PrOpCom

Making Nigerian Agricultural Markets Work for the Poor

Monograph Series # 15

Mapping of Ofada Rice Production Area

By

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MAPPING OF OFADA RICE PRODUCTION AREAS

BY

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REPORT OF A STUDY COMMISSIONED BY

PropCom

40 Mississippi St., Maitama, Abuja, Nigeria

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List of Acronyms

ADPs	Agricultural Development programmes
AMREC	Agricultural Media Resources and Extension Centre
GIS	Geographical Information Systems
GPS	Global positioning Systems
TOR	Terms of Reference
LGA	Local Government Area
FAO	Food and Agricultural Organisation
PropCom	Promoting pro-poor opportunities in the service and commodity market
FGD	Focus Group Discussion
FORMECU	Forestry Monitoring, Evaluation and Coordinating Unit
LANDSAT	Land Satellite

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EXECUTIVE SUMMARY

PropCom's proposition to support activities that impact on the Ofada rice value chain requires accurate information to develop appropriate interventions. Mapping of the Ofada rice value chain is important in obtaining the kind of information required. The mapping exercise could facilitate geographical targeting of interventions where they are needed, improve cost effectiveness of infrastructural development spending and more efficiently reach those who need intervention most. These no doubt are some of the cogent reasons for PropCom's commissioning of this study.

The terms of reference of the mapping exercise as specified by PropCom are to:

- Identify the major areas of production of paddy that is used for Ofada rice broken down by aromatic and non-aromatic use.
- Map the flow of Ofada rice from paddy production, soaking, parboiling and milling
- determine the estimated quantity (in metric tons) that flow through these various channels linking the major markets that sell Ofada rice to traders, re-packagers and consumers and linked back to the major sources of products be it field paddy, par-boiled paddy or milled rice.
- Establish a directory of clusters of major sources of commercial field paddy, par-boiled paddy and milled Ofada rice, both aromatic and non-aromatic; for use as public information to help in integration of the value chain and as a means to lower transaction costs.

In addition to the terms of reference specified by PropCom, the research team added the following objectives:

- Determine the distances of rice production areas from input sources, parboiling points, threshing points, milling points and marketing or repackaging points.
- Empirically determine the land area currently devoted to Ofada rice production and the potentials for expansion
- Characterize and classify the land resources in each of the three States for upland and lowland rice production considering such parameters as soil textural class, available Nitrogen, soil depth, Soil pH and water.

The mapping exercise was preceded by selection and training of field supervisors and enumerators on spatial data acquisition using hand held Global Positioning Systems (GPS) and how to conduct focus group discussion. They were then deployed to the three states to recruit and train field workers on spatial data acquisition for the mapping exercise. The mapping focused on attributes of locations, production, value addition facilities, groups of rice farmers, par biolers, and millers in each village.

The mapping exercise identified major Ofada rice production areas in Ogun, Osun and Ekiti States. It identified 254 Ofada rice farmers majority of whom are males, 204 parboilers mostly females, 36 rice mills in 55 villages and 11 local government areas in the three states.

Obafemi Owode local government area of Ogun State produced the highest quantity of Ofada rice (135,850 KG) in the study area. This was closely followed by Irepodun/Ifelodun Local government area of Ekiti (134,90KG). These two local government areas host Ofada village and Igbemo Ekiti respectively where there is a long tradition of rice production. The next highest producer is Oriade local

government area in Osun State which recorded a production level of 70,100 KG. The highest quantity of rice parboiled and milled was 109,800 Kg and this is from Obafem Owode Local government area. The lowest quantity parboiled and milled was 7, 670 Kg and this is from Ijero local government area of Ekiti State. The quantity of Ofada rice sold in paddy form was 21,110 Kg in Ogun Waterside local government area of Ogun State and 15,700 Kg in Ekiti West Local government area of Ekiti State. The total quantity of rice sold in paddy form was 36, 813Kg.

The distance analyses data consistently show that facilities for rice threshing, parboiling, milling, were readily available at local levels and within a short distance (between 2 and 4 kilometres) of the farmers' farm or residence. Although urban markets may appear to be very far away from rice production locations according to the distance analysis data, farmers did not seem to have problems selling their paddy or milled rice as buyers came directly to these locations to buy. The data further show that locations of Ofada rice production inputs such as seeds, agrochemicals and fertilizer were far away from farmers' field and residence (between 5 and 30 kilometres) and may not be readily available to the majority of rice farmers. This situation points to the need for direct intervention to improve access of farmers to all rice production inputs.

The total arable crop land in rice production areas of Ekiti state is 100,524.411Ha. This represents about 84 percent of the total arable land area in the four local governments where rice is produced. Less than 10 percent of this is currently under rice cultivation. In Osun state, Oriade local government area identified as the rice production area has 47,710Ha (79%) arable land. In Ogun state apart from 67% (337,180Ha) of land available as arable land with possibility for upland rice cultivation, about 625,62Ha or (12.5%) of the land area was categorised as wetland. This area could be explored for lowland rice cultivation within the five local government areas studied.

It was established that the soils around Aramoko, Ijero Ekiti up to Ifaki were highly suitable for upland rice cultivation while the soils around Ado-Ekiti, Iyin Ekiti, Igede Ekiti and Igbemo are marginally suitable. The soils around Efon Alaye, and Oke Imesi were classified as moderately suitable. The implication of this is that rice farmers in Igbemo Ekiti would require special attention in soil management and land amendment practices to guarantee steady and improved productivity. In Osun state soils close to Ilesha, particularly Erin Oke was classified as highly suitable, but over 79% of the arable land are categorised as marginal. Ogun state presents a unique feature especially around Obafemi Owode local government where almost 50% of the arable soil is considered as highly suitable for the cultivation of upland rice. This is a bit surprising given the long years of rice cultivation in the area one would expect the soil to be generally deficient in critical rice soil nutrients. It could be that most farmers in this area who adopt the well known use of rotational fallow system have somehow perfected this form of land management strategy for ensuring quick replenishment of lost soil nutrients

Ijebu North Local government area presents a slightly different picture. One half of the area is categorised as marginally suitable while the other half is classified as moderately suitable. Soils of Ijebu water-side are mostly deficient in nitrogen and phosphorus. The focus in this area should be development of lowland rice production.

In conclusion, the distance analysis maps reveal the importance of spatial targeting and prioritization of interventions. It is hoped that this result will be utilized by PropCom in developing, prioritizing and targeting interventions to positively impact the Ofada rice value chain in south western Nigeria**.**

A number of issues related to the Ofada rice value chain require further research and analysis. This mapping exercise was carried out when there was no crop growing on the field. A more detailed mapping of the production system with empirical farm management data would reveal more comprehensively the problems associated with each stage of the Ofada rice production system.

MAPPING OF OFADA RICE PRODUCTION AREAS

INTRODUCTION

Rice (*Oryza sativa L.*) which was once considered a special treat during festivals in most homes in Nigeria has assumed the position of one of the most important staple foods in recent years. While domestic production of the commodity estimated at 4.6 metric tonnes has not kept pace with the increasing demand, the country has had to resort to massive importation over the years. The domestic production levels remained either stagnant or even depressed in some cases due to crude and back breaking methods still employed by most producers, weak infrastructural base, high production costs and numerous market imperfections.

Ofada rice is commonly assumed to be a type of rice that has long been cultivated and produced in a community called Ofada in Ogun State. Its rise to eminence as a popular type of rice is associated with what has been described as its characteristic bold, short, mouth-filling, palate caressing, red coated karnel in its unpolished form. Although many varieties of rice produced locally fit the description of Ofada rice, each type comes with different kinds of local names associated with either the communities where such varieties are produced or the original source of the variety. For instance some local rice called Igbemo rice, Kogi rice, etc fit the Ofada rice description. The term Ofada rice therefore refers generically to mean any locally produced rice that fits the description profiled above irrespective of where the rice is produced in the three states where this study was carried out.

As noted in one of PropCom's documents, Ofada rice has recently become popular as specialty rice often served at parties and other status events by the elites; sold in fast food restaurants, and also in ½ kg boxes by marketers in Lagos, Ibadan Abeokuta and other cities in the South West with spread effects to other parts of the country. The proposition by PropCom to support activities that impact on the entire Ofada rice value chain is a step in the right direction. However information is required to support decision making and develop appropriate interventions. Mapping of the Ofada rice value chain is important in developing a decision support mechanism for the overall improvement of the rice production system. Mapping will facilitate geographical targeting of interventions where they are needed, improve cost effectiveness of infrastructural development spending and more efficiently reach those who need intervention most.

The terms of reference of the mapping exercise as specified by PropCom are to:

- Identify the major areas of production of paddy that is used for Ofada rice broken down by aromatic and non-aromatic use.
- Map the flow of Ofada rice from paddy production, soaking, parboiling and milling
- determine the estimated quantity (in metric tons) that flow through these various channels linking the major markets that sell Ofada rice to traders, re-packagers and consumers and linked back to the major sources of products be it field paddy, par-boiled paddy or milled rice.

- Establish a directory of clusters of major sources of commercial field paddy, par-boiled paddy and milled Ofada rice, both aromatic and non-aromatic; for use as public information to help in integration of the value chain and as a means to lower transaction costs.

In addition to the terms of reference specified by PropCom, the research team added the following objectives:

- Determine the distances of rice production areas from input sources, parboiling points, threshing points, milling points and marketing or repackaging points.
- Empirically determine the land area currently devoted to Ofada rice production and the potentials for expansion
- Characterize and classify the land resources in each of the three States for upland and lowland rice production considering such parameters as soil textural class, available Nitrogen, soil depth, Soil pH and water.

Study Area

The mapping exercise covered Ofada rice production communities in the five (5) rice production areas of Ogun state, namely, Obafemi Owode, Abeokuta North, Ogun Water side, Ifo, Ewekoro and Ijebu-North Local government areas. Also included are the rice production clusters of Igbemo, Ijero, Aramoko, Efon Alaye Afawo, Are, Erio all in Ekiti State and Erin-Ijesha and Erin -Oke in Osun State.

Sampling method

A combination of purposive and multi-stage random sampling procedure was used in selecting the sample for this study. States were selected purposively based on the terms of reference provided by PropCom. The Local government areas were also selected purposively based on the terms of reference and the local governments identified by the State ADP for rice cultivation. Villages and farmers in the local government areas were selected based on the proportional volume of rice production activities. In some communities and villages, complete enumeration of rice farmers, parboilers, and millers were carried out depending on the number of such people in each community or village.

Mapping Methodologies

The mapping exercise was preceded by selection and training of field supervisors or enumerators on the use of Global Positioning Systems (GPS) and how to conduct focus group discussion. Field supervisors were then deployed to the three states to recruit and train field workers on the use of GPS in the acquisition of spatial data for the mapping exercise and on how to conduct focus group discussions. The focus group discussions involved groups of rice farmers, parbiolers, and millers in each village and it centred on types and varieties of rice cultivated, farm size, length of period of rice cultivation, paddy yield, quantities of paddy sold as paddy, quantity milled, etc.

The following spatial variables were used for the mapping exercise:

Variable	**Source**
Distance to and from production and value addition facilities	GPS coordinates
Empirical farm size	GPS coordinates of farm perimeter

Soil Fertility/characterization of land resources	Soil samples analyzed + FAO Digital Soil Map of the World
Land use/Land cover	Geomatics of Canada
Ofada rice paddy production sites	GPS coordinates
Ofada rice milling and per boiling sites	GPS coordinates
Quantity of Ofada rice through value chain	Fieldwork data
Directory of commercial paddy/milled rice	Fieldwork data

Creating the GIS maps

Trained enumerators obtained the coordinates of locations needed for creating the maps using high precision GPS receivers (Garmin 12+, Garmin Etrex and Megalin receivers). The coordinates were incorporated into geo-referenced map of the study areas. Location of farms, markets, roads, and value addition infrastructure were incorporated into the maps. These data, including the geographic location of farmers' residence and farms form the farmers' GIS directory. Other data considered useful for spatial analysis were also collected. The full attributes of the area were captured through observation, Focus Group Discussion FGD, key informant interviews, discussion with rice growers association in each State and secondary sources.

Soil samples were collected from the top (15cm from the top) and sub-soil (Beyond 15cm from the top) of selected sample of farms in each local government area and the geographical coordinates of points where soil samples were collected was obtained.

The attributes were then put into a relational database in a Geographical Information System (GIS). Spatial data were analysed using Arc view 3.2a

Additional data acquisition

Additional data were obtained from secondary sources such as Satellite remote sensing data, Topographical map sheets, census/farm household list of the Agricultural Development Programmes.(ADPs). Socioeconomic and production data were analyzed using descriptive statistics.

Results and discussion

Socioeconomic characteristics and profile of the Ofada rice production system

A total of 254 farmers, 204 parboilers, 36 rice mills, were contacted in 55 villages and 11 local government areas in the three states where Ofada rice is produced in south western Nigeria. These data are presented in Table 1 below. Figure 1 is the map of the study area showing clusters of Ofada rice production areas in Ogun Osun and Ekiti States.

Table 2 shows the socio-economic characteristics of Ofada rice farmers. The data show that over 70percent of the farmers are below the age of fifty years. This is an indication that most of them are in their very active years. This age structure is not typical of the farming populace in Nigeria as many previous studies indicate that most farmers are over fifty years. Table 2 shows that many other varieties of rice other than Ofada were cultivated in the rice production areas in south western Nigeria. Even in Ogun State where Ofada rice is very popular and is the dominant variety in some local government areas, some local varieties of rice such as Mokwa, Igbemo with similar characteristics to that of Ofada were cultivated.

The data in Table 3 also show that over 78 percent of Ofada rice farmers are men while the remaining 22 percent are women. Most of the farmers are small scale producers as over 80 percent of them cultivated less than 1 hectare.

This issue of farm size was explored empirically by taking GPS perimeter coordinates of a random sample of at least ten farms in each local government area. This was done to obtain the actual size of the farm using GIS area measurement menu in ArcView 3.2a. The average farm size across the three States was 3.95 Ha from what farmers reported, while the average farm size from empirical measurement was 0.72 Ha. There was very low correlation between what the farmer reported and the results obtained from empirical measurement. This is depicted in Figure 3.

Only a small proportion (4%) of the farmers used mechanized land preparation. The data in Table 3 also indicate very low external input in the Ofada rice production system as less than 20 percent of the farmers used fertilizers, improved seeds and all the farmers threshed their rice manually. Most (68%) Ofada rice farmers sourced their seeds from their previous harvests.

A prominent deficiency in the Ofada rice production system is the lack of commercial seed production. Farmers convert part of their grains to seed year after year. This may be partly responsible for the characteristic low yield associated with Ofada rice.

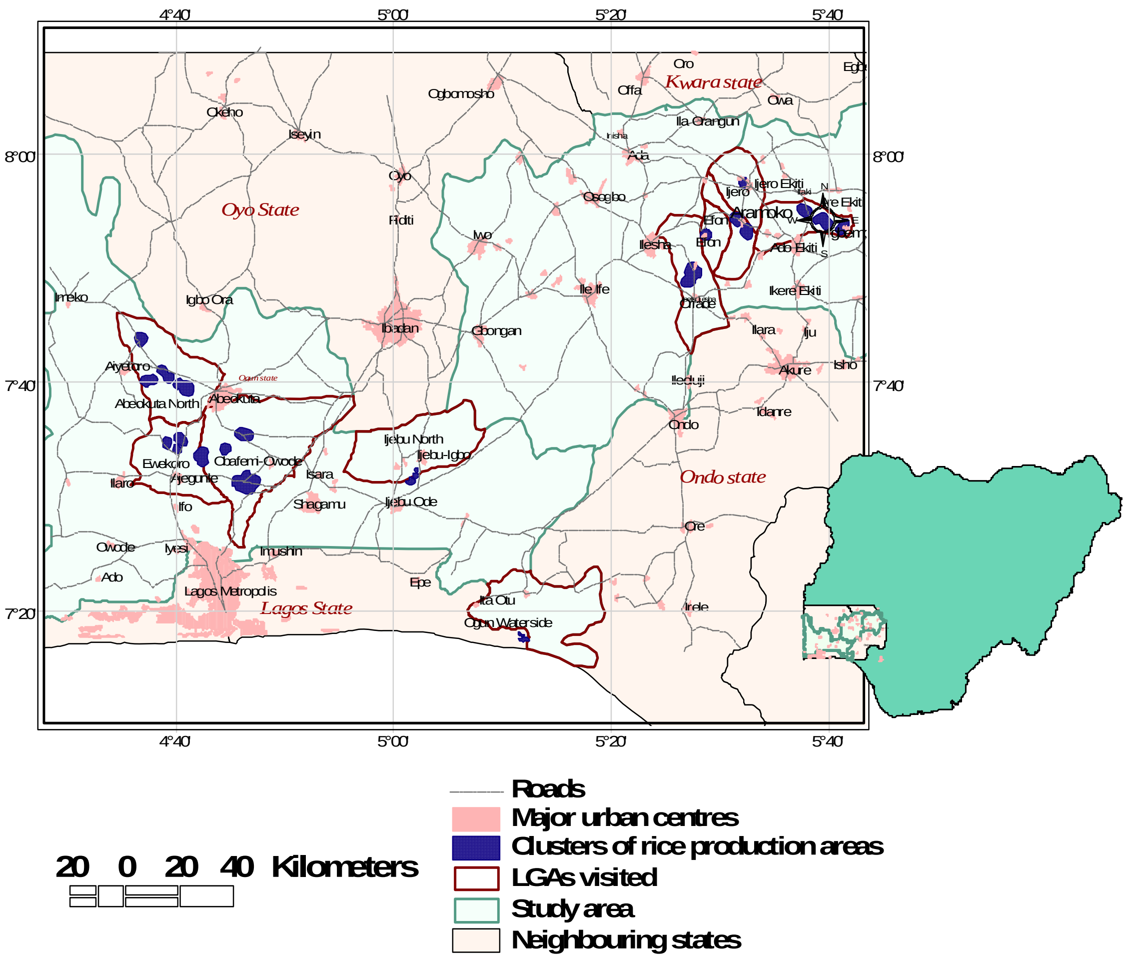


Fig 1: Map of the study area showing Ofada rice production clusters (Inset map of Nigeria)

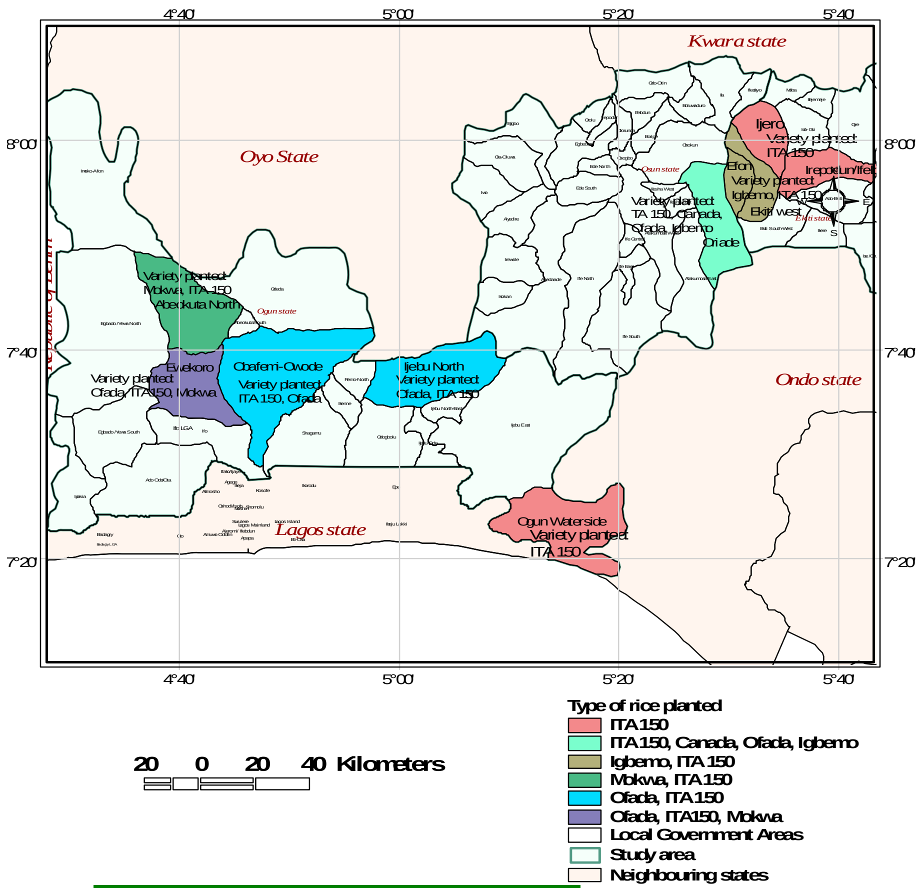
Table 1: Production data in the Ofada rice value chain

	No of Farmers	No of Parboilers	No of Rice Mills	Total Farm Area (Ha)	Qty per Cluster	Qty per LGA	Qty per State
Osun State							
Oriade LGA	26	26	12	64	70100	70100	70100
Ogun							
Abeokuta North	28	17	0	55.53	47700	47700	
Ewekoro	15	15	5	17.2	40000	40000	
Ijebu North	15	12	1	46.9	25350	25350	
Ogun Water side	15	16	4	27.3	11425	11425	
Obafemi Owode	42	40	4	325.9	140750	140750	265225
Ekiti							
Ijero Ekiti	15	15	1	8.2	11800	11800	
Ekiti West	34	11	3	16.6	22400	22400	
Irepodun/Ifelodun	53	41	3	109.1	17100	17100	
Efon –Alaaye	11	11	3	13	1700	1700	53000
Total	254	204	36	683.73	388325	388325	388325

State L.G.As Clusters Varieties planted

Table 2: Location of clusters of rice farms and varieties cultivated

Ekiti	Efon –Alaye	Efon –Alaye	Igbemo, Ofada, ITA 150
	Ijero	Ijero-Ekiti	Igbemo, Ofada, ITA 150
	Irepodun/Ifelodun	Afao	Igbemo, Ofada, ITA 150
		Are	Igbemo, ,ITA 150
		Igbemo	Igbemo, ITA 150
		Iworoko	Igbemo, ITA 150
	Ekiti west	Erio	Igbemo, ITA 150
		Aramoko	Igbemo, , ITA 150
Osun	Oriade	Erinoke/Erin Ijesha	ITA150,Canada,Ofada,Igbemo
Ogun	Abeokuta north	Alamala Baracks	ITA150, Mokwa
		Ijale papa	ITA150, Mokwa
		Anigbado	ITA150, Mokwa
		Tibo-Akungun	ITA150, Mokwa
	Ewekoro	Onibotuje	
		Adekunle-Sigo road	
		Mosan	
		Egan	
	Ijebu North	Aparaki	
		Imope	
		Odosapo	
	Obafemi owode	Ogboloko	Ofada, ITA 150,
		Ofada-Abaren	
		Moloku Asipa	
	Ogun waterside	Odeomi	
		Lago Island	
		Mufere island	



LGA	VARIETY PLANTED
Ijero	ITA 150
Ekiti West	Igbemo, ITA 150
Efon	Igbemo, ITA 150
Irepodun/Ifelodun	ITA 150
Oriade	ITA 150, Canada, Ofada, Igbemo
Abeokuta North	Mokwa, ITA 150
Obafemi-Owode	ITA 150
Ijebu North	Ofada, ITA 150
Ewekoro	Ofada, ITA150, Mokwa
Ogun Waterside	ITA 150

Fig 2: Map showing Ofada rice production clusters and the varieties of rice cultivated

Table 3: Socioeconomic characteristics of Ofada rice farmers

VARIABLE	FREQUENCY	PERCENTAGE
Age		
<30	27	13.7
31-40	62	31.5
41-50	52	26.4
51-60	43	21.8
>60	13	6.6
Total	**197**	**100**
Sex		
Female	42	21.3
Male	155	78.7
Total	**197**	**100**
Marital Status		
Married	184	93.4
Single	13	6.6
Total	**197**	**100**
Household size		
1-5	59	29.9
6-10	126	64.0
>10	12	6.1
Total	**197**	**100**
Farm size		
<2.5	162	82.2
2.6-5.0	32	16.2
>5.0	3	1.5
Total	**197**	**100**
Method of Land Preparation		
Manual & Mechanized	1	0.5
Manual	188	95.4
Mechanized	8	4.1
Total	**197**	**100**
Fertilizer usage		
No	157	79.9
Yes	40	20.3
Total	**197**	**100**
Weeding Interval		
Once	25	12.7
Twice	120	60.9
More than twice	52	26.4
Total	**197**	**100**
Sources of seeds		
Agro services	35	17.8
Previous harvest	134	68.0
Fellow farmers	27	13.7
Open market	1	0.5
Total	197	100

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VARIABLE	FREQUENCY	PERCENTAGE
Marketed rice form		
Milled form	171	86.8
Paddy form	26	13.2
Total	**197**	**100**
Type of thresher		
Manual	197	100

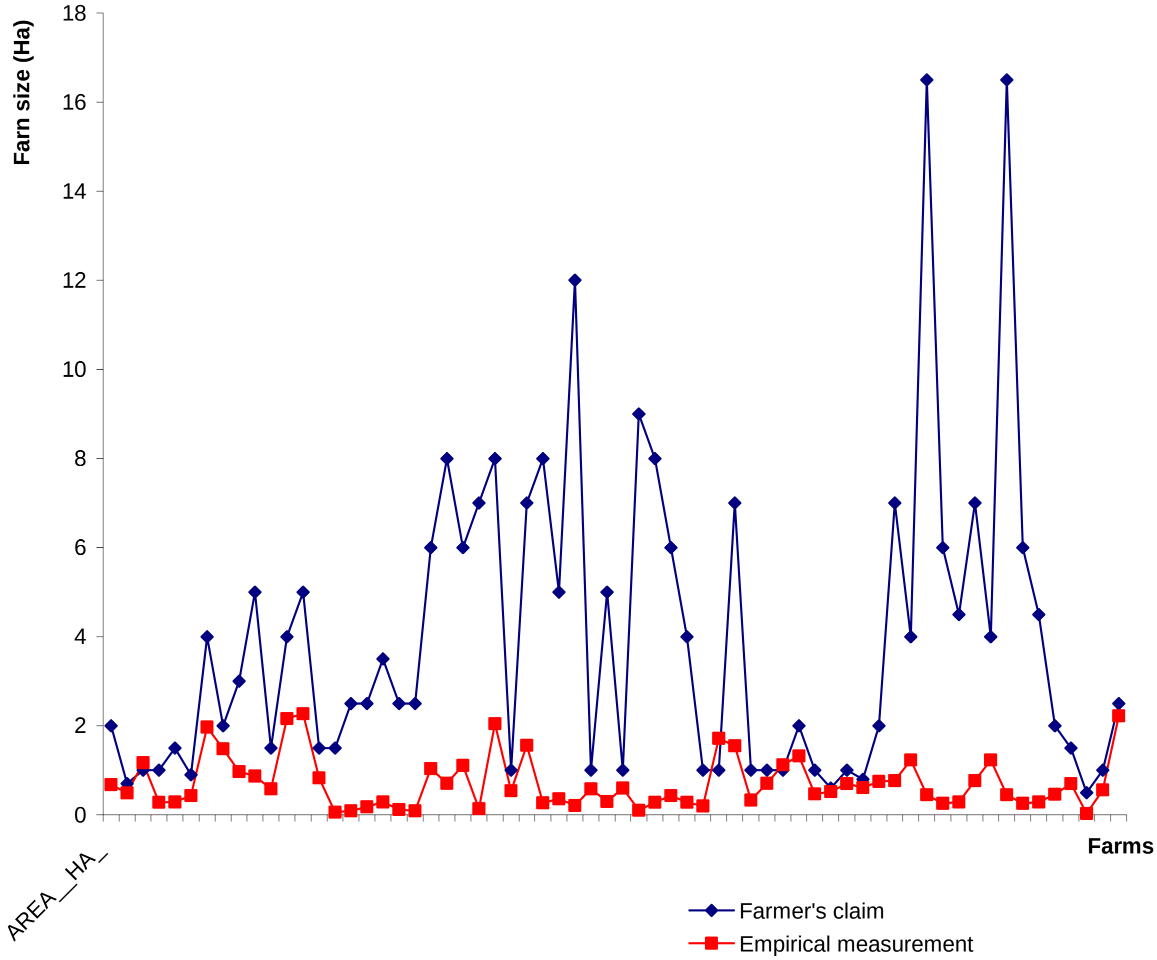


Fig. 3: Chart showing comparison between farmer's claim and empirical farm size

Table 4: Proportion of flow of Ofada rice through production and processing points in the three States

State	Local Government Areas	Quantity produced (kg)	Quantity soaked (kg)	Quantity parboiled (kg)	Quantity sold as paddy (kg)	Quantity milled (kg)	Quantity of whole grain rice recovered (kg)
Ekiti	Ijero	11800.00	0.00	7670.00	0.00	7670.00	4985.50
Ekiti	Ekiti West	45900.00	0.00	29835.00	15700.00	29835.00	19392.75
Ekiti	Efon –Alaye	17000.00	0.00	17000.00	0.00	15550.00	11070.50
Ekiti	Irepodun/Ifelodun	134900.00	0.00	87685.00	0.00	87685.00	56995.25
Osun	Oriade	70100.00	64100.00	64100.00	0.00	64100.00	41665.00
Ogun	Abeokuta North	41250.00	0.00	36260.00	0.00	36260.00	23569.00
Ogun	Obafemi-Owode	135850.00	0.00	109850.00	0.00	109850.00	71402.50
Ogun	Ijebu North	42000.00	0.00	42000.00	0.00	42000.00	27300.00
Ogun	Ewekoro	40000.00	0.00	24708.00	0.00	24708.00	16060.53
Ogun	Ogun Waterside	31710.00	0.00	9004.00	21113.00	9004.00	5852.60
							277330.3

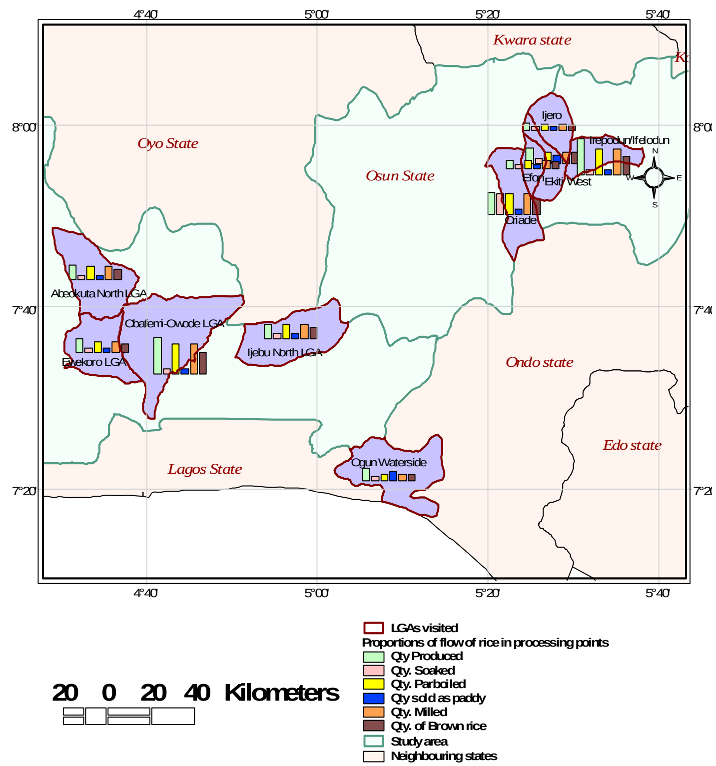
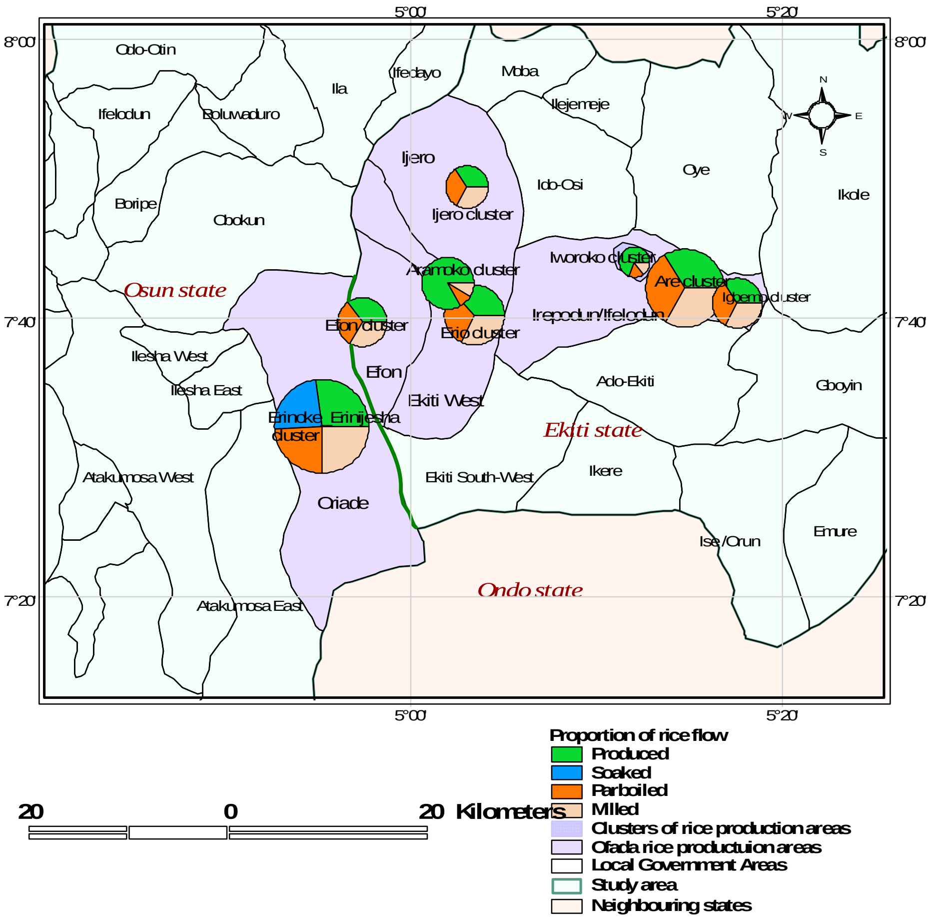
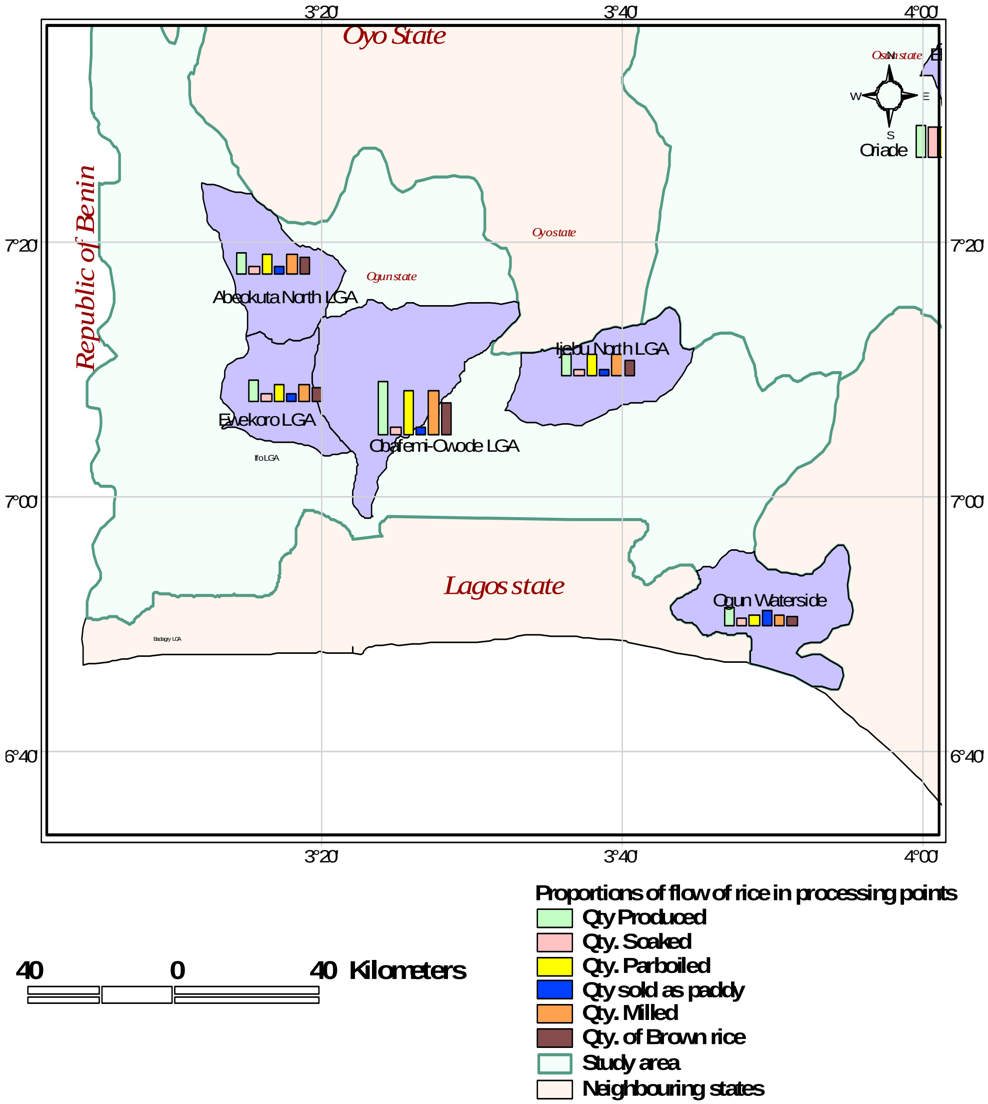


FIG. 4: Map showing proportion of flow of rice through production and processing points in the three States



Local Government Areas	Quantity produced (kg)	Quantity soaked (kg)	Quantity parboiled (kg)	Quantity milled (kg)
Ijero	11800		7670	7670
Ekiti West	45900		29835	29835
Efon - Alaye	17000		17000	15550
Irepodun/ Ifelodun	134900		87685	87685
Oriade/ Osun State	70100	64100	64100	64100

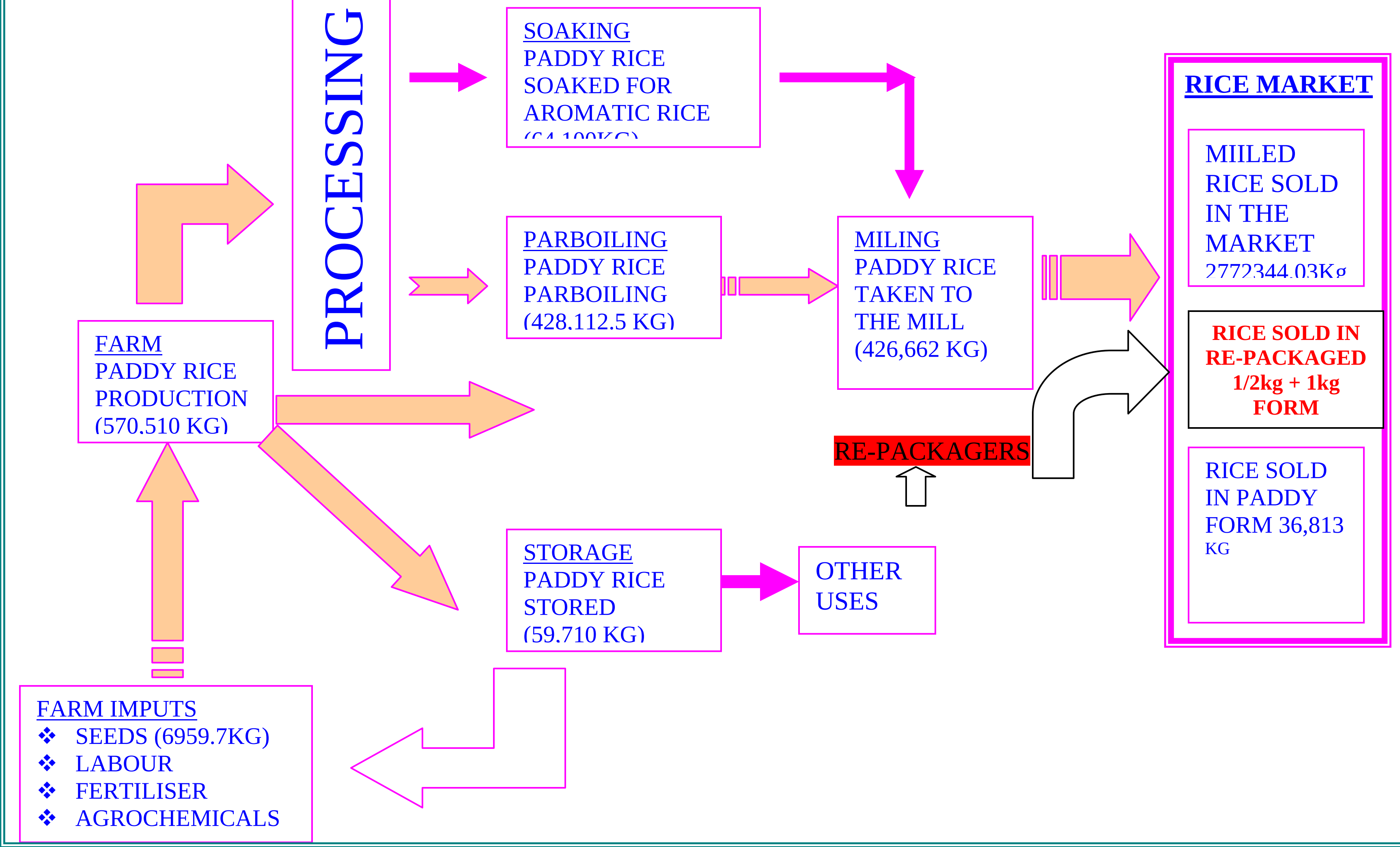
Fig 5: Map showing proportion of flow of rice through production and processing points in Ekiti and Osun States



Local Government Areas	Quantity produced (kg)	Quantity parboiled (kg)	Quantity milled (kg)
Abeokuta North	41250.00	36260.00	36260.00
Obafemi-Owode	135850.00	109850.00	109850.00
Ijebu North	42000.00	42000.00	42000.00
Ewekoro	40000.00	24708.00	24708.00
Ogun Waterside	31710.00	9004.00	9004.00

FIG 6: Map showing proportion of flow of rice through production and processing points in Ogun State

FIG 7: FLOW CHARTS SHOWING MOVEMENT OF RICE FROM PADDY PRODUCTION TO MARKET



FLOW OF OFADA RICE FROM PRODUCTION THROUGH PROCESSING POINTS TO MARKETS

Data in Table 4 and Figures 4-7 show the flow of Ofada rice from production through processing points to markets in the three States. Table 4 shows the quantities of rice produced, soaked, parboiled, sold as paddy and milled. The data indicates that Obafemi Owode local government area of Ogun State produces the highest quantity of Ofada rice (135,850 KG) in the study area. This is closely followed by Irepodun/Ifelodun Local government area of Ekiti (134,90KG). These two local government areas host Ofada village and Igbemo Ekiti respectively where there is a long tradition of rice production.
The next highest producer according to the data in Table 4 is Oriade local government area in Osun State which recorded production level of 70,100 KG. Erin-Oke is the leading rice producing village in the local government area and it happens to be the only place where “aromatic” Ofada rice was produced.

“Aromatic” Ofada rice is produced by soaking the rice for three to five days for it to ferment before parboiling. Generally, soaking rice for a few hours before parboiling appears to be a common practice in rice processing. The quantity of rice soaked at Erin Oke for the production of “aromatic” rice was 64,100 Kg.

The quantities of rice parboiled and the quantities taken to mills are the same in all the local government areas surveyed. This perhaps is because parboiling is a necessary and important stage in processing rice into edible forms. The highest quantity of rice parboiled and milled was 109,800 Kg and this is from Obafem Owode Local government area. The lowest quantity parboiled and milled was 7, 670 Kg and this is from Ijero local government area of Ekiti State.

Some producers sold some quantities of rice in paddy form. These are usually sold to marketers and packagers or re-packagers who later parboil, mill and package in 1/2Kg and 1Kg packets. The quantity of Ofada rice sold in paddy form was 21,110 Kg in Ogun Waterside local government area of Ogun State and 15,700 Kg in Ekiti West Local government area of Ekiti State. The total quantity of rice sold in paddy form was 36, 813Kg as shown in the flow chart in Fig 7.

The quantity of whole grain Ofada rice recovered from milling is 65% of the quantity of parboiled paddy sent for milling. In cases where there is a wide disparity between the quantity recovered and quantity sent for milling, it would be as a result of quality of milling machine, the state of parboiled rice, and the variety of rice being milled. The quantity of whole grain rice recovered was 295,856.13Kg, as shown in Fig 7.

DISTANCE ANALYSIS

Distance to and from production facilities determines to a large extent access to those facilities, quality of final products and transactional costs. Distances from and to facilities across the three States were analysed and are presented in Figures 8-13. More distance analyses maps focusing on rice production at the local level in each State are presented in Figures 14 to 32

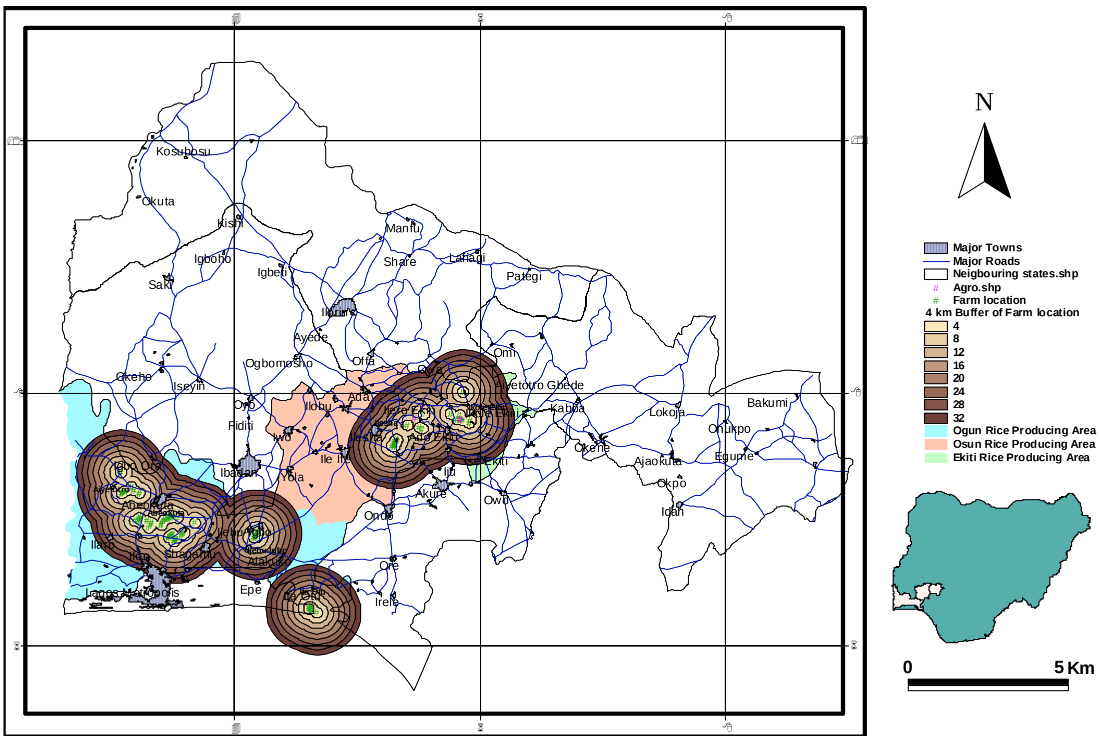


Fig8: **Distance Analysis Farm locations and Agrochemicals points**

Buffer zone (KM)	Agrochemicals	%
0-4	2	28.6
5-8	2	28.6
9-12	2	28.6
13 and above	1	14.2

Figure 8 and the table attached to it indicate that only about 28 percent of Ofada rice farmers were within four kilometre range of source of Agrochemicals across the three States. Over seventy percent of the farmers would need to travel at least between 5-12 kilometres to obtain agro-chemicals

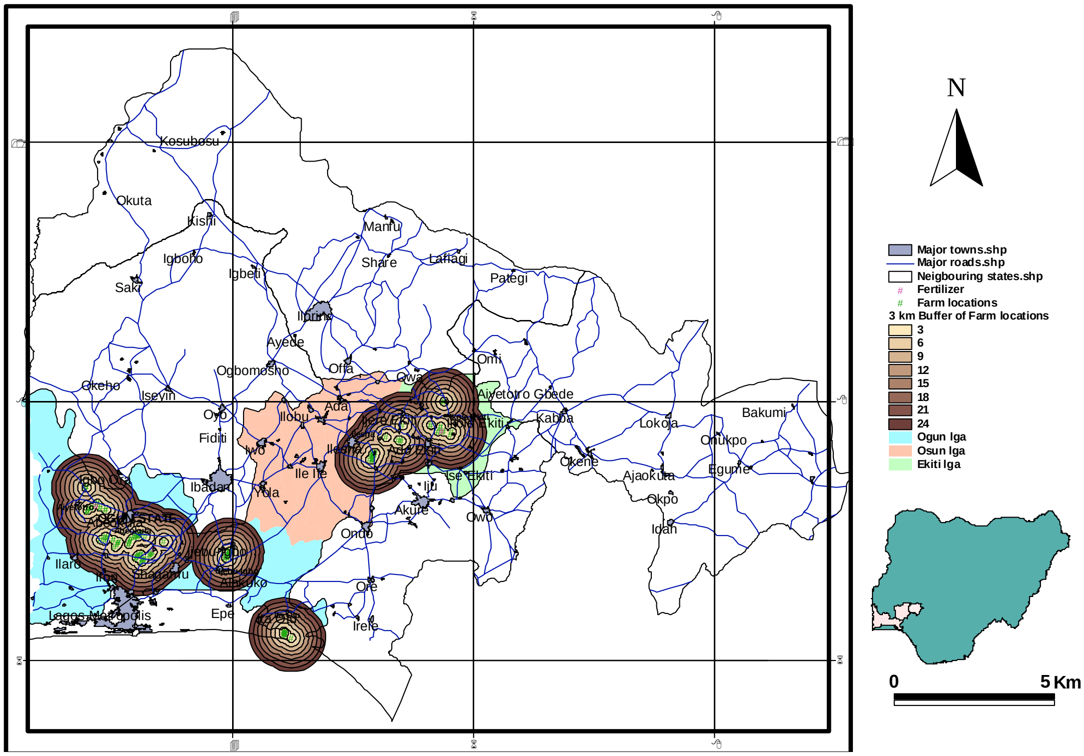


Fig 9: Distance from farm locations to source of fertilizers

Buffer zone (KM)	Fertilizers	%
0-10	3	37.5
11-20	5	62.5

As for distance to fertilizer points, about 40 percent of Ofada rice farmers would need to travel at least 10 kilometres as shown in Figure 9, in order to obtain fertilizer. This finding seems to partly explain the reason for the very few numbers of farmers who actually used fertilizer in rice production as reported in the earlier section of this report.

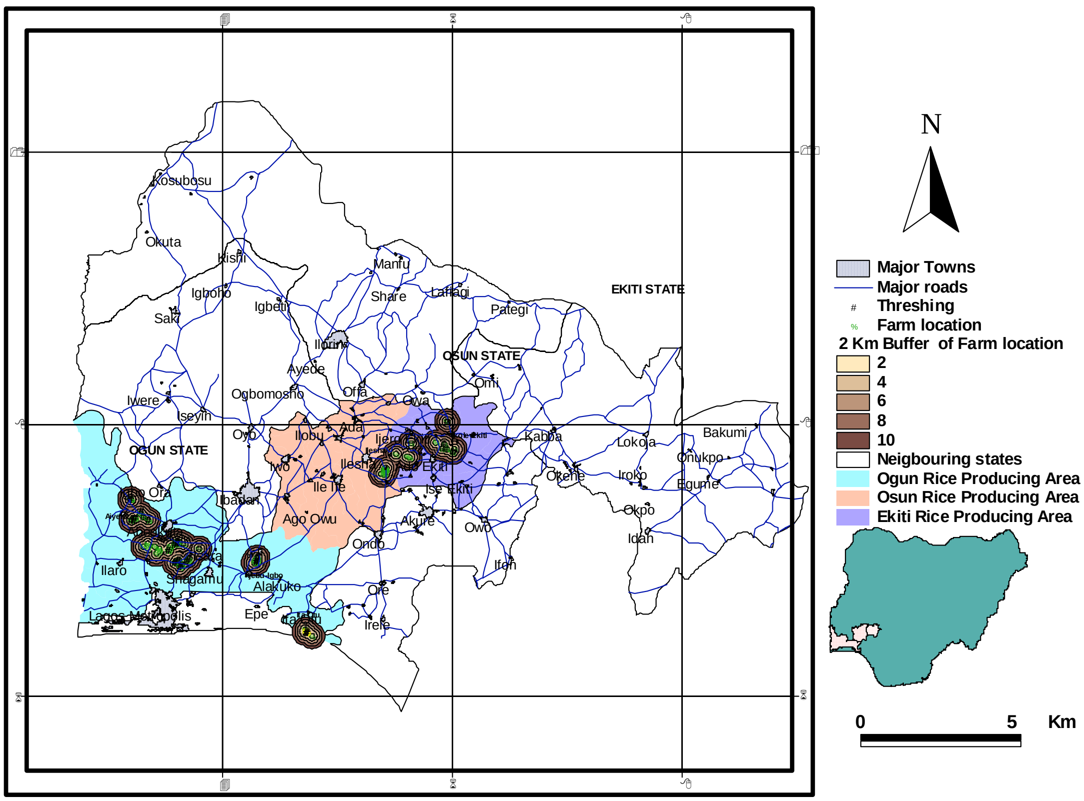


Fig 10: Distance from farm location to point of threshing

Buffer zone (KM)	Threshing points	%
0-2	106	90.6
3- 4	8	6.9
5 and above	3	2.5

As shown in Figure 10, most rice farmers threshed their paddy within the farm or close to the farm location as such over 90 percent of the farmers travelled a distance of between 0 and 2 Kilometres to threshing points. Similarly, most parboiling of paddy took place within a distance of 0 to 4 kilometres of the farmers' farm as shown in Figure 11. The same trend of short distance from farms to rice paddy markets and rice milling points are recorded as shown in Figures 12 and 13 across the three States.

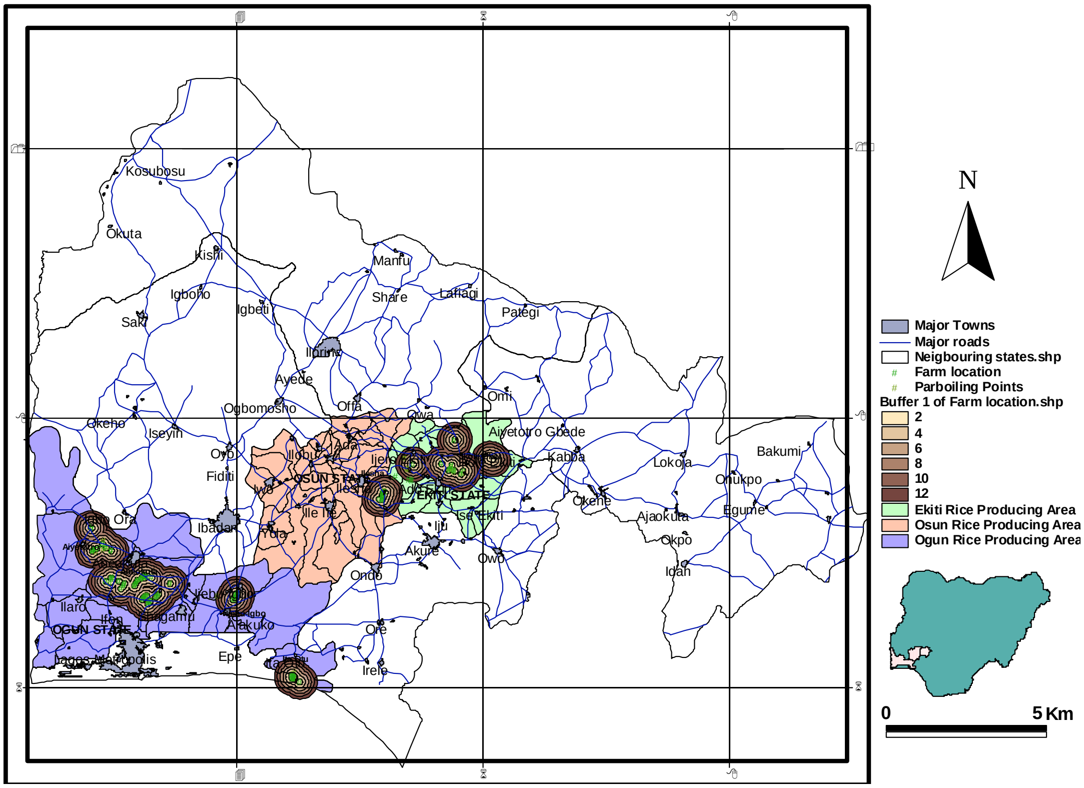


Fig 11: Distance from farm locations to parboiling points

Buffer zone (KM)	Parboiling points	%
0-4	104	95.4
5- 8	4	3.7
9 and above	1	0.9

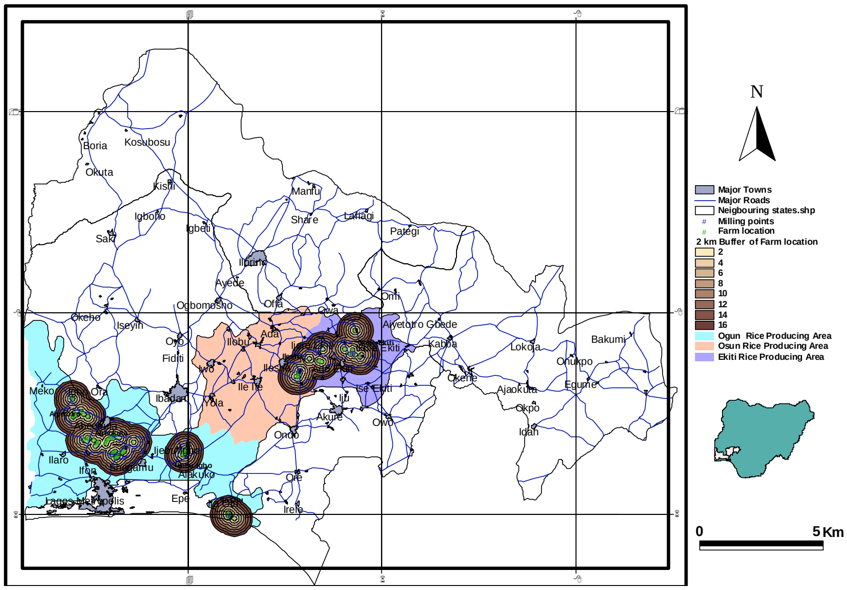


Fig 12: Distance between farm locations and paddy markets

Buffer zone (KM)	Paddy markets	%
0-7	30	79
8-14	1	2.1
15-21	1	2.1
22 and above	3	6.3

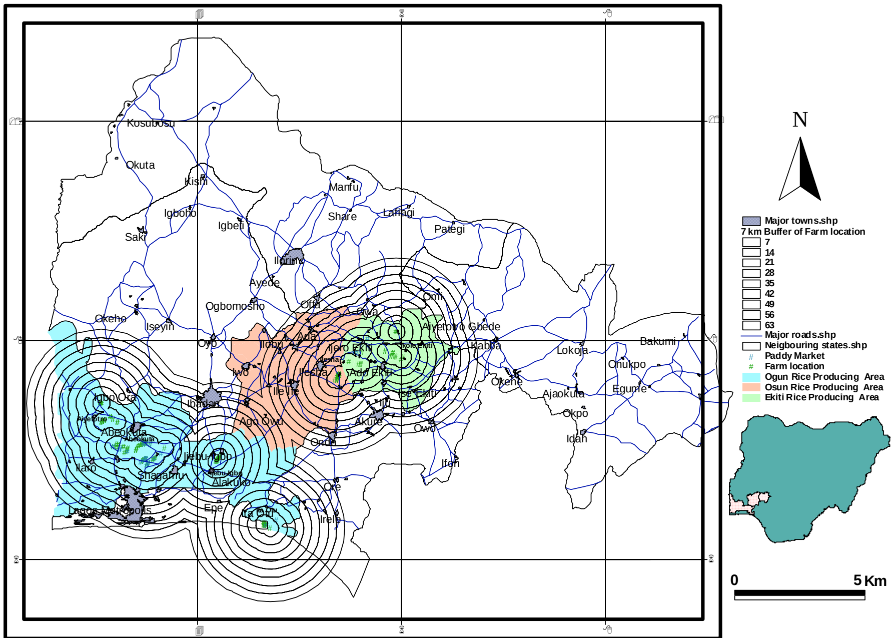
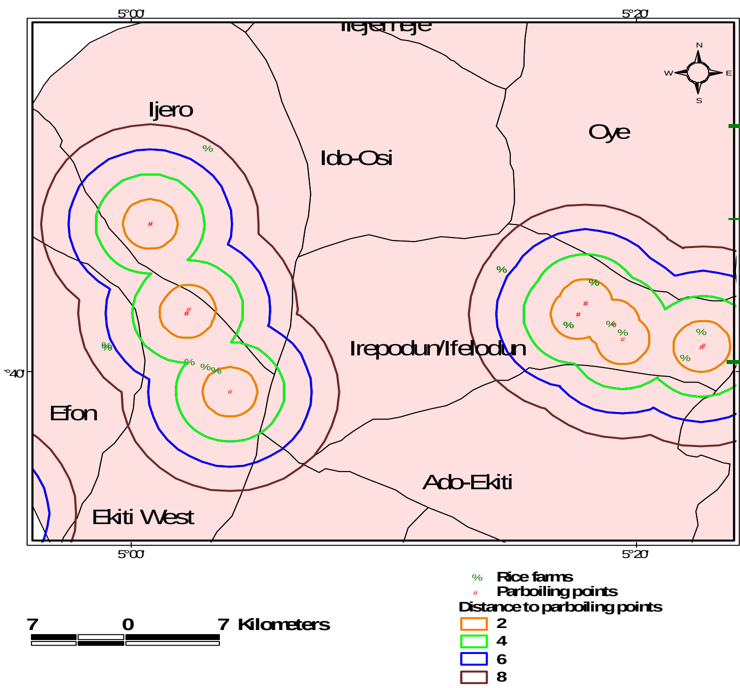


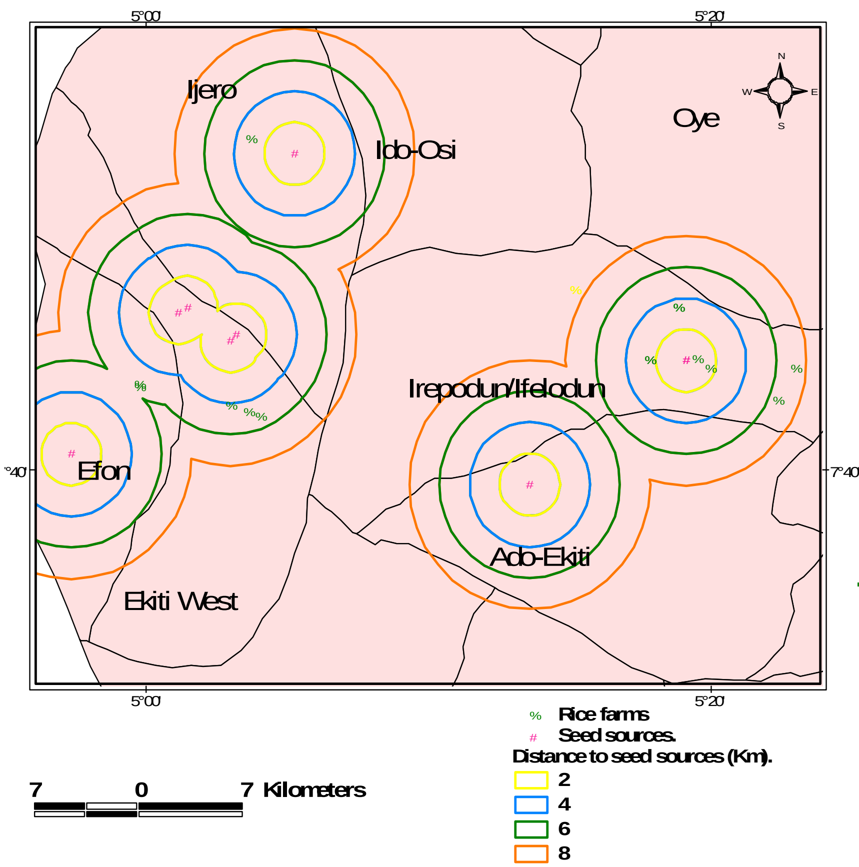
Fig. 13: Distance from farms to rice milling points

Buffer zone (KM)	Rice milling points	%
0-4	40	81.7
5- 8	6	12.2
9 and above	3	6.0



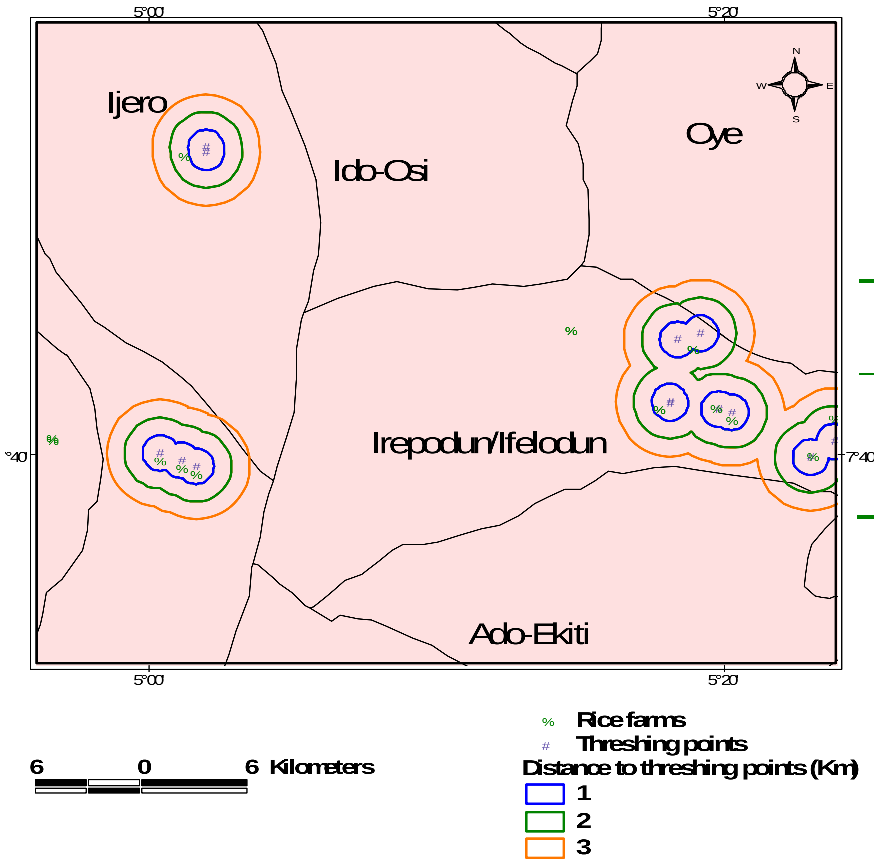
Distance (km)	No of farmers	% of Farmers
2	9	56.25
4	2	12.5
6	5	31.5

Figure 14: Distance from farms to parboiling points in Ofada rice production clusters in Ekiti Sate



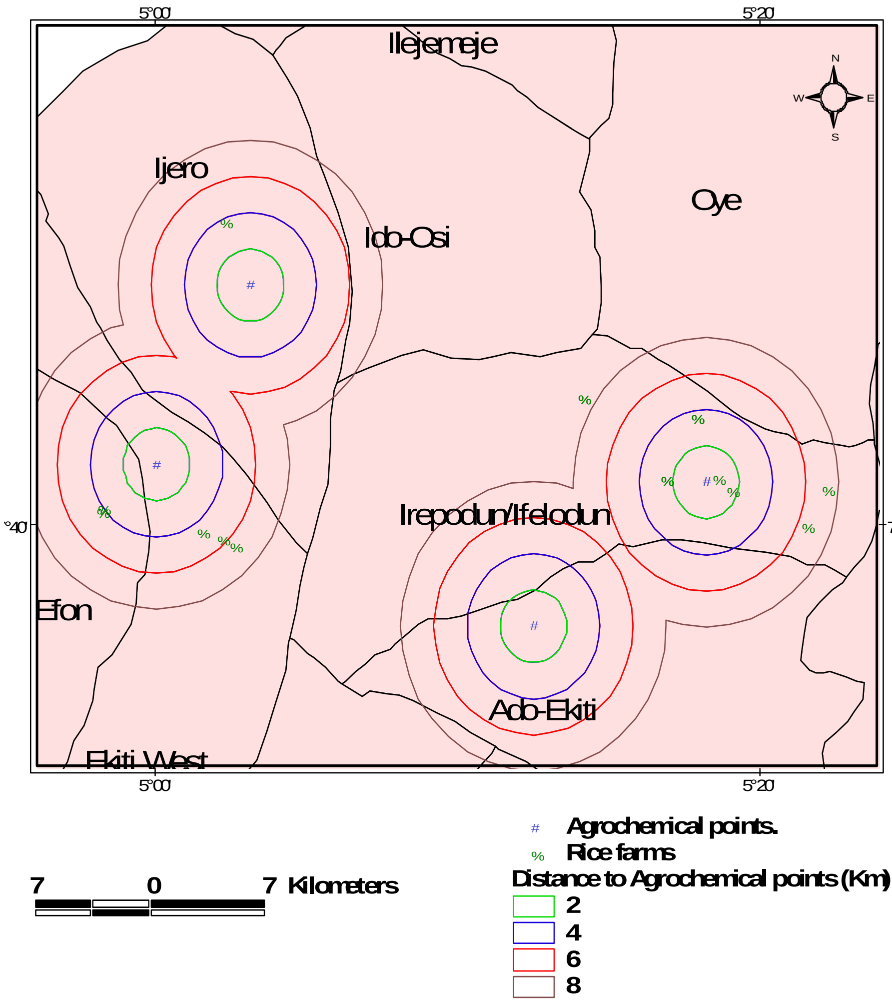
Distance (km)	No of farmers	% of Farmers
2	2	12.5
4	7	43.75
6	5	56..25

Figure 15: Distance from farms to seed sources in Ofada rice production clusters in Ekiti Sate



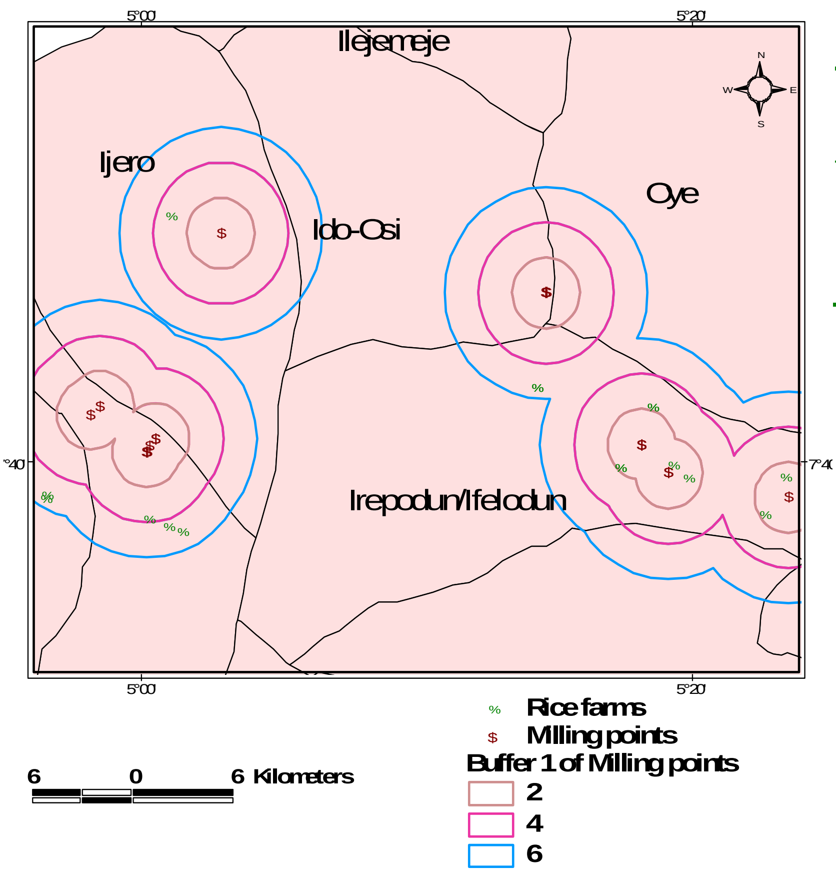
Distance (km)	No of farmers	% of Farmers
2	10	62.5
4	2	12.5
>6	4	25

Figure 16: Distance from farms to threshing points in Ofada rice production clusters in Ekiti Sate



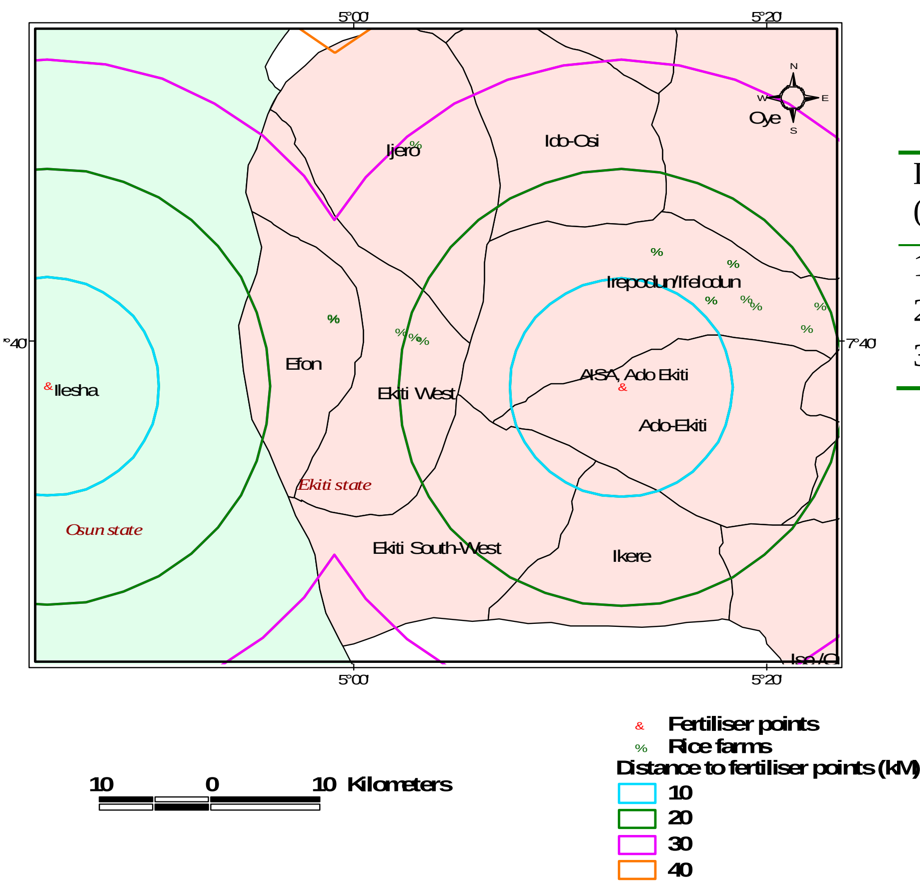
Distance (km)	No of farmers	% of Farmers
2	2	12.5
4	5	31.5
>6	9	56.25

Figure 17: Distance from farms to agrochemical points in Ofada rice production clusters in Ekiti Sate



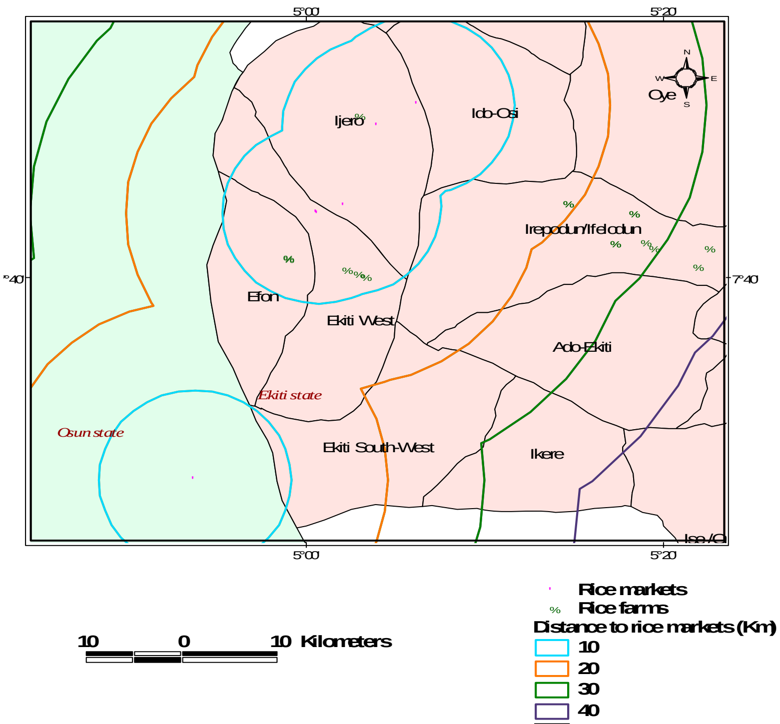
Distance (km)	No of farmers	% of Farmers
2	6	37.5
4	4	25
6	6	37.5

Figure 18: Distance from farms to milling points in Ofada rice production clusters in Ekiti Sate



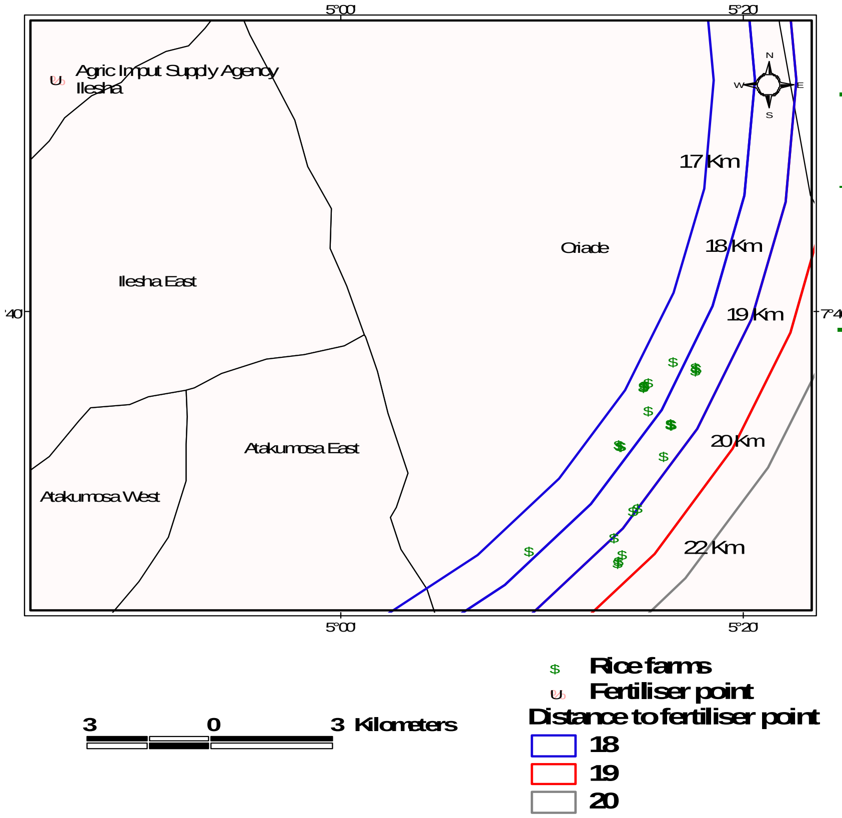
Distance (km)	No of farmers	% of Farmers
10	0	0
20	12	75
30	4	25

Figure 19: Distance from farms to fertilizer points in Ofada rice production clusters in Ekiti Sate



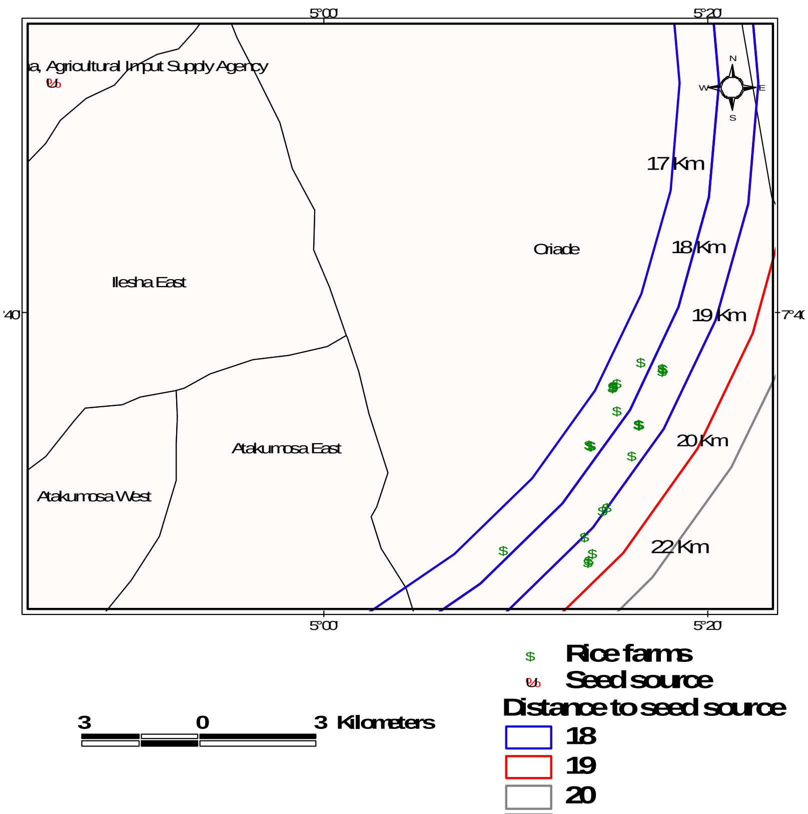
Distance (km)	No of farmers	% of Farmers
10	5	31.25
20	2	12.5
30->40	6	56.25

Figure 20: Distance from farms to markets in Ofada rice production clusters in Ekiti Sate



Distance (km)	No of farmers	% of Farmers
18	10	25.6
19	25	64.1
20	4	10.3

Figure 21: Distance from farms to fertilizer points in Ofada rice production clusters at Erin –Ijesha, Osun Sate



Distance (km)	No of farmers	% of Farmers
2	14	56
4	6	24
6	5	20

Figure 22: Distance from farms to seed sources in rice production clusters in Erin Oke, Osun Sate

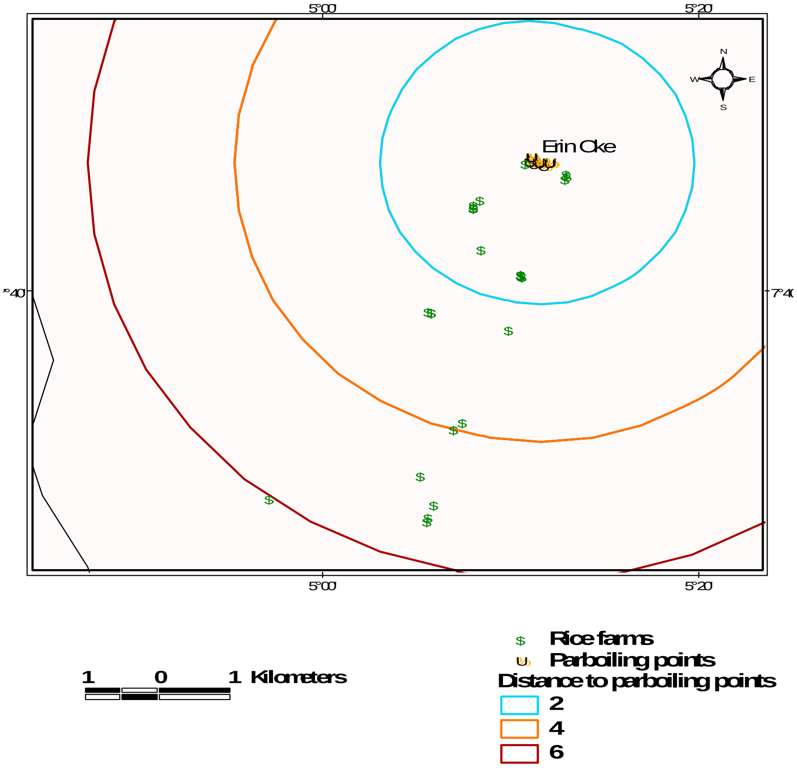
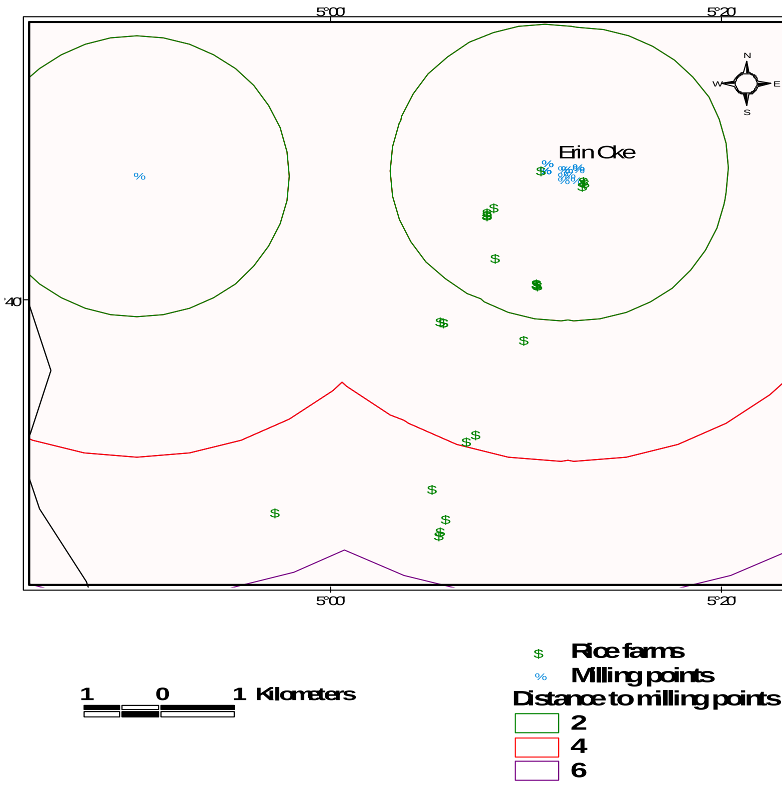
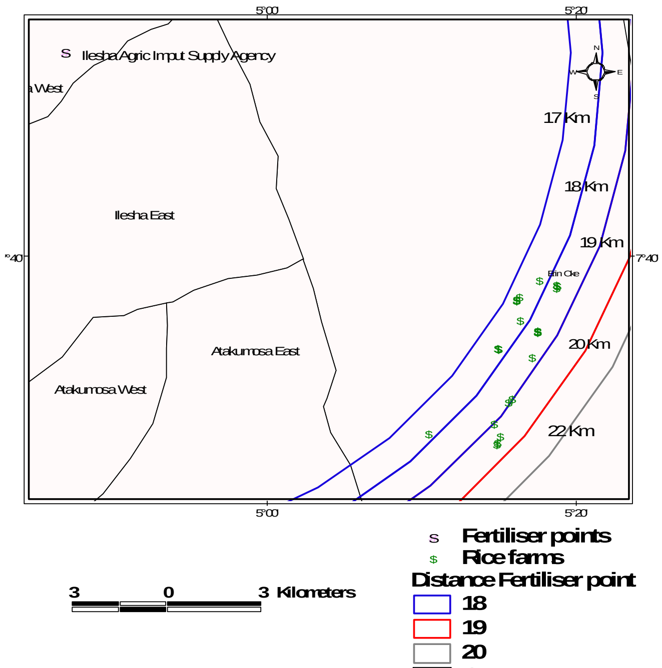


Figure 23: Distance from farms to parboiling points at Erin Oke, Osun Sate



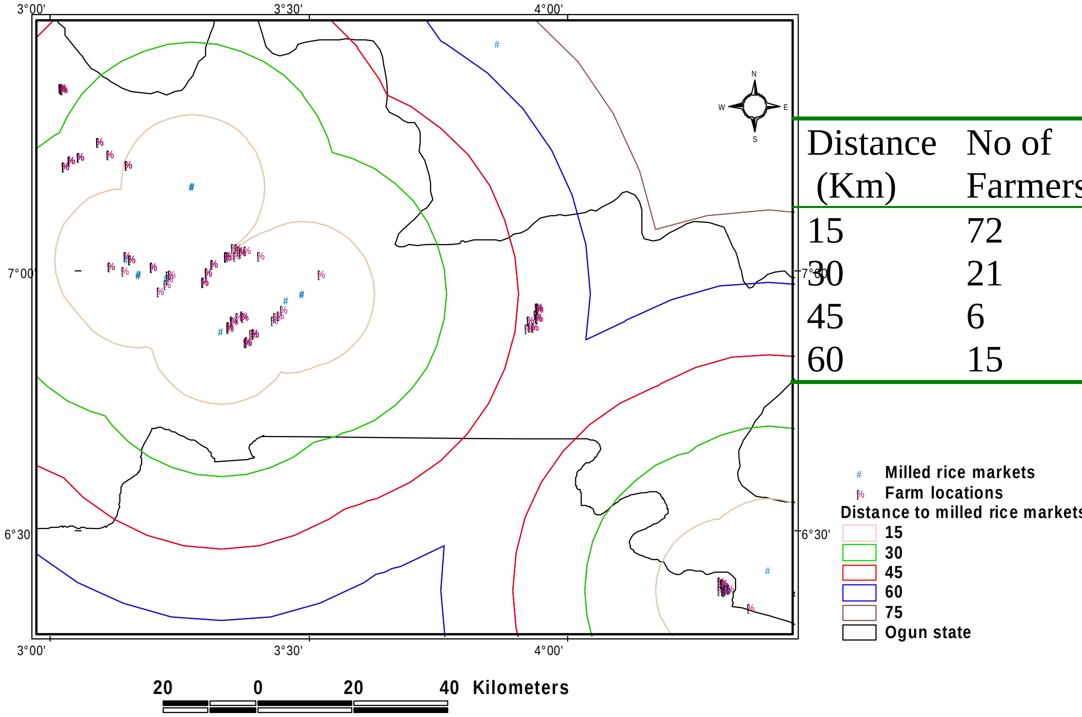
Distance (km)	No of farmers	% of Farmers
2	14	56
4	6	24
6	5	20

Figure 24: Distance from farms to milling points at Erin Oke, Osun Sate



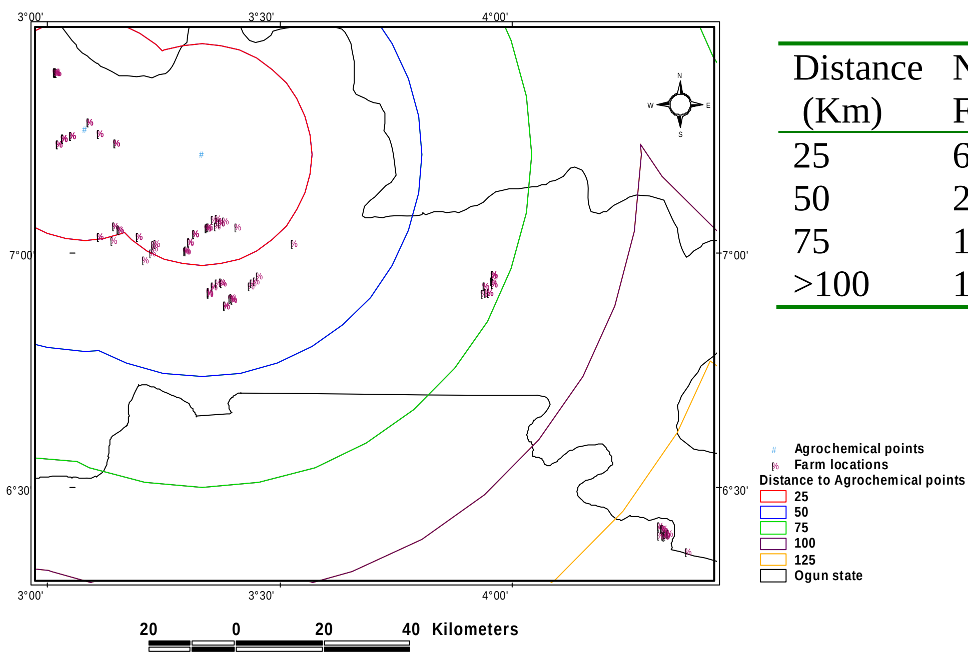
Distance (km)	No of farmers	% of Farmers
18	10	25.6
19	25	64.1
20	4	10.3

Figure 25: Distance from farms to fertilizer source at Erin Oke, Osun Sate



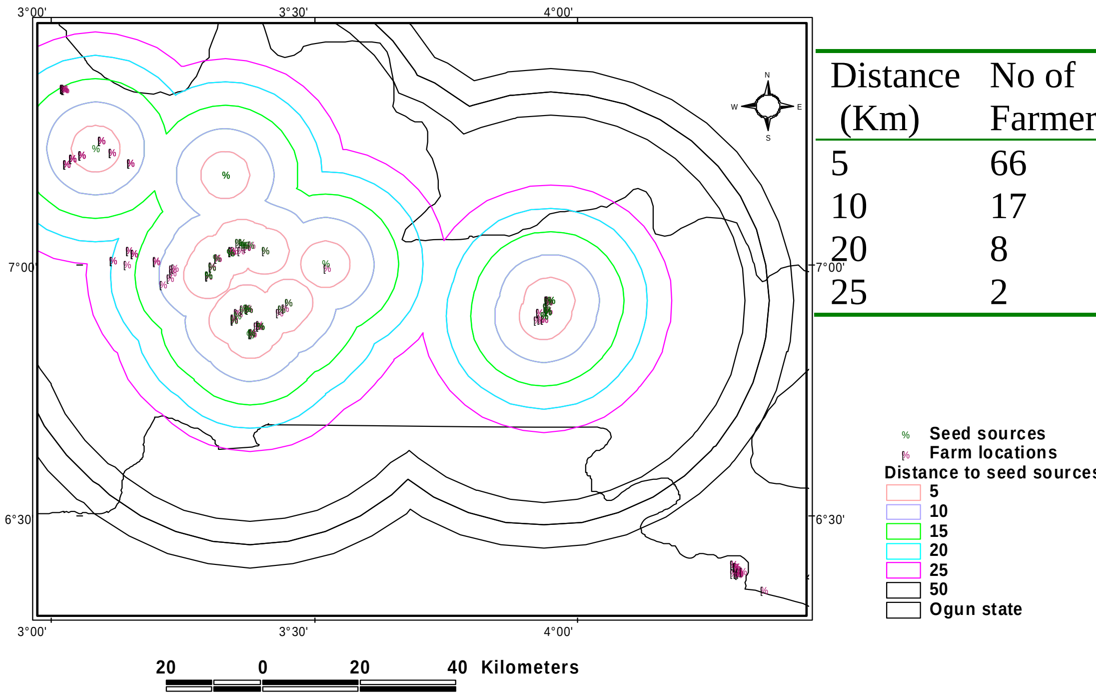
Distance (Km)	No of Farmers	% of Farmers
15	72	63.16
30	21	18.42
45	6	5.26
60	15	13.16

Figure 26: Distance from farms to milled rice markets in Ogun Sate



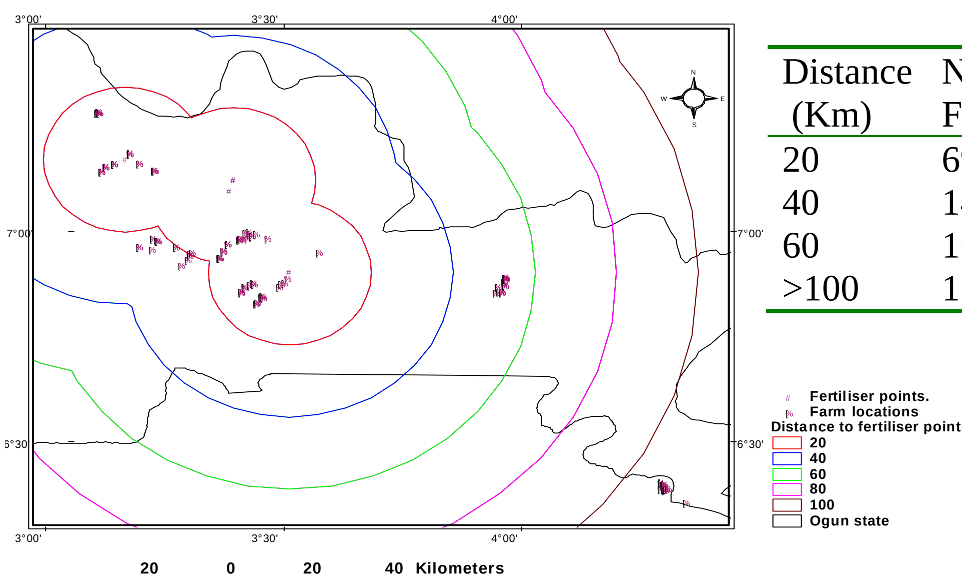
Distance (Km)	No of Farmers	% of Farmers
25	61	53.5
50	23	20.2
75	15	13.15
>100	15	13.15

Figure 27: Distance from farms to Agrochemical points in Ogun Sate



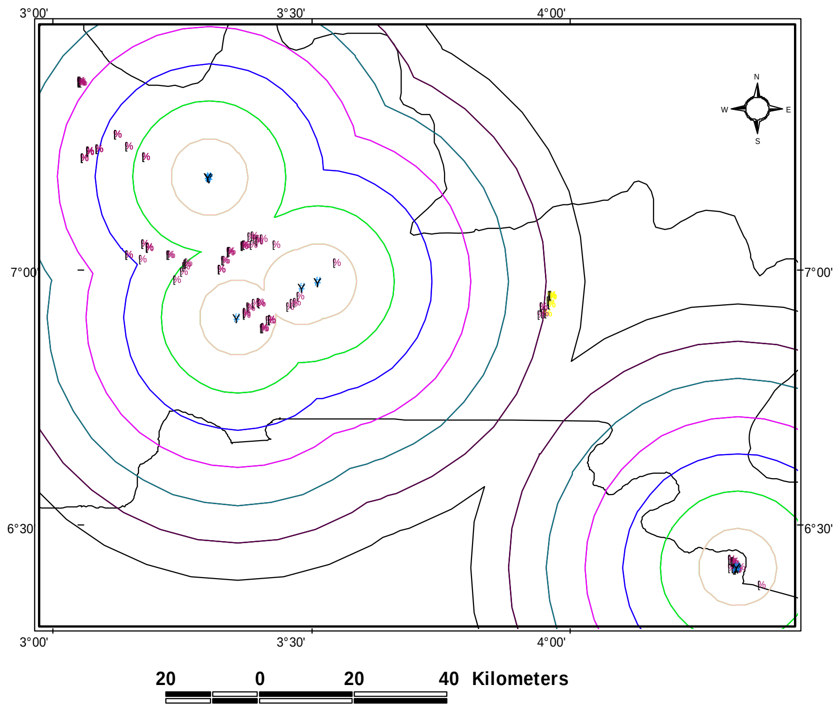
Distance (Km)	No of Farmers	% of Farmers
5	66	
10	17	
20	8	
25	2	

Figure 28: Distance from farms to sources of seeds in Ogun Sate



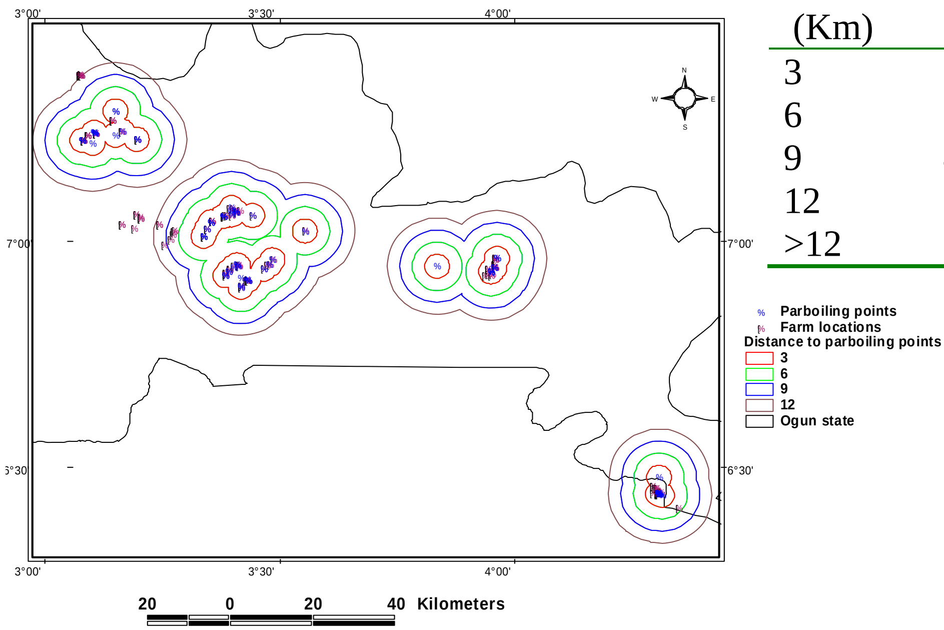
Distance (Km)	No of Farmers	% of Farmers
20	69	60.5
40	14	12.28
60	16	14
>100	15	13.1

Figure 29: Distance from farms to fertilizer source in Ogun Sate



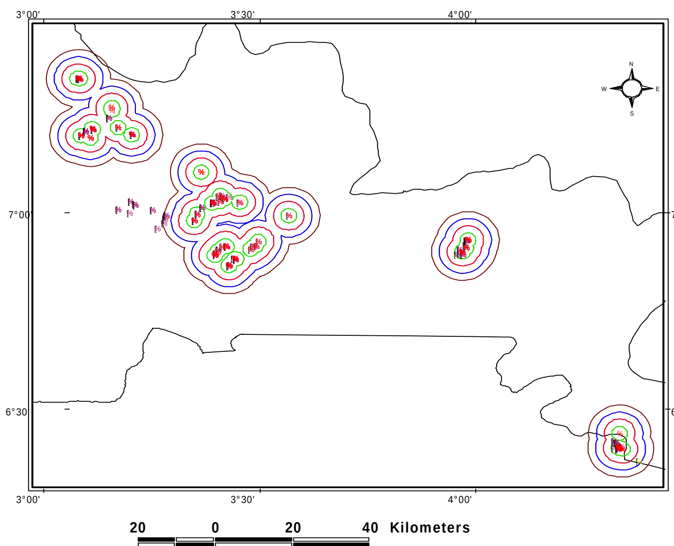
Distance (Km)	No of Farmers	% of Farmers
5	36	31.6
10	27	23.7
15	15	13.2
20	13	11.4
25	6	5.2
30	3	2.6
35	14	12.3

Figure 30: Distance from farms to rice milling points in Ogun Sate



Distance (Km)	No of Farmers	% of Farmers
3	92	80.7
6	1	0.87
9	4	3.51
12	9	7.9
>12	8	7.0

Figure 31: Distance from farms to rice parboiling points in Ogun Sate



Distance (Km)	No of Farmers	% of Farmers
2	90	78.9
4	2	1.75
6	1	0.87
8	4	3.51
>8	17	14.9

Figure 32: Distance from farms to rice threshing points in Ogun Sate

Distance (Km)	No of Farmers	% of Farmers
5	62	54.4
10	10	8.8
15	3	2.6
20	2	1.8
25	16	14
>25	21	18.4

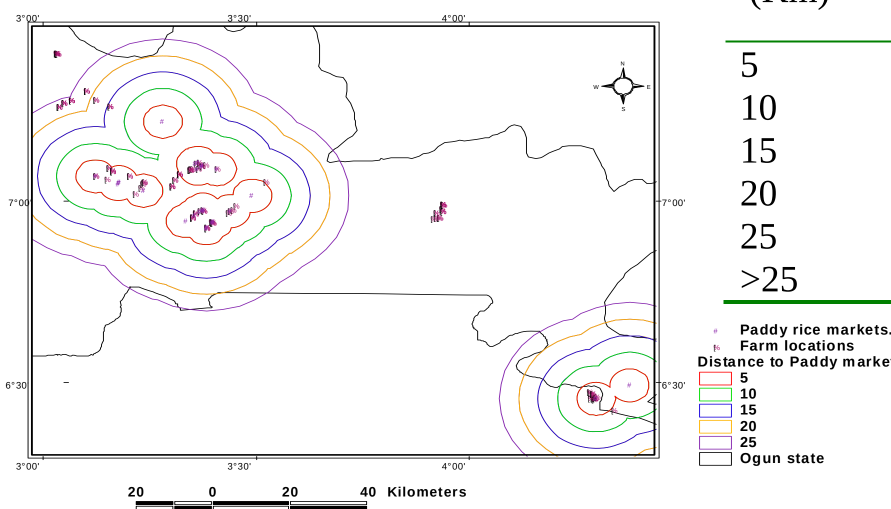


Figure 33: Distance from farms to paddy markets in Ogun Sate

DISTANCE ANALYSIS AT THE LOCAL LEVEL

The distance analyses data presented in Figures 13 to 33 consistently show that facilities for rice threshing, parboiling, milling, were readily available at local levels and within a short distance (between 2 and 4 kilometres) of the farmers' farm or residence. Although urban markets may appear to be very far away from these rice production locations according to the distance analysis data, farmers did not seem to have problems selling their paddy or milled rice as buyers come directly to these locations to buy. The same data show that points of production inputs such as seeds, agrochemicals and fertilizer were far away from farmers' field and residence (between 5 and 30 kilometres) and may not be readily available to the majority of rice farmers. This point to the need for direct intervention by agencies concerned to improve access of farmers to all production inputs.

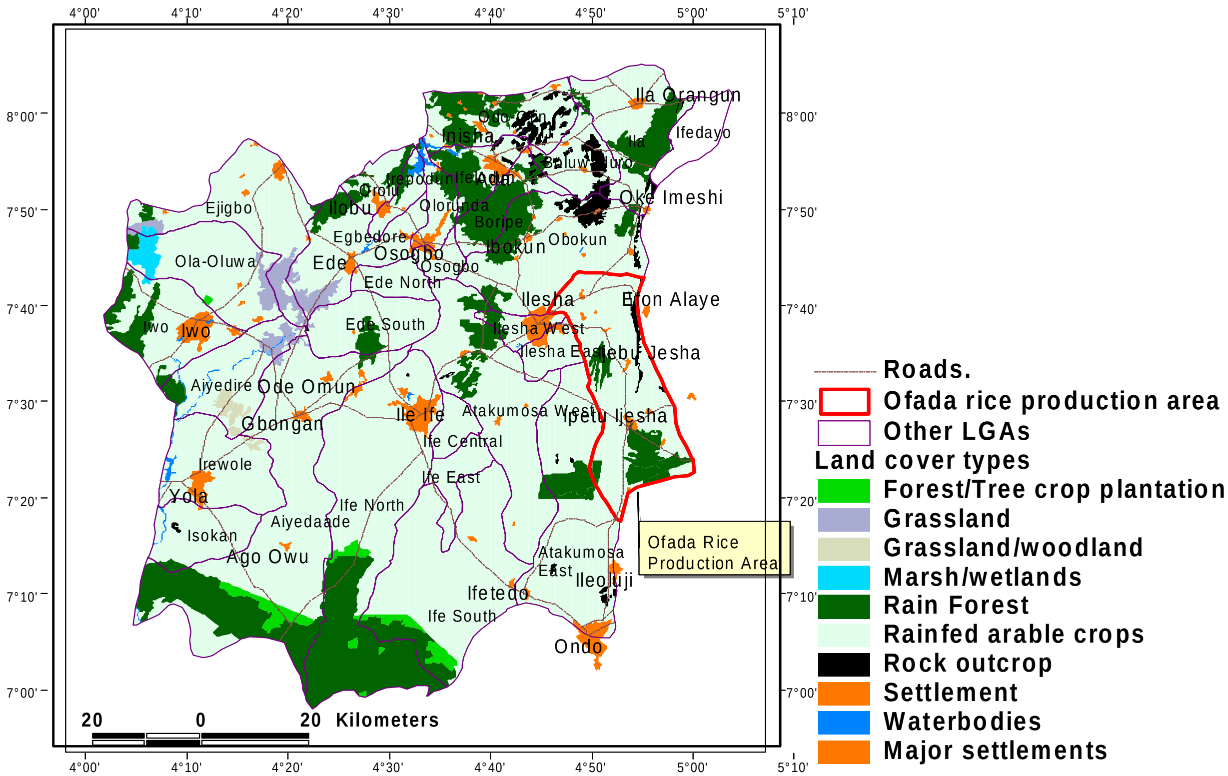
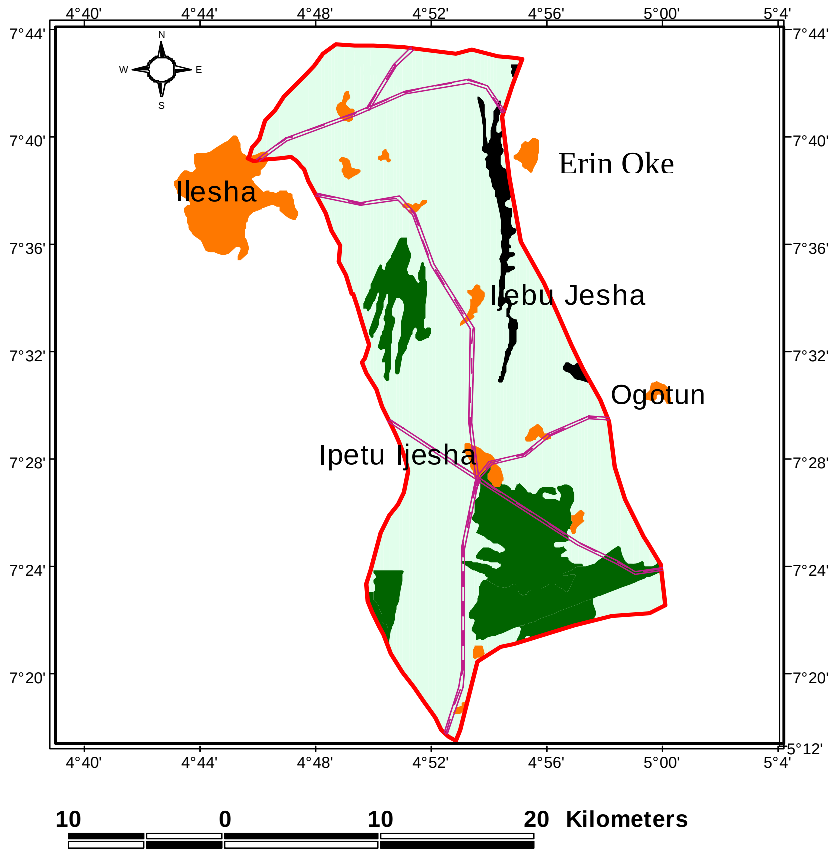


Figure 34: Map of land use and land cover of Osun State



Land cover categories	Land Coverage (Ha)	% Land Coverage
Forest	9918.3	16.43
Arable crop land	47710	79
Rock out crops	1,463.3	2.42
Major settlements	1259.3	2.08

Figure 35: Map of land use and land cover in rice producing areas of Osun State (Erin Oke)

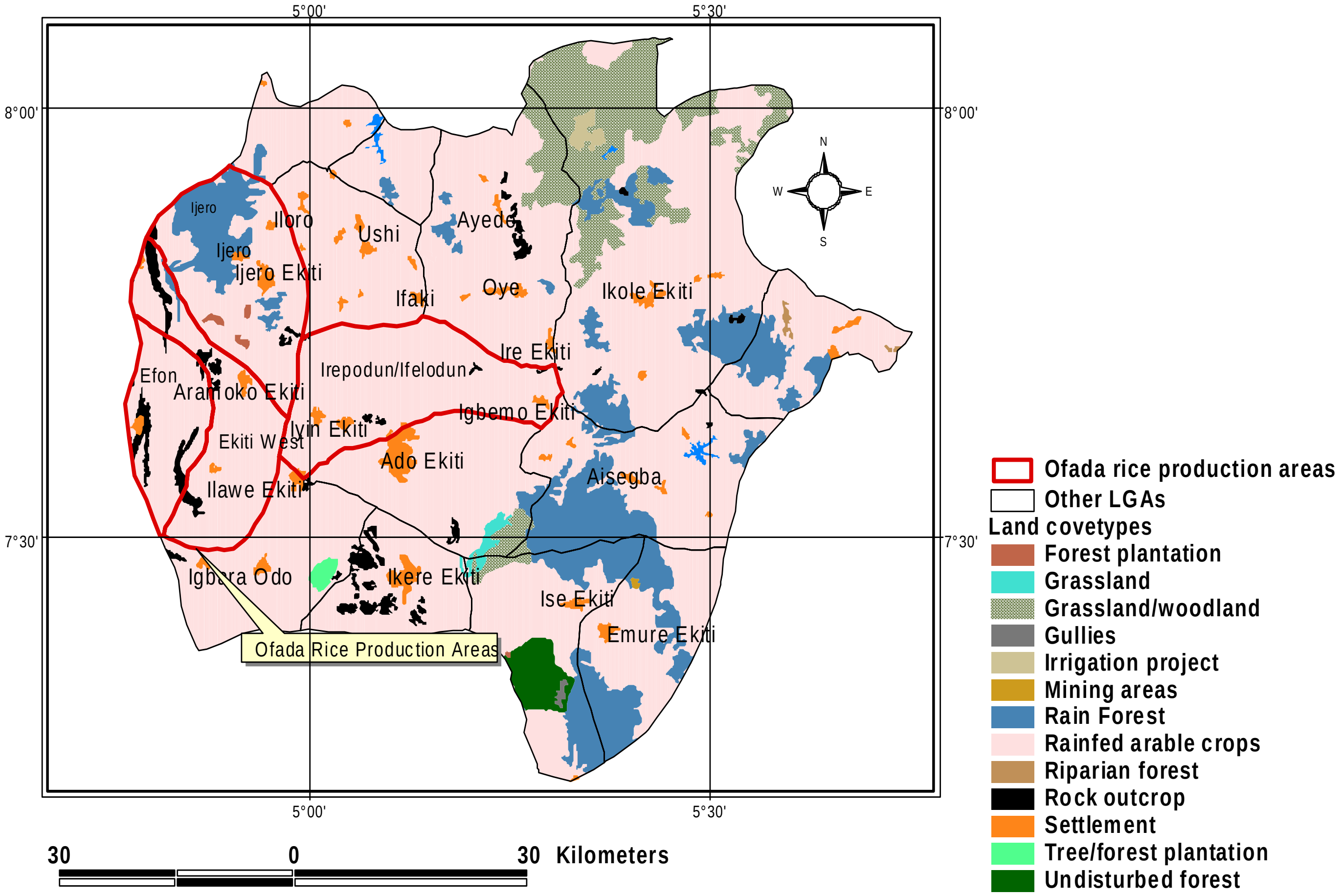
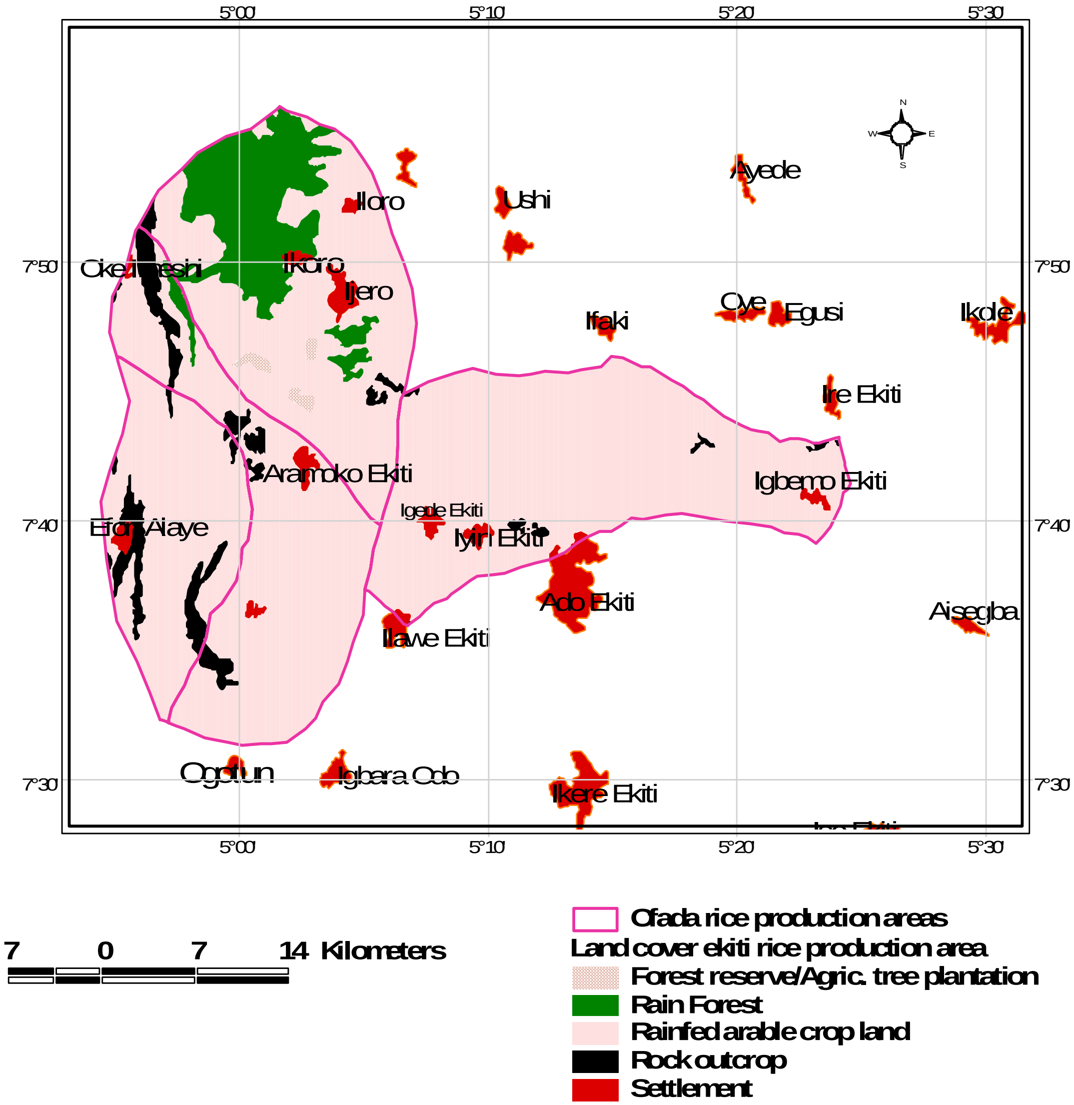


Figure 36: Map of land use and land cover of Ekiti State



Land cover categories	Land Coverage (Ha)	% Land Coverage
Forest reserve/ Agric. tree plantation	520.87	0.44
Arable crop land	100524.41	84.18
Rock out crops	5271.61	4.41
Major settlements	2420.5	2.03
Rain forest/riparian forest	10679.73	8.94

Figure 37: Map of land use and land cover in rice producing areas of Ekiti State

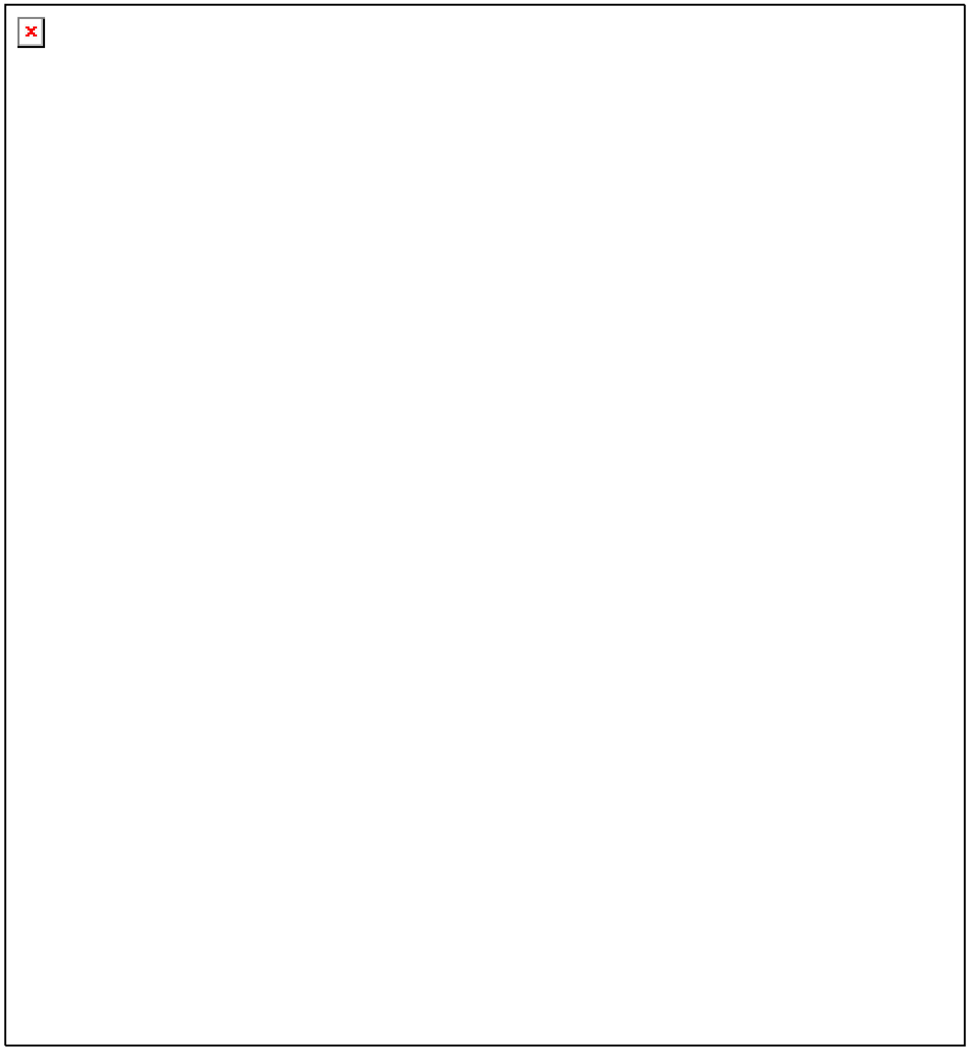
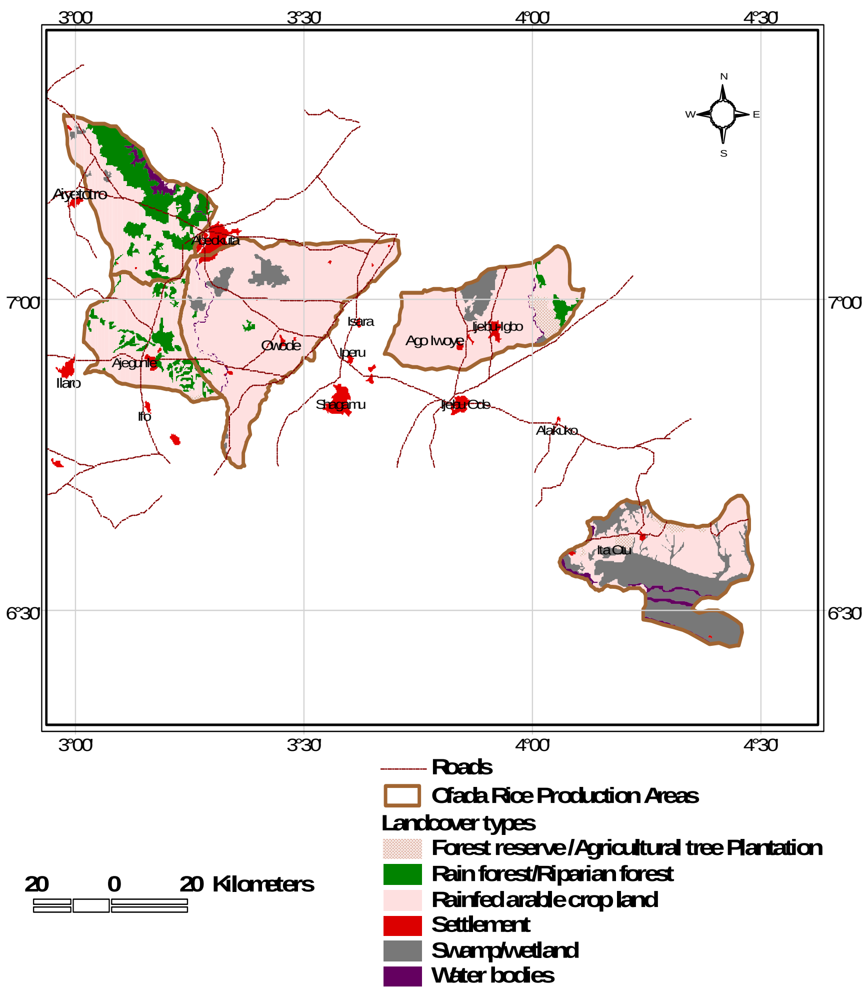


Figure 38: Map of land use and land cover of Ogun State



Land cover categories	Land Coverage (Ha)	% Land Coverage (Ha)
Forest Reserve/ Agric. Tree crop plantation	8671.8	1.86
Arable crop land	337180	72.2
Rain forest/riparian forest	44767.3	9.6.1
Major settlements	4411.3	0.94
Swamp/wetlands	62562.7	12.5
Water bodies	9462.32	2.02

Figure 39: Map of land use and land cover in rice producing areas of Ogun State

LAND SUITABILITY FOR RICE PROUCTION

Ofada rice production areas can be described in terms of its soil conditions and land cover types. The study examined land suitability with specific reference to rice cultivation. Land use/land cover classification is one useful way of identifying areas where environmental limitations are at a minimum for extensive cultivation of Ofada rice. This kind of information when combined with that of soil conditions provides useful data on where precisely is best for rice cultivation. The land use/land cover of the three states under study are described in terms of size of land occupied by human settlements and natural features such as forest, water bodies, crop plantations and rock out crops. More importantly is the size of available arable land since areas suitable for different types of agricultural development can be identified from the available land.

The land cover maps were developed from the data on National land cover categorisation by the Forestry Monitoring Evaluating and Coordination Unit (FORMECU). The data had been prepared from series of over flights and mosaics of several scenes of LANDSAT Imageries. Although the land cover maps were created for the three states; Ekiti, Osun and Ogun state specific attention was paid to the rice production areas within these states. The land cover maps are presented in Figures 34 to 39.

In Ekiti state, four local government areas were studied namely; Efon- Alaye, Ekiti west and Irepodun / Ifelodun and Ijero which constitute the major rice production area in Ekiti State. The arable crop land is about, 100,524.411Ha which represents about 84 percent of the land area of the area. Less than 10 percent of this is currently under rice cultivation in the State.

In Osun state, Oriade local government area identified as the rice production area had quite an expanse of rocks and rock out crops. In spite of this there is still about 47,710Ha (79%) arable land.

Ogun state has a slightly different configuration in the land cover categories identified. Six major categories of land cover types were identified as against four in Osun and the five in Ekiti. Apart from 67% (337,180Ha) of land available as arable land with possibility for upland rice cultivation, about 625,62Ha or (12.5%) of the land area can be categorised as wetland. This area could be explored for lowland rice cultivation within the five local government areas studied.

Availability of arable land however does not ultimately determine site selection for crop production especially when the aim is maximum yield with optimal production input. Since farmers lack the wherewithal to effect soil amendment and improve the quality of soil, accurate determination of the most suitable locations for specific crops becomes a better option to maximise crop yield and productivity.

To do this, soil characteristics have to be mapped and matched with expected crop yield. From such information a prescription map can be developed to show for instance how much of chemical fertilizer could be applied to particular locations across the field. Other type of prescription map is to decide based on the information available best land site for a crop. Since it would be practically impossible to take and analyse soil samples from every location across the entire study area, samples of soil was collected from 10 farms per local government area contacted and it was analysed to determine which soils could provide the greater support to upland rice in the study area and South western Nigeria at large.

Five parameters were considered most crucial for rice production namely; available Phosphorus, Cation Exchange Capacity (CEC), organic carbon, Textural class, pH, available Nitrogen and soil depth.

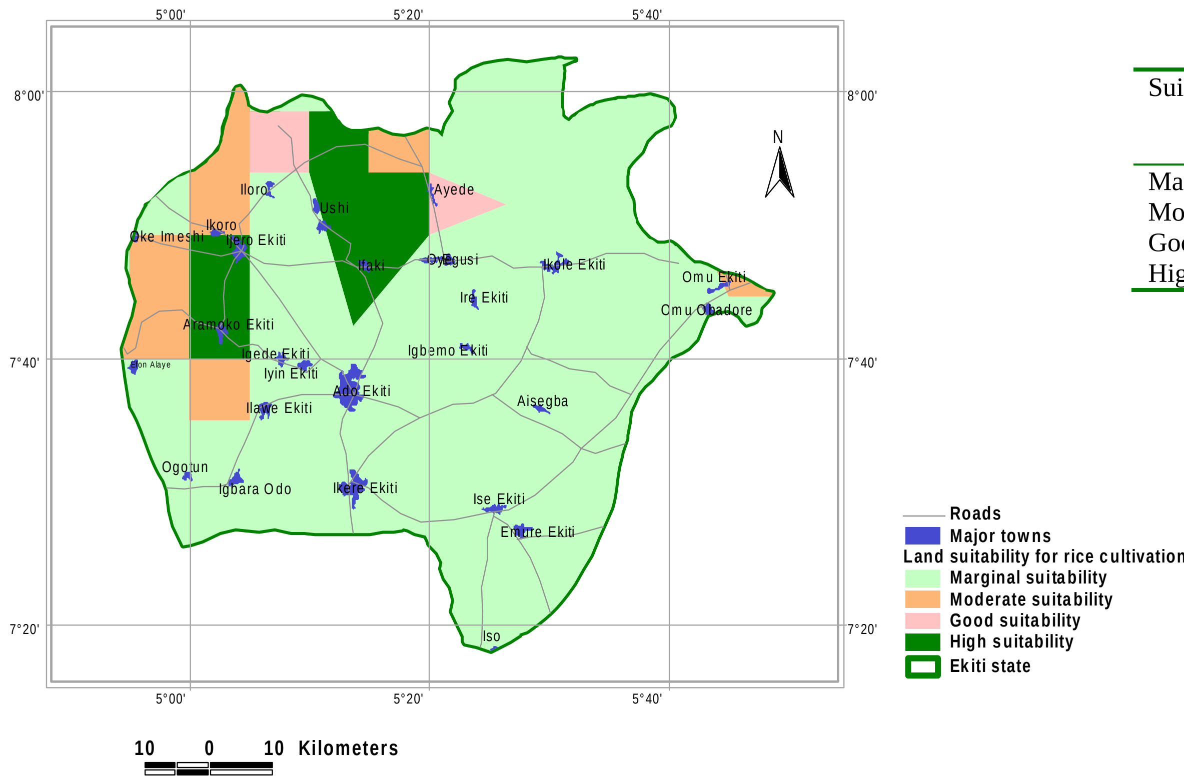
The data collected were combined with the FAO soil classification that has been created as ArcInfo format grid and converted back to shape files. Each land quality (Soil parameters) is a thematic layer in the GIS which contains spatial data and its associated attributes. Each of the parameters was added into the GIS as a layer and by Overlay operation (Multiplication) the parameters were combined to give a single layer. The evaluation model for rice is defined using the value of factors rating as follows: suitability=R*NAI*D*T. The overlay process of these layers was performed to produce a resultant polygonal layer upon which the evaluation model was applied. The resultant layers produced the suitability maps for rice.

The suitability evaluation for rice was based mainly on the method described by FAP (1983). The map resulting from the overlay process of the selected land qualities was finally reclassified as either; Highly suitable, Moderately suitable, Good and Marginally suitable. The requirement of rice was reviewed from a number of publications (FAO (1983), FAO (1991), LLD (1990), Sys et al (1993), Delante (1993)) and Eco crop website of the Food and Agricultural organisation. The qualities considered in developing the suitability maps are as stated in Table 5.

Table 5: Land Quality factors for upland rice

Land use requirement			Factor rating			
Rainfall (R)	Annual rainfall	m.m	>1,500	1100-1500	900-1100	<900
Soil Depth (D)						
Nutrient availability Index (NAI)	NAI		>0.60	0.40-0.60	0.10-0.40	<0.10
	N	%	>0.2	0.1-0.2	<0.1	-
	PH	-	5.6-7.3	7.4-7.8 5.1-5.5	7.9-8.4 4.0-5.0	>8.4 <4.0
Water retention capacity (T)	Soil texture	-	CL, Si, SCL, SiL, C, AC	L, SiCL, SiC, SL	LS	G, S, SC

Temperature and rainfall are generally adequate and well distributed and almost uniform over south western Nigeria. Hence temperature in particular was not considered in the land suitability calculation. The land suitability maps for rice production clusters in the three States are presented in Figures 40 to 42



Suitability	Land area (million Ha)	% of land area
Marginal	0.42	78.3
Moderate	0.053	9.7
Good	0.051	9.4
High	0.014	2.6

Fig. 40: Land suitability map for rice production in Ekiti State

Suitability	Land area (million Ha)	% Total land area
Marginal	0.69	75.1
Moderate	0.079	8.6
Good	0.11	11.96
High	0.04	4.3

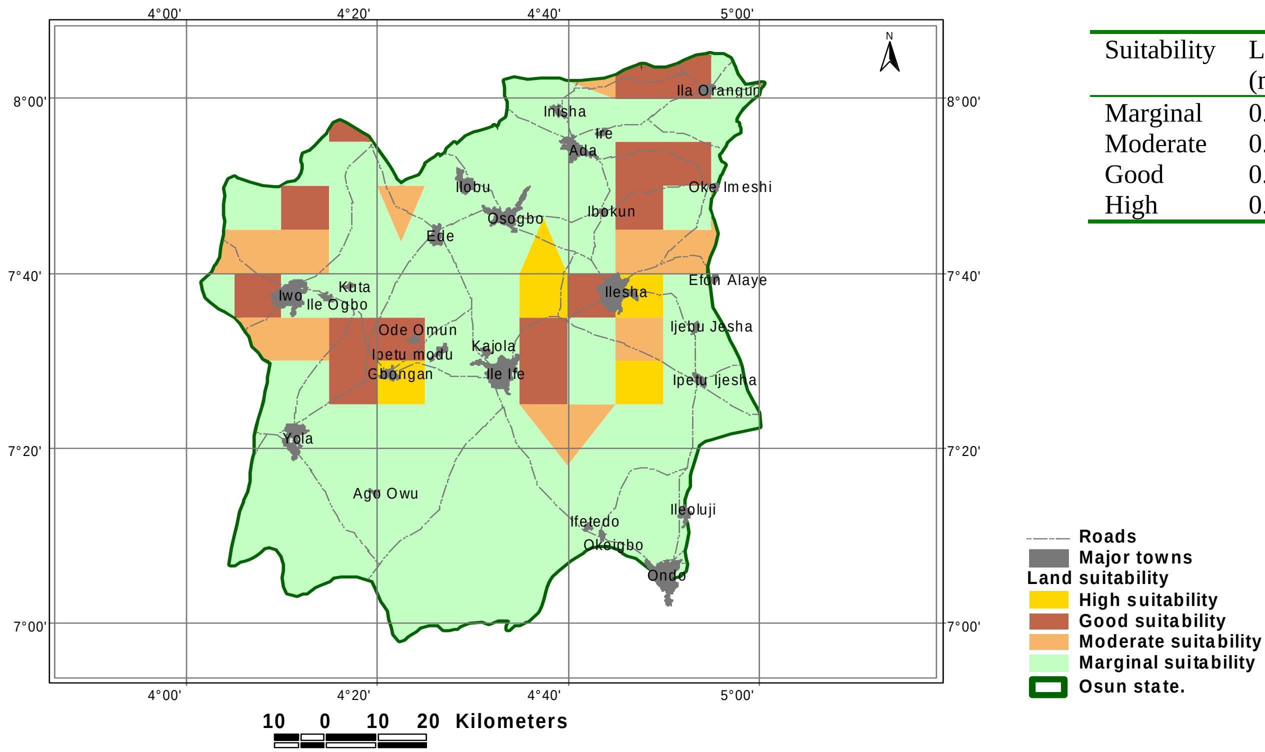
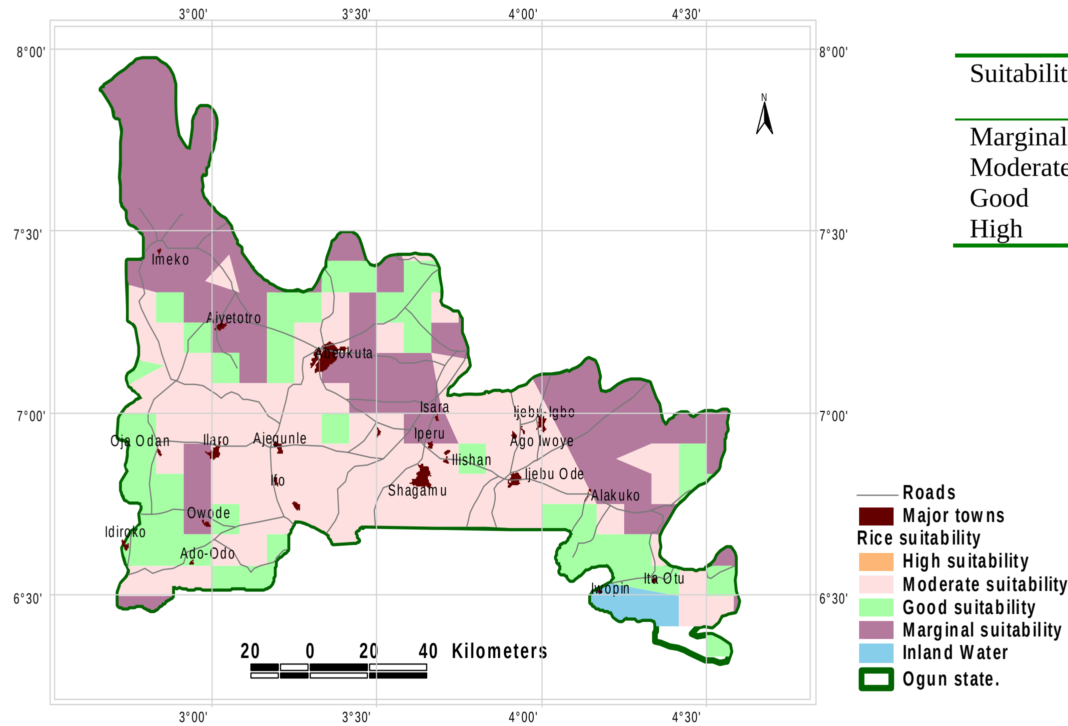


Fig. 41: Land suitability map for rice production in Osun State



Suitability	Land area (million Ha)	% Total area
Marginal	0.53	26.49
Moderate	0.7	35.37
Good	0.43	21.63
High	0.33	16.51

Fig. 42: Land suitability map for rice production in Ogun State

In Ekiti west local government area, it was established that the soils around Aramoko and Ijero Ekiti up to Ifaki were highly suitable for upland rice cultivation while the soils around Ado-Ekiti, Iyin Ekiti Igede Ekiti and Igbemo are marginally suitable for rice cultivation. The soils around Efon Alaye, and Oke Imesi have moderate suitability. The implication of this is that rice farmers in Igbemo Ekiti would require special attention in soil management and land amendment practices to guarantee steady and improved productivity.

In Osun state soils close to Ilesha, particularly Erin Oke was classified as highly suitable, but over 79% of the arable land are categorised as marginal.

Ogun state shows a little exception especially around Obafemi Owode local government where almost 50% of the arable soil is considered as highly suitable for the cultivation of upland rice. This is a bit surprising given the long years of rice cultivation in the area one would expect the soil to be generally deficient in critical rice soil nutrients. The explanation could be that most farmers adopting the rotational fallow system have somehow perfected a form of land management strategy that ensured quick replenishment of soil nutrients

Ijebu North Local government area presents a slightly different picture. One half of the area is categorised as marginally suitable while the other half is classified as moderately suitable. Soils of Ijebu water-side are mostly deficient in nitrogen and phosphorus

Generally soils of south-western Nigeria have been described by Moss (1957), Smyth and Montgomery (1962). The parent material is a major determinant of soil characteristics. Soils of the study area are predominantly forest soils derived from metamorphic and igneous rocks (basement complex). An exemption is the Ijebu water-side dominated by deltaic deposits, fresh water swamp soils and saline mangrove soils.

Soils of the basement complex parent material have red to brown upper subsoil with higher clay content than the surface or lower sub-soil. The soils are characterized with slight to moderate leaching. Nitrogen response may not be obtained on soils that are newly cleared from about 10 years of bush fallow. Total N is generally above 0.1% (considered minimum for rice) while organic matter is usually above 1.5%. Because these soils have high Phosphorus adsorption capacity, phosphorus deficiency could present a serious problem. Since most of the phosphorus is in organic form, a high proportion of the available P is released through mineralization of organic phosphorus. The potassium status of these soils could vary widely. In high rainfall areas, economic response to K could be obtained after a year as a result of erosion, low mineral reserves and wide variation in the mineral composition of the parent material. There is a general decline in the initial soil fertility under continuous cultivation.

Summary, conclusions and recommendations

PropCom's proposition to support activities that impact on the Ofada rice value chain requires accurate information to develop appropriate interventions. Mapping of the Ofada rice value chain is important in obtaining the kind of information required. The mapping exercise is expected to facilitate geographical targeting of interventions where they are needed, improve cost effectiveness of infrastructural development spending and more efficiently reach those who need intervention most. These no doubt are some of the cogent reasons for PropCom's commissioning of this study.

The mapping exercise identified major Ofada rice production areas in Ogun, Osun and Ekiti States. It identified 254 Ofada rice farmers majority of whom are males, 204 parboilers mostly females, 36 rice mills in 55 villages and 11 local government areas in the three states.

Obafemi Owode local government area of Ogun State produced the highest quantity of Ofada rice (135,850 KG) in the study area. This was closely followed by Irepodun/Ifelodun Local government area of Ekiti (134,90KG). These two local government areas host Ofada village and Igbemo Ekiti respectively where there is a long tradition of rice production. The next highest producer is Oriade local government area in Osun State which recorded production level of 70,100 KG. The highest quantity of rice parboiled and milled was 109,800 Kg and this is from Obafem Owode Local government area. The lowest quantity parboiled and milled was 7, 670 Kg and this is from Ijero local government area of Ekiti State. The quantity of Ofada rice sold in paddy form was 21,110 Kg in Ogun Waterside local government area of Ogun State and 15,700 Kg in Ekiti West Local government area of Ekiti State. The total quantity of rice sold in paddy form was 36, 813Kg.

The distance analyses data consistently show that facilities for rice threshing, parboiling, milling, were readily available at local levels and within a short distance (between 2 and 4 kilometres) of the farmers' farm or residence. Although urban markets may appear to be very far away from rice production locations according to the distance analysis data, farmers did not seem to have problems selling their paddy or milled rice as buyers come directly to these locations to buy. The data further show that locations of Ofada rice production inputs such as seeds, agrochemicals and fertilizer were far away from farmers' field and residence (between 5 and 30 kilometres) and may not be readily available to the majority of rice farmers. This situation points to the need for direct interventions to improve access of farmers to all rice production inputs.

The total arable crop land in the rice production areas of Ekiti state is 100,524.411Ha. This represents about 84 percent of the total land area. Less than 10 percent of this is currently under rice cultivation in the State. In Osun state, Oriade local government area identified as the rice production area has 47,710Ha (79%) arable land. In Ogun state apart from 67% (337,180Ha) of land available as arable land with possibility for upland rice cultivation, about 625,62Ha or (12.5%) of the land area was categorised as wetland. This area could be explored for lowland rice cultivation within the five local government areas studied.

It was established that the soils around Aramoko, Ijero Ekiti up to Ifaki were highly suitable for upland rice cultivation while the soils around Ado-Ekiti, Iyin Ekiti, Igede Ekiti and Igbemo are marginally suitable for rice cultivation. The soils around Efon Alaye, and Oke Imesi were classified as moderately suitable. The implication of this is that rice farmers in Igbemo Ekiti would require special attention in soil management and land amendment practices to guarantee steady and improved productivity. In Osun state soils close to Ilesha, particularly Erin Oke was classified as highly suitable, but over 79% of the arable land are categorised as marginal. Ogun state presents a unique feature especially around Obafemi Owode local government where almost 50% of the arable soil is considered as highly suitable for the cultivation of upland rice. This is a bit surprising given the long years of rice cultivation in the area one would expect the soil to be generally deficient in critical rice soil nutrients. The could be that most farmers adopting the who are well known to use the rotational fallow system have somehow perfected this form of land management strategy for ensuring quick replenishment of lost soil nutrients

Ijebu North Local government area presents a slightly different picture. One half of the area is categorised as marginally suitable while the other half is classified as moderately suitable. Soils of Ijebu water-side are mostly deficient in nitrogen and phosphorus

In conclusion, the distance analysis maps reveal the importance of spatial targeting and prioritization of interventions. It is hoped that this result will be utilized by PropCom in developing, prioritizing and targeting interventions to positively impact the Ofada rice value chain in south western Nigeria**.**

A number of issues related to the Ofada rice value chain require further research and analysis. This mapping exercise was carried out when there was no crop growing on the field. A more detailed mapping of the production system with empirical of farm management data would reveal more comprehensively the problems associated with each stage of the Ofada rice production system.

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Appendix 1: Soil analysis parameters

GRIDCODE	CATEGORY	RICECODE	
32	Medium Textured Soils (loamy) || coarse textured soils	2	
23	Course Texture Soils (sandy) || medium textured soil	3	
43	Fine Textured Soils (clay) || medium textured	1	Textural Classification of soils
42	Fine Textured Soils (clay) || coarse textured	1	
32	Medium Textured Soils (loamy) || coarse textured soils	2	
32	Medium Textured Soils (loamy) || coarse textured soils	2	
43	Fine Textured Soils (clay) || medium textured	1	
32	Medium Textured Soils (loamy) || coarse textured soils	2	
34	Medium Textured Soils (loamy) || fine textured soils	2	
30	Medium Textured Soils (loamy) ||	2	
32	Medium Textured Soils (loamy) || coarse textured soils	2	
24	Course Texture Soils (sandy) || fine textured soils	3	
30	Medium Textured Soils (loamy) ||	2	
34	Medium Textured Soils (loamy) || fine textured soils	2	
43	Fine Textured Soils (clay) || medium textured	1	
34	Medium Textured Soils (loamy) || fine textured soils	2	
23	Course Texture Soils (sandy) || medium textured soil	3	
42	Fine Textured Soils (clay) || coarse textured	1	
30	Medium Textured Soils (loamy) ||	2	
43	Fine Textured Soils (clay) || medium textured	1	
43	Fine Textured Soils (clay) || medium textured	1	
30	Medium Textured Soils (loamy) ||	2	
20	Course Texture Soils (sandy) ||	3	
97	Water		CEC
23	Course Texture Soils (sandy) || medium textured soil	3	
97	Water		
97	Water		
20	Course Texture Soils (sandy) ||	3	
34	Medium Textured Soils (loamy) || fine textured soils	2	
20	Course Texture Soils (sandy) ||	3	
97	Water		
30	Medium Textured Soils (loamy) ||	2	
20	Course Texture Soils (sandy) ||	3	
43	Fine Textured Soils (clay) || medium textured	1	
20	Course Texture Soils (sandy) ||	3	
30	Medium Textured Soils (loamy) ||	2	
24	Course Texture Soils (sandy) || fine textured soils	3	

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99	99 = Glaciers, Rock, Shifting sand, Missing data

Nitrogen

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3818	30	>0.08-0.2 ||	2
3850	30	>0.08-0.2 ||	2
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3922	34	>0.08-0.2 || >0.2-0.5	2
3939	32	>0.08-0.2 || >0.02-0.08	2
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3941	23	>0.02-0.08 || >0.08-0.2	3
3957	23	>0.02-0.08 || >0.08-0.2	3
3976	32	>0.08-0.2 || >0.02-0.08	2
3977	34	>0.08-0.2 || >0.2-0.5	2
3978	34	>0.08-0.2 || >0.2-0.5	2
3979	23	>0.02-0.08 || >0.08-0.2	3
3994	34	>0.08-0.2 || >0.2-0.5	2
4007	32	>0.08-0.2 || >0.02-0.08	2
4055	30	>0.08-0.2 ||	2
4056	34	>0.08-0.2 || >0.2-0.5	2

4090	25	>0.02-0.08 || >0.5	3
4096	21	>0.02-0.08 || >0-0.02	3
4097	12	0-0.02 || >0.02-0.08	4
4098	12	0-0.02 || >0.02-0.08	4
4115	30	>0.08-0.2 ||	2
4116	32	>0.08-0.2 || >0.02-0.08	2
4117	12	0-0.02 || >0.02-0.08	4
4118	40	>0.2-0.5 ||	1
4119	12	0-0.02 || >0.02-0.08	4
4143	32	>0.08-0.2 || >0.02-0.08	2
4144	32	>0.08-0.2 || >0.02-0.08	2
4145	23	>0.02-0.08 || >0.08-0.2	3
4146	21	>0.02-0.08 || >0-0.02	3
4163	43	>0.2-0.5 || >0.08-0.2	1
4177	24	>0.02-0.08 || >0.2-0.5	3
4187	12	0-0.02 || >0.02-0.08	4
4206	20	>0.02-0.08 ||	3
4207	30	>0.08-0.2 ||	2
4208	20	>0.02-0.08 ||	3
4209	97		
4210	20	>0.02-0.08 ||	3
4211	23	>0.02-0.08 || >0.08-0.2	3
4224	97		
4236	12	0-0.02 || >0.02-0.08	4
4237	97		
4238	20	>0.02-0.08 ||	3
4239	34	>0.08-0.2 || >0.2-0.5	2
4255	12	0-0.02 || >0.02-0.08	4
4256	12	0-0.02 || >0.02-0.08	4
4257	97		
4258	30	>0.08-0.2 ||	2
4278	20	>0.02-0.08 ||	3
4279	43	>0.2-0.5 || >0.08-0.2	1
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4288	20	>0.02-0.08 ||	3
4322	24	>0.02-0.08 || >0.2-0.5	3
4351	43	>0.2-0.5 || >0.08-0.2	1
4370	34	>0.08-0.2 || >0.2-0.5	2
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PH

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The nutrient availability index based on the method developed by Radcliff et al (1982) and is given by NAI=N*P*K*pH. Due to absence of data on Phosphorus and Potassium, NAI in this study was limited to N*pH

Appendix 2: land suitability rating for the Ofada rice production areas.

Ofada rice production area	Suitability rating	Land Area (Ha)	% Land cover
Ogun state			
Abeokuta North	High		
	Moderate	5589.3	8.36
	Good	25228.6	37.72
	Marginal	36066.5	53.92
Ewekoro	High	61566	99.3
	Moderate		
	Good		
	Marginal	406.3	0.7
Ijebu North	High		
	Moderate	49389	57.87
	Good	1446	1.7
	Marginal	34515	40.43
Obafemi Owode	High	42816.3	30
	Moderate	34187.5	24
	Good	8586.7	6
	Marginal	56629.5	40
Ogun water side	High	8155.9	14.11
	Moderate		
	Good	31454.5	54.38
	Marginal	18225.4	31.51
Oriade	High		
	Moderate	9160.5	16.15
	Good		
	Marginal	47580.2	83.85
Ekiti State			
Efon	High	350.1	1.95
	Moderate	8438.3	46.85
	Good		
	Marginal	9221.2	51.2
Ekiti west	High	4876.8	17.45
	Moderate	14247.1	50.97
	Good		
	Marginal	8827.7	31.58
Ijero	High	11947.4	34.04
	Moderate	11788.5	33.59
	Good		
	Marginal	11362	32.37
Irepodun/Ifelodun	High	2171.0	5.66
	Moderate		
	Good		
	Marginal	36186.8	94.34