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Land access, livelihoods, and dietary diversity in a fragile setting in northern Uganda

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Food systems in fragile contexts are hardly investigated. We examined the crop value chain activities, agriculture income, coping strategy, and food consumption score (FCS) among South Sudan refugees (n=394; refugee HH) and Uganda host communities (n=420; host HH) living on the northern border of Uganda. Secondary data analysis was conducted using baseline data collected from an NGO-supported project. Linear regression analysis was conducted to test the association between the type of crop for growing and selling, agriculture income, coping strategy, and FCS in the refugee HH and host HH, separately. The mean number of growing and selling crops was 2.7 (SD 1.7) and 0.6 (1.0) in the refugee HH and 3.6 (1.4) and 1.3 (1.1) in the host HH. Overall food insecurity and FCS was poor in both refugee and host HH. Larger land access was associated with diverse crop production and crop selling in both groups (p<0.05). The greater number of crop types grown was marginally associated with FCS in host HH only (β=1.00; p=0.05). Selling more types of crops was associated with agriculture income in both groups (p<0.05) and was not related to rCSI in either group, but marginally associated with FCS among only host HH (β=0.84; p=0.04). An inequitable food system existed between the host community and South Sudan refugees residing on the northern border of Uganda. The findings suggest that diversifying crops for selling and enhancing marketing channels could aid both host and refugee communities in establishing resilient food systems.

KEYWORDS

food system, refugee, food security, crop diversity, Uganda, climate change, resilience, disaster

Introduction

Food systems are the combination of all activities that involve the production, processing, distribution, consumption, and disposal of food and products along the food value chain (Pingali and Sunder, 2017). Food security, climate-smart agriculture, and food system resilience are inextricably connected and need to be viewed holistically to account for social cohesion and economic opportunity. Food system research has predominantly centered on the Global North with an increasing focus on shifting from industrial agriculture toward more climate-smart agroecological practices.

Sub-Saharan Africa faces an increasing number of shocks due to climatic events and agricultural risks, leading to worsening food scarcity and malnutrition (World Bank, 2021). The proportion of the population in Sub-Saharan Africa suffering from acute malnutrition increased

by nearly 30 percent in 2022 (123 million), now affecting nearly 12% of the region's total population (WFP, 2022). While immediate assistance to the continent has been provided through in-kind food aid or cash voucher programs, repeated droughts, rising food prices and lack of social assistance leave the population increasingly vulnerable (Baptista et al., 2022). Poor agricultural practices such as deforestation, soil erosion, and residue burning exacerbate climate change impacts. Supply chain and regional trade infrastructure is lacking throughout the continent, disrupting the flow of food and basic goods and further complicating issues of access and (Baptista et al., 2022). There is a growing need for more research into the scope and vulnerability of food systems in low-and middle-income countries (LMICs) about the inequitable access to food, resources, and agricultural inputs. Investigations have to be made to build resilient, risk-informed, and shock-responsive food systems to ensure food security ahead of potential food crises (Tendall et al., 2015; Pingali and Sunder, 2017).

About 12% of Ugandans are chronically food insecure (FAO, WFP, and IFAD, 2019). Almost 70% of households in Uganda are engaged in subsistence farming. As such, land access is seen as a significant determinant of food security. National policies prioritize economic growth through privatization and consolidation of land, which has caused the deepening of socioeconomic inequities (Oxfam International, 2022). Issues of illegal land grabbing by large institutions are pervasive in Uganda, with few government protections for individual citizens (Muhumuza and Akumu, 2019). Uganda has various systems of land tenure, with many engaging in informal tenure systems that need formal documentation of land ownership, which can lead to insecurity in land ownership. Furthermore, available land is becoming scarcer, with significant proportions of Ugandans renting their land (FAO, 2018a; NRC, REACHI, and UNHCR, 2019). The availability or size of land ownership is positively associated with increased food security (Apanovich and Mazur, 2018; Semazzi and Kakungulu, 2020). Although agriculture is Uganda's largest source of employment, the food system in Uganda is increasingly vulnerable to drought, decreased soil quality, and price fluctuations.

Uganda is the third most refugee-hosting country globally (Oxfam International, 2022) and is home to 1.4 million refugees. By the end of 2021, there were 950,000 South Sudanese refugees registered in the country. South Sudan was established as an independent nation in 2011 from Sudan, however, only 2 years later, in 2013, armed conflict broke out, followed by a 5-year civil war (Human Rights Watch, 2021). Since this conflict erupted, almost 2.3 million South Sudanese have fled to neighboring countries (USA for UNHCR, 2019).

Most of these South Sudan refugees have lived on the Northern border of Uganda. Uganda government's progressive policies toward refugees aim to enhance the livelihoods and increase food security of the refugee population at least up to the level of nationals (Bashaasha et al., 2021). The refugee policy seeks a long-term development approach that promotes self-reliance, local integration and economic development of the refugees and their host communities, moving away from short-term camp-based humanitarian interventions.

In Uganda, as refugees are allocated scant areas of land for food production and income generation, poor soil quality and quantity, affect food availability, nutrient density, and therefore, crop production, sales, and food consumption (Integrated Food Security Phase Classification (IPC), 2022). As refugees are not often given legal ownership of land, practices to preserve the quality of the soil over time are not feasible or within their control.

Although the relations between refugees and their respective host communities have been largely positive, the proximity of living has occasionally led to tension over natural resources, livelihoods, and land occupation which may lead to rising tensions, perceived discrimination about other resources, and violent conflicts (IRRI, 2019; Okiror, 2020; Rustad et al., 2021).

Uganda Boosting Economic-Socio Resilience Using Triple Nexus (called BEST; 2021–2024) was planned by World Vision Uganda and World Vision Korea, funded by Korea International Cooperation Agency (KOICA). The BEST project has been implemented in Terego District Project on the Northern border of Uganda targeting 8,400 refugee populations living in Imvepi Settlement and 3,600 host populations within Odupi sub-county (Figure 1). The BEST project attempted to enhance socio-economic resilience for refugees and host communities through some initiatives: (1) cash transfers to vulnerable households to stimulate the market linkages and address their immediate needs, (2) climate-smart agriculture training and materials, (3) facilitation of increased farmland access for refugees, (4) connections to financial institutions and providing financial literacy programs, and (5) building community-based structures to promote social cohesion.

Based on the data collected from the BEST project, this study explores the food environment-related components shaped differently between South Sudan refugees and host communities in Northern Uganda. Specifically, it is hypothesized that land ownership for farming, crop production and selling, agriculture-related income, use of coping mechanisms, and food consumption would differ between these two groups (Figure 2). This study will be an exemplary research that glimpses into the conditions of other refugees in the context of development approach and has policy and programming implications for sustainable refugee interventions.

Methods

Data source

The baseline survey of the BEST project was designed cross-sectionally, and the data were collected from 16th to 28th August, 2021. The survey respondents were an adult among households of South Sudan refugees in Zone I, II, III and IV, Imvepi Settlement and host community households within Lugbari, Imvepi, Orivu, Okavu, Otumbari and Ombokoro Parishes, Odupi Sub-county.

The sample size was determined by parameters with a confidence level of 95% and a confidence limit of 5%. The hypothesized proportion of outcome in the population was 0.5 with a design effect of 1. The sample size calculated from the formula above is a total of 762 individuals (380 host households and 382 South Sudan refugee households [hereafter; refugee HH]). For each of these groups, a total of 384 were determined to be the target sample.

Random samples from each location were based on the distribution of beneficiary populations in the settlement and host communities ensuring all villages were included. A sample comprised 70% refugee households and 30% host community households. A multistage random sampling technique was applied, and the data collection was completed among 817 respondents (397 refugee households and 420 host community households).

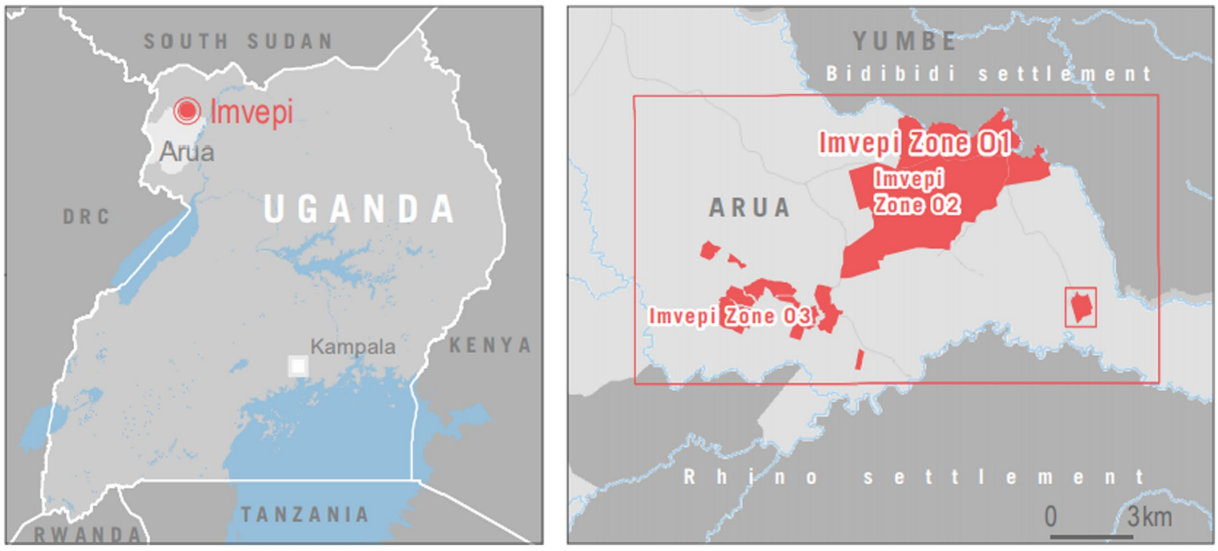

FIGURE 1
Study area. Administrative boundaries: UBOS; Natural features: © OpenStreetMap Contributors, UNHCR; Roads: © OpenStreetMap Contributors; UNHCR; Settlement boundaries and infrastructures: © OpenStreetMap Contributors, REACH Initiative, UNHCR; Coordinate System: WGS 1984 UTM Zone 36N.

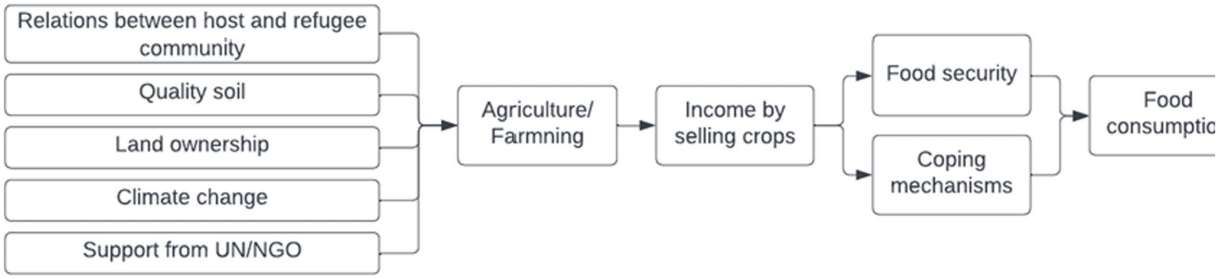

FIGURE 2
Conceptual framework of food system in South Sudan Refugee and Uganda host community, Northern Uganda*. *Author's Own Conceptualization.

A household questionnaire was prepared to collect information on the perceptions and attitudes of refugee and host communities on household production and livelihood activities, food security, food consumption, key conflict triggers, community management of conflicts, community resilience to climate change and specific actions for improving effective project implementation. Data were collected electronically via smartphones using KOBO tool, a mobile survey application.[1] The enumerators were trained and pre-tested to minimize inconsistencies in understanding the assessment methodology and were given ongoing support by the supervisors during fieldwork. Team leaders and the coordinators supervised and reviewed the data collected by enumerators for quality checks daily prior to submission to the server. Quality checks included a review of open-ended responses, analysis of outliers and extreme values, and checks of missing or incomplete data.

1 https://www.kobotoolbox.org/

Study variables

Agriculture-related practices were sources of the main livelihood, access to land for farming, and land ownership. Main livelihood sources included crop farming, casual labor, in-kind support from NGOs and government, petty trade/salaried employment, and others. Land size for farming had five options: 30×30 m, 50×50 m, 100×100 m, 1–2 acres, and ≥ 3 acres. Land ownership was categorized into three groups: allocated in the settlement, personal land, and rented/communal/others.

Crop diversity is defined as the total number of crop the survey participants grew or sold in the last year. The respondents were requested to list all types of crops they grew and sold in the last year. Each crop was summed to count all types of crops grown and sold. The respondents recalled all types of crops that they produced and sold using an open-ended question and we identified 20 types of crops: beans, cabbage, cassava, cowpeas, dodo, eggplant, groundnut, maize, millet, okra, onion, potatoes, pumpkin, rice,

sorghum, *simsim*, *sukuma*, sweet potatoes, tomatoes, and vegetables (in alphabetical order).

Agriculture income in the last season (Uganda shilling) was defined as income earned or revenue generated from sources essentially premised on agricultural activities in the last season.

Reduced coping strategy Index (rCSI) is a proxy indicator of using coping mechanisms (Maxwell and Caldwell, 2008). The current index was calculated using a list of five diet-related coping strategy mechanisms to measure food insecurity across the categories of dietary change, increase short-term household food availability, decrease numbers of people and rationing. The questions included as follows: (1) consumed less preferred foods, (2) borrowed money to buy foods, (3) decreased food quality during meals, (4) reduced food quantity during meals, and (5) reduced the number of daily meals. The respondents replied how often the coping strategy was used per week with five options: (1) almost every day, (2) pretty often (4 times a week), (3) once in a while (3 times a week), (4) once in a week, and (5) never. The response was scored 0–4 points according to the frequency of the item. The score of "borrowed money to buy foods" was weighted two times and "decrease food quality during meals" was weighted three times. The response was summed to structure an rCSI (range: 0–35) with a higher value indicating a worse household situation.

The food Consumption Score (FCS) reflected households' dietary diversity and nutrient intake. FCS was calculated from 8 food groups consumed during a 7-day reference. The eight food groups included grains, vegetables, fruits, flesh foods, pulses, dairy foods, fat, and sugary foods. The respondents were asked how many days in the past week they consumed the food groups. In addition to the frequency of consumption of each food, grain groups were weighted 2 times, flesh foods 4 times, legumes 3 times, dairy foods 4 times, fatty foods 0.5 times, and sugary foods 0.5 times. Each person had a range of 0–100 score and the FCS was categorized into the following thresholds: 0–21 for poor; 21.5–35 for borderline; >35: for acceptable (INDDEX Project, 2018).

The respondents were asked about agriculture-related challenges they faced. We identified a key word of the statement by reading the statements repeatedly by two researchers (i.e., crop damage by wild animals, climate change, poor soil quality).

Demographic characteristics included the respondent's age, education level, and marital status (married, widowed, separated, single).

Statistical analysis

The final analytic samples are 814 households. Exploratory data analysis was conducted to calculate the mean (SD) for continuous variables and the proportions for categorical variables. Demographic characteristics such as respondent's gender, age, highest education, marital status, and response by household head were compared between refugee HH and host HH using a chi-squared test. Access to agricultural land, land ownership, and land allocation were compared between refugee HH and host HH using a chi-squared test. Crop diversity, food consumption score, reduced coping strategy index, and agriculture income were compared between refugee HH and host HH using Student-*t* test.

Linear regression was conducted to the association between land size and crop diversity (i.e., the number of crop types grown, and the number of crop types sold) and the association between crop diversity and agricultural income in the last year, rCSI, and FCS among host HH and refugee HH, separately, adjusting for demographic characteristics such as respondent's age, marital status, respondent's education, a response by household head. The data analysis was analyzed using STATA 17.0.

Ethical approval

This study was deemed to have an exemption of ethical review from the Johns Hopkins School of Public Health as a secondary data analysis.

Results

Out of 814 survey respondents, 394 were refugee HH and 420 were host HH. 71% were in the ages of 18–44 years, with 55% of refugees and 37% of host respondents aged between 18 and 34 years. A majority (84%) of the survey respondents achieved at least primary education, with 20% of refugee HH heads and 16% of host HH heads attaining a maximum of secondary education. Almost one-third of refugee HH heads (30.3%) were either separated, single or widowed (Table 1).

A total of 39.3% of refugee HH and 79.3% of host HH depended on crop farming for their livelihood ($p < 0.001$). While 12.4% of refugee HH were engaged in casual labor, and 16.8% in petty trade/salaried employment, 24.4% were dependent on in-kind support from NGOs and the government for their livelihoods. A majority of respondents had access to agricultural land (87.1% of refugee HH and 99.8% of host HH; $p < 0.001$). However, 89.3% of host HH owned personal land and 10.7% rented communally owned land while refugee HH primarily depended on allocated (46.9%) and renting communal land (40.8%) with only 12.2% owning personal land ($p < 0.001$). Of those who had access to agricultural land, the majority of host HH accessed ≥3 acres (44.2%), at least 1–2 acres (35.9%) and less than 10% had an access plot size less than 100×100 m^2. Of refugee HH, only about 0.8% had access to ≥3 acres of land, while 45.8% had access to less than 30×30 m^2 land ($p < 0.001$; Table 2).

On average the refugee HH grew 2.7 (SD: 1.7) types of crops, whereas the host HH grew significantly more types of crops (Mean: 3.6, SD:1.4) ($p < 0.001$). The refugee HH sold around 0.6 (SD: 1.0) types of crops while the host community sold more (Mean:1.3, SD:1.1; $p < 0.001$; Table 3). The host HH produced two to four dominant staple crops such as maize, cassava, sorghum, beans, and *simsim* (Figure 3) while the refugee HH mainly produced sorghum, maize, *simsim,* and a variety of vegetables.

Of those engaged in agriculture/crop farming, the challenges concerning crop production varied between host HH and refugee HH. For the refugee HH, major challenges were related to inadequate land for agriculture (27.3%), animals destroying crops (15.8%), poor soils (16%), and lack of farm inputs, labor, and market – accounting for 7%. For the host HH, the major challenges included climate change (24.3%), pests and diseases (11.7%), and poor soils (11.9%; Supplementary Table 1).

In the refugee HH, the average agricultural income in the past season was 34,361 Uganda Shilling (UGX, SD: 78101), which was almost three times more in the host community at 159,794 UGX (SD:

TABLE 1 Demographic characteristics of the respondents.

	South Sudanese (*n*=394)		Uganda host community (*n*=420)		Total (*n*=814)		*p*-value
	n	%	*n*	%	*n*	%	
Respondent's sex							
Male	124	31.6	189	45.0	313	38.5	<0.001[§]
Female	269	68.4	231	55.0	500	61.5	
Respondent's age							
18–24 years old	92	23.4	50	11.9	142	17.5	<0.001[§]
25–34 years	126	32.0	107	25.5	233	28.6	
35–44 years	94	23.9	110	26.2	204	25.1	
45–59 years	51	12.9	95	22.6	146	17.9	
60 years and above	31	7.9	58	13.8	89	10.9	
Respondent's education level							
None	71	18.0	60	14.3	131	16.1	0.001[‡]
Primary	238	60.4	263	62.6	501	61.5	
Secondary	80	20.3	69	16.4	149	18.3	
Tertiary	3	0.8	23	5.5	26	3.2	
University	2	0.5	5	1.2	7	0.9	
Respondent's marital status							
Single	45	11.5	26	6.2	71	8.7	0.004[‡]
Married	272	69.2	321	76.4	593	72.9	
Divorced	2	0.5	7	1.7	9	1.1	
Separated	32	8.1	18	4.3	50	6.2	
Widowed	42	10.7	48	11.4	90	11.1	
Total	393	100.0	420	100.0	813	100.0	
Is Respondent a HH[1] head							
No	96	24.4	128	30.5	224	27.5	0.051
Yes	298	75.6	292	69.5	590	72.5	

HH[1] = Household.
[§]$p < 0.001$; [‡]$p < 0.005$.

29956; Table 3). The mean rCSI score of the refugee HH was higher at 14.7 (SD: 4.8) while that of the host HH was 11.8 (SD: 6.3) (tested by *t*-test; $p < 0.001$). The host HH showed a better dietary diversity (mean FCS: 43.4, SD:10.9) when compared to refugee HH (40.0, SD: 10.1; $p < 0.001$; Table 3). The host HH showed healthy and diverse food consumption in dairy products (16% vs 2%), fruits (55% vs. 23%), and meat products (63% vs. 50%) than refugee HH (all $p < 0.05$; Supplementary File 2).

Households owning/receiving larger land were likely to produce more diverse crops and sell diverse crops, in both refugee and host HH. More crop types grown were not associated with agriculture income or rCSI in the refugee HH and host HH ($p > 0.05$). A marginal association was found between the number of crop types grown and FCS in the host HH ($\beta = 1.00$; $p = 0.05$). A greater number of crop types sold were associated with agriculture income in both groups, were not associated with the use of coping strategy mechanisms in either of the two groups and were marginally associated with FCS among host HH only ($\beta = 0.84$; $p = 0.04$; Table 4).

Discussion

This study has revealed the existence of an inequitable food system between the host community and South Sudan refugees residing on the northern border of Uganda. The refugees had relatively smaller land for farming, inhibiting farming practice improvement. Compared to the host communities, the refugee households had significantly lower growing crop diversity and agricultural earnings. More frequent use of coping mechanisms and a higher rate of poor food consumption was found in the refugee HH than in the host HH. The difference in farming land size determined crop diversity in these groups. Growing crop diversity was associated with FCS only in the host HH. On the other hand, neither of the two groups showed any association between growing crop diversity and rCSI. Selling more diversified crops was associated with higher agriculture income in both groups and was marginally associated with FCS among host HH. Neither of the groups showed an association with the use of coping mechanisms.

TABLE 2 Main Livelihoods, access to agricultural land, and land ownership.

	South Sudanese (*n*=394)		Uganda host community (*n*=420)		Total (*n*=814)		*p*-value
	n	%	*n*	%	*n*	%	
Main livelihood source							
Crop farming	155	39.3	333	79.3	488	60.0	<0.001[$]
Casual laborer	49	12.4	36	8.6	85	10.4	
In-kind support from NGOs and government	96	24.4	0	0.0	96	11.8	
Petty trade/Salaried employment	66	16.8	45	10.7	111	13.6	
None/others	28	7.1	6	1.4	34	4.2	
Access to agricultural land[1]	343	87.1	419	99.8	762	93.6	<0.001[$]
Having landownership	*n* = 343		*n* = 419				
Allocated in settlement[2]	161	46.9	0	0.0	161	21.1	<0.001[$]
Personal land[3]	42	12.2	374	89.3	416	54.6	
Rented/communal/others[4]	140	40.8	45	10.7	45	10.7	
Land size for farming							
30 by 30 m	157	45.8	12	2.9	169	22.4	<0.001[$]
50 by 50 m	88	25.7	21	5.1	109	14.4	
100 by 100 m	44	12.8	49	11.9	93	12.3	
1–2 acres	51	14.9	148	35.9	199	26.4	
≥3 acres	3	0.8	182	44.2	185	24.5	

[1]Household having access to land for agricultural purposes.
[2]Land parcel is allocated to the household by (primarily to refugees).
[3]Land bought and owned by the respondent's household.
[4]Rented from communally owned parcels of land.
[5]Respondent's household participation in any agricultural activity.
[$]$p < 0.001$.

TABLE 3 crop diversity, food consumption score, reduced coping strategy index, and agriculture income.

		South Sudanese (*n*=394)		Uganda host community (*n*=420)	*p*-value
	n	Mean (SD)	*n*	Mean (SD)	*p*-value[1]
Crop diversity					
Number of growing crop	394	2.7 (1.7) (Median: 3; range:0–9)	420	3.6 (1.4) (Median: 4; range: 0–8)	<0.001[$]
Number of selling crop	394	0.6 (1.0) (Median: 0; range:0–7)	420	1.3 (1.1) (Median: 1; range: 0–6)	<0.001[$]
Food consumption score (FCS)	394	40.0 (10.1)	420	43.4 (10.9)	<0.001[$]
rCSI[1]	393	14.7 (4.8)	401	11.8 (6.3)	<0.001[$]
Agricultural income in the last season	292	34,361 (78101) (Median: 0; range: 0, 32,500)	373	159,794 (29956) (Median: 80,000; range: 9,000, 200,000)	<0.001[$]

[1]Reduced Coping Strategy Index (RCSI) was calculated from a list of five food-related coping strategies and a higher value of rCSI indicates worse the situation of a household.
[$]$p < 0.001$.

Access to land for farming and soil quality

Access to more farming land has been shown to improve dietary diversity, food security, and caloric intake (FAO, 2018a). A majority of the surveyed refugee HH (87%) reported having access to farming land, but only 12% of them owned personal land. This indicated a limited available farming area to the refugee HH compared to the host HH. This observation is consistent with previous studies on refugees in Uganda, which showed that the primary source of land access is through government allocation, and typically smaller plots of land were provided to refugees than the host communities (FAO, 2018a; NRC, REACHI, and UNHCR, 2019). Due to the large number of refugees in Uganda, the allocated land is often insufficient in both quantity and quality for some new arrivals. The newly entering refugees tend to only receive land for residential purposes (Betts et al., 2019; Bohnet and

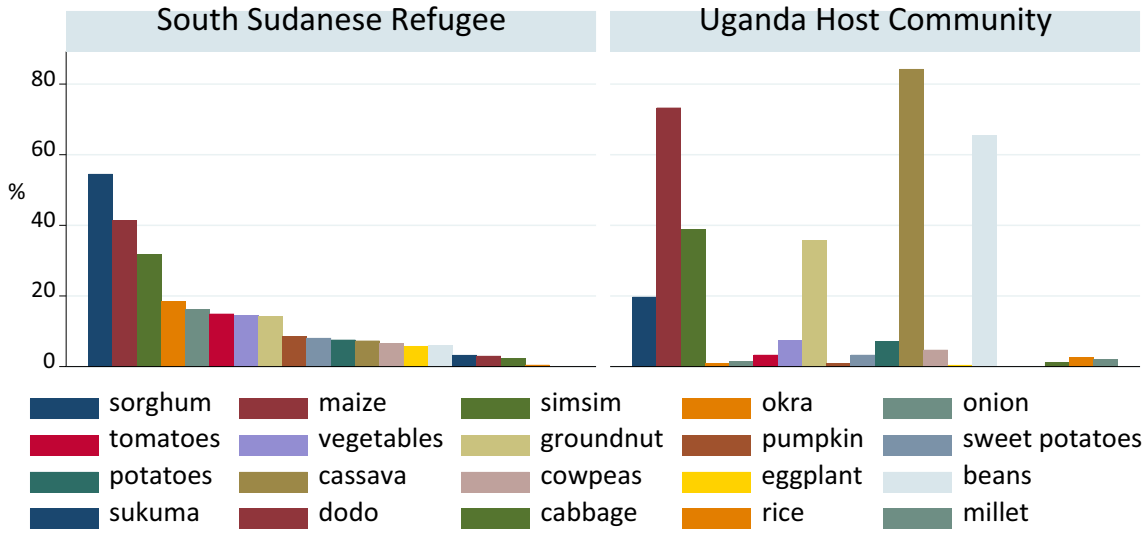

FIGURE 3
Type of crop production between South Sudan refugee and Uganda host communities, in Northern Uganda.

TABLE 4 Association between crop diversity and food consumption score (FCS), reduced Coping Strategy Index (rCSI), and agricultural income in the last season.

	South Sudan refugee (*n*=394)		Uganda host community (*n*=420)	
	Adjusted β (95%CI)[1]	*p*-value	Adjusted β (95%CI)[1]	*p*-value
A. Association between land size and crop diversity				
Diversity of growing crop	*n* = 342		*n* = 412	
30 by 30 m	(REF)		–	
50 by 50 m	0.76 (0.37, 1.15)	<0.001	(REF)	
100 by 100 m	0.42 (−0.07, 0.92)	0.10	0.50 (−0.08, 1.07)	0.09
1–2 acres	0.81 (0.34, 1.29)	0.001	0.61 (0.11, 1.10)	0.02*
> = 3 acres	–	–	0.86 (0.37, 1.35)	0.001‡
Diversity of selling crop				
30 by 30 m	(REF)		–	
50 by 50 m	0.43 (1.5, 0.71)	0.003	(REF)	
100 by 100 m	0.32 (−0.04, 0.68)	0.082	0.11 (−0.34, 0.56)	0.64
1–2 acres	0.64 (0.30, 0.98)	<0.001	0.50 (0.11, 0.89)	0.01*
> = 3 acres	–		0.69 (0.31, 1.07)	<0.001§
B. Association between crop diversity and agricultural income, coping mechanism use, and food consumption score (FCS)				
Agricultural income in the last season	*n* = 291		*n* = 372	
Diversity of growing crop	5,650 (−486, 11,786)	0.071	12,761 (−12,028, 37,552)	0.31
Diversity of selling crop	29,820 (22,460, 37,181)	<0.001	89,905 (61,994, 117,814)	<0.001§
rCSI	*n* = 394		*n* = 420	
Diversity of growing crop	−0.04 (−0.33, 0.24)	0.76	−0.27 (−0.73, 0.20)	0.27
Diversity of selling crop	0.05 (−0.43, 0.53)	0.84	−0.06 (−0.66, 0.55)	0.86
FCS	*n* = 394		*n* = 420	
Diversity of growing crop	0.38 (−0.20, 0.96)	0.20	0.84 (0.04, 1.64)	**0.04***
Diversity of selling crop	0.44 (−0.54, 1.42)	0.38	1.00 (−0.01, 2.01)	0.05

[1]Adjusted for respondent's age, marital status, respondent's education, response by household head, category of household head (father, mother, others).
*$p < 0.05$; †$p < 0.01$; ‡$p < 0.005$; §$p < 0.001$.

Schmitz-Pranghe, 2019). The refugee populations also face additional challenges, such as inadequate access to land, crop destruction by wild animals, poor soil quality, and lack of farm inputs, which result in limited crop diversity. With relatively large and high-quality land for farming, the host communities reported different types of challenges with climate change, reduced rainfall, and issues such as pests, disease, and poor soil quality (FAO, 2018b).

A few previous studies reported that crop diversity (production and selling) could be determined by land size, market prices, and access to inputs (Whitney et al., 2018; Atube et al., 2021). These conditions might influence the distinct crop value chain activities between refugee and host communities. The major crops grown by host communities included sorghum, *simsim*, and cassava, with the successful production of cassava requiring substantial land area which poses a limiting factor for refugee populations (FAO and IFAD, 2005). Factors such as rainfall variability and risk aversion can lead to an increased level of diversified crop portfolios (Bezabih and Sarr, 2012). Among the host community HH, factors such as climate change and pest infestation would negatively affect crop yields. Similarly, the limited size and access to agricultural land among the refugee HH would limit their crop yields. This results in agricultural income being dependent on the choice between self-consumption and selling produce for profit.

It was evident that host communities are utilizing financial capital rather than social ties while refugee communities thrive on food assistance programs and tend to rely more on borrowing food as their primary coping strategy, given their limited financial capital, access to the market, and lack of social connections and market price awareness. Studies in similar contexts have revealed that households exhibit a wide range of resilience to food insecurity and climate change, and they adopt food-compromising coping measures, such as reducing the consumption of less preferred food, decreasing the size of portions, and reducing the number of meals per day. Additionally, they engage in financial coping measures, such as borrowing food and purchasing food on credit (Umar et al., 2014; Drysdale et al., 2019; Danso-Abbeam et al., 2022).

Previous studies have also shown the potential for income generation, poverty alleviation, and food security increase through crop diversification in fragile settings (Birthal et al., 2015; Asfaw et al., 2018). In our study, however, diversifying crop types grown itself was not enough to lead to agricultural income or to prevent the unwanted use of coping mechanisms. Enabling an environment for the sale of diverse crops could contribute to income generation, which stresses the importance of an effective market system even in fragile settings.

Despite the potential benefits of crop diversification, our study did not find any association between growing crops and FCS among the refugee community. This is due to the refugees' heavy reliance on food assistance, which is driven by factors such as limited access to farming lands and poor agricultural capacity (FAO, 2018a). The Ugandan refugee policy aims to promote self-reliance through cultivating allocated land, with food programs gradually scaling back assistance. The World Food Programme (WFP) provided rations based on the minimum caloric intake of 2,100 calories per day, with 100% of the ration being provided to extremely vulnerable individuals (Meyer et al., 2019; Schuler, 2022). Improving the food consumption scores of refugees would require strengthening the market chain for various crops and increasing access to fresh and animal-source foods through livestock rearing and food purchases.

Conclusion

This study contrasted the inequitable food systems of South Sudan refugees and the host community on the Northern border of Uganda by examining the crop value chain activities, agriculture income, coping strategy, and FCS. This disparity is primarily attributed to differences in access to institutional financial support and agricultural land, which was also influenced by people's livelihood activities in the area. Given our findings, both communities could benefit from measures aimed at promoting diverse crop sales. To do so, improving equitable local market infrastructure, enhancing equitable market access, and promoting comprehensive local groups could help both the refugee HH and the host community HH, increase agriculture income, adapting short-term market shocks and mid-term climate anomalies (Asfaw et al., 2018).

The availability of agricultural land is one of the critical reasons for the disparity between the two groups. Our findings emphasize that land ownership of agricultural land has a significant impact on food sovereignty and resilience. Dominant land ownership by the state or by generational landowners often results in exploitative or exclusionary decisions that affect vulnerable populations such as IDPs and refugees (Calo et al., 2021). Reforming land ownership and entitlement could be key to ensuring food system resilience and improving food security for both refugees and host communities. The competition between refugees and the host communities in the limited market environment and resources would be a major challenge. Reforming land relations is important for economically empowering vulnerable populations and reducing their reliance on food assistance to achieve food system resilience and improve food security (Fan et al., 2014).

The significant differences in the average agricultural income and rCSI between the two groups imply the disparity in food security between them. Economic vulnerability among the refugee enhances dependency on food assistance in the Northern Uganda region. Thus, refugee policies have to focus on creating viable economies in these remote border areas by addressing the socio-economic preconditions of such spaces. Economic empowerment by increasing access to financial institutions and services is essential for refugees to help protect them against the impacts of food scarcity and increase food security. Lowering legal, cultural, and informational barriers to financial systems for refugees would allow them to reduce the risks involved in agricultural production, increase production and sales in the market, and reduce their dependence on food assistance.

Achieving refugees' self-reliance and long-term welfare outcomes can be challenging. Development approaches for refugee issues have been around as long as the concept of refugee itself, but the scarcity of empirical evidence for the model or understanding of the relationship between refugees and development requires systematic learning of socio-economic conditions for the model to succeed. Our study findings revealed the difference in land use and food environment, and subsequent food insecurity status between refugees and host community population could provide implications for evidence-based decisions, policies and programming beyond humanitarian emergency support.

Strengths and limitations

This study provides novel insights and recommendations for the development of sustainable food systems that guarantee food security for

both refugees and the host communities on the northern border of Uganda. Nevertheless, there are several limitations. The data sources did not quantify the crops produced and sold. Thus, the diversity of crops sold and produced served as a proxy indicator of the total production activities, including the extent and scale of such activities. Also, information on other food sources such as livestock and poultry for meat and dairy products was not collected. The food consumption score was generated using a simple list of eight food groups. This has significant limitations in terms of revealing dietary diversity. Furthermore, we encountered substantial missing data on food expenditures and agricultural income. Some households had no agricultural income as they engaged in other means of livelihood. Furthermore, some refugee households obtained their food without purchasing it from the market.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: The data that support the findings of this study are available from World Vision but restrictions apply to the availability of these data. Requests to access these datasets should be directed to jeongeun_son@wvi.org.

Author contributions

The authors confirm their contribution to the paper as follows. YK, JS, and KR: study conception and design. YK and SG: analysis. KR: interpretation of results. SG, TF, AT, and AS: draft manuscript preparation. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1178386/full#supplementary-material

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