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Drivers of Land Share and Allocation in a Multiple Crops Farming in Southwest, Nigeria

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ABSTRACT
Background and Objective: Inappropriate optimization of land allocation among crop stands has led to inadequate land use resulting in unexpected crop yields. In consequence, this study examined the drivers of land share and allocation among specific food crops cultivated by smallholder farmers in southwest Nigeria. **Materials and Methods:** A sample size of 346 respondents was picked by a multi-stage sampling procedure across the selected 5 agricultural zones in Southwest Nigeria. Primary data were collected through interview schedules and questionnaire administration. The analytical tools were descriptive statistics, (at 95% confidence interval), fractional multinomial logit, and multivariate regression. **Results:** The findings identified maize, cassava, and vegetables (okra) as the most crops grown in multiple. The average farm size was 7.67 ha, and the percentage average proportions of land allocated were 34.83% for maize, 34.90% for cassava, and 27.01% for okra. The estimates of fractional multinomial logit were robust and significant at ($p<0.001$), with the share of land allocated to maize being the base outcome, while cropping intensity ($p<0.003$), access to credit ($p<0.000$), and extension service ($p<0.001$) are the determinants of land allocation for maize, cassava, and okra, respectively. Also, the multivariate regression revealed that the output of maize and okra were significantly influenced by the land allocated to each crop at ($p<0.004$) and ($p<0.005$), respectively. **Conclusion:** The share of land among various food crops is driven by farmers' education, credit access, extension services, and cropping intensity while the aggregate output of individual crops is determined by their land shares and the crop's share of land as well as extension contact. It recommended a precise share of land space for the specific crops grown in combination for viable crop growth and optimum yields.

KEYWORDS
Land share, land allocation, drivers, fractional multinomial logit, multivariate regression, multiple crops farming

INTRODUCTION
Smallholder farmers are concerned about the share of land allocation among food crops in a multiple cropping system while growing some crops on the fields, which is most appropriate for precision agriculture. Actualizing the objective of proportional distribution of land tracts among mixed crops emerging on the same plot remains the major task for crop cultivators. Optimal land use and resource allocation have to do with the selection of the most suitable crop enterprises, determining the appropriate

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land allocation for each crop, and selecting the best methods and input combinations to maximize net farm returns[1]. Given this empirical concept, the agronomic practice of land allocation between crops becomes a serious challenge for rural households as they have to consider many factors when choosing the size of cropland[2]. For instance, obsolete farming practices in conjunction with land ownership issues among farmers in Nigeria remained a huge challenge to optimize the limited farmland.

The allocation of agricultural lands and crop rotations includes establishing the composition and ratio of agricultural lands and the types, varieties, number, and areas of the crops being rotated; it also includes reviewing the planned transformation of lands, developing land improvement measures, and rationally citing agricultural lands and crop rotations.

Land share or allocation in this context is the proportion of land area occupied by specific crops cultivated amid others, which is said to be affected by several exogenous variables. For instance, farmers' decisions on cropland allocation among crop groups are based on crop species, land suitability or accessibility, climatic and environmental factors, and other socio-economic characteristics[3-5].

Many African farmers inculcate the habit of diversifying into various crop combinations to evenly spread the risks associated with weather or calamities and increase the total output of individual fields compared to pure stands. In this way, crop enterprise combinations are said to support better livelihood and enrich the income of food crop farmers[6]. The mechanism of crop mixture and acreage of land share/allocation of individual crops are important because of their practical applications in policy formulation, resource allocation, agricultural extension, farmer education, crop diversification, value chain development, land use planning, and environmental sustainability. The land is an essential input to arable crop farming. It is realized that the analysis of land share and allocation among crops may be a veritable land optimization and farm precision practice. Nevertheless, the understanding of cropland allocation at the farm household level can guarantee improvement in agricultural practices because it complements various farm operation plans and other resources employed by the farmers[7].

Generally, the significance of this study is to improve farming methods especially the aspect of proportional land share and distribution among food crops for accurate precision and speeding up productivity. Therefore, food crop farmers should recognize the influence of land allocation on specific crops and plan to optimize cropland use and other farm resources. The empirical analysis of drivers of land share and allocation among food crops in Southwest Nigeria will provide valuable information for farmers and other stakeholders. It can guide decision-making to allocate resources more effectively, improve agricultural productivity, promote crop diversification, enhance crop viability, and ultimately contribute to regional food security.

Because of this, it is aimed to identify the food crops cultivated by the farmers with the share and allocation of land among various crops, determine the covariates of share and allocation of land among various crops cultivated, and examine the influence of the land allocation on production or output of food crops.

MATERIALS AND METHODS

Study area and target population: The study was conducted between July, 2018 and December, 2021 in Southwest Nigeria. This location has a total land area of 114,271 km^2, representing 12% of the country's land mass, and comprises six states, which include Oyo, Osun, Ogun, Lagos, Ondo, and Ekiti States[8]. Also, the whole area is bounded in the East by Edo and Delta States, West by the Republic of Benin, North by Kwara and Kogi States, and South by the Gulf of Guinea. The climatic conditions in the southwest regions are predominantly tropical and are characterized by distinct wet and dry seasons. During the wet season, the region experiences the influence of the southwest monsoon wind originating from the Atlantic Ocean. This period is characterized by increased rainfall, higher humidity, and generally cooler temperatures. The

Average rainfall is 1480 mm with a mean monthly temperature range of 18-24°C during the rainy season and 30-35°C during the dry season. The vegetation types in Nigeria's South-Western Region encompass various ecosystems. Along the coastal belt are freshwater swamps and mangrove forests characterized by brackish water and salt-tolerant vegetation. Tidal movements influence these areas, vital habitats for diverse flora and fauna. Moving inland, the lowland rainforest dominates the landscape, extending towards Ogun State and parts of Ondo State[9]. The atmosphere here allows farmers to grow varieties of arable crops, cassava, maize, yam, guinea corn, rice, sweet potato, and vegetables (such as okra, garden egg, cucumber, tomatoes, and pepper). Tree/cash crops like oil palm, mango, orange, cashew, cocoa, and kola-nut. Its agroecological condition also supports grazing land and raising livestock such as sheep, goats, cattle, and poultry. In addition, the southwest region is highly populous, dominated by adults, youth, and children with many of these being farmers. The farming households, though smallholders, feed the millions of inhabitants in Nigeria. Small-scale farmers make up 80% of farmers in Nigeria and produce a substantial percentage of the food consumed by Nigerians[10].

Sampling approach: The first stage involved the purposive selection of Osun and Oyo States from the list of states in the southwest; this was followed by a selection of 5 agricultural zones (2 from Osun and 3 from Oyo States. At the final stage, a proportionate sampling of farmers was done from each zone using the Cochrane formula. The choice of these regions is due to the prevalence of food crop farmers[11]. The steps involved in the sampling method were implicitly depicted in Table 1.

According to the information provided here, the required sample size was determined using the population proportionate factor stated as[12]:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)} \tag{1}$$

where, S is required sample size, N is population size, X^2 is table value of chi-square for 1 degree of freedom at the desired confidence level (95%), normally (1.96×1.96 = 3.841), p is population proportion (assumed to be 0.50), d is degree of accuracy expressed as a proportion (0.05). In Table 1, the study drew a population size (N) equal to 60348 and assumed a population proportion (P) of 0.50, chi-square (χ^2) for 1 degree of freedom at 95% confidence level, normally (1.96×1.96 = 3.841) and degree of accuracy (d) of 5%. This method of obtaining sample size is based on probability assumption, which permits every individual farmer to be a good representative of the entire population in the study area. Therefore, following this procedure, the sample size is as given below:

$$S = \frac{3.841 \times 60348 \times 0.5(1-0.5)}{(0.05)^2 (60348-1) + 3.841 \times 0.5(1-0.5)} = 382 \text{ farmers}$$

Across these survey areas, a total number of 346 out of 382 farmers proportionally selected were finally used for this study, while the others were dropped because of incomplete information.

Data collection and method of data analysis: Information was elicited on the socio-economic characteristics of the farmers, input-output, and specific farm-level data through structured questionnaires. Descriptive statistics (percentage, mean, and standard deviation) were used to assess the food crops grown by individual farmers with the respective land allocation among various crops, while Fractional Multinomial Logit, as well as Multivariate regression, were run to predict the factors that influence the allocation of farmland among crops and examine the nexus between the share of land allocation to specific crops and production output, respectively.

In addition, Table 2 was constructed to give more adequate information about how the variables included in these models were measured and operationalized in the analysis.

Table 1: Approximated population of food crop farmers in Southwest Nigeria

States	ADP zones	Selected-ADP zones	LGAs in zone	Selected LGAs	Registered farmers consisted in LGAS
Oyo	5	Ibadan/Ibarapa	14	Ido	3104
				Egbeda	4319
				Akinyele	4403
				Ibarapa Central	4906
		Ogbomoso	5	Surulere	5829
				Oriire	7541
		Saki	9	Kajola	3054
				Iseyin	3513
				Iwajowa	4022
Osun	3	Iwo	7	Iwo	4685
				Irewole	3880
		Ife/Ijesa	10	Atakumosa	4302
				Oriade	2976
				Ife-East	3914
Total	8	5	45	14	60348

Source: ADP Office, Oyo and Osun States, 2021

Table 2: Description and measurement of variables

Dependent variables	Variables description
Output of food crops	Kilogram/Naira
Land share and allocation to specific crops (ha)	Ratios/Fraction
Independent variables	
Socio-economic characteristics	
Sex	Yes = 0, No = 1
Primary occupation	Yes = 0, No = 1
Marital status	Yes = 0, No = 1
Actual age of the farmer	Continuous (year)
Household size	Person (count)
Educational qualification	Continuous (year)
On-farm income	Continuous (Naira)
Farm distance to homestead	Continuous (km)
Credit access	Yes = 0, No = 1
Total size of farm	Continuous (hectares)
Area of land cultivated	Continuous (hectares)
Cropping intensity	Continuous (year/hectare)
Extension services	Yes = 0, No = 1
Farm labour intensity	Continuous (man days/ha)
Multiple cropping	Yes = 0, No = 1

Fractional multinomial logit model: The fractional multinomial logit model was also used to examine the factors that influence the share of land allocation to specific crops grown on the farm. For instance, Miller and Plantinga[13] described an aggregate land allocation model used by several economists[14,15] to estimate factors influencing the share of land allocated to various agricultural uses to be fractional multinomial logit. It is a combination of fractional logit and multinomial logit models. The model (FMNL)[7] is specified as:

$$pi1, pi2, \ldots\ldots\ldots\ldots pik\text{-}1, pik = f(X_1, X_2, \ldots, X_n) \quad (2)$$

where, pi is the proportion of land allocated to a specific crop out of the total land area cultivated, while X_1-X_n represents explanatory variables related to household-specific, farm-level, and community characteristics.

The multinomial logistic specification model for the share functions is as follows:

$$P_{ij} = \frac{e^{\beta_j X_i}}{1+\sum_{k=j}^{j} e^{\beta_k X_i}} \forall = 1,2,\ldots\ldots k \quad (3)$$

Conceptually, the sum of shares allocated to all the crops equals unity or 1, the total land cultivated. The household is faced with the choice of allocating land to (a) Maize, (b) Cowpea, (c) Rice, (d) Yam, (e) Sweet potato, (f) Cassava, (g) Guinea corn and (h) Vegetable crops. The choice of the above crops may be influenced by their popularity with farmers and demand by consumers. The proportion of household land allocation to each crop enterprise is designated as pj1, pj2...pj8, respectively, if the farmers cultivated all. The proportions of land allocated to maize (pi1), land allocated to cassava (pi2), and land allocated to okro (pi3) are different possible outcomes. Specifically, for this study, the share of land allocated to maize, cassava, and okra each represents the different possible outcomes and predicts the following explanatory variables:

X_1 = Sex (dummy)
X_2 = Age of farmers (years)
X_3 = Marital status (dummy)
X_4 = Farmers education (years)
X_5 = Household size (persons)
X_6 = Access to extension (dummy)
X_7 = On-farm income (Naira)
X_8 = Credit access
X_9 = Cropping intensity (crop/ha)
X_{10} = Labour intensity (man days/ha)

Multivariate regression analysis: The multivariate regression model used here to determine the effect of land allocation on crop outputs has features similar to the ordinary least square regression model. As the name implies, multivariate regression is a technique that estimates a single regression model with more than one outcome variable. Multivariate multiple regression takes note of the kind of predictors which have unique properties. The model is specified like OLS only that the dependent variable is more than one as previously adapted by Alexopoulos[16] and Raufu *et al.*[17]:

$$Y_i = \beta_0+\beta_i Xi+\mu_i \quad (4)$$

$$Y_1, Y_2, Y_3 = \beta_0+\beta_i X_i+\mu_i \quad (5)$$

Where:
Y_i = Individual farmer's output of crops (maize, cassava, okra)
X_i = Vector of explanatory variables
β_i = Vector of unknown coefficients
μ_i = Independently distributed error term
i = Number of observations = 1, 2, 3....n

$$Y_1, Y_2, Y_3 = \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+...\beta_{10}X_{10}+\mu_i \quad (6)$$

where, Y_1, Y_2, Y_3 is maize, cassava, and okra outputs in kg, respectively.

X_1 = Sex (dummy)
X_2 = Age of farmers (years)
X_3 = Marital status (dummy)
X_4 = Education (years)
X_5 = Household size (persons)
X_6 = Access to extension (dummy)
X_7 = Land allocated to maize (ha)
X_8 = Land allocated to cassava (ha)
X_9 = Land allocated to okra (ha)
X_{10} = Farm distance (km)

RESULTS AND DISCUSSION

Cropping system adopted by the food crop farmers: The prevalent cropping system adopted by arable crop farmers is more of multiple planting techniques in the tropics as recently examined by Ogunwande[18]. Results in Table 3 indicate that 68.5% of food crop farmers adopted a three-crop combination, specifically maize, cassava, and okra. This finding is similar to the study carried out by Ogunwande[18], who reported that mixed cropping (64.9%) ranked first among the most adopted cropping systems in Southwest Nigeria. Also, 21.38% of farmers adopted a four-crop combination, which included maize, cassava, okra, and yam, while the remaining 10.12% adopted a combination of more than four crops, specifically maize, cassava, okra, yam, and cowpea. Additionally, the data revealed that most farmers planted an average of three crops per plot.

This indicated that most smallholder farmers were involved in multiple cropping in the study area to prevent total crop loss and unforeseen circumstances. Similar past studies done by Sanzidur Rahman and Chima[19] also contributed to the fact that farmers practice mixed cropping, especially for food crops in Nigeria with at least 2 crops combined on a plot. It validates that African food crop farmers commonly cultivate numerous arable crops in a growing season on the same plot. For the farmers, the implication is to be food secure and diversified.

Land allocation/share among food crops: Considering the result in Table 4, the number of observations is equivalent to 346 farmers, an average value of 0.3459, 0.3838, and 0.2701 ha of land representing the area of land shared by maize, cassava, and okra crops, respectively. The minimum land share among these crops (maize, cassava, and okra) ranges from 0 to 0.069 ha, respectively, while the maximum area ranges between 0.89 to 1 ha for maize, cassava, and okra crops. This result revealed a significant dispersion in the mean values of land allocation among food crops, although the fraction of land allocated to maize and cassava is almost the same relative to the size of land allocated to okra. The standard deviation of farmland allocated to the three crops partially varied from one another. It indicated that the allocation of agricultural land among food crops is being competed. This finding can inform the development of agricultural land policies and plans at regional and national levels. Policymakers can use the insights gained to design targeted interventions and programs that address different crops' specific needs and constraints, ensuring efficient land allocation and maximizing agricultural productivity.

FMNL regression estimates of factors influencing land allocation for maize, cassava, and okra crops: This section exhibits factors influencing the proportion of land share by specific crops grown in multiple cropping. Table 5 presents the regression coefficients and statistical significance for variables across three crops: Maize, Cassava, and Okra. Key findings include a significant negative effect of farmers' age on Maize land share (-0.002*), marital status on Cassava share of land area (-0.053**), and household size on Okra land share (-0.024**). Extension access positively influences all three crops' portions of land share in a mixed cropping system, with strong significance for Okra land proportion (0.570***). Credit access has a significant positive effect on all crops in terms of land occupied, particularly on Cassava and Okra land shares. Crop intensity has a significant positive effect on Cassava land proportion (0.169***) and a negative effect on Maize land fraction (-0.022***) within the mixed cropping system. The overall model is highly significant ($p<0.0000$) which indicates a goodness of fit of the model. This analysis found its relevance in the concept of land resource economics because it delved deeper into accounting for the portion of farmland occupied by individual crops within the multiple choice of crops. Overall, smallholder farmers who originally cultivate small plots of land and also maximize the use of the farm size for maximum output embark on mixed cropping. Comprehensive studies on the fraction of land needed by each crop are vital in the African arable cropping system, particularly the multiple cropping choice.

Table 3: Distribution of the respondents by cropping activities

Cropping patterns	Crop combinations	Frequency	Percentage
Maize/cassava/okro	3 crops combination	237	68.50
Maize/cassava/okro/yam	4 crops combination	74	21.38
Maize/cassava/okro/yam/cowpea	>4 crops combination	35	10.12
Mean = 3 crops combination			

Source: Field Survey Data Analysis, 2021

Table 4: Summary statistics of land allocation to food crops (maize, cassava and okra)

Food crops land allocation/share (ha)	Average values	Standard deviations	Minimum area	Maximum area
Maize land share	0.346	0.178	0.069	1
Cassava land share	0.386	0.178	0	0.889
Okro land share	0.2701121	0.1731561	0	1
Number of observation = 346				

Source: Field Survey Data Analysis, 2021

Table 5: FMNL regression estimates of factors influencing land allocation among food crops

	Maize			Cassava			Okra		
Variable	Coefficient	Standard error	z-value	Coefficient	Standard error	z-value	Coefficient	Standard error	z-value
Sex	0.0413	0.312	0.186	0.015	0.126	0.903	0.254	0.161	0.115
Age	-0.002*	0.001	0.081	0.003	0.005	0.411	0.004	0.006	0.406
Marital	-0.053**	0.027	0.030	0.193*	0.117	0.099	0.344**	0.155	0.027
Education	0.004***	0.002	0.004	-0.002	0.007	0.362	-0.002	0.009	0.806
Hholdsize	0.007	0.005	0.110	-0.001	0.005	0.673	-0.024**	0.009	0.013
Extacces	0.075**	0.033	0.021	0.322**	0.128	0.012	0.570***	0.177	0.001
Income	0.024	0.016	0.138	-0.068	0.067	0.310	-0.127	0.093	0.169
Credit account	0.002***	0.000	0.002	0.403***	0.083	0.000	0.465***	0.108	0.000
Cropinten	-0.022***	0.003	0.000	0.169***	0.017668	0.000	-0.045**	0.0202	0.025
Labinten	0.026***	0.008	0.003	0.003	0.037754	0.935	-0.065	0.0439	0.136
Number of obs	346								
Wald χ^2	271.04								
Probablity >Chi^2	0.0000								

Land share maize: Base outcome, Cropinten: Cropping intensity, Labinten: Labour intensity. Source: Field Survey Data Analysis, 2021
Statistical significance levels: ***1%, **5% and *10%

Result of multivariate regression model for determining the effect of land allocation on the output of food crops: The result of multivariate regression in Table 6 presented the number of observations, parameters, root mean square estimation (RMSE), R-squared, f-ratio, and p-value obtained from the analysis. Each of the three models was observed to be empirically significant at p = 0.000. The standard R^2 showed that all the predictor variables jointly explained 19.9, 26.8, and 15.5% of the variance in the outcome variables (maize, cassava, and okra outputs), respectively.

As occurred in the maize output (kg) model, the major finding revealed that the age of farmers, years of education, access to extension, and maize land share, as farm distance have positive coefficients and are statistically significant at different levels, which implied that a unit change in these variables leads to an equivalent change in maize output. The age of farmers is significant at 1% and directly related to the output of maize, which indicates that as the age of farmers increases, maize output increases alongside. This is possible because the older farmers have several years of farming experience; the finding corroborates many of the previous works by Mzyece *et al.*[20]. Years of education are also significant at 1% and show a positive influence on maize output; it indicates that as the years of schooling increase among the food crop farmers, the output of maize tends to increase. This suggested that educated farmers perform better in maize farming than their counterparts with no education, as the farm skills and knowledge are acquired through the learning process. In addition, access to extension services has a positive coefficient and is significant at 1%, which implies that maize output grows with more influence of extension workers on farming activities. It suggested that extension agents' activities in creating

Table 6: Multivariate regression estimates of the effect of land allocation on the output of food crops

Equation	Obs	Parms	RMSE	R^2	F-values	p-values
Ln maiz_prod	346	10	0.991535	0.1991	9.278697	0.0000
Ln cass_prod	346	10	1.328982	0.2682	13.68125	0.0000
Ln okro_prod	346	10	1.121853	0.1551	6.854011	0.0000

	Maize			Cassava			Okro		
Exp. Vars	Coefficient	Standard error	t-value	Coefficient	Standard error	t-value	Coefficient	Standard error	t-value
Constant	6.520451	0.5189	12.56	7.45188	0.6956	10.71	10.19966	0.58715	17.37
Sex	0.144740	0.1831	0.79	0.17664	0.2454	-0.72	0.040238	0.207161	0.19
Age	0.036568***	0.0064	5.72	0.016895**	0.0085	1.97	0.002979	0.007229	0.41
Marital	-0.340497**	0.1605	-2.12	-0.96250***	0.2152	-4.47	-1.11185***	0.181643	-6.12
Education	0.044456***	0.0104	4.29	0.054646***	0.0139	3.93	0.015273	0.011735	1.30
Hholdsize	-0.047521***	0.0108	-4.39	-0.018927	0.01451	-1.30	-0.011155	0.012248	-0.91
Extacces	0.358554***	0.1352	2.65	1.573036***	0.18119	8.68	0.186459	0.152949	1.22
Maize land SH	0.407562***	0.1424	2.86	-1.45751***	0.41975	-3.47	-0.320241	0.374219	-0.86
Cassava land SH	-0.11998	0.3599	-0.33	0.494518	0.482411	1.03	-1.10174***	0.407225	-2.71
Okra land	-1.141886***	0.3695	-3.09	-0.21971	0.495321	-0.44	1.175067***	0.418123	2.81
Farm dist	0.040224***	0.0131	3.07	-0.003076	0.017561	-0.18	-0.000828	0.014825	-0.06

Source: Field Survey Data Analysis, 2021 Statistical significance levels: ***1%, **5% and *10%

awareness, sharing information, and innovation on farm technologies contribute to improving maize farms in the study area. In addition, the fraction of land share maize is directly related to the output of maize and statistically significant at a 5% level. It implied that an increase in the area of land allocated to maize farms will increase maize output ceteris-paribus. This result suggested that the increased output of maize is attributed to more land shared with maize farms and cordially agrees with a prior expectation. The analysis revealed that the farm distance is also empirically determined by the output of maize. It has a positive coefficient and is significant at 1%, indicating that the output of maize tends to grow as the farm location becomes farther away from the homestead. This is expected because the nearest farmlands are marginalized and lack fertility or are prone to overuse, which might cause low output of some food crops, including maize.

However, marital status (if married), household size, and land share okro are significant but negatively influence the output of maize. In the case of marital status, it is significant at a 5% level and inversely related to maize output. It is assumed that the married farmers depend upon their production to satisfy their homes, reducing the farmers' resultant output. For household size, the coefficient is also negative and significant at 1%, indicating that an increase in household size leads to a decrease in maize output. This finding suggested that a farmer with a large family size faced high consumption. It satisfies the a priori expectation since consumption takes a large share of the household heads' resources. Land area shared by okra on individual farms is a significant variable at 1% and is indirectly related to maize output. This result implies that a unit increase in a hectare of land area allocated to other crops combined with maize crops leads to a decrease in the proportion of land occupied by maize stands and equally reduces maize output. This satisfies the a priori expectation since land is a variant farm resource.

In the cassava output (kg) model, five explanatory variables (age of farmers, marital status, years of education, access to extension, and the maize land share are experimentally significant and determine the quantity of cassava output. The age of farmers is positive and significant at a 5% level. This implied that the age of farmers and cassava output commoved in the model since the cassava output increases as the farmers grow up. It, therefore, suggested that the age of farmers complements the cassava output. Moreover, years of education have a direct relationship and are significant at a 1% level, indicating that a unit increase in years of education causes a unit increase in cassava output as well. The result aligns with the a priori expectations because the education exposes them to different farm training and innovations. Access to extension contact is also positively associated with the outcome variable and was significant at 1%; this finding showed that more access to extension services increases cassava output. The activities of extension agents are necessary to improve cassava output in the study area.

The marital status has a negative coefficient and is significant at 1%, indicating that the married ones among respondents obtained less cassava output in the end. This result is expected since the married farmers will have to reserve some cassava produce for home use, which finally depends on the output. The hectare of maize land share has an inverse relationship with cassava output and was statistically significant at a 1% level. This implies that an increase in the land share maize tends to reduce land share cassava, which causes a reduction in cassava output. Lastly, in the case of the okra output model, the result showed that marital status, land share maize, and land share okra significantly determined the quantity of okra produced. The marital status negatively influenced the output of okra and was significant at a 1% level. This implied that for a married farmer, there is the possibility of getting a reduced turnout from total production. The land share maize negatively affected the share of the farm area allocated to okra crops and was significant at 5%; this result indicated that the more the land share maize, the less the land allocated to okra, resulting in a decrease in output.

CONCLUSION

This study examined the factors influencing land share and allocation among food crops in southwest Nigeria. The predominant cropping pattern observed was a maize/cassava/vegetable (okra) mix or a general mix of food crops, practiced by 68.5% of farmers. The proportion of land allocated within mixed cropping systems was found to be quantifiable, directly affecting food crop output. The summary statistics revealed substantial variations in land allocation among food crops, indicating competition for farmland. Additionally, the study identified labor-use intensity, credit access, and extension services as key drivers of land allocation in multiple cropping systems, particularly for maize, cassava, and okra. Furthermore, the output of maize and okra was significantly influenced by the land allocated to each crop. The study concludes that land distribution among food crops is primarily determined by farmers' education, credit access, extension services, and cropping intensity. Moreover, the overall yield of individual crops is influenced by their respective land shares, the land share of co-cropped species, and extension contact. It is recommended that precise land allocation strategies for specific crop combinations be reinforced through improved farmer education, better credit access, and enhanced extension services to ensure sustainable crop growth and optimal yields.

SIGNIFICANCE STATEMENT

The empirical analysis of land share or allocation for specific food crops by smallholder farmers has significant drivers that must be known through research. By investigating the various factors influencing land allocation within crops cultivated on one plot, this study makes provision for farmers' land use manipulation as well as conservation. The findings offer valuable insights into the socioeconomics, Good Agronomic Practices (GAPs), and adequate farm precision for sustainable agricultural development. Understanding the underlying drivers behind land allocation among food crops is essential for addressing challenges related to food security, resource use management, and general agriculture under arable farming.

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