Journal of the Andaman Science Association Vol. 25(2):217-225 (2020)
ISSN 0970-4183, Printed in India

Impact of COVID-19 Pandemic on Agricultural Production and Marketing Systems of Andaman and Nicobar Islands

A Velmurugan, Jayakumara Varadan, T.P. Swarnam, S.K.Zamir Ahmed, T. Subramani, T.K. Biswas, I. Jaisankar and P. Perumal
ICAR-Central Island Agricultural Research Institute, Port Blair
Corresponding author: velu2171@gmail.com

Abstract

This study reports on the various consequences of the COVID-19 lockdown for farming systems by combining quantitative and qualitative sources of information collected from selected respondents with a focus on Andaman and Nicobar Islands, India taking into account the associated emergency responses of government. The restrictive measures including the total lockdown had negative consequential effect on agricultural production by way of labour shortage, input scarcity, difficult in movement of harvested produce and market access that affected the farm income and supply chains for agricultural produce. The study also identified different factors that contributed to the severe disruption of agricultural systems in the islands following the lockdown. Some of the most important knocks from the lockdown period and beyond that have negative implication for island agriculture and supply chain for farm products, scarcity of agricultural workers, narrow margin for share croppers, insufficient local storage facilities, bottlenecks for free access to the rural markets and urban consumers, greater dependence on mainland supply for agricultural produce and uncertain interisland connectivity resulting in inflated prices. Thus the pandemic has raised the need to support local capacity towards self-sufficient through well-planned food production systems and bridging only the gap in demand through external supply and creating enough storage facilities for form produce in the future.

Keywords: impact assessment, agriculture, tropical island, crop calendar, food systems

Introduction

The outbreak of the COVID-19 (novel SARS-CoV-2 virus) has evolved into one of the most serious pandemic situations in the past hundred years (Dhama et al., 2020; Sohrabi et al., 2020). Worldwide, entire population have been experiencing unprecedented lockdown situations aimed at slowing the spread of the disease, causing disruption to economic activities and abrupt changes in policies aimed at containing the spread of the virus and providing life saving treatment to the public (Chatterjee et al., 2020; Kumar et al., 2020; Singh et al., 2020a). India took early action to limit the spread of COVID-19, implementing a 21-day nationwide lockdown starting on March 24, 2020 that was extended by 19 days (15 April to 3 May 2020) in the second phase, by 14 days (4 May to 17 May 2020) in the third phase, and finally by 14 days (18 May to 31 May 2020) in the fourth phase.

Due to extensive COVID-19 mitigating actions, economic activities related to agricultural systems have faced several constraints that have arguably outweighed the direct impacts of COVID- 19 (Mahendra Dev, 2020; Pothan et al., 2020). As a result of travel restriction / ban, strict quarantine measures, curfew and value chain disruptions have restricted food access, while inputs shortage coupled with lack of fund to purchase them have jeopardized production capabilities of agriculture. At the national level, agricultural production was further threatened by unprecedented shortage of agricultural labour in some regions that disrupted planting, intercultural operations, harvest, particularly rice transplanting in the Indo-Gangetic plains at the beginning of the *kharif* season (Singh et al., 2020).

At the national level the current pandemic has created challenges for procurement operations (Saha and Bhattacharya, 2020; Pothan et al., 2020) besides yield loss. Adhikari et al. (2020) and Mahajan and Tomar (2020) reported a drop of about 10% in the online availability of various foods (with no impact on retail prices) in the immediate aftermath of the first Indian lockdown.

Evaluating different scenarios of inverse labor migration using a spatial *ex ante* modelling framework, Singh et al., (2020) reported a loss in total system productivity between 9% and 21%. However, empirical evidence of the specific impacts of COVID-19 outbreak on food and agricultural markets is still emerging.

In Andaman and Nicobar Islands, the principal activities of most people usually relate to agricultural production including livestock farming and fishery related activities which are intrinsically linked to their livelihood, economy, social systems and the environment. In remote islands and tribal areas in particular, agriculture is often the dominant source of livelihood for local communities. In Andaman Islands, the total production from rice based farming system is driven by timely transplanting of rice and, consequently, the timely sowing of succeeding crop in rotation. Similarly vegetable production is heavily dependent on family and hired labour whereas in many vegetable growing areas of South Andaman it is operated by share croppers. The sudden exodus of migrant labor and share croppers has affected intercultural, harvest and post-harvest operations in major crops.

The national level studies and still evolving situations in Andaman and Nicobar Islands necessitated a regional level assessment of COVID-19 impact on agricultural production systems and marketing. This paper presents a quantitative and qualitative assessment of information collected from different sources to identify and describe the implications of COVID-19 lockdown and related effects on agricultural systems and supply chain in Andaman and Nicobar Islands. Further, we suggest potential technological solutions to cope with the emerging situations and similar disastrous conditions in the future.

Methodology

In India, the initial lockdown of 21 days (from 25 March to 14 April 2020) was subsequently extended by four times. Later with the easing of restrictions, the standard operating procedure for various activities was put into operation. Thus, a study was undertaken during March to December 2020 to assess the impact of the COVID-19 lockdown and its cascading implications on island agriculture. In other words the study covered late summer (predominantly vegetable and plantation), monsoon season (rice) and beginning of land preparation for summer crops. In terms of COVID occurrence, the study period covered beginning of the pandemic, spreading to the community to easing of the restrictions in the islands in tandem with the national policy.

Due to pandemic situations and restrictions imposed on travel primary data was collected through telephonic survey of randomly selected 57 farmers from across the islands along with 10 personal communications using a pre-evaluated questionnaire covering major impacts and constraints faced by them. Further, a survey was conducted involving different consumers (60) and retailers (14) in order to construct and analyze the supply chain for agricultural produce. The data was collected and/or contributed by the trans-disciplinary expert team, representing a wide range of views and expertise. The present study followed semi-empirical approach by combining different quantitative and qualitative sources of information, including expert elicitation, in order to identify, describe and analyze the different factors affecting island farming systems and livelihood following the COVID-19 lockdown since March 2020. We have also collected and analyzed data pertaining to sowing/ transplanting, yield and yield loss for major crops grown in this island over normal situation (presumed as average of last three years).

Results and discussion

The situation unfolded by the COVID-19 crisis and extended lockdown period in the island has affected both the demand and supply of agro-foods including supply from mainland. At the national level, India has witnessed an estimated loss of over INR 32,000 *crore* (4.5 billion US$) every day during the first 21 days of the COVID-19 lockdown (The Hindu Business Line, 2020). In order to better represent the above situations and provide more clarity to the regional impacts, the results of this study is grouped into farmers perception of the problem, impact on agricultural operations, production and supply chain that are presented below in subsections.

Impact of lockdown on supply chain

Of all of the measures put in place in response to the COVID-19 pandemic, it was the sudden ban / severe restriction placed on the transport sector at the initial phase seriously impacted the supply of agricultural produces. Since agricultural produce is an essential commodity, it was generally exempted from the directives of the lockdown to avoid any compromise on food security in the island. However, this could not provide the desired support for agriculture as the associated implications for agricultural activities and their mitigation down to farm level were not integrated into these directives.

Due to the lack of sufficient cold storage facility for the perishable goods such as vegetables, fruits, milk and fish products of predominantly marginal and small farmers of the island could not be stored for a longtime. To make the situation worse, the supply of onion, potato, pulses and livestock products from mainland became scarce which escalated their prices. Though some residential agro-food markets were allowed to stay open with restrictions, difficulties in transportation and distribution of goods and produces affected the availability and price. For the same reason, supply could not reach remote Nicobar Islands and thus forcing the public to solely depend on the local produces for some time. Under such constrained situations four vegetable and fruit supply chains were identified and analyzed for their role to serve producer and consumer during the lockdown period (Fig. 1).

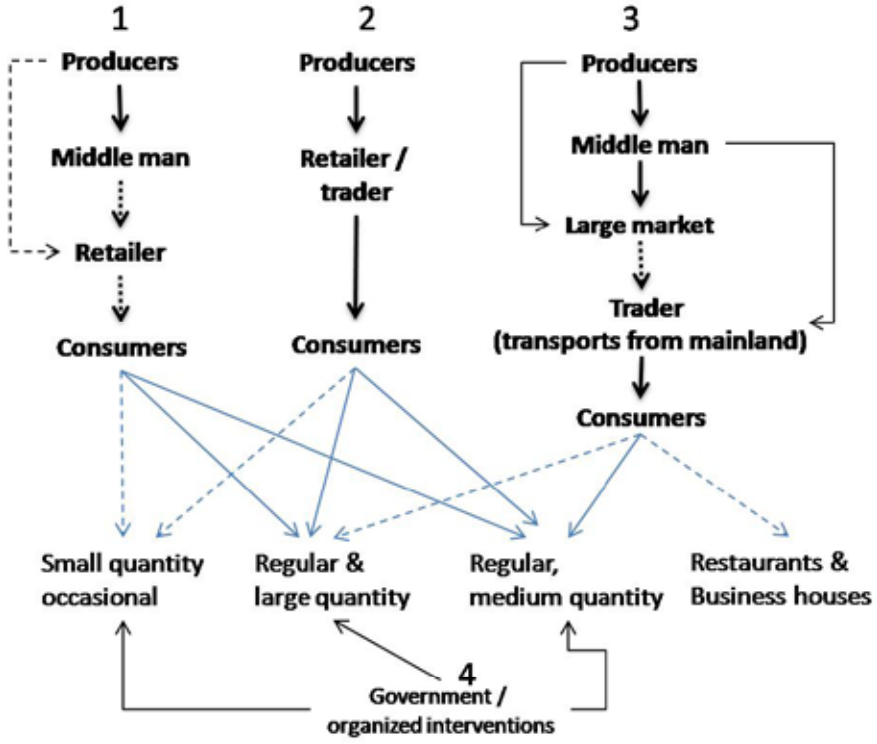

Fig. 1: Supply chains of fruits and vegetables to different categories of consumers during COVID-19 lockdown in Andaman Islands

(1 – Production-supply in the island; 2- emerged during lockdown;
3- Supply from mainland; 4- Lockdown measure / Special interventions)

Besides the pandemic lockdown, the agricultural sector in the island is already been weakened during the preceding years as a result of shortage of fertilizers, manures and agro-chemicals. Further, the pandemic coincided with the harvesting period for summer season vegetables which was the major source of income for the share croppers and farmers that is predominant in South Andaman. As a result, the existing supply chains (1 and 3) have weakened and the shortage of vegetables has become a serious concern for the island population. In addition, the local producers have lost the market for regular supply due to closure of restaurants / business houses, a condition experienced in large cities of mainland India (Mahendra Dev, 2020). During this period, the new supply chain 2 has emerged wherein the traditional retailers and those who lost their jobs due to lockdown have purchased the vegetables and fruits from the farmers at farm gate and directly sold to urban consumers at their doorstep through whatever available mode of transport. Incidentally, this new supply chain has not increased the welfare of the farmer-producers as the whole marketing margin was cornered by these mobile retailers. The condition got reversed to a certain extent after the first phase of lockdown due to government interventions through supply chain 4 to reach out to both producers and consumers. Meanwhile, a new direct marketing opportunity has opened up for the small scale livestock farmers. Thus, the interconnections of each of the nodes of agricultural supply chains proved to be critical in affording a holistic and integrated response to ensure food security and nutrition, particularly during crisis situations (Gregorioa and Ancog, 2020). Meanwhile, in the far away Nicobar group of Islands, the Nicobari tribes were forced to fall back up on their traditional *tuhet* system of community farming for fruits, vegetables and tubers.

Constraints to market access

Since the three districts of Andaman & Nicobar Islands differ geographically, demographically and administratively, the constraints on agricultural supply chain effected by lockdown also vary among them (Table 1). Restrictions imposed on movement of harvested fruits and vegetables among villages and to the urban markets at Port Blair were the major constraint invariably faced by the farmers of all the districts. Moreover, the closure of Sunday market at Jungligat and Chouldari; and other daily vegetable markets at Bathu Basthi and Aberdeen Bazaar in Port Blair denied the access of farmers to their prospective markets.

Table 1: Constraints on agricultural supply chain due to lockdown (N=67)

Sl. No.	Constraint	Response (%)				
		North & Middle Andaman	South Andaman	Nicobar	Mean	Ranking
1	Transport	60	60	40	53.3	1
2	Market access	60	50	40	50.0	2
3	Seed	45	40	20	35.0	3
4	Plant protection	40	30	20	30.0	4
5	Institutional support	35	25	30	30.0	4
6	Manures/fertilizers	40	35	10	28.3	6
7	Labour	25	40	10	25.0	7
8	Credit	35	25	10	28.3	8
9	Harvesting	30	25	10	21.6	9
10	Others (medical/attitude)	10	15	10	11.6	10

While the non-availability of seeds, plant protection chemicals, fertilizers/manures, labour and credit constrained the continuance of farming operations, farmers could not get the timely agro-advisories from the Line Departments *viz*. Agriculture, Animal Husbandry, Fisheries, CIARI and its Krishi Vigyan Kendras. Except for lack of transportation, market access and Institutional support, the farmers of Nicobar district were not facing much constraint regarding paid inputs, labour and credit due to their resilient *tuhet* farming system which is subsistence in scale, organic by default and communal in operation

Assessment of farmers adaptation to lockdown

Agriculture including livestock and fisheries is the dominant source of employment, income and food for local communities in rural and remote areas of India (Singh et al., 2020b). In spite of the constraints imposed by lockdown, farmers of Andaman & Nicobar Islands managed to overcome them and revert back to normal farming operations but not without some impact on their livelihood. The impact was qualitatively assessed as very difficult, constraint and able to manage (Fig. 2). It was observed that availability of food was the major constraint to many (>50%) but later it was managed by the Government intervention to supply additional food grins through Public Distribution System. All other farm operations, livestock farming and fishery activities were felt as difficult or constraints by majority of the respondents. Even after easing of restrictions to the movement of fishing boats, and other enabling activities, the sale of fishery products failed to recover due to shutdown of tourism sector and changed perception of people on marine products. Similarly due to halt / restrictions on transportation movement of agricultural produces and inputs, farm operations were severely affected during May-June 2020. During the peak of the vegetable harvest, produce could often not reach the markets or find the consumer thus severely disrupting normal supply chains. This resulted in significant loss to farm income. Only large farmers and livestock farmers connected with supply chain and extension support could manage to get good return.

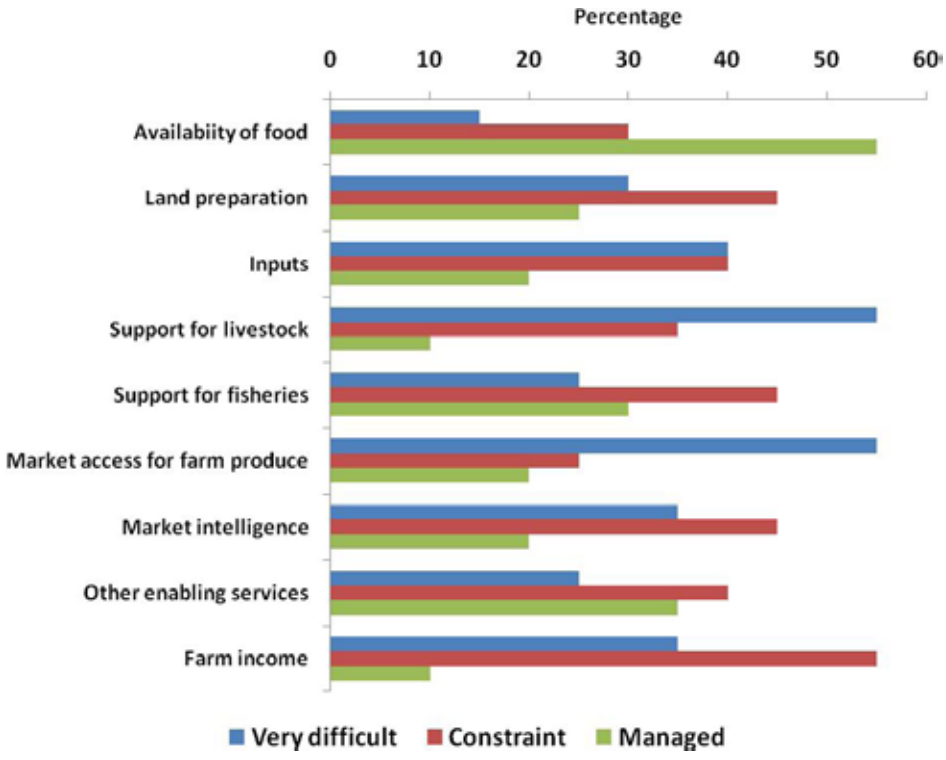

Fig. 2: Adaptation of farmers to lockdown (based on the assessment of farmers' perception)

In Nicobar Islands tribes are invariably dependant on the local fruits, vegetable and livestock products and the marketable surplus is shared among themselves (Velmurugan et al., 2016). Unlike the farmers and consumers in Andaman, tribes from Nicobar are not exclusively dependent on the market supply due to the availability of diverse food item in their *tuhet* (community) and home garden. However, more interestingly farmers from all the three districts (25-35%) felt the need for support from expert / extension functionaries during the lockdown period to cope with different constraints. Thus, the experience with COVID-19 highlights the importance of the agriculture sector and extension services in ensuring the achievement of food security especially during times of crisis.

Impact on agricultural operations

It is well known that timely agricultural operation is the key to successful production. But the sudden lockdown and subsequent gradual easing of restrictions on farm operations resulted in shortages of agricultural labour and inputs which disrupted planting, plant protection, harvest, and land preparation besides shortage of feed and fodder for livestock. Here the lockdown impact on agricultural operation particularly vegetable and rice system is discussed.

In Andaman Islands usually vegetables are cultivated during post monsoon-summer season (November – April). Solanaceous crops followed by cucurbits, okra and leafy vegetables are largely cultivated during this period. In March due to the condition created by COVID-19 lockdown, farmers could not harvest and sale the leafy vegetables ready for harvest as the market was closed. By the time the restrictions were eased out the crop lost its economic value in the consumer market. Subsequently, due to shortage of man power, uncertain market access, restricted / high cost of transport farmers could not carryout harvesting of vegetables for its regular supply. This means, early termination of harvest with the consequential economic loss. The situation is depicted in Fig. 3.

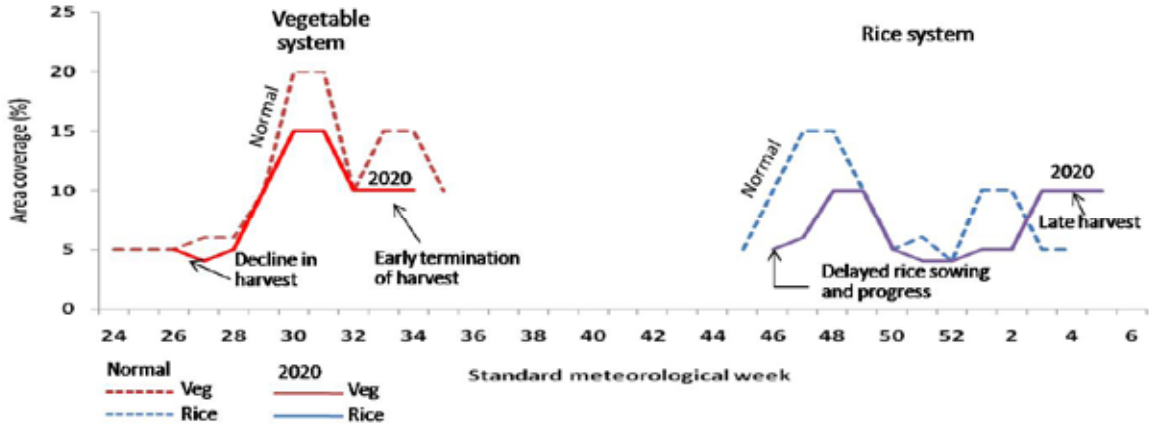

Fig. 3: Impact of lockdown on vegetable and rice production systems

The pandemic restriction also affected the land preparation, and sowing of the subsequent rice crop in most places, except for Nicobar Islands. The delay in sowing coupled with non-availability of required inputs and man power resulted in decline of rice acreage by 12 to 18% at various places. Several studies exhibited that the late sowing of rice and subsequent delay in transplanting had a cascading influence on productivity of the entire rice based cropping system (Boschetti et al., 2009; Chakraborty et al., 2017; Singh et al., 2019).

Further, late sowing of medium duration rice varieties could have accounted for late harvest and subsequent yield loss ranging from 6-15%. Singh et al., (2020) assessed the potential of COVID-related reductions in the agriculture

workforce to disrupt production of the dominant rice-wheat cropping system in the Indo-Gangetic plains using a spatial *exante* modelling framework. The simulated yield outcomes under transplanting delay scenarios from COVID-19 indicated 6 – 18% loss on the rice yields, but the loss was significantly higher for *rabi* crops.

Impact on food production

As discussed earlier, the changed conditions created by unusual COVID-19 affected food production systems, supply chains and thus food security at different levels and in a variety of ways. Evidence presented by Narayanan (2020) suggested that during the initial phase of the lockdown the closure of mandis in several states was a main reason for the disruptions in food supplies, from production units to consumption centers. Similarly the present study also indicated decrease in crop harvest (described as harvestable yield t/ha) with higher variability than the normal condition in major vegetable and fruits due to uncertain market, transport restrictions and disturbance to the existing supply chains (Fig. 4). The maximum loss of 30% was observed in solanaceous vegetables while cucurbits the least (15%). Interestingly fruits also recorded minimum loss (14%) as it found its way to the consumer market. This necessitated the transport of more than normal requirement of vegetables and fruits from mainland. For the same reason, the supply from mainland could not be done on time resulting in imbalance and shortage in supply. All these conditions resulted in scarcity and high price of fruits and vegetables. However, the production system in Nicobar island was not significantly affected as it mostly dependant on the local crops and varieties with minimal external inputs. But in a long-term this might affect the balance diet and nutritional security of tribes.

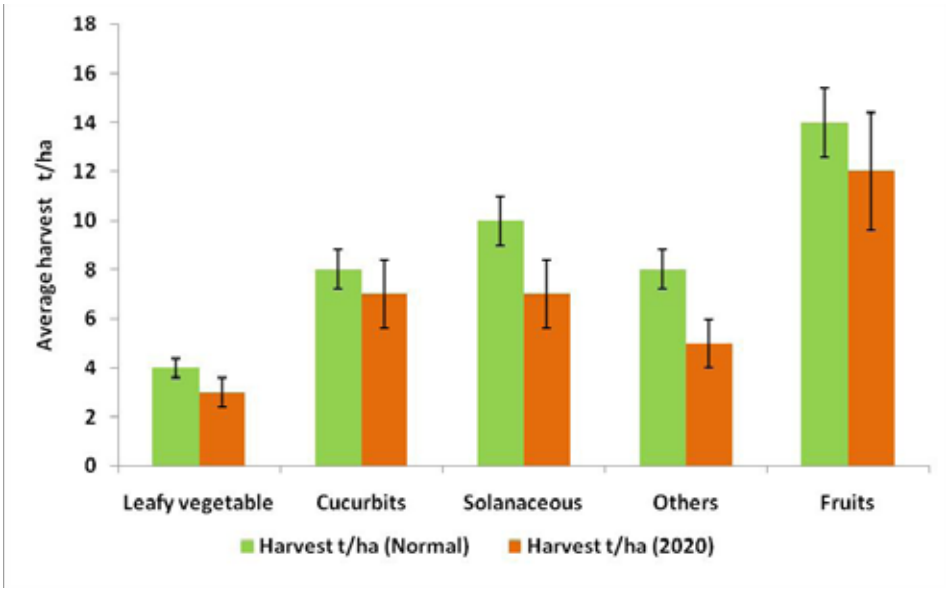

Fig. 4: Impact of lockdown on average harvest of fruits and vegetables

Policy implications

In Andaman and Nicobar Islands rural markets were either wholly or partially closed. At the same time supply chain in the urban centre was affected due to the lockdown, preventing farmers from earning normal income. As a result, farmers urgently required credit to sustain farming systems and to maintain their family, particularly in April-May, since it was the peak period of vegetables production and preparation for subsequent monsoon crop. Thus the likes of the COVID-19 pandemic have raised the need to support local capacity towards being self-sufficient through well-planned local food production systems for the island conditions. While sustaining the efforts to significantly improve productivity and income among island farmers, urban communities could be supported for

engaging in urban agriculture initiatives at the community and household levels.

At the same time analysis of technological options indicated that management practices and technologies do exist to avoid or alleviate the consequences of transport restrictions, labor shortage, delayed input supply, although there are significant challenges to alleviate the impact of lockdown on agricultural production (Singh et al., 2020). Some of the measures to deal with the delay and mitigate production losses are, delay/staggered nursery sowing, direct drilling / directly sown rice, crop diversification, integrated farming system and building agricultural input buffer stocks at different administrative levels having convergence with disaster management in agriculture. Meanwhile mobilizing existing scientific / technical man power and linking with area specific action plan by utilizing the recent advances in information technology enabled services might prove to be highly useful strategy to address the immediate challenges of island farming communities.

Conclusions

The imposition of mobility restrictions and community quarantine lockdown as a direct response to the COVID-19 pandemic in India resulted in disruptions of agricultural food systems, creating supply and demand shocks. In Andaman and Nicobar islands, due to the completeness of the lockdown with the primary focus on stopping the disease spread, daily wage-earners, farmers, agricultural retailers, consumers and other stakeholders faced the consequential challenges and difficulties affecting their livelihood. More importantly it also affected the exiting supply chain for vegetables, fruits and fishery products to the local consumers.

However, experiences have shown that partial restriction, providing market intelligence, rationalizing household needs, organizing supply chain, flee market, mobile market / farm produce on wheel, use of village resource centre, medical and extension services for livestock and fisheries could have reduced the impact without compromising the objectives of the COVID-19 lockdown. At the same time the pandemic situation has raised the urgent need to support local capacity towards self-sufficiency through well-planned local food production systems. As risks and uncertainties related to price volatilities, inclement weather, and climate-change related hazards that characterize farm production systems may arise in the future, there is a need to support more studies on better management of the resources and social organization based on our experiences learned in containing the COVID-19 pandemic.

References

Adhikari, J., Timsina, J., Khadka, S.R., Ghale, Y. & Ojha, H. (2020). COVID-19 impacts on agriculture and food systems in Nepal: implications for SDGs. Agric. Syst. 102990.

Boschetti, M., Stroppiana, D., Brivio, P.A. & Bocchi, S. (2009). Multi-year monitoring of rice crop phenology through time series analysis of MODIS image. Int. J. Remote Sens. 30, 4643–4662.

Chakraborty, D., Ladha, J.K., Rana, D.S., Jat, M.L., Gathala, M.K., Yadav, S., Rao, A.N., Ramesha, M.S. & Raman, A. (2017). A global analysis of alternative tillage and crop establishment practices for economically and environmentally efficient rice production. Nat. Sci. Rep. 7, 9342.

Chatterjee, P., Nagi, N., Agarwal, A., Das, B., Banerjee, S., Sarkar, S., Gupta, N. & Gangakhedkar, R.R. (2020). The 2019 novel coronavirus disease (COVID-19) pandemic: a review of the current evidence. Indian J. Med. Res. https://doi.org/ 10.4103/ijmr. IJMR_519_20.

Dhama, K., Sharun, K., Tiwari, R., Sircar, S., Bhat, S., Malik, Y.S., Singh, K.P., Chaicumpa, W., Bonilla-Aldana, D.K. & Rodriguez-Morales, A.J. (2020). Coronavirus Disease 2019 – COVID-19. Preprints. 2020a. 2020030001. https://doi.org/ 10.20944/ preprints202003.0001.v1.

Gregorioa, G.B. & Ancog, R.C. (2020). Assessing the Impact of the COVID-19 Pandemic on Agricultural Production in Southeast Asia: Toward Transformative Change in Agricultural Food Systems. Asian Journal

https://doi.org/10.37801/ajad2020.17.1.1

Kumar, P., Kalita, H., Patairiya, S., Sharma, Y.D., Nanda, C., Rani, M., Rahmani, J. & Bhagavathula, A.S. (2020). Forecasting the dynamics of COVID-19 pandemic in top 15 countries in April 2020: ARIMA model with machine learning approach. medRxiv. https://doi.org/10.1101/2020.03.30.20046227.

Mahajan, K. & Tomar, S. (2020). Here Today, Gone Tomorrow: COVID-19 and Supply Chain Disruption. Working Paper No. 28, 2020. Ashoka University, Department of Economics.

Mahendra Dev, S. (2020). Addressing COVID-19 Impacts on Agriculture, Food Security, and Livelihoods in India. IFPRI Blog. April 8, 2020. https://www.ifpri.org/blog/add ressing-covid-19-impacts-agriculture-food-security-and-livelihoods-india.

Narayanan, Sudha, (2020). Food and Agriculture During a Pandemic: Managing the Consequence. https://www.ideasforindia.in/topics/agriculture/food-and-agriculture-during-a-pandemic-managing-theconsequences.html.

Pothan, P.E., Taguchi, M. & Santini, G. (2020). Local food systems and COVID-19. In: A Glimpse on India's Responses. Rome (online). www.fao.org/in-action/food-for-citi esprogramme/news/detail/en/c/1272232/.

Saha, T. & Bhattacharya, S. (2020). Consequence of Lockdown amid COVID-19 Pandemic on Indian Agriculture Food and Scientific Reports, 1, pp. 47–50.

Singh, B., McDonald, A.J., Kumar, Virender, Poonia, S.P., Srivastava, A.K. & Malik, R.K. (2019). Taking the climatic risk out of directly sown and transplanted rice in Eastern India: insights from agro-climatology and dynamic simulation. Field Crop Res. 239, 92–103.

Singh, B., Paresh B. Shirsathb, M.L. Jata, A.J. McDonaldc, Amit K. Srivastavad, Peter Craufurde, D.S. Ranaf, A.K. Singhg, S.K. Chaudharig, P.C. Sharmah, Rajbir Singhi, H.S. Jath, H.S. Sidhuj, B. Gerardk, & Hans Braunk. (2020). Agricultural labor, COVID-19, and potential implications for food security and air quality in the breadbasket of India. Agricultural Systems 185:102954.

Singh, R.K., Rani, M., Bhagavathula, A.S., Sah, R., Rodriguez-Morales, A.J., Kalita, H., Nanda, C., Patairiya, S., Sharma, Y.D., Rabaan, A.A., Rahmani, J. & Kumar, P. (2020a). The prediction of COVID-19 pandemic for top-15 affected countries using advance ARIMA model. JMIR Pub. Heal. Surveill. 6, 1–10. https://doi.org/10.2196/19115.

Singh, R.K., Sinha, V.S.P., Joshi, P.K. & Kumar, M., (2020b). Modelling agriculture, forestry and other land use (AFOLU) in response to climate change scenarios for the SAARC nations. Environ. Monit. Assess. 192 (236), 2020. https://doi.org/10.1007/s10661- 020-8144-2.

Sohrabi, Catrin, Alsafi, Zaid, O'Neill, Niamh, Khan, Mehdi, Kerwan, Ahmed, Al- Jabir, Ahmed, Iosifidis, Christos & Agha, Riaz, (2020). World Health Organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19). Int. J. Surg. 2020.

The Hindu Business Line (2020). Covid-19 Lockdown Estimated to Cost India $4.5 Billion a Day: Acuit´e Ratings. The Hindu Business Line. Available at: www.thehindubusiness line.com/economy/covid-19-lockdown-estimated-to-cost-india-45-billion-a-day-acuit-ratings/article31235264.ece.

Velmurugan, A., Swarnam, T.P., Dam Roy, S. & Zamir Ahmed, S.K. (2016). Unraveling the tribal farming of Nicobar Islands. Sara Book Publicaion, Ahmedabad, India. P.147.

Received : 23th December 2020 Accepted: 28th December 2020