Applied Science and Technology Annals Vol.1, No.1 (2020); 26–33
ISSN: 2717-5014 (Print). Available online at www.recast.tu.edu.np
DOI: https://doi.org/10.3126/asta.v1i1.30269

Research Article

Agriculture is a panacea in all emergencies

Govinda Rizal [1,3], Shanta Karki [2,4] and Kishor Dahal [1,5]*

[1]Institute of Agriculture and Animal Science, Tribhuvan University, Kirtipur, Nepal
[2]National Center for Fruit Development, Kirtipur, Nepal
[3]Email: grizal@gmail.com, ORCID ID: 0000-0002-6245-1996
[4]Email: shantakyoto@gmail.com, ORCID ID: 0000-0001-8431-2674
[5]Email: dahalkcc@gmail.com, ORCID ID: 0000-0001-5147-8037

Received: May 29, 2020; Accepted: June 14, 2020; Published: May 25, 2020

Abstract: Agriculture is a panacea during all emergencies except the emergencies in agriculture itself. The recent novel coronavirus that caused COVID-19 pandemic has once again rejuvenated this realization. In Nepal, where the agrarian economy is still predominant, the effect of the pandemic differs from that of industrialized and developed countries where commercial agriculture is in practice. The fear of the outbreak of COVID-19, lockdown for its prevention, and diversion of state resources to health and other welfare sector have both direct, and indirect as well as short-term, mid-term, and long-term effects on the agriculture sector. Until now there is no complete assessment of the loss caused by the lockdown in the agriculture sector. Therefore, this study was conducted to collect representative data and information regarding the loss caused at different stages of various agricultural commodities. The data were collected using a semi-structured questionnaire survey from 60 respondents and analyzed using MS-Excel. The findings show that the harvest and supply chain of perishable vegetables, fruits, fish, poultry, dairy, and cut-flower sectors were the worst hit during the lockdown in Nepal. Many city-dwellers returned to villages during lockdown time that coincided with rice cultivation season. The rice harvests later in the year is expected to be high and enough for the country. However, the challenges are the timely availability of inputs, uncertainties of weather, limitation of storages, and disturbances in the internal distribution system. These challenges should be converted into an opportunity to develop the overall agricultural sector through utilization of the currently available surplus human resource for increase in quality production, establishing agri-processing industries, smoothening of the marketing and distribution channels.

Keywords: *agri-chaos, commercial farming, natural farming, returnees, COVID-19*

सारांश: कृषि क्षेत्रको आफ्नै आपतमा बाहेक सबै आपत बिपतमा कृषि कर्म एक समाधानको उपाय हो । कोभिड-१९ (COVID-19) महामारी पैदा गर्ने नविन कोरोना भाइरसको प्रकोपले उक्त भनाईलाई पुनःबोध गरायो । नेपालको कृषि अर्थतन्त्रमा अझै परम्परागत प्रणाली प्रवल छ जुन औद्योगिक र विकासशील देशहरूमा चल्दै आएको व्यवसायिक कृषि प्रणाली भन्दा फरक छ, तसर्थ नेपालको कृषिमा महामारिको प्रभाव पनि आफ्नै प्रकारको छ । कोभिड-१९ प्रकोपको त्रास, यसको रोकथामको लागि गरिएको बन्दाबन्दी र राज्य स्रोतहरू स्वास्थ्य र अन्य कल्याणकारी क्षेत्रहरूमा परिचालन हुँदाको कृषि क्षेत्रमा प्रत्यक्ष र अप्रत्यक्ष साथै अल्पकालीन, मध्यकालीन र दीर्घकालीन असरहरू पर्नेछन् । कृषि क्षेत्रमा भएको घाटाको पूर्ण मूल्यांकन नभइसकेको परिप्रेक्षमा एक सर्वेक्षण गरियो । यो सर्वेक्षणका लागि अर्ध-संरचित प्रश्नावली तयार गरि अनलाइनको माध्यमवाट ६० जना कृषिसँग सम्वन्धित व्यक्तिवाट तथ्याङक तथा जानकारी संकलन गरियो र एमएस-एक्सेल प्रयोग गरेर विश्लेषण गरियो । उक्त विश्लेषणबाट छिटो बिग्रने कृषि उत्पादनहरु जस्तै ताजा तरकारी, फलफूल, माछा, कुखुराको मासु, अण्डा, दुध र दुधका परिकार, र पुष्प क्षेत्रहरू बन्दाबन्दीबाट सबैभन्दा बढी प्रभावित भएको निष्कर्ष निकालियो । धेरै शहरबासीहरू बन्दाबन्दीको समयमा गाउँ फर्किए र धान रोपाईमा सम्लग्न हुन सक्ने पाइयो । यसको नतिजा यस वर्ष धानको कुल उत्पादनमा वृद्धि र देशको लागि पर्याप्त हुने आकलन गर्न सकिन्छ; यद्यपि चुनौतीहरू जस्तै उत्पादन सामाग्रीको समयमा उपलब्धता, मौसमको अनिश्चितता, भण्डारणको सीमितता, र आन्तरिक वितरण प्रणालीहरूको समस्याहरू यथावत् छन् । यो समय यस्ता चुनौतीहरूको सामना गर्दै कृषि क्षेत्रमा चाहिने जति श्रमशक्तीको प्रयोग गरेर गुणस्तरीय उत्पादन वृध्दी, प्रशोधन उद्योग स्थापना, व्यवस्थित बजारीकरण गरी कृषि क्षेत्रको समग्र विकास गर्ने अवसर हो ।

* Corresponding author, E-mail: dahalkcc@gmail.com; Tel: +977-01-98-450-46069

1. Introduction

The government of Nepal, to prevent the introduction and spread of Novel Coronavirus that causes COVID-19, enforced lockdown, encouraged social and physical distancing, cancelled large gatherings, closed academic institutions across the country since 19th March 2020 onward, and from 23rd March 2020, there was a complete lockdown across the country (Pradhan, 2020). The people restricted themselves inside their residences wherever they were, and the security forces made sure the people followed government's order with complete obedience.

The impact of lockdown became noticeable in various sectors of agriculture. During the first week of lockdown, the transports of fresh vegetables, fruits, milk, fish, and poultry sectors were adversely affected, which was gradually facilitated to regularize the supply chain. Harvesting of wheat, drying, and processing activities were limited.

The period of lockdown coincided with the peak season of economic and agricultural activities. The period from spring to summer in Nepal is a peak time when wheat is harvested and spring rice (*Chaite Dhan*) is cultivated and harvested, and tropical fruits ripen. Maize is cultivated, and field preparation, sowing, and transplantation of main season rice take place. The off-season vegetables, fruits, and flowers fetch higher prices. However, due to the lockdown the products ready to harvest remained in the fields and the workers locked up indoor. There was a complete absence of workers across the nation for some time. Ripe banana, papaya, and watermelon that remained in the field for lack of workers and buyers became easy meals for bats and rats. Tomato and other vegetables remained in the field without harvest and the already harvested products ready for the market had to be dumped due to the ban on the movement of vehicles that completely halted transportation. Harvested ginger and turmeric could not be transported to factories, which were also locked. Ready coffee and tea could not be exported. Picking up of coffee fruits and tea leaves and their processing could not be carried out.

Spring is a flowering season when the bee farmers become as busy as the bees. Bee farmers could neither take beehives for foraging nor multiply their colonies. Milk farmers had no containers to preserve the daily collection that they could not sell. They protested by spilling milk on roads in front of the cameras.

Poultry sector that was passing through intermittent ups and downs due to occasional avian-flu epidemics, experienced a hard blow. The chicken ready for the market had to be sustained on feed with a future of diminishing return. Eggs had to be destroyed and fish remained in ponds on a low diet. The gradually flourishing poultry sector met with an immediate setback.

It was the time for tourists to flock to Nepal's historical, rural and natural sites, mountaineers to ascent to mountain peaks, citizens to celebrate new year and festivals, youths to marry and people to participate in wedding celebrations and religious processions like *Jatra*. The Nepali new year and Buddha Jayanti, weddings and social rituals which used to be celebrated with festivities were limited to indoor prayers and isolations. All these factors hampered the food supply chain at the consumption end. Similarly, flowers that used to be consumed during these occasions remained at the gardens.

Workers both regular and daily wage earners remained at home, transportation, construction, and maintenance works were affected badly.

Closure of agro-vets and agriculture supply stores affected the timely availability of agricultural inputs such as tractors, tillers, trans-planters, seeds, fertilizers, pesticides, feeds, vaccines, etc. When the farmers were at home and shortage of management inputs, American Fall Armyworm (*Spodoptera frugiperda*) infested and damaged maize crops. There was a short supply of feeds for cattle, chicken, and fish. The disturbance in the milk supply adversely affected the health of infants. The progress Nepal was making toward food and nutrition security, was at stake due to disruption in the supply chain.

This study was conducted to gain some insight on which aspect of the agriculture sector was the worst hit by the lockdown and physical distancing. The data was collected based on the information provided by the respondents mentioned in the acknowledgment. This is the first comprehensive report on the effect of the lockdown on the agriculture sector.

2. Materials and Methods

The data for this report were collected while staying under lockdown, using online resources. It utilizes both the primary and secondary data sources. The primary data was generated from the online survey, and interviews with experts and farmers. Questions for discussion were shared through social media. Secondary information was collected from news, media including radio, television, and print newspapers.

2.1 Online survey

A semi-structured questionnaire was sent to different stakeholders related to agriculture. The respondents were from all the geographical regions of Nepal. Besides their personal information, the respondents were asked questions on loss, impact,

and opportunities. A list of 14 agriculture commodities affected by the lockdown were included. The respondents were asked to choose one out of 14 commodities that were the worst hit of all. The actual loss due to lockdown, most affected stage of the commodity, most affected commodity, and value of loss in rupees (NRs) were compiled. The respondents were asked if there were any positive aspects and opportunities created by the lockdown. Responses of 60 respondents received from the online survey was compiled and used for the data analysis.

2.2 Loss calculation

The respondents were asked to mention their losses within range, in NRs, for individual commodities. The ranges were analyzed in two ways (Evans, 2000; Feller, 1968). First, the statistics of loss were shown based on the percentage of respondents against the range for each commodity. Second, the mean of the lowest and the highest values of the range was calculated. The average range was multiplied with the number of respondents to estimate the total loss for the crop. It gives the estimate of loss for the surveyed sample population.

2.3 Secondary data collection

The news of losses in different sectors of agriculture published in national and local dailies were collected. News and opinion broadcasted through radios, FMs, and Televisions and shared through social media were referred. The authenticity of the news was confirmed through interviews. Such interviews were also taken to fill in the gaps in the information provided by the news media.

2.4 Statistical analysis

The questionnaire was generated using Google forms (https://docs.google.com/forms/u/0). The responses were auto collected using google spreadsheets. It was downloaded to MS excel, cured, and analyzed for descriptive statistics, graphs, and tables.

3. Results

A total of 63 respondents responded to the questionnaire sent to individual addresses. After data curation, 60 responses were taken for analysis. At this stage incomplete responses were removed from the analysis. The respondents were from six out of seven provinces, and 25 out of 77 districts of Nepal. The age of the respondents ranged between 20 and 62 years, and the average age was 31 years, and the model age was 25 years. They included 16 females and 44 males.

3. 1 The most affected commodities

Among the 14 commodities adversely affected by the lockdown, the worst affected commodity was fresh vegetables. Fifty percent of respondents mentioned that vegetable was the worst affected commodity (**Figure 1**) followed by chicken and eggs (15 %), maize (12 %), milk (7 %) and cut-flowers (5 %).

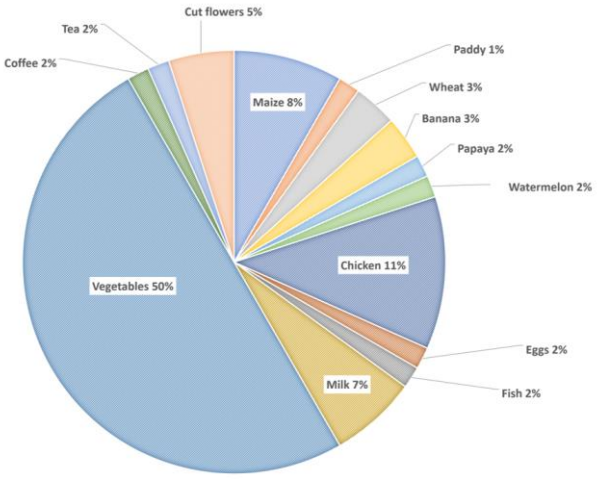

Figure 1. Pie chart showing the effect of lockdown on the individual agricultural commodity.

3.2 The most affected stage of commodities

Different commodities were affected in different stages along the production phase, supply chain, and marketing channel. This study divided the journey of food from the field (farm) to fork into three stages- production stage, harvest stage, and supply chain stage. The major effect of the strict lockdown on maize, rice, chicken, and eggs was mostly during the production stage. Wheat and vegetables were the worst hit during the harvesting stage. The major loss from vegetables, milk, chicken, and eggs, fruits (banana, watermelon, and papaya), cut flowers, coffee, and tea came from the disruption of the supply chain- that included closedown of markets and transportation, and enforced absence of supply agents. As per the responses, the least affected stage from among affected commodities was rice at the tillering stage, production stage of fruits, tea, coffee, and cut flowers, those being the commodities of perennial nature.

3.3 Effect of lockdown on selected commodities

Each commodity under this study was in a different stage and the loss was estimated stagewise (**Figure 2**). Most respondents agreed that cereal crops were adversely affected at the production stage and harvest stage while fruits and vegetables were badly hit in the production and supply chain or during the marketing stage.

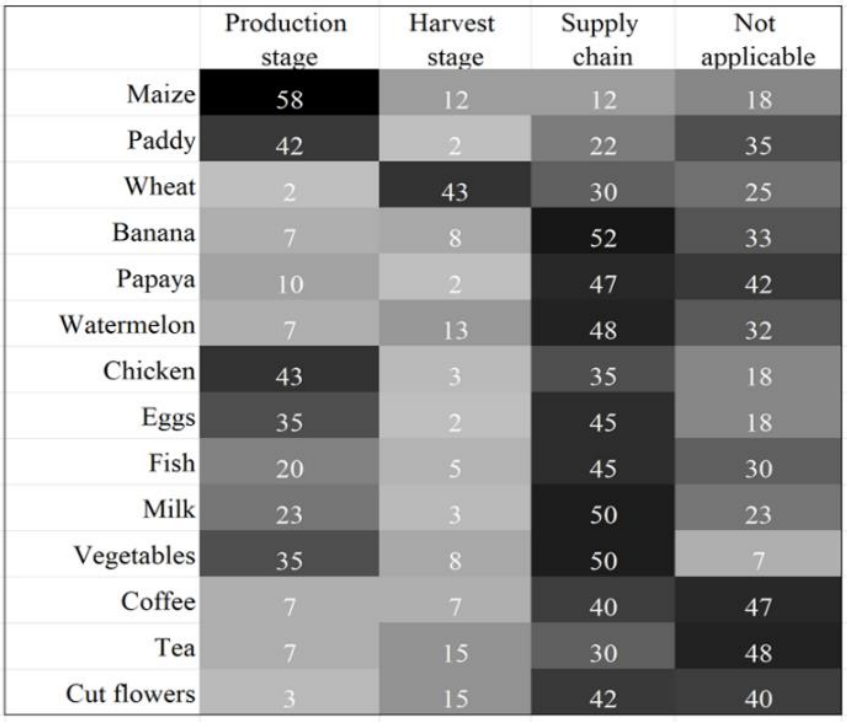

Figure 2. A heatmap generated based on the respondents' answers to what stage was most affected for each commodity. The gray shows the minimum responses and black shows the maximum responses in support of the loss. The number in each cell shows the percentage of respondents specifying the loss.

3.4 Estimation of loss in values

The loss in values was grouped into four categories- NRs 1 to 10,000; NRs 10,001 to 1,00,000; NRs 1,00,001 to 1 M, and NRs >1 M. When compiled, the total loss from 60 respondents resulted to more than NRs 63 crores (**Figure 3**) which indicated a huge loss in the country's overall agriculture sector.

Cereals

Among the cereal crops, the amount of loss on the three major commodities maize, rice, and wheat was evaluated. The effect of the lockdown was during the production stage of maize and rice, and harvest and supply chain for wheat.

Maize can be grown all-round the year in Terai, and twice in mid-hills. This time, the maize crop was mostly in the seedling stage. During the lockdown, the American Fall Armyworm (*Spodoptera frugiperda*) and other pests took an opportunity in the field. Based on the responses, 58 % of respondents claim that loss in maize was at the production stage, followed by 12 % each during the harvest stage and supply chain. To 18 % of the respondents, this was not applicable (**Figure 2**).

The extended lockdown coincided with the seeding (raising seedlings) for the main season rice cultivation. It was also the harvesting time for the spring rice (*Chaite Dhan*) in some areas of Terai. The supply and distribution of fertilizer and seed were affected in certain areas. Based on the responses received, 42 % of respondents said the loss in rice was at the production stage, followed by 22 % in the supply chain and only 2 % responded loss during the supply chain. This question did not apply to 35 % of the total respondents (**Figure 2**).

Among the cereal growers, wheat farmers suffered the most from the lockdown. It was the time of harvest and the workers were away. The crop remained in the field for a long time. Forty-three percent (43%) responded loss during harvest stage, 30 % in the supply chain, and 2 % in the production stage (**Figure 2**). It was found that 32 % of respondents mentioned loss between NRs 10,000 to 100,000 in maize and wheat. The calculated total loss mentioned by the 60 respondents was NRs 43,450,022 for wheat, NRs 23,120,024 for maize, and NRs 12,815,018 for rice (**Figure 3**).

Fruits

The effect of lockdown on the economy of three fruits- banana, papaya, and watermelon was analyzed. All the fruits were ready for the market. The major loss was from the shutdown of transportation facilities. The respondents who mentioned the loss due to lack of transportation included 52 %, 47 %, and 48 % for banana, papaya, and watermelon, respectively (Figure 2). The total loss of fruits in terms of value was NRs 52,450,021 worth of banana, NRs 24,855,019 of watermelon, and NRs 22,925,019 of papaya (**Figure 3**).

	Respondent (%)					
Range (Rs.)	1 to 10,000	10,001 to 1,00,000	1,00,001 to 1,000,000	> 1 M	N.A.	Total loss (Rs)
Maize	25	32	17	5	22	23120024
Paddy	17	22	18	3	40	17815018
Wheat	18	32	12	12	27	43450022
Banana	12	22	23	13	30	52450021
Papaya	15	27	17	5	37	22925019
Watermelon	17	18	23	5	37	24855019
Chicken	10	12	22	28	28	101065022
Eggs	12	15	18	25	30	89080021
Fish	10	15	28	15	32	59375021
Milk	15	17	23	17	28	63295022
Vegetables	12	22	27	23	17	86550025
Coffee	15	18	12	2	53	10000014
Tea	12	22	12	2	53	10100014
Cut flowers	15	22	10	7	47	26060016
Total						**630140276**

Figure 3. The heatmap shows the percentage of respondents who determined the losses in values (NRs) for each commodity. The percentage of respondents who were not directly involved with certain commodities chose "Not applicable; N.A." The last column contains the total estimated loss of 60 respondents. The loss was calculated by multiplying the mean value of the range with the number of respondents for the range. Respondents who were not involved with specific commodities were asked to choose "Not applicable; N.A."

Chicken and eggs

The poultry sector was another worst hit due to the sudden lockdown. Chicken and eggs ready for the market had to be contained for a longer time or destroyed when the return was calculated to go negative. Both chickens for meat and eggs suffered both at production as well as transportation stage. 43 % and 35 % of the respondents mentioned the loss of chicken and eggs, respectively at the production stage while 35 % and 45 % responded the loss due to supply chain disruption (Figure 2). In terms of monetary value, chicken and eggs were the worst hit among the commodities. Based on the response of the respondents, calculated NRs 101,065,022 worth of chicken, and NRs 89,080,021 of eggs were lost to the lockdown (**Figure 3**).

Fish

The nature of loss in fish was like the losses of chicken. The fish had to be sustained on a low diet beyond their harvest time. Forty-five percent of the respondents said the loss was due to supply chain disruption and 20 % said it was at the production stage (**Figure 2**). The calculated NRs 59,375,021 worth of fish were lost (**Figure 3**).

Milk

In the dairy sector, fresh milk that could not reach the market due to the disruption in transportation was a loss. The loss in the fresh milk supply was transient but huge. Fifty percent of the respondents agreed that the loss in fresh milk was at the supply chain, 23 % during the production stage, and 3 % during collection (**Figure 2**). Milk worth NRs 63,295,022 was lost (**Figure 3**).

Vegetables

Vegetables were another worst hit commodity. Vegetables like green leafy vegetables, beans, okra, brinjal, cabbage, cauliflower, and tomatoes that rot in a short time were severely affected. 50 %, 35 %, and 8 % of the respondents mentioned that the losses were during transportation, production stage, and harvest stages, respectively (**Figure 2**). The calculated loss was NRs 86,550,025 from vegetables among the surveyed population (**Figure 3**).

Cash crops

Coffee and tea are major agricultural exports from Nepal. The lockdown affected the export of tea and coffee. The tea leaf pickers and coffee beans pickers and processors were under lockdown. It is feared that both quantity and quality may be negatively affected. Regarding the loss of coffee and tea, 40 % and 30 % of respondents mentioned it was at the supply stage, 15 % and 7% mentioned at harvest and 7 % and 7% at the production stage, respectively (**Figure 2**). The calculated loss was NRs 20,200,028 from coffee and tea among the surveyed population (**Figure 3**).

Cut flowers

Nepal's newly emerging enterprise– the cut-flower– saw a sudden and indefinite setback in the business. The cut-flower entrepreneurs were unprepared for the loss. There are a few entrepreneurs in this sector, but the loss was high. The study found that 42 %, 15 %, and 3 % of

respondents mentioned that the losses were at supply, harvest, and production stages, respectively (**Figure 2**). The calculated loss was NRs 26,060,016 from cut-flowers among the surveyed population (**Figure 3**).

4. Discussion

Although the sample size was small, the respondents were from all the provinces except Karnali province, 27 % were female and 73 % males. The samples represented well those parts of Nepal where the effect of lockdown was high.

As per the respondents' answers vegetables were the worst hit among the 14 severely affected commodities. The high score is also because instead of individual commodities, common term vegetable was used. From the key informant interviews and newspapers, it was clear that among the vegetables, the tomato was the worst hit commodity. Other vegetables included beans, green leafy vegetables, capsicum, cabbage, and cauliflower.

The halt of export caused losses to coffee and tea. This season was the time to exhaust the old stock, empty the go-downs, and replace it with fresh stuff. The short supply of workers and halt of international transportation ruined the export of these important commodities.

The cut-flower business was negatively impacted by both the direct and indirect effects of the lockdown and physical distancing. Due to the lockdown the harvested flowers could not be transported (Jha, 2020). The lockdown was during the season of festivals, marriages, and celebration. Hotels and restaurants were shut down. The markets for cut-flowers abruptly dwindled to null and void. Buddha Jayanti, when hundreds of thousands of Buddhists from across the world used to flock to Nepal, was not celebrated to avoid crowds. Temples and weddings that used to be the major consumers of flowers did not function.

From the closure of restaurants, hotels, and eateries; the return of tenants from cities to villages, the number of vegetable consumers sharply declined.

The damage of maize crops by American Fall Armyworm reached up to 20-25 % but some farmers have reported up to 80 % crop loss (Pradhan, 2020).

4.1 Impact of the lockdown

Based on the responses collected from the survey and key informants, there were several direct and indirect as well as short-, medium- and long-term impacts of the month-long lockdown. There is a shortage of agriculture inputs such as seeds, fertilizer, feeds, vaccines, plastics needed for mulch or tunnels, etc due to the diminished import. It has escalated black marketing in some corners and unnecessary hoarding in others. The market and food supply chain has disintegrated. It may take time to get back to the normal order. In the meanwhile, a new set up may replace the previous system. In the absence of a regular supply of pesticides and vaccines, some other insects and pests of crops or animals may become epidemic. Due to continuing lockdown and no sign of redress, fewer people may cultivate seasonal vegetables and rear chicken on a large scale leading to their shortages soon. The imbalance in production will fluctuate the price of dressed meat in the market.

After the lockdown is eased and the movement of people is unrestricted, Nepal is expected to receive about 2 to 6 million of its population back to the country from foreign employment. This will create an abundance of human resource which can be utilized in different sectors including agriculture. In developed countries the situation may be reversed, that is they will lose their foreign workers creating a shortage of workers (Shilobo, 2020 April 22; Shilobo, 2020, April 14). This situation could create a global agriculture chaos due to unpredictable migration patterns.

The poultry and dairy entrepreneurs and large-scale vegetable farmers are hesitant to make huge investments. Only a few entrepreneurs may take up commercial production of commodities with short shelf-lives. It may be difficult to convince farmers to take up commercial farming of highly perishable commodities like vegetables, milk, and meat. The low and daily wage-earning farm workers who were first laid off may not return to agriculture if they find an alternative in other sectors or some youths may be tempted to go abroad. Paradoxically, those abroad may return to the country and take up farming. More farmers may be compelled to take more debts, and many may be unable to pay back such debts. It may be difficult to bring back those entrepreneurs who have gone bankrupt due to the lockdown. Therefore, the government should provide some relief to encourage them to continue their agri-business.

When people have low access to fresh fruits, vegetables, meat, and milk; their diet is mostly cereal based. It could lead to nutrition-related complications in the future. They may run into mineral and vitamin deficiencies, and roughage shortages leading to health complications. The mission to achieve food and nutrition security is once again in question.

In other countries also the COVID-19 pandemic caused a huge setback to agriculture. There were partial to complete lockdowns, restrictions of movements led to labor shortages and ready to harvest farm products were left to rot in the field. It was reported that the dairy farmers grappling with low prices and a sudden drop in demand from the lockdown were dumping out as many as 3.7 million

gallons of milk every day, according to estimates from Dairy Farmers of America, the country's largest dairy cooperative (Jeffery, 2020). Similarly, chicken processors dealing with staffing problems have been forced to euthanize chickens because of the reduced capacity (Jeffery, 2020).

4.2 Lessons learned from the sudden lockdown

The commercial farmers and entrepreneurs have started to realize the importance of insurance of their enterprises, crops, and animals. It is expected to give a boost to the insurance practices. It is satisfying to see vegetable vendors and shop earners conscious of personal protection, hygiene and are getting comfortable with the use of gloves, masks, and protective eyeglasses. People have stayed away from restaurants and hotel meals. The culture of improved sanitation, eating from one's kitchen has improved which will improve family environment. More entrepreneurs will focus on post-harvest activities, such as an increase in medium- and long- term storage facilities, improved transportation facilities, home deliveries, and product diversification especially of perishable commodities like milk, meat, vegetables, and fruits. As many people from cities have returned to villages where its main season for rice cultivation, the production of rice may increase to the extent that its production becomes sufficient for the country. It is time to plan for the availability of inputs like seed and fertilizers for rice cultivation and make necessary arrangements to store the rice harvest that is expected six months later. Many people who were lost to city life have got an opportunity to work in home gardens and fields. This practice increases the respect for agriculture, which was on a decline in the recent past. People look for sustainable, nature-based multiple cropping patterns than commercial monoculture.

The people advocating organic agriculture will have more followers, which will reduce dependency on imported inorganic fertilizers for some time in the future. Besides the loss of harvest-ready perishable agri-produces, there was an awakening among the citizens on the need to focus on agriculture. People have once again realized the importance of land for food production and the residents in urban areas who have no cultivable plots have resorted to roof-top and veranda farming. This has engaged the people and helped them to remain inside their compounds. The practice of recycling of water and waste from the kitchen has become a habit. There is a sudden increase in online material and virtual discussion on good agricultural practices. People with knowledge and access to the internet can now find more information, order online than ever before. The new debate has started on which of the two sectors, agriculture or health should receive a higher share of the budget from the government.

4.3 Way forward

Owing to the dominance of many small-land holder farmers, the Nepalese agricultural economy is more resilient. It is time that the government becomes extra-sensitive in increasing farmer's interest in crop diversity. Government through its various institutions, agencies, and officials must increase the farmers' access to farm machinery, postharvest management of agri-products as well as product diversification. Farmers must be taught on different ways of product diversification during the normal situation as well as when the harvest is surplus. Small and medium-scale farmers have resorted to small scale product diversification. Their initiatives must be promoted and encouraged to go commercial scale and remain sustainable. Five years ago, Nepal faced a sequence of earthquakes (FAO, 2015) and an economic blockade (PTI, 2015). The present lockdown has the impact of both the previous catastrophes.

The previous experiences should provide mechanisms and strategies to deal with the present situation. This lockdown should allow the government to plan and implement programs as per the previously designed strategic development missions such as agriculture development strategy, fruit decade, fifteenth five-year development plan, doubling the farmer's income initiative, and to achieve the set targets. This is also a good time to review the past efforts and make amendments to achieve better agriculture development. Provincial and local level governments must be sensitized to empower agriculture enterprises.

At this time, the focus should be on backstopping the agri-entrepreneurs and filling up the vacant position of agriculture technicians in all levels of government. It shall also be an opportunity to fulfill international commitments such as feed the future initiative, sustainable development goals (SDG, 2015), food and nutrition security, etc. This also provides an opportunity to build back better in terms of the government's priority to health, education, and agriculture sectors.

Mechanization of agriculture for production and harvesting, use of drones for sprays, the establishment of processing industries for product diversification, systematic marketing strategies including online order and home delivery systems, cold storage for long term storage of agri-products are some of the areas that governments, entrepreneurs and all development partners could collaborate for an overall improvement of the agriculture sector.

5. Conclusions

After the initial days of the lockdown the importance of food to save the people from hunger and the need for a balanced diet to improve their immunity power was severely felt. Therefore, entire food production and supply chain (agriculture including the livestock sector) was recognized and classified as an "essential sector" during the COVID-19 lockdown period and hence agricultural activities were allowed to run and remained comparatively less interrupted so that people could have access to enough food. Despite facing huge losses as shown by this study, this is the sector that remains active and engages people during this lockdown period. So, agriculture remains as one of the forefront sectors of the economy and people's lives at such times of emergencies.

Acknowledgments: The authors acknowledge the following personalities for their valuable information and opinion as respondents or key informants: Anil Gautam, Ankita Shrestha, Arun Kafle, Ashok Gurung, Asmita Shrestha, Babi Basnet, Bed Prasad Bhattarai, Bhawani Pandey, Bikash Adhikari, Binod Dev Bhatta, Bipin Aryal, Bipin Neupane, Bishnu Prasad Panth, Chandan K.C, Damodar Poudyal, Dawa Tshiring Tamang, Deepak Aryal, Dilli Bhandari, Ganesh Gautam, Gayatri Phulara, Harish Chandra Bastola, Jib Raj Paudel, Kabita Basyal, Kabita Poudel, Kailash Bhatta, Kamala Tamang, Khem Raj Dahal, Krishna, Kul Prasad Tiwari, Kushal Acharya, Menuka Pandey, Nav Raj Adhikari, Prachanda Kattel, Pragya Poudel, Pratik Ojha, Ram Chauhan, Ram Prasad B.K, Ramila Dhakal, Ronika Thapa, Suchit Shrestha, Sujan Dhungel, Suraj Gautam, Tirtha Raj Paudel, and Yagya Khadka. The authors extend their gratitude to several other respondents who chose not to be public.

Authors' Contributions: G.R., S.K. and K.C. conceived and designed the experiments; G.R. carried out the survey and drafted the manuscript, prepared figures and tables, S.K. analyzed the data and revised the manuscript, K.D. revised the survey questionnaire and draft of article. All authors have contributed substantially to this research work.

Funding information: There was no external funding support for this research and publication.

Conflicts of Interest: The authors declare no conflicts of interest.

References

Evans M, Hastings N, Peacock B. Statistical Distributions, 3rd ed. New York: Wiley, 2000.

Feller W. An Introduction to probability theory and its applications, Vol. 1, 3rd ed. New York: Wiley, 1968.

Google Forms. https://docs.google.com/forms/u/0/(nd)

Jeffery A Newburger E. Wasted milk, euthanized livestock: Photos show how coronavirus has devastated US agriculture. Food and Beverages, CNBC. 2020 May 2. Available from: https://www.cnbc.com/2020/05/02/coronavirus-devastates-agriculture-dumped-milk-euthanized-livestock.html

Jha DK. Farmers destroy crop as lockdown brings floriculture market to standstill. Business Standard. 2020 April 30. Available from: https://www.business-standard.com/article/markets/lockdown-brings-floriculture-market-to-standstill-farmers-destroy-crop

Pradhan B. Collective efforts to fight fall armyworm in Nepal. CIMMYT. 2020 April 7. Available from: https://www.cimmyt.org/news/collective-efforts-to-fight-fall-armyworm-in-nepal/

Pradhan TR. Oli announces suspension of all flights, all long-haul transport and all non-essential services. The Kathmandu Post. 2020 March 21. Available from: https://tkpo.st/2U8o7Qp

Shilobo W. Agriculture after Covid-19. Bangkok Post. 2020 April 22. Available from: https://www.bangkokpost.com/business/1904870/agriculture-after-covid-19

Shilobo W. Agriculture After the Pandemic. Project Syndicate: The World's Opinion Page. 2020 April 14. Available from: https://www.project-syndicate.org/commentary/covid19-labor-shortages-agriculture-automation-by-wandile-sihlobo-2-2020-04