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Perceived effects of COVID-19 on smallholder farmers' agricultural production practices in Ethiopia

Asrat Mulat Asegie[1]*, Samuel Tadesse Adisalem[1] and Amogne Asfaw Eshetu[2]

[1]*Department of Rural Development and Agricultural Extension, Wollo University, Dessie, Ethiopia*
[2]*Department of Geography and Environmental Studies, Wollo University, Dessie, Ethiopia*
**Corresponding author email: asrat19mlt@gmail.com*

This study analyzed the perceived effects of COVID-19 on smallholder farmers' agricultural production practices in the South Wollo and Oromo Administrative Zones of Ethiopia. Data were collected from 270 randomly selected respondents from September 5 to October 10, 2020. Data were analyzed qualitatively and quantitatively. The severity of problems is analyzed using a four-point Likert scale. The quantitative data were analyzed using mean and one sample t-test, while qualitative data were analyzed through thematic analysis. The one sample t-test result revealed that the respondents' level of agreement is statistically and significantly different from neutral in all cases at the 95 and 99% levels of confidence. These immediate problems caused the smallholder farmers to develop concerns about the effects of the COVID-19 pandemic. Smallholder farmers in Jige faced challenges like a lack of markets, collaboration issues, delayed agricultural activities, spoilage of produce, labour issues, and increased input prices. The government and development practitioners should prioritize timely agricultural input delivery through cooperative unions, transfer of information and advisory services, and the marketing of agricultural products using alternative strategies. This research contributes evidence-based information for decision-makers to devise appropriate and locally adaptable policy documents for the given policy recommendations.

Keywords: agriculture, COVID-19, Ethiopia, Likert scale, perceived effect, smallholder farmers

Introduction

The COVID-19 pandemic has caused unprecedented disruptions to global farming and socioeconomic systems due to its swift spread (Kesar et al. 2020; Middendorf et al. 2021). It could have direct and indirect impacts on the food production systems and the livelihoods of farmers (Jha et al. 2021; McBurney et al. 2021); it also affected both domestic and upgraded agricultural value chains (Arouna et al. 2020) and disturbed agricultural input supply (Arouna et al. 2020; Jha et al. 2021). In addition, because rural labour forces were depleted, the agricultural supply chain became vulnerable (Kumar, Padhee, and Kumar 2020). Similarly, the absence of an alternative marketing strategy for farmers caused the output market to collapse (Arouna et al. 2020). The lockdown resulted in the massive loss of jobs (Arouna et al. 2020; Kumar, Padhee, and Kumar 2020), reduced purchasing power of consumers (Arouna et al. 2020), restricted mobility of farmers (Aromolaran and Muyanga 2020; Boef et al. 2021), and reduced the demand for perishable agricultural products (Food and Agriculture Organization of the United Nations (FAO) 2020; Arouna et al. 2020).

Millions of smallholder farmers in low-income countries have been adversely affected by the COVID-19 pandemic (Aromolaran and Muyanga 2020; Workie et al. 2020) and have become highly vulnerable to food supply shocks (Huss et al. 2021). For example, COVID-19 influenced crop management activities in West Africa (Jha et al. 2021), decreased income of rural households by one-third in Kenya (Janssens et al. 2021), increased the cost of farm labour in Nigeria (Aromolaran and Muyanga 2020), and created an economic slump in the rural areas of South Africa (Visagie and Turok 2021).

As of 28 November 2020, Ethiopia had experienced 108,438 confirmed COVID-19 cases and 1686 deaths due to the ongoing pandemic (World Health Organization (WHO) 2020). The majority of Ethiopia's agricultural sector, a vital livelihood for the majority of the population (CSA 2020a), is susceptible to unseasonal rain, drought, and desert locust (Kassegn and Endris 2021). The pandemic, when combined with existing calamities, severely impacted the livelihoods of the farming community. The finding of Wieser et al. (2020) showed that 55% of respondents reported either a reduction or the total disappearance of household incomes.

International humanitarian organizations have expressed concerns about the potential rise in food insecurity due to the COVID-19 pandemic (Hirvonen, Brauw, and Abate 2021). To the best of the knowledge of the researchers, only a few studies have been conducted regarding the concerns and perceptions of organizations and smallholder farmers on the impact of the COVID-19 pandemic. These include the effect of the COVID-19 pandemic on agricultural systems (Boef et al. 2021; Boughton et al. 2021; Stephens et al. 2020; Varshney et al. 2021), food security (Blazy, Causeret, and Guyader 2021; Nechifor et al. 2021; Prosser, Lane, and Jones 2021), supply chain (Deconinck, Avery, and Jackson 2020), and rural livelihoods (Agarwal 2021; Harris et al. 2020; Mahmud and Riley 2021). However, the literature on the perception of smallholders regarding the effects of COVID-19 on agricultural production are almost negligible. Due to the uniqueness of the pandemic, its effects and the perceived concerns of the farming community have not been well analyzed. Besides, most extant reports are the result of mobile phone surveys (Boef et al. 2021; Hirvonen, Brauw, and Abate 2021; Wieser et al.

2020), which does not represent all possible sample households. For example, in Ethiopia, only 40% of the rural people have access to mobile phones (Wieser et al. 2020). It is difficult to generalize a research finding drawn from non-representative samples.

Understanding the nature of such unpredictable pathways as presented by COVID-19 is critical to identify present and future system intervention strategies (Goswami et al. 2021). Knowing the perception of farmers would be useful for designing agricultural policy and the delivery of helpful extension and the advisory services (Hansson and Sok 2021; Pu and Zhong 2020). For example, authors such as Shiyani et al. (2002) argued that lack of adequate information on farmers' perception about new varieties often placed them in wrong target regions where they either failed or met only with partial success (Shiyani et al. 2002). Understanding farmers' behaviour and perceptions of pandemic effects is crucial for designing effective strategies that maximize potential benefits in various agro-ecological and socioeconomic environments. As a result, this study analyzed the perception of smallholders in South Wollo and Oromo zones towards the effect of COVID-19 on access to agricultural inputs, production activities, and marketing of agricultural products. To that end, the study's objective was to answer the following question: How did smallholder farmers perceive the effects of COVID-19 on their farming practices?

Theoretical framework of the study

Proper understanding of farmers' capacity while reacting to the COVID-19 pandemic shock requires examining their coping strategies (Yazdanpanah et al. 2021). Yilma et al. (2014) also underlined that in the absence of formal and effective protection systems in times of shocks and risks, rural farmers in developing countries undertake a variety of remedial actions which in turn are influenced by the magnitude and perceived effects of the shocks. Besides, as stressed by Zinn and Taylor-Gooby (2006), the way individuals respond in managing emergencies is largely regulated by their understanding of the extent of risk exposure and their measures taken to mitigate perceived risks. That means, how individuals rate the magnitude of risks and their degree or preparedness to mitigate the risk depends on the type or risk, and the experience and attitude of individuals (Poulios et al. 2021). Consequently, understanding of the risks farmers faced and their coping mechanisms enables the prioritization of designing feasible mitigating strategies.

Empirical studies like those of Yilma et al. (2014), Abid et al. (2015), and Chew et al. (2020) have revealed that decision-making by farmers regarding coping shocks is complex and depends on varied factors which can be categorized as economic, social, and psychological. Psychological factors by far play the most important role in determining the way people cope with the threat of epidemics and their adverse consequences. When the case of COVID-19 is considered, understanding the way smallholder farmers perceived the extent of the risk and their coping strategies played a paramount role in minimizing the expected adverse impacts of the pandemic (Abid et al. 2015). The psychometric paradigm, which holds that risks are quantifiable and predictable is the most influential and among the earliest models of risk perception (Slovic 1987).

Based on the cognitive theory of stress, we attempted to investigate the perception of smallholder farmers towards the effects of the COVID-19 on their livelihood. According to Lepore and Evans (1996), the cognitive theory of stress helps researchers to comprehend the factors affecting the preventive and coping strategies of individuals while encountering stress. This theory considers health-related risks like COVID-19 as a stressor which can activate the coping style of affected communities.

Materials and methods

Description of the study area

This study was conducted in South Wollo and Oromo Special Zones to analyze the perception of smallholder farmers towards the effect of COVID-19 on farming practices. South Wollo is bordered on the south by North Shewa and the Oromo region, on the west by East Gojjam and South Gondar, on the north by North Wollo, and on the east by Afar region and Oromo Special Zone (SWZAD 2022). The total area of the zone is 1,815,748 ha, of which 659,012 ha is cultivable, 245,804 ha is covered by forests and shrubs, 331,555 ha is forage land and 579,377 ha is allocated for other purposes such as house construction, roads and infrastructure (SWZAD 2022). Dessie, which is located 400 km north-east of Addis Ababa, is the centre of the South Wollo administrative zone. South Wollo is located between 11° 10'N and 11°41'N latitudes and 38°28'E and 40°5'E longitudes (Mekonen, Berlie, and Ferede 2020). According to SWZAD (2022), 51.2% is Dega, 42.4% is Weynadega, and 6.4% is Kolla. Elevation ranges from 927 m (over the dry plain/Arabati) in the east to 4261 m above sea level (Degat Mountain) in the west (SWZAD 2022). Mean annual temperature of 15–20°C. The study area has bimodal rainfall regimes, locally known as *kiremt* and *belg* seasons. *Kiremt* is the big rainy season usually extending from June-to-September, and *belg* is the small rainy season extending from January-to-March. The mean annual rainfall ranges between 500 and 900 mm in the lowland area and 950–1100 mm in the highland area (SWZAD 2022). South Wollo Zone has 20 districts and 9 city administrations. The total population of South Wollo Zone is 3,289,390 of whom 1,659,263 are female (CSA 2020b).

Oromo Special Zone is bordered on the south and west by North Shewa Zone, on the north by south Wollo, and on the east by the Afar region (OSZAD 2022). The total area of the zone is 419,200 ha, of which 14.4% is cultivable, 10.96% is covered by forests, 37.4% is covered by shrubs, 21.3% is covered by grazing land, and 16.84% is allocated for other purposes such as house construction, roads and infrastructure (OSZAD 2022). Kemisie, which is located 330 km north-east of Addis Ababa, is the administrative centre of the Oromo Special Zone. The Oromo Special Zone is located between 10°15'N and 11°28'N latitudes and 39°41'E and 40°22'E longitudes

(OSZAD 2022). Elevation ranges from 1000–2500 m above sea level (OSZAD 2022). Oromo special zone has five rural woredas and four city administrations. The total population of Oromo special zone is 594,265 of whom 295,122 are male and 299,143 are female (CSA 2020b).

Crop production and livestock rearing are the dominant source of livelihood in the study areas. The study area has three agro-ecological zones (Dega, Woynadega, and Kolla).[1] The dominant crops grown in the study area are wheat, teff, sorghum, maize, barley, vegetables, fruits and spices The major livestock resources in the area are cattle, sheep, goats, poultry, camels, and other equines (OSZAD 2022; SWZAD 2022). Alongside crop cultivation and livestock rearing, daily labour, small businesses, migration and remittance are the other important income sources for farming households in the study area zone (Asegie, Adisalem, and Eshetu 2021).

Sampling design

The study areas were selected purposively since they are food insecure and drought-prone areas. The COVID-19 pandemic was expected to exert great pressure on vulnerable farming systems of smallholder farmers. Moreover, the selected study areas fall within the mandate area of Wollo University. The survey was launched on 5 September 2020 and ended on 10 October 2020, by which time the country was under numerous containment measures. During the survey period the incidence of the COVID-19 pandemic was severely increasing (World Health Organization (WHO) 2021). The period is also a critical season for undertaking agricultural production and management activities such as ploughing, sowing, and weeding. Therefore, the respondents' perceptions, concerns, and expected impacts from COVID-19 were based on a complex combination of access to information, the social spread of information in the study area, as well as their own anticipated experiences due to the pandemic. The sampling units of the study were rural households whose head was aged 18 or older, who are mainly engaged in agriculture. The sex of the household head was disregarded. Therefore, any farming household that fulfilled these criteria was included in the sampling frame. Using Yamane's (1967) formula for a finite population of 32,214 households, 275 sample respondents were selected randomly using the simple random sampling technique. In addition to sampled households, 32 key informants were interviewed from kebele development agents, the woreda office of agriculture, the zonal agricultural department offices and the COVID-19 taskforce of each study woreda.

Data collection and analysis

To collect the relevant data, a questionnaire was designed in the context of the target smallholder famers' current farming practices to capture how they perceive the effect of the COVID-19 pandemic on their farming system. The semi-structured interview guideline was prepared to collect relevant data on demographic and socioeconomic characteristics, income-generating activities, the use of agricultural inputs and information, the immediate effects of COVID-19 on farming practices, problems faced in agricultural product marketing, the severity of problems on farming practice, and the perception of smallholder farmers regarding the effect of COVID-19 on their agricultural practices.

For this survey, five enumerators were assigned. Training on the details of the interview schedule was given to the enumerators. Training was also provided on how to approach women and adhere to ethical principles during interviews. A pilot survey was conducted on 10 households before the actual survey to validate the data collection tools and some technical corrections were made to the final interview guideline. To smoothen the data collection process, consultation with woreda and kebele agricultural development workers was taken on how to approach sample households. Kebele development agents aided in the identification of randomly selected households in conveniently clustered locations for contact with interviewers. As a result, four clusters were established in each kebele to conduct interviews. The schedule was then prepared for those clusters to collect data, and kebele development agents and local administrates assisted in bringing selected respondents to the site. When selected respondents were unable to be reached on the scheduled date, enumerators interviewed those households at their residence. Face-to-face interviews with selected respondents and key informants were used to collect data. Some of the key informant were interviewed via mobile phone.

In order to analyze the data, both quantitative and qualitative approaches were employed. Qualitative data were analyzed thematically. The contents of the questionnaire were classified into themes and sub-times. Then, the discussion was further supported with narration and explanation techniques. In addition, direct quotations and case reporting were used to narrate qualitative data. The data on demographic and socioeconomic characteristics, income-generating activities, the use of agricultural inputs and information, the immediate effects of COVID-19 on farming practices, and problems faced in agricultural product marketing were analyzed using percentage and mean. To analyze the severity of problems in farming practice, each respondent was asked 11 questions to respond to, on a four-point Likert scale (0 = not faced at all, 1 = faced the problem slightly, 2 = faced the problem modestly, and 3 = faced the problem severely). In the case of analyzing the perception of farmers, respondents were asked 11 questions to respond to, based on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Then, the interval was made to group the mean scores on each question based on the given scales. Furthermore, we employed the one sample t-test to test whether the level of agreement of respondents on the perceived effects of COVID-19 pandemic was statistically and significantly different from neutral or not. Finally, all the data collected from the survey were quantified (percentage, frequencies, and means) and analyzed using SPSS version 25, a software package used for statistical analysis.

Results and discussion

This study analyzed the perceived effects of COVID-19 pandemic on agricultural activities of smallholder farmers. The analysis was conducted based on the cognitive theory of stress to assess the perception of smallholder farmers towards the effect of COVID-19 on their agricultural practices. Agricultural practices are defined as activities starting from land preparation to harvesting and marketing of agricultural products. The details of the results and the discussion are presented in the following sections.

The use of agricultural inputs and information by farmers

Improved seeds and fertilizers are crucial agricultural inputs for smallholder farmers, significantly increasing production and productivity in the agricultural sector. According to key informant interviewees, a large number of smallholder farmers have been using improved varieties of seeds for crops such as teff, maize, sorghum, and wheat.

As shown in Table 1, approximately 66% of respondents used improved seeds and fertilizer during the 2020 production season. In the study area, primary farmers' agricultural cooperatives are the dominant source of agricultural inputs (Table 2). A small number of respondents purchased inputs from the local market as well. Seed exchange with other farmers, as well as own saved seeds, are additional sources of improved seeds in the study area. Access to agricultural inputs may have direct implications for farm productivity and be linked to the effects of COVID-19 on farming practices.

Table 3 shows the frequency of farmers' contact with development agents from May to September. The season was chosen to compare the frequency of farmer contact with development agents prior to and during COVID-19 in the same season for two consecutive years (2019 and 2020).

During COVID-19, the frequency of contact is noticeably reduced. As a result, there is a mean difference between before and during COVID-19. There is also an increase in the number of respondents who have yet to be contacted by development agents. This could imply that the COVID-19 affected farmers contacting development agents for agricultural information. According to a key informant from Gerbi kebele of Dawachefa woreda:

> Everyone fears the pandemic to engage in face-to-face communications. Development agents abstain from leaving their homes. Experts cannot provide agricultural information to farmers. Only a few farmers used mobile phone calls to get agricultural information from development agents.

Similarly, a development agent from Ketari kebele of Jama district said, 'The COVID-19 restricted the contact of development agents with farmers, especially the first week of March 2019 to provide extension services.'

Table 1: The use of inputs for agricultural production.

	Utilization status in the production season (n = 270)	
Input type	Used	Not used
Improved seeds	179 (66.3)	91 (33.7)
Fertilizes	180 (66.7)	90 (33.3)

Note: Figures in brackets refer to percentage values for the given frequencies.

The immediate effects of COVID-19 on farming practices

The current study also looked at the short-term effects of COVID-19 on farming practices in the study area. Weeding is one of the most severely affected agricultural practices, according to the study (Figure 1). Farming is a labour-intensive practice in developing countries such as Ethiopia. The majority of farming practices in the study area are done with shared labour on a collective basis. Weeding and harvesting are primarily group activities in the research area. However, the nature of the pandemic prevents people from gathering in one place without maintaining appropriate physical distance. As a result of the pandemic fear, smallholder farmers have faced a shortage of daily labour and shared labour to weed their crops on time. Despite the fact that the problem primarily affects farmers' weeding activities, other farming activities are also affected proportionally due to labour shortages (Figure 1).

Farmers used a round labour sharing mechanism to practise 'Jige', an indigenous collective working practice. To maintain physical distance in the pursuit of pandemic control, the required farming labour could not gather in a single plot. Consequently, farmers were forced to work alone or use only family labour. During this time, the farmland for labour-poor farmers was heavily infested with weeds, reducing productivity. The COVID-19 pandemic has been confirmed to have had an impact on harvesting, marketing, and labour accessibility, among other things (Goswami et al. 2021). One of respondent in Jama woreda stated:

> During weeding season, rural labour is brought in from neighbouring woredas. This year, no labourers have arrived in search of seasonal work. I was waiting for them to hire someone to do the weeding. But I couldn't do it … The majority of my crop is unweeded.

Similarly, a respondent in Shekela kebele said:

> In previous cropping seasons, we collaborated. I'm afraid to come into contact with each other now that I've learned the pandemic is contagious … My family members couldn't believe it. I decided to stop communicating with Jige members and instead work with my family members. I engaged my five children in weeding and ploughing activities … we attempted to cover it despite some seasonal delays.

The other key informant from Oromo Special Zone elaborated similarly: 'to supplement labour shortages, smallholder farmers used family labour and a small group of Jige members by maintaining recommended physical separation.'

This shows that smallholder farmers realized that the pandemic could harm their families and the community if there were mass gatherings. Having proper cognitive

Table 2: Source of input for smallholder farmers.

	Where they bought input?		
Input type	Local market	Cooperatives	Other sources
Improved seeds (n = 179)	45 (25.1)	155 (86.6)	5 (1.9)
Fertilizers (n = 180)	38 (21.1)	165 (91.7)	0

Note: Figures in brackets refer to percentage values for the given frequencies. Percentages are computed from the number of users only.

Table 3: Frequency of extension contact with development agents (DA) before and after COVID-19 pandemic.

Frequency of contact	DA contact before COVID-19	DA contact during COVID-19
No contact at all	75 (27.8)	126 (46.7)
1 days	15 (5.6)	58 (21.5)
2 days	87 (32.2)	56 (20.7)
3 days	46 (17.0)	18 (6.7)
4 days	30 (11.1)	7 (2.6)
5 days	14 (5.2)	4 (1.5)
More than 5 days	3 (1.1)	1 (0.4)
Mean	2	1

Figures in brackets refer to percentage values for the given frequencies.

understanding of the impact of COVID-19, smallholder farmers adopted their coping strategies to meet their labour demand (Poulios et al. 2021, Yazdanpanah et al. 2021).

COVID-19's influence on farmers varied according to farming type and season. The results illustrated in Figure 2 show that the COVID-19 pandemic had a greater impact (67%) on Meher[2] (main) season rain-feed farming activity. In addition, 49.6% of Belg[3] season rain-feed producers were affected by the pandemic. Furthermore, the pandemic also affected irrigation-based producers. Smallholder farmers use irrigation to grow a variety of vegetables and fruits, which made them more vulnerable to the pandemic. Because of the small number of respondents engaged in irrigation-based farming activity compared to the total number of respondents, the affected percentage was comparatively low. Empirical evidence confirms that summer season crops were severely affected in India (Workie et al. 2020).

Smallholder farmers faced a variety of agricultural product marketing challenges due to COVID-19. As Figure 3 indicates, 79.3% of respondents faced an increase in transportation costs. In Ethiopia, the government reduced the number of seats per vehicle by half and doubled the tariff to compensate for the fewer seats. Smallholder farmers who sell their agricultural products using small vehicles faced additional costs in this regard. Simultaneously, the selling price fell, and demand for the products (particularly perishable vegetables and fruits) also fell (Figure 3). These exacerbated issues had a significant impact on smallholder producers. In Ethiopia, marketing infrastructure is very poor, and agricultural products are marketed face-to-face with buyers in small, crowded, and fragmented markets. This condition violated the COVID-19 safeguards. In such a situation, no one could maintain physical distance. When the government imposed containment measures, there was no way to connect producers and consumers. As a result, a large number of respondents encountered various types of marketing-related issues in the study area.

As a vegetable farmer at Bulbulo kebele in Worebabo woreda explained:

> I use irrigation to grow head cabbage and lettuce on my farmland. It was harvested in March 2019, when the country was declared to be in the grip of a pandemic. There is tension among all producers and consumers. Transportation costs have doubled as a result of government measures. I was forced to pay $2.5 for 100 kg of

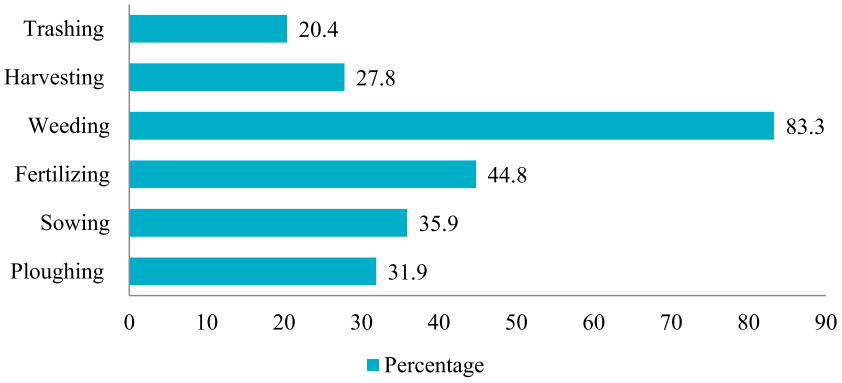

Figure 1: The immediate effects of COVID-19 on farming activities.

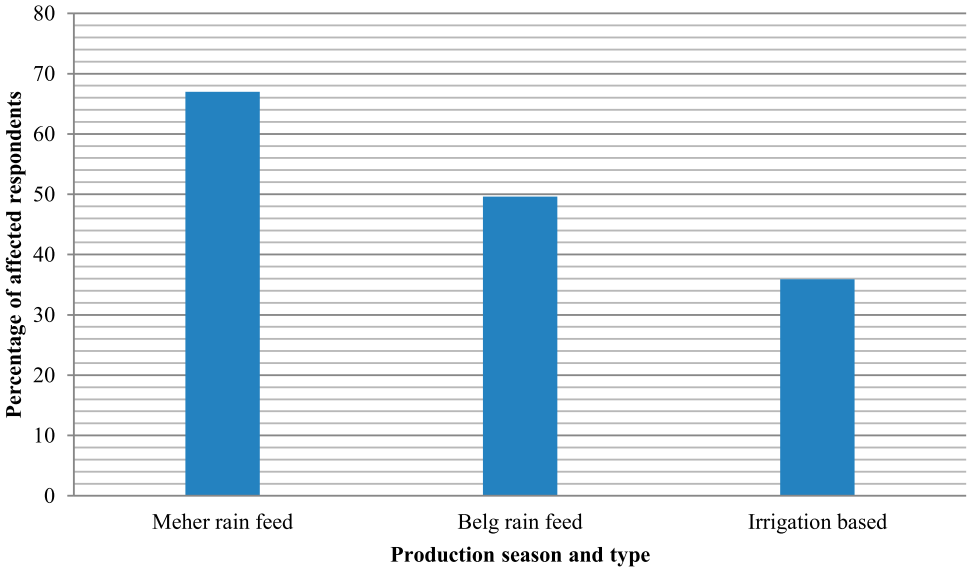

Figure 2: Affected farming season by COVID-19.

> cabbage when I normally paid around $1.2. When I arrive at the market, the buyers are dispersed … Vegetables are not demanded because of contamination concerns. I threw it at the market and returned home … very risky, and I lost money in my vegetable business as a result.

Studies confirm that farmers were forced to pay extra transportation charges to market their agricultural produces (Goswami et al. 2021). Transportation costs of pesticides to regions including eastern parts of Africa have almost trebled (Workie et al. 2020). Similarly, in Nigeria, the ability of farmers to sell their produce has declined due to COVID-19 restrictions on the movement of traders from outside communities, resulting in oversupply and lower farmgate prices (Aromolaran and Muyanga 2020).

Vegetable producers, in particular, faced a significant challenge in the study area. According to Figure 3, 69.6% of respondents experienced selling price deflation. Vegetable demand in the study area fell during the pandemic due to concerns about vegetables being contaminated and thus becoming a virus host. According to related research findings, farm product prices collapsed as a result of transportation restrictions and market disruptions, forcing farmers to sell their harvested products at extremely low prices (Rasul et al. 2021). Consumer consumption levels also fell during the pandemic (Kenenisa, Mekonnen, and Wubishet 2020). The income and productive potential of people were reduced as a result of mobility restrictions and lockdowns. Consequently, consumers were forced to reduce their consumption levels and food preferences.

According to a study conducted in Myanmar, lower crop prices reduced household income (Boughton et al. 2021). The COVID-19 pandemic increased the amount

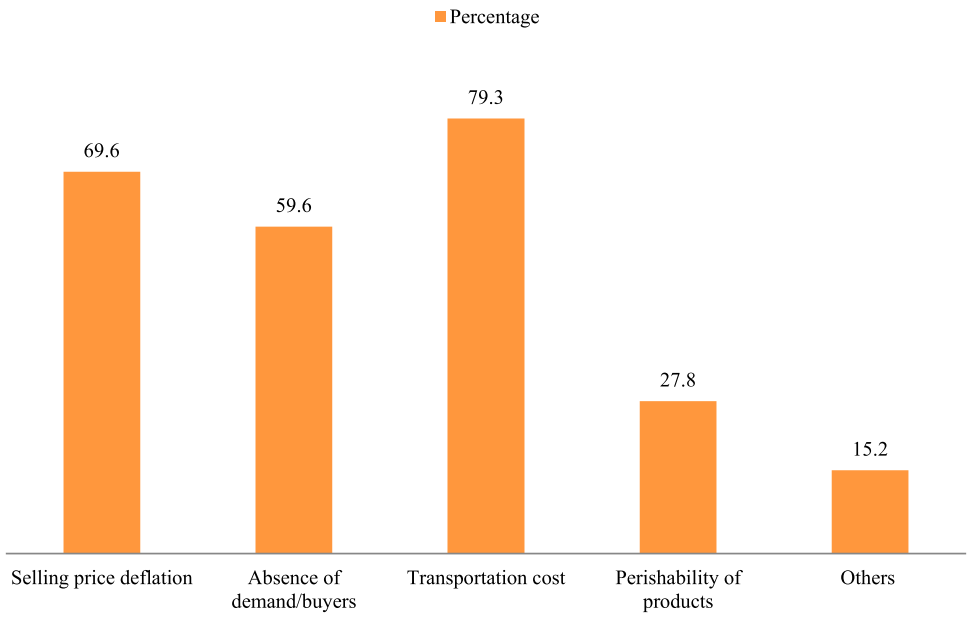

Figure 3: Main problems faced in agricultural product marketing.

Table 4: How severe are problems?

Area of problem confrontation	Severity of the problems				Mean (SD)
	Not faced at all	Faced slightly	Faced modestly	Faced severely	
Difficulty of accessing inputs	104 (38.5)	67 (24.8)	60 (22.2)	39 (14.4)	1.1 (1.1)
Increased input price	88 (32.6)	50 (18.5)	65 (24.1)	67 (24.8)	1.4 (1.2)
Difficulty of getting good markets	17 (6.3)	12 (4.4)	68 (25.2)	173(64.1)	2.5 (0.8)
Difficulty of accessing animal feed	128 (47.4)	9 (3.3)	50 (18.5)	83 (30.7)	1.3 (1.3)
Difficulty of accessing veterinary services	110 (40.7)	29 (10.7)	44 (16.3)	87 (32.2)	1.4 (1.3)
Delay/missing agricultural activities	68 (25.2)	61(22.6)	56 (20.7)	85 (31.5)	1.6 (1.2)
Problem of securing rural labour	99 (36.7)	34 (12.6)	42 (15.6)	95 (35.2)	1.5 (1.3)
Spoilage of fruits& vegetables	103 (38.1)	11(4.1)	64 (23.7)	92 (34.1)	1.6 (1.3)
Difficulty of contacting with DAs	109 (40.4)	27 (10)	60 (22.2)	74 (27.4)	1.4 (1.3)
Difficulty of working in *Jige*	35 (13)	24 (8.9)	94 (34.8)	117 (43.3)	2.1 (1.0)
Difficulty of renting assets	144 (53.3)	11(4.1)	46 (17)	69 (25.6)	1.2 (1.3)

Note: A four-point Likert scale was used to calculate mean and standard deviation (0 = not faced at all, 1 = faced slightly, 2 = faced modestly, 3 = faced severely). The values in parenthesis are the percentages calculated from total sample size. In the last column, the values in the parenthesis are standard deviations.

of unmarketable agricultural produce (Pu and Zhong 2020).

Problem confrontation due to impact of COVID-19 on farming practices

It is to be expected that access to agricultural inputs such as improved seeds, fertilizers, and pesticides would be hampered by the COVID-19 pandemic. This study, using a four-point Likert scale (0 = not faced at all, 1 = faced the problem slightly, 2 = faced the problem modestly, and 3 = faced the problem severely), shows the major problems that confronted the farming community: 24.8%, 22.2%, and 14.4% of respondents had slightly, modestly, and severely limited access to agricultural inputs, respectively (Table 4). The COVID-19-induced lockdown also raised agricultural input costs. According to the study, the price of agricultural inputs affected about 18.5%, 24.1%, and 24.8% of the respondents, respectively. Furthermore, as shown in Table 4, 64.1% of respondents were most adversely affected by the difficulty in finding good markets for their products. The summary of key informants shows that the COVID-19 pandemic severely affected sales of agricultural products. Consistent with these results, the report of iPES FOOD (2020) indicated that market closures across Africa as a result of COVID-19 cut off vital provisioning routes for communities and sales outlets for farmers. Pan et al. (2020) also reported that COVID-19 affected agricultural products sales and trade in China. Evidence from China, Myanmar, and Nigeria supports this finding, demonstrating that the COVID-19 pandemic significantly disrupted access to agricultural markets (Aromolaran and Muyanga 2020; Boughton et al. 2021; Pu and Zhong 2020).

Working together in Jige[4] was modestly (34.8%) and severely (43.3%) severely affected. In Ethiopia, farming is done manually, which requires the involvement of a large group of farm labourers on a single land parcel. Key informants from Deye kebele of Worebabo woreda said, 'the COVID-19 highly affected the labour sharing during ploughing, fertilizing, and weeding.' Similarly, key informants from Ketari kebele of Jama district said, 'the pandemic mainly restricted *jige* work in the local area.' Such conditions caused the problems of securing rural labour. According to Aromolaran and Muyanga (2020), COVID-19 decreased the availability of rural labour and increased labour costs, resulting in a decrease in cultivated areas. As shown in Figure 1, among the various farming activities affected, the inability to find rural labour, due to fear generated by the pandemic, was the most significant limiting factor in agricultural production. In addition to the fear of being infected, the shortage of workers was also due to the lockdowns, which affected livestock management practices as well, especially in terms of feeding, and sanitary rules on animal care and welfare (Hashem, González-bulnes, and Rodriguez-Morales 2020). Kenenisa, Mekonnen, and Wubishet (2020) also reported that labour shortages were experienced due to COVID-19.

The results also show that some of the smallholders faced serious problems as a result of vegetable spoilage. One case study participant from Dawachefa woreda's Gerbi kebele stated:

> On more than 1 hectare of land, I planted onions and tomatoes. I rented more land to grow these vegetables, as well. My vegetables were ready to harvest in the middle of March 2019. However, an unexpected occurrence … An outbreak of COVID-19 occurred, resulting in the complete loss of the vegetables. The market is frozen. The transportation options are limited. As a result, my products rot on the farm … I recorded an unavoidable loss.

In contrast to this result, Anagah (2020) found that the lockdown benefited local vegetable producers by allowing them to sell at unexpectedly higher prices due to the bans on importing agricultural produce from neighbouring countries. This implies that the effect of COVID-19 on agricultural products was determined by the volume of production and marketing orientation. For example, when vegetable consumption is dependent on imports, the price of domestic products rose due to increased demand, causing transportation to be halted during the pandemic. Access to veterinary services is another issue that some smallholders faced as a result of the pandemic. Evidence confirmed that COVID-19 caused an increase in veterinary healthcare tasks (Hashem, González-bulnes, and Rodriguez-Morales 2020). Farmers were forced to postpone or cancel certain agricultural production

activities due to the COVID-19 pandemic. Farmers harvested crops without sufficient cultivation/planting because there were no labourers to hire because they had to stay at home to prevent the spread of the pandemic (Anagah 2020). Agricultural production is a long process from planting, through nurturing and harvesting to commodity shipment, which involves labour at various stages (Workie et al. 2020). One of the respondent from Deye kebele said '[…] my plot prepared for sorghum cultivation was changed to *teff* due to delay of fertilizer at cooperatives.'

Farmers were forced to switch to less productive crops due to a lack of necessary agricultural inputs. Consistent with this finding, Pu and Zhong (2020) reported that the lockdown hindered the flow of necessary production inputs in China. It was also found that farming showed decreased resilience because of its dependence on inputs (mainly seeds and fertilizer) from distant markets in foreign countries (Adhikari et al. 2021). Smallholder farmers in the study area had to interact with development agents in order to obtain information on improved agricultural practices. The cost of agricultural inputs also rose due to transportation issues and other factors. Another issue that a small number of smallholder farmers faced was the difficulty in obtaining inputs. One key informant from Ketari kebele of Jama woreda explained this as follows:

> There was a delay in the supply of inputs due to the large number of people allowing them to maintain physical distance. As a result, only a limited number of farmers are served per day, extending the waiting period for agricultural inputs.

According to the study, only 14.4% of respondents had difficulty accessing inputs. This could imply that access to agricultural inputs is not a significant issue in the study area. A similar finding was reported by Goswami et al. (2021) as access to inputs was not significantly affected. In contrast, Aromolaran and Muyanga (2020) conveyed that the COVID-19 pandemic reduced the availability of farm inputs in Nigeria. Low supplies of insecticides and pesticides were already disturbing the efforts to protect the crops in countries affected initially (Workie et al. 2020). This disparity in reports implies that the severity of the pandemic in accessing agricultural inputs may vary across locations and time of infestation. Besides the inability to access agricultural inputs, some farmers also incurred higher costs of agricultural inputs during the pandemic. Similar findings were reported by Kenenisa, Mekonnen, and Wubishet (2020) that the operational cost for smallholder farmers increased as a result of COVID-19 pandemic.

Perception of respondents regarding the effects of COVID-19 on the agricultural activities

Table 5 depicts the farmers' anticipated effects of the COVID-19 pandemic on farming activities. Based on the immediate impact of the pandemic, smallholder farmers predicted their perception of COVID-19's impact on the upcoming seasons. A five-point Likert scale was used to assess farmer perceptions (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). As shown in Table 5, the one sample t-test was employed to test whether the level of agreement of respondents on the effects of COVID-19 pandemic on their farming practices was statistically and significantly different from neutral. The test result revealed that their level of agreement is statistically and significantly different from in all cases at 95 and 99% level of confidence and at 269 degree of freedom. The result implies that COVID-19 affected the farming practices in the study area in different ways. Respondents showed high level of agreement particularly on the effect of COVID-19 in reducing their ability to access food items at affordable prices, restricting their ability to work with others, reducing their income from the sale of agricultural products as well as from non-farm activities, among others.

In the present study, farmers showed their strong concerns regarding the effect of the COVID-19 pandemic in that it reduced their income from the sale of agricultural products (mean = 4.36) as well as from non-farm activities (mean = 4.13). A concomitant finding was reported by Middendorf et al. (2021) in Senegal, that the income of households decreased due to the disruption or closing down of markets where products are sold. Similarly, a study conducted in Myanmar reveals that the majority of workers experienced a negative impact on non-farm work and wages during the crisis (Boughton et al. 2021).

Table 5: One sample t-test result on level of agreement on the effects on COVID-19 on farming practices (N = 270).

	Score options (%)						
Perception domains	1	2	3	4	5	Mean (SD)	t-value
Restricted crop production	15.6	20.7	11.9	33.7	18.1	3.18 (1.37)	2.183**
Reduced/stop my income from off-farm activities	0.4	7	15.9	54.1	22.6	3.91 (0.83)	18.027***
Reduced/stop my income from non-farm activities	0.4	4.1	9.3	55.2	31.1	4.13 (0.77)	24.162***
Reduce my ability of livestock production	12.6	18.1	8.9	30.7	29.6	3.47 (1.4)	5.467***
Reduce my ability of vegetable and fruit production	2.6	14.1	23.3	28.5	31.5	3.72 (1.13)	10.522***
Reduce my income from sale of agricultural products	0	3.7	5.6	41.5	49.3	4.36 (0.75)	29.751***
Affect my contact with development agents	0.7	30.4	11.1	33.7	24.1	3.5 (1.18)	6.972***
Restrict my ability to work with others	0.4	5.2	3	42.6	48.9	4.34 (0.8)	27.550***
Reduce my access to agricultural information	1.1	33.3	11.5	31.1	23	3.41 (1.2)	5.679***
Reduce my access to get agricultural inputs	1.1	34.1	9.3	30.7	24.8	3.44 (1.23)	5.920***
Reduce my ability to access food items	0	4.1	3.3	55.9	36.7	4.25 (0.71)	29.050**

Note: Values in parenthesis are standard deviations (rounded to two decimal places); **, *** (the mean difference in the level of agreement is statistically significant different from neutral at 0.05 and 0.01 alpha levels, respectively); mean values are based on a five-point scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree).

Respondents were also concerned that the COVID-19 pandemic restricted their ability to work with others. As presented in Table 5, 48.9% of respondents strongly agreed that the pandemic restricted their ability to work with others. This is due to the transmission behaviour of the pandemic through physical contact. This concern manifested in its immediate effect on labour availability and work in Jige (Table 4; Figure 1). The COVID-19 pandemic affected vegetable and fruit production and marketing. These products are perishable and cannot be preserved for a long period of time due to a lack of suitable storage facilities.

The results of the study revealed that 31.5% of respondents strongly agreed and 28.5% agreed, with a mean score of 3.72, that the pandemic reduced the ability of smallholder farmers to produce and market vegetables and fruits (Table 5). Authors such as Huss et al. (2021) reported that the presence of on-farm storage technologies improved the food security status of smallholder farmers during the COVID-19 pandemic. The pandemic also reduced the ability of smallholders to access food items due to the lockdown of the market and increased price. The results in Table 5 show that 36.7% of the respondents strongly agreed that the pandemic reduced the ability to access food items and the mean score of their perception was 4.25. This level of perception could be due to the fact that food insecurity in Ethiopia in particular and in sub-Saharan Africa in general is smallholder agricultural-based (Ouko et al. 2020) which is more vulnerable to natural hazards and calamities (Goswami et al. 2021; Huss et al. 2021). Similarly, in Nigeria, the majority of households reported decreased availability and higher prices of food items in the COVID-19 period (Aromolaran and Muyanga 2020).

Smallholder farmers also showed their concern that the pandemic would reduce their access to agricultural information and agricultural inputs (Table 5). The mean score of the perception scale is above 3, which implies the majority of the respondents agreed on the perceived effect of the COVID-19 pandemic on accessing agricultural inputs and information. The cost of agricultural inputs increased while delivery delays occurred due to the lockdown. Similar to the present study, Boughton et al. (2021) reported that the transportation restriction disrupted input retailers at both the demand and supply sides. Livestock production is another important activity in the study area. Smallholder farmers (mean = 3.47) showed their concerns that the pandemic would reduce their ability to manage and market livestock resources (Table 5). This finding is in agreement with the findings of Boef et al. (2021) who reported the cost of transactions and doing business during the COVID-19 pandemic may have increased the scarcity and price of inputs beyond what farmers can recover. Before the outbreak of the pandemic, farmers were accessing updated agricultural information from development agents. However, contact with development agents was affected by the pandemic that limited smallholders from getting timely agricultural information about improved technologies, production and harvesting seasons, and aspects of agricultural product marketing. Authors such as Boef et al. (2021) argued that social distancing prevented stakeholders from meeting to exchange goods, services, and information, but the sector has gradually been getting up to speed with information technology.

Conclusions

Agriculture, particularly crop production and livestock rearing are the dominant income-generating activities in the study area. The COVID-19 pandemic put additional pressure on the already vulnerable smallholder farming system. Farming activities such as weeding, fertilizing, sowing, ploughing, etc. were affected by the COVID-19 pandemic due to labour unavailability. The COVID-19 pandemic resulted in smallholder farmers losing or receiving reduced income from the sale of agricultural products. The pandemic brought an immediate disruption in the economic activities of smallholder farmers. It is evident that the COVID-19 pandemic affected smallholder farmers in terms of accessing good markets, and created difficulty in working together and securing rural labour, accessing agricultural information and advisory services, and accessing animal feed and veterinary services. These immediate problems created similar longer-term concerns: that the pandemic would reduce their income from the sale of agricultural products, restrict their ability to work with others, reduce their vegetable and fruit production and management, reduce their ability to access food items, and reduce their access to agricultural information and advice and agricultural inputs. Generally, the results show that smallholder farmers were strongly concerned about the effects of the COVID-19 on their farming practice.

The results of this study provide the benchmarks to undertake an in-depth examination of the actual impacts of the COVID-19 pandemic on smallholder farming systems from production to marketing and consumption. Hence, the results will be valuable to policymakers and other responsible stakeholders to prepare and develop appropriate intervention strategies to cope with the impact of the COVID-19 on the agricultural system. Therefore, the government and other development practitioners should focus on timely delivery of agricultural inputs via farmers' cooperative unions, transfer of agricultural information and advisory service by keeping in place the proper protective measure, and marketing of agricultural products using alternative marketing strategies.

Limitation of the study

This study used cross-sectional data from selected sampled households. As a result, the finding may not show the trend and resilience of smallholders to shocks and stresses. In addition, the study was conducted in a limited geographical area, which fails to provide the overall recommendation at national or regional level. Therefore, future research should focus on examining the impact of the COVID-19 pandemic and the resilience of smallholders to stresses and shocks across different geographical areas.

Notes

1. Kolla (agroecological zone equivalent with lowland between 500–1500 m above sea level); Weynadega (middle land, between 1500 to 2300 m) and Dega (highland, between 2300 and 3200 m) (National Meteorological Agency (NMA) 2007).
2. Any temporary crop harvested between the months of Meskerm (September) and Yekatit (February) is considered as a meher season crop (CSA 2020a).
3. Any temporary crop harvested between the months of Megabit (March) and Pagume (August) is considered to be a Belg season crop (CSA 2020a).
4. Jige refers to informal organization of farmers for working together by sharing labour during the agricultural activities of ploughing, weeding, sowing, harvesting, and trashing.

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