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The social and gendered effects of COVID-19 on groundnut farmers in Burkina and Mali

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ABSTRACT

The COVID-19 pandemic impacted all socioeconomic activities across the world, leading to slowdowns, downturns, job and income losses, and other disruptions with considerable effects on poverty, hunger, and malnutrition in the fragile sociopolitical environment of West and Central Africa (WCA). The measures taken by the different States to prevent, control and cope with the COVID-19 pandemic differed, based on the nature and degree of preparedness, the economic performance of the State, and the adaptability and flexibility of the sociopolitical system. However, the measures taken by the Governments seem to have focused less on the rural areas where agriculture is the main occupation of the people. This study examined the social and gendered effect of COVID-19 on groundnut farmers in nine regions of Mali and Burkina Faso. The data were collected through surveys, key informant interviews, and focus group discussions involving 919 farmers. The study revealed that although farmers were aware of COVID-19 and received training on its disruptive effects, the most significant effects of COVID-19 on groundnut farmers in Mali and Burkina Faso included decrease in food availability for households, decrease in output price and limited access to output markets. However, these significant effects of COVID-19 were perceived and ranked differently by female and male farmers in the two countries, depending on the specificities of the social policies of each country and the social construction of gender roles and responsibilities in the groundnut production systems. The study recommends gender-responsive social policies that better respond to the long-term effects of COVID-19 and other such pandemics on food systems and rural livelihoods, and to build capacity to anticipate and respond to future pandemics and crises in agricultural production systems.

Keywords: Burkina-Faso, COVID-19, farmers, gender, groundnut, Mali

RÉSUMÉ

La pandémie de COVID-19 a impacté toutes les activités socio-économiques à travers le monde, entraînant des ralentissements, des récessions, des pertes d'emplois et de revenus, et d'autres perturbations avec des effets considérables sur la pauvreté, la faim et la malnutrition dans l'environnement sociopolitique fragile de l'Afrique de l'Ouest et du Centre (WCA). Les mesures prises par les différents États pour prévenir, contrôler et faire face à la pandémie de COVID-19 ont varié, en fonction de la nature

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et du degré de préparation, de la performance économique de l'État et de l'adaptabilité et de la flexibilité du système sociopolitique. Cependant, les mesures prises par les gouvernements semblent avoir moins porté sur les zones rurales où l'agriculture est la principale occupation des gens. Cette étude a examiné l'effet social et sexospécifique de la COVID-19 sur les agriculteurs de l'arachide dans neuf régions du Mali et du Burkina Faso. Les données ont été collectées par des enquêtes, des entretiens avec des informateurs clés et des discussions de groupe. L'étude a impliqué 919 agriculteurs. L'étude a révélé que, bien que les agriculteurs aient été informés de la COVID-19 et aient reçu une formation sur ses effets perturbateurs, les effets les plus significatifs de la COVID-19 sur les agriculteurs de l'arachide au Mali et au Burkina Faso comprenaient une diminution de la disponibilité alimentaire pour les ménages, une baisse des prix de sortie et un accès limité aux marchés de sortie. Cependant, ces effets significatifs de la COVID-19 étaient perçus et classés différemment par les agriculteurs hommes et femmes dans les deux pays, en fonction des spécificités des politiques sociales de chaque pays et de la construction sociale des rôles et responsabilités de genre dans les systèmes de production d'arachide. L'étude recommande des politiques sociales sensibles au genre qui répondent mieux aux effets à long terme de la COVID-19 et d'autres pandémies de ce type sur les systèmes alimentaires et les moyens de subsistance ruraux, et à renforcer la capacité à anticiper et à répondre aux futures pandémies et crises dans les systèmes de production agricole.

Mots-clés : Burkina Faso, COVID-19, agriculteurs, genre, arachide, Mali

INTRODUCTION

The COVID-19 pandemic is considered one of the most devastating plagues that ravaged lives and affected the world economy in the 21st century. According to the International Monetary Fund (IMF) simulations, global economic growth underperformed and the world economy is said to be in recession by the first half of 2020. Other reports concluded that COVID-19 will seriously dampen fragile economies in the lowest-income countries where the health systems are inefficient (Kinda *et al.,* 2020). There was ample evidence that the COVID-19 pandemic will hurt rural populations where the poverty rate is highest, especially the dryland areas of West and Central Africa (WCA) that are currently faced with additional climatic stresses, economic, and social crises. The social, economic, and political consequences of COVID-19 have been perceived differently depending on many factors, including the economic development of countries (Inoue *et al.,* 2020; Abimbola *et al.,* 2021) and the prevention and response measures put in place by each country. Mali and Burkina-Faso are among the few countries in West Africa that experienced the late onset of COVID-19. It was not until March 2020 that Burkina Faso and Mali reported the first cases of COVID-19.

The first cases of COVID-19 in Mali and Burkina Faso were reported during the time of aggravated political, social, economic, security and food crises. For instance, in Mali, the first cases of COVID-19 appear at a time when the government has declared a state of food and nutrition emergency following the climatic hazards that occurred during the 2019 agricultural season. An estimated 1.3 million people were acutely food insecure; 1.7 million people were malnourished, including children under 5 and pregnant and lactating mothers (Cadre harmonisé, 2020; OCHA, 2020). In Mali, as of March 2020, about 5.8 % of pre-pandemic COVID-19 workers were

off work due to the pandemic. (INSTAT, 2020). In the same vein, the economic situation before and during the COVID-19 crisis in Burkina Faso is almost similar to that of Mali in 2020. According to Atake (2018) before the COVID-19 pandemic, 39.04% of households in Burkina-Faso were vulnerable to poverty, with a very pronounced trend in rural areas. Consequently, it is estimated that the agricultural and manufactured food sectors would suffer the most from the negative effects of COVID-19 due to the low resilience capacities of small-scale agricultural enterprises and the price volatility (Pam and Ahouri, 2021). More importantly, it is posited that COVID-19 will further increase food insecurity due to the decline in economic activity, migrant remittance income, rising transaction costs, weak domestic demand, and disruption in domestic and imported food supplies to local markets due to the closure of borders (UN-Mali, 2020).

To manage and cope with the economic disruptions caused by COVID-19, the Governments of Burkina-Faso and Mali undertook measures targeted mostly at limiting the mobility of people through general lockdowns, border closures, curfews, prohibition of gatherings (closure of places of entertainment, and worship), etc. The two countries also implemented three additional measures to mitigate the effects of COVID-19 and to support consumption and production. These include individual protection (distribution of masks, distribution of hydro-alcohol gels, etc.), exemptions (e.g., Tax exemptions), and assistance to vulnerable people (payment of electricity and water bills, money transfers, and distribution of food, reactivation of showcase stores, securing of stocks of consumer products, etc.). However, these social protective measures envisaged by the two states to address the negative effects of COVID-19 have had little impact on the agricultural sector and the rural world, which are characterized by precarious livelihoods, and high poverty rates.

Mali and Burkina Faso have the highest poverty rates and lowest social indicators in the world. Nearly one in two Malians, or Burkinabe is poor. In both countries, the vast majority of the poor are illiterate, living in rural areas, and depend on agriculture for their livelihoods and survival (Cherrier *et al.*, 2011; USAID, 2020; USAID, 2021). For example, in the case of Burkina, 9 out of 10 jobs are informal (Pam. and Ahoure, 2021). Furthermore, according to Pam and Ahoure (2021), poverty is more acute in rural areas than in urban areas. For instance, the poverty incidence in 2018 was 10.0 % in urban areas compared with about 44.6% in the rural areas of Burkina Faso (Pam and Ahoure, 2021). Although the measures put in place to protect the population and mitigate the effects of COVID-19 reduced its spread, unfortunately, some of these measures had negative impact on food and nutritional security, particularly through the increase in the price of necessities, poor access to food, the drastic drop in the marketing of agricultural products, increase in transport costs, difficulty in accessing agricultural inputs, etc. Although many studies have been conducted on many aspects of the COVID-19 pandemic. However, the impacts of the different policy measures on food and nutrition security and livelihoods have not been assessed in Mali and Burkina Faso in particular and rural areas in general.

Many studies have been conducted in Burkina-Faso and Mali on the effects of COVID-19, such as on the labor market (Balde *et al.*, 2020; Kinda *et al.*, 2020; Koné *et al.*, 2021); on the students' perceptions on face-to-face/ended learnings in the context of COVID-19 (Mali and Lim, 2021); the adoption of physical distancing measures against COVID-19 by internally displaced people (Ag Ahmed *et al.*, 2021), the responses to COVID-19 (Doumbia *et al.*, 2020; Andrieu *et al.*, 2021; Dugué, *et al.*, 2021), and the clinical management and mortality among COVID-19 cases (Skrip *et al.*, 2020). Unlike in Mali, there is some research on the effects

of COVID-19 on producers in Burkina Faso (Andrieu *et al.,* 2021; Jha *et al.,* 2021), food security (Zidouemba *et al.,* 2020), and nutrition (Madzorera *et al.,* 2021). Our study differs from all the aforementioned studies in its geographical scope and the type of crop targeted. In this study, we focus on groundnut because of its important role in generating income in the semi-arid zones of Burkina Faso and Mali. Therefore, drawing from the experiences of both male and female groundnut growers, the study analyzes the measures taken by the Mali and Burkina Faso governments to respond to the COVID-19 health crisis and its effects on the food systems and livelihoods of groundnut growers. It contributes to the existing literature on the analysis of the social and economic effects of pandemics on smallholder farmers in developing countries.

Rationale

The COVID-19 pandemic has changed the dynamics of the overall economy, impacting many fields, including the agricultural sector, as the fear spread by COVID-19 led to excess demand for and hoarding of major commodities. Before COVID-19, farmers in many parts of Sub-Saharan Africa, except for areas previously affected by the Ebola virus disease, were unfamiliar with policy interventions aimed at curbing the spread of an infectious disease (Huss *et al.,* 2021; Traoré *et al.,* 2021). The impact of the pandemic on agriculture and food demand includes various macroeconomic aspects, significant instability in credit markets, exchange rates, energy, and primarily, the expected upwelling of unemployment, and the shrinkages in the overall economic activity (Workie *et al.,* 2020). Štreimikienė *et al.* (2021), hinted at the need to take into account the contextual and gender dimensions in mitigation measures and responses to the COVID-19 pandemic so as not to exacerbate the already existing gender, urban-rural and sectoral inequalities. Additionally, the consequence of the COVID-19 pandemic in rural areas is seen to have far-reaching ill effects that hamper production, marketing processes, and harvesting of agricultural produce (Workie *et al.,* 2020). In the same vein, Alvi *et al.* (2021) also noted that while the effects of COVID-19 may be insignificant in the short term on smallholders' food stocks, the mobility restriction measures aimed at mitigating its effects could be seen to reinforce the existing social norms and increasing care duties limiting women's ability to seek information outside their immediate social networks. The implication is that the gender dynamics of some of the COVID-19 prevention measures may result in the marginalization of women. Thus, women, the vulnerable food systems, and overall development opportunities may be hampered by the measures and responses to COVID-19 if gender dimensions are not considered or acknowledged during the design, planning, and implementation of the interventions.

METHODOLOGY

This study relied on primary data collected using both structured and unstructured questionnaires. Trained enumerators were deployed to interview the sampled groundnut farmers. A reconnaissance survey was first conducted, and the results were used to guide the sampling procedure, update the questionnaire, and the method of interview. To ensure a good understanding and a high response rate, the interviews were conducted in the local languages (mainly in Bamanankan in Mali; and Moore and Dioula in Burkina Faso). The survey data was collected using the Survey CTO application. In addition to demographic information (gender, age, education, household size, religion, and tribe), the questionnaire also gathered information on the farmers' landholding and management practices, knowledge of improved groundnut varieties, agronomic and socio-economic constraints in production and utilization of groundnut, varietal preferences, household assets, income and expenditures (food, health, education, housing, consumer goods, and durables), the effects of COVID-19 pandemic on the groundnut value chain and groundnut production-related

information, (commercialization, and consumption) for the year 2019/2020 cropping season in the selected nine regions in Burkina Faso, and Mali.

Research Setting: Study area and target population. The target population for the study were the groundnut farmers in Burkina Faso and Mali. The study used survey data of groundnut growers in the Sudan Savannah, and Sahelian agro-ecological zones of Burkina Faso and Mali. The selected regions in Burkina-Faso were Cascade, Centre Nord, Centre Ouest, Centre Sud, Plateau Nord, and Plateau Central, and the regions selected in Mali are Kayes, Koulikoro, and Sikasso. Fig. 1 presents the map of the study areas, showing the location (regions) of the sampled groundnut growers.

Groundnut production is the predominant source of income for most of the inhabitants of these regions, mostly cultivated by smallholder farmers under rain-fed conditions. These regions are characterized by a high incidence of poverty. The rural populations in Mali are particularly more impoverished, such that about 53.6% of them are reported to be living below the national poverty line of about 175,000 FCFA/$310 in 2016 (Modular and Permanent Household Survey, 2016), compared to 36.9% in urban areas (INSTAT, 2016). Similarly, the 2014 Continuous Multisectoral Survey (CMS) reveals that in Burkina Faso, 92% of the poor live in the rural areas. The poorest areas of Burkina Faso are the Nord, Boucle du Mouhoun, Centre-Ouest, Centre-Nord, and, Est regions, which account for over 60% of the country's poor (Institut national de la Statistique et de la démographie (INSD, 2014).

Furthermore, one of the peculiarities of the selected nine regions is the social organization and the importance of groundnut in the diet of the population and income generation for the farmers. In each of the study regions, women and young people have limited access to agricultural land, and agricultural equipment and participate less in agricultural innovations and training because of the patriarchal structure of the agricultural production system, compare with other rural communities in West and Central Africa. Although, groundnut production and commercialization enhance the market participation of youth and women.

Sampling Technique. The study sites and countries were purposively selected because the Burkinabe and Malian national breeding programs conduct trials and demonstration plots and have implemented participatory plant breeding activities with farmer organizations for 20 years in these regions. The selected regions are the main groundnut-producing areas in Burkina Faso and Mali. The sampling procedure followed a multi-stage sampling technique to select the respondents across the groundnut production agroecological zones across Burkina Faso, and Mali. The security situation was taken into consideration in the selection of regions and districts; secure and groundnut-producing areas in Northern, Eastern regions, and central regions of Mali and Burkina Faso were purposively selected. Table 1 shows the sample distribution of the groundnut growers across the study countries and regions.

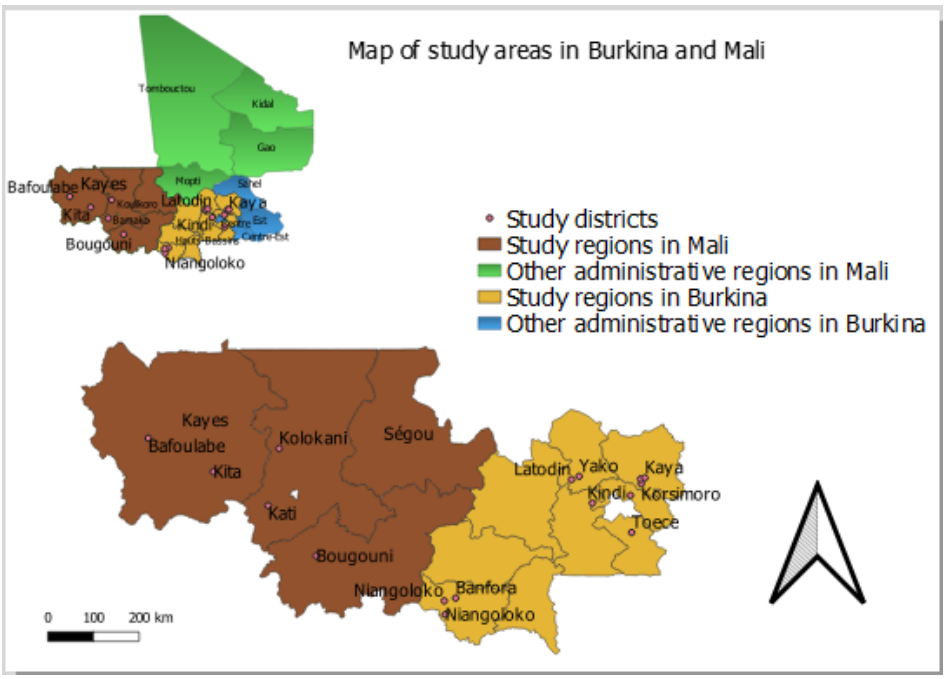

Figure 1. Administrative map of study areas in Mali and Burkina Faso

Purposive and simple random sampling techniques were employed to select 919 farmers. In the first stage, a district was purposively selected from the nine regions and two villages were purposively selected from each of the selected districts based on physical accessibility and the involvement of men and women in groundnut production, commercialization, and consumption. At least 30 groundnut growers were randomly selected from a list of groundnut producers, provided by farmer grassroots organizations. A total of 919 respondents took part in this study, consisting of 470 groundnut growers in Burkina and 449 groundnut growers in Mali (see Table 1). The share of women in the total sample is 51.70% (243 respondents) in Burkina and 49.89% (224 respondents) in Mali. Besides the survey, additional data were collected through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) from knowledgeable male and female groundnut growers.

Data analysis. The data were analyzed using various methods. Descriptive statistics were used to analyze the socio-demographic characteristics of the samples. The chi-square test is based on the dispersion index using the law of probability (Mizère *et al.*, 1999).

This test demonstrates the significant difference between binary qualitative data of respondents (i.e., men and women; or between producers in Burkina-Faso and Mali). The Wilcoxon ranking sum test is used to rank the effects of COVID-19, based on their importance on groundnut farmers. The Wilcoxon Mann-Whitney ranking sum test is used to test the hypothesis of a zero median difference between two independently sampled populations (Harris and Hardin, 2013), such as those in Burkina-Faso and Mali. The chi-square test and Wilcoxon ranking test are used to determine and rank the severity of COVID-19 disruptive effects among men and women groundnut growers in Mali and Burkina. The Wilcoxon ranking test is a robust test that detects any type of difference between two sub-samples. The Wilcoxon Mann-Whitney ranking sum test is used to test the hypothesis of a zero-median difference between two independently sampled populations (i.e., between male and female respondents, or between male respondents from Mali and Burkina) (Harris

and Hardin, 2013). This test uses the Wilcoxon law as follows:

$$R - \frac{n(n+1)}{2}$$

With R= sum of the ranks of the sample

n= sample size

Table 1. Sampling Size

Countries	Study Regions	Males		Females		Pooled	
		N	%	N	%	N	%
Burkina-Faso	Cascade	92	64.33	51	35.66	143	30.42
	Centre Nord	38	41.30	54	58.69	92	19.57
	Centre Ouest	33	41.25	47	58.75	80	17.02
	Centre Sud	20	57.14	15	42.85	35	7.44
	Nord	39	35.13	72	64.86	111	23.61
	Plateau Central	5	55.55	4	44.44	9	1.91
	Pooled	**227**	**48.29**	**243**	**51.70**	**470**	**51.14**
Mali	Kayes	76	47.20	85	52.79	161	35.85
	Koulikoro	90	46.63	103	53.36	193	42.98
	Sikasso	59	62.10	36	37.89	95	21.15
	Pooled	**225**	**50.11**	**224**	**49.88**	**449**	**48.85**
Total sample		**452**	**49.18**	**467**	**50.81**	**919**	**100.00**

The Wilcoxon ranking test is applied to the scores of the COVID-19 effect variables (access to the output market, decrease in output prices, decrease in food availability, reduced purchase power, etc.). The effects of COVID-19 on peanut farmers were evaluated on a scale of 1 to 5, with 5 being the most important/severe and 1 the least important/severe. If the score is close to 5, it means that the effect of the variable is very severe on groundnut producers. Then, the average of the scores is used to compare and rank the variables by sex in the two countries. Based on the importance of the average score, the effects of COVID-19 are ranked from 1 to 3; 1 being the most severe and 3 being the least severe. A p-value is significant at 5% or 1% indicates a difference in the ranking between the male and female respondents. The application of these statistical methods allows us to evaluate, assess and understand the effects of COVID-19 on groundnut farmers by taking into account the production contexts, the national economic political and economic environments, the types of responses to COVID-19 deployed by the two countries, and the gender roles, identities, and responsibilities in the local settings of groundnut production.

The qualitative data were analyzed using qualitative content analytical methods (Krippendorff, 1980; Miles *et al.,* 2013) to complement the quantitative analysis and deepen farmers' experience of COVID-19. The FGDs and KIIs data were transcribed and coded to capture the various thematic areas of the semi-structured checklist guides.

RESULTS AND DISCUSSION

Socioeconomic characteristics of groundnut growers in Mali and Burkina Faso. Table 2 highlights the demographic characteristics of the sampled groundnut growers. The results show that the average age of the sampled groundnut farmers is 45 years. However, the male respondents are averagely older (49 years) than female respondents (41 years) across the study countries. The average years of experience in groundnut production are 21 years for the entire sample, and higher for male farmers (24

years) compared to female farmers (19 years). The male groundnut growers from Mali are the most experienced in groundnut production (25 years). This is because men start farming at a young age in Mali. Before marriage, young boys are allowed by their elders to cultivate peanuts to meet their expenses, while women often start groundnut production after they are married. Cultural practices as such could be positively influencing the production experience of men more than that of women. Years of experience are attributed to individual capacities and competencies in agricultural practice (Vincens, 2001). The average age in groundnut production is only one component of the intrinsic experience in groundnut production.

The results show that the illiteracy rate is very high; about 53% of respondents had no formal education. A higher among producers in Burkina-Faso (55.5%) have no formal education compared to Mali (50.4%). The proportion of women (62.4%) who have not received formal education is higher than that of men (52.9%). The high rate of female illiteracy in Mali and Burkina Faso can be explained by the widespread cultural norms in rural settings that disadvantage and hinder women from attending or completing different levels of education (Maiga *et al.*, 2019). For a long time in Mali, for instance, educating women or the girl child was perceived negatively due to traditional or religious beliefs leading to many girls being taken out of school to be given out in marriage (Lange, 1998).

Table 3 highlights the production features and information of the sampled groundnut growers. In terms of membership in agricultural associations, the data show that 42.8% of all the respondents are members of a grassroots organization. However, Malian respondents are highly involved in agricultural associations (66.7%) compared with the respondents in Burkina Faso (18.2%). On the other hand, more female groundnut growers (43.9%) identified as members of farmer organizations compared to men (41.7%), in the two countries. This can be explained by the fact that more women than men are easily mobilized for informal or less formal collective actions (Carvalho, 2002; Saussey, 2011), whereas men organize themselves mainly around formal and or conventional groups. Rural women tend to create savings and loan groups to cope with the deprivation and uncertainty of access to finance (Servet, 1995; Semin, 2007). These groups increasingly function as social safety nets in times of crisis.

The data show that there is a significant difference in the area or size of land used for groundnut cultivation by country and gender. The average plot size for groundnut cultivation in Mali (2.3 ha) is larger than in Burkina (1.3 ha). However, the average groundnut land area cultivated by men (2.3 ha) is much higher than that of women (1.3 ha) in both countries. Plot size is one of the variables that are statistically correlated with the gender of the farmer (Ragasa and Sengupta, 2012). While men are the primary plot owners and are responsible for household food consumption, women often have access to fallow and marginal agricultural land pieces that are not in use and are abandoned by men. The lack and poor lack access is a general constraint for women in Africa (Mbanda and Ncube, 2020). Inequalities in access to land and credit make women more vulnerable to the disruptive effects of conflict, health and political crises, and insecurity (Maiga *et al.*, 2019). The difference in land size and the inequalities in access and control over land ownership rights have serious repercussions on production, and risk and crisis management strategies (food insecurity and growing poverty trends).

Men produced an average of 1251 kg of unshelled groundnut compared to the amount harvested by women (508 kg), hence the volume of groundnut produced by men is more than twice that of women. The overall yield of groundnut is 453 kg/ha across the

study countries is very low compared with the average yield in West and Central Africa of about 1 ton per hectare and the global average of1.65 tons per ha (Desmae *et al.,* 2022). The share of groundnut harvests that is marketed (66%) is twice the quantity that is consumed (31.5%).

Table 2. Socio-demographic characteristics of groundnut growers

	Burkina (N=470)			Mali (N=449)			Overall (N= 919)		
	Male (n=227)	Female (n=243)	Pooled (n=470)	Male (n=225)	Female (n=224)	Pooled (n=449)	Male (n=470)	Female (n=467)	Pooled (n=937)
Sex (%)	48.29	51.70	100.00	50.11	49.89	100.00	50.16	49.83	100.00
Ave. age of respondent	49	41	45	48	41	45	49	41	45
Ave. year in g/nut production	23	19	21	25	18	22	24	19	21
Marital status (%)									
Married	96.0	90.9	93.5	96.4	84.8	90.6	96.2	87.9	92.1
Single	3.5	0.8	2.2	2.2	0.9	1.6	2.9	0.9	1.9
Widow/widower	0.4	8.2	4.3	1.3	14.3	7.8	0.9	11.3	6.1
Level of education (%)									
Adult education	9.7	11.5	10.6	18.7	8.9	13.8	14.2	10.2	12.2
Koranic education	8.8	1.6	5.2	9.8	6.3	8.0	9.3	3.9	6.6
No formal education	47.6	63.4	55.5	39.6	61.2	50.4	43.6	62.3	52.9
Primary education	25.1	19.3	22.2	18.7	17.4	18.0	21.9	18.4	20.1
Secondary education	7.5	4.1	5.8	11.1	5.4	8.2	9.3	4.7	7.0
Tertiary education	0.0	0.0	0.0	1.8	0.9	1.3	0.9	0.4	0.7
Others	1.3	0.0	0.7	0.4	0.0	0.2	0.9	0.0	0.4
Ave. household size	11	10	11	24	23	24	18	17	17

Table 3. Groundnut production features

	Burkina (N=470)			Mali (N=449)			Overall (N= 919)		
	Male (n=227)	Female (n=243)	Pooled (n=470)	Male (n=225)	Female (n=224)	Pooled (n=449)	Male (n=470)	Female (n=467)	Pooled (n=937)
Association membership (%)									
No	83.3	80.2	81.8	33.3	32.1	33.3	58.3	56.2	57.2
Yes	16.7	19.8	18.2	66.7	67.9	66.7	41.7	43.9	42.8
Ave. plot size (ha)	1.5	1.1	1.3	3.1	1.5	2.3	2.3	1.3	1.8
Ave.(unshelled) production (kg)	665.4	354.2	509.8	1837	662.5	1249.8	1251.2	508.4	879.8
Ave.(unshelled) yield (kg/ha)	433.2	336.4	384.8	596.2	447.3	521.8	514.7	391.9	453.3
Importance of groundnut among all cultivated crops in the household (%)									
First crop	11.9	13.2	12.6	27.6	56.3	41.9	19.7	34.7	27.2
Second crop	34.6	39.2	36.9	38.8	26.3	32.6	36.7	32.8	34.7
Third crop	25.9	22.9	24.4	17.4	9.8	13.6	21.7	16.4	19.0
Purpose of groundnut production (%)									
Home consumption	20.7	26.8	23.7	25.2	53.1	42.6	23.0	39.9	31.5
Market	78.4	71.6	75.0	73.3	41.1	49.9	75.9	56.3	66.1

Seed	0.44	1.2	0.8	1.0	5.8	7.6	0.7	3.5	2.1
Others	0.44	0.4	0.4	0.4	0.0	0.0	0.4	0.2	0.3

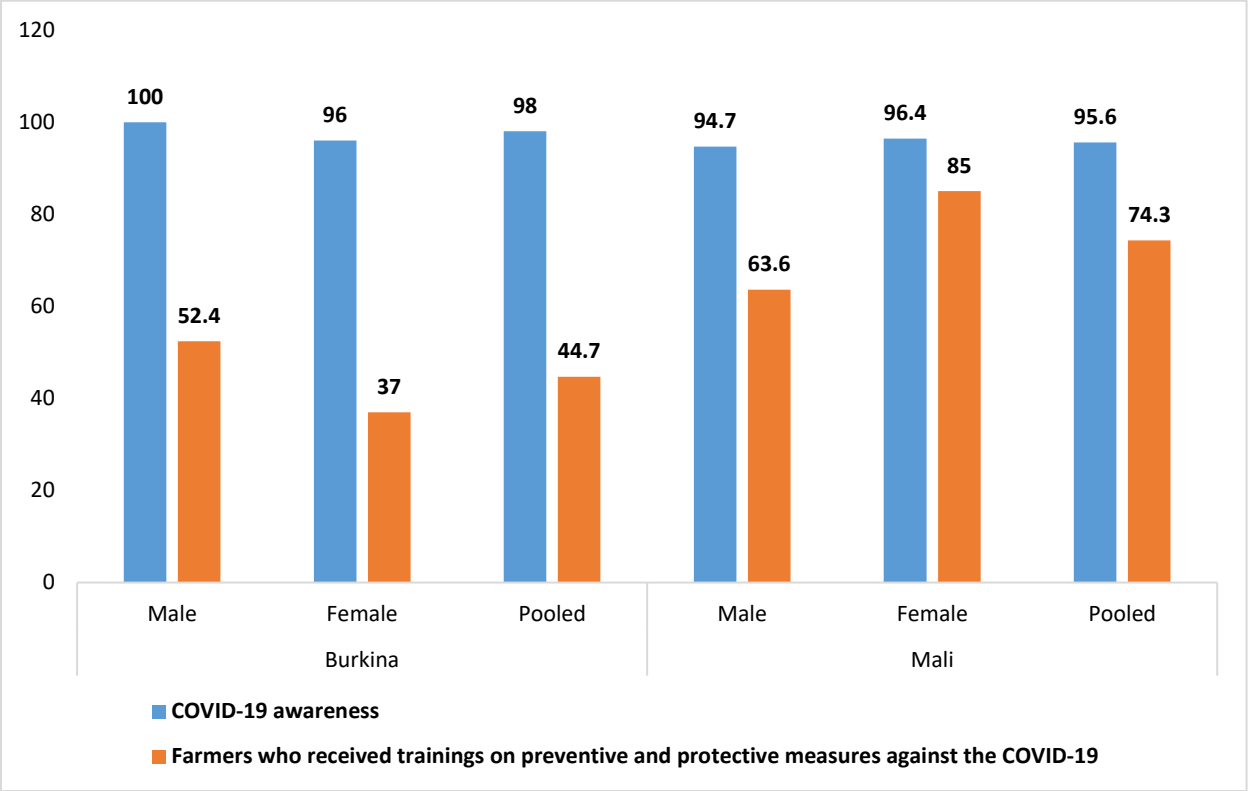

Fig. 2. COVID-19 awareness and knowledge of preventive measures

COVID-19 Awareness and Knowledge of Preventive Measures. Figure 2 presents the rate of COVID-19 awareness and the percentage of respondents who received training on protection measures against the COVID-19.

Figure 2 shows that the COVID-19 awareness rate is very high among the groundnut growers across the study countries, wherein 98% and 96% of respondents in Burkina Faso and Mali were aware of COVID-19, i.e., they know and believe in the existence of COVID-19. This result is quite similar to those of Rana *et al.* (2021) in Bangladesh where 96.9% of the respondents were aware of COVID-19. Among the respondents, it is the male respondents from Burkina Faso (100%) and the female respondents (96%) from Mali were most aware of the COVID-19 pandemic. However, the percentage of the farmers who received training on preventive measures against COVID-19 differs across the country study and by gender. To limit the spread of COVID-19, the governments of Burkina Faso and Mali adopted several measures, including awareness-raising campaigns about the COVID-19 pandemic, closure of the borders, shutting down of production units and services (markets, drinking places, urban and interurban transport services), the ban on gatherings of more than 50 people at a time, etc. These measures aimed at limiting the spread of the virus also affected and decreased economic and non-economic activities in all sectors (Agriculture, Industry, and Services) of the economy (Kinda *et al.*, 2020). In terms of awareness campaigns and training programs on COVID-19 preventive measures, radio, television, and health centers have been used to train and sensitize the

population on the measures to mitigate the spread of COVID-19.

Overall, 45% and 74% of the respondents in Burkina and Mali respectively received training on the protective and preventive measures to curtail the spread of the virus. In Burkina Faso, 52% of male respondents and 37% of female respondents compared to 64% of male and 85% of female respondents in Mali have been trained on the control measures for the spread of the virus. These figures show clearly gender differences in the countries, wherein a lower percentage of men (52%) received training on control measures against COVID-19 in Burkina Faso compared to a much higher percentage of women (85%) in Mali. These results contradict those of INSTAT (2020) which reported that about 54% of the people surveyed in rural areas in Mali had never believed in the existence of COVID-19; 35.3% had not heard of COVID-19; and 4.3% did not believe in the existence of COVID-19 (INSTAT, 2020). This difference between the results of our study and those of INSTAT (2020) can be explained by the scope of the studies. Ours targeted a category of producers in a limited number of regions, while INSTAT's study covered all rural areas of Mali.

Effects of the COVID-19 Pandemic on Groundnut Production. Table 5 describes the farmer's level of agreement on the diverse effects of COVID-19 on household well-being. The result showed COVID-19's disruptive effects across the countries and also by gender. Less than 22% of respondents in Burkina and 11.6% in Mali perceived that the COVID-19 pandemic affected the groundnut production systems. The pandemic has significantly impacted the groundnut supply chain of women as well as men. A percentage of women (87.5% in Mali and 85% in Burkina) agreed that COVID-19 affected their income compared to 77.6% and 65% of men in Mali and Burkina Faso respectively. This result is in line with the findings of Alvi *et al.* (2021) in India and Nepal where 85% of households suffered a loss of income due to the lockdown.

In addition, groundnut plots decreased more in Burkina than in Mali due to poor sales of farm produce, low availability of inputs as a result of border closure, and the inaccessibility of external markets. A higher percentage of respondents (82.5) in Mali reduced their groundnut acreage more than those in Burkina Faso (44.7%). A female groundnut grower reported on the reasons for the reduction in the area of groundnut fields as an induced effect of COVID-19:

"*I purposely reduced my groundnut field size this year. I was afraid that I would not be able to get enough fertilizer and herbicides on our markets here. That would be a waste of energy. Why produce more with avoidable risks? After much reflection, I reduced my groundnut field to minimize the loss" (Woman key informant interview, Kolokani, Mali, November 2022).*

More than 52% and 40% of surveyed men in Burkina and Mali respectively think that COVID-19 has led to a decrease in output prices, especially with the weakening of government subsidy policies. However, only 37% of Burkina Faso and 41% of surveyed women in Burkina Faso and Mali, respectively reported that COVID-19 has led to a decrease in output prices. The food supply and demand channels, which indicate a decrease in food stock and a rise in food prices, are directly affected by the pandemic (Workie *et al.,* 2020). The UN- Mali (2020) report concurred with the fact that the decrease in supply is to be feared than an increase in prices, particularly following the closure of borders, the slowdown in the importation of foodstuffs, and the speculative behavior of traders. 71% of the surveyed men and 94% of women in Mali; and 52% of surveyed men and 34% of women in Burkina Faso believe that COVID-19 led to limited market access. This shows that the restrictive measures as a result of the COVID-19 pandemic have restricted somehow respondents' access to the market.

Table 4. Effects of COVID-19 on groundnut farmers in Burkina and Mali

	Burkina (N=470)				Mali (N=449)			
Farmers' level of agreement about COVID-19 effects on household well-being outcomes	Male (n=227)	Female (n=243)	**Pooled (n=470)**	Chi-2 (test)	Male (n=225)	Female (n=224)	**Pooled (n=449)**	Chi^2 (test)
COVID-19 affected groundnut supply	23.3	20.2	**21.8**	Ns	14.7	8.5	**11.6**	0.05*
Increase in land allocation for groundnut production	5.3	4.0	**4.7**	Ns	31.3	1.33	**1.33**	ns
Reduction of farmers' -income	64.8	85.0	**74.9**	9.07***	67.6	87.5	**77.6**	7.07***
Groundnut plot areas decrease	92.5	98.0	**44.7**	0.02**	71.1	94.0	**82.5**	6.e-10***
Output prices decrease	52.4	37.0	**39.4**	0.09*	40	40.62	**40.31**	ns
Limited access to input/output markets	52.4	34.2	**30.0**	8.e-05***	71.1	94.0	**82.6**	ns
Food availability decreases for households	45.4	33.3	**43.3**	0.00***	31.11	30.36	**30.74**	ns
Decline in the flow of remittances to the household	31.3	26.8	**30.9**	0.02**	71.6	67.4	**69.5**	ns
Induces panic buying of other essentials	52.4	34.2	**30.0**	0.00***	31.11	32.59	**31.85**	Ns
Reduction in the purchasing power	34.36	25.93	**24.12**	Ns	40.0	40.6	**40.3**	Ns
Choice of poor nutrient products	34.4	25.9	**24.1**	0.06*	24.889	24.55	**24.72**	0.09
Reduction in per capita meals	30.4	24.7	**27.5**	Ns	44.9	41.1	**43.0**	Ns

Significant at 1% '***'. 5% '**'. 10% '*'; ns= not significant

Additionally, half of the surveyed men and one-third of women in Mali and Burkina Faso believe that COVID-19 had limited market access. This shows that despite the restrictive measures as a result of the COVID-19 pandemic, people continued to access the market without real limitation, without often respecting the barriers and social distancing measures. These results are quite similar to INSTAT (2020), in which about 54% of the people surveyed in rural areas in Mali had never believed in the existence of COVID-19; 35.3% had not heard of COVID-19; 19.6% thought there were not enough cases; and 4.3% did not believe in the existence of COVID-19 for other reasons (INSTAT, 2020). Furthermore, about 31% of respondents reported that COVID-19 has led to a decrease in the availability of foodstuffs. About 32% of respondents' families have made mass purchases of foodstuffs to prevent possible shortages that the COVID-19 pandemic could cause. In poor households, low-nutrient foods were mostly consumed. This finding is consistent with the study by Huss, *et al.* (2021) in Kenya where COVID-19 affected dangerously household food security.

Table 4 also shows that 31% and 69.5% of respondents in Burkina Faso and Mali, respectively, believe that the flow of remittances to their households has

decreased because of COVID-19. This trend could be explained by the loss of migrants' jobs in Western countries where the COVID pandemic has had a seemingly greater impact on the economies compared to countries in the South. This clearly shows that remittances are more important in Mali than in Burkina Faso, not only because of the numerical importance of Malian migrants but also because of the size of the flows of the remittances. In 2017, migrant remittances to Mali were $1.0 billion (World Bank and KNOMAD, 2018), which was larger than development assistance. Therefore, remittances from migrants to their families of origin play an important role in poverty alleviation strategies for the poorest (Machethe, 2004). Remittances and cash transfer initiatives were seen to increase the resilience of rural populations during years of poor harvests, disasters, or political and health crises (Generoso, 2015). The survey also shows, in terms of percentages, that women producers in both countries are monetarily poorer than men. Overall, our results suggest a strong food security shock to which smallholder households were exposed during the COVID-19 pandemic. In Mali, there was no significant difference between the effects of COVID-19 on men and women. In addition, many respondents did not notice the negative effects of COVID-19 on their groundnut production activity or their lifestyle.

Ranking of the severity of COVID-19 effects on groundnut production. To rank the severity of COVID-19 disruptive effects on male and female groundnut growers, the Wilcoxon ranking test is used to understand the difference in effects of COVID-19 on male and female groundnut growers in Mali and Burkina. This ranking method was used to assess ways and areas where the COVID-19 pandemic had the most impact on groundnut production and groundnut farmers in Mali and Burkina Faso. The variation of the ranking scores enables evaluating the differences in the effects of COVID-19 by country and by gender.

Table 5 presents the ranking of the most significant top three effects of COVID-19 identified by the respondents which include a decrease in food availability; limited access to output markets and a decrease in output price. For the men in Burkina, the limited access to output markets (ranked 1st), followed by the decrease in output prices (ranked 2nd), while women ranked a decrease in food availability (ranked 1st), the limited access to outputs (ranked 2nd), and the decrease in output prices as the most three significant COVID-19 impacts. However, in However, in Mali, male respondents ranked the limited access to output markets (ranked 1st), decrease in food availability for households (1st ex aequo), and the decrease in output prices (3rd), while women identified access to output markets (ranked 1st), decrease in food availability (1st ex aequo), and the reduction of the purchasing power (ranked 3rd) as the most impactful effects of the COVID-19 pandemic. Whereas respondents' rankings of COVID-19's effects vary by gender in each country, the effect of COVID-19 is spread across the board on the household welfare generally. The gender dimension of each effect may be influenced by the gender roles and responsibilities of men and women in each country.

In Burkina-Faso the ranking of limited market access and decreased food availability in the household alternate by gender. For men, limited market access is the primary effect of COVID-19, compared to decreased food availability for women. However, for women in Burkina Faso and Mali, the decrease in food availability is the most detrimental effect they attribute to the COVID-19 pandemic. According to Obayelu *et al.* (2021), barriers to trade and market interaction increase transaction costs, which in turn hampers smallholder farmers' income generation opportunities and potentially decreases their on-farm investments. Consequently, women have few resources and use their groundnut produce to meet household food needs.

Table 5. Ranking of COVID-19 effects on groundnut producers

COVID-19 effects	Average rating score (Burkina) (N=470)			Average rating score (Mali) (N=449)			Top three effects of COVID-19 (Burkina)		Top three effects of COVID-19 (Mali)	
Characteristics	**Male (n=227)**	**Female (n=243)**	**P value[t]**	**Male (n=225)**	**Female n=224)**	**P value[t]**	**Male (n=227)**	**Female (n=243)**	**Male (n=225)**	**Female n=224)**
Decrease in output prices	1.7	1.4	**0.02****	2.0	1.5	**0.00*****	2	2	3	
Limited access to output markets	1.9	1.4	**0.00*****	2.2	1.9	**0.04****	1	2	1	1
Decrease in food availability	1.3	1.5	**0.08***	2.2	1.9	**0.01****		1	1ex	1ex
Decline in the flow of remittances	1.2	1.2	**ns**	1.7	1.6	**ns**				
Panic buying of essentials	1.4	1.2	**ns**	1.4	1.5	**ns**				
Capacity to maintain their activities	1.3	1.2	**ns**	1.6	1.5	**ns**				
Reduced purchasing power	1.5	1.3	**0.09***	1.8	1.7	**ns**	3			3
Consumption of poor of quality food products	1.4	1.2	**0.06***	1.2	1.1	**ns**				
Reduction of meals per day	1.5	1.3	**ns**	1.0	1.1	**ns**				

Average of the scores from 1 to 3 according to the relevance
ns= not significant statistically; *: Significant at 10%; **: Significant at 5%; ***: Significant at 1%

In the same vein, Tchamani (2020) noted that women are constantly concerned with balancing the needs of their families which adds to their stress.

Decreasing output prices are also among the top three effects of COVID-19 on respondents for both men and women. This price decrease was observed because of the preventive measures put in place by the governments. The reduction in purchasing power as a result of a decrease in household income is one of the topmost-ranked effects of COVID-19 on male respondents in Burkina-Faso. Workie *et al.* (2020) and Roubík *et al.* (2022) reported that as the pandemic worsens, the purchasing power and the ability to produce and dispense food were indirectly affected. Even if the difference is not significant between the sexes, the data showed that the purchasing power of men in Burkina and women in Mali has been negatively impacted by COVID-19.

CONCLUSION

The effects of COVID-19 on groundnut farmers in Burkina and Mali are multiple, complex, context-specific, and gendered. The study found three major effects of COVID-19 on both male and female groundnut farmers which are a decrease in food availability, limited access to output markets, and the decrease in output price. The COVID-19 pandemic's disruptive effects combined with social and gender disparities make its consequences more devastating and wide-ranging from market access to output prices

and food availability touching all measure aspects of household welfare Since groundnut production in the two countries is intended for market and household consumption, the impact of COVID-19 on food security in rural areas may be exacerbated for the simple reason that the cash income from groundnut production may use to meet both socioeconomic needs of the household, hence, reducing on savings and food need from groundnut consumption. Subsequently, the responses to the COVID-19 pandemic in agriculture require immediate and long-term actions and interventions (Štreimikienė *et al.*, 2021), so that the COVID-19 pandemic will not further exacerbate and intensify the ecological, environmental, and poverty trends (Paraschivu and Otilia, 2021) that the small-scale producers in Burkina-Faso and Mali have faced for decades.

Given the socio-economic and environmental contexts, reducing inequalities must be key in the future implementation plan to strengthen the resilience of producers. The COVID-19 crisis was a strong reminder of the need to readapt the social policies and anchor them to the socioeconomic realities of both countries. Social protection policies in Burkina Faso, and Mali need to be more effective in taking into account gender dimensions, in formulating more inclusive and equitable social actions, to better respond to the long-term effects of COVID-19 on food systems and livelihoods and to better anticipate and respond to future pandemics and crises in agricultural production systems. Since the pandemic is not completely over, there is also a need to intensify COVID-19 awareness and education campaigns among farmers regarding the preventive measures of the COVID-19 pandemic to contain the spread which may subsequently reduce labor availability and crop productivity.

Both men and women felt the indirect effects of COVID-19 on their livelihoods. Rural areas in many developing countries produce food that feeds nearby cities and the nation (Mishra *et al.,* 2021). The results reveal that the immediate impacts of COVID-19 may influence the resilience of the food system due to the significant effects of the pandemic on food availability, production supply chains, and effects on inputs and outputs markets. The health of farmers, and disruption of the production and supply chain of agricultural and food products have potential ripple effects on the entire food system.

Burkina-Faso and Mali are developing countries with inefficient social policies for the informal workers, farmers may face an even greater challenge as they are often much less resilient to shocks and there are often fewer supporting mechanisms to reduce the impact of the diseases like COVID-19 (Tittonell, 2014). The Malian and Burkinabe governments showed commitment to reducing poverty, hunger, and food insecurity, particularly in rural areas, through their willingness to put in place strategic frameworks for poverty reduction and to formulate a social protection policy (Cherrier *et al.*, 2011). Although social policies in Mali and Burkina recognize the multidimensional nature of social protection, their articulation, mainly in the framework of the health development programs, is limited to taking into account health-related risks to the detriment of the social and economic risks faced by vulnerable the populations (ODI, 2009). Because the social policy is not thought of holistically, the responses in terms of promoting human development and reducing poverty and precariousness are not very preventive, protective, inclusive, and equitable. As a result, in the face of pandemics such as COVID-19, social protection programs do not respond to the needs of vulnerable populations (ODI, 2009; Cherrier *et al.*, 2011) like poor farmers and women farmers, because they are simply gender-neutral in their conception, budgeting, and implementation. This is why most food distribution campaigns initiated by governments and NGOs have targeted heads of households when they should be more effective by targeting beneficiaries according to their needs and level of vulnerability.

Hence, in many rural areas, given the growing trend of poverty, food could not be distributed to the real beneficiaries in time because non-needy people were registered on the list of the destitute. Oliver de Sardan, J.-P. *et al.* (2014) reports a similar situation in Niger of a cash transfer campaign to vulnerable households where the main difficulty was targeting the truly vulnerable in the communities.

STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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