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Role of income from rice cultivation on livelihoods of rice farmers: Evidence from Ahero Region, Kenya

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In Africa, the demand for rice has increased rapidly as urbanization progresses and assistance is being provided to improve productivity and rice farming management. In the rice-cultivation area near Lake Victoria in western Kenya, where farmers are called "outgrowers", wage labor costs put pressure on rice farming and reduce profits. However, wage laborers were rice farmers living in the same area. The purpose of this study was to clarify the role of income from wage labor for the livelihood of rice farmers. A semi-structured survey using a questionnaire was conducted to clarify the situation of rice cultivation management in 2016 in an area near Lake Victoria. Furthermore, the diet and household accounts of rice farmers over one year were analyzed to assess the role of rice as a food- and income source in the rice-cultivation areas. Income from rice varied widely among households and yields differed significantly between years. In the target households, income earned from wage labor was higher and more stable than that from rice cultivation, comprising approximately 16% of the farmer's total income. Farmers rely on multiple sources of income to balance their daily income and expenditures. Some rice farmers cultivate rice and earn wages as laborers in the same area. Hence, if ways to reduce wage labor costs are promoted, it may negatively affect the household budget of farmers with the smallest landholdings due to a reduction in income.

Key words: Rice farmers, account book, income source, livelihoods, western Kenya.

INTRODUCTION

Rice (*Oryza* species) is an important staple food crop and strategic commodity for food security in large parts of sub-Saharan Africa. For decades, rice demand has been increasing along with high population growth and rapid urbanization (subsequently changing consumer food consumption patterns and preferences toward rice) (Thenyaa and Ngecu, 2017). Rice consumption in Africa more than tripled from 9.2 to 31.5 Mt between 1990 and 2019 (Tsujimoto et al., 2019). Rice is the third most important staple food crop in Kenya, after maize and

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wheat, and is primarily produced as a cash crop by rural farmers (Apind et al., 2015). Development assistance and support is being provided to improve rice cultivation productivity and management to countries in Africa, and Kenya is one of the recipients (JICA, 2011, 2015; Otsuka et al., 2022).

Kenya's western Victoria Lake region is the second largest rice-producing area in the country and is irrigated by two large-scale irrigation facilities introduced by the government in the 1970s. Rice production in Kenya is classified into three major categories: National Irrigation Board (NIB) Schemes, Non-NIB irrigation, and rainfed production (Apind et al., 2015). This region has small-scale non-NIB irrigated rice-growing areas, where farmers called "outgrowers" are responsible for the water supply and the organization of their own irrigation. Several outgrowers near Ahero found that rice farming is less profitable due to high labor costs (Abra et al., 2021). To boost income from rice farming, either productivity must increase or wages and labor costs have to be reduced. However, subsequent investigations revealed that wage labor for rice cultivation is conducted by people from the same area (Yamane, 2021). Unless we clarify what role rice cultivation plays in the livelihood maintenance of rice farmers, it will not be possible to assess the condition of rice farming by simply focusing on the farm management of rice farmers. In Africa, unlike Asia, rice is a commercial crop for farmers, who grow it for sale. In some cases, rice farmers also have cash income sources other than rice cultivation. In addition to fishing and selling papyrus mats (Ondiek et al., 2016), wage labor in rice cultivation is also thought to be an important cash income in the rice cultivation area on the shores of Lake Victoria (Yamane, 2021). Farmers also earned cash through the cultivation of corn and sorghum, which are staple foods, as well as livestock farming such as cattle and goats, and various other activities (Yamane et al., 2015). Consequently, rather than focusing only on rice farming management, it is necessary to consider the characteristics of household income and the position of rice farming within that income and devise appropriate support.

This study clarifies the roles of rice cultivation as both a food and commercial crop and analyzes wage labor income's impact on livelihoods of small-scale rice farmers in the Awach irrigation area (near the Lake Victoria) in western Kenya. A multi-year questionnaire survey with rice farmers who also engaged in wage labor was conducted to understand the fluctuation in farmers' rice cultivation and rice farm management. In addition, we asked the farmers to maintain a household account book for one year to provide information about consumed foods and income from rice cultivation and other sources: ratio and role of rice consumption in rice farmers' diets, ratio and role of the income obtained from rice in the household, and ratio of income from wages obtained from rice farming by household. Household account books were used to analyze in detail the types of household income sources, their respective income patterns, expenditure items, and expenditure patterns throughout the year. Since it is difficult to collect information on the number of actual paid labors in the seasonal changes in income in the survey using questionnaires, household account books were used. The women in the households were responsible for rice cultivation and earned income to feed their family. We asked them to fill in a household account book and food diary every day for a year, and we clarified the income acquisition pattern, amount, and percentage of total income according to the degree of wages, and compared it with the income obtained from rice farming and other income sources and proportion of rice in the diet, among other factors.

MATERIALS AND METHODS

This study clarifies the role of rice as both a food- and commercial crop and analyzes the impact of wage labor income on the livelihoods of small-scale rice farmers in the Awach irrigation area (near Lake Victoria) in western Kenya. It also examines the relationship between wage laborers and their employees in this area.

Study area

The Kano Plain (0° 04' to 0° 20'S; 34° 48' to 35° 02'E) is spread east of Wyndham Bay on Lake Victoria's eastern coast. The Ahero area of the Kano Plain on the eastern shore of Lake Victoria is a rice-growing area that follows the Mwea, the largest rice cultivation area located in central Kenya. Approximately 910 ha of land is suitable for rice cultivation (Yamane et al., 2019), with 11 small-scale rice cultivation areas farmed by outgrowers (900 ha; Figure 1). There are two large-scale irrigated areas, Ahero irrigation scheme and West-Kano irrigation scheme in the surrounding area under the jurisdiction of the National Irrigation Borad (NIB), a Kenyan government agency, and there are multiple small-scale irrigated rice cultivation areas called outgrowers in the vicinity. The Awach Kano River is an important water source in the Awach Scheme. The plain is at an altitude of approximately 1,140 m and is dotted with seasonal or permanent wetlands close to the lakeshore. Further, it does not witness floods because of its high altitude and serves as a residential area.

This study targeted an outgrower scheme, the Awach Scheme (approximately 120 ha), in which nearly 300 household farmers participate in small-scale irrigation. This scheme's rice cultivation area has been operational since the 1940s, even before the NIB began large-scale irrigation for rice. A large amount of wage labor cost has been invested in rice farming operations (Abra et al., 2021). Farmers obtain the funds necessary for cultivation by selling livestock, for example. All the areas are in this study are also residential areas of the Luo people, descendants of a Nilotic pastoral people. Luo villages comprise paternal extended families. In the Awach Scheme, two main paternal families, the Kimira and Katolo clans, cultivate rice (Yamane et al., 2019). Under the Awach Scheme, sales from rice cultivation totaled only 34,813 KSh/household, with high management costs (25,899 KSh/household) and a profit of only 8,783 KSh/household in 2012 (Yamane et al., 2019). Therefore, the scheme did not yield significant profit from rice cultivation. Moreover, the high

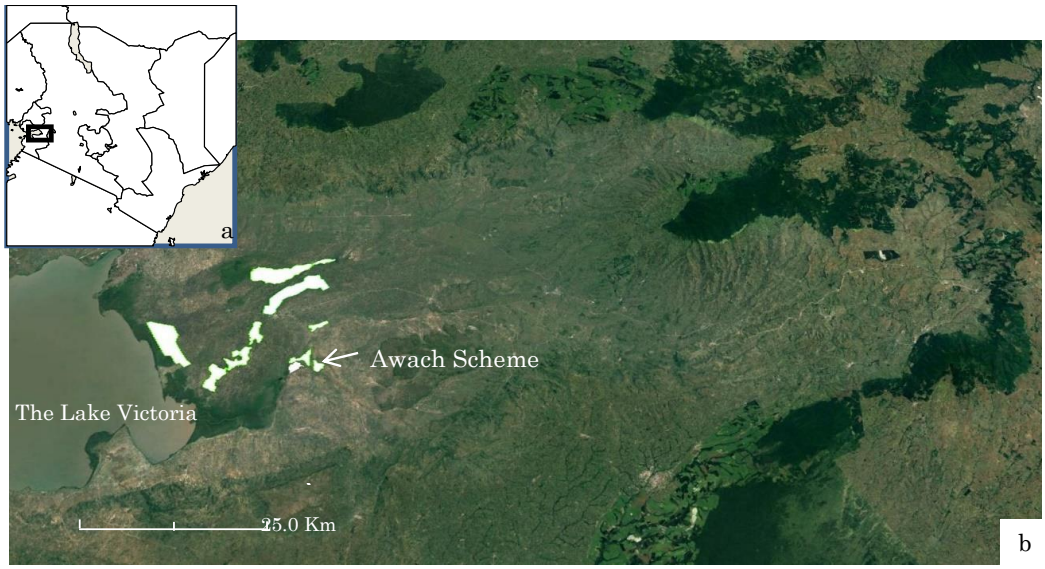

Figure 1. Location of the study site in Kenya (a) and a map showing the distribution of rice cultivation areas near Lake Victoria (b).

management costs put pressure on rice cultivation, with wages accounting for a large proportion at around 80% (20,600 KSh/household).

In 2016, the author rented paddy fields in the area and cultivated rice (Yamane et al., 2019), which involved two rounds of plowing, leveling and cleaning, transplanting, weeding, creating a bird ridge, cutting rice, gathering rice, shushing, and transporting it to consumers. Plowing was done twice using tractors or cows, and wages were paid in most cases. These tasks were loosely divided by sex; men often plow and harvest, and women often plant, weed, and collect rice. Some rice farmers cultivate rice and earn wages from rice cultivation under this scheme as laborers. In this area, 90% of people in the same scheme are hired as wage workers (Yamane, 2021).

Data collection

Information about rice farming and farmers' livelihoods under the Awach Scheme, such as the method and historical information on rice cultivation in the area and daily life activities, was collected for 2010-2013 and 2016 from five elderly people. Following this, a questionnaire to get information of rice farmers such as education attainments, laborer population, income sources, land conditions, livelihood capitals, land transfers, natural resources, and household land sizes was prepared, and a survey conducted. From October 2016 to February 2017, the author cultivated rice in the Awach Scheme to obtain information about the cultivation practices of rice and wage labor through a participatory observation survey following the methods of Maxwell (2005).

Three surveys were conducted to collect information on the actual situation of rice cultivation and farm management in 2012, 2016, and 2017. In the first survey, in 2012, 17 residents were hired. After three days of training, they were sent to rice-cultivating farmers' residential areas in each scheme to conduct interviews using a questionnaire. The target farmers were selected from all areas without considering factors such as the regional economy, ecological environment, rural conditions, and regional transportation. The survey data of 77 households under the Awach Scheme were analyzed considering the present rice cultivation situation, such as cultivation area per household and productivity, and targeting farmers who had cultivated rice in 2011. In 2012, 25.6% of households under this scheme were targeted. There was no significant difference in the scale of rice cultivation or method of rice cultivation, depending on the location of the households. Rather, even among households located close to each other, there were differences in cultivation areas and methods of inputting wage labor. Therefore, in the second and third surveys, we surveyed households that were relatively close to the paddy fields. The same survey was conducted in 2016 and 2017 for 39 rice farmers (13% of the total farmer households) and 24 rice farmers (8% of the total farmer households). In these two subsequent surveys, households were selected with consideration of the clan to which the farmer belonged, as it was possible that members of the clan to which the scheme chief belonged were given preferential treatment in terms of water use.

Description of a one-year food consumption and household account book by a rice farmer who also works as a wage labor under the Awach Scheme

A farmer (born in 1956) from Household A in Awach, who cultivated rice under the Awach Scheme, was asked to share the household account book maintained for one year from August 1, 2017, to July 31, 2018. The commodities purchased for every meal and income from different sources were recorded. If she had used the income of other household members to purchase commodities, the members' names and amounts were recorded. The author lived in this household for two months, one month each, in 2013 and 2016, sharing and observing their livelihoods. The household budget focused on daily meals as the farmer was responsible for them, as well as caring for children and grandchildren who were students at the time; her husband and earning sons supported her when required. She has four sons, and three of them provide money

when needed, but her last-born son is still a student. Additionally, at the time of the survey, her husband was ill and contributed little to household income. Consequently, the farmer was responsible for rice cultivation in her household, and she obtained income by working as a wage laborer for another rice farmer. Furthermore, the account books provided information about consumed foods and income from rice cultivation and other sources: the ratio and role of rice consumption in rice farmers' diets, the ratio and role of the income obtained from rice in the household, and the ratio of income from wages obtained from rice farming by household.

Data management and analysis

Data collected were stored in Microsoft Office Excel 365 and analyzed using Excel statistics using the non-parametric Mann-Whitney U-test.

RESULTS AND DISCUSSION

Family structure and agricultural activities of rice farmers

Family labor was used for rice cultivation in the study area. Luo households, *dalla* in the Luo language, comprise an expanded paternal family with a household head, his wives, and children. Rice farmers' villages in the study area have extended patriarchal families from two main clans. A comparison of the survey results from 2012 and 2017 shows that the family structure and agricultural activities of rice farmers are generally constant in this area.

The average number of members was 4.6 in 2012 for 77 households and 4.7 in 2017 for 24 households; the number of people engaged in agriculture was two per household in both 2012 and 2017. Wage labor was used for work requiring large amounts of labor on one occasion, such as rice planting, weeding, and harvesting, However, only a few members held salaried jobs. According to a questionnaire, agriculture was the main source of income for many households.

Awach Scheme rice farmers cultivate maize and sorghum in addition to rice for consumption. The average cultivation area for these cereals is almost equal to that of rice. The yield of other cereals, except rice, for self-consumption per household was 217 kg in 2012 and 387 kg in 2017. Farmers keep livestock such as cattle, goats, and sheep. The average number of cattle was 6.1 in 2012 and 6.9 in 2017, and that of small animals was 5.8 in 2012 and 6.6 in 2017. Furthermore, approximately 14 chickens and two ducks were kept on average in 2017; four out of 24 households kept donkeys for luggage transportation.

Rice farm management

Family structure and agriculture were constant, whereas rice farm management was not. In 2016, the average rice cultivation area and average yield per household for the 39 households were 0.7 ha/household and 1,795 kg/ha (Table 1), respectively. In 2017, the average rice cultivation area and average yield per hectare for the 24 households were 0.8 ha/household and 2,396 kg/household, respectively. The rice yield per hectare in 2017 was approximately 1.3 times higher than that in 2016, although the cultivation area per household was almost the same in both years. This is associated with some farmers failing to harvest rice. Despite cultivation, 13 of the 39 households failed to harvest rice throughout the year. In 2016, the average yield of rice farmers who successfully harvested rice was 1246 kg/household. The average yield per hectare in 2016 (1795 kg/ha) was very low compared with the average rice yield under rainfed conditions in Kenya (2.8 t/ha) (MOA, 2009). According to the 10-year (2010-2019) rainfall data of Kisumu from the British Institute (Figure 2), rainfall in 2016 was the lowest over the 10-year period. Therefore, the low yield was thought to be caused by water shortage. Based on the author's observations, many Awach paddy fields dried up during the 2016 cultivation period.

The average sales volume per household in 2016 was 354 kg/household, which yielded 19,667 KSh/household. However, when management cost was subtracted from income, households earned an average of only 468 KSh/household per year, and the 13 households that failed to harvest rice suffered losses of −8441 KSh/household from management cost. The remaining 26 households that harvested rice successfully earned 4,923 KSh/household on average from rice cultivation, which is still very low compared to that in 2012 (8783 KSh/household) (Yamane et al., 2019), further indicating that 2016 was not a successful year in terms of profit. Analysis of the operating expenses in rice cultivation showed that no farmer had cultivated leased land because they had inherited paddy fields. Agricultural chemicals and chemical fertilizers are rarely used. However, labor costs accounted for 85 and 88% in 2016 and 2017, respectively.

In 2017, the sales volume was 1736 kg/household. The state of rice farming was better than in 2016, at 29,701 KSh average profit per household, five times that of the previous year. Average sales per household was 55,240 KSh, higher than that of the previous year by approximately 20,000 KSh/household.

Rice farm income for households

To compare household rice cultivation over different years, seven households that were surveyed in both 2016 and 2017 were chosen, and the rice farming management of these households was observed (Table 2). In 2016, some farmers failed to harvest, possibly because of low precipitation that year. Therefore, the rice

Table 1. Fluctuations in rice farming management over two consecutive years per household of Awach rice farmers, in Kenya in 2016 and 2017.

Parameter	Unit	2016				2017	
		Average[a]	Succeeded [b]	Failed [c]	Household A	Average	Household A
No. of households	-	39	26	13		24	
Cultivated area	ha	0.7	0.7	0.8	1.2	0.8	0.6
Yield	kg	830	1,246	0	2,700	1,802	1,260
Productivity	kg/ha	1,795	2,692	0	2,224	2,396	2,076
Sales volume	kg	354	531	0	1,800	1,736	900
Percentage of sale per yield	%	36	53	0	67	93	71
Price of sales	Ksh	19,667	29,500	0	110,000	48,373	30,000
Profit[d]	Ksh	468	4,923	-8,441	47,200	20,127	11,207
Management cost[e]	Ksh	19,199	24,577	8,441	62,800	28,246	18,793
Wage labor cost	Ksh	16,330	22,029	4,933	58,200	25,013	14,852
Water fee	Ksh	1,272	1,050	1,715	3,000	2,304	3,700
Rental fee	Ksh	0	0	0	0	0	0
Seed price	Ksh	976	972	985	1,600	469	0
Pesticide	Ksh	90	0	269	0	168	0
Fertilizer	Ksh	530	526	538	0	292	0

[a]Average of all farmers surveyed in 2016. [b]Average data of farmers who could harvest rice to sell in 2016. [c]Average data of farmers who failed to harvest rice in 2016. [d]Profit = Price of sales – Management cost. [e]Management cost = (wage labor cost + water fee + rental fee + seed price + Pesticide + Fertilizer).

yield per household was higher in 2017than in 2016, except for Household 1. Five out of seven households recorded negative profits in 2016, whereas five made a profit in 2017. Overall, the management of rice cultivation was not stable over the two years. Furthermore, even within the same household, the state of rice farming varied greatly by year, and agriculture could thus be likened to gambling. For instance, Household 3 cultivated more than 4 ha in 2016, but had minimal yield and incurred a loss of more than 50,000 KSh. In 2017, the farmer reduced the cultivation area and obtained a profit of approximately 10,000 KSh. Meanwhile, Household 1 cultivated 1.2 ha in 2016 and earned nearly 50,000 KSh, but in 2017, it cultivated only half of that area and obtained less than half of the profit, at approximately 10,000 KSh. For Household 2, the harvest of 2016 led to a loss of around 20,000 KSh, but in 2017, its profit was 70,000 KSh.

Thus, rice-farming income varies greatly depending on the household and year, and the corresponding income is unstable. Nevertheless, many Awach farmers continue to grow rice despite high labor costs.

Characteristics of Household A

Income from rice cultivation can be considered an unstable source. However, despite their high wages, Awach rice farmers continue to grow rice. Rice planting and weeding are the most labor-intensive tasks and are typically performed by women. These tasks were primarily outsourced to other farmers under this scheme. To determine the wage cost and how it is used, an example from Household A is considered. Household A ranked fourth in earnings among the 39 households in 2016, and tenth among the 24 households in 2017 (Table 2). In addition to income from rice sales, the amount of cash earned from wage labor and the burden of a household need to be determined. Therefore, the account books of the farmers who looked after the

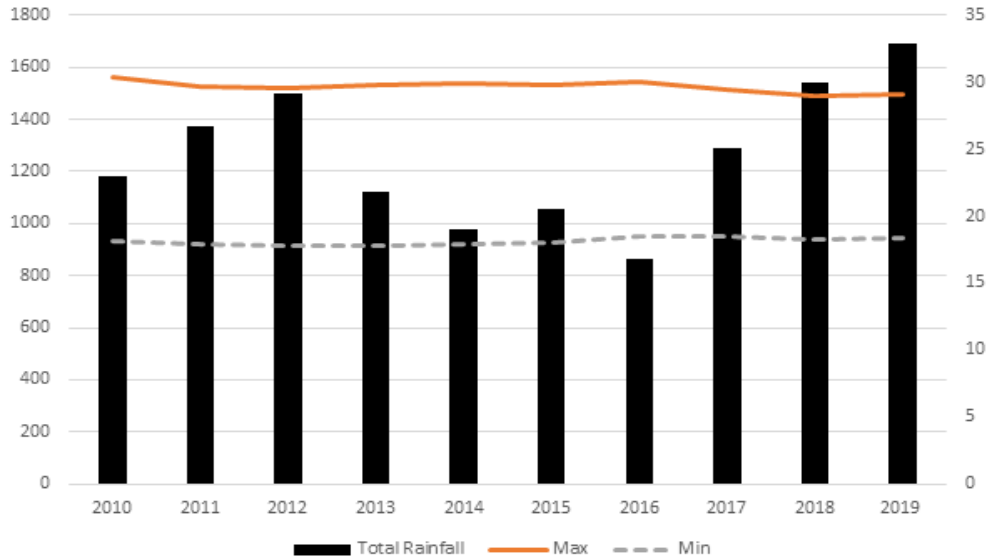

Figure 2. Total rainfall per year and average daily maximum and minimum temperatures from 2010 to 2019 for Ahero.
Source: https://weatheronline.co.uk/

Table 2. Annual comparison of rice cultivation area, production volume, and rice cultivation management for seven households of rice farmers from the Awach area in Kenya in 2016 and 2017.

House-hold No [a]	Cultivated area (ha/household)		Yield (kg/household)		Sales volume (kg/household)		Productivity (kg/ha)		Sales amount (Ksh/household)		Management cost [c] (Ksh/household)		Labor cost (Ksh/household)		Profit[d] (Ksh/household)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
1(HA)[b]	1.21	0.61	2,700	1,260	1,800	900	2,224	2,076	110,000	30,000	62,800	18,793	44,200	31,250	47,200	11,207
2	0.61	1.62	0	3,420	23	3,060	0	2,113	24,000	105,600	47,600	31,350	58,200	14,852	-23,600	74,250
3	4.86	1.21	0	1,350	450	1,020	0	1,112	6,200	38,760	60,060	26,801	59,100	24,801	-53,860	11,959
4	0.81	1.21	810	2,700	540	900	1,001	2,224	24,000	32,000	25,000	24,734	19,200	24,634	-1,000	7,266
5	0.40	0.81	2,160	1,530	450	630	5,339	1,891	44,000	21,000	22,700	20,836	18,700	20,836	21,300	164
6	0.81	0.81	0	2,250	0	900	0	2,781	0	30,000	14,250	49,941	3,350	47,441	-14,250	-19,941
7	1.01	0.81	540	1,440	0	3,090	534	1,780	0	1,200	5,500	18,845	3,000	18,845	-5,500	-17,645

[a]Seven households that were investigated in both 2016 and 2017 were included. [b]HA means Household A. [c]Management cost = (wage labor cost + water fee + rental fee + seed price + Pesticide + Fertilizer). [d]Profit = Price of sales – Management cost

Table 3. Example of daily income and expenditures for one week of Household A, the household of a rice farmer from the Awach area in Kenya (October 2017).

2017 Oct		Daily income earned by the farmer (KSh)								Farmer's daily expenditures (KSh)							
		Farmer's income from different sources								Expenditures for different items							
		Charcoal sale	Fire wood sale	Working for others	Rice sale[a]	Merry-go -round[b]	From other family members[c]		Total	Staple food[d]	Side dish	Spices and sugar[e]	Telephone bill[f]	Daily necessities	School fee	Total	Balance
1st	Sun	-	80	200	0	-		1000	1280	410	200	280	0	0	0	890	390
2nd	Mon	210	160	0	200	400	Second son	0	970	360	180	280	0	0	0	820	150
3rd	Tue	360	90	360	0	-		0	810	360	180	280	0	0	0	820	(10)
4th	Wed	260	-	0	0	300	Husband	500	1060	360	140	280	0	0	0	780	280
5th	Thu	-	70	240	0	-		800	1110	360	140	280	0	0	0	780	330
6th	Fri	280	160	400	0	-	Third son	0	840	370	160	270	0	0	0	800	40
7th	Sat	180	120	0	0	500		0	800	360	180	270	0	0	0	810	(10)
8th	Sun	160	-	0	140	-	Third son	1000	1300	450	180	220	0	0	0	850	450
		242	113	150	43	400		413	1021	379	###	270	0	0	0	819	203

[a]Of the 12 bags of rice that she harvested, she sold ten bags and kept two bags for stock. This is the income earned by selling two stored bags of rice. [b]A self-help group that is an informal credit union to lend money when farmers need cash. [c]On days when there was insufficient daily income to cover daily expenses, the income was supplemented by funds from other family members. [d]Maize, wheat, and potatoes were bought as staple foods. Maize was bought almost daily. [e]Prepaid card fee for prepaid phones. Soap and sponges were mainly bought as daily commodities. [g]Balance of daily income and expenses.

household budget were closely examined.

Role of wages and income from rice sales in Household A

The daily budget records for the first week of October from the annual income and expenses recorded from April 1, 2017, to March 31, 2018, in Houshold A were perused. The farmer shows income losses, earning an average of about 600 KSh per day from various sources of income (Table 3). From this income, daily meals were mainly purchased (Table 4). Wage labor income was around 200 to 400 KSh per day and earned on average four times per week in October, accounting for a large proportion of the total income. However, due to seasonal fluctuations, this income decreased to once a week in January, during the off-season, and increased to five days per week in May. In addition, to income from multiple sources, income from other family members, such as the husband and three sons, compensated for the shortage of seasonal changes in wage labor (Table 4). A balance between daily income and expenditure was achieved throughout the year (Figure 3). In January, a large amount of tuition fees had to be paid to the youngest son and daughter, which was obtained from rice farming and covered by bank account savings and support from one of the sons because the sons' own children were still under school age and therefore he could afford to support his younger brothers' school fees.

The total annual income from various sources was 375,828 KSh (Table 4). The combination of the resale of charcoal (23.7%) and firewood (10.0%) was the highest income source among her multiple sources. The amount of money obtained from wage labor was the third-largest income source, at about 16%, surpassing 60,000 KSh. Approximately 90% of wage laborers in the area are hired from within the same scheme (Yamane, 2021), and she also earns wages several days a week under the same scheme.

Household A sold 900 kg (ten bags) of rice for 30,000 KSh in 2017, which was kept in a bank account to meet daily expenses or to pay tuition fees. The farmers also had to conduct threshing and milling of the rice in two stocked bags (Table 4). For this farmer, the income from stored rice

Table 4. Total annual income and expenditures by item for household A, the household of a rice farmer from the Awach area in Kenya from August 1, 2017, to July 31, 2018.

Income	Ksh/year	%	Expenditure	Ksh/year	%
Charcoal	89,169	23.7	Staple food[c]	138,206	38.8
Firewood	37,749	10.0	Side dish	63,964	18.0
Merry-go-round [a]	42,600	11.3	Spices and sugar	122,595	34.5
Working for others	61,680	16.4	Telephone bill[d]	1,043	0.3
Rice sales[b]	23,910	6.36	Daily commodities[e]	6,549	1.8
Other family members	120,720	32.1	School fees	23,434	6.6
Total	375,828	100		355,793	100

[a]A self-help group that lends money when farmers need cash. Most of the survey sites consisted only of women. [b]Of the 12 bags of rice that she harvested, she sold ten bags and kept two bags for stock. This is the income earned by selling stored rice. [c]Maize, wheat, and potatoes were bought as staple foods. Maize was bought almost daily. [d]Prepaid card fee for prepaid phones. [e]Soap and sponges were mainly bought as daily commodities.

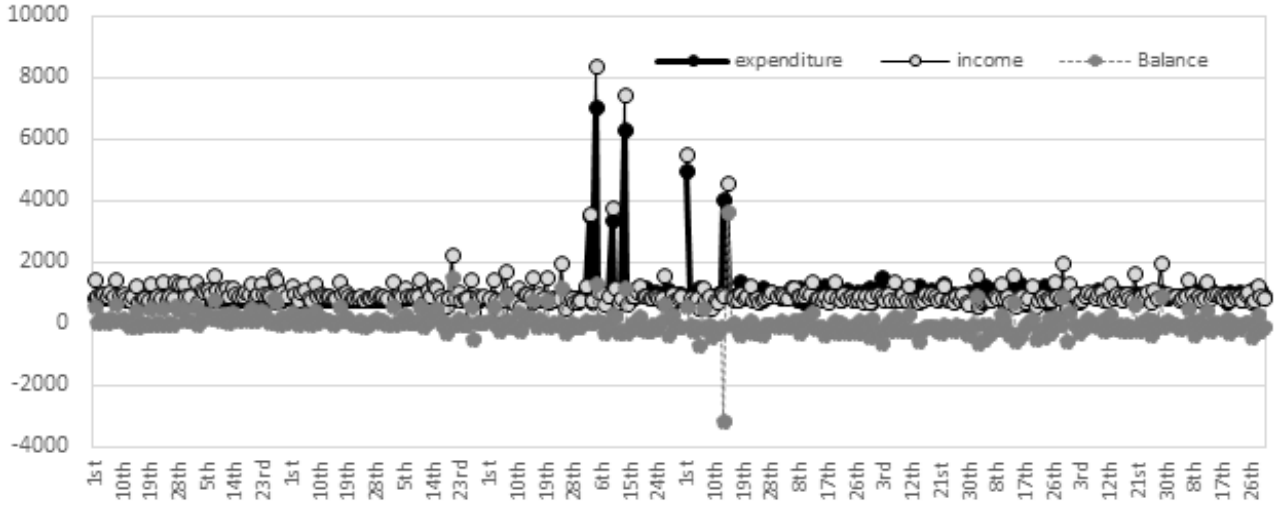

Figure 3. Changes in daily expenditures and income in Household A, a rice farmer's household in the Awach area in Kenya, over one year (from August 1, 2017, to July 31, 2018).

sales was 23,910 KSh, below the total wage labor of 61,810 KSh.

Regarding expenditure, food expenses were the highest, amounting to approximately 90% in total. Approximately 70% of the cash spent on household meals was covered by the farmer's earned income, whereas the rest was covered by the income of other household members (Table 4).

Percentage of rice in household meals

The household harvested 12 bags of 90 kg each of rice in 2016, sold ten bags in February 2017, and stocked two bags for consumption. This household produced more than 1000 kg of rice, but it consumed rice only 55 times between July 2017 and July 2018. January is the time of the rice harvest. Between April and May, rice was consumed for one-third of the month, but only once or never in other months. Therefore, although rice is cultivated, it contributes little to self-consumption.

Conclusion

This study sought to clarify the role of rice cultivation in cash income and food security for Awach farmers, a non-NIB rice-growing area of outgrowers, around the shores of Lake Victoria. Rice farming, was an unstable source of cash income, with some farmers making profits and losses in 2016, but was generally profitable in 2017. In Awach, the maintenance and management of irrigation

canals is incomplete, rice is produced by largely relying on rainwater, and the amount of production is greatly affected by rainfall. In 2016, when rainfall was low, some farmers failed to harvest and suffered losses. Since the yield depends on weather conditions, the state of rice cultivation differs greatly from year to year, even for the same farmer. The same can be said for outgrower rice-growing areas that extend around the National Irrigation Corporation. In non-NIB, or outgrower areas, there are 11 rice-growing areas where irrigation canals are developed and managed by agricultural democratic bodies. The maintenance and management of these outgrower irrigation canals in Awach are as vulnerable, and rice cultivation is largely subject to annual fluctuating rainfall (Yamane et al., 2019). In the outgrower areas, rice cultivation can be a large source of income, but it is unpredictable. However, income from wage labor was considered comparatively stable and it supports Household A even though the amount was low. Farmers in Awach employ people from the same scheme as wage labor. For instance, income from wage work accounted for approximately 16% of the income of Household A over one year. Further, the total income from rice sales was 53,910 Ksh and less than the income from wages (61,680 Ksh). Therefore, wages for rice cultivation can also indirectly support households.

Rice is a commercial crop in many African rice-growing areas (Atera et al., 2018). In the study area, the ratio of wage labor to non-farm income in rural households could be more stable than rice income. Furthermore, African rice farmers earn non-farming income, apart from rice-related income, and there may be differences in the role of rice cultivation among areas (Anang and Yeboah, 2019; Abdullah et al., 2019). The target area of western Kenya is environmentally harsh compared to the rest of Africa, and the target household's low agricultural income is consistent with this (Ondiek et al., 2016). However, wage labor was conducted in the region, with the target rice farmer having a higher income from wage labor than rice sales. Hence, support focusing solely on rice farm management may negatively affect the earnings of farmers with the smallest landholdings. Therefore, effective support plans should match farmers' actual situation and devise comprehensive methods to improve their rice farm management and off-farm income. Thus, understanding the role of rice cultivation in rice-farming households that require assistance is necessary, and even if support focuses on rice cultivation, all farmer households and the relationship between local farmers must be studied to provide adequate support.

For both African and non-African countries, diversification may be a household strategy to manage risk and overcome market failure, or to promote specialization within the household based on its individual attributes and comparative advantages (Davis et al., 2017; Ondiek, 2016). For example, households in the Yala Swamp on the shores of Lake Victoria, near the target area, earned around 20% of their household income from selling agricultural products and the rest from non-farming sources (Thenyaa and Ngecu, 2017). The share of agricultural income among rural African farmers' households is still high compared to that in other developing countries (Lanjouw and Lanjouw, 2001). The median African rural household earns three-fourths of its income from agriculture (Davis et al., 2014, 2017). However, it is common to have multiple sources of income, where off-farm income share increases (Abeje et al., 2019).

This study conducted a detailed, one-year information survey of a rice farmer's household that was also involved in wage labor, using qualitative information based on a household account book. Thus, it provides the income and expenditure situation of rice farming households under the Awach Scheme, and the data showed that wages represent a stable income. As there is no considerable difference in the number of Household A members, cultivated area, and number of livestock raised from other households, Household A can be considered typical. However, quantitative data from the questionnaire survey shows that income from rice cultivation differs among households. More data are required to quantitatively study this situation in this region.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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