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Agricultural Recovery and Resilience in Sudan

Findings from the THABAT Project Baseline Survey of Farmers

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EXECUTIVE SUMMARY

This report presents the findings from a baseline survey of farmers conducted as part of IFPRI's impact evaluation of a sub-component of the food security component of the THABAT project in Sudan. The report documents farmers' pre-intervention conditions across agricultural production, input access, climate-smart practices, food security, market conditions, and institutional trust in the three states in which the project is being implemented—Kassala, Northern, and River Nile.

Sudan's ongoing conflict has severely disrupted agricultural systems, markets, and rural livelihoods. The Sudan Enhancing Community Resilience Project (THABAT) provides resilience-oriented agricultural support that is critical for sustaining food production, protecting livelihoods, and supporting local economic recovery ('*thabat*' in Arabic means 'stability' or 'firmness'). The project is a USD 130 million initiative financed through the Sudan Transition and Recovery Support Trust Fund (STARS) Multi-Donor Trust Fund. This report focuses on Component 2 of the project, which aims to enhance food security through directly providing agricultural production inputs, both goods and services, to farmers.

The baseline survey covered 1,308 beneficiary farmers from 115 farmer organizations across the three project states during the 2025/26 agricultural year. The main findings from the analysis of the survey data include:

- Beneficiary farmers demonstrate relatively strong agricultural production potential despite operating in a fragile and conflict-affected environment.
- Agricultural input support from the THABAT project reached most households, especially climate-adapted improved seeds for wheat, sorghum, and vegetables, and DAP and urea inorganic fertilizers.
- However, adoption of climate-smart and adaptive agricultural practices, beyond the use of climate-adapted improved seeds and fertilizers, generally remains low.
- The food security indicators of beneficiary farmers are stronger than those seen in broader crisis-affected populations in Sudan. However, food insecurity levels vary substantially across the three project states.
- Farmers continue to face major structural constraints to their economic activities that are related to inflation and currency fluctuations. They also face significant barriers in accessing markets, financial services, and technology, and are subject to substantial conflict-related risks.

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1. INTRODUCTION

Sudan's ongoing conflict has severely disrupted agricultural production, markets, service delivery, and household livelihoods. Yet, agriculture remains central to food security, rural incomes, and local economic recovery, particularly in relatively accessible agricultural production areas. In this context, investments that sustain farmers' productive capacity, strengthen local institutions, and improve access to agricultural inputs, services, and markets are essential for protecting rural livelihoods and supporting early economic recovery in rural communities.

The THABAT project is a USD 130 million investment that aims to support and complement current humanitarian aid and associated services and ultimately improve food security and resilience in Kassala, Northern, and River Nile states in Sudan. The project started in 2024 with an initial implementation period of two years. It is funded by the Sudan Transition and Recovery Support (STARS) multi-donor trust fund, which is managed by the World Bank. THABAT has two main components with slightly different and complementary objectives: (i) a Provision of Basic Services component (USD 74 million) that is being implemented by UNICEF, and (ii) an Improving Food Security (USD 56 million) component that is being implemented by the World Food Programme (WFP) through the international non-governmental organization, Mercy Corps.

This report focuses on the farmer baseline survey that is part of the evaluation program for the second THABAT project component on improving food security. Activities under the food security component target four important value chains—sorghum, wheat, vegetables, and horticultural crops (beans). There are three sub-components to the food security project component that provide support to farmers through farmers' organizations:

- Increasing agricultural production and resilience by supporting farmers with agricultural inputs and farming services. This sub-component targets farmers and farmers' organizations (FOs) through the delivery of climate-smart agricultural and veterinary services; inputs, including improved seed, urea and DAP fertilizers, farming services like land preparation or harvesting, and farm machinery; support services, such as postharvest technologies and small-scale rehabilitation of irrigation canals; and technical assistance. Farmers' organizations are being supported in enterprise planning, organizational management, and commercialization efforts. In addition, the capacity of community extension trainers is being expanded so they can better guide farmers' organizations in the use of climate-smart agricultural techniques. Farmers' organizations are also gaining access to digital agriculture advisory platforms.
- Supporting value addition in supported agricultural value chains, through cash grants of up to USD 100,000 to private small and medium-scale enterprises (SMEs). The second sub-component of the THABAT project's food security component supports SMEs to enhance their value addition activities by providing various agricultural services, including transport, logistics, storage and packaging, and small-scale processing.
- Scaling up and strengthening community consumer cooperatives to better serve as market outlets for the food produced by THABAT project-supported farmers and SMEs. The third sub-component strengthens the capacity of consumer cooperatives through technical and financial assistance, including in-kind support, training in inventory

management, procurement of renewable energy systems and clean cooking equipment, and digital enrollment platforms.

The International Food Policy Research Institute (IFPRI) is responsible for evaluating the impact of the three different sub-components of the THABAT project under the food security component on the various target agricultural value chains and target populations. However, this report is only focused on the first sub-component of the THABAT project's food security component—the impacts of the sub-component on farmers and FOs. It does not cover SMEs and consumer cooperatives that are more central to the second and third sub-components. The impact of THABAT on SMEs and consumer cooperatives will be assessed through the analysis of data from separate survey instruments that will be presented in another report.

To assess the impact of the first sub-component of the THABAT project's food security component, IFPRI is conducting baseline and endline surveys covering beneficiary and non-beneficiary farmers. The key outcomes of interest for the evaluation include farm-level production and productivity, access to various agricultural services, adoption of climate-smart agricultural practices, and food and nutrition security. This report summarizes findings from a baseline survey conducted on a sample of farming households that benefited from the first sub-component of the THABAT project.

Beyond measuring key outcomes related to farmers' production capacity, the baseline survey also captured important attributes and characteristics of farmers across the following themes:

- Farmer and household characteristics,
- Agricultural production and productivity levels,
- Access to THABAT support services and any associated adoption of climate-smart agricultural practices,
- Food and nutrition security and associated welfare indicators, and
- The level of trust in institutions and the business environment expressed by the sample farmers.

2. LITERATURE AND CONTEXT

Agriculture plays a central role in economic development, food security, and poverty reduction in sub-Saharan Africa, where a substantial gap persists between actual and potential agricultural productivity (Abate 2016, Adenle et al. 2018, Jama and Pizarro 2008, Staatz and Dembélé 2007, Diao et al. 2010). This gap underscores the importance of strengthening agricultural systems to enhance livelihoods and food security across the region.

Sudan exemplifies this challenge. Prior to the outbreak of the current conflict in April 2023, the nation's agrifood sector contributed about 35 percent of GDP and 40 percent of employment (World Bank 2025). Despite this, agricultural performance remained weak due to poor infrastructure, limited political commitment to improving productivity and value addition in agrifood value chains, low and inconsistent public investment, and weak implementation of development strategies (Alhelo et al. 2023). Public spending was also skewed toward large-scale irrigated schemes, while smallholder farmers—who form the backbone of the sector—received relatively limited support (WB-MFEP 2016).

As a result, agricultural productivity in Sudan lags behind that of many African countries (World Bank 2022, Mohamed et al. 2026). This gap is driven in part by the low adoption of productivity-enhancing inputs, including fertilizers, improved seeds, and pesticides, particularly among poorer farmers, which further reinforces disparities in agricultural performance. The literature emphasizes the critical role of improved inputs in accelerating agricultural development. The adoption of fertilizers, improved seeds, and other modern technologies has been consistently associated globally with higher yields and increased farm incomes (Abate 2016, Jama and Pizarro 2008, Nin-Pratt 2016, Abate et al. 2018). In addition, the importance of increasing agricultural productivity has gained further urgency under the pressures of climate change and environmental degradation. The adoption of climate-smart agricultural practices is vital for achieving both productivity growth and environmental sustainability (Nciizah and Wakindiki 2015, Nshakira-Rukundo et al. 2026). However, adoption rates of such innovations remain low in developing countries and are even more constrained in fragile and conflict-affected settings such as Sudan (Nshakira-Rukundo et al. 2026). Nshakira-Rukundo et al. (2026) suggest that adoption of productivity-enhancing technologies in these contexts is influenced by multiple factors, including access to training and extension services, information availability, input subsidies, and farmers' prior experience with the technologies.

Beyond input use and technology adoption, market participation among Sudanese farmers remains limited. Structural constraints such as poor rural infrastructure, inadequate transportation networks, and underdeveloped telecommunications systems significantly limit farmers' ability to access markets, obtain price information, and commercialize their produce (World Bank 2020).

Finally, broader macroeconomic and institutional factors play a vital role in shaping agricultural outcomes (Daudi and Muba 2025, Elbadawi and Ismail 2021, Osman and Ali 2021). As argued by Elbadawi and Ismail (2021), stable macroeconomic conditions, including effective management of exchange rate fluctuations and inflation, are essential for maintaining agricultural input affordability and market stability. Macroeconomic uncertainties coupled with limited public investment in the agrifood sector in Sudan have undermined its

potential growth. Beyond these underlying constraints, the outbreak of the armed conflict in 2023 continues to undermine agricultural development efforts in Sudan (Osman and Ali, 2021). The THABAT project and associated services are expected to mitigate some of these underlying constraints and shocks that are hampering growth in the agrifood sector in Sudan.

3. SAMPLE DESIGN AND DATA

The baseline survey was designed to establish pre-intervention conditions among farmers targeted by the WFP-implemented food security enhancing component of the THABAT project in Kassala, Northern, and River Nile states. These states represent strategically important agricultural production zones that have remained relatively secure and accessible despite Sudan's broader conflict-related disruptions and therefore provide an important context for assessing the value of agricultural investments in building the resilience of local food systems.

The three target states differ considerably in agroecological conditions, irrigation systems, market access, livelihood structures, and exposure to economic and conflict-related shocks. These differences provide an important opportunity to assess how interventions to enhance the resilience of food systems, particularly through improved agricultural production, perform under varying production and institutional environments.

The targeting and identification of THABAT project beneficiaries were conducted in two stages. First, Mercy Corps selected FOs based on the following three eligibility criteria: (i) active registration and operation in Sudan, (ii) at least 100 farmer members, and (iii) having farmer members cultivating the target crops of wheat, sorghum, vegetables, and beans. FO representatives then identified farmers among their members based on their cultivation practices and crop portfolios for both the summer and the winter seasons. The THABAT project used FOs as the primary delivery platform for the provision of agricultural support and associated services in the lead-up to planting for the June to November 2025 summer season or the October 2025 to March 2026 winter season. Beyond facilitating the distribution of agricultural inputs, FOs also play an important role in coordinating the production activities of local smallholder farmers, strengthening local institutional capacity, facilitating extension and training activities, and potentially improving the market integration of farming households.

3.1 Baseline survey sample

The sample was constructed using beneficiary lists provided by Mercy Corps. These contained the names of 27,420 farmers from 152 FOs who received support for the June to November 2025 summer season and the October 2025 to March 2026 winter season for the first time. These farmers had not received support from the THABAT project prior to these two seasons. The sample selection process was implemented at the FOs level to ensure representation across all FOs covered by the program. Although Kassala has more farmers, they are concentrated in fewer and larger FOs, while River Nile has a high number of smaller FOs.[1] As a result, the sample includes a larger share of farmers from River Nile state.

In selecting a sub-sample of farmers for the summer agricultural season, the sampling frame identified 9,487 beneficiary farmers from 70 eligible FOs. A random sample of 1,576 farmers was drawn from this sampling frame—625 in Kassala, 194 in Northern, and 575 in River Nile. Data collection from the farmers in this summer season sub-sample was conducted using

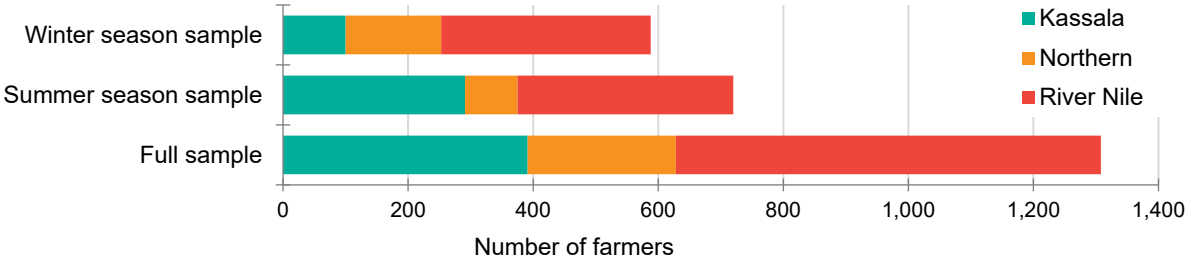
[1] In addition, in Kassala, Mercy Corps prioritized in the sample selection process the inclusion of vulnerable FOs that lack resources and have less access to land and agricultural inputs.

computer-assisted telephone interviewing (CATI) between 9 October and 23 December 2025. 720 interviews were successfully completed.

For the winter season sub-sample, we drew a separate random sample of farmers from 80 eligible FOs. A total of 1,885 farmers were selected—225 farmers in Kassala, 465 in Northern, and 1,195 in River Nile. Interviews of the farmers in the winter season sub-sample took place between 5 January and 8 March 2026, yielding 588 completed interviews.

Overall, we collected information from 1,308 beneficiary farmers from 115 FOs in the three target states (Figure 3-1). This two-season data collection process captured seasonal variations in agricultural production, market engagement, and household economic and livelihood conditions. The two-season survey design is particularly important in the Sudanese agricultural context, where production systems, labor demand, irrigation use, market participation, and food security conditions vary substantially between summer and winter seasons. Capturing both agricultural production cycles strengthens the analytical value of the baseline and should improve the ability of the endline assessment to identify intervention-related seasonal changes. The endline survey is planned to be administered to these same sample farmers.

Figure 3-1 Baseline survey sample of treatment farmers, by agricultural season and state



Source: Authors' analysis of survey sample.

3.2 Variables of interest

Baseline indicators were selected to capture multiple dimensions of agricultural resilience, productive capacity, welfare, and institutional conditions among the sample beneficiary farmers. The indicators reflect both intermediate outcomes associated with agricultural support and broader household welfare outcomes that may evolve over time as the THABAT project intervention matures. The baseline survey also collected data on key household characteristics and outcome variables. We group the collected data into five main domains.

- **Farmer and household profile:** These attributes describe beneficiary farmers in our data through their socio-demographic and socio-economic characteristics such as age, gender, and education level. In addition, we collected information on household ownership of basic and productive assets to assess their baseline economic conditions and productive capacity.
- **Agricultural production and productivity indicators:** These include total cultivated land, land cultivated under main crops, crop yields and harvests in the previous agricultural seasons, the value of the main crops harvested based on self-reported crop price data, total sales of the main crops, and total sales of all crops. These variables relied on the recall of data for the previous summer (June to November 2024) and the

previous winter (October 2024 to March 2025) agricultural seasons. These characteristics and outcomes are collected to examine farmers' production potential.

- **Access to agricultural support services:** These indicators capture in part the access that the sample farmers have to agricultural assistance from the THABAT project. Farmers were asked if they had received any support for their agricultural activities, the source of any support received, whether from the THABAT project, government agencies, non-governmental organizations, or other sources, and the type of support received, including inputs, technical assistance, training, and financial support.
- **Food and nutrition security indicators:** These outcomes measure a key dimension of the welfare status of the sample households. Using data from the survey, we use three indicators to measure the food and nutrition security of the households—the Food Consumption Score (FCS), the Household Dietary Diversity Score (HDDS), and the Food Insecurity Experience Scale (FIES). The computation of these widely used measures followed standard practice (FAO 2020, Leroy et al. 2015, Ballard, Kepple, and Cafiero 2013, FAO 2013, WFP 2008, Ruel 2003). Together, these indicators capture complementary dimensions of food access, dietary quality, and food-related vulnerability, which are particularly important in fragile and shock-prone environments.
    - FCS was calculated using the standard WFP methodology that combines dietary diversity, food frequency, and the nutritional importance of consumed food groups over the previous seven days. Based on FCS, households are grouped into three categories: poor, borderline, and acceptable food consumption.
    - HDDS is computed as the number of food groups household members reported consuming in the previous seven days from among eight food groups.[2] Thus, HDDS ranges between 0 and 8. Higher scores indicate greater dietary diversity and improved access to a variety of foods (Hoddinott and Yohannes 2002, Hatloy et al. 2000).
    - FIES was constructed from responses to eight standardized food security questions on the household's difficulties in accessing adequate food over the past 30 days.[3] FIES ranges from 0 to 8 and can be used to categorize households as food secure, mildly food insecure, moderately food insecure, or severely food insecure.
- **Institutional trust and business environment:** Institutional trust and perceptions of the business environment are particularly important in conflict-affected settings, where weak institutions, market disruptions, inflation, and insecurity can substantially constrain farmers' ability to invest, adopt technologies, and participate in markets. Respondents were asked to indicate their level of agreement or disagreement with statements that capture trust in market actors, institutions, and the overall enabling

[2] The HDDS is an indicator of the economic ability of the household to access a variety of foods and has been validated as a proxy indicator for household energy availability (e.g., Ruel 2003, FAO 2013, Leroy et al. 2015). Several studies have shown that an increase in dietary diversity is strongly associated with household food security (e.g., Hoddinott and Yohannes 2002, Hatloy et al. 2000). We follow the HDDS guidelines of the Food and Agriculture Organization of the United Nations (FAO) by using a recall period of one week.

[3] The self-reported FIES captures the difficulties households face in accessing adequate food due to financial or other resource constraints. FIES was developed by FAO and is widely applied to measure the prevalence of food insecurity in a population (Ballard, Kepple, and Cafiero 2013, FAO 2020). FIES is based on an eight-question questionnaire module that focuses on the respondent's experiences of difficulties in accessing sufficient and nutritious food over the last 30 days.

environment for agricultural and business activities. Composite indicators were constructed to reflect baseline perceptions in this domain.

Collectively, the indicators obtained through the baseline survey of farmers provide a multidimensional view of resilience by capturing productive assets, adaptive practices, institutional conditions, food security outcomes, and exposure to structural constraints. These dimensions are expected to evolve as the interventions of the THABAT project expand over its period of implementation.

4. BASELINE STATISTICS

4.1 Household characteristics

The findings from the baseline survey reveal important differences in agricultural production capacity, socioeconomic conditions, and resilience-related characteristics across beneficiary farmers and states. Understanding these differences is important for interpreting future project impacts and for identifying areas where additional support may be required to strengthen agricultural livelihoods and adaptive capacity.

Table 4-1 reports individual- and household-level baseline characteristics of respondents in our sample. The majority of respondents are male, reflecting the predominantly male representation within beneficiary FOs and agricultural production systems in the target areas, as also documented in recent studies on Sudan (Mohamed et al. 2026, Kirui et al. 2023). Kassala has the highest share of female respondents (20 percent), suggesting relatively greater female participation in agricultural activities or farmers' organizations compared to Northern and River Nile states. Educational attainment varies substantially across states, with beneficiary farmers in Kassala exhibiting considerably lower levels of formal education than those in Northern and River Nile. Around 37 percent of respondents in Kassala reported no formal education, compared to only 9 percent and 11 percent in Northern and River Nile, respectively. These disparities may have important implications for the adoption of technology, training effectiveness, access to information, and adaptive capacity. Rates of finishing high school or secondary education were considerably lower in Kassala compared to Northern and River Nile.

In terms of household assets, smartphones and televisions were the most owned assets across the sample. Almost two-thirds of households reported having access to the internet. Smaller shares of households in Kassala reported owning a car, a generator, and solar panels compared to households in Northern and River Nile. However, households in Kassala were more likely to own a motorcycle than households in the other two states.

The highest rate of livestock and agricultural landownership is in River Nile state, followed by Northern. Only about 45 percent of households in Kassala state reported owning livestock. However, landownership is relatively high in Kassala state, with 78 percent of sample farmers there stating that they owned agricultural land. The level of landownership is only slightly lower than what is found in Northern and River Nile states. However, average landholdings in Kassala state (21 feddans) are relatively larger than those of households in Northern (9 feddans) and River Nile (8 feddans). This landholding pattern is consistent with the FAO's 2023 geospatial assessment of cultivated areas, which found greater cropland availability in Kassala state (Kumar et al. 2023). The relatively larger average landholding size in Kassala suggests that the THABAT project prioritized farmers there who are actively engaged in agricultural production and capable of utilizing the agricultural support package provided by the project.

The ownership of other productive assets, such as animal-traction plows, donkey-pulled carts, and water pumps, was generally higher in Northern and River Nile states than in Kassala.

Table 4-1 Characteristics of baseline survey respondents and households

	Full sample	Kassala	Northern	River Nile
Respondent is male (yes = 1)	0.92 (0.27)	0.80 (0.40)	0.99 (0.09)	0.96 (0.18)
Respondent age (years)	47.64 (12.76)	43.33 (13.02)	48.39 (12.42)	49.86 (12.10)
Highest formal education achieved (yes = 1)				
No formal education	0.19 (0.39)	0.37 (0.48)	0.09 (0.29)	0.11 (0.32)
Primary	0.22 (0.41)	0.22 (0.41)	0.22 (0.42)	0.22 (0.41)
High school	0.28 (0.45)	0.21 (0.41)	0.27 (0.44)	0.32 (0.47)
Secondary	0.12 (0.32)	0.07 (0.26)	0.15 (0.36)	0.13 (0.34)
Technical and vocational education	0.02 (0.15)	0.03 (0.16)	0.04 (0.20)	0.01 (0.12)
University	0.18 (0.38)	0.11 (0.31)	0.22 (0.42)	0.20 (0.40)
Household asset ownership (yes = 1)				
Car	0.17 (0.38)	0.12 (0.33)	0.26 (0.44)	0.17 (0.38)
Motorcycle	0.14 (0.35)	0.22 (0.42)	0.03 (0.17)	0.14 (0.34)
Tok-Tok (motorized auto-rickshaw)	0.14 (0.35)	0.13 (0.34)	0.19 (0.40)	0.13 (0.33)
Television	0.78 (0.42)	0.58 (0.49)	0.86 (0.35)	0.86 (0.34)
Radio	0.19 (0.40)	0.19 (0.39)	0.13 (0.34)	0.22 (0.41)
Smart telephone	0.80 (0.40)	0.73 (0.45)	0.83 (0.38)	0.83 (0.39)
Electrical generator	0.05 (0.22)	0.03 (0.16)	0.06 (0.24)	0.06 (0.25)
Solar panels	0.14 (0.35)	0.10 (0.30)	0.31 (0.46)	0.11 (0.31)
Internet access	0.62 (0.49)	0.56 (0.50)	0.64 (0.48)	0.65 (0.48)
Productive asset ownership (yes = 1)				
Agricultural land	0.87 (0.34)	0.78 (0.41)	0.82 (0.38)	0.93 (0.25)
Agricultural land owned (feddan)	12.06 (45.21)	20.86 (74.73)	9.47 (39.72)	7.89 (10.66)
Livestock	0.68 (0.47)	0.45 (0.50)	0.75 (0.43)	0.79 (0.41)
Animal-traction plow	0.07 (0.25)	0.00 (0.05)	0.09 (0.29)	0.10 (0.29)
Tractor	0.03 (0.17)	0.03 (0.16)	0.03 (0.17)	0.04 (0.18)
Fishing boat	0.03 (0.17)	0.02 (0.13)	0.04 (0.20)	0.03 (0.18)
Donkey-pulled cart	0.41 (0.49)	0.32 (0.47)	0.35 (0.48)	0.49 (0.50)
Water pump	0.24 (0.42)	0.07 (0.25)	0.43 (0.50)	0.27 (0.44)
Observations	1,308	391	237	680

Source: Authors' analysis of survey data.
Note: Standard deviations in parentheses. 1.0 feddan ≈ 0.4201 ha

4.2 Crop production

Variables describing the agricultural production of farming households in the survey sample during the summer and the winter seasons of the previous agricultural year are reported in Table 4-2. Across the sample, larger land areas were cultivated in the 2024 summer season (5.76 feddans) than in the 2024/25 winter season (4.82 feddans), on average. This difference was primarily driven by farmers in Kassala, as farmers in Northern and River Nile states cultivated less land in the 2024 summer season than in the 2024/25 winter season, on average.

Table 4-2 Crop production of sample farming households during the 2024 summer and 2024/25 winter agricultural seasons

	Full sample	Kassala	Northern	River Nile
Summer season (June to Nov 2024)				
Total cultivated land (feddan)	5.76 (4.60)	8.23 (4.62)	3.41 (3.04)	3.28 (2.98)
Cultivated land under main crop (feddan)	5.11 (5.15)	7.32 (5.72)	2.84 (2.96)	2.46 (2.61)
Main crop harvest value (1,000 SDG)	3,173.60 (3070.51)	3,174.92 (3,034.28)	2,843.28 (2,673.59)	3,315.85 (3,347.83)
Sales of main crop (1,000 SDG)	2,060.07 (2208.24)	2,074.68 (2,288.35)	1,863.29 (1,944.78)	2,108.30 (2,117.81)
Sales of other crops (1,000 SDG)	3,439.04 (4854.30)	3,107.11 (4,271.89)	2,940.00 (5,692.99)	4,507.69 (5,775.26)
Winter season (Oct 2024 to Mar 2025)				
Total cultivated land (feddan)	4.82 (3.60)	6.99 (3.92)	4.91 (3.55)	4.28 (3.34)
Cultivated land under main crop (feddan)	3.75 (2.51)	5.53 (2.77)	3.68 (2.51)	3.37 (2.27)
Main crop harvest value (1,000 SDG)	5,018.43 (4551.10)	3,875.83 (4,243.30)	5,437.56 (5,172.35)	5,223.91 (4,418.28)
Sales of main crop (1,000 SDG)	2,516.54 (2597.79)	2,221.16 (2,289.72)	2,803.89 (3,027.56)	2,523.44 (2,556.85)
Sales of other crops (1,000 SDG)	3,909.45 (5531.61)	4,414.63 (7,433.14)	3,843.72 (5,359.51)	3,776.57 (4,919.60)
Observations	1,308	391	237	680

Source: Authors' analysis of survey data.
Note: Standard deviations in parentheses. To limit the influence of extreme observations, continuous variables presented in this table were winsorized at the 5th and 95th percentiles. Values below the 5th percentile were set to the 5th percentile value, while values above the 95th percentile were set to the 95th percentile value. The statistics reported are based on the winsorized data. 1.0 feddan ≈ 0.4201 ha; 1,000 SDG ≈ USD 1.987 based on the average exchange rate in November 2024, corresponding to the reference period of the previous agricultural season (Bank of Khartoum, 2024).

The values of the harvest and sales of the main crop were higher in the 2024/25 winter season than in the 2024 summer season in the three states, on average. Farmers from Northern state were shown to have the highest average values for main crop harvest and sales for the 2024/25 winter season, when compared to farmers in Kassala and River Nile. The average value of the harvest in Northern state was around 5.4 million SDG for the 2024/25 winter season, higher than the 5.2 million SDG in River Nile and substantially higher than the 3.9 million SDG in Kassala. We observe a similar trend for the variable on sales of the main crop.

In terms of the number of farmers who reported cultivating these crops, the main crops cultivated during the 2024 summer season were sorghum, okra, and lentils, while wheat, beans, and onions were the main crops cultivated during the 2024/25 winter season (Table 4-3). Sorghum was cultivated in all three states during the 2024 summer season. Kassala had the largest number of sorghum farmers, but the highest average yields were recorded in Northern state at 621 kg/feddan, although this figure is based on a small number of observations. In terms of the other two main crops for the 2024 summer season, farmers in Northern and River Nile states cultivated okra that yielded 710 kg/feddan and 1,488 kg/feddan, respectively. Cultivation of lentils and pigeonpea (balila) was primarily in Kassala, where the average yield was 367 kg/feddan.

Table 4-3 Average yields for main crops in the 2024 summer and 2024/25 winter agricultural seasons

	Yield (kg/feddan)			
	Full sample	Kassala	Northern	River Nile
Summer season (June to Nov 2024)				
Sorghum	463.9 (493.4)	441.3 (503.8)	621.2 (620.1)	529.6 (405.7)
Observations	188	148	8	32
Okra	1,277.2 (1,593.2)	–	710.2 (759.1)	1,487.9 (1,753.1)
Observations	62	–	12	46
Lentils and Pigeonpea (Balila)	368.2 (257.7)	366.9 (260.0)	–	–
Observations	55	54	–	–
Winter season (Oct 2024 to Mar 2025)				
Wheat	819.2 (632.1)	762.5 (669.1)	696.7 (649.7)	868.7 (615.3)
Observations	691	71	155	465
Beans	715.4 (455.8)	–	883.5 (459.8)	587.6 (418.1)
Observations	42	–	19	22
Onion	8,503.8 (4,242.3)	–	–	8,002.7 (3,841.4)
Observations	45	–	–	41

Source: Authors' analysis of survey data.
Note: Pigeonpea (Balila) is red boiled lentils. Standard deviation in parentheses. We do not report yields for crops that had fewer than five observations per state.
1.0 feddan ≈ 0.4201 ha

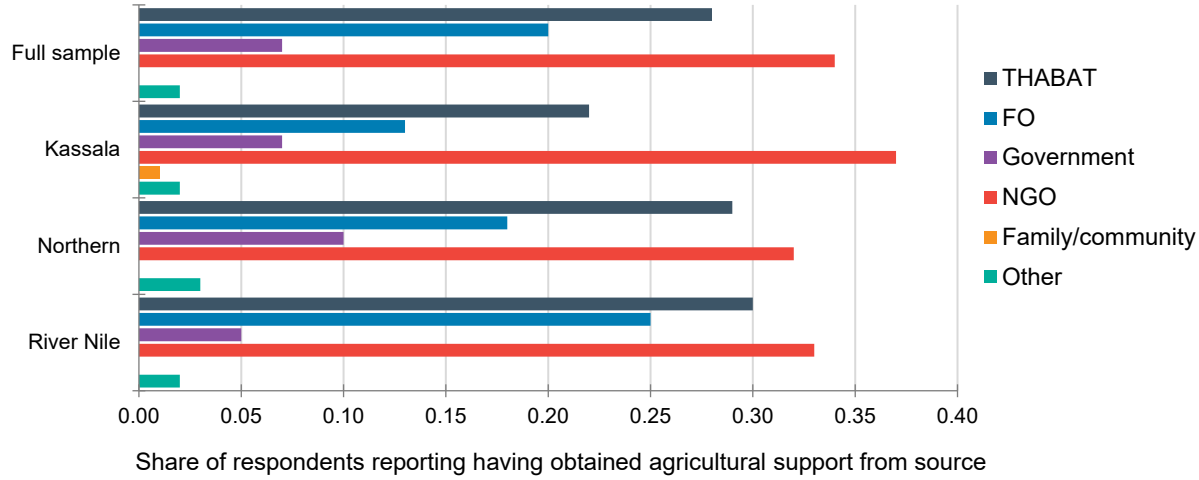
During the 2024/25 winter season, wheat was the most cultivated crop across all three states, with yields ranging from 697 kg/feddan in Northern to 869 kg/feddan in River Nile, on average. Recorded average yields for beans were 588 kg/feddan in River Nile and 884 kg/feddan in Northern, while they were not cultivated by many farmers in Kassala. Onions were predominantly cultivated in River Nile.

4.3 Support for agriculture

As not all farmers might be familiar with the THABAT project, we asked whether they have received agricultural support from a range of actors and projects, including THABAT. The type of support includes access to inputs as well as technical support during land preparation and irrigation. At baseline, 87 percent of THABAT beneficiary farmers reported receiving some form of agricultural assistance, with support coverage being highest in River Nile (Table 4-4).

Figure 4-1 shows that non-governmental organizations and the THABAT project are the primary sources of support received by the sample farming households, reaching 34 percent and 28 percent of the households, respectively. FOs account for 20 percent of reported support. Government-provided assistance remains limited, reaching only 7 percent of the farming households.

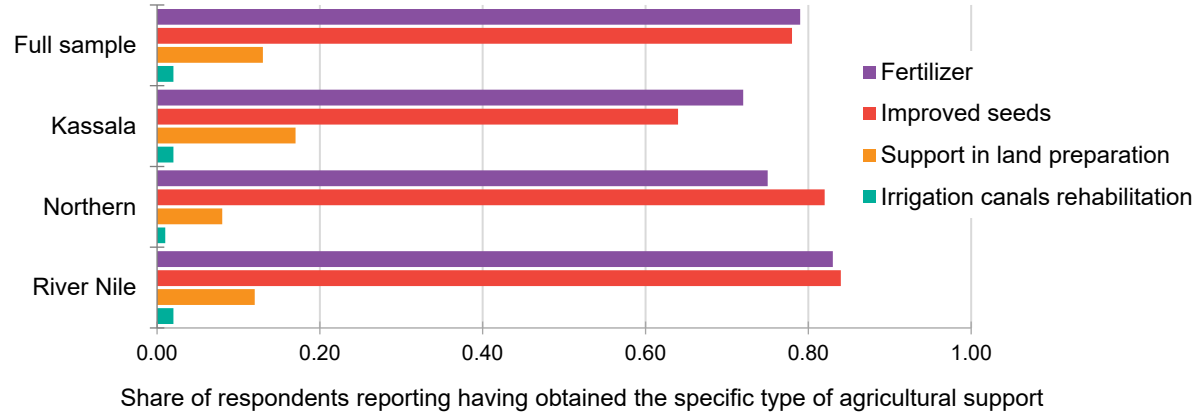
Figure 4-1 Sources of agricultural support reported received by farmers, by state



Source: Authors' analysis of survey data.
Note: FO=farmers' organization; NGO=non-governmental organization

Figure 4-2 highlights the main types of support that were received by the farming households in the sample. Assistance is overwhelmingly concentrated on improved production inputs, particularly improved seeds (78 percent) and fertilizers (79 percent). The share of farming households receiving these inputs is consistently higher in Northern and River Nile states than in Kassala. Support for land preparation is more limited and is most common in Kassala. It is important to note that the improved seeds distributed under THABAT are climate-smart, i.e., drought-tolerant and early-maturing, and therefore represent an embedded form of climate-smart support.

Figure 4-2 Types of agricultural support reported received by farmers, by state



Source: Authors' analysis of survey data.

Other types of climate-smart support, particularly those related to training, technologies, and advisory services, are reported at very low levels (Table 4-4). Similarly, support related to value addition, market linkages, and post-harvest handling remains limited. This pattern highlights the strong emphasis that has been placed on input provision, alongside significant gaps in advisory services, market integration, and climate-smart capacity building. Assistance at baseline was largely focused on input support (improved climate-adapted seeds and fertilizer), with limited provision of training, market linkages, or climate-smart and digital interventions.

Table 4-4 Agricultural support received by THABAT beneficiary farming households, by state, share of sample farming households

	Full sample	Kassala	Northern	River Nile
Received any agricultural support (yes = 1)	0.87 (0.34)	0.81 (0.39)	0.87 (0.34)	0.90 (0.30)
Source of agricultural support received				
THABAT project	0.28 (0.45)	0.22 (0.41)	0.29 (0.46)	0.30 (0.46)
Farmers' organization	0.20 (0.40)	0.13 (0.33)	0.18 (0.39)	0.25 (0.44)
Government	0.07 (0.25)	0.07 (0.26)	0.10 (0.30)	0.05 (0.23)
Non-governmental organization	0.34 (0.47)	0.37 (0.48)	0.32 (0.47)	0.33 (0.47)
Family or community	0.00 (0.07)	0.01 (0.09)	0.00 (0.00)	0.00 (0.07)
Other	0.02 (0.14)	0.02 (0.12)	0.03 (0.18)	0.02 (0.13)
Type of agricultural support received				
Irrigation canal rehabilitation	0.02 (0.13)	0.02 (0.14)	0.01 (0.11)	0.02 (0.13)
Support in land preparation	0.13 (0.34)	0.17 (0.38)	0.08 (0.27)	0.12 (0.33)
Improved seeds	0.78 (0.42)	0.64 (0.48)	0.82 (0.38)	0.84 (0.36)
Inorganic fertilizer	0.79 (0.41)	0.72 (0.45)	0.75 (0.43)	0.83 (0.37)
Better access to improved harvesting methods	0.01 (0.11)	0.02 (0.12)	0.01 (0.11)	0.01 (0.10)
Better access to improved postharvest methods	0.01 (0.08)	0.01 (0.09)	0.00 (0.06)	0.01 (0.09)
Market linkages with small and medium-sized enterprises (SMEs)	0.01 (0.10)	0.00 (0.05)	0.00 (0.06)	0.02 (0.13)
Market linkages with consumer cooperatives	0.01 (0.10)	0.00 (0.05)	0.00 (0.06)	0.02 (0.13)
Climate-smart agricultural technologies	0.01 (0.09)	0.00 (0.05)	0.00 (0.00)	0.01 (0.11)
Digital technologies	0.01 (0.08)	0.00 (0.05)	0.00 (0.00)	0.01 (0.10)
Training in climate-smart agriculture	0.02 (0.15)	0.01 (0.11)	0.01 (0.11)	0.03 (0.18)
Training in digital technologies	0.01 (0.11)	0.01 (0.07)	0.00 (0.00)	0.02 (0.14)
Observations	1,308	391	237	680

Source: Authors' analysis of survey data.
Note: Standard deviations in parentheses.

To understand who is benefiting from these agricultural services and, hence, the THABAT project, we characterize access to these services as a function of the observable characteristics of farmers. The regression results in Table 4-5 highlight some statistically significant associations between household characteristics, location, and access to different types of agricultural support:

- Receipt of any agricultural support (column 1) is positively associated with household wealth, as measured by the basic household assets index. In addition, households located in River Nile state are more likely to have received some form of agricultural support compared to households in Kassala (the base category for the states).
- Rehabilitation of irrigation canals (column 2) is positively associated with higher educational attainment. Respondents who completed high school or university education are more likely to have received irrigation-related support.
- Male and educated respondents have relatively higher access to land preparation support (column 3). Also, households in both Northern and River Nile states are more likely to have had access to land preparation support than households in Kassala.

Table 4-5 Results of linear regression analyses of the determinants of access to agricultural support services by farming households

Variables	(1) Received any agricultural support (yes = 1)	(2) Irrigation canal rehabilitation (yes = 1)	(3) Support in land preparation (yes = 1)	(4) Received improved seeds (yes = 1)	(5) Received inorganic fertilizer (yes = 1)
Respondent is male (yes = 1)	0.02	0.01	0.07**	0.09	0.03
	(0.05)	(0.01)	(0.04)	(0.05)	(0.04)
Respondent age (years)	-0.00	0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Highest formal education achieved (yes = 1)					
Primary	-0.03	0.00	-0.02	-0.01	-0.03
	(0.03)	(0.01)	(0.02)	(0.04)	(0.04)
High school	0.02	0.03***	0.06*	0.04	0.04
	(0.03)	(0.01)	(0.03)	(0.04)	(0.04)
Secondary	0.02	0.00	-0.02	0.03	-0.01
	(0.04)	(0.01)	(0.03)	(0.05)	(0.05)
TVET	0.01	-0.01	0.03	0.04	0.04
	(0.08)	(0.01)	(0.07)	(0.09)	(0.09)
University	0.04	0.02*	0.06*	0.06	0.04
	(0.03)	(0.01)	(0.03)	(0.04)	(0.04)
Asset indices					
Household assets	0.03*	0.00	-0.02	0.03	0.05**
	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Productive assets	-0.03	0.00	0.02	-0.03	-0.04*
	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
State (yes = 1)					
Northern	0.04	-0.02	-0.12***	0.14***	-0.01
	(0.03)	(0.01)	(0.04)	(0.04)	(0.04)
River Nile	0.08**	-0.01	-0.07*	0.16***	0.08**
	(0.03)	(0.01)	(0.04)	(0.04)	(0.03)
Constant	0.81***	-0.01	0.11***	0.49***	0.68***
	(0.06)	(0.02)	(0.04)	(0.07)	(0.06)
Observations	1,308	1,308	1,308	1,308	1,308
R-squared	0.02	0.01	0.02	0.06	0.03

Source: Authors' analysis of survey data.
Note: Coefficients reported come from linear probability models. Standard errors, clustered at the farmers' organization level, are given in parentheses. *, *, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

- Access to improved seeds (column 4) is associated with geographic location—farming households in Northern and River Nile states are more likely to have received improved seeds than those in Kassala.
- Finally, access to chemical fertilizers (column 5) is positively associated with higher ownership of basic household assets, but negatively associated with ownership of productive assets.

4.4 Adoption of improved and climate-smart agricultural practices

Table 4-6 reports on the adoption by the farming households in the survey sample of improved inputs and climate-smart agricultural practices. Mechanized land preparation is widely adopted—78 percent of farmers prepared land using machinery in the 2024 summer

season, with the highest use in River Nile state (86 percent). Use of mechanization increased further in the 2024/25 winter season, reaching 91 percent overall. This pattern reflects greater intensification of winter production across all states and is consistent with broader trends highlighted by FAO (2026) of increased availability of agricultural machinery in 2025, particularly in relatively secure states. Improved security conditions have enabled the restoration of private-sector functionality in machinery services, in contrast to conflict-affected areas where access to such services remains more constrained.

Table 4-6 Adoption of improved inputs and climate-smart agricultural practices during the 2024 summer and 2024/25 winter agricultural seasons, share of farmers

	Full sample	Kassala	Northern	River Nile
Summer season (June to Nov 2024)				
Machinery for land preparation	0.78 (0.41)	0.73 (0.44)	0.78 (0.42)	0.86 (0.35)
Improved climate-smart seeds	0.31 (0.46)	0.30 (0.46)	0.19 (0.40)	0.37 (0.49)
Chemical fertilizer	0.56 (0.50)	0.31 (0.46)	0.78 (0.42)	0.87 (0.34)
Drought or heat tolerant varieties	0.22 (0.41)	0.22 (0.41)	0.21 (0.41)	0.23 (0.42)
Fast or early maturing varieties	0.21 (0.40)	0.22 (0.42)	0.15 (0.36)	0.20 (0.40)
Agroforestry or tree planting	0.07 (0.26)	0.05 (0.22)	0.11 (0.31)	0.09 (0.29)
Water harvesting or efficient irrigation	0.18 (0.39)	0.18 (0.38)	0.22 (0.42)	0.18 (0.39)
Crop rotation or intercropping	0.20 (0.40)	0.20 (0.40)	0.23 (0.43)	0.20 (0.40)
Soil conservation or erosion prevention	0.18 (0.38)	0.16 (0.36)	0.16 (0.37)	0.22 (0.42)
Integrated pest management	0.50 (0.50)	0.46 (0.50)	0.53 (0.50)	0.56 (0.50)
Early warning or weather information	0.19 (0.39)	0.19 (0.39)	0.14 (0.35)	0.22 (0.41)
Winter season (Oct 2024 to Mar 2025)				
Machinery for land preparation	0.91 (0.29)	0.86 (0.35)	0.93 (0.26)	0.92 (0.28)
Improved climate-smart seeds	0.65 (0.48)	0.54 (0.50)	0.65 (0.48)	0.67 (0.47)
Chemical fertilizer	0.91 (0.28)	0.72 (0.45)	0.93 (0.26)	0.95 (0.21)
Drought or heat tolerant varieties	0.31 (0.46)	0.25 (0.43)	0.29 (0.45)	0.34 (0.47)
Fast or early maturing varieties	0.18 (0.38)	0.14 (0.35)	0.13 (0.34)	0.20 (0.40)
Agroforestry or tree planting	0.06 (0.24)	0.06 (0.23)	0.06 (0.23)	0.06 (0.24)
Water harvesting or efficient irrigation	0.17 (0.38)	0.20 (0.40)	0.18 (0.39)	0.16 (0.36)
Crop rotation or intercropping	0.19 (0.39)	0.24 (0.43)	0.19 (0.39)	0.18 (0.38)
Soil conservation or erosion prevention	0.16 (0.37)	0.14 (0.35)	0.14 (0.35)	0.17 (0.38)
Integrated pest management	0.53 (0.50)	0.51 (0.50)	0.57 (0.50)	0.51 (0.50)
Early warning or weather information	0.16 (0.37)	0.18 (0.39)	0.12 (0.32)	0.17 (0.38)
Observations	1,308	391	237	680

Source: Authors' analysis of survey data.
Note: Standard deviations in parentheses.

Adoption of improved seeds and fertilizers shows strong seasonality. In the 2024 summer season, only 31 percent of farmers used improved seeds, with notably lower adoption in Northern state. Fertilizer use during the 2024 summer was more widespread overall (56 percent) but varied by state—lowest in Kassala (31 percent) and highest in River Nile (87 percent).

Conversely, adoption rates of improved seed and fertilizer increased substantially in the 2024/25 winter season—use of improved seeds was 65 percent and fertilizer use exceeded 90 percent across all states. While the reported availability of improved seeds and fertilizers improved slightly in 2025, access remained generally uneven and inconsistent across states, with a strong reliance on market-based channels, local agro-dealers, and distribution by international NGOs (FAO 2026).

Despite relatively high use of conventional inputs, adoption of climate-smart and resource-conserving practices was low in both seasons. Use of drought- or heat-tolerant varieties was limited, with 22 percent of farming households in the 2024 summer season and 31 percent in the 2024/25 winter season reporting to have planted these varieties. Adoption of early-maturing varieties was below 20 percent in both seasons. Practices such as agroforestry, soil conservation, crop rotation, and water-efficient irrigation are consistently reported by less than 20 percent of farmers.

Use of integrated pest management was comparatively higher than the use of other climate-smart agricultural practices—its use was reported by about half of farmers in both seasons. However, use of early warning systems or weather information remains limited, particularly in Northern state.

4.5 Food and nutrition security

Table 4-7 shows the food security status of the sample farming households, as measured by the three metrics: Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), and Food Insecurity Experience Scale (FIES). The average FCS in the sample is 62.5. Most households (88 percent) have an acceptable FCS. The average HDDS is 6.9 food groups. Similarly, the average FIES is 2.14. Based on FIES, 57 percent of households are categorized as not experiencing food insecurity.

Table 4-7 Food and nutrition security indicators of sample farming households, by state

	Full sample	Kassala	Northern	River Nile
Food Consumption Score (FCS), mean	62.54 (21.60)	54.31 (23.14)	63.25 (21.81)	67.09 (19.08)
Poor, share of households	0.02 (0.16)	0.06 (0.24)	0.02 (0.13)	0.01 (0.09)
Borderline, share of households	0.09 (0.29)	0.19 (0.39)	0.08 (0.27)	0.05 (0.21)
Acceptable, share of households	0.88 (0.32)	0.75 (0.43)	0.91 (0.29)	0.95 (0.22)
Household Dietary Diversity Score (HDDS) (0-8), mean	6.90 (1.33)	6.44 (1.54)	6.89 (1.29)	7.17 (1.13)
Food Insecurity Experience Scale (FIES) (0-8), mean	2.14 (2.58)	3.48 (2.80)	1.73 (2.39)	1.51 (2.21)
Food secure (FIES ≤ 1), share of households	0.57 (0.49)	0.35 (0.48)	0.65 (0.48)	0.68 (0.47)
Mildly food insecure (1 < FIES ≤ 3), share of households	0.14 (0.35)	0.15 (0.35)	0.16 (0.37)	0.13 (0.33)
Moderately insecure (3 < FIES ≤ 6), share of households	0.18 (0.39)	0.30 (0.46)	0.11 (0.32)	0.14 (0.35)
Severely food insecure (FIES > 6), share of households	0.10 (0.31)	0.21 (0.41)	0.08 (0.27)	0.05 (0.22)
Observations	1,308	391	237	680

Source: Authors' analysis of survey data.
Note: Standard deviations in parentheses.

Food security appears to be lower in Kassala than in the other two states. For example, only 35 percent of respondents in Kassala reported not experiencing any form of food insecurity in the last 30 days, while closer to 70 percent of respondents in Northern and River Nile reported not experiencing any form of food insecurity. This pattern of higher food insecurity in Kassala is also seen in the FCS and HDDS measures.

Overall, the sample of farming households included in the baseline survey appears to be generally food secure, with most showing acceptable FCS levels. This pattern may reflect the project focusing on farmers with relatively larger landholdings and the capacity to expand their agricultural production. However, the level of food security in the three states, based on the analysis of the baseline survey data, is significantly higher than other recent national and state-level estimates. For example, the results from the 2024 IFPRI smallholder farmers survey show substantially greater food insecurity in the three states, with only 32 percent of households classified as food secure in Kassala, 35 percent in Northern state, and 31 percent in River Nile (Mohamed et al. 2026). This divergence in estimates of the prevalence of food insecurity in the three states should be investigated further.

4.6 Trust and business environment

The results from the baseline survey show that farming households have high trust in development actors, with respondents reporting very strong confidence in development agencies and non-governmental organizations across all three states (Table 4-8). Around 60 percent of farmers reported trusting local and state government institutions.

At 62 percent, trust in local leaders is slightly stronger than it is for local and state government institutions, particularly in Kassala (76 percent). In contrast, 45 percent of farmers have trust in banks and financial institutions, with the weakest perceptions in River Nile. Strong trust in non-governmental organizations and community leaders lends support to decisions to design interventions that are delivered through local cooperatives, extension agents, and community extension trainers.

Markets are perceived as accessible but neither profitable nor favorable. While 67 percent of farmers in the sample report having sufficient market access, only 43 percent perceive that prices in local markets are favorable. Perceptions of transport and road infrastructure are more positive—73 percent of the sample believe that infrastructure allows easy access to markets, especially in Northern state.

The baseline data highlight limited access to technology and finance. Only 33 percent of farmers view modern agricultural technologies as affordable and accessible, while only 37 percent believe that credit is not difficult to access. This reflects broader constraints in Sudan, where access to finance and financial technologies remains limited and disrupted by conflict (FSD Africa 2023).

Less than half of farmers report favorable conditions in labor and training. Around 44 percent consider labor costs affordable. Similarly, 49 percent report that training programs are available.

Macroeconomic and contextual challenges remain significant, particularly those arising due to inflation and currency fluctuations. The resultant price instability and exchange rate volatility affect the majority of farmers. Only 29 percent report that inflation has a limited impact, and 33 percent say the same for currency fluctuations. Similarly, only 40 percent of farmers report a low risk of conflict-related disruptions, with higher confidence in Kassala (50 percent) relative to River Nile (37 percent) and Northern (30 percent). These patterns reflect the broader operating environment in Sudan, where agriculture continues to be adversely affected by macroeconomic instability, conflict, and structural constraints (Daudi and Muba 2025, World Bank 2025)

Table 4-8 Farmers' trust in institutions and perceptions of market and business environment, share of respondents, by state

	Full sample	Kassala	Northern	River Nile
Trust (yes = 1)				
In development agencies and non-governmental organizations	0.79 (0.41)	0.80 (0.40)	0.74 (0.44)	0.81 (0.39)
In financial institutions	0.45 (0.50)	0.55 (0.50)	0.47 (0.50)	0.39 (0.49)
In local government	0.60 (0.49)	0.71 (0.45)	0.57 (0.50)	0.54 (0.50)
In local leaders	0.62 (0.48)	0.76 (0.43)	0.58 (0.49)	0.56 (0.50)
In state government	0.58 (0.49)	0.67 (0.47)	0.58 (0.49)	0.53 (0.50)
Beliefs about market and business environment for agricultural production (agree = 1)				
There are sufficient markets available for selling	0.67 (0.47)	0.71 (0.46)	0.65 (0.48)	0.65 (0.48)
The prices in local markets are favorable	0.43 (0.50)	0.54 (0.50)	0.37 (0.48)	0.39 (0.49)
Infrastructure allows easy access to markets	0.73 (0.45)	0.66 (0.47)	0.81 (0.39)	0.73 (0.44)
Modern agricultural technologies are accessible and affordable	0.33 (0.47)	0.47 (0.50)	0.30 (0.46)	0.27 (0.44)
It is easy to access financial support or loans	0.37 (0.48)	0.46 (0.50)	0.35 (0.48)	0.32 (0.47)
The cost of labor is reasonable and affordable	0.44 (0.50)	0.49 (0.50)	0.45 (0.50)	0.40 (0.49)
Training programs to improve skills are available	0.49 (0.50)	0.60 (0.49)	0.38 (0.49)	0.46 (0.50)
Currency fluctuations have minimal negative impact	0.33 (0.47)	0.39 (0.49)	0.28 (0.45)	0.31 (0.46)
Inflation rates do not adversely affect costs	0.29 (0.45)	0.39 (0.49)	0.22 (0.42)	0.24 (0.43)
There is minimal risk of disruptions due to conflict	0.40 (0.49)	0.50 (0.50)	0.30 (0.46)	0.37 (0.48)
The current government policies related to agriculture are fair and consistently applied	0.41 (0.49)	0.50 (0.50)	0.42 (0.49)	0.33 (0.47)
Environmental regulations are clear and do not overly restrict agricultural activities	0.66 (0.47)	0.73 (0.44)	0.62 (0.49)	0.63 (0.48)
Observations	1,308	391	237	680

Source: Authors' analysis of survey data.
Note: Standard deviations in parentheses.

Perceptions of the policy environment are somewhat more moderate. A minority of respondents (41 percent) held the opinion that government agricultural policies were fair and consistently applied, with higher agreement in Kassala (50 percent). In contrast, two-thirds of respondents felt that environmental regulations are clear and not restrictive, with the most positive perceptions again in Kassala (73 percent).

5. CONCLUSIONS

This Sudan Strategy Support Program (SSSP) Working Paper summarizes the findings from a baseline survey of farmer beneficiaries of the THABAT project in Sudan. Through one of its sub-components, the THABAT project is targeting farmers through selected FOs to deliver climate-smart agricultural services, climate-adapted agricultural inputs, including improved seeds, fertilizers, and planting machinery, other farm support services, such as postharvest technologies and small-scale rehabilitation of irrigation channels, and technical assistance.

The baseline survey collected comprehensive information on the characteristics of farmers as well as key outcome variables that are expected to reflect some of the intermediate and ultimate effects of the THABAT project. These characteristics and outcomes are organized across five main domains: farmer and household profile, agricultural production and productivity, access to agricultural support, food and nutrition security, and trust and business environment. Beyond characterizing and profiling households' demographic and socioeconomic attributes, we also compare farmers' agricultural production and productivity potential as well as food security status with the broader context of Sudan. Finally, we describe the institutional and business environment in which farmers operate, along with their perceptions and trust in local institutions and development actors. Such characterization is crucial for understanding the expected impact of the THABAT project on food production, livelihoods, and local economic recovery.

We find that households and farmers included in the THABAT project exhibit relatively higher agricultural production potential compared to national averages in Sudan. This is consistent with the targeting of the THABAT project, which prioritized FOs and associated farmers who could benefit from agricultural support. We note that although farmers report relatively modest landholding, their adoption of climate-smart agricultural practices remains low, which threatens the sustainability of their agricultural livelihoods.

The findings show that farmers included in the THABAT project generally reported relatively good levels of food security on average. However, we find considerable variations in the share of households that are food insecure across the three THABAT project states—food insecurity appears to be relatively more prevalent in Kassala than in Northern and River Nile.

Trust in non-governmental organizations and related agencies appears to be higher than that in local institutions and local leaders, despite some important differences across states. Markets are perceived as accessible but neither profitable nor favorable. While most farmers report having sufficient access to markets, a substantial share of our sample perceives that prices in local markets are not favorable. This perception is perhaps due to the high inflation in Sudan that has been fueled by the civil conflict. These higher costs have driven the costs of market operations higher, especially for fuel to transport goods and services to and between markets.

To summarize, the data and descriptive evidence described in this paper offer important insights into the context, living conditions, and economic environment of farming households in Kassala, Northern, and River Nile states before they became beneficiaries of the THABAT project. Several broad characteristics of these farming households can be seen:

- Farming households in the sample show relatively higher agricultural production capacity and have reasonably good access to agricultural production inputs, including

land. This suggests that access to services provided under the THABAT services can further boost their agricultural productivity potential. However, differences in these characteristics of farming households between the project states suggest the need for targeted, context-specific implementation strategies.

- Despite their relatively better agricultural production potential and food security conditions, the low adoption by the farming households in the survey sample of climate-smart agricultural practices, including circular bioeconomy practices that enhance efficient use of production resources, suggests the need for dedicated efforts to improve adoption of these practices. The climate-smart agricultural practices to promote might include household organic waste recycling and reuse in agricultural production. Livestock enterprises should be encouraged to reuse crop residues as feed and to better manage the plant nutrients in livestock dung for crop production. Such integration of livestock and crop production practices will enable farms that have livestock feeding on crop residues after the summer harvest to realize higher yields in the winter season through higher accumulations of organic matter from livestock manure. Additionally, the low adoption of climate-smart agricultural practices also calls for expanding the expertise of agricultural extension services to facilitate the diffusion of climate-smart agricultural practices and improve the market integration of farming households.
- Farming households in Sudan face multiple shocks from a diverse set of sources, including inflationary pressure, unfavorable local prices and markets, weather-related shocks to production, as well as the risk of conflict. This suggests that input support alone is unlikely to generate sustained resilience gains. The resolution of the current conflict is critical to achieving success in agrifood sector growth in Sudan. With peace, inflation pressures would ease and more reliable and efficient agrifood value chains would be restored to facilitate the rebuilding of sustainable and resilient food systems in the country.

Analysis of the data to be collected in the endline survey, when coupled with the data here from the baseline survey, will help to uncover whether the THABAT project improved the agricultural production potential and resilience of these farmers and to what extent. The future analysis of the two surveys will provide critical evidence on whether resilience-oriented agricultural support can improve agricultural productivity and farmer households' welfare outcomes in fragile settings.

Nonetheless, several methodological considerations are important to bear in mind when interpreting the findings drawn from the baseline survey data.

- The program design and implementation were not perfectly suited for generating experimental variation in access to agricultural support services. Randomizing the interventions associated with such a large project was challenging and infeasible because of implementation-related constraints. Thus, the impact evaluation relies on non-experimental and observational variation by comparing the outcomes of beneficiary and non-beneficiary farmers before and after they joined the project. This constrains attribution to the project of any differences found between the two groups.
- Due to operational timelines and phased implementation, some sampled farmers had already begun receiving selected forms of support during baseline data collection. As a

result, certain baseline indicators may partially reflect this early project exposure, which may mute somewhat the level of impact that might otherwise be attributed to the THABAT project.

- Data collection relied on computer-assisted telephone interviewing (CATI). This method limited the amount of information that could be obtained from survey respondents and also led to considerable non-response among targeted respondents. With CATI, there are always concerns about sample selection bias against households without telephones. However, as the sample for this baseline survey consisted of farming households whose contact information was obtained from the implementing agency of the THABAT project, this concern of selection bias in the baseline survey sample is not as relevant as it would be if the sample were to be representative of the entire population of farming households in the three states.
- Finally, some production and income indicators rely on self-reported recall data. These data and any analyses of them should therefore be interpreted with appropriate caution.[4]

[4] Several previous studies show the implications and impacts of recall bias and associated mismeasurement in agricultural statistics (Desiere and Jolliffe 2018, Gourlay et al. 2019, Abay et al. 2019, Abay et al. 2023).

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