-CARES (Prime  
220 Minister's Citizen Assistance and Relief in Emergency Situations) Fund aimed at building  
221 capacity to resolve similar national challenges caused by future pandemics.

222 According to the Food Corporation of India (FCI) on 1 April 2020 food grains constituted 77  
223 million tons of cereals against a buffer supply requirement of 21 million tons. On this  
224 background, the Government of India announced that for the following 3 months, 5 kg of free  
225 grains would be distributed to people registered under the National Food Security (NFS) Act  
226 to prevent issues of food security. It is estimated that the FCI stocks may free up with help

227 from the Government to help, e.g., the migrants registered under the schemes of different  
228 states (Verma, 2020).

229 The Indian Council of Agricultural Research (ICAR) is spearheading several initiatives of the  
230 Indian Government in terms of assessing and mitigating the impacts of the COVID-19  
231 lockdown on agriculture and its allied sectors. This includes the preparation of a roadmap to  
232 minimize its demerits and prevent the worst impacts on farm and food systems. While the  
233 government has exempted many key agricultural operations from harvesting to the  
234 transportation of produce to the markets according to the directives of the lockdown, ICAR is  
235 responsible for issuing specific advice to farmers directing them to take general precautions  
236 and safety measures during harvesting, post-harvest operations, storage, and marketing of  
237 Rabi crops.

238 Despite provision of this massive financial assistance by the Government of India, experts  
239 have noted that an estimated 87 million farmers in India alone have largely “refrained” from  
240 expressing much optimism (Mahendra Dev, 2020). Still, these initiatives seem largely to have  
241 soothed the farmers’ concerns during the extended lockdown period.

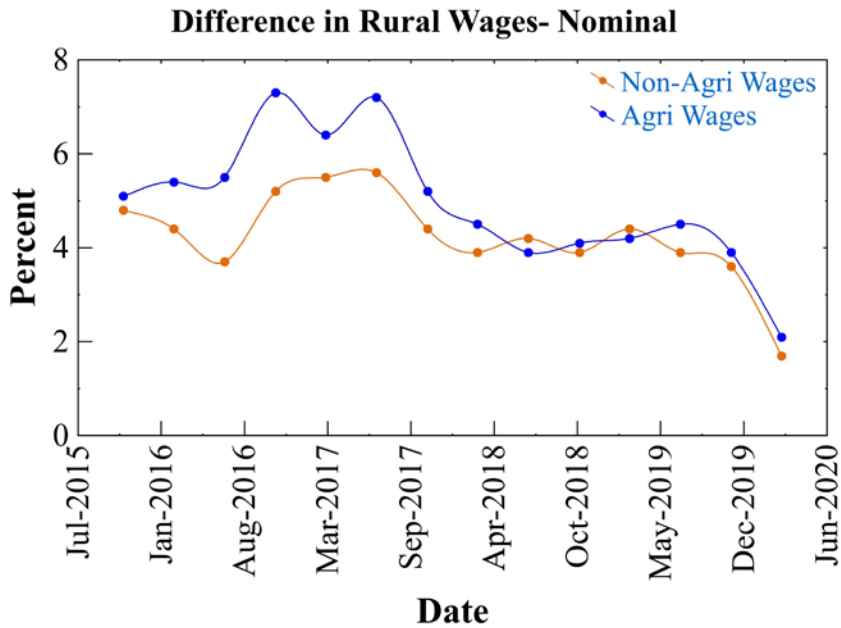
242 The state of Uttar Pradesh is generally considered as the “food bowl” of India. In the Uttar  
243 Pradesh, after a complete lockdown of 17 days, the total cases of COVID-19 had risen to  
244 above 500 with a death toll of 35 and approximately 119 recoveries. A fairly modest number  
245 considering that this state in terms of population is the largest in India. At this time the  
246 COVID-19 pandemic had not yet reached the community spread stage with the state  
247 government, related administrators, doctors, nurses, and other personnel working tirelessly to  
248 adopt the best strategies for mitigating the health impacts. Meanwhile, due to the  
249 completeness of the lockdown and primary focus on stopping the spread of the disease, daily  
250 wage earners, farmers, agricultural marketers, consumers, and other stakeholders suffered  
251 enormously. Subsequently, the Government of Uttar Pradesh issued a set of modified  
252 regulations, permitting suppliers to continue the transport of fruits, vegetables, milk, honey,  
253 mushrooms, and related horticultural produce inside the state, implicitly aimed at sustaining  
254 local farm systems. Also, permissions to avail agricultural commodities, seed fertilizers, plant  
255 protection chemicals, and farm machineries by concerned departments, shops, retailers, and  
256 wholesalers were granted. The effect of these efforts were immediately apparent in urban  
257 areas, i.e., as witnessed by the absence of “panic” with respect to the purchase of fruits and  
258 vegetables in the cities. Further, ICAR issued specific advice on farm practices applicable to

259 this particular state, which were shared among farmers in every district by agricultural  
260 consultants (Krishi Vigran Kendras, KVK) using social media such as email services,  
261 WhatsApp, mobile messaging, and phone calls. By the end of May, in the state of Uttar  
262 Pradesh, a total of 679 related messages and advisory documents had been circulated by  
263 KVK experts using WhatsApp, mKISAN, and Kisan Call Centers, respectively, reaching  
264 more than 500.000 farmers, which by any standard is a commendable effort from the state's  
265 frontline extension system.

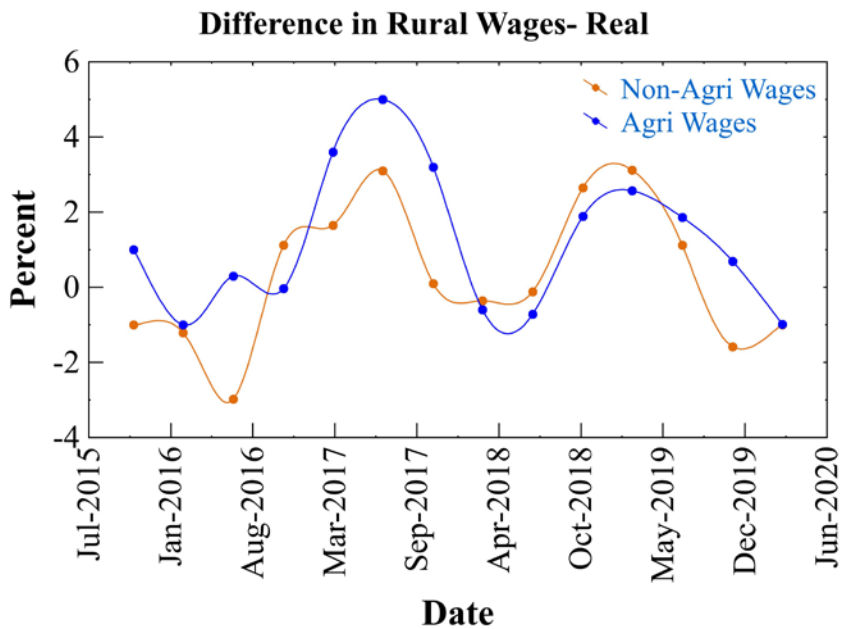
### 266 *3.4 The economic challenges of local farmers*

267 As per records from the Government of India about 263 million people are directly engaged  
268 in farming or more generally in the agricultural sector of India. Of these, over 55% do not  
269 own the croplands. Before COVID-19 the part of the GDP of India stemming from the  
270 agricultural sector experienced growth rates at around 3.2% per year for six continuous years  
271 from 2014 to 2019 (Mahendra Dev and Sengupta, 2020). The National Statistical Office of  
272 India continuously collects information on the agricultural sector and before COVID-19  
273 expected a similar growth of between 2.4% and 3.7% from the fiscal year 2019 (FY19) to the  
274 fiscal year 2020 (FY20) (National Statistical Office of India,  
275 <http://www.mospi.gov.in/national-statistical-office-nso>). This expected growth has been  
276 replaced by a sharp decline of about 5% in the first quarter (Q1) of the 2020 fiscal year (FY)  
277 due to the lockdown (FAO, 2020).

278 Trends in the agricultural part of the GDP of India can largely be attributed to variations in  
279 wages in the agricultural sector and hence to the operation of local farm systems. Figure 2  
280 compares recent variations of the average wage related to agricultural activities (“agri  
281 wages”, blue curves) vs. the average wage related to non-agricultural activities (“non-agri  
282 wages”, brown curves) in India's rural areas (i.e., “rural wages”). The average wages are here  
283 differentiated into nominal and real wage, respectively. In general, progression in the real  
284 wage is linked to changes in the overall national GDP of India, whereas progression in  
285 nominal wages relate to the market conditions for agricultural products.



286



287

288 Figure 2. (Top panel) Variations in the average nominal wage (agriculturally related vs. non-  
 289 agriculturally related in rural areas). (Bottom panel) Variations in the average real wage in  
 290 rural areas. Based on data from the Reserve Bank of India (RBI), <https://www.rbi.org.in/>.  
 291 Accessed 16 May, 2020.

292 From 2015 to 2020 the average nominal wage has decreased from 4.3 to 0.86% (Figure 2).  
 293 Meanwhile the real wage exhibited large fluctuations but as of December 2019 is negative for  
 294 both the agricultural wage and non-agricultural wage. As expected this is synchronized with  
 295 the drop in the national GDP of India seen from 2018 to 2019 (Figure 1). Meanwhile, the  
 296 former seems to suggest that the current agricultural production in India is substantially

297 higher than the demand. Combined, the data depicts a situation, where despite an overall  
298 long-time positive growth of Indian agriculture (measured in terms of the GDP), many  
299 farmers were already economically challenged before COVID-19.

### 300 *3.5 Disruption of Indian farm systems*

301 Since agricultural produce are essential commodities, they were principally exempted from  
302 the directives of the lockdown initiated March 24 to avoid compromising food security.  
303 However, this has turned out to create more problems than solutions for India as the related  
304 implications on agricultural activities (and mitigation thereof) down to the farm level were  
305 not integrated into these directives. Likewise, the fact that the agricultural sector as a whole  
306 was already weakened as a result of the widespread drought conditions experienced since  
307 2015 was arguably not addressed properly. Thirdly, the coincidence with the harvesting  
308 period for Rabi crops in the month of April was highly unfortunate, generating serious  
309 concerns with respect to the management of the matured crops (harvesting, threshing,  
310 winnowing, bagging, and transportation to suitable locations) from the farmers.

311 The initial total lockdown of 21 days was first extended to 19 days in the second phase and  
312 further to 14 days in the third phase. Some of the most important adversities in this period  
313 affecting farm systems and value chains include (i) a surplus of agricultural workers for the  
314 harvest season in some regions (resulting in wages dropping), lack of migrant labor in others  
315 (resulting in lack of manpower to work the paddy and secure the harvest); (ii) insufficient  
316 storage facilities; (iii) difficulties in transporting and distributing goods and produce; (iv) no  
317 or limited access to the mandis (rural markets); (v) insufficient availability of agricultural  
318 produce to meet demands, resulting in inflated prices on agricultural products. The first four  
319 of these significantly disrupted local farm efficiencies, whereas (v) in principle should have  
320 been a benefit to farmers. In the following, we address these and other disruptions to Indian  
321 farming.

#### 322 *3.5.1 Impacts on farm operations in Uttar Pradesh*

323 To evaluate the impact of the COVID-19 lockdown and its cascading implications at the  
324 farm level and from a micro-economic perspective, a telephone survey was carried out  
325 amongst 570 randomly selected farmers spread across 57 districts (out of 75) of the Uttar  
326 Pradesh during the period 25 March to 10 May, 2020. During these pre-structured interviews,  
327 local farmers were asked to reveal how the lockdown affected their farm operations as well as

328 their investment in and the profitability of major Rabi crops, including wheat (530 data  
329 points), mustard (530 data points), lentil (400 data points), chickpea (430 data points) and  
330 field pea (290 data points). Likewise, impacts on the investment and profitability of major  
331 bovines, mainly cattle and buffalo (each with 460 data points), were also surveyed. Changes  
332 with respect to normal conditions were quantified by comparing indicators drawn from the  
333 results of the interviews (e.g., investment patterns and profitability) representing the initial  
334 lockdown period (March-May 2020) with results obtained from a similar survey carried out  
335 in the same period last year March-May 2019).

336 Results from our telephone survey confirmed an overall *increase in farm level production*  
337 *costs* and a *decrease in profitability* during the lockdown. Though the prices of conventional  
338 fertilizers like urea and diammonium phosphate (DAP) dropped to around Rs 83/q and Rs  
339 12/q, respectively, the prices of other inputs like bio-fertilizers, fungicides and insecticides  
340 increased by up to Rs 45/kg, Rs 32/kg and Rs 50/kg due in parts to lack of availability.  
341 Similarly, for agricultural laborers an average wage gain up to the level of Rs 36/laborer/day  
342 was reported. The coefficient of variation with respect to price jumps was found to fluctuate  
343 considerable from 0.24 to 0.51, indicating a very unbalanced market. With respect to  
344 profitability, wheat (-3.14%), field pea (-7.17%), chickpea (-10.31%) and lentil (-3.38%)  
345 growers were most negatively affected, whereas mustard (+7.72%) growers experienced an  
346 increase in profitability. Even though local market prices were up by between 5.03% and  
347 11.18% during the lockdown period (e.g., due to a reduced supply of produce) as compared  
348 to the same period last year, the increased production costs of between 3.34% and 4.89%  
349 generally dominate, leading to loss of profitability at the farm level. For livestock, the survey  
350 indicated significantly increasing costs across all investments indicators during the lockdown  
351 period compared to the year 2019, including for concentrated feed (12.56%), green fodder  
352 prices (46.15%), animal treatment costs (13.72%), animal handling charges (14.16%) and the  
353 total cost of milk production from cattle (11.54%) and buffalo (10.54%). A variation in the  
354 price stability was observed across the sampled respondents and districts. Similarly, for  
355 profitability indicators, a reduction in the total quantity of milk sold (13-15%), milk prices (4-  
356 5%) and benefit-cost ratios (5.2 -7.3%) were evidenced during the lockdown.

357 Overall, the survey attributes the observed increases in farmers' production cost and  
358 decreased profitability to increased input costs caused by limited access to essentials for farm  
359 operations and to markets. This conclusion aligns well with local farm level observations  
360 made by KVK experts and is counterfactual to the official guidelines issued by the local

361 government of Uttar Pradesh, which called for the relaxation of a complete lockdown with  
362 respect to agricultural inputs shops.

### 363 *3.5.2 Laborers: too many or too few?*

364 As laborers from, e.g., nearby cities and rural areas were forced to migrate back to their  
365 respective villages, the availability of laborers for carrying out farm operations (harvesting of  
366 wheat, threshing of maize, digging of seed potato) has dramatically increased in some local  
367 communities. There, daily wages at the village level have dropped by as much as 15-20%,  
368 whereas in other communities with similar lack of labor (e.g., as indicated in the survey from  
369 Uttar Pradesh) daily wages have increased. Restrictions on the movement of labor and food  
370 processing units could eventually help to recover wages within rural agricultural units  
371 (Zhang, 2020). Meanwhile, in many rural communities the departure of thousands of migrant  
372 laborers back to their homes have led not only to increasing wages but to serious issues in  
373 hiring other laborers in the midst of the Rabi season. The more or less complete interruption  
374 of such services has created large problems for the operation of many farm systems. Despite  
375 reported skepticism with respect to mitigating government initiatives, a newly arrived  
376 permission to use machine harvesting for harvest Rabi crops was therefore generally well  
377 received. Here, the unavailability of expert operators of these machines however has  
378 introducing another limiting factor affecting farm operations. Thus, about 5000 combined  
379 harvesters are encountering this situation, which allegedly has discouraged many farmers to  
380 take risks with respect to the use of new agriculture technologies for crop cultivation.

### 381 *3.5.3 Transport and distribution of goods and produce*

382 The normal distribution of essential raw materials to farms all over India and from farms to  
383 markets is and has been severely affected by the lockdown. For example, despite sincere  
384 efforts by state governments to ensure the supply of seed for cultivating crops, these are not  
385 adequately available and accessible to all needy farmers. Moreover, (similarly to the case of  
386 Uttar Pradesh) when available their cost prices have increased by as much as 30-40%,  
387 severely impacting the farmers' revenues. Another issue is the local shortage of harvesters  
388 and fertilizers at the time of the lockdown, which has been impossible to account for, and  
389 resulted in falling production curves (Sengupta & Felman, 2020).

### 390 *3.5.4 Markets*

391 Due to the reduced number of wholesalers in the mandis, vegetables sales have decreased,  
392 causing distress to vegetable farmers. On the other hand, the incomes of said vegetable  
393 farmers, and, in turn, the retailers has increased at the same time due to the higher prices  
394 quoted by them owing to the shortage of products. The prices of the majority of the seasonal  
395 vegetables like cabbage, cauliflower, potato, brinjal, cucurbits, and many more have thus  
396 increased by as much as 40-45%. Similarly, the prices of fruits such as oranges, grapes,  
397 apple, and others have increased by 30-40%. The supply of sugarcane for juices has been  
398 forestalled but increased in units of jaggery production. As a result, the price of jaggery has  
399 been reduced by 20-25%.

400 Unlike vegetable farmers dairy farmers are experiencing the COVID-19 crisis in terms of  
401 increased rates of feeds and concentrates. Moreover, since shops selling sweets and other  
402 related items are not operational, other income sources linked to the production of cattle milk  
403 have not performed as expected. Consequently, daily farmer need to sell their milk at much  
404 below normal prices and quantities.

#### 405 *3.5.5 Other influencing factors*

406 Considering the manifold challenges faced by farmers in India due to the COVID-19  
407 lockdown, it is unsurprising if many Indian farmers feel they have little to hope for. To  
408 exemplify, even before COVID-19 farmers in the Bundelkhand region of Uttar Pradesh have  
409 been fighting for years to overcome the challenges imposed by unpredictable extreme  
410 weather (e.g. floods and drought). Most of their resources have therefore already been  
411 employed in an attempt to tackle these challenges. These attempts however are only sparsely  
412 documented in official papers. Due to the absence of a worthy economic support system,  
413 many farmers in Bundelkhand are therefore persistently staking everything on the “next” crop  
414 season, taking heavy loans and sinking into debt traps. This observed behavior clearly goes  
415 against the longstanding belief that Indian farmers are risk-averse. Rather they have already  
416 experimented and invested for their betterment.

417 Although it was originally planned that the lockdown should last only three weeks, it was  
418 prolonged several times, and farm experts have been increasingly worried about the  
419 possibility of a regular economic collapse in the mandis, as well as for the implications of  
420 these hard times on farmers’ mental health. Thus, the failure to harvest in the past has  
421 previous led to a spate of suicides, which is continuing till date. For example, as per reports  
422 published in national newspapers in May, two farmers from the states of Tamil Nadu and



423 Karnataka, respectively, committed suicides owing to their failure in selling their farm  
424 produce during the first week of the lockdown. Hence, even as the situation is changing from  
425 a complete lockdown to a different, controlled state of operations, it is not assured that farm  
426 systems will be able to perform effectively. Rather, despite the different relief packages  
427 farmers will very likely remain in an economically difficult situation that could potentially  
428 lead to further disruption of farm operations dumping of vegetables, fruits, and other farm  
429 produce, damaging the economic status of the farmers further.

430 In the seven districts of the Bundelkhand region of Uttar Pradesh (Banda, Chitrakoot,  
431 Hamirpur, Jalaun, Jhansi, Lalitpur, and Mahoba) plagued by highly varying weather  
432 conditions, a change in cropping patterns are being witnessed in response to the COVID-19  
433 crisis in the agricultural sector. This includes irrigation of the winter crop instead of the rain-  
434 fed Kharif (autumn) crop. Potentially, this change could be the first step towards more robust  
435 agricultural systems, though at the moment it seems more an act of desperation.

#### 436 **4 Conclusions and perspectives**

437 The fact that India is a developing country with an agro-based economy is perhaps the  
438 principal reason why, in a socio-economic sense, the pre-existing health risk from COVID-19  
439 has been strongly magnified and why India as a whole has been so severely impacted – and  
440 not only economically – by the pandemic. This is in spite of the relatively few cases initially  
441 compared to the country's size (Singh et al. 2020b). As of September 2020, this situation has  
442 of course changed dramatically with India now occupying second-place in the world with  
443 respect to the number of infections. Despite the launch of the above mentioned suite of  
444 initiatives by the Government of India, many of the particular disruptions experienced by the  
445 agricultural sector from the national to the farm level during the Rabi (spring) harvest season  
446 of 2020 are expected to persist even into the Kharif (autumn) harvest season due to a partial  
447 collapse of supply chains and the agro-based economy, lack of storage facilities and the still  
448 advancing state of the COVID-19 disease in India.

449 The COVID-19 pandemic has evolved into a global challenge. In this paper, we have outlined  
450 the implications for Indian farmers of fighting the spread of the disease through a complete  
451 lockdown ordered by the Prime Minister of India on March 24, 2020. As a result of the  
452 lockdown, tens of thousands of people have left the major cities on account of unemployment  
453 and returned to their rural villages to avoid the pressures of maintaining a family in cities  
454 with high living costs. They have returned unemployed, in some places to compete for local

455 jobs with other potentially migrant workers that have been unable to travel to seek  
456 employment in other communities that now suffer from a shortage of laborers. Rural markets  
457 have been wholly or partially closed due to the lockdown, preventing an influx of income to  
458 farmers and harvesters. As a result, farmers urgently required money to sustain farm systems,  
459 particularly in April, since it is the season of Rabi (spring) harvest. Immediately after the  
460 outbreak of COVID-19, the Government of India therefore launched a number of relief  
461 packages, in particular aimed at helping the poor and farmers, which however seems to be  
462 inadequate and not fulfilling the requirement of the farmers. Some experts fear that a full-  
463 blown economic collapse of the sector could be imminent, even after the return to normal  
464 conditions, and so far the Government of India has not outlined a plan-B to deal with such a  
465 situation. “Having life, hoping for the future” seems to be the general message relayed. As  
466 result, the mental health, livelihoods and well-being of farmers all over India could be  
467 jeopardized.

468 While farmers generally would be expected to recover even from an economic collapse,  
469 people in India below the poverty line are mostly likely to be the last to overcome the impact  
470 of the lockdown. In 2020, wages within both the agricultural and non-agricultural wages have  
471 been declining due in no small part to the current situation, however, the decline relating to  
472 non-agricultural work has been the steepest (Kundu, 2019). This seems to indicate that the  
473 relief packages and other initiatives introduced by the Government of India and local  
474 administrations and aimed at sustaining farm systems have enjoyed some success, although  
475 the expected major impact on farmers’ wages has not yet been observed.

476 To ensure better conditions for the autumn harvest than was the case for the spring harvest,  
477 state governments could potentially develop a modality to ensure the effective procurement  
478 of, e.g., wheat by opening purchase centers at the village level. Adequate provision of  
479 commodities required for farm level production including seeds, fertilizers, chemicals for the  
480 standing vegetable crops, and the forthcoming zaid (mungbean, groundnut, summer maize,  
481 pearl millets) and Kharif (paddy, pigeon pea) crops at reasonable prices could also be  
482 ensured. Animal feeds and concentrates should be made available at subsidized rates to  
483 prevent losses to the dairy farmers, and the number of milk collection centers by the state  
484 dairy cooperatives could be increased. Vegetables growers, who are the typically small  
485 holders and capital starved entities, will require special attention and it will be important to  
486 ensure their access to city mandis and local markets, facilitating sale of their semi-perishable  
487 produce like vegetables. Overall, village- and city-based organizations, groups, and

488 government agents should proactively and voluntarily aid the farmers of the state to enable  
489 continuity of agricultural operations and ensure income flows.

490 *Sustainable development of Indian farming systems*

491 In view of the current aggressive development in COVID-19 infections in India, which might  
492 necessitate new or prolongate existing measures that will continue to affect farm systems,  
493 Indian harvesters seek for clarification on many of the aspects mentioned but principally on  
494 the following main questions: (i) What shall be the (present and future) source of income for  
495 farmers in India? (ii) Will the money come from their own sources? (iii) Are the relief  
496 packages and contingency plans already declared by the Government of India sufficient for  
497 addressing the needs of the people and to build resilience? (iv) What is the solution to the  
498 issue of migrated labor? Arguably, all of these issues remain to be addressed properly. On  
499 this background, it seems evident that new and more sustainable policy measures and  
500 pathways are required that consider the regional and demographic differences in India. These  
501 might include updated rules regarding direct procurement, direct cash transfers to farmers and  
502 landless laborers, and interest subvention. Whether such measures are appropriate from a  
503 transformative perspective, i.e., as means of promoting more sustainable farm operations in  
504 India, is another matter. It is evident from the COVID-19 crisis as well as from the recent  
505 challenges due to drought that current practices at the farm level are not sustainable. On the  
506 other hand, lessons learned from the current crisis clearly indicates where efforts towards a  
507 sustainable development of agricultural systems could be focused. First of all, the observed  
508 lack of qualified personnel to work the farms during the lockdown points towards an urgent  
509 need for increased education, which in turn could pave the way for increased awareness of  
510 sustainable agricultural practices in India. Secondly, the need for migrant laborers have  
511 prompted local communities in many places to innovate new local practices and to reach out  
512 to new parts of the community for help, utilizing local resources, generating local incomes  
513 and advancing social cohesion. While not all of these local developments will be in line with  
514 the SDG's, there is no doubt that some will be able to provide guidance towards sustainability  
515 in farm operations in a way that is specially tailored to Indian agriculture and which might  
516 scale well. While it is beyond the current study to elaborate on this, field work will needed to  
517 reveal these important lessons. Last but not least, under the pandemic India has invested  
518 significant amounts of it's GDP to sustain the agricultural sector and in turn local farmers. If  
519 this could be combined with a more sustainable transition of, e.g., farm systems, value and  
520 distribution chains, and markets, this could bring about not only increased food security and

521 resilience to a future pandemic situations but also pave the way for a lasting and sustainable  
522 evolution of Indian agricultural systems.

523

#### 524 **CONFLICT/DECLARATION OF INTEREST**

525 The authors declare no potential conflict of interest.

526

#### 527 **ACKNOWLEDGEMENTS**

528 The authors wish to thank the College of Horticulture and Forestry, Rani Lakshmi Bai  
529 Central Agricultural University, Jhansi, U.P., India for providing facilities to carry out the  
530 analyses described in this research.

531 **Sources of funding:** This research did not receive any specific grant from funding agencies  
532 in the public, commercial, or not-for-profit sectors

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