

Intensification Processes of Land Use in Southern Nigeria

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雑誌名	The science reports of the Tohoku University. 7th series, Geography
巻	27
号	2
ページ	201-217
発行年	1977-12
URL	http://hdl.handle.net/10097/45052

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Shuhei SHIMADA*

1 Introduction

Dr. Essang examined the notion of land surplus¹⁾ which had been applied to Nigeria, and he pointed out that the notion was lacking in precision, clarity and analytical usefulness. And he further set forth that the belief in the existence of surplus land had adversely influenced some aspects of Nigeria's rural development strategy (Essang 1973, p. 69).

The author has also examined the application problem of land surplus economy model to Nigerian economy, from different view of Dr. Essang,²⁾ and tried to make it clear that the rapid increase in food production in Nigeria up to 1960s could not be explained as what is imagined in land surplus economy model (Shimada 1976b). That is, the rapid increase in food production under traditional cultivation system in Nigeria can not be explained by extensive development of acreage of cultivation land only. But rather we should think that some intensification processes of land use have been played an important part in the rapid increase in food production.

The main objective of this paper is to point out some intensification processes of land use which have been seen in Southern Nigeria. This means that the author will review the traditional cultivation systems and illuminate its positive aspects which have been underestimated by some economists or agricultural economists who regard Nigerian economy as a land surplus economy. But it is also intended in this paper that the intensification processes under traditional cultivation system have come up to the limits of its capacity, and this is contributing to stagnation of food production today.

Concerning to the negative aspects which are thought to be the causes of stagnation of food production, there have been proposed many discussions. There

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- 1) 'Land surplus' notion has applied to the tropical West African economy and the Nigerian economy to explain their rapid increase of agricultural production (Myint 1964, Helleiner 1966, 24-29). In 'land surplus' economy model, the expansion of agricultural exports was thought to be achieved virtually through the expansion of the cultivation land and not through the application of new techniques or high yielding varieties (Ekundare 1973, *Federal Republic of Nigeria ... 1970*, p. 38).
- 2) Dr. Essang's study is chiefly based on the conceptional and statistical review, and not based on the studies concerning to agricultural production systems.

thought to be many bottlenecks which retard development in the food production; for example, traditional land tenure system (Adegboye 1966a and b, 1967, Famoriyo 1972, Hugh 1969, Meek 1957), application of primitive tools, poor marketing and distributing systems (Olayemi 1972, Oni 1972), lack of effective rural credit institutions (Olatunbosun 1975), damage from drought and the Civil War, and the lack of effective agricultural planning or performance (Olatunbosun 1975, p. 145 Wells 1974, p. 8).

But what the author tries to stress here is that the intensification in land use, which has sustained the rapid increase in food production in Nigeria up to 1960s,³⁾ runs up against a wall today, and it seems to be contributing to stagnation of food production.

2 Some determinant which brings on the change in cultivation system

Some types of cultivation systems have been identified in so called traditional agriculture in Southern Nigeria, and it has been cleared up that there were considerable wide range in terms of intensity of land use and techniques, and probably in terms of productivity of land and labour in such cultivation systems. Morgan (1959) proposed that six categories in the use of land can be designated in Southern Nigeria, from shifting cultivation to permanent cultivation and tree cultivation. Floyd (1969) also identified that there are five general systems of cultivation by traditional farmers in the Eastern Nigeria, from shifting cultivation to intensive sedentary cultivation (See Table 1).

Coexistence of these various cultivation systems in Southern Nigeria is the result that peasant farmers in each regions have developed their cultivation systems driven by some internal or external necessity. Thus, prior to analysing

Table 1 Cultivation systems

By W.B. Morgan (1959)	By B. Floyd (1969)
Shifting cultivation	Shifting cultivation
Rotational bush fallow	Bush fallowing
Cereal-roots	Rudimentary sedentary cultivation
Roots-cereals	Intensive sedentary cultivation
Roots	Compound farming
Rotational planted fallow	Terrace farming
Permanent cultivation	
Tree cultivation	
Flood land cultivation	

3) The author is not sure when the intensification in land use has began to come up to its limits in Nigeria. However it can be said that land deterioration (owing to intensive land use) has quicken its pace since about 1960 when acreage of unused cultivable land has become scarce (Shimada 1976).²⁾

the intensification process in land use (change in cultivation system), the author will take a look at some determinants which bring on the change in cultivation system.

It is widely acknowledged that traditional agricultural system have responded both to internal stimuli, such as population growth, and to external stimuli, such as the rapid growth in demand of export cash crops. Rapid growth of cocoa production in Western Nigeria, cotton and groundnuts cultivation in Northern Nigeria and palm production in Eastern Nigeria are the result that Nigerian peasant farmers have responded to external stimuli. In 'vent for surplus' model by Myint (1964), these dramatic expansion of cash crops' production was thought to have been achieved by the expansion of the cultivation land and the mobilization of underutilized labour.

Concerning the internal stimuli, the foregoing study seems to support the hypothesis that the intensification in land use develops as a response to the increasing needs of a growing population. For example, Boserup (1965) has set up a hypothesis which recognizes population as an independent variable conditioning changes in land use. This view of population as the determinant variable in agricultural change is supported by current and historical evidence from the developing countries. And many geographers admit this view implicitly or explicitly (Prothero 1972).

Lately Levi (1976) has examined Boserup's view and he has posed a question on the view which regarded population pressure as an important determinant of technical change in agriculture. He says that the density of population can not be regarded as equivalent to pressure of population. And he also says that population density is misleading when used as an indicator of population pressure. As an alternative on the basis of a theoretical definition of the term 'pressure', he has proposed a new determinant, i.e. the dependency ratio⁴) (the ratio of population to labour).

However, it will not be discussed here what kinds of factors play an important role as determinants or stimuli which bring on the technical change in agricultural and cultivation systems. Because it is not possible here to distinguish a cause-and-effect relationship as Boserup or Levi has done. But in this paper, the author uses population density as a most important determinant which brings on the

4) Levi said "'Pressure' on resources has been defined as actual output, or demand, is assumed to be related mainly to the size of the population. Potential output could conceivably be measured by somehow measuring and aggregating the stock of resources - predominantly land and labour. ... the stock of labour will represent ... potential output. Thus, actual output relative to potential output is represented by the ratio of the two proxy variables: total population and the size of the labour force." (Levi 1970, p. 66).

change in cultivation system, as population density is now the most convincing evidence.

3 Increase in productivity of land

3.1. Two analytical points of view

To analyze the cultivation systems precisely, not only a spacedimensional approach but also a time-dimensional approach is necessary. In other words, both a land utilization approach and an ecological approach are necessary (Uzozie 1971).

Land use pattern or crop combination pattern is a projection of cultivation cycle on the ground, and it can be said that land use pattern is a segment of cultivation cycle (See Fig. 1). It is not enough to analyze only land use pattern or crop combination pattern. We can not understand cultivation systems as a whole till we pay attention both to land use pattern and sequence of farming operation.

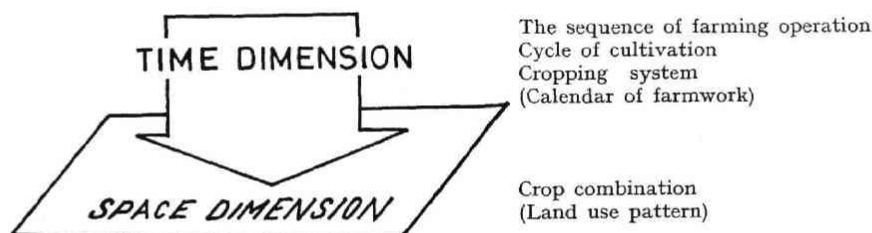


Fig. 1 Cultivation System

As to the analysis of crop combination (or land use) pattern, the statistical approach seems very appropriate which was developed by Weaver⁵⁾ (1954) and later used by Uzozie (1971) in Nigeria. But unfortunately, we lack good quality statistics which we can use effectively for the purpose of our study, we must refer to many reports of rural surveys. These rural surveys which have done by some geographers, anthropologists and economic agriculturists also have many informations about cultivation cycle. So, these surveys are very useful for us to analyze traditional cultivation systems. This is why the author uses in this paper not only

5) Weaver selected the standard deviation formula to establish both the identity and the number of crops in the basic combination for some region, expressed as follows;

$$\sigma = \sqrt{\frac{\sum d^2}{n}}$$

where d is the difference between the actual crop percentage in a given county (or region) and the appropriate percentage in the theoretical curve, and n is the number of crops in a given combination (Weaver 1954, 177-181).

the result of agricultural censuses but also some evidences which have been disclosed by some rural surveys.

3.2. Intensification processes

According to the evidence which has been disclosed by many studies, we can identify four intensification processes of land use as follows,

- (a) Lengthening of the period of successive cultivation and shortening of the period of fallow
(Increase in acreage of cultivation land and decrease in that of land under fallow),
- (b) Transition from rotational land use to permanent land use
(Increase in acreage of compound land),
- (c) Change in crop combination
(Increase of interplanting and/or mixed cropping),
- (d) Increase of composting and/or manuring, and improvement in farm implement
(Increase in acreage of land which is manured and/or composted).

Explanatory notes put in parenthesis are written from space-dimensional point of view.

Now these four processes will be examined not only theoretically but also empirically in the light of Southern Nigerian case. The discussion will be advanced according to the foregoing order.

- (a) Lengthening of the period of successive cultivation and shortening of the period of fallow

From space-dimensional point of view, this process can be said as an encroaching process on fallow land. Ruthenberg (1971) has proposed R as a symbol which indicates the intensity of the rotation, and he defined the symbol R as the number of years of cultivation multiplied by 100 and divided by the length of the cycle of land utilization.⁶⁾ If we use the characteristic to explain this process, we can say that the value of R becomes larger and larger in this process.

Then we must prove here what kinds of changes in cultivation system have taken place which enabled to lengthen the period of successive cultivation in Southern Nigeria. To conclude taking in advance, the author thinks it is possible that the lengthening of the period of successive cultivation is related to the

6) When a level of intensity of land utilization has been achieved permanent farming, and the R value comes to 100, Ruthenberg proposes a different definition of R . According to his definition, for example $R=150$ would indicate that 50 per cent of the area is carrying two crops a year. The author thinks that the characteristic R can't be used when it exceeds 100. In case farmers are practicing two or more crops a year, we must devise the other characteristic to classify different cultivation systems (Ruthenberg 1971, 2-4, 55-57).

Table 2 Patterns of crop rotation

Year	1st	2nd	3rd	4th	5th~8th
(a) MbaAliko (Tiv)	Yam	Bulrush millet Guinea corn	Fallow — (Beniseed, Sweet potatoes, Groundnuts and Cassava)		
(b) Nnewi (Onitsha Province)	Yam Maize Pepper Beans Okra Vegetables	Cocoyam Maize Pepper Beans Okra Vegetables	Yam Maize Vegetables Beans Cocoyam	Cassava Beans Vegetables	Cassava Fallow —
(c) Ibadan Division	Maize Yam	Maize Yam Beans Gourd	Maize Cassava	Cassava	Fallow —
(d) Ilorin	Maize Guinea corn	Yam Maize	Cassava	Fallow —	

Sources: (a) Bohannan, P. & L. Bohannan (1968), 39-57

(b) Floyd (1969), p. 177

(c) Meek (1957), p. 14

(d) Morgan (1959), 138-150

introduction of new root crop (cassava) to Southern Nigeria. Table 2 shows some examples of the succession of crops which have been observed in Southern Nigeria. We can find from these examples that cassava is usually planted in the last year of cultivation, or in other words, cassava is planted on the cultivation land which will be laid in fallow in a short time. Cassava has outstanding ability to produce tolerable yields on soils of low fertility, even on soils too poor for other crops. To addition this, cassava has another merit that it requires relatively small additional input of labour and not necessitate new methods of cultivation. So farmers can grow cassava easily on third or fourth cultivation land whose fertility is almost exhausted and which had been laid in fallow formerly. Growth periods of cassava is commonly 5-15 months and its root may be left in the ground for two years or occasionally as long as three years as cassavas are perenial plants (Johnston 1958, p. 108). Therefore by growing cassava, the period of successive cultivation has been lengthened and contrary the period of fallow has been shortened. From Table 3 too, we can see the distinctive feature of cassava that it is planted on cultivation land on which other crops are growing but when it is harvested, it grows by itself as a sole crop. This is because cassava is planted at the end of succession of cultivation, and be left in the ground for two or three years.

Cassava became popular in Southern Nigeria after the last quarter of 19th

Table 3 Acres under cultivation per farmer and in particular crops, sole and mixed separately

	Eastern Nigeria	Western Nigeria	Mid-Western Nigeria
Yam (s)	0.16	0.22	0.09
(m)	0.53	0.11	0.91
Maize (s)	-	0.31	0.01
(m)	0.43	0.29	0.92
Old cassava* (s)	0.14	0.12	0.19
(m)	0.03	0.02	0.07
New cassava* (s)	0.05	0.05	0.12
(m)	0.39	0.15	0.41
Cocoyam (s)	0.05	0.02	0.01
(m)	0.20	0.11	0.15

* "Old" crops are harvested during the survey year; "New" crops are not. Nigeria. Federal Office of Statistics, *Rural Economic Survey of Nigeria: Farm Survey 1964/65*, Lagos (1966), Table 1

Table 4 Acreage under cultivation per farmer

	Yam (A)	Cassava (B)	(B)/(A) %
Eastern Nigeria	0.69	0.61	88
Western Nigeria	0.33	0.34	103
Mid-Western Nigeria	1.00	0.79	79

Calculated from Table 3

century, and its spreads are rather new. But in 1960s, its cultivation is widely developed in all over the Southern Nigeria (Shimada 1976)¹). And acreage of land on which cassava is grown is nearly same that of yam (See Table 4). Growth rate of cassava production over changes in cultivation system should seem to be great. It can be safely said that increased food production in Southern Nigeria depends largely upon this process which is sustained and actualized by growth of cassava production. And the role of this process will become more and more important in accordance with diminution of unused cultivable land.

(b) Transition from rotational land use to permanent land use

As explained in parenthesis, this is the increasing process of acreage of compound land. And this increase of acreage of compound land has two meanings, namely expansion of acreage of cultivation land and intensification in agriculture.

Throughout Southern Nigeria, cultivation land can be divided generally into two categories, such as compound land (inner farmland) and outer farmland. Compound land is usually utilized for producing vegetables and fruits. But the

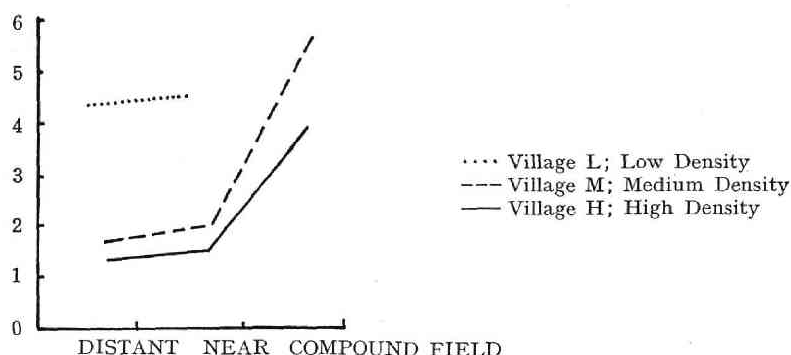


Fig. 2 Yield Trends of Total Production in Kg of Dry Matter/ha for Three Field Types Under Three Population Densities

Source: Lagemann and others 1976, p. 214

rising demand for staple foods led to the raising of basic starchy foodstuffs (yam or cocoyam) in addition to vegetables within the compound plots (Floyd 1969, p. 81). On compound land, permanent cultivation is a common feature, and that increase of acreage of compound land means increase of total cultivation land. As land use on compound land is more intensive than that on outerfarm land, this process holds at the same time the characteristic of intensification process.

It is generally observed that land fertility of compound land are higher than that of non-compound land in spite of frequent use of it. This is supported by Fig. 2 which shows the differences of production per hectare by types of cultivation land. This is because farmers are practicing more advanced and intensive techniques of production on compound land. This is why the author thinks that the expansion of compound land can be recognized as an important process which backs up the increase in food production.

It is widely acknowledged that the areas of compound-type gardening increased in proportion to the growth of population, and in the highly populated area, the acreage of compound land itself increased. In Oko region of Eastern Nigeria where population density is 530 persons per square miles, acreages of compound land are 1400, and that of outer farmland are 1600. And further, at Orlu Okigwi and Awka Divisions where population density is over 1000 persons per square miles, it is reported that almost all farmland is occupied by compound land (Grove 1951). And in the case of Ozubulu village group of Eastern Nigeria, Udo reports the rapid change in land use. He says that about in 1930, villages were separated by farmlands and by other unoccupied lands, but in 1958, almost all unoccupied land has distinguished and farmlands have been gradually replaced by compound land (Udo 1965). Increasing population density eventually push to

compound-land farming as well as reduce the length of the fallow period. But it is difficult to conclude whether compound-land farming comes after shortening of fallow period or not.

Anyway compound-type gardening has become very common and widespread practicing in Southern Nigeria. And hybrid system of permanently cultivated compound farms and occasionally cropped outer farms are to be found throughout Southern Nigeria, especially in Eastern Nigeria. This means that this process also played an important role in increasing food production in Southern Nigeria. But we can't make clear when and where this process, extension of compound land, was taken place as one of means to increase food production.

(c) Change in crop combination

There seems to be two important changes in crop combination. One of them is the change from yam dominant crop combination to cassava dominant crop combination as stated before (3.2.-(a)). And the other is increase of interplanting and/or mixed cropping.

In Southern Nigeria, practicing of interplanting and mixed cropping is one of the most common features. When the land is cleared of bush, yam is planted first, and then two or more plants are interplanted. Besides this, we can see many other types of combination of crops which are interplanted or mixed cropped.

If yields per acre of each crops are maintained in spite of intensification of land use, land productivity of cultivation land will increase in accordance with the increase of interplanting or mixed cropping. Of course it is difficult to maintain soil fertility of land on which crops are planted more and more intensively and sequentially. So before we apply this process to the explanation of increased food production in Southern Nigeria, it is essential to examine reduction rate of land productivity which is brought on by increase of mixed cropping or interplanting. Only a few data are available concerning this point (Table 5 and 6). What we can learn from Table 5 and 6 is that the diminishing rates of yield owing to inter- and/or mixed cropping are generally below 30%. Therefore we can safely say that in Southern Nigeria, increase of interplanting or mixed cropping means increase of food production.

Then can we show the fact certifying that there really happened the increase of inter- and/or mixed cropping in Southern Nigeria? No, there are too little data available to analyze this point. So it can not be helped that the author barely be able to point out some interesting viewpoints.

Reviewing some studies which tries to analyze crop combination pattern in Southern Nigeria (Agboola 1968, Uzozie 1971), it seems that yam and/or cassava are the most or the second most major food crops in Western and Eastern Nigeria. (See Fig. 3, 4). In the region where yam is thought to be the mainstay in crop

Table 5 Average yield of each crops, sole and mixed separately

			Yield (ton per acre)		Rate of decrease in yield as compared (m) with (s) (percentage)	
			1963/64*	1964/65**	1963/64*	1964/65**
Yam	sole (s)		4.40	3.83	12	10
	mixed (m)		3.86	3.43		
Maize	(s)		0.40	0.44	25	23
	(m)		0.30	0.34		
Cassava	(s)		4.31	4.43	24	40
	(m)		3.29	2.65		
Cocoyam***	(s)		2.94	3.11	23	32
	(m)		2.26	2.31		

* Nigeria. Federal Ministry of Information, *Annual Abstract of Statistics*, Lagos (1965), p. 33, Table 4-5

** Nigeria. Federal Office of Statistics, *Rural Economic Survey of Nigeria: Farm Survey 1964/65*, Lagos (1966), Table 1

*** in Eastern Nigeria

Table 6 Range of yield of each crops at Uboma

		Yield (tons per acre)	Percentage
Yam mixture	Compound farm Yam/Cocoyam/Cassava/Vegetables	3.7	100~78
	Other farms Yam/Cocoyam/Cassava/Maize/Vegetables	2.9	
Cassava	Sole	3.3	100~88
	Mixed Cocoyam/Cassava	2.9	
Cocoyam	Sole	2.6	100~69
	Mixed Yam/Cocoyam/Cassava/Maize/Vegetables	1.8	
Maize	Mixed Cassava/Maize	0.20	100~90
	Mixed Yam/Cocoyam/Cassava/Maize/Vegetables	0.18	

Source: Oluwasanmi (1966), p. 91

combination, yam is usually cropped solely and then cocoyam or maize are mixed- or intercropped (Floyd 1964, 91-108). And in the region where cassava has taken the place of yam as the mainstay in crop combination, cassava is solely cropped and cocoyam, maize and yam are intercropped later (Oluwasanmi and others 1966, p. 84). Thus, it seems that cocoyam and maize are interplanted or mixed cropped with yam or cassava. And it is rarely that yam and cassava are

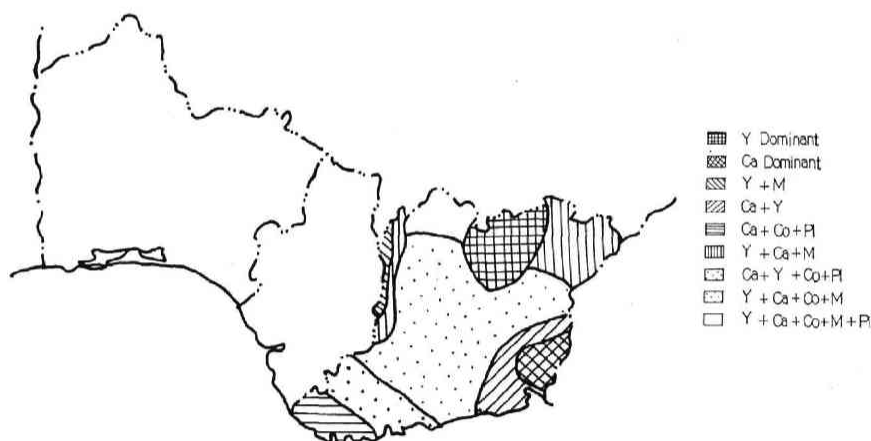


Fig. 3 Food Crop Combination Regions in Western Nigeria

Y: Yam Ca: Cassava Co: Cocoyam M: Maize Pl: Plantain Pi: Pigeon Pea

Source: after Uzozie 1971, p. 68

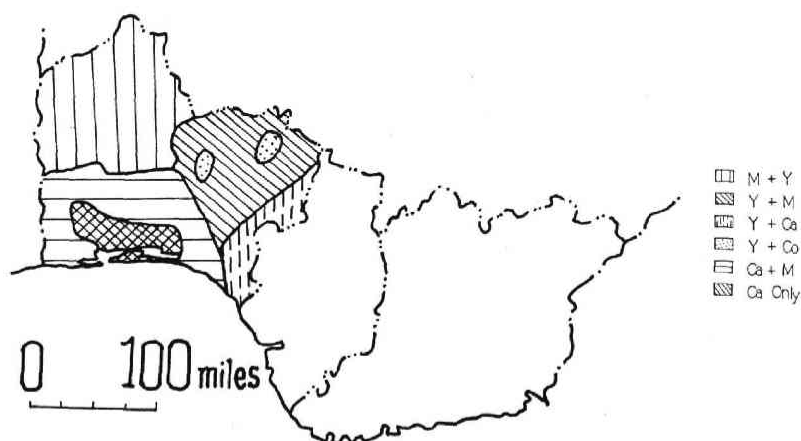


Fig. 4 Food Crop Combination Regions in Eastern Nigeria

Y: Yam Ca: Cassava Co: Cocoyam M: Maize

Source: after Agboola 1968, p. 146

mixed cropped in the same plot. So if we can set forth that the growth rate of production of maize and cocoyam is higher than that of yam, we can safely say that mixed cropping or intercropping have developed. However it is not proper to compare with the growth rate of maize's and cocoyam's production and that of cassava in this case. Because, as mentioned before (3.2.-(a)), cassava is a crop which is introduced into Nigeria relatively new, and even now expanding its cultivation land.

Table 7 Production of principal food crops, 1950 and 1957

	1950 (million ton)	1957 (million ton)	% change
Eastern Nigeria			
Yam	2.48	2.41	- 2.8
Cassava	1.58	1.73	+ 9.5
Cocoyam	0.28	0.38	+35.7
Maize	0.06	0.10	+66.7
Western Nigeria			
Yam	2.26	1.65	-27.0
Cassava	1.13	1.40	+33.9
Cocoyam	0.21	0.15	-28.6
Maize	0.24	0.22	- 8.3

Source: Okigbo (1962), 49-50

Table 8 Production of principal food crops in Nigeria (in 000 tons)

	Average production for the period between		% change
	1958/59-1962/63	1962/63-1966/67	
Yam	12,930.8	13,828.8	+ 6.9
Cassava	2,791.6	3,007.0	+ 7.7
Cocoyam	1,051.0	1,530.0	+45.6
Maize	959.4	1,115.2	+16.2

Source: Oni (1972), p. 147

Seeing Table 7 and 8 in this context, we can find general trend that output of yam remains relatively stagnant or to be decreased, output of maize is increased or even in case it is decreased (Table 7), the rate of its decline is lower than that of yam, and output of cocoyam is increased rapidly than that of yam except for the case of Western Nigeria. And this trend can be seen all through the period of 1950s and 1960s. According to these evidence, it can be said that food production in Southern Nigeria have been increased through this process at least since 1950.

(d) Increase of composting and/or manuring, and improvement in farm implement

Concerning to manuring or composting, we can say without great fail that in Southern Nigeria the effect of manuring or composting does not have positive meanings but defensive one. Because manuring or composting is practiced only when farmers are forced to do so, and it is not practiced positively to raise productivity of cultivation land. In spite of all these efforts, such as manuring or composting, fertility of the soil in Southern Nigeria is found to deteriorate with increase of frequency of land use, and the productivity of land declines in Southern Nigeria. Please see Fig. 2 again, we can learn from this figure that crop yields is

Table 9 Fertility indicators of compounds and outer fields in three survey villages of differing man/land ratios in Eastern Nigeria

Soil Fertility Indicators		Population Density		
		Low*	Medium	High
Compounds				
Org. C	(%)	n.a.	2.06	1.06
pH		n.a.	5.06	5.06
Ca+Mg	me/100 gm	n.a.	3.50	2.77
K	"	n.a.	0.14	0.21
P	"	n.a.	36.18	19.18
N	"	n.a.	0.17	0.09
Outer fields				
Org. C	(%)	2.37	2.10	1.35
pH		4.51	4.72	4.42
Ca+Mg	me/100 gm	1.21	1.75	1.20
K	"	0.09	0.06	0.10
P	"	14.85	9.12	9.72
N	"	0.17	0.16	0.10

* Village L did not have well developed compound plots

Sources: Lagemann and others (1976) p. 212

lower in the area where population density is high, and higher in the area where that is relatively low. And then see Table 9 which shows the fertility indicators of compounds or outer land in three villages of differing man/land ratios in Eastern Nigeria, we can see that the higher the population density and the greater the intensity of land use, the lower is soil fertility. In short, in the area where the population density is high, the intensity of use of the land is high, and soil fertility is low and, as a result, the crop yield are low.

Shortening the period of fallow (Process (a)), increase of successive cultivation on compound farmland (Process (b)) and increase of inter- and mixed-cropping (Process (c)), all these are the processes which increase the frequency of land use. And what we can learn from Fig. 3 and Table 9 is that the land productivity has been decreased in accordance with the development of these processes. Although in a short term, the development of these processes lead to the raise of productivity of land as mentioned before, but, in a long term, it inevitably bring the decrease of land productivity.

The author thinks that one of the most important causes of stagnation of food production since 1970 is due to this cause. Because practicing of manuring and composting is a fundamental work to maintain soil fertility, but it has not only been sufficient, but also the use of chemical fertilizer has been small. As for the effects of chemical fertilizer in Nigeria, we can almost disregard it. As small quantities of fertilizer ranging between 1000 and 5000 tons in terms of nutrient content have

Table 10 Farm implements used at some villages

Tiv*	(Shifting cultivation)
	heavy hoe, small hoe, digging stick, trade matchet, knife, aga (used for pressing long grass, millet or guinea corn stalks to the ground)
Uboma**	(Intensive sedentary cultivation)
	digging iron rod, curved weeding matchet, axe and climbing rope, short-handled hoe
Cocoa farmer***	
	hoes, matchets and cutlasses, cocoa knives, baskets

Sources: * Bohannon (1954) 81-82
 ** Oluwasanmi and others (1966) 85-87
 *** Galletti and others (1956) 166-169

been used in Nigeria over the period 1954/55-1962/63,⁷⁾ and that such fertilizers were used primarily at plantations and research stations until 1961 when fertilizer subsidy scheme was begun in the North Nigeria.

Then are there any kinds of change in farm implement? It must be true that many kinds of farm implements have been improved partially, but not fundamentally. And there are few implements which were newly introduced into Southern Nigeria and came to be widely used, for example steel matchets and axes (Morgan & Pugh 1969, p. 67). The chief implements used in Southern Nigeria are the hoe, the digging stick, the cutlass and the sickle and that have been invariable. And these chief implements are used in all around the Southern Nigeria, both in the area where farmers practise shifting cultivation and in the area where farmers practise permanent cultivation (Table 10). This also means that only few and partial improvement in farm implement was carried out and therefore its effect on increasing food production was nominal. The cutting efficiency of newly introduced steel matchets are undoubtedly greater than that of traditional ones, and it has eased the task of clearance and has increased productivity per man power. But it seems that there are no fundamental improvement in farm implement or introduction of epoch-making tools which have realize the raise of land productivity. Some small improvement in farm implement is also thought to play an assistant role for development of Process (a), Process (b) and Process (c).

4 Summary

In this paper, the author proposed four intensification processes of land use and then examined that in the light of Southern Nigerian case. The analysis suggests that these intensification processes have been developed in all over the

7) Import of fertilizer in value was L175,000 per year on the average over the period 1955 and 1970. Almost all of these fertilizer came from Netherlands (Nigeria Federal Office of Statistics, *Annual*...).

Southern Nigeria, and that have greatly contributed to increase in food production. But it is also suggested that the intensification of land use has come up to its limit today, mainly due to the deterioration of land fertility.

Changes in farming practice which support these intensification processes and increase in food production have been taken place very rapidly and extensively, deterioration of land fertility has also been rapid. So some efforts to maintain soil fertility have proved fruitless, because a some quantity of additional manuring or composting has not been able to make up for such rapid deterioration of soil fertility. This seems one of the main reasons which contributes to stagnation of food production.

At the end, the author will show relationships between these intensification processes and increase in food production, or between land deterioration process and decrease in food production diagrammatically as follows;

	1950s*	1960s	1970s
Intensification processes (a), (b), (c) and (d)	↗	↑	↑
Land deterioration	↘	↘	↓
Food production	↗	↗	↘

* The author thinks 1950s is the decade when Nigerian economy got out of land surplus economy and the intensification processes began to play an important role in Nigerian food production (Shimada 1976).²⁾

Of course this is a tentative proposition, and more precise studies and strictly defined examinations are needed.

The author would like to express his hearty thanks to Prof. K. Nishimura and Prof. S. Kiuchi who gave sincere guidance and continuous encouragement in his study. And the author also would like to express his thanks to Prof. R.K. Udo, the Head of the Department of Geography, University of Ibadan, who kindly decided to accept him to the Department as an Honorary Research Fellow.

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