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Full Length Research Paper

Cropping system analysis of two agro ecological zones of Southwestern Nigeria

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Proper understanding of cropping system within agro ecological zone is needed if adequate agricultural development programme will be planned. Therefore, the study looked into the cropping systems practiced by farmers in Southwestern Nigeria, described the cropping system and crop combination of farmers and also described and compared the socio-economic characteristics of farmers in the agro ecological zones studied. Ogun (derived savannah zone) and Osun States (forest zone) were purposively sampled while multi-stage sampling procedure was used to select 298 farmers in both States. Structured interview schedule consisting of open and close ended questionnaire in addition to focus group discussion was used to quantify the socio-economic status of the farmers. The average age of farmers in the two agro ecological zones were 45.00 ± 3.24 and 48.00 ± 2.98 for forest and derived savannah zones respectively. The average year of formal education of the farmers were 6.00 ± 2.74 years and 7.00 ± 2.11 years for the forest and derived savannah zones respectively. Also, the average farm size of the respondents was 0.52 ± 0.17 ha and 0.47 ± 0.13 ha for forest and derived savannah zones, respectively. There was a significant difference between the farm sizes of farmers in the two agro ecological zones (P ≤ 0.01). About 43.00 and 34.00% apiece of respondents in forest and derived savannah zones practiced arable plus permanent crop farming system. Mixed cropping was the most preferred cropping system in the forest zone while mixed cropping and crop rotation were the dominant cropping systems in the derived savannah zone. The study therefore, concluded that cereal/tuber crop combination is the most practiced among farmers in the two agro ecological zones in Southwestern Nigeria which may affect the final productivity of the available land as the two crops combination depletes soil nutrient.

Key words: Farming system, cropping system, crop combination.

INTRODUCTION

Traditional cropping systems vary, since they have evolved in response to prevailing soil and climatic conditions and social and ethnological preferences (Okigbo, 1980; Kang, 1986). Traditional farmers often plant more than one crop species in a small patch of cleared and burnt land after several years of bush fallow.

Intercropping, the practice of growing two or more crops simultaneously in the same field is common throughout the tropics. Major food crops in humid tropical regions include; plantain / banana (*Musa* spp), rice (*Oryza sativa* L.), and root crops (such as cassava (*Manihot esculenta*), yam (*Dioscorea* spp), sweet potato (*Ipomea batata*) and cocoyam in the humid zone; sorghum (*Sorghum bicolor* L.) Moench), maize (*Zea mays* L.) and cowpea (*Vigna unguiculata* (L.) Walp) in the sub-humid zone; millet (*Pennisetum glaucum* (L.) R.Br and cowpea in the semi-arid zone (Okigbo, 1980; Mudahar, 1986) with little

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external input and minimum livestock integration. Consequently, farm productivity is low and the cycle of low input, low yield and low income perpetuates poverty (IITA, 1998). As a result of the traditional cropping system, crop production expands into less fertile land. The poor productivity of this system and the emergence of unsustainable farming pose the greatest threat to food security in the sub-region (Woomer et al., 2001).

Crop production systems in West Africa and Nigeria in particular, involve several different cropping patterns. Among these systems is intercropping which, according to Andrews and Kassan (1976), involves growing two or more crops simultaneously on the same field and the ways in which the crops are managed. It was noted that this form of crop production is common among subsistence farmers who practice low-input agriculture (Ntare, 1990) and those who lack land and / or capital in combination with plentiful labour (Hildebrand, 1976). Apart from ensuring greater yield stability, intercropping has been found to be beneficial in reducing damage caused by pests and diseases (Andrews, 1974).

A farming system could be defined as a population of individual and homogeneous farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate (FAO, 2001; Doppler, 2002). The main emphasis in farming systems analysis is a holistic approach, whereby household structure, gender, social networks, local institutions, information, policies, markets and all other factors as they affect the livelihood of the various homogeneous groups are brought into play. The analysis could be static, dynamic and comparative depending on the objectives of the study. The dynamic analysis is the analysis of the developments over time in each of the identified homogeneous farming groups; static is the comparison of the farming systems at a point in time while comparative analysis of the farming systems is the analysis of similarities and differences among the identified farming systems. All relies on parameters and interpretation that are supported by statistical calculations (Doppler, 2002). However, cropping system is a subset of farming system in which the available resources of the farmer is evaluated in the production of crops within a unit area of land. The resources combination in addition to the socio-economic condition of the farmer affects the final output of the farmer.

Given the wide range of climates and types of soil that exist around the globe, there are substantially different constraints to productivity from countries or site to another. Francis (1993) indicated that there are so many constraints of soil and climatological factors, and interaction among these factors make it difficult to establish the precise physical or climatical constraints for a given area without “on the ground” experience or survey. According to Francis (1993), the participation of farmers in this process can be crucial. There may be economic, political or social reasons why productivity is limited in a given situation and this reason may not be apparent to a researcher or extension specialist who is familiar only to crop and soil.

Many farmers in developing countries are struggling to produce in poor environmental conditions with few tools for coping with drought, pests, and disease. Agricultural research is needed to help these farmers reduce their risk, improve their productivity, and protect their natural resources. Therefore, a sound knowledge of the prevailing cropping systems in any agro ecological zone is pertinent to the generation of agricultural and food security policies for farming families. This ensures that innovations to be developed are suitable to meet the economic needs of the various homogeneous groups and have a high probability of being accepted by the farm families. The analysis of the cropping systems of two main agro ecological zones in Southwestern Nigeria is the focus of this study. The specific objectives of the study were to:

1. Describe and compare the socio-economic characteristics of farmers in the two agro ecological zones in the study areas and
2. Describe cropping system and crop combination in the two agro ecological zones in the study areas.

STUDY SETTING

The study was conducted in two agro-ecological regions of rain forest and derived savanna States of Southwestern Nigeria. Ogun and Osun States (Figure 1) are both agrarian States. Ogun State has extensive industrial encroachment with a population of about 2, 338,570 (NPC, 1991) and covers a land area of 16, 762 km^2. The coordinates of the state is 7°00’N 3°35’E/ 7°N 3.583°E with transitional savanna vegetation. It experiences approximately eight months (March to October) of bimodal rainfall and five months (November to March) of dry season each year with slightly irregularity in the rainfall distribution annually. Osun is an inland state with a total land area of 9, 251 km^2 and a population of 2,203,016 (NPC, 1991). The state falls within 7°30’N 4°30’E/ 7.5°N 4.5°E, and the vegetation is rainforest with some patches of Guinea savanna. It experiences approximately eight months (March to October) of bimodal rainfall and four months (November to February) of dry season each year with slightly irregularity in the rainfall distribution yearly. Weather data for Osun State was obtained from the meteorological stations of the Obafemi Awolowo University, Ile-Ife, located in the centre of Osun State while that of Ogun State was obtained from the meteorological station of the Agricultural Development Authority (ADP), a parastatal of Ogun State Government which is located within the State capital city of Abeokuta. The soil of Osun State is classified as ultisol (low base status forest soils), well drained, grayish brown to brownish red while, that of Ogun state is an underlain basement complex rock with quartz schist, coarse grained and fine grained granite and gneiss as parent material (Aiboni, 2001).

Sampling process

Ogun (derived savannah zone) and Osun States (forest zone) were purposively sampled while multi-stage sampling procedure was

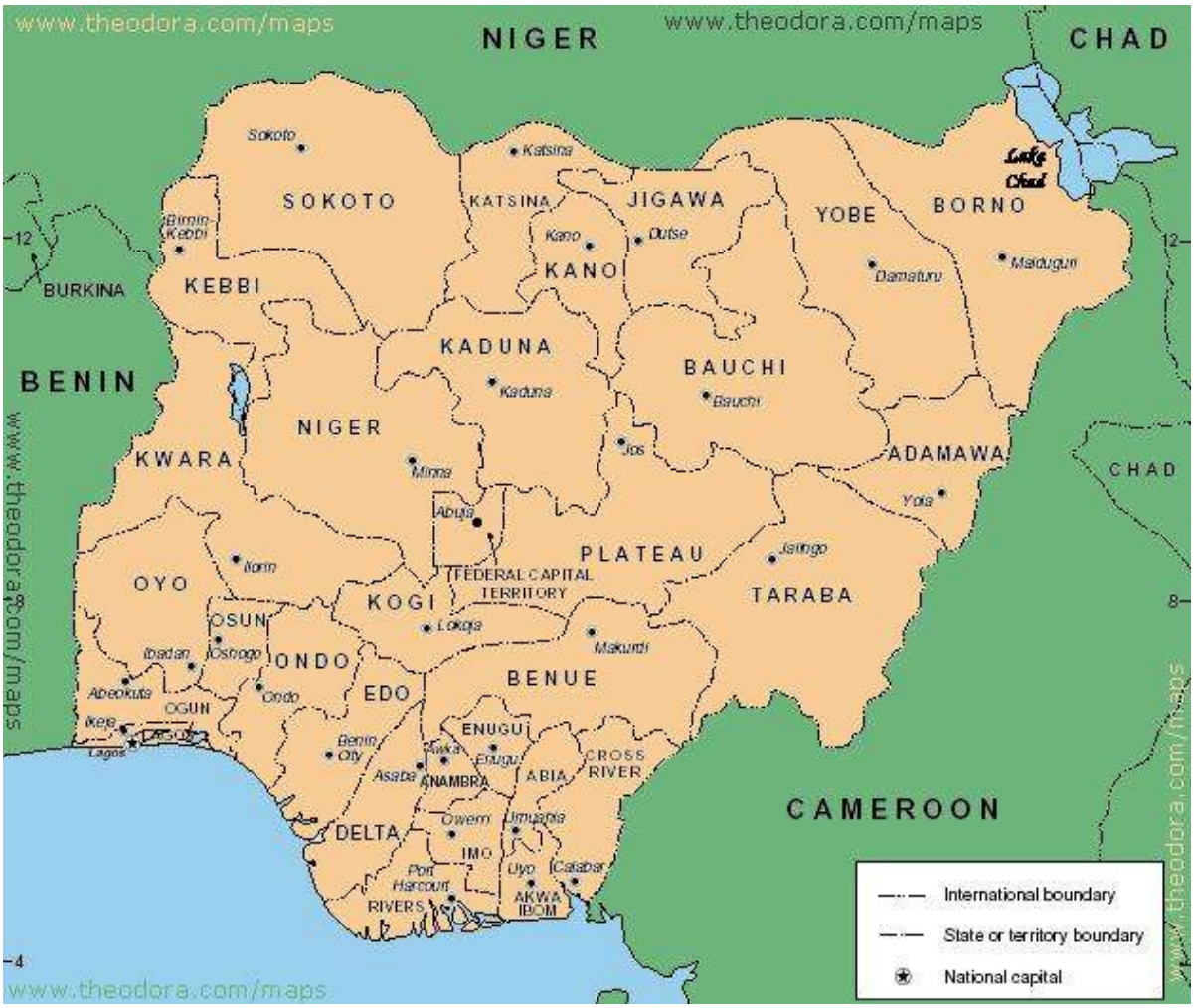

Figure 1. Map of Nigeria showing the 36 States of Nigeria. (www.theodora.com/maps 2011).

used to select 298 farmers in both states. At the first stage, five Local Government Areas were purposively selected in each state for their agro-ecological representation. At the second stage, three communities were randomly selected from each of the selected LGAs in the states respectively to give 15 communities both for the rainforest and the derived savannah agro ecological zones. At the last stage, 10 farmers from the list of the extension agent covering each of the selected communities were randomly selected to give 150 farmers for each of the zones respectively. In all, 298 (148 from the rainforest zone and 150 from the derived savannah zone) respondents were interviewed for the study within a time frame of eight weeks. A structured interview schedule consisting of open and close ended questionnaire in addition to focus group discussion was used to quantify the socio-economic statues of the farmers. Simple description statistical techniques such as frequency counts, percentages, means and standard deviation were used to analyze and summarized the data collected.

Measurement of variables

Selected socio-economic characteristics of farmers like age, years of formal education, household size, farm size in hectare and distance of farm to home/farmstead were measured by their absolute values. Furthermore, farmers were asked to supply information on the type of farming system they practice and the type of cropping system they practiced. Farmers were also asked to supply information on the crop combination planted if they were not planting by monocropping. Responses to these questions were summarized and analyzed. Data were summarized using frequency, percentage and standard deviation and a two-sample t-test was used to compare the selected socio-economic characteristics of farmers across the two agro ecological zones of the study areas.

RESULTS AND DISCUSSION

Data in Table 1 revealed the characteristics of the respondents in the two agro ecological zones of the study areas. The data revealed that the mean age of the respondents was 45.00 ± 3.24 years in the forest zone and 48.00 ± 2.98 years in the derived savannah zone. The T-test analysis also established that there is no significant difference between the ages of respondents in the two agro ecological zones in the study areas. On

Table 1. Selected socio-economic characteristics of respondents in the study area.

Characteristics	Forest zone (n = 148)		Derived savannah zone (n = 150)		
	Percentage	Mean ±SD	Percentage	Mean ±SD	t_c
Age (Years)		45.00 ±3.24		48.00 ±2.98	1.85
Literacy levels (Years)		6.00 ±2.74		7.00 ±2.11	1.12
Primary occupation (%)	60.00		78.00		
Household size (number of persons)		5.00 ±2.45		6.00 ±2.30	0.65
Farm size (ha)		0.52 ±0.17		0.47 ±0.13	2.54**
Farm distance from home/farmstead (km)		4.32 ±1.42		1.50 ±0.80	1.99**

SD = standard deviation; t_c = T-test values between respondents in the forest zone and the derived savannah agroecosystem of South-western Nigeria; ** = Significant at 0.01 level, n = number of respondents.

literacy, the average years of formal education was 6.00 ± 2.74 years for respondents in the forest zone and 7.00 ± 2.11 years for respondents in the derived savannah zone. Further analysis also showed that there exists no significant difference among the years of formal education of the respondents in the two zones as seen in the result of the T-test conducted. About 60.00% of the respondents in the forest zone had agriculture as their primary occupation while 78.00% of the respondents in the derived savannah zone had agriculture as their primary occupation. The average household size of the respondents in the forest zone is 5.00 (± 2.45) people and 6.00 (± 2.30) in the derived savannah zone. The T-test conducted showed no significant difference in the average household size of the respondents in the two agro ecological zones in the study areas. The average household size in the two zones were in tandem to the stand of Ekong (2011) who established that average household size in Southwestern Nigeria is 6 people.

Significant differences were found in farm size between the two agro ecological zones ($p < 0.01$). The average farm size (ha) of the respondents in the forest zone is 0.52 ± 0.17 and 0.47 ± 0.13 in the derived savannah zone. Farm distance from home/farmstead also showed a significant different ($P< 0.01$) across the two agro ecological zones. The average farm distance from home/farmstead of respondents in the forest zone was 4.32 ± 1.42 km while that of derived savanna was 4.32 (± 0.80). It could be deduced that farmers in the derived savannah zone are closer to their farms compared to their counterparts in the forest zone in the study areas. There may be likelihood of the concept of urbanization which is more prominent in the forest zone. The settlements in the area are more of urban set up compare to the savanna that are scattered and dispersed (Morgan and Moss, 1965). Blench and Dendo (1994) also found that the expansion and invasion of the fulbe pastorals to the sub-humid and humid conditions of the Southwestern Nigeria might have contributed to the type of cluster and small settlements which existed in the zone.

The farm sizes of the respondents in the two agro ecological zones (Table 2) revealed that about 39.00% of the respondents in the forest zone had 0.51 to 1.00 ha of farmland while 43.00% of the respondents in the derived savannah zone had 0.51 to 1.00 ha of farmland. Also from the table, 21.00% (forest zone) and 22.00% (derived savannah zone) of the respondents had about 0.01 to 0.50 ha of farmland in the study area. About 18.00% of the respondents in the forest zone had 1.01 to 1.50 ha of farmland while 19.00% had 1.01 to 1.50 ha in the derived savannah zone study area. Only 10.00 and 5.00% of the respondents in forest zone and derived savannah zones, respectively, had above 2.01 ha of farmland in the study area. The average of the farmland in hectare of the respondents in the two agro-ecological zones was given as 0.52 and 0.47 for forest and derived savannah zones, respectively. This difference is statistically significant ($p < 0.01$) as seen from the Table 1.

Data in Table 3 showed the different farming systems in the two agro-ecological zones of the study areas. The table showed that the farming systems showed a similar pattern with little variations in the two agro-ecological zones. From the results, 43.00% of the respondents in the forest zone practice arable plus permanent cropping while 34.00% in the derived savannah zone practice arable plus permanent cropping. Also, 22.00 and 25.00% of the respondents in forest and derived savannah zones, respectively, practice arable cropping only while 12.00 and 13.00% of the respondents in forest and derived savannah zones, respectively, practice livestock plus arable plus permanent cropping in the study area.

Livestock plus arable cropping is another major farming system adopted in the derived savannah zone with about 18.00% of the respondents practicing it while the other major cropping system in the forest zone is permanent cropping only with about 10.00% of the respondents involved in it. The study therefore, further confirmed the earlier findings of Blench and Dendo (1994) concerning the intrusion of the fulbre pastorals in the zone hence, the pockets of variations in farming systems in the two agro ecological zones studied although, it could not establish whether these changes is due to the variation in ecology alone or whether it is also been influenced by other factors.

Data in Table 4 revealed the farm size and the cropping system of the respondents in the two agro-ecological

Table 2. Respondents farm size (ha) in the agro ecological zones in the study area.

Farm size (ha)	Forest zone		Derived savannah zone	
	Frequency	Percentage	Frequency	Percentage
0.01 - 0.50	32.0	21.00	34.0	22.00
0.51 – 1.00	57.0	39.00	65.0	43.00
1.01 – 1.50	27.0	18.00	28.0	19.00
1.51 – 2.00	18.0	12.00	15.0	10.00
Above 2.01	14.0	10.00	8.0	5.00
Total	148	100	150	100

Field survey.

Table 3. Respondents farming system in the agro ecological zones in the study area.

Farm size (ha)	Forest zone		Derived savannah zone	
	Frequency	Percentage	Frequency	Percentage
Arable cropping only	33.0	22.0	38.0	25.0
Permanent cropping only	15.0	10.0	5.0	3.0
Arable + Permanent cropping	64.0	43.0	50.0	34.0
Livestock only	5.0	4.0	10.0	7.0
Livestock + Arable	14.0	9.0	27.0	18.0
Livestock + Arable + Permanent	17.0	12.0	20.0	13.0
Total	148	100	150	100

Field survey.

Table 4. Average arable farm size and the cropping system of the respondents*.

Farm size (ha)	Forest zone (%)				Derived savannah Zone (%)			
	Sole cropping	Mixed cropping	Crop rotation	Shifting cultivation	Sole cropping	Mixed cropping	Crop rotation	Shifting cultivation
0.01 - 0.50	9	56	20	15	10	50	22	18
0.51 – 1.00	8	57	25	9	15	48	33	4
1.01 – 1.50	20	45	24	11	24	36	38	2
1.51 – 2.00	19	50	28	3	30	25	36	9
Above 2.01	22	40	31	7	32	24	35	8

Respondents in percentage.

zones. A pattern was discovered in the forest zone irrespective of the farm size, mixed cropping was mostly practiced by the respondents. The mixed cropping and crop rotation was the prominent cropping systems among respondents in the derived savannah zone. It was found that the respondents in the derived savannah zone practiced crop rotation cropping system. This revealed that while a single cropping system (mixed cropping) dominated the landscape in the forest zone, two (crop rotation and mixed cropping) cropping systems held sway in the derived savannah zone.

Data in Table 5 revealed the arable farm size and the proportion crop combination of respondents in the two agro ecological zones in the study area. Across the different farm sizes in hectare in the two zones, cereals/tuber crops combination is the most practiced by the farmers. This could be seen as 63.00 and 65.00% (0.01 to 0.50 ha), 67.00 and 62.00% (0.51 to 1.00 ha), 70.00 and 63.00% (1.01 to 1.50 ha), 68.00 and 70.00% (1.51 to 2.00 ha) and 71.00 and 70.00% (above 2.01 ha) in the two zones respectively plant cereal/tuber crops combination. This could be explained to mean that irrespective of the agro-ecological zone and the farm size cultivated in the study area, cereal/tuber crops combination is the most important option among the arable crop farmers. This finding from the crop combination of the arable farmers in both agro-ecological zones also revealed the state of things in Southwestern Nigeria about the cultivation of legumes which could actually reduce the rate of nutrient loss in the soil by fixing nitrogen in the soil. It then means that serious effort should be made in encouraging farmers in the two agro

Table 5. Average arable farm size and proportion crop combination of percentage respondents.

Farm size (ha)	Forest zone (%)					Derived savannah zone (%)		
	Cereal/cereal crops	Cereal/legumes crops	Cereal/tubers crops	Legume/tuber crops	Cereal/cereal crops	Cereal/legumes crops	Cereal/tubers crops	Legume/tuber crops
0.01- 0.50	6	18	63	13	10	10	65	15
0.51– 1.00	8	13	67	12	12	12	62	14
1.01– 1.50	5	15	70	10	12	19	63	6
1.51– 2.00	7	15	68	10	10	14	70	6
Above 2.01	9	12	71	8	5	15	70	5

Field survey.

ecological zones to plant legumes both for economic reason and that of soil improvement.

CONCLUSION AND RECOMMENDATION

The study concluded that the socio-economic characteristics of the farmers in the two agro ecological zones were invariably similar except for significant difference in their farm sizes and the distance from their farm to home or farmstead. Also, the study revealed that 39.00 and 43.00% of the respondents in forest and derived savannah agro ecological zones respectively had 0.5 to 1.00 ha farmland. This established that small land holding is still prevalent in the rural areas of Southwestern Nigeria irrespective of the agro ecological zone. Lastly, cereal/tuber crop combination is the preferred crop combination by farmers in the two agro-ecological zones. This showed that despite the changes in ecology of the areas, the same cultural background shared actually influence the choice of crop combination of farmers. The study therefore, recommends that agricultural development programme compatible with farmers farming system, cropping system and crop combination should be planned to improve the standard of living of the rural people. Also, information needed to correct the wrong practices or crop combination should be given to the farmers so as to maximize agricultural productivity.

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