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Income Generation (Farm and Non-farm) and Expenditure Pattern of Smallholder Farmers in North Kordofan State, Sudan

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ABSTRACT

This study was conducted in North Kordofan State, covering Sheikan, Um Rawaba and El Rahad localities during the period of 2022 - 2024. The main objective of this study was to find out the income generation activities (farm and non-farm) in traditional farming system in North Kordofan State. Primary data were collected using household questionnaire. 434 households were selected from twelve villages representing the study area. A sampling frame was developed from existing records at the Ministry of Production and Economic Resources and International Fund of Agricultural Development projects. A multi-stage cluster random sampling technique was used to select the targeted sample. Comparisons of means, analysis of variance and descriptive statistics were used in data analysis. Both EXCEL and SPSS analytical tools were used. The study results showed that farm income represents 64.5% from the total family income while off-farm income represents 35.5%, the income generated from crop production was the highest and represent 66%, 43% of the total farm income and total family income respectively. Food expenditure represents 66% while non-food expenses only 34% from total family expenditure. The average family income was higher than family expenses. Average income was equal to 2,618,301, whereas the mean expense was equal to SDG 1,915,926, giving a net positive income of SDG 702,375. The correlation coefficient (0.386**) indicates a moderate relationship between income and expenses, meaning that as income increases, expenses also tend to rise, but not at the same rate. The study concluded that small farmers in the study area depend largely on farm income particularly crop production. The study recommends that improved technologies and services should be available and accessible to producers in time and at affordable price.

Keywords: Smallholder farmers, Farm and non-farm income, North Kordofan State

1- INTRODUCTION

The agricultural sector is the most important economic sector in Sudan; it contributes about 43% of the country Gross Domestic Product (GDP). The sector provides employment for more than 70% of the population and provides inputs to many major manufacturing industries. Agriculture is the key sector for poverty reduction and food security, for fueling growth and replacing oil as the key engine of the economy. The Agriculture Revival Programme (ARP) aimed to increased agricultural exports and decreased reliance on oil exports through increased productivity, improved food security and agricultural incomes, reduced rural poverty and redressed regional imbalances.(ARP pepper, 2017)

The rain-fed farming system is an important agricultural subsector, typically divided into semi-mechanized farming, traditional crop production and livestock systems. Depending on rainfall, the rain-fed subsectors contributed three-quarters of foreign exchange earnings from agricultural exports (Seirab, 2005). Traditional rain-fed farming is practiced by family households with farms ranging from 2 to 50 hectares in size, farming for income and subsistence (FAO, 2021). Traditional rain-fed farming covers about 18 million feddans, growing about 95 percent of the country's millet, 38 percent of sorghum, 67 percent of groundnut and 38 percent of sesame. The subsector also grows gum Arabic, rosella and melon seeds for export. Semi-mechanized rain-fed farming is practiced by large farmers and companies with low rent leases granted by the federal government and produces 40 percent of the country's sorghum, 62 percent of sesame and 90 percent of sunflower and cotton grown in the country (IFAD, IAMDP, project design report, 2017).

In Sudan, poverty remains a rural phenomenon and closely associated with the livelihood systems of rain-fed agriculture. The Interim Poverty Reduction Strategy Paper revealed that 46.5% of Sudan population is found below the poverty line, with 26.5% of the urban and 66.5% of the rural (IPRSP, 2004). The last country poverty assessment revealed that 39% of the population found below the poverty line and it's around 37% on North Kordofan (Central Bureau of Statistics 2015).

During the last decades North Kordofan State has experienced huge variations in the environmental conditions- drought, desertification and instability of rainfall - are the major environmental troubles, these symptoms have a major influence and effect on the economic activities, crop production, poverty and food security. North Kordofan State faces a number of problems which are the result of combination constraints such as environmental, economic, resources, marketing, inputs and political factors.

In North Kordofan State, Sorghum and Millet are an important staple food crops while Sesame and Groundnut representing main cash crops. Since these crops have a great influence on farm economy it is important to increase and maintain high yields. In order to measure the impact of improved agriculture technologies on the rain-fed farmers economy it is essential to study the current farm economy situation and to see how do smallholder farmers in the study area generate their income in general including farm and non-farm income and compare it with household expenditure

2. STUDY AREA AND RESEARCH METHODOLOGY

2.1 Study area

The study area covers North Kordofan State, which includes: Sheikan, Um Rawaba and EIRahad localities. The area in general is subjected to further degradation due to hardship environmental condition, climatic instability, desert moving to the south, recurrent drought, cutting down of trees for various uses, over cultivation and over grazing. The area of North Kordofan is estimated to be 195,280 km² of which approximately 45 million feddans is suitable for agriculture and forestry activities. The main problems facing agriculture in state are the unfortunate climate and the low rainfalls. The soils in generally are sandy soil in the northern parts of the state interested with some clay soil and the valleys and oasis; the central parts of the state are clayed Pedi plains to clay plains. In the southern parts of it, soils are moderately fertile but are good for the majority of the dry lands' crops. The main crops grown in the state according to the availability of water are millet, sorghum, sesame, groundnuts, watermelons and Roselle. Sometimes field crops are mixed with some local variety of beans (MoP&ERs, 2024).

Awouda, E.M. (1996) reported that, the vegetation growth is affected by the amount of rainfall and the type of soil. In the northern parts of the State, where rainfall is relatively low, there are scattered shrubs and low grasses. In drier parts *Acaciatortilis*, *Lepladenia pyrotechnic*, *Moeura crassifolia*, *Acasia albida* and *Acasia senegal*. Towards its wetter edge area, *Combretum glutinosum*, *Guiera senegalens* alternate with *Acasia Senegal* were the main type of vegetation.

2.2 Research Methodology

2.2.1 Data sources

Both primary and secondary data will be used, primary data collected through designed household questionnaire to gain data regarding household income and expenditure, while secondary data depend on published & unpublished books, reports and articles from IFAD, FAO and other related institutions

websites. The study depends on database that collected by Seed Development Project (SDP) and Integrated Agricultural and Marketing Development Project (IAMDP) that funded by IFAD.

2.2.2 Sampling and Sample Frame

A sample frame will be developed from existing records and database at the Seed Development Project (SDP) and Integrated Agricultural and Marketing Development Project (IAMDP) that project co-financed by IFAD and Sudan government and used to accomplish random selection.

Multi-stage cluster random sample system will be used to identify the sites and respondents from the three determine localities of North Kordofan State. In the first stage was selected three localities out of eight (37.5%). Second stage 45% of targeted communities were selected randomly 12 communities out of 27, while 10% of the targeted beneficiaries were randomly selected as the third stage.

2.2.3 Sample size

434 households were selected randomly from 4340 households that equaled 10% from total population that served by Integrated Agricultural and Marketing Development Project (IAMDP) that funded by IFAD and government of Sudan and State Ministry of Production and Economic Resources in North Kordofan State as leads agency. The IAMDP targeted 27 communities from three targeted localities and 12 of them were selected from a total (45%), giving a total of 434 selected household for the study area and selected 8-12 households from each community, this due to homogeneity of household potentiality in the selected community.

Distribution of population and sample size

Locality	Population		Sample	
	Communities	Households	Communities	Households
Sheikan	9	1387	4	145
El Rahad	9	1230	4	114
Um Rawaba	9	1723	4	175
Total	27	4340	12	434

2.2.4 Analytical Frame of work

Comparisons of means, analysis of variance and descriptive statistics will be used to describe study area covered. Both EXCEL and SPSS analytical tools will be used in data analysis.

Regarding to main study objective that stated as “Find-out how smallholder farmers in North Kordofan State generate their income in general and compare it with household expenditure, some formulas will be stated to calculate total yearly household income and expenditure.

To calculate total household income (THHI) it is necessary to calculate farm income (FI) and non-farm income (NFI). The FI included income from crop (ICP), income from livestock selling (ILS), income from animal production (IAP) and income from forestry (IF). The non-farm income (NFI) source includes: local trading (ILD), employment (IE), gifts (IG), local labor (LL) and property renting.

Formula (1) $THI = FI + NFI$

Formula (2) $FI = IFC + ILS + IAP + IF$

Formula (3) $NFI = ILD + IE + LL + others$

In order to calculate the yearly total household income, the mean yearly total household income should be calculated by adding all observed values and divided by number of observations

Formula (4) Mean HHI

$$\bar{X} = \frac{\sum X_i}{n}$$

The main components of the total household expenditure (THHE) are basic expenses (BE) that include food items and watering and secondary expenses (SE) that include health, education and other expenses such as social events, shelters, clothes and others.

Formula (5) THHE= BE + SE

3. RESULTS AND DISCUSSION

3.1 Income Generation and General Expenditure

Assessment of household income generation and general expenditure **in order** find out how do smallholder farmers in North Kordofan State generate their income in general, including of both, farm and non-farm income, and compare it with household expenditure.

3.2 Sources of income in study area

The empirical data analysis provide insight into the revenue sources, income levels, and their geographic distribution across different localities in traditional rain fed area in North Kordofan State. Tables (1) and (2) illustrate total household income sources. Results explicates the diversification of sources that comprises of, the average income generated from crop production, which represented the highest one (1,118,766) and represent 43% of the total family income followed by income generated from local trading, which equal to 381,489 SDG that represent 14% while the lowest one is the income generated from forest production (63,824) represent 2%, others are in between which consist of Salary and remittances (321,428) which represent 12%, livestock selling (278,601) that recorded 11%, seasonal laboring (226,088) represent 9%, farm residual (157,116) represent 6% and the animal production (70.948 SDG) that scored 3% from the total family income.

The total family income consist of farm income and non-farm income components, the first one component includes income generating from crops selling, farm residual, livestock selling, animal production and forest production, while the non-farm income component includes income generated from local seasonal trading, local laboring and salary & remittances as sources of income. The empirical data analysis revealed that the farm income represent 64.5% from the total family income while non-farm income represent 35.5% as shown in Table (2). The study found that highest farm-income generated from crop selling which represent 66.2% of the total farm income, followed by livestock selling which contributes by 16.3%, Farm residual as farm income sources came in the third one which contribute by 9.3%, while the forest production represent the lowest farm income source (3.8%) while animal production contribute around 4.2% from the farm income.

The local trading generated the highest sources of non-farm income components that reached to 41.1%, employment salaries and remittances ranked the second as a source of non-farm income, and contribute approximately 34.6%, while the lowest one is seasonal laboring which represent 24.4% from the total non-farm income.

Farm incomes are much higher than non-farming incomes across all localities, with Sheikan reporting the highest farm income (2,381,314 SDG) and Um Rawaba the lowest (1,131,659SDG). Non-farm income is significantly lower than farm income in all localities, with Sheikan again having the highest value (1,073,947 SDG), followed by Um Rawaba (955,503 SDG) and El Rahad as least one (797,499 SDG). The average total income follows the same trend, with Sheikan having the highest income levels and Um Rawaba the lowest. This suggests that diversification into farm activities is a critical income strategy; especially in areas with lower agricultural productivity Table (3). The significant standard errors (SE±) confirm notable variations in income levels across localities, which may be influenced by factors such as land potentiality, market access and alternative employment opportunities. The significant level found in the comparison between the three localities covered by the study indicated that Sheikan was higher in their farm income (69%) compared to El Rahad and Um Rawaba (68% and 54% respectively). These findings could be attributed to alternative employment opportunities and seasonal migration in Um Rawaba locality rather than others. The ranking of higher income was also extended to the non-farm

incomes, Sheikan gave lowest (31%) compared to El Rahad (32%) and Um Rawaba (46%). Other farm income sources such as livestock, forest products and non-farm activities contribute but remain secondary to crop production. These results assure that crop production represent major sources of farm income within the study area

Non-farm income sources, including trade, local laboring, casual Labour and employment salaries and remittances play a crucial role in rural livelihoods, especially given the seasonality and climatic risks associated with agriculture. Diversification is essential: The reliance on non-farm activities highlights the need for rural economic policies that support small businesses, vocational training, and microfinance programs. Market access improvements: Poorer localities like Um Rawaba may benefit from enhanced road networks, storage facilities, and cooperative marketing strategies. Climate resilience: Given the risks of drought and desertification in North Kordofan, climate-smart agriculture (e.g., drought-resistant crops, soil conservation) should promote.

Empirical data revealed that crop production is the dominant income source, with a maximum value of 12,430,000 SDG and a high standard deviation, indicating significant variation among sources and farmers. Other farm income sources such as farm residuals, livestock, and forest production contribute to income but with much lower values. Notably, the average income from crop production (1,118,766 SDG) is much higher than that from livestock (278.6014 SDG) and other non-farm activities.

Table (1) Statistical limitation of the sources of revenues (SDG)

Source of revenue	Average	Percent	Std. Deviation
Crop production	1,118,766	43%	1,491.254
Farm residual	157,116	6%	178.9841
Livestock	278,601	11%	380.4936
Animal production	70,948	3%	182.4521
Forest production	63,825	2%	203.5278
Salary	321,428	12%	407.9369
Laboring	226,088	9%	310.8271
Merchant (trade)	381,489	14%	803.8761
Other source	0	0	0
Total revenue	2,618,261		

Sources: Survey data, 2023

Table (2) Sources of revenues (1000 SDG) and percent within categories

Category	Source of revenue	Revenue	Percent
Farm income (64.5%)	Crop production	1119	66.2
	Farm residual	157	9.3
	Livestock	279	16.5
	Animal production	71	4.2
	Forest production	64	3.8
	Total farm income	1690	100
	Non-farm income (35.5%)		

Salary and remittances	321	34.6
Laboring	226	24.3
Merchant (trade)	382	41.1
Other source	0	0
Total non-farm income	929	100

Total family income **2619**

Sources: Survey data, 2023

Table (3) Descriptive statistic of income from farm and non-farm source by localities

Income source	Sheikan		El Rahad		Um Rawaba	
	Income in SDG	%	Income in SDG	%	Income in SDG	%
Crop production	1,730,971	50	900,096	37	753,958	36
Farm residual	178,789	5	181,817	7	123,165	6
Livestock selling	229,965	7	432,719	18	218,502	10
Animal production	188,527	5	28,991	1	857	0
Forest production	53,062	2	121,491	5	35,177	2
Salaries& remittances	250,996	7	414,429	17	319,200	15
Seasonal laboring	256,358	7	158,070	6	245,314	12
From merchant	566,593	16	225,000	9	390,989	19
Farm income	2,381,314	69	1,665,114	68	1,131,659	54
Non-farm income	1,073,947	31	797,499	32	955,503	46
Family income	3,455,261	1.00	2,462,613	100	2,087,162	100

Sources: Survey data, 2023

3.2 Family Expenditure

The study divided the total family expenditures in the study area into two main components, the first one is food expenses (basic expenses) that include food items and water expenses, while the second component is the non-food items (secondary expenses), which consist of expenses that devoted to education, health, buildings & shelters, social affairs and others expenses.

Referring to the comparison showed in Table (4) between food and non-food expenses, the total family expenditure reached 1,915,027 SDG in average, of which food items expenses around (1,264,643 SDG) which represent 66% while non-food expenses only 34% of the total family expenditure, this could be attributed to the wide range of items for food items expenses.

The results show that 10% of total expenditure devoted to purchasing flour as a higher item followed by cost of water, meat and social expenses which represent 9% of the total expenditure for each one. Cost of sugar occupied the third ranking of total expenditure and represent 8%. The cost devoted to health care and shelter construction from non-food represents 7% of the total expenditure, the cost of bread of food items consumed the same percent. The lowest expenses found in devoted to cost of tea, coffee and spices. These results attributed to that the families depend on cereal crops (flour of sorghum, millet and wheat (bread) in addition to water expenses, these items consumed which represent 26% of the total expenditure

The household expenditures (food and non-food items) are substantial and vary significantly ($p=0.01$) across locations as shown in table (4) and (5). Although there are highly significant difference on the food and non-food items needs according to the geographical location

Table (4) Descriptive of food and non-food items expenses of the families in North Kordofan case study

Items	Cost in SDG			
	Minimum	Maximum	Mean	Percent
Food items expenses				
cost of water	0	1056000	168,253.73	9
cost of flour	24000	480000	185,746.77	10
cost of bread	0	365000	135,394.01	7
cost of onion	9600	240000	67,370.51	4
cost of oil	19200	336000	106,074.88	6
cost of meat	24000	864000	171,618.89	9
cost of dry okra	0	163200	48,306.45	3
cost of spices and salt	9600	144000	64,514.75	3
cost of sugar	43000	384000	157,122.58	8
cost of tea	9600	192000	36,001.84	2
cost of coffee	0	180000	53,723.04	3
cost of milk	0	336000	70,516.04	4
Total food items (basic)	139,000	4,740,200	1,264,643.49	66
Non-food expenses				
educational expenses	0	550000	108,332.26	6
health expenses	0	524000	141,923.50	7
building expenses	0	750000	129,244.24	7
social expenses	0	2400000	173,960.83	9
other expenses	0	270000	97,822.58	5
Total non-food items	0	4,494,000	651,283.41	34
Total expenditure			1,915,925.90	100

Sources: Survey data, 2023

Table (5) Expenditure of respondents according to their geographical distribution or locality base

Variable	Expenditures		
	Food items expenses	Non-food items expenses	Total expenses
Location			
Sheikan	1,232,622 (64%)	707,935 (36%)	1,940,557
El Rahad	1,185,713 (68%)	578,782 (32%)	1,746,495
Um Rawaba	1,342,593 (67%)	651,573 (33%)	1,994,166
Mean	1,153,642	646,096	1,893,739
SE±	1,353.04**	2,248.39 ns	1,474.77**

Sources: Survey data, 2023

Table (6) Comparing expenses against revenue in rural community of North Kordofan (1000 SDG)

Variable under estimation /1000	Mean	SE±
Revenue	2,619	1.472
Expenses	1,915	11.581
SE±		6.526**
Difference	+ 704	
Correlation value	0.386**	

Sources: Survey data, 2023

3.3 Comparison between revenue and expenditure

The all sources of income started from zero, whereas the range is ranging from (980,000 – 12,430,000). Table (6) stated that average income is equal to 2,618,301, whereas the mean expense is equal to 1,915,926 SDG, suggesting a net positive income. The correlation coefficient (0.386**) indicates a moderate relationship between income and expenses, meaning that as income increases, expenses also tend to rise, but not at the same rate. The significant difference between income and expenses suggests that rural households, on average, generate a profit, though variations exist. The economic vulnerability of smallholder farmers is evident from the disparity between mean household expenditures for basic needs and income, which are insufficient to cover costs. This aligns with findings that rural poverty is exacerbated by dependence on rain-fed agriculture, as 66.5% of rural populations in Sudan live below the poverty line. A highly significant differences was detected ($p=0.01$) between them. The income gives 704 SDG more than expenses; this fact is due to the wide range and high diversity of incomes in rural area compared to small needs which might be the basic. It was seen in the village and communities near to the town were higher in their cost of live. Most of the above mentioned results illustrate that smallholder farmers in North Kordofan State depend largely on generate their income from farm income sources that represent 65% out of total family income in general, selling crop production is the most sources of income from farm income. Eldukheri, 1997 and Alemu, 2015 found the similar statement.

In comparing family income with family expenditure, the study revealed the different between them is positive which assured profitability of traditional rain fed farming system in North Kordofan

4. CONCLUSION AND RECOMMENDATIONS

The study conclude that smallholder farmers in traditional farming system in North Kordofan State depend largely on generate their income from farm income sources that represent 65% out of total family income in general, selling crop production is the most sources of income from farm income. Off-farm income represent 35%, local trade is the highest one rather than other off farm income.

Food items expenses represent 66% while non-food expenses only 34% of the total family expenditure. The study found that higher expenses devoted to purchasing flours followed by cost of water, meat and social expenses. Cost of sugar occupied the third ranking, health care and shelter construction and cost of bread of food items consumed the same percent. The lowest expenses devoted to cost of tea, coffee and spices. These results attributed to that the families depend on cereal crops (flour of sorghum and millet and bread (from wheat) in addition to water expenses, these items consumed which represent 26% of the total expenditure.

In comparing family income with household expenditure, the study revealed the different between them is positive which assured profitability of traditional rain fed farming system in North Kordofan.

The study designed the following recommendations

- Credit facilities should be made available and accessible to farmers and their cooperatives in the study area in order to promote their production and income generated from their farms, through improved technologies usage
- Recommended improved technologies and services should be made readily available and accessible to producers in time and at affordable price.
- Agricultural policies need to be directed toward supporting production system and governed institutional set up (institutional relationship between research centers and extension authority)
- Adopting solar-powered pumping systems as strategic mechanism to reduce water related expenditures, which account for 26% of total expenses in the study areas.

REFERENCES

- Abdelatif AM Ijaimi, (2021): Analysis of Historical Price Trends of Key Cash and Staple Crops in Sudan. Provided for Integrated Agricultural and Marketing Development Project (IAMDP), Elobied, North Kordofan State, Sudan
- Adofu, et al (2012): The economic Impact of Improved Agricultural Technology on CASSAVA Productivity in Kogi State of Nigeria, *International Journal of Food and Agricultural Economics* ISSN 2147-8988 Vol. 1 No.1 pp. 63-74
- ARP, (2017): Agricultural Revolution pepper, Federal Ministry of Agriculture in collaboration with Ministry of Finance and National Economic after South Sudan secession, Khartoum, Sudan
- ARC, (2005): Agricultural Research Corporation, Elobied research station report regarding crop productivities in North Kordofan comparing to national and international productivities of main crops, Elobied. North Kordofan State, Sudan.
- Awouda, El Hag Mekki. (1996): Potential Volume of Timber Resources in Sudan and Mode of Exploitation, First National Economic Conference, Khartoum, Sudan.
- Central Bureau of Statistics – CBS - (2008): Sudan Central Bureau of Statistics. Fifth population and housing report. Khartoum, Sudan
- Elamin, E. Samar, M. A. (2015): Farming systems and food security in western Sudan: Are the things improving. Agricultural Research Corporation (ARC), Agricultural Economics and policy Research Center (AEPRC), Khartoum, Sudan P2.
- Eldukheri, I. A. A, Mekki, M. A, and El Agab, S. E (2001): North Kordofan Rural Development Project, of International Fund for Agricultural Development, Baseline Report. El Obeid, Sudan.
- FAO,(2025): Special Report – 2024 FAO Annual Crop and Food Supply Assessment Mission (ACFSAM) to the Sudan. March 2025. Rome
- IPRSP (2004): The Interim Poverty Reduction Strategy Paper, prepared by national experts from National Economics Sector, presented in country strategic workshop, Khartoum, Sudan

- IFAD, (2021): Republic of Sudan Country Strategic Opportunities Programme 2021-2027 Executive Board — 132nd Session Rome, 19-21 April 2021, EB 2021/132/R.21 Rome.
- IFAD, (2017): Integrated Agricultural and Marketing Development Project (IAMDP) Final project design report Main report and appendices, Near East, North Africa and Europe Division Programme Management Department, Rome
- International Monetary Fund (IMF) 2021: the final reports of IMF for 2018, 2019 and 2020 season,
- Maruod E. Maruod (2022): Groundnut Shelling Machine and unrefined oil/ seed cake Study, Integrated Agricultural and Marketing Development Project (IAMDP), Elobied, Sudan
- Ministry of Production and Economics Resources (2025): Annual post harvest assessment reports for 2022, 2023, 2024 and 2025 seasons. Department of Planning and Policy of North Kordofan State, El Obeid, Sudan
- Ministry of Production and Economics Resources (2024): Document of Agricultural Strategy and Natural Resource base Policies. Department of Planning and Policy of North Kordofan State, El Obeid, Sudan
- Ministry of Finance, Department of Planning and Economy (1985): The Strategy of Kordofan Regional Government to Combat Desertification and alleviate the Effects of drought, Kordofan Region, El Obeid, Sudan.
- Norman, D.W. (2002). The Farming Systems approach: A historical Perspective. <http://www.fao.org/docrep/V5330E/V5330E00.htm>
- Osman, E.I., Ibrahim, N.E. (1998): Performance of improved sorghum genotypes under irrigated and rain-fed situations of the Sudan. *Sudan Journal of Agricultural Research* 1:1-7
- Oweis, T., D. Prinz, A. Hachum (2001): Water Harvesting: Indigenous Knowledge for the Future of the Drier Environments, ICARDA, Aleppo, Syria.
- Practical Action (2010): Water Harvesting in SUDAN. Company Reg. No. 871954, England | Reg. Charity No.247257 | VAT No. 880 9924 76 | Patron HRH The Prince of Wales, KG, KT, GCB
- Salih A. A. M (2008): Use of Controlled Spate Irrigation for the Improvement of Sorghum Growth and Productivity in North Darfur State. PhD thesis, University of Khartoum, Sudan
- Save The Children Federation/US, (1988): Baseline Report, Um Ruwaba localities, North Kordofan State, Sudan Field Office. Sudan.
- Seaman, J, Clarke, P, Boudreau, T and Holt, J (2000): The Household Economy Approach, Save the Children, 17 Grove Lane, London, SE5 8RD, UK.
- Serab, Mohamed Osman (2005): Review Some Issues Related to Agriculture in Sudan, Amira for Press and Dissemination Khartoum Bahary, Sudan (text in Arabic)
- Smale, M., Cohen, J., Nagarajan, L., (2009): Local markets, local varieties – rising food prices and small farmers’ access to seed, IFPRI Issue Brief 59
- Shawgi Ali et al (2012): Policy strategies interventions and the way forward for sesame crop: A case study of Kordofan region, Sudan, Third RUFORUM Biennial Meeting 24 - 28 September 2012, Entebbe, Uganda
- UN, (2023): United Nations in Sudan Annual Report, 2023. Chapter 1: Key Developments in the Country and Regional Context. Outcome, 2.1: livelihoods and local economic recovery. Pp 16-18, Rome