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Impact of the Ongoing Conflict on Smallholder Farmers in Sudan

Evidence from a Nationwide Survey

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ABSTRACT

This study addresses the impact of the ongoing conflict in Sudan on smallholder farmers' intentions and challenges during the 2023 summer agricultural season. A nationally representative survey of 3,284 smallholder farmers was conducted. Due to the security hazards and connectivity challenges, we used a combination of three interview types, Interactive Voice Recording (IVR), Computer-Assisted-Telephone-Interviews (CATI) and face-to-face (in-person) interviews. Key findings are that close to a third of the farmers were displaced from their farms' locations and 40 percent were unable to prepare for planting season because of the conflict. Most of the farmers who did not prepare for the summer season at the time of the interview were not intending to plant later in the season. The key challenges that prevented them from planting were the lack of finance to buy agricultural inputs (such as seeds and fertilizers) and/or to hire farm labor. This is compounded by bad weather conditions, poor quality of the local seed varieties, higher cost of improved seeds, and delayed rains (climate challenges). In addition, the ongoing conflict has had direct and indirect impacts that prevented many farmers from planting this season. It disrupted market functionality and reduced the availability of and/or raised the cost of agricultural inputs and farm labor. The lack of finances has also seen farmers reduce the size of the area they planted this season compared to last year's season. The compounding challenges of these reduced production are expected to be felt as soon as the harvest season begins. The implications suggest the need for rapid intervention to support farmers during the harvest and winter seasons to mitigate the impact of the conflict on agricultural activities.

Keywords: Sudan, conflict, smallholder farmers, summer planting season 2023, displacement.

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HIGHLIGHTS

- The data are collected using a combination of methods (IVR, CATI, and in-person) interviews and covered 3,248 farmers from 16 states.
- **84 percent of** the surveyed farmers are male, and **88 percent** are aged between **18 and 64** years.
- **28 percent of** the farmers were displaced from their usual place of residence because of the conflict.
- **50 percent of** those forced to relocate moved to other states, while the other **50 percent** moved to a different location within the same state.
- **40 percent of** the farmers did not prepare for planting in the summer season. Among them, **44 percent** did not even have plans to plant later in the season.
- **61 percent of** the farmers did not plant because they did not have money to buy agricultural inputs or hire labor.
- **69 percent of** the farmers indicated that markets are open as usual, while **31 percent** indicated that markets are not open as usual.
- **50 percent of** the farmers found wages for farm labor higher at the time of interview than before the conflict.
- **57 percent of** the farmers used/will use local seeds for the summer season.
- **42 percent of** the farmers indicated that they have never used fertilizers. **44 percent** of those using fertilizer indicated that the prices are very expensive this season compared to last season.
- **67 percent of** the farmers grow cereals, **12 percent** grow vegetables and fruits, and **11 percent** grow oil seeds.
- **24 percent of** the farmers cultivated less land area than last year; however, **46 percent** will grow similar area to last year, and **29 percent** will grow even larger areas than last year.
- **52 percent of** those cultivating less areas indicated the reason was that they have less/poor inputs (seeds and fertilizer).
- **62 percent of** the farmers found the prices of livestock to be either higher or much higher at the time of interview than before the conflict.
- **58 percent of** the farmers found the prices of crops to be either higher or much higher at the time of interview than before the conflict.
- **61 percent of** the farmers found the prices of bread to be either higher or much higher at the time of interview than before the conflict.
- **81 percent of** the farmers found the prices of sugar to be either higher or much higher at the time of interview than before the conflict.
- **77 percent of** the farmers found the prices of cooking oil to be either higher or much higher at the time of interview than before the conflict.

1 INTRODUCTION

The conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) is now entering its ninth month with no clear end in sight. Besides the catastrophic humanitarian crisis caused by the conflict, it continues to have a damaging impact on the economic activities and livelihoods of people. Thousands of lives have been lost, and many individuals and households have lost their assets and sources of income due to the direct exposure to clashes, large-scale looting, and destruction of belongings. In addition to the lack of access to water, healthcare, electricity, fuel, and banking services, the high levels of physical insecurity and shortage in supplies of goods and services have worsened the humanitarian situation for millions of people who are still in the conflict areas. The ensuing conflict has led to destruction of key infrastructure, constrained domestic and international trade, and disrupted production activities and supply chains. Since the conflict broke out in April 2023, the number of displaced people continued to swell. As of December 2023, about 1.4 million people have crossed borders out of the country and another 5.4 million individuals – mainly from Khartoum state, Darfur, and Kordofan regions – have moved to a state other than their usual state of residence (UN-OCHA, 2023). A recent survey showed that most of the forcibly displaced individuals (82 percent), indicated food security is at the top of their priority needs (DTM Sudan, 2023).

The conflict has direct and indirect effects on the agricultural, industrial, and services sectors. The concentration of the manufacturing and service sectors in Khartoum has resulted in dire losses in access to goods and services because Khartoum continues to be the epicenter of conflict. Khartoum state has the highest number of banks' branches in the country, with 43 percent of all bank branches being in Khartoum as of 2018 (MoFEP,2020). Additionally, a sizable portion of manufacturing firms are based in Khartoum (MoFEP, 2020). More broadly, the agrifood system as a whole is expected to be affected drastically. A recent study estimates that the conflict will have a substantial impact on the agrifood system GDP, with a 21 percent drop from its level in 2021 and a 23 percent reduction in employment as a result (Siddig et al., 2023). The agro-processing sector is the most affected element within the agrifood system. An early assessment of the impact of the conflict on the operations of agri-food processing and manufacturing enterprises showed that majority of the surveyed firms (73 percent) permanently or temporarily closed their firms while just about 20 percent reduced their operations due to the conflict (Kirui et, al. 2023; Abushama et al.,2023). Furthermore, the conflict has dire effects not only on primary and secondary agricultural production in conflict regions like Khartoum, Darfur, and Kordofan, but also indirectly affects farmers, traders, and processors in non-conflict regions. These negative spillover effects on agri-food actors in non-conflict regions further exacerbate the food supply crisis that is currently underway in Sudan (Abushama et al.,2023). On the macroeconomic level, the conflict has led to rapid price inflation and currency depreciation, further worsening the difficulty in accessing food.

Since the conflict erupted in mid-April 2023, a number of studies have been conducted on its implications to the economy of Sudan; including the agricultural sector, agrifood processing firms and the economywide effects, the political economy of conflict and agrifood systems, and farmers intentions and food security (Kirui et al., 2013; Siddig et al., 2023; Abushama et al., 2023; Mercy Corps, 2023; FEWS NET, 2023).This study complements the previous studies by focusing on the impact of the current conflict on the intentions and challenges of farmers during the agricultural season using data from a new survey with a nationally representative sample of smallholders. Specifically, the objectives of this study are twofold: (i) to assess the readiness of smallholder farmers and livestock producers for the summer agricultural season, and (ii) to assess the welfare consequences (proxied by prices of key

commodities) amidst the on-going conflict and attendant disruptions. Due to the prevailing circumstances and limited possibilities of in-person surveys, we leveraged rapid telephone-based approaches using Interactive Voice Recording (IVR) to quickly reach farmers across the country. The IVR approach was supplemented by a Computer-Assisted-Telephone-Interviews (CATI) survey and an in-person (face-to-face) survey to reach the targeted sample. A total of 3,284 farmers provided information via these surveys. More details about the three methods of data collection are provided in the methodology section.

This is the first nationwide survey of farmers after the conflict erupted. It builds on an earlier survey conducted by Mercy Corps (2023) in two states (Blue Nile and South Kordofan), but the current study has two additional distinctive features. First, it is a nationwide survey, covering the entire country except the Darfur region, where the connectivity challenges and the intensity of conflict hindered data collection. Secondly, the survey questionnaire includes additional key variables (such as fertilizer use and prices) and price comparison of an additional key commodity (bread) that represent an indicator of farmers' welfare in Sudan.

Key findings are that about 28 percent of the farmers were displaced by the on-going conflict – 14 percent have moved to another place within their usual state of residence, while another 14 percent have moved to another state. Additionally, 60 percent of smallholder farmers were prepared or have prepared for the summer agricultural season. More than 40 percent of those that were not prepared to plant were not willing to plant later in the season. Results show that conflict has had direct and indirect impacts that prevented farmers from planting this season. The conflict has also disrupted market functionality and reduced the availability of and/or raised the cost of agricultural inputs including seeds, fertilizers, and farm labor wages. Furthermore, most of the farmers who have used or were going to use local seed varieties, had seed reserves from the previous season for planting. The lack of finances to buy key inputs such as seeds and fertilizers was indicated by 61 percent of surveyed farmers as a reason for not planting this season.

The rest of this study is organized as follows: the following section 2discusses the applied methodology, section 3 reports and discusses the results, while section 4 provides the key conclusions and some policy implications, while recommending some interventions for national and international actors.

2 METHODOLOGY

This section describes the overall methodological approach applied in this study, including the choice of data collection method, the sampling procedures, and the survey implementation plan.

This study was designed to collect pre-harvest data from smallholder farmers across Sudan. The survey consisted of 21 questions, designed in English, and translated into Arabic, and recorded for mobile IVR data collection. IVR is a desirable approach in settings where in-person surveys are not possible and where the number of questions posed to the farmers are relatively few. The use of IVR methodology to collect information from or convey extension messages to farmers has been proved a cost effective and reliable tool (Janda et al., 2001; Dione et al., 2021). Given the difficulty of data collection using conventional data collection methods at times of conflict the IVR served as an appropriate tool in reaching reasonable number of farmers concurrently in a short period of time. A total of about 15,000 registered mobile phone numbers (mainly belonging to farm households across Sudan) were gathered from different sources. This formed the master database of telephone numbers from which sampling procedures were conducted. We also commissioned additional collection of telephone numbers (through farmers and farmer cooperatives) by a third party hired by the survey company in states that were underrepresented but safe to operate in. Table 1 summarizes the available telephone contacts per state.

Table 1: Availability of telephone contacts

No	State	Available telephone contacts
1	Al Gezira	1,342
2	Al Qadarif	1,457
3	Blue Nile	1,618
4	Central Darfur	1,134
5	East Darfur	1,213
6	Kassala	3,119
7	Khartoum	5,834
8	North Darfur	3,247
9	North Kordofan	2,625
10	Northern	989
11	Red Sea	1,403
12	River Nile	1,754
13	Sennar	1,187
14	South Darfur	2,608
15	South Kordofan	1,340
16	West Darfur	1,422
17	West Kordofan	3,207
18	White Nile	3,449
	Total	**38,948**

Source: SSSP and collaborators telephone database.

2.1 Sampling strategy and survey implementation plan

Following power calculation and taking into consideration the percentage of the population living in the states based on the National Baseline Household Poverty Survey NBHPS 2014/2015 (the most recently available survey with a national sampling strategy in Sudan), a nationally representative sample size was determined to be 4,500. The state-level sub-samples were determined accordingly based on the share of the population living in the states. Table 2 provides the distribution of the sample by state.

It is notable that conflict-related disruptions in telecommunication infrastructure, power supply shortages, road blockades, and movement restrictions, have affected the data collection processes. In some states, such as West and North Darfur, the farmers were unreachable due to the forced displacement of many citizens residing in those areas. Overall, it was challenging to reach farmers due to infrequent and unpredictable network coverage, and power blackouts that were experienced during the data collection period. Other Darfur states such as South Darfur, Central Darfur, and East Darfur also witnessed active violent conflict, and hence, replacing IVR with in-person surveys through enumerators was of extremely high risk. This resulted in significant underrepresentation of the sample in those states due to the small number of completed surveys in comparison with the targeted sample (Table 2). For this reason, these states have been dropped from the analysis.

Table 2: Targeted and achieved responses.

No	State	Targeted	Achieved	Completion Rate (percent)
1	Al Gezira	702.0	304	43
2	Al Qadarif	229.5	289	126
3	Blue Nile	175.5	243	138
4	Central Darfur	81.0	1	1
5	East Darfur	135.0	32	24
6	Kassala	193.5	203	105
7	Khartoum	621.0	198	32
8	North Kordofan	301.5	225	75
9	Northern	112.5	206	183
10	Red Sea	139.5	234	168
11	River Nile	180.0	325	181
12	South Darfur	342.0	22	6
13	South Kordofan	126.0	423	336
14	Sennar	175.5	158	90
15	West Kordofan	270.0	206	76
16	White Nile	234.0	215	92
17	West Darfur	148.5	0	0
18	North Darfur	333.0	0	0
	Total	**4,500.0**	**3,284**	**73**

Source: Authors' compilation based on SSSP farmers' pre-harvest survey.

Owing to the challenges and having tried to reach all the contacts available for each state (and several repeated attempts), some complementary approaches (CATI and in-person surveys) were applied to bridge the gap between desired sample and the achieved sample after several weeks of implementation. Overall, 2,008 completed surveys were achieved via IVR while 639 responses were achieved via

CATI and 637 responses through face-to-face interviews, making the total completed interviews 3,248 (Table 2).

2.2 Survey flow and implementation plan

2.2.1 Interactive Voice Recording (IVR)

The contact database was a combination of numbers provided by Mercy Corps (12,871) and additional numbers (2,635) collected in the field, targeting farmers in various farmers' groups, cooperatives, and other agricultural institutions. These numbers were then called reaching out to farmers across 16 states. This ran from August 8 - September 27, 2023, with 2,008 completed interviews. The schema (Figure 1) provides a summary of the IVR process starting from the targeted audience to the completed IVR responses.

Figure 1: Summary of IVR completion at the different stages

Source: Authors' compilation based on SSSP farmers' pre-harvest survey

Out of 14,598 calls made about 4,365 (30 percent) started the survey. Notably, most farmers who started the IVR survey dropped off at its initial stages – the attrition rate after the first question was 68.5 percent. However, the attrition rate for the subsequent question was consistently the same throughout the full set of questions. The high rate of attrition at the beginning could be attributed to varied factors including that farmers were not familiar with IVR method, farmers lacked interest to participate after listening to the introduction, or recipients are not farmers. The latter is explained by the high pick uplevel and the share of recipients listening to the introductory message, but as soon as they realized that the survey is targeting farmers, they drop off.

2.2.2 Computer-Assisted Telephone Interviews (CATI)

After several weeks of implementing the IVR and exhausting the master telephone roster, it became clear that some states were unreachable. Therefore, we devised additional approaches to reach the targeted sample size by state. Additional contacts were sourced (from farmer co-operatives and other farmers' organizations and groups) in states that were deemed safe to operate. Eight enumerators (call center operators) were trained to implement the same questionnaire that was already implemented via IVR. The CATI data collection continued for three weeks (from 9-30 October 2023). 7 states were prioritized (Al Gezira, Kassala, Northern, River Nile, Sennar, West Kordofan, and White Nile states). The enumerators were provided by an additional 1,800 contacts while recording the responses via CATI form. This effort yielded a total of 639 completed interviews.

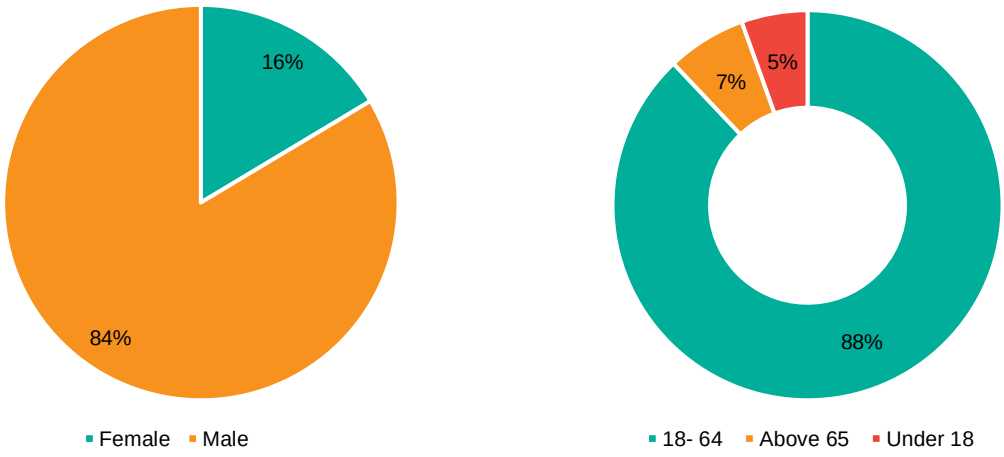
2.2.3 Complementary in-person interviews

In addition to the IVR and the CATI approaches, the data collection firm further located additional farmers in these 'safe states' through the various farmer organizations for face-to-face interviews. The enumerators visited several villages and organized places for the interviews reaching a total of 637 completed interviews. In the end a total of 3,284 interviews in 16 States were completed. We present a brief analysis of the data collection methods in subsequent sections.

2.3 Farmers' demographic and regional characteristics

Most farmers were males aged between 18 and 64 years. At the national level, males represented 84 percent of the surveyed sample. The domination of male farmers was observed in all the states with a relatively good representation of female farmers in North Kordofan and South Kordofan states– with 39 percent and 30 percent of farmers, respectively. This is in line with the reported higher participation of females in the agricultural workforce in Kordofan and Darfur regions, compared to the national average (World Bank, 2019). Most of the farmers are aged between 18 and 64 years (88 percent) (Figure 2). Al Qadarif state has the highest percentage of younger farmers (below 18 years) among all states.

Figure 2: Farmers age and gender.



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

As described in the methodology section, the survey was intended to cover the whole country (18 states). However, the security hazards and connectivity challenges have significantly disadvantaged our sample. The Darfur region's rampant network disruption limited the responses in those states. Hence, the exclusion of West Darfur and North Darfur entirely from the sample was inevitable due to complete unreachability (not included in Table 3), and data was collected in 16 out of 18 states. It is also notable that very few observations were recorded in Central (1), East (32) and South (22) Darfur states (Table 3). Thus, out of abundance of caution, we exclude these three states (1.94 percent of the total) from further analyses and interpretation. Most of the complete responses are from South Kordofan, River Nile, Al Gezira, and Al Qadarif (Table 3).

Table 3: Total number of surveyed farmers by state and method of interviews

No	State	IVR	CATI	In-person	Total
1	Al Gezira	130	166	8	304
2	Al Qadarif	289	0	0	289
3	Blue Nile	243	0	0	243
4	Central Darfur	1	0	0	1
5	East Darfur	32	0	0	32
6	Kassala	40	73	90	203
7	Khartoum	198	0	0	198
8	North Kordofan	225	0	0	225
9	Northern	14	45	147	206
10	Red Sea	234	0	0	234
11	River Nile	36	122	167	325
12	South Darfur	22	0	0	22
13	South Kordofan	423	0	0	423
14	Sennar	45	95	18	158
15	West Kordofan	25	102	79	206
16	White Nile	51	36	128	215
Total		**2,008**	**639**	**637**	**3,284**

Source: Authors' compilation based on SSSP farmers' pre-harvest survey

3 RESULTS AND DISCUSSIONS

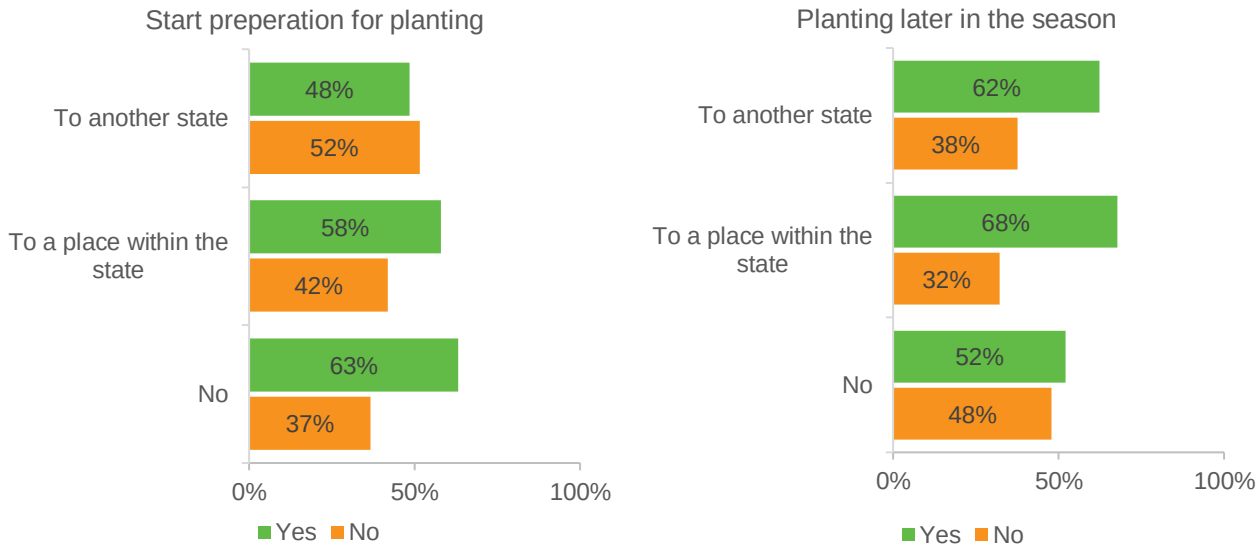
3.1 Preparedness for planting season and market functioning

3.1.1 Displacement and preparedness

It is noteworthy that 28 percent of the surveyed farmers were displaced from their usual place of residence because of the conflict. Approximately, 50 percent of them were moved to other states and the other half moved to a different location within their usual state of residence. The majority (73 percent) of those displaced originated from Khartoum state (Figure 3).

The displacement of farmers has affected their abilities to prepare for planting in the season as well as their willingness to plant later in the season. Farmers who were displaced to another state were even less likely to have been prepared for the planting season compared to farmers who were displaced to another place within their state of residence. 58 percent of the farmers who were displaced to another state indicated that they prepared for the planting season, while only 48 percent of the farmers who were displaced to another state indicated that they prepared for the planting season. Farmers who were displaced to another state were slightly less likely to plant later in the season compared to the farmers who were displaced to another place within their state of residency, 62 percent, and 68 percent, respectively.

Figure 3: Displaced farmers and planting decisions



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

3.1.2 Start of rain and rainfall patterns

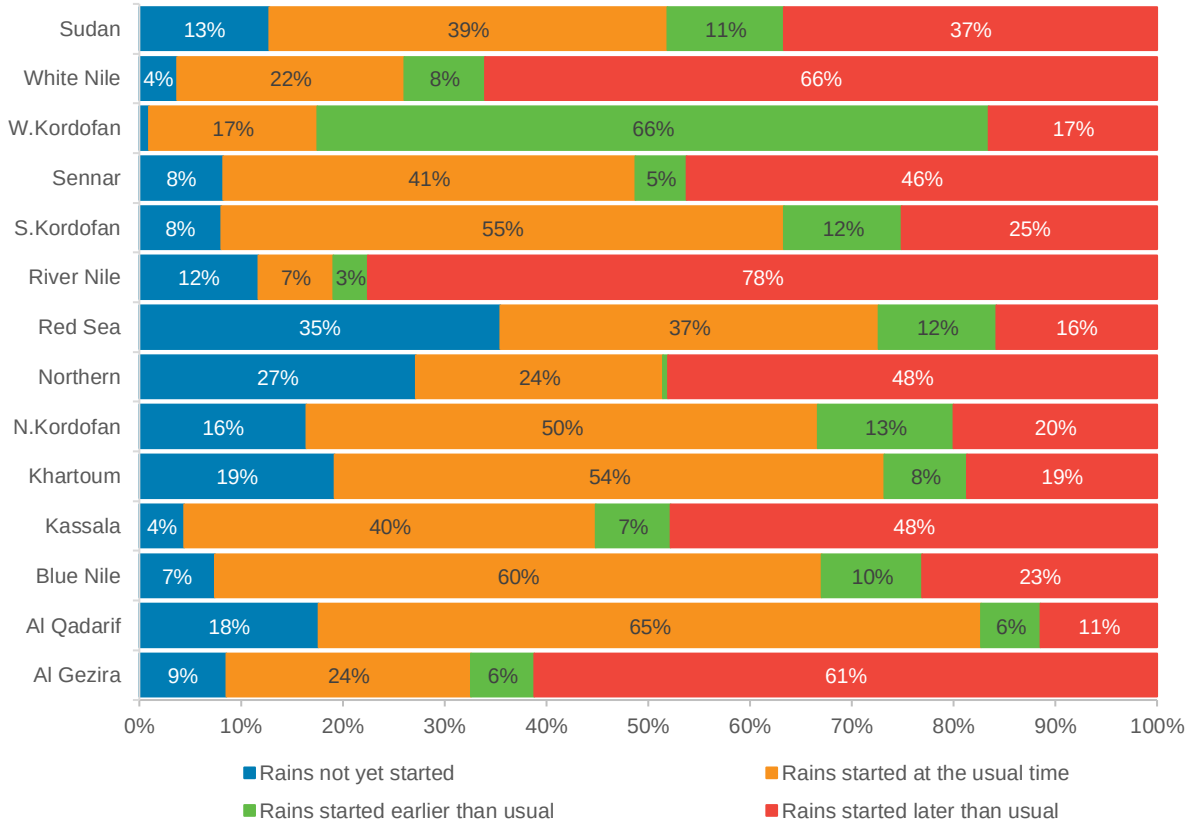
The Northern part of Sudan is drier with limited rainfall compared to the rest of the country. Instructively, the annual rainfall averages between almost zero in the North to nearly 900 mm in the Southern parts of South Darfur and South Kordofan and Blue Nile (World Bank, 2022). It is worth mentioning that in states such as Al Qadarif, Kordofan and Darfur that mainly depend on the rainfed system (both traditional and mechanized), there was a higher percentage of farmers indicating that rains came on time

compared to Al Gezira, Northern, Khartoum, and River Nile states that depend on irrigated or/and rain-fed systems.

Rainfalls are not essential for agricultural and livestock production in the River Nile, Northern, Red Sea, and Al Gezira states. Nevertheless, farmers in these states predominantly indicated that rains started later than their usual time (78 percent, 48 percent, 16 percent, 61 percent, respectively). Agriculture and livestock production in the Darfur and Kordofan regions as well as Blue Nile state, parts of Al Qadarif state, and parts of Sennar state is solely rainfed. The majority of the farmers in these states indicated that indicate that rains started at their usual time. More specifically, 65 percent, 60 percent, 55 percent, and 50 percent of the farmers in Al Qadarif, Blue Nile, South Kordofan, North Kordofan, respectively, indicated that the rains started at their usual time. An outlier are the results for West Kordofan, which is solely a rainfed state, however, 66 percent of the farmers indicated that rain started earlier than the usual time.

Overall, farmers in the rainfed states may have had the opportunity to prepare for the planting season. However, dryland farming represents 88 percent of the national cultivated area and contributes around 75 percent to national food grains production in the country (Al Badawi et al., 2022). The start of the rains in unusual times is concerning especially in the rainfed sector given the current situation of the conflict, where most farmers will not be fully prepared for planting.

Figure 4: Start of rain by state (when did the rains start in your location?)

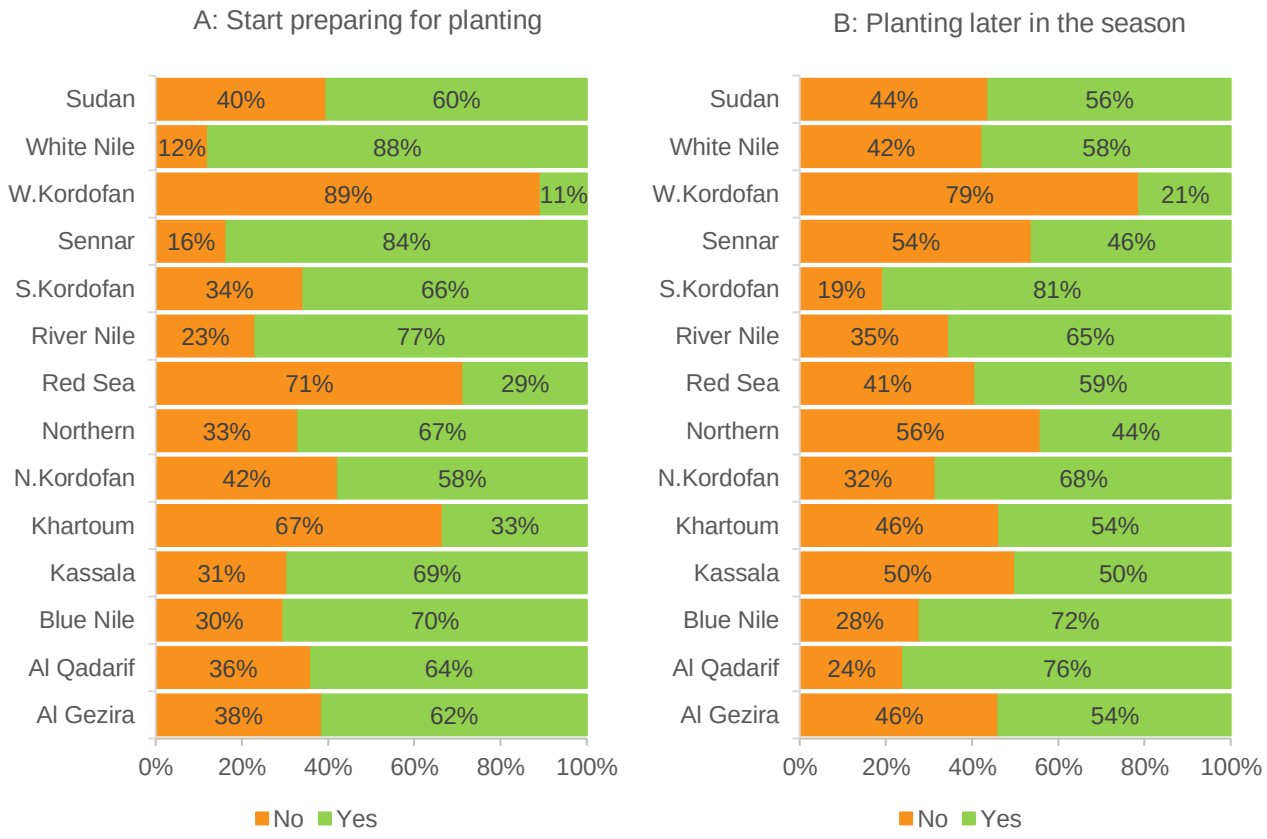


Source: Authors' compilation based on SSSP Pre Harvest Survey.

3.1.3 Preparation for the summer season and challenges

At the national level, 40 percent of farmers indicated that they did not prepare for planting in the summer season. Among them, 44 percent indicated that they do not even have plans to plant later in the season. This translates to an average of 18 percent of farmers at the national level that did not or would not plant this season. Together with the 22 percent of the smallholder farmers that delayed preparation for planting in the season, this would pose a significant anticipated reduction in agricultural production this season. Results from Mercy Corp (2023) indicated a similar pattern in South Kordofan and Blue Nile states. According to their study on the two states, 46 percent of farmers indicated that they did not prepare for planting this season, and roughly 20 percent indicated that they do not plan to plant later in the season.

Figure 5: Preparation and willingness of farmers to plant by state



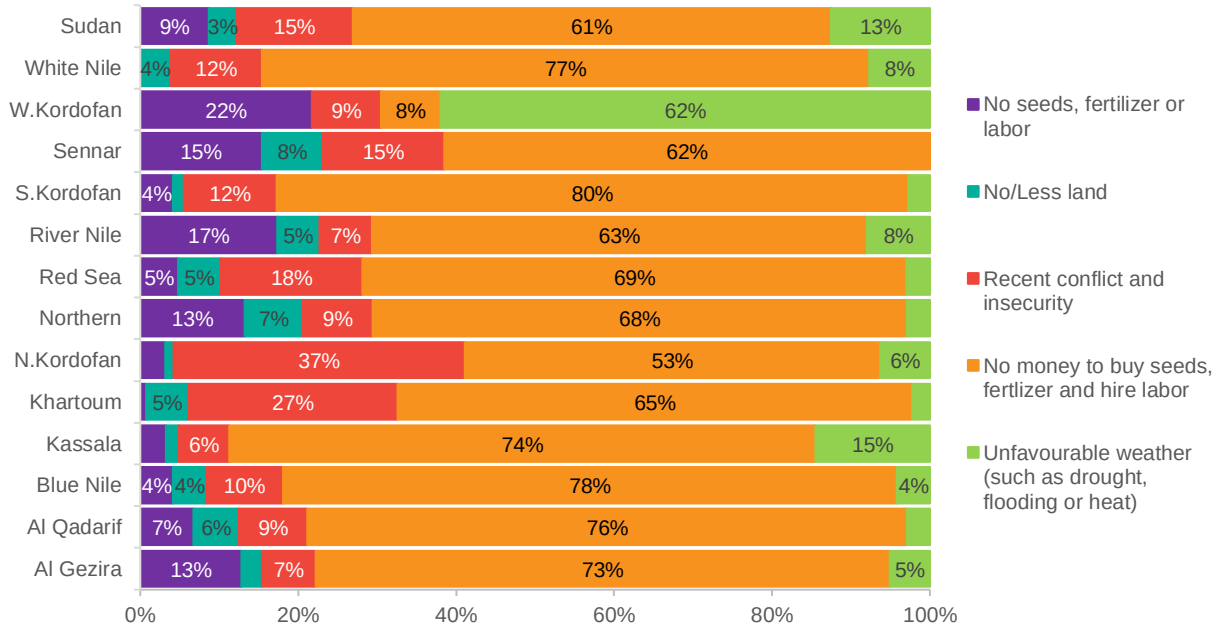
Source: Authors' compilation based on SSSP farmers' pre-harvest survey

At the sub-national level, most farmers from West Kordofan state indicated that they could not prepare for planting in the summer season and a large fraction of those (80 percent) were also not planning to plant later in the season. Even before the conflict, West Kordofan farmers were already suffering from climate-related hazards such as dry spells, limited access to agricultural inputs, and constrained funding of farming activities other than their own meagre resources (OCHA, 2023). In Khartoum state, which witnessed the highest intensity of clashes, 67 percent of small holder farmers have indicated that they did not prepare for planting and 46 percent of them were not planning to plant later in the season (Figure 5).

The conflict has impacted the planting decisions of smallholder farmers directly and indirectly. At the national level, 15 percent of the farmers indicated that the conflict and the associated insecurity was the main direct reason keeping them off farming activities this season. Some farmers were displaced and could not access their farms having moved to seek refuge in other places within or outside their usual states of residence. The direct impact of the conflict was felt the largest in North Kordofan state where 37 percent of the farmers attributed their lack of preparation for planting to the recent conflict and its insecurity (Figure 6). North Kordofan has witnessed a severe siege on its capital city Al Obeid by the RSF forces with some farmers recently reporting that they had been denied access to their farms (Siddig et, al., 2023).

One of the significant indirect impacts of the conflict was limiting the availability of farming inputs such as seeds and fertilizers and limiting farmers' ability to finance their operations. Overall, more than 60 percent of the farmers highlighted the lack of money to fund their operations as the main reason for not engaging in farming this season. The conflict has affected the banking sector significantly, as evident by the large-scale looting of the Central Bank of Sudan in Khartoum and the infrastructural damage that affected the banking transfer systems across the country (Abushama et al., 2023; Sudan Transparency and Policy Tracker, 2023). Another indirect impact channel of the conflict is the limited availability of inputs. At the national level, 9 percent of the farmers indicated that the main reason for not preparing for the season was the lack of seeds, fertilizers, and labor. At state level, majority of the farmers across the country reported lack of money or finance to fund their planting operations as the primary reason of their ill preparedness for the planting season, except in West Kordofan, where farmers mainly attributed their lack of preparation to bad weather and specifically delayed rains (Figure 6).

Figure 6: Reasons for not planting in the summer season by state

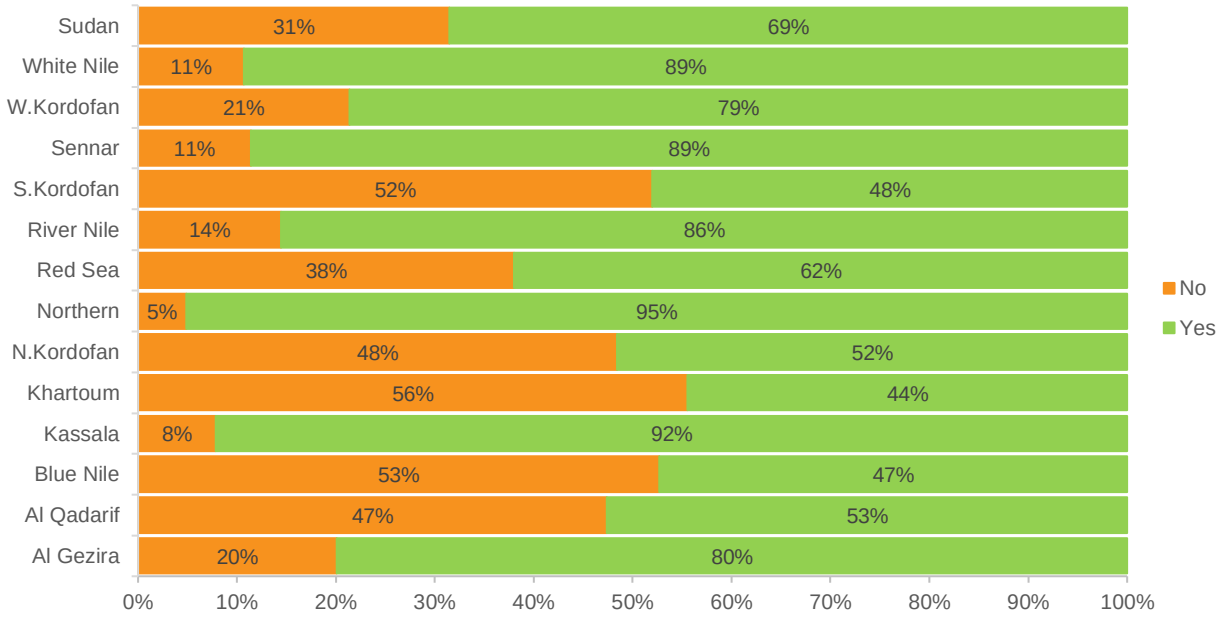


Source: Authors' compilation based on SSSP farmers' pre-harvest survey

3.1.4 Market functionality

Market functionality is a key factor in catalyzing small farmers' production decisions. The on-going conflict has disrupted the functionality of local markets in Sudan. At the national level, almost a third of surveyed smallholder farmers indicated that local markets in their locations were not open as usual on market days. As expected, the states that witnessed a higher intensity of clashes, such as Khartoum, Blue Nile, South Kordofan, and North Kordofan states reported the highest proportion of closed or dysfunctional markets (Figure 7). On the other hand, markets were mostly open as usual in the relatively safer states, such as Northern, Kassala, White Nile, Sennar, River Nile, and Al Gezira (Figure 7).

Figure 7: Market functionality by state (are local markets open as usual?)



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

3.2 Availability and cost of labor and key inputs

3.2.1 Wages of farm labor

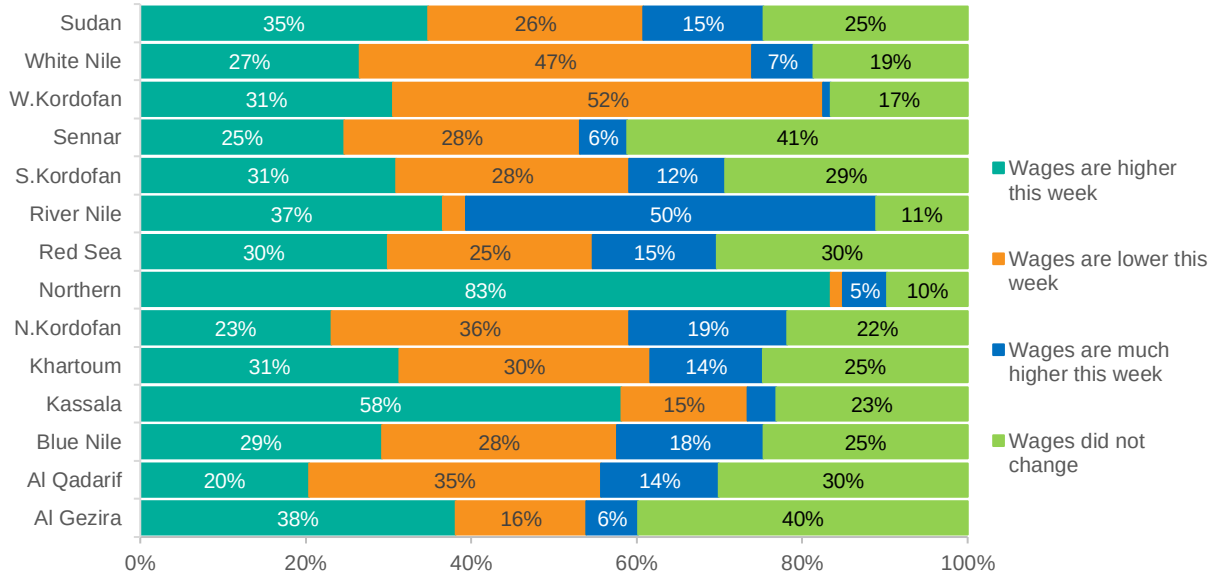
The conflict has influenced the availability of labor and the wages paid to the farm workers. From the supply side, the displacement and movement of workers is reported across several states. Similarly, from the demand side, there are noticeable production shocks, which affected the demand for labor (Siddig et al., 2023; Kirui et al., 2023). Nonetheless, the overall impact of the conflict and the increase in the supply of labor in the host states is ambiguous. Several studies attempted to investigate the impact of migration including conflict-related forced migration (Edo 2019; Khan, 2021; Al-Dalahmeh & Dajnoki, 2021; Dias, 2021). Some of these studies find positive impact of the displaced or immigrants on the wages in the host communities (Khan, 2021), while others suggest that the overall impact depends on the level of education and skills of the migrant workers. The migrants with higher levels of education and skills will increase wages in the labor market of host communities, while low skilled labor will reduce the wages in the labor market of host communities (Edo, 2019).

We posit that during the ongoing conflict in Sudan, the influx of displaced individuals and movement of households from conflict-affected areas to safer hosting communities and states has resulted in an increase in consumption and increase in house rents in the hosting states. These would in turn increase incomes and potentially investment opportunities in these hosting communities and states.

Another important attribute that can partially explain the increase in the wages of farm labor in some states is that households in Sudan who experience a disruption of farming activities shift from farm labor to wage employment, or non-farm family business as a coping strategy (World Bank, 2023). This would result in a decrease of farm labor supply and thus increase the wages of farm labor. When asked about the wages of farm labor compared to the time before the conflict had erupted, half of the farmers indicated that wages are either higher or much higher this week compared to their level before the conflict (Figure 8). Interestingly, a quarter of the farmers noted that farm labor wages were lower as compared to the situation before the conflict (Figure 8).

State-level observations confirm the dichotomy of the increase and decrease in wages. While half of the surveyed farmers in River Nile state reported that wages were much higher and an overwhelming majority (83 percent) of farmers in Northern state reported that the wages were just higher than usual, most farmers (52 percent) in West Kordofan state reported that wages were lower (53 percent). These findings align with Edo (2019) analysis of high skilled migrants moving wages upwards, while low skilled migrants move them downward in host communities. The River Nile and Northern states are among the highest recipients of internally displaced people, while West Kordofan was among the least hosting destinations for displaced individuals (only 1.2 percent of the displaced persons are hosted in West Kordofan compared to 12 percent in River Nile state and 12 percent in Northen state (DTM Sudan, 2023)). With the current conflict being mostly urban-based and Khartoum-centric, majority of the displaced persons, expected to be of higher skills and education levels than rural host communities (like in the River Nile and Northern states) justify the labor wage increases in those regions.

Figure 8: Cost of farm labor by state (how would you compare the wages of farm labor this week with them before last Ramadan?)



Source: Authors' compilation based on SSSP farmers' pre-harvest survey.

Disaggregation of the results based on the method of data collection indicated that farmers tend to report higher perceptions regarding the prices and cost in interactive interviews compared to voice-recorded interviews. In the IVR only 29 percent indicated that wages are much higher during the interview week, while in the CATI, 40 percent indicated that wages are much higher that week, and 49 percent of the in-person surveyed farmers indicated that wages are much higher than the period before the conflict. We also note that the differences in these proportions may also be due to the timing of the survey – with IVR having been completed earlier while the CATI and the in-person surveys were conducted several weeks later.

Table 4: Cost of farm labor by type of interview

No	Type of survey	Wages are higher this week (percent)	Wages are lower this week (percent)	Wages are much higher this week (percent)	Wages did not change (percent)
1	CATI	40	19	7	34
2	IVR	29	30	15	26
3	In-person	49	21	21	10
	Total (number)	**1,143**	**854**	**477**	**810**

Source: Authors' compilation based on SSSP farmers' pre-harvest survey

3.2.2 Use of seeds and fertilizers

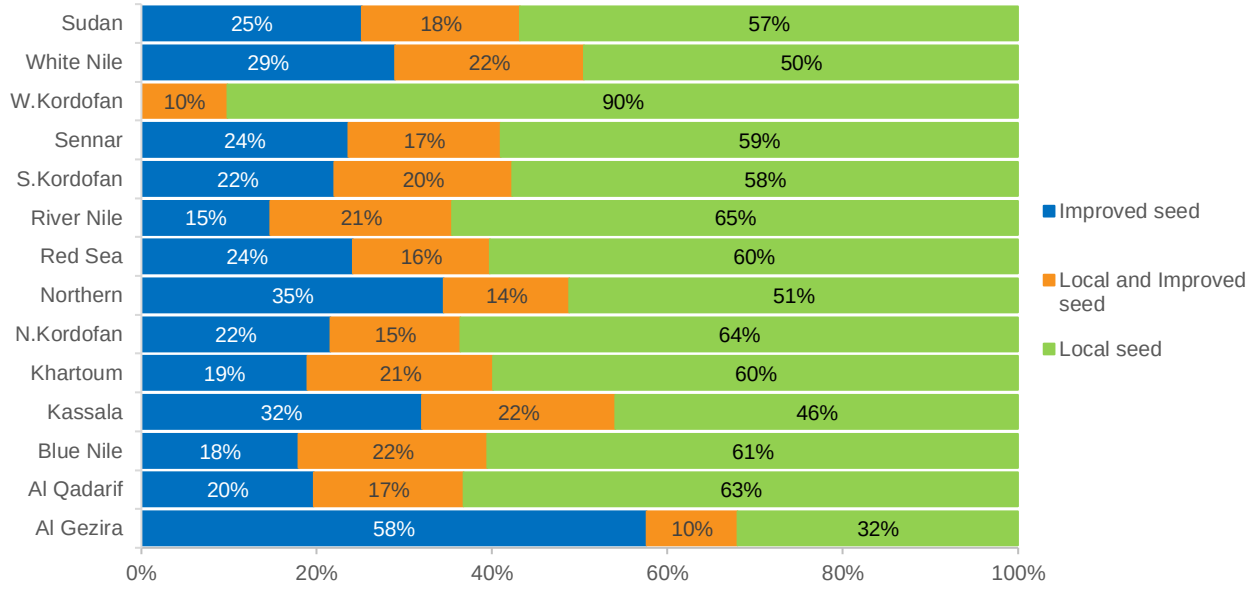
There are three main sources of seeds in Sudan – formal sector, informal sector, and seeds from aid agencies and organizations. The formal sector provides certified improved (good quality) seeds while the informal seed system provides local seed varieties but of poor quality. There is limited data on the actual proportion of farmers using improved seeds and local seed varieties in Sudan. Based on the 2011 census data, it is estimated that only 12 percent of the farmers in Sudan obtain their seeds from the formal sector (Al Badawi et al., 2022). Most of the farmers, especially in the traditional rainfed obtain their seed supply from the informal sector. The quality of seeds has large implications on the expected harvest.

Overall, our analysis shows that most of the farmers (57 percent) would mostly use local seeds compared to 25 percent that planned to use mainly improved seeds (Figure 9). State-level responses, however, suggest that apart from Al Gezira state, more than half of the farmers in all states indicated that they used/would use local seed varieties in the summer season. In Al Gezira state, 58 percent of the farmers indicated that they used/will use improved seeds, while another 10 percent indicated that they would mix improved and local seed varieties.

In relatively safer states such as Al Gezira, Northern, Kassala, White Nile, Sennar, and Red Sea, the proportion of farmers using improved seeds is higher than in less safe states. The magnitude of disruption of the supply chains for key inputs coupled with the efforts of the international organizations such as the (FAO) to distribute seeds (of sorghum, millet, groundnut, and sesame) to more than one million farmers may be influencing the decision farmers in these states made on what crops to plant and what type of seeds to use (Siddig et al., 2023).

Notably, in Khartoum state, just about 19 percent of farmers indicated that they used or were planning to use improved seeds. This might be due to the availability of improved seeds before the start of the conflict in the state. Furthermore, in West Kordofan no farmers solely used or were planning to use improved seeds only, however, 10 percent of the farmers indicated that they mixed/would mix local and improved seed varieties.

Figure 9: Use of seed by state (what type of seed you used/ will you use this season?)



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

There were no significant differences in the type of seeds to use by the interview approach (Table 5). However, local seed varieties remained the predominant type of seeds the farmers used or intended to use.

Table 5: Use of seed by type of interview

No	Type of survey	Improved seeds (percent)	Local and improved seeds (percent)	Local seeds (percent)
1	CATI	34	22	44
2	IVR	23	18	59
3	In-person	24	14	63
	Total (number)	**1143**	**854**	**477**

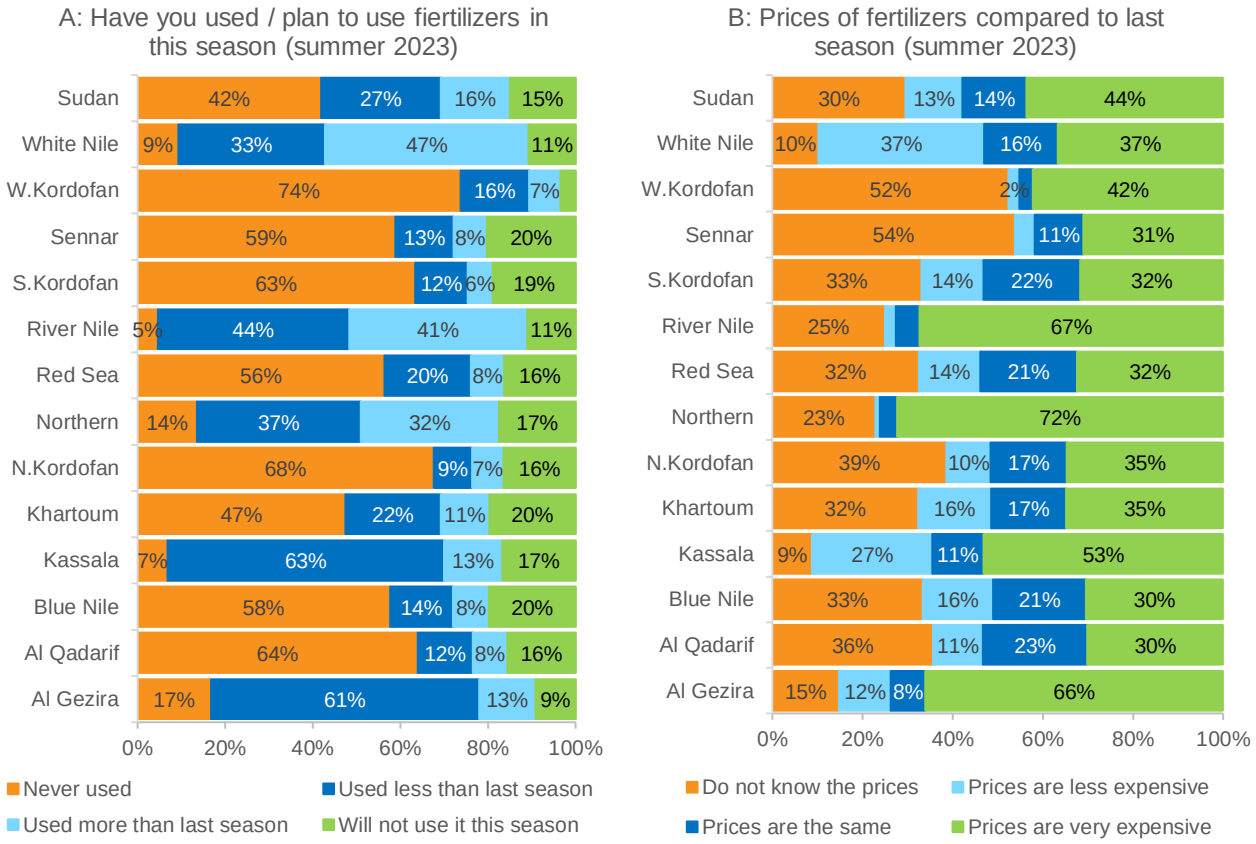
Source: Authors' compilation based on SSSP farmers' pre-harvest survey

Besides the low adoption of improved seeds, low agricultural productivity in Sudan is pegged on the low adoption of other productive inputs such as fertilizer (Al Badawi et al., 2022). Sudan's use of fertilizers is significantly below that of the neighboring countries such as Egypt and Ethiopia. In 2021, it was estimated that Sudan used just about 7.1 kilograms of fertilizer per hectare of arable land compared to 42.0 and 542.5 kilograms per hectare in Ethiopia and Egypt, respectively (World Bank, 2021). It is also worth noting that this rate declined from about 9.3 kilograms per hectare in 2016 to 7.1 kilograms per hectare in 2018-2021 (World Bank, 2021).

Our findings show that 42 percent of farmers at the national level have never used fertilizers before. Moreover, 15 percent of the farmers did not/would not use fertilizer this summer season, while another 27 percent will use less fertilizer than what they did in the last planting season. On the other hand, 16 percent of the farmers indicated that they plan to use more fertilizer than they did last season. The demand for the fertilizer may have been discouraged by the unfavorable price changes. Responding to a question on fertilizer prices, 44 percent of the farmers reported that prices are very high this season

(summer season 2023). A previous assessment has shown that the demand for fertilizers in Sudan is relatively low due to their high prices relative to crop prices (Al Badawi et al., 2022). It is also interesting to note that 30 percent of the farmers at the national level reported that they do not know the price of fertilizer, which confirms our earlier findings that 42 percent of the farmers have never used fertilizer before (Figure 10).

Figure 10: Use and cost of fertilizers by state



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

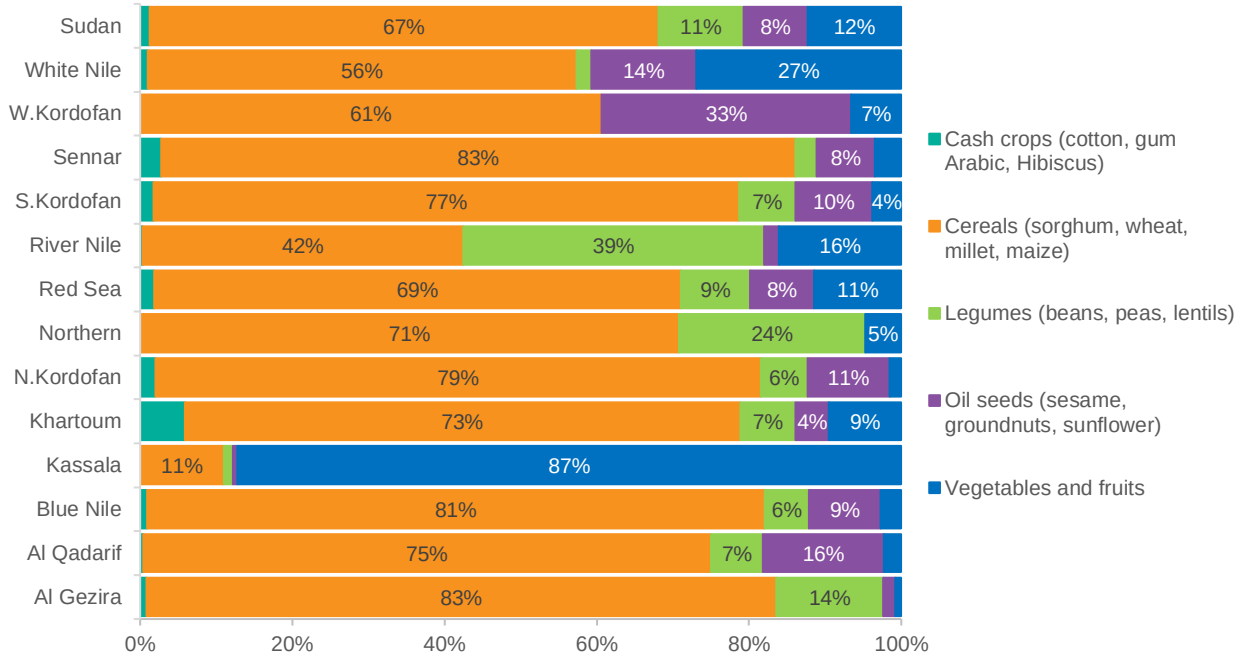
3.3 Type of crop and changes in cultivated area

The farmers' responses to our question on what the most important crops they have planted/will plant this season (summer season 2023) showcased that 67 percent of the of farmers at the national level indicated that they planted/planned to plant cereal crops. Other important crops as indicated by farmers are vegetables and fruits with 12 percent planted/planned to plant, legumes with 11 percent planted/planned to plant, oil seeds with 8 percent planted/planned to plant, while just 1 percent of the farmers indicating that they planted or planned to plant cash crops such as cotton, gum Arabic, and hibiscus (Figure 11). These proportions are replicated across states, except in Kassala, where the majority (87 percent) of farmers planted or planned to plant vegetables and fruits, and in the River Nile state, where legumes were an important choice for 39 percent of the farmers.

The relatively low tendency to plant cash crops will have a significant impact on the country's exports. The exports of cotton, gum Arabic, and hibiscus amounted to 12 percent of the total exports of the

country in 2022, while exports of sesame amounted to 11 percent (CBoS, 2022). Therefore, this is expected to result in widening trade balance deficit and result in a significant deterioration of the exchange rate, which surged to almost 1000 SDG/USD as of early November 2023 (FEWS NET, 2023).

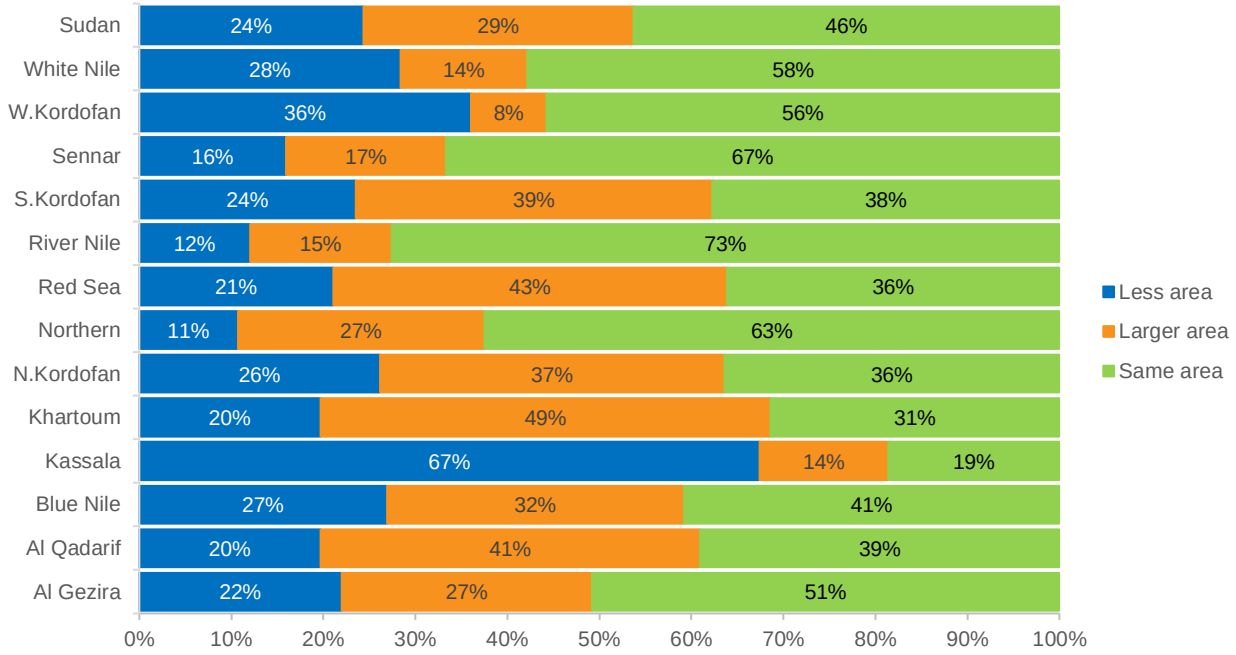
Figure 11: Type of crops planted by state



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

In addition to the choice of crop, the farmers must also decide on the land area to cultivate based on the availability of inputs, labor, and security to run the operations. Therefore, the surveyed farmers were asked "*for their most important crop, have/will they cultivate a larger area, similar area or smaller land area compared to last season?"*. Our findings suggest that 46 percent of the farmers were going to plant similar areas as last season. Due to the limitations of the rapid surveys, we unfortunately did not capture the main crop planted last season. Nevertheless, a quarter of the farmers planted or planned to plant less area than the previous season. State level variations are presented in Figure 12.

Figure 12: Planted area by state

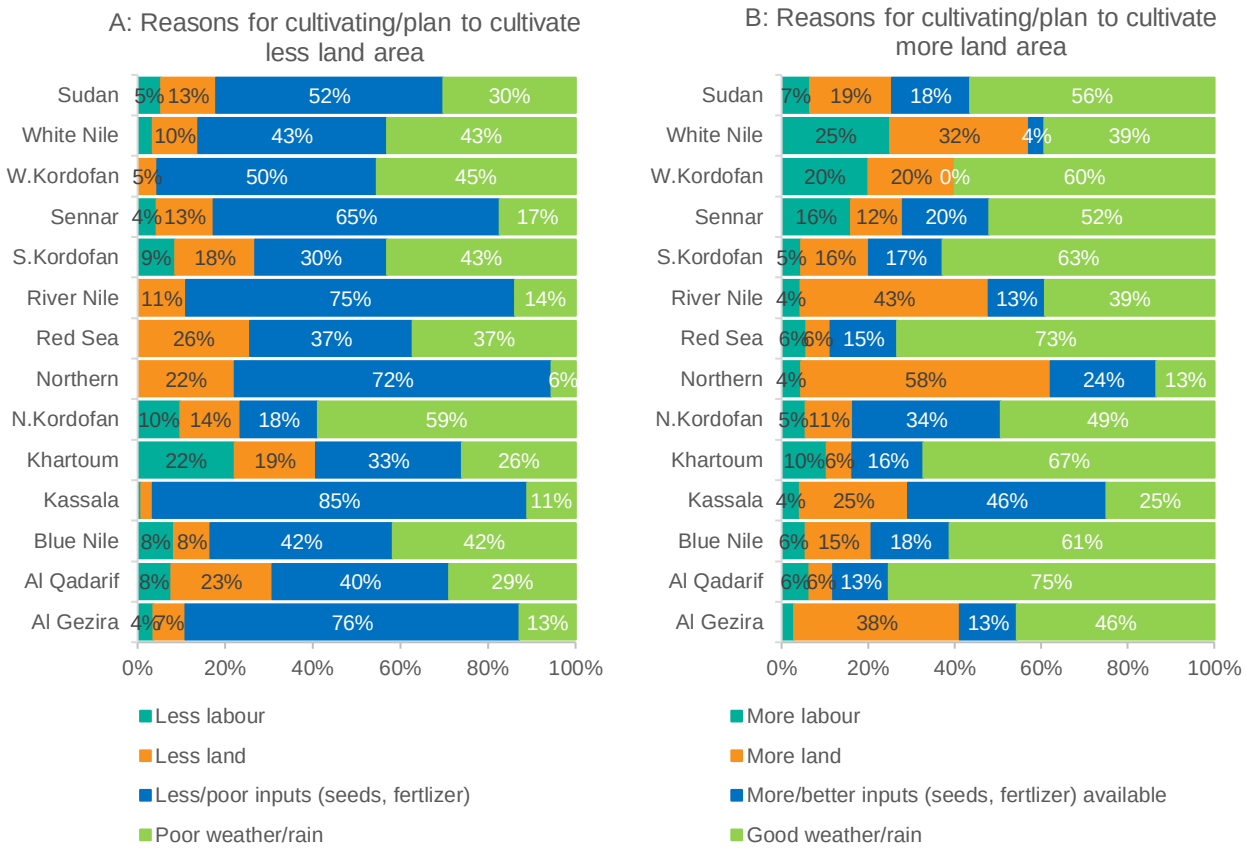


Source: Authors' compilation based on SSSP farmers' pre-harvest survey

The weather conditions, alongside the availability and quality of inputs (seeds, fertilizers) were the most important reasons for farmers to vary the size of their cultivated land area this season. The leading reasons for cultivating less area are *unavailability and bad quality of inputs,* especially in Kassala, River Nile and Al Gezira states, and *bad weather* especially in North and West Kordofan states. On the other hand, the reported main reasons for cultivating more land area than the previous season were *good weather/rain,* especially in Al Qadarif and Red Sea states, *availability of more inputs* (seeds, fertilizers), especially in Kassala, or *more land available* such as in the Northern state (Figure 13).

At the beginning of the survey in August 2023, 23 percent of surveyed farmers indicated that they cultivated or planned to cultivate less land area. This proportion has increased to 27 percent for the farmer interviewed in October 2023. Similarly, the proportion of those that indicated they would plant larger areas decreased from 39 percent to just 11 percent during the two interview periods (August and October), respectively. This may be explained by the recent reports from FEWSNET (2023) showing that although the cumulative rainfall during the season was broadly average to above average, localized irregularities in the temporal and spatial rainfall distribution, combined with persistently above-average temperatures, have aggravated conflict-related impacts on crop production. The unequal rainfall distribution at the local level is noticed through the existence of a significant intrastate variations of farmers reporting good weather (rainfall) and others reporting bad weather within the same state (such as in North Kordofan state (Figure 13)).

Figure 13: Reasons for changing the cultivated land area by state



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

In line with our results, (FAO, 2023) using satellite remote sensing data found that in July total cultivated land was 48 percent below July's 5-year average. In contrast, total cultivated land increased in September though it was still 10 percent below September's 5-year average. Moreover, (FEWS NET, 2023), using satellite data also observed a decrease in the cultivated area especially in the irrigated schemes Al Rahad and Al Gezira by 20 percent compared to last season, and lower vegetative greenness compared to last year. This will result in a reduction in the output because of reduced use of land as well as a reduction in agricultural productivity. Although the literature suggests that armed conflict reduces productivity and total agricultural output without affecting land use (Adelaja et al., 2020; Adelaja and George, 2019), our findings suggest that both cultivated land area and agricultural output will be affected by the ongoing conflict in Sudan.

3.4 Prices of key commodities

The ongoing conflict is expected to significantly impact the prices of key commodities. The high transportation costs resulting from insecurity and long routes have considerably affected the prices in general. Further security hazards followed the announcement by the SAF that some essential roads such as Bara Road, which links the Western part of the country (Darfur and Kordofan regions) to the Central part of the country and the capital Khartoum (Siddig et al., 2023; Abushama et al., 2023) are closed. The essential roads that link the Greater Kordofan and Darfur regions with the capital city were highly insecure as the SAF announced it as a military supply route. Other challenges that have increased the transportation cost and thus the prices include violence, looting, and the crossing through different

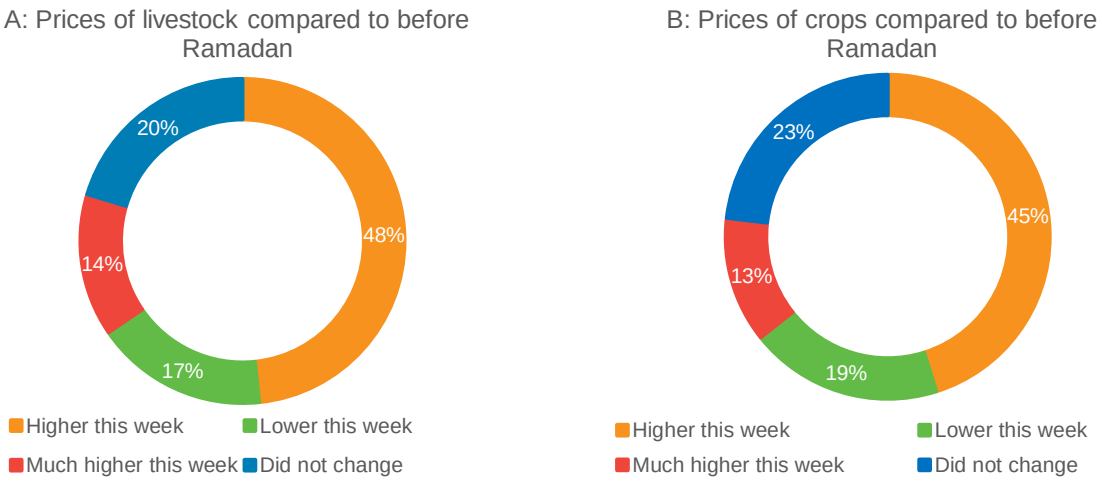
checkpoints along routes, which increased the length of trips (FEWS NET, 2023). The transportation costs and in-land trucking costs have increased by 250 percent as of July 2023 (Abushama et al., 2023). The reduction in the supply of commodities because of the disruption of market functionality aggravates the surge in prices. Moreover, the influx of displaced individuals and households to certain states would lead to increased demand and prices of key commodities.

3.4.1 Prices of crops and livestock

Prices of livestock and crops reflect the cost of food, and higher prices can incentivize farmers and herders to expand their production of crops and livestock. Overall, the changes in livestock and crop prices at the national level were largely similar (Figure 14). Unsurprisingly, more than half of the surveyed farmers reported that prices of livestock and crops are higher/ much higher during the interview week compared to the period before the conflict. Just about 20 percent of the farmers reported similar price ranges of crops and livestock before and after the conflict. Livestock in Sudan is mainly raised in the western part of the country in the Greater Kordofan and Greater Darfur regions. At the state-level, states located further away from the main livestock production areas such are River Nile, White Nile, and Al Gezira, reported the highest surge in livestock prices.

On the other hand, compared to livestock, crops are grown on a wider geographic spread. However, significant increases in crop prices were reported in the states hosting the displaced population such as Al Gezira, River Nile, and North Kordofan (DTM Sudan, 2023). Furthermore, although North Kordofan state is a major farming state, the ongoing heavy fighting and the siege of its capital city of Al Obeid has led to a surge in prices of crops.

Figure 14: Prices of crops and livestock



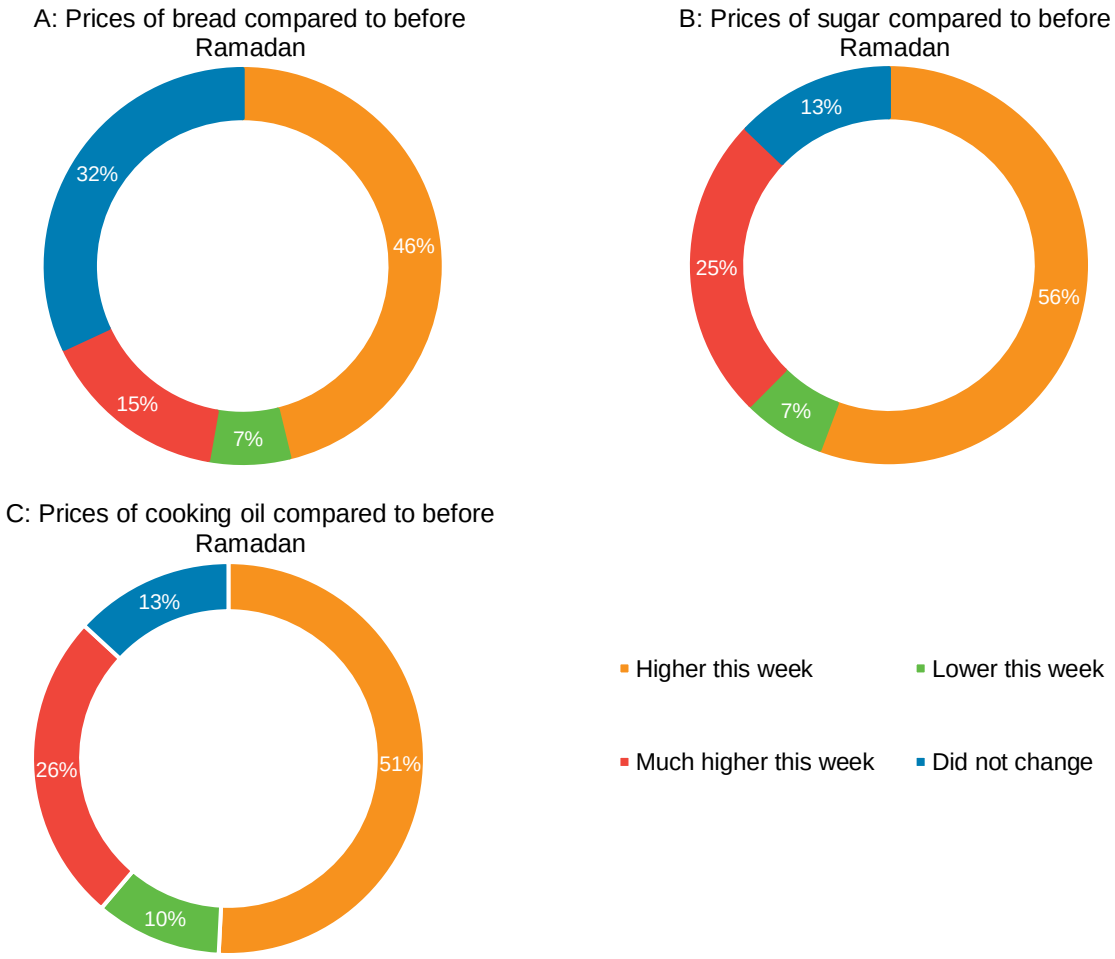
Source: Authors' compilation based on SSSP farmers' pre-harvest survey

3.4.2 Prices of bread, sugar, and cooking oil

Overall, prices of food commodities have been severely impacted by the conflict (WFP, 2023a; WFP, 2023b; WFP, 2023c). Before the conflict, food prices in Sudan have been considerably affected by international commodity prices, seasonality, and exchange rate fluctuations (Ahmed et al., 2023). Findings from our study show that most farmers indicated that prices of sugar, cooking oil, and bread, are

higher and much higher this week compared to their levels before the conflict, especially in the Northern, River Nile, Al Gezira, and West Kordofan states. For bread, 32 percent of the farmers reported no changes in prices, which could be explained by the higher degree of price regulation and control. In contrast, only 13 percent of the farmers reported no changes in the prices of sugar and cooking oil commodities. Prices of bread have often been more stable compared to other commodities because bakeries have tended to keep the prices of bread constant periodically despite the rise in prices of flowers by reducing the weight of bread (Ahmed et al., 2023).

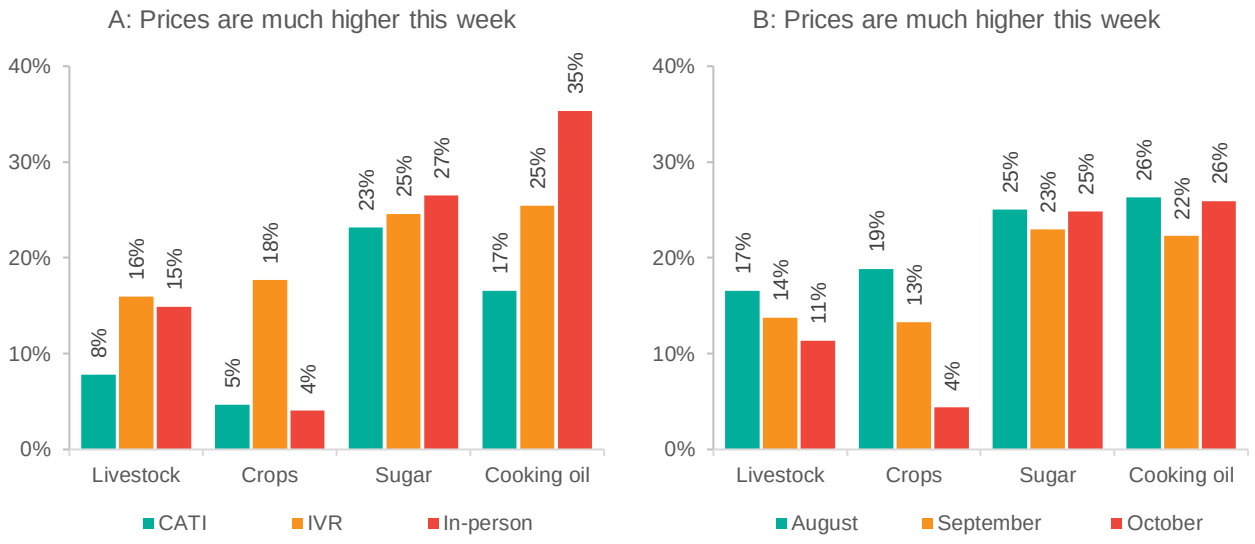
Figure 15: Prices of bread, sugar, and cooking oil



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

As depicted in Figure 16, the perceptions of farmers about the prices of the selected food commodities are relatively similar across methodologies (IVR, CATI, in-person) and times of data collection (August, September, and October). Later in the season as harvest time approaches, they perceive a decreasing trend in prices of key commodities, especially crops.

Figure 16: Percentage of farmers reporting prices are much higher by state, month and crop



Source: Authors' compilation based on SSSP farmers' pre-harvest survey

4 CONCLUSION AND POLICY IMPLICATIONS

The nationwide pre-harvest survey of 3,284 smallholder farmers was conducted between August and October 2023. The aim of the survey and study was to understand the impact of the conflict on smallholder farmers, their intentions, and the challenges they faced during the agricultural season in view of the direct and indirect effects of the conflict on agricultural production, both in conflict-affected regions and in non-conflict regions.

Our key findings are that close to a third of the farmers were displaced from their farms and have moved to other states or to safer areas within their states, most of the displaced being from Khartoum state. Further, a considerable number of farmers were unable to prepare for the summer planting season (40 percent) because of the conflict. Unfortunately, many of these farmers were not intending to plant later in the season. The most notable challenge that prevented farmers from planting was the lack of finance to buy agricultural inputs such as seeds and fertilizers or to hire farm labor. The cost of inputs, especially improved seeds, is either much higher or higher for most farmers across the country compared to input price levels before the conflict. This is compounded with bad weather conditions, poor quality of local seed varieties, and climate challenges, namely, delayed rains. The lack of finances has resulted in farmers reducing the size of their cultivated land area this season compared to last season. The impact of these compounded challenges on production is expected to be revealed as relatively lower output when the harvest season begins. The immediate impacts of the conflict are also reflected in the surge of prices of livestock and crops, but more pronounced in key household commodities such as sugar, cooking oil and bread.

Although most farmers indicated that they are growing cereal crops this season, the availability of these cereal crops be challenged, which would affect their accessibility and ultimately would affect food security. The spike in food prices reported by the surveyed farmers is alarming. Given that, many farmers this season are expected to face considerable challenges in meeting their food needs unless they re-

ceive supplementary food assistance. The challenges faced by farmers during the summer season (limited finance, limited availability of inputs, and high prices of inputs) are expected to continue in the harvest season, as well as in the coming winter season (2023/2024) if the conflict continues.

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