

Declining Yield of Oil Palm: A case study of Four Oil Palm Plantations in Nigeria and Cameroun

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ABSTRACT

This paper investigates the achievable yield and extent of oil palm yield decline over time in four large oil palm plantations in Nigeria and Cameroon. In Nigeria the highest achieved palm oil yield was 2.64 tonnes per hectare for 9-year-old palms in one of the plantations studied. By the eighteenth year, the yield had declined to 1.38 tonnes of palm oil per hectare. The Cameroon Development Corporation has achieved a yield of 20 tonnes of fresh fruit bunches (equivalent to 4.20 tonnes of palm oil) per hectare in Ndiabou. This yield level has, under proper management, been recently achieved in a Nigerian oil palm plantation. It is hoped that this yield level will be sustained over a long period of time. Drastic falling off in yield is due to declining soil fertility and improper management of plantations and oil mills. The need for increased investment in oil palm research and adoption of improved oil palm management practices is emphasized.

INTRODUCTION

Declining yield of the oil palm over time adversely affects resources productivity and leads to increasing unit cost of production. By the nature of the oil palm and other tree crops, the yield increases with age during the early years of harvest and, after reaching the peak, stabilizes around the peak for some years before falling off gradually. In Malaysia the potential crude palm oil yield per hectare (ha) for the oil palm increases sharply from 0.2 tonne in the third year after planting to 4.42 tonnes in the sixth year; reaches a peak of 5.44 tonnes in the tenth year and thereafter falls off gradually to 4.45 tonnes; 3.76 tonnes and 3.36 tonnes

in the eighteenth, twenty fifth and thirtieth year respectively (Lanagan, 1977).

In Nigeria falling yields in mature oil palm plantations after about the ninth year from planting (Nigeria, 1946) began to give rise to some concern about 1940 when yield dropped from 6.72 tonnes to 2.24 tonnes of fresh fruit bunches (ffb) per ha per year. The Oil Palm Research Station (1948, p.41), noting that the problem was that of soil fertility and various disease conditions, concluded tentatively "when a palm plantation has reached a very low level of yield, restorative measures, while practically possible, are not likely to be economic".

It is relevant to note that oil palm cultivation in African countries is disadvantaged compared to that in Asian

countries. This is due to unfavourable agro-climatic conditions, which Waters (1927) identified. Whereas in Malaysia palm oil yields of 5.5 to 6 tonnes are achievable, a yield of 3 tonnes of palm oil per ha, per year is considered to be good for most African countries (Bank Pertanian Malaysia, 1981). In Nigeria the tenera hybrid palm, produced and distributed by the Nigerian Institute for Oil Palm Research (NIFOR) for cultivation, is asserted to have a potential yield of 15-20 tonnes of ffb per ha per year with an average annual palm oil yield of 3.5 tonnes per ha (NIFOR, 1985). Under proper management, as in Okomu Oil Palm Co. Plc. in Edo State, Nigeria, yields of about 17 tonnes of ffb per ha per year, and extraction rates of between 19 and 22% oil to ffb have recently been achieved.

While oil palm yields decline over time as highlighted above, it is doubtful whether a yield of 5 tonnes of palm oil per ha is achievable in Nigeria and Cameroon, which is Nigeria's neighbour. Cameroon is brought in because part of the selected oil palm seeds used for planting in Nigeria as from the mid 1930s came from Ndian oil palm estate in Cameroon owned by the United Africa Company Limited (UAC). This Company through its subsidiary also owned oil palm estates in Nigeria – the Calabar and Cowan Oil Palm Estates. The subsidiary, Pamol still owns Calabar Oil Palm still owns Calabar Oil Palm Estate (COPE) in Calabar, Cross River State, but the Cowan Estate in Ajagbodudu situated in Delta State was acquired by the then Mid-western Nigeria State Government.

In view of the doubt expressed above, this paper investigates the achievable yield and extent of oil palm yield decline over time in four oil palm plantations in Nigeria and Cameroon. The second section of this paper deals with the methodology while the third section presents and discusses the findings. The last section concludes the paper and offers some recommendations.

METHODOLOGY

To estimate achieved yield and extent of yield decline over time, production statistics were obtained from oil palm estates owned by Pamol, the Cameroon Development Corporation (CDC), Adapalm Nigeria, Limited and Risonpalm Nigeria Limited. Adapalm and Risonpalm Companies used to be outstanding in Nigeria with respect to achieving high oil palm yields.

Quantity of palm oil and palm kernel produced per ha per year in oil palm estates owned and operated by Pamol in Nigeria and Cameroon were derived from the UAC Statistical and Economic Review (1951) as well as from Macfarlane and Oworen (1965). The statistics cover the periods 1937/38 to 1938/39, 1945/46 to 1949/50 and 1963. Harvested output of ffb per ha was also obtained from COPE for palms planted between 1989 and 1993 for the 1997 to 1998 production period.

Production statistics for CDC oil palm estates cover the period 1987/88 to 1996/97 for palms planted between the mid 1960s and the 1980s. They were obtained from the Golden Jubilee Publication of the Cameroon Development Corporation (undated). Production Statistics of Adapalm and Risonpalm estates were from surveys, which this author started in 1986 (NIFOR, 1986).

Due to limited information, harvested output of ffb per ha in CDC is pooled average for all the years of planting. For Adapalm and Risonpalm Estates, harvested output of ffb per ha was estimated according to the year of planting and over the production period for which information was available. To reduce the effect of climatic variations on oil palm yield, achievable harvested output of ffb according to age of palm was obtained as the average for different years of planting. Achieved palm oil and palm kernel extraction rates from the CDC and palm

Table 1: Palm Oil and Palm Kernel Production in Pamol Owned Oil Palm Estates in Nigeria and Cameroon

Period	Hectarage in Production	Production in Tonnes per hectare	
		Palm Oil	Palm Kernel
1937-38	5,099	0.24	0.09
1938-39	6,345	0.34	0.12
1945-46	7,930	0.99	0.35
1946-47	7,930	1.06	0.35
1947-48	7,930	1.13	0.38
1948-49	7,930	1.14	0.35
1949-50	7,930	0.87	0.29
1963	10,965	1.13	0.49
1998	137	1.62	0.67

Source: Derived from (1) United Africa Company Limited Statistical Economic Review, No. 7, March 1951, p.13, (2) Macfarlane D. L. and Oworen M.A. (1965). "Investment in oil palm plantations in Nigeria. A Financial and Economic Appraisal" (Economic Development Institute, University of Nigeria, Nsukka) p. 19 and (3) Field Study of Pamol Estate, Calabar, Nigeria

Adapalm oil mills were obtained for the purpose of computing achievable palm oil kernel yields over time. The Risonpalm oil mill data was not utilized because, unlike the CDC and Adapalm oil mills which milled tenera bunches only, the Risonpalm mill combined dura and tenera bunches between 1986 and 1996

FINDINGS AND DISCUSSION

Achieved palm oil and palm kernel yield in Pamol owned estates in Nigeria and Cameroon

Table 1 shows achieved palm kernel production in Pamol owned oil palm estates in Nigeria and Cameroon between 1937 and 1963. As can be derived from the Table, palm oil and palm kernel production averaged 0.29 tonne and 0.11 tonne per ha respectively between 1937 and 1939 when hectarage in production increased from 5,099 ha to 6,345 ha. Between 1945 and 1950, when the area under production was 7,930 ha, palm oil

and palm kernel production, as can be derived from the Table, averaged 1.04 tonnes and 0.3 tonnes per ha respectively. Palm oil production in particular gradually increased from 0.99 tonne per ha in the 1945-46 season to 1.14 tonnes per ha in the 1948/49 season before falling to 0.87 tonne per ha in the 1949/50 season. The drop in production may have been due to the ageing effect, unfavourable climatic conditions or reduction in the labour force, which dropped from 3,257 during the 1947/48 season to 2,909 and 2,784 persons during the 1948/49 and 1948/49 and 1949/50 seasons respectively. The statistics below reflect progress in the cultivation of improved oil palm varieties and use of improved machinery in palm oil and palm kernel extraction. Palm oil production in Pamol Estate, Calabar, Nigeria was 1.62 tonnes per ha while palm kernel production was 0.67 tonne in 1998 for palms planted in 1989. It is relevant to note that Pamol replanted the Calabar oil palm estate with rubber in the 1960s and diversified to cultivate oil palm in 1989.

ii) Achieved oil palm yield in Cameroon Development Corporation owned oil palm estates.

Table 2 shows achieved oil palm yield (ffb, palm oil, and palm kernel) and palm oil and palm kernel extraction rates during the 1987/88 to 1996/97 period. FFB harvested during the 1987/88 to 1991/92 period (approximately 10 percent drop in harvested output). The quantity of palm oil produced during the 1987/88 to 1991/92 period averaged 1.61 tonnes per ha per year compared to 1.43 tonnes per ha per year during the 1992/93 to 1996/97 period (approximately 11 per cent drop in milled output). Estimated yield of palm oil during the 1987/88 to 1996/97 period is 1.5 tonnes per ha. Palm oil extraction rate dropped from 21.2 per cent during the 1987/88 to 1991/92 period to 20.7 per cent during the 1992/93 to 1996/97 period.

Table 2: Achieved Oil Palm Production in the Cameroon Development Corporation Owned Estates

Production year	Achieved Oil Mill Extraction Rates (%)		Achieved Production (tonnes/ha)		
	Palm Oil	Palm Kernel	FFB	Palm Oil	Palm Kernel
1987/88	21.1	4.2	8.05	1.70	0.34
1988/89	21.0	4.0	7.73	1.62	0.31
1989/90	21.0	4.0	7.89	1.66	0.32
1990/91	21.6	4.3	7.61	1.64	0.33
1991/92	20.5	4.3	7.08	1.45	0.30
1992/93	20.6	4.4	7.37	1.52	0.32
1993/94	20.9	3.9	6.89	1.44	0.27
1994/95	20.7	3.8	6.40	1.32	0.24
1995/96	20.5	4.8	6.40	1.32	0.36
1996/97	20.6	5.3	6.60	1.36	0.35
Average					
1987/88 to 1991/92	21.1	4.2	7.67	1.61	0.32
1992/93 to 1996/97	20.7	4.4	6.94	1.43	0.31

Source: Derived from Cameroon Development Corporation (Undated): Golden Jubilee 1947 to 1997.

Decline in palm oil production over time, as in this case, is not only due to falling off of oil palm bunch yield but also to ageing of the oil mill and inadequate supply of spare parts which were imported. Table 2 shows that palm kernel production fell from 0.32 tonne per ha per year during the 1987/88 to 1991/92 period to 0.31 tonne per ha (approximately 3 per cent drop). The palm kernel situation is different from that of palm oil extraction in that uncracked nuts are usually carried forward if an oil mill develops faults.

iii) Achieved oil palm yield in Risonpalm and Adapalm Estates.

Table 3 shows average harvested output of ffb per ha according to age of palms planted in Risonpalm and Adapalm Estates. Yield of palms as reflected by the harvested output in Risonpalm estates increases with increase in age of palms and reaches a peak when the palms are 9 years old. For the 1978 to 1981 plantings, average ffb output per ha increased from 0.6 tonne when palms were 4 years old and then reached the peak of 11.9 tonnes at 9 years of age and thereafter declined to 5.6 tonnes at 15 years of age and slightly over 4 tonnes between the 16th and 19th years. For the 1982 to 1985 plantings

average ffb output per ha increased from 1.2 tonnes when the palms were 4 years old and then reached the peak of 7.9 tonnes at 9 years of age and thereafter declined to 3.3 tonnes between the 12th and 15th year. Average output of ffb per ha from the 4th to 15th year of age of the palms as can be derived from Table 3 is 7.29 tonnes (standard deviation = 3.29 tonnes) for the 1978 to 1981 plantings, and 5.15 tonnes (standard deviation = 2.35 tonnes) for the

1982 to 1985 plantings. The lower average output of ffb for the 1982 to 1985 plantings reflects poor management of Risonpalm estate during the 1990s particularly non-application of fertilizer's as at when due.

Information on harvested output of ffb in Adapalm estate before 1985 was not available to the writer and as such harvested output of ffb per ha was not computed for palm ages 4 to 8 years. The pooled average harvested ffb per ha as shown in Table 3 were at its peak (11.6 tonnes) when the palms were 11 years of age and declined thereafter to 6.9 tonnes between the 18th and 19th year. The fall off in yield is about 40.5 per cent from the peak. In the case of the 1978 to 1981 plantings in Risonpalm estate, the fall off in yield is about 64.1 per cent from the

Table 3: Average Harvested Weight of Fresh Fruit Bunches (Tonnes Per Hectare) According to Age of Palms

Age of Palms (Year)	Risonpalm Estate		Adapalm Estate
	1978-81 Plantings	1982-85 Plantings	1977-1978 plantings
4	0.6	1.2	n.a
5	2.6	3.8	n.a
6	5.7	6.4	n.a
7	8.9	7.8	n.a
8	9.7	7.7	n.a
9	11.9	7.9	10.3
10	10.8	7.7	10.9
11	9.4	6.0	11.6
12	7.3	3.6	11.2
13	6.9	3.0	9.5
14	8.1	3.3	8.6
15	5.6	3.4	10.0
16	4.2	n.a	9.7
17	4.2	n.a	6.8
18	4.2	n.a	6.9
19	4.3	n.a	6.9

Note: n.a = Not available to the writer

Source: Computed from Risonpalm and Adapalm Statistics on harvested output of fresh fruit bunches

peak. It is relevant to point out that the 1978 planting yielded 13.9, 12.6 and 13.8 tonnes of ffb per ha during the 9th, 10th and 11th year respectively. Table 4.4 shows achieved production of palm oil and of palm kernel per hectare based on the harvested output of ffb and the extraction rates obtained in Adapalm 30 tonnes ffb per hour mill between 1985 and 1996. Between 1985 and 1990 achieved palm oil extraction rate averaged 17.60 per cent but fell to 16.50 per cent during the 1991 to 1996 period (6.3 per cent decline). Average palm oil extraction rate in Adapalm was 17.1 per cent compared to 21 per cent achieved by CDC mills (Table 2). The Adapalm mill suffered from inadequate maintenance. Note has to be taken of the fact that the planting materials in Adapalm and CDC estates differ and also that pickers are paid separately to gather fallen fruits in CDC estates whereas in Adapalm estate harvesting and fruit collection are carried on by the harvesting team which may, in order to reduce effort in fruit picking, harvest under ripe bunches. Palm kernel extraction rate in Adapalm estate averaged 3.9 per cent during the 1985 to 1990 period and

dropped to 3.8 per cent during the 1991 to 1996 period. These achieved rates are less than what obtained in the CDC oil mills (Table 2). Probably some of the palm nuts were left uncracked.

Palm oil production as shown in Table 4 averaged 1.78 tonnes per ha per year during the 1985 to 1990 period but declined to 1.31 tonnes per ha per year (26.4 per cent decline which in magnitude is greater than the decline in harvested output of ffb). The decline in Adapalm palm oil yield is therefore not just due to ageing of palms but also to the decline in extraction rate. It is relevant to note that Adapalm estate between 1985 and 1996 did not obtain an annual palm oil yield of 3.5 tonnes per ha as expected by NIFOR (1985). The highest harvested output of ffb was 13.21 tonnes per ha from the 1978 planting in 1986 when the palms were 9 years old. Assuming that 20 per cent palm oil extraction rate was achieved, the highest palm oil yield in this estate was 2.64 tonnes per ha for 9-year-old palms. By the 18th year of age palm oil yield per ha (based on 6.9 tonnes ffb per ha and 20 per cent oil extraction rate) was 1.38 tonnes which is higher than what obtained in the Pamol owned estates in Nigeria and

Table 4: Achieved Palm Oil and Palm Kernel Production in Adapalm Estate, 1985-1996

Production Year	Fresh Fruit Bunch Output Per Hectare (Tonnes)	Achieved Mill Extraction rates (Per cent)		Production-Tonnes Per Hectare	
		Palm Oil	Palm Kernel	Palm Oil	Palm Kernel
1985	6.44	19.4	4.1	1.25	0.26
1986	11.69	19.2	4.3	2.24	0.50
1987	11.30	19.2	4.4	2.17	0.50
1988	12.33	15.5	3.6	1.91	0.44
1989	10.66	15.7	2.8	1.67	0.30
1990	8.59	16.6	4.3	1.43	0.37
1991	8.70	16.9	4.5	1.47	0.39
1992	10.32	17.7	4.3	1.83	0.44
1993	7.80	19.1	4.1	1.49	0.32
1994	6.77	15.8	3.7	1.07	0.25
1995	6.93	15.2	2.4	1.05	0.17
1996	6.63	14.3	3.5	0.95	0.23
Average					
1985-1990	10.17	17.6	3.9	1.78	0.40
1991-1996	7.86	16.5	3.8	1.31	0.30

Source: Computed from Adapalm Statistics.

Cameroon during the 1950s and early 1960s. Palm kernel production averaged 0.40 tonne per ha during the 1985 to 1990 period but declined to 0.30 tonne per ha during the 1996 period (25 per cent decline). Decline in oil palm yield as can be deduced from Table 4 occurred as from 1989.

iv) Achieved oil palm yield in Calabar Oil Palm Estate (COPE)

Table 5 shows average harvested output of ffb according to age of palm as derived from the harvest statistics for 1997 and 1998 in Pamol owned COPE. Compared to ffb yield for palms planted in Adapalm up to the 9th year of age, ffb yield per ha in COPE is much lower. In the COPE

average ffb yield between ages 5 and 9 was 3.05 tonnes per ha (derived from Table 5) whereas for palms planted in Adapalm between 1982 and 1985 the average ffb yield is 6.72 tonnes per ha (derived from Table 3). The highest yield, as can be seen in Table 5, is 10.34 tonnes of ffb per ha for palms planted in 1989 when they were 10 years old. The low yield of ffb in COPE is very likely to be due to soil fertility problems. It is worth recalling that part of the COPE planted with palms in 1940 by Pamol Limited developed symptoms of magnesium deficiency (Bull and Chapas, 1956).

Table 5: Average Harvested Weight of Fresh Fruit Bunches (Tonnes Per Hectare) in Calabar Oil Palm Estate

Year of Planting	Age of Palms						
	4	5	6	7	8	9	10
1989						6.01	10.34
1990					4.08	6.29	
1991				3.21	3.04		
1992			2.10	1.83			
1993		1.19	0.88				
1994		1.72					
Average		1.46	1.49	2.57	3.56	6.15	10.34

Source: Derived from Pamol harvest Statistics from 1997 and 1998

The COPE operates a 3 tonnes ffb per hour mill, the achieved oil extraction rate of which was 15.8 per cent in 1998. Since the mini mills achieve lower oil extraction rates compared to the 20-40 tonnes ffb per hour mills which in Nigeria yield about 20 per cent oil to milled ffb when well maintained, yield of palm oil from a given weight of ffb will be lower than what obtained in Adapalm mill when this mill was new.

IMPLICATIONS

Policy makers in oil palm growing countries of Africa should acknowledge the fact that their countries are disadvantaged in oil palm cultivation compared to that in Malaysia. They will benefit from importing Malaysian oil palm experts and exporting their oil palm scientists and plantation managers to Malaysian oil palm plantations for periods long enough to permit adaptation of Malaysian oil palm techniques to African conditions and environment. This is in line with what the Japanese did in order to increase agricultural productivity (Johnston, 1951). There are presently Malaysian oil palm experts in Nigeria and Cameroon. Nigerians and Cameroonians should be sent for periods of one to two years to study oil palm plantation management in Malaysia.

It is very unlikely that there are land reserves in Nigeria and Cameroon suitable for oil palm cultivation that will yield 15 to 20 tonnes of ffb per ha per year from the 9th to the 25th year of planting (using the present improved oil palm varieties). By the nature of the oil palm, yield will decline over time due to ageing effect and improper management. The need for annual application of fertilizers at rates determined by oil palm nutritionists (based in oil palm research institutes) cannot be over-emphasized. Availability of fertilizers has been a serious problem in Nigeria for about a decade now. Much has to be done to improve on supply. As the palms age,

inadequate field maintenance adversely affects access to some of the ripe bunches which may rot on the trees.

Decline in palm oil yield over time is in part due to inadequate maintenance and ageing of oil mills. Existing mills should therefore be properly maintained and utilized as this will go a long way to improve yield of palm oil and palm kernel.

Over time the relative price changes for resources will not favour low and declining oil palm production. Pressure on government to ban importation of palm oil and other vegetable oils will not be in the best economic interest of the country whose oil palm resources are inefficiently utilized. Oil palm growers in Nigeria and Cameroon as well as other oil palm growing African countries need to appreciate this fact.

Under improved management of oil palm plantations, annual yield of ffb per ha will not be as low as 4 tonnes. At NIFOR main station, Udom (1987) estimated the harvested output of ffb in field 14 planted in 1954 to be 9.18, 9.99 and 11.08 tonnes per ha in 1985, 1986 and 1987 respectively, implying that cultivated oil palm tree in Nigeria are capable of yielding up to 10 tonnes of ffb per ha per year when they are over 30 years of age. As mentioned earlier, yields of 20 tonnes of ffb per ha per year and 19-22% oil extraction rate are achievable. Output response to improved plantation management is not immediate. Replacement of ageing and low yielding palms is an economic issue not considered by this paper.

The need for government to invest more funds in oil palm research and dissemination of information on improved oil palm management techniques cannot be over emphasized in Nigeria, Cameroon and other African oil palm growing countries.

CONCLUSION

Given the biological nature of the oil palm, yield will decline over time beginning from about the eighth to tenth year of planting. Over the years the cultivation of improved palm oil and palm kernel machinery has led to increased yield of cultivated palms in Nigeria and Cameroon.

The expected yield of ffb and palm oil per ha per year has however not been achieved due to soil fertility, disease and management problems. The problem of drastic falling off in oil palm yield after the eighth to tenth year of planting should be addressed by research and adoption of improved oil palm management practices.

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