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'Normal' Yields by Tree Ages as a Basis for Tree Crop Insurance Scheme in Nigeria

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SUMMARY

Nigeria's major tree crops, which used to provide substantial sums of foreign exchange, have, for some time, ceased to make significant contributions to the national economy. Now that there is a slump in the oil market, a suggestion is made to encourage tree crop production through an innovative programme of farm insurance. The basis of the scheme is 'normal' yields by tree ages.

INTRODUCTION

The major economically significant tree crops grown in Nigeria are cocoa, oil palm, rubber and kola. Coffee, cashew and citrus are, as yet, relatively unimportant, and are destined mainly for internal trade; so also is kola. The first three permanent crops are the major exports and, before the era of the oil boom in Nigeria, they produced the bulk of foreign exchange used to finance imports of goods and services.

The main areas of cocoa production in Nigeria are spread over the southwestern region; notably, Ondo, Oyo and Ogun States, which account for over 95% of Nigerian production. The bulk of cocoa production takes place on thousands of smallholdings and only a small proportion is cultivated under plantation conditions.

The oil palm, widely exploited in southern Nigeria, naturally grows wild, but new and high-yielding varieties have been introduced, especially

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since the mid-1970s, by the Federal and State Governments; both plantation estates and smallholder units were involved, especially in Cross River, Rivers, Imo, Bendel and Ondo States.

Bendel State produces about 85 per cent of Nigerian rubber, whilst the Eastern States produce most of the rest. Close to 86 per cent of the Bendel State production came from peasant holders, in contrast with the other parts of the country where plantations under private or public management accounted for the greater part of production (Agboola,[3] p. 113).

The remaining tree crops—kola, coffee, citrus and cashew—are grown largely in southwestern Nigeria, with the exception of coffee which is also produced in Plateau State.

In recent years, production of the major tree crop exports in Nigeria has been inhibited by a limited rate of expansion; in some cases production has even shown a decreasing trend. Table 1 shows the trends in the production of selected tree crops in Nigeria from 1970 to 1978.

Because of the absence of a significant increase in Nigeria's production of the main tree crop exports since the 1970s, her position among the world's producers of these crops has moved backward. In the case of cocoa, for example, Nigeria has changed from being the second largest world producer to the fourth largest after the Ivory Coast, Ghana and Brazil. With regard to palm oil, Nigeria has moved from her position as the world's largest producer to being its second largest producer, having

TABLE 1
Trends in Production of Selected Tree Crops in Nigeria 1970–78
('000 metric tonnes)

Year	*Cocoa*	*Palm oil*	*Rubber*	*Coffee*
1970	305	540	65	3
1971	257	600	62	4
1972	241	590	57	4
1973	215	585	66	2
1974	205	600	68	2
1975	225	640	68	3
1976	121	655	53	3
1977	187	660	59	3
1978	185	680	na	3

Sources: (i) *Cocoa statistics*.[4] (ii) *Statistical yearbook*.[6]
na = Not available.

been overtaken by Malaysia. There are also strong indications that, in the next few years, Indonesian production may exceed that of Nigeria.

Ivory Coast and Malaysia, the two countries which have respectively, made dramatic strides in cocoa and oil palm production in recent years, achieved their current levels by means of a package of improved varieties, devising new techniques of management and instituting innovative government support programmes.[5]

The efforts being made by the Federal and State Governments of Nigeria to boost the production of the major tree crop exports, as enunciated in the Third National Development Plan, are embodied in the following three strategies:

(a) Inducing smallholder participation in planting and re-planting and in plantation development by means of subsidies and intensive extension services.
(b) Developing nucleus plantations for demonstrating modern plantation culture.
(c) Providing processing facilities.

To strengthen the existing government strategy and, in particular, to introduce some innovation into the government support programmes, it is suggested that the Government considers instituting a yield insurance scheme* for tree crops production. The objective of this study is to analyse the application of the age-yield relationship to a tree crop insurance programme for possible adoption in Nigeria.

It has been argued by Adesimi and Alli that insurance research on arable crops must take into consideration the full variation in farm yields. Averages obscure these variations and do not fully reflect the risks involved. For this reason, the yields for individual farms over a long period were recommended for study to arrive at an insurable production and a premium rate required to cover the losses that would have had to be paid under the scheme during the 'history' years.

However, as tree crops increase in age, the biological evidence is that there is an increase in production because of increased bearing surface in the earlier years. (After the trees reach maturity, there is a levelling off in yield and a decline thereafter (see Fig. 1).) A simple average of past yields,

* For details of the problems associated with, and the advantages accruing from, an agricultural insurance scheme in Nigeria, see Adegeye and Akinwumi[1] and Adesimi and Alli.[2]

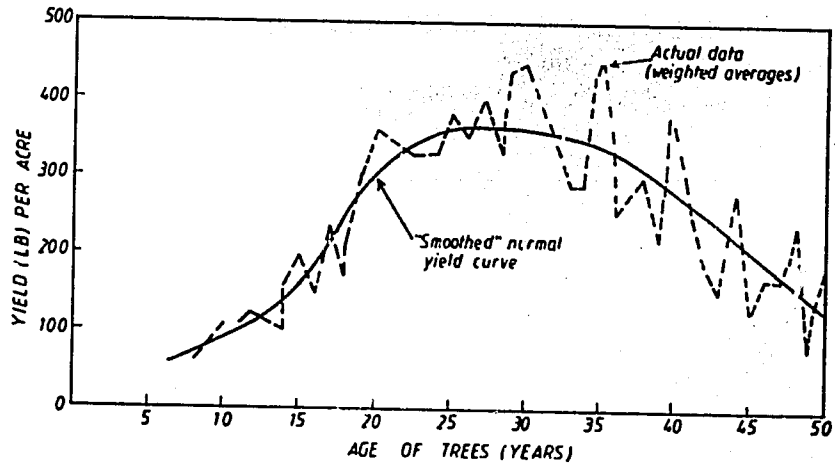

Fig. 1. Cocoa yields (lb) per acre by tree ages. Actual weighted averages compared with 'smoothed' data.

particularly where the 'history' period extends back to the earlier tree ages, would not give a true indication of what future yields might be expected to be. Thus, some recognition must be accorded to the trends in yields associated with advanced age of the trees.

APPLICATION OF AGE-YIELD RELATIONSHIP TO TREE CROP INSURANCE SCHEME

For the purpose of this study a survey was conducted in the Ife division from which cocoa yields were obtained from 500 farmers in 1981. The sample was selected in such a way as to contain sufficient data in each age group, and the respondents were also well distributed among the high- and low-yield farmers to make the average more representative of the farming population. This procedure resulted in an average, or 'normal', yield expectation for each age.

The average yield per acre for each age was weighted by the size of farm in cocoa crop and a smoothed freehand curve was drawn through these points. These curves for the different ages of trees should provide a meaningful indication of the average relationship between age and cocoa yields. The weighted average yields for the Ife cocoa farms by tree ages are shown in Fig. 1.

On the basis of the sample, it appears that yields increase on average

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until the trees reach about 28 years of age, after which they tend to decline. It is also observed that, after this age, the weighted average yields become increasingly erratic, probably because of older trees being more susceptible to variability in seasonal weather conditions. More smoothing of the weighted average was therefore necessary at ages greater than 28 years than at younger ages.

From the evidence it is clear that an insurable production, based on a simple average of past yields, especially with regard to cocoa trees at the younger ages, might be so low in comparison with future yields that growers might not be adequately protected if insured on that basis. Consequently, consideration must be given to trends in yields, as we have done in Table 2, which illustrates the age–yield relationship to the tree crop insurance scheme being suggested.

The yields for an individual grove may be superimposed upon the basic pattern of yields (the 'normal' yield curve) to determine its yields in relation to the average expectation for trees of the same age. Then, the lower yields in the earlier producing years could still be used in arriving at an appropriate insured production for the grove. Hypothetical coverages could be assumed, ranging perhaps from 50 to 100 per cent, and, if these were to be compared with actual production for the grove during its 'history' years, a measure of the risk involved would emerge. An illustration is provided in Table 3, which was based on actual data collected during the field survey in respect of a cocoa grove in the Ife division.

TABLE 2
Trends in Yields of Cocoa Trees for Selected Ages: 'Normal' or Average Yields (Dried Beans)

Age (years)	*Yield (lb) per acre ('Normal')*
10	102
15	157
20	305
25	368
30	372
35	342
40	220
45	200
50	128

Source: Field survey, 1981.

TABLE 3
Illustration of the Suggested Programme for Determining Indemnity and Premium per Acre

Season (*1*)	*Ages of trees (years)* (*2*)	*Actual yield (lb)* (*3*)	*'Normal' yield* (*4*)	*'Expected' yield** (*5*)	*100 per cent coverage†* (*6*)	*Annual loss* (*7*)
1975–76	15	200	157	160	160	0
1976–77	16	150	180	184	184	34
1977–78	17	240	215	219	219	0
1978–79	18	170	230	235	235	65
1979–80	19	280	285	291	291	11
1980–81	20	350	300	306	306	0
Total	—	1 390	1 367	—	1 395	110

* Column (4) multiplied by 'yield rating' ('yield rating' would be 1390 divided by 1367, or 1·02).
† 100 per cent of column (5).
Source: Field survey, 1981.

This grove produced a total of 1390 lb of dried cocoa beans during the 6 years. The trees were 15, 16, 17, . . . , 20 years of age. The 'normal' yields for these same ages totalled 1367 lb. The 'yield rating' (this grove's output in terms of 'normal') would be 1390/1367, or 1·02. The normal yield for 15-year-old trees (157 lb) was multiplied by the yield rating to determine an 'expected' yield (160 lb) for this grove in the 1975–76 season. One-hundred per cent (hypothetical) of this 'expected' yield would provide full risk coverage of 160 lb per acre for the 1975–76 season. Since the actual production of 200 lb per acre was higher than the coverage, no indemnity would be paid to the insured farmer during the 1975–76 season. However, in the 1976–77 season, the actual production of 150 lb per acre was below the coverage; this would thus mean that an indemnity based on this loss (34 lb per acre) would be paid.

Deficiencies in yields below full risk coverage totalled 110 lb for the 6 years. Two assumptions could be made in connection with the determination of the premium charge. First, if the scheme is conceived of as self-supporting, a premium rate based on one-sixth of 110 lb, or 18·33 lb, might not be adequate, since deficiencies in each of the succeeding years are likely to be much larger owing to the erratic behaviour of yields after the trees have reached the age of about 28 years.

In consequence of this, a premium rate higher than 18·33 lb might be charged.

However, if farmers are to be encouraged to participate in the scheme, there is need for the Government to charge an attractive premium, and this would suggest that the scheme may not be required to be self-supporting. An adequate subsidy could be given which would require a premium rate less than, or equal to, 18·33 lb. The exact level of subsidy accorded would depend on the extent of the Government's commitment to agricultural development.

Although this study employed the example of a cocoa study, the principle is easily applicable to other tree crops cultivated in Nigeria. Comprehensive studies on the yields of tree crops by ages in respect of the more important tree crops are crucial to the institution of this scheme.

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