



# Enhancing Cocoa Beans Quality through Improved Cultural Practices in Major Cocoa Producing States of Nigeria

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## Abstract

In West Africa, low adoption of agricultural innovations by farmers has been partly due to the complexity of the innovation structure or new knowledge beyond the farmers' socio-economic adaptive capacities. Different attempts have been made to improve cocoa beans quality in Nigeria among which was the recommendation of 'improved cultural practices' or 'best known practices' (ICMP). This had recorded little success because of the complexity and enormity of the ICMP. The present study, therefore, made an attempt to resolve this, in the major cocoa growing states of Nigeria, through farmers-researcher participatory approach with the aid of interview guide. Collected data were analyzed using descriptive statistics and the Principal Component Analysis procedures in SPSS to identify the minimum essential practices out of the overall ICMP for sustainable cocoa production. The result showed that cocoa farmers practiced 47 activities recognized as ICMP which were grouped as nursery, on farm, harvesting or post-harvest activities. The highest overall percentage use of any of these activities was 3 %, while the least being smaller than 1 %. It was found that 13 out of 47 activities contributed 71.45 % to the overall ICMP, whereas the current cumulative percent use of these 13 activities was 28 %. The individual percent use of each of the 13 activities was about 3 %. The highest contributors among the 13 activities were coded ba1 and ba11 while the least was bb4. Efforts to intensify the use of these 13 activities rather than the 47 activities should be encouraged among farmers for sustainable and high quality cocoa production.

### Keywords:

best practice, cocoa, cocoa bean quality, improved cultural practice, Nigeria

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## INTRODUCTION

Annually, about 3 million tonnes of cocoa beans are used for the production of a wide range of chocolate and cocoa flavored foods globally (Badrie et al., 2015, Hajra & Yang 2015). In West Africa, the average cocoa farm has been estimated to vary from 3 to 4 hectare plot, operated by a family that lives on the farm or nearby (Akanni and Dada, 2012). Estimates place the number of West African cocoa farms at 1.5 to 2 million (Yusuf, 2014). Nigeria comes fourth after Ivory Coast, Ghana and Indonesia being the world leading cocoa producer and exporter (Egwuatu, 2015). Cocoa contributes about 20.6 % to Nigeria foreign exchange earnings (Government of Nigeria, 2015). Many factors, however, constrained the quantity and quality of cocoa beans production making it difficult for farming families to realize the true potential of cocoa farming (Aneani et al., 2012).

These factors could be generally grouped under three major categories which are genetic, edaphic and management factors. The genetic factors have to do with the varieties of cocoa seeds or seedlings and this varied widely in Nigeria ranging from very poor and low yielding varieties to exotic or high yielding inbred lines. The availability of these high or improved varieties to the smallholder farmers still remains a source of concern in Nigeria. While much improvement or success has been recorded in the area of genetics (McMahon et al., 2009), the edaphic or management aspect of cocoa production still remain under developed.

The edaphic factor has to do with the soil fertility and fertility constraints as well as the climatic conditions such as the rainfall amount, relative humidity, temperature and the amount of sunshine hours (Shamshuddin et al., 2011). Basically the management factors include agronomic cultural practices such as the time of planting, site selection, type of soil amendments (Onwuka et al., 2007) and its methods of application (Padi & Owusu, 1998). All other factors constant, these practices could help improve the quantity and quality of cocoa beans and reduce the infestation of pests and disease (McMahon et al., 2009).

The International Cocoa Organization (ICCO, 2008) has however recognized this and had given out a long lists of activities tagged as best known practices or improved cultural management practices which were supposed to be adopted by farmers so as to achieve sustainable cocoa production, covering the aspects of economic, social and environmental sustainability. These improved cultural management practices have been disseminated among the smallholder farmers through agricultural extension agents, farmer organizations and national research institutes but the success of this in terms of its adoption has been considerably low, hence the low ranking of the Nigerian Cocoa beans in the world markets.

ICCO (2008) further stipulates that no effort should be spared to implement recommended best known practices or ICMP in order to ensure high quality cocoa. From choosing the structure and texture of the soil, preparing and establishing the farm, selecting the planting material, managing the farm, harvesting, through to processing and quality control, were all noted as vital factors and should all be implemented by cocoa producers. Though the ICMP has a sound scientific background but its wide spread adoption has been constrained by farmers' socio-economic conditions particularly in the Cocoa producing states of Nigeria (Oluyole, 2009; Aneani et al., 2011).

In a bit to identify why this recommendation had recorded little success. This research made considerable efforts to identify 47 different improved cultural management practices under the ICCO recommendations to the cocoa growers. In cocoa growing states in Nigeria, there are farmer organizations sometimes called father's schools, where farmers are trained and assisted in sustainable cocoa production. These 47 improved cultural management practices are mandated to be adopted by the farmers on their farms. While many of those trained farmers tried to adopt this, the quality of their quantity and quality of their cocoa beans are yet to receive a significant improvement. The huge list of 47 improved cultural management practices could somehow create drudgery and discouragement to the farmers (Oluyole, 2009). This

study therefore seeks to resolve this through factor and principal components analysis by ascertaining those practices out of the 47 recommended practices that could give similar contributions as the 47 recommended practices to cocoa beans quality. Similarly, the research questions were formulated to know the percentage of use of the various ICMP by farmers, and what combinations of improved cultural management practices would give optimum cocoa beans quality which farmer could adopt when having difficulties in adopting the overall ICMP.

## MATERIALS AND METHODS

### Description of study location

The study was carried out in South West Nigeria. South West Nigeria comprises six states, namely, Ekiti, Lagos, Ondo, Ogun, Osun, and Oyo States. It is bound by the Atlantic Ocean in South, Kwara State in the North, and the Republic of Benin in the West. The Southwest region, which has a land area of about 114,271 square-kilometer (about 12% of total land mass of Nigeria) (Government of Nigeria, 2015), lies between latitude 4° 20' and 9° 23' North of the equator and longitude 2° 25' and 6° 31' East.

The target population of this study consisted of farmers from Cocoa Grower Association of Nigeria (COGAN) in Ondo and Osun States. Multi-stage sampling technique was employed to select respondents for this study. The first stage is the purposive selection of Ondo and Osun States being the highest cocoa producing states in South West Nigeria. The second stage involves the purposive selection of the two highest cocoa producing Local Government Areas in each selected state, that is, Idanre and Ondo-East Local Government Areas from Ondo State and Ife-south and Ife-east Local Government Areas from Osun State. In Ondo State, 16 Local Governments produce cocoa and fourteen Local Governments from Osun State (NCARD, 2010; NCDC, 2010a, 2010b) out of which 10% of each is selected. The third stage involves the purposive selection of three cocoa producing communities where the members of Cocoa Grower Association of Nigeria domicile were selected from the Local Governments Area of

each state. The fourth stage involved the random selection of 50% cocoa farmers registered with cocoa grower association in the selected communities.

The sample size for this study was, therefore, two hundred and eighty-three respondents.

The primary data for this study were collected from the respondents using interview guide where four facilitators from Sustainable Tree Crop Production unit of IITA were employed to get the target respondents from the selected local government areas. Well-trained enumerators were also employed to help aid in data collection. Relevant information was also sourced from the literatures, past research works, internet, and libraries. The variables were measured with a 3-point rating scale of regularly (2), occasionally (1), and never (0).

List of ICMPs and their codes

Nursery operations or activities (Ba):

Selection of suitable nursery site close to plantation (Ba1)

Preparation of ground surface-level off and install drains (Ba2)

Construction of nursery shed (Ba3).

Preparation of parameter fence (Ba4)

Filling the polythene bags (15cmx30cm) with potting mix or top soil (Ba5)

Line bags in nursery (row of 8- 40cm air gap) to maintain air space (Ba6)

Selection of improved seed variety (Ba7)

Clean seeds and dip in fungicide i.e. thiram (Ba8)

Collection of germ seeds at three to five days and plant into pots (Ba9)

Removal of twisted, deformed seedling (Ba10)

Regular browsing on the nursery beds (Ba11)

Hardening-off plants ten to fourteen days before transplanting (Ba12)

ICMPs of farm activities (Bb)

Pruning of cocoa trees during raining season (Bb1)

Weeding the cocoa farm at least twice a year (Bb2)

Regular removal of dead (mummify pods) (Bb3)

Regular removal of mistletoes (Bb4)

Regular removal of stagnant water from the farm (Bb5)

Removal of cocoa pod husk from the farm (Bb6)

Removal of coupons from the trees (Bb7)

Planting of improved/disease resistant variety to replace the older trees (Bb8)

Fertilizer application (three bags/ acre) (Bb9)

Regular removal of mosses (Bb10)

Regular removal of epiphytes (Bb11)

Spot application of recommended fungicides/ insecticide (Bb12)

Application of plant extract (Bb13)

Burying of removed diseased pods outside cocoa farm (Bb14)

Spraying before pre-harvest interval (Bb15)

Regeneration of coupon where necessary (Bb16)

Maintenance of planting space of 3.1mx3.1m (Bb17)

Sourcing for improved seeds from research institute and ADPs (Bb18)

Harvesting activities (Bc);

Pods are harvested at two weeks interval (Bc1)

Sharp harvesting hook/sickle is use to harvest yellow pods (Bc2)

The stalk between the tree and the pod is carefully cut (Bc3)

The bark of the trees are not cut or wounded with knife/cutlass (Bc4)

Pods are not pulling off by hand during harvest (Bc5)

ICMPs of on-farm processing/post-harvest activities; (Bd)

Harvested pods are stored for a few days (Bd1)

Wounded pods are not store more than one day (Bd2)

Off-farm pods breaking (Bd3)

Use of club or wooden mallet to break the pods (Bd4)

Beans are fermented for five to six (5-6) days (Bd5)

Use of banana leaves to cover heap or fermentation box (Bd6)

Turning of the beans once daily from day three (Bd7)

Dry the fermented beans for seven days (Bd8)

Use of a raise platform or flat cement concrete to dry beans (Bd9)

Thorough sorting during drying (Bd10)

Bagging dried beans with jute bag (Bd11)

Store the dried beans in a cool dry place free from smoke (Bd12)

Principal Component Analysis procedure (CPA) was employed to analyze the data collected.

Model specification

$$P_1 = a_{11}X_1 + a_{12}X_2 + \dots + a_{1k}X_k$$

$$P_2 = a_{21}X_1 + a_{22}X_2 + \dots + a_{2k}X_k$$

$$P_3 = a_{31}X_1 + a_{32}X_2 + \dots + a_{3k}X_k$$

$$P_4 = a_{41}X_1 + a_{42}X_2 + \dots + a_{4k}X_k$$

P = Principal component of ICMPs activities

X<sub>j</sub> = variables (j=1, 2, 3.....k).

## RESULTS AND DISCUSSION

### Contributions of some nursery activities to ICMPs

The principal component analysis of the nursery practices (see Table 1) showed that activities such as Ba1, Ba11 or Ba9 contributed 50.85% with the percentage use of 10.0%, 10.0%, 5.0% respectively to the improved cultural management practices (ICMPs). Ba8 or Ba9 activity contributed 16.07%, while Ba9 or Ba8 in the third component contributed 13.26% with the percentage use of 5.0% each.

Farmers engaged in different nursery activities under the ICMP. The results demonstrated that farmers had greater use of Ba10 among other nursery activities. The percentage contribution of the Ba10 activity to the overall ICMP was, however, very low. It was found that practices such as Ba1, Ba8 and Ba9, which cumulatively contributed 80.14 to the ICMPs, had low level of adoption (10, 5 and 5.0%, respectively). It could, therefore, be argued that the combination of Ba1, Ba8 and Ba9, which gave greater return to ICMPs, should be promoted among farmers rather than the general activities which individually or cumulatively contributed less to the ICMPs. This finding concurs with the report of Vos and Ritchie (2003) who identified some crop growing methods that could be adopted for greater yield. An increase in the percentage use of these components (Ba1, Ba8 & Ba9) could help raise the productivity level and the quality of cocoa beans, whereas reducing the

Table 1  
Percentage Contributions of Some of the Nursery Activities to the ICMP

Nursery Practices	% Contribution to ICMP	Cumulative %	% Use
Component 1 (Ba1 or Ba11 or Ba3)	50.85	50.85	10, 10 or 9
Component 2 (Ba8 or Ba9)	16.07	66.92	5, 5
Component 3 (Ba9 or Ba8)	13.26	80.18	5, 5

drudgery associated with many activities among the cocoa farmers.

**Contributions of some of the on-farm activities to the ICMP**

From the results presented in Figure 1, on-farm activities such as Bb8, 7, 17, 4, and 5 had the greatest use of 8 % each among the cocoa farmers. Further analysis showed that five activities such as Bb 8, 7, 14, 13, 17, 4 and 11 out of the 18 on-farm activities had the highest contributions to the ICMPs. A comparative analysis of the % contributions and % use (see Table 2) pin-points that activities such as Bb 8, 7, 17 and 4 had significant contributions to the ICMP and are well used among the farmers while activities such as Bb 14, 13 and 11, even though they had made great contributions to ICMPs and were less practiced. Table 2 also showed that 7 out of the 18 on-farm activities (Figure 1) contributed 71.12 % to the ICMPs. Increased awareness and use of these activities could, therefore, raise the adoption of ICMPs, reduced farmer’s drudgery due to practicing so

many activities, and eventually improve the quality of cocoa beans produced. This result is in conformity with the submission of Adigun (2013) who opined that farmers need to be informed that proper practices of cultural management will reduce chemical application, increase yield, and enhance quality.

**Contributions of harvesting activities to ICMP**

Figure 2 shows the percentage distribution of use of the five harvest activities among farmers. The percentage use of the various activities was 20 % each. This indicated that there was an even distribution in terms of use of the activities among farmers. The principal components analysis of these activities (see Table 3) revealed that Bc 4 had 43.9 % contributions to the ICMPs. Bc4, 1 and 3 activities cumulatively contributed 83.09% to ICMPs. The % use of these activities was 20 %. A slight increase in the % use of Bc4 while maintaining the good use of Bc1 and 3 would, therefore, be needed to increase the cocoa quality of the study area.

**Contributions and use of some of the post-**

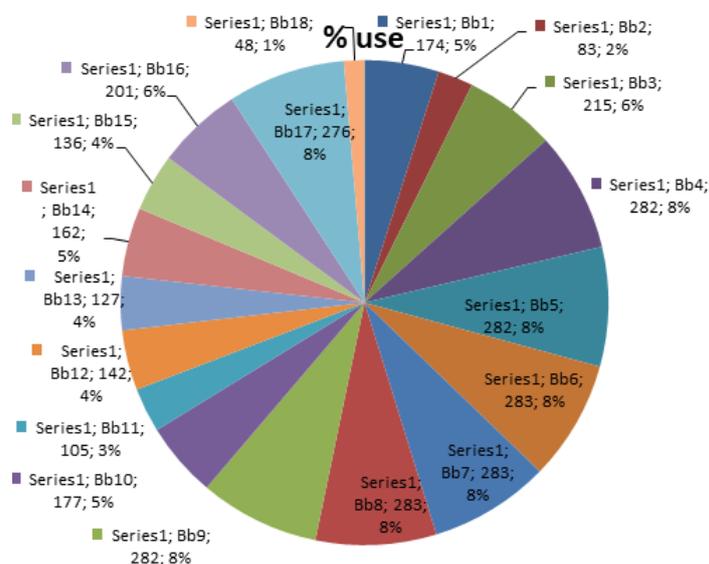


Figure 1. Percentage Use of the Various on Farm Activities by the Farmers

Table 2  
Percentage Contributions of Some of the on Farm Activities to the ICMP

On-farm activities	% Contribution to ICMP	Cumulative %	% Use
Bb 8	17.68	17.68	8
Bb 7	13.88	31.56	8
Bb 14	10.63	42.19	5
Bb 13	9.74	51.93	4
Bb 17	6.85	58.78	8
Bb 4	6.50	65.28	8
Bb 11	5.84	71.12	3

**harvest activities to ICMPs**

Among the various post-harvest activities used by the farmers in the study area, Bd 12 and bd 3 had the highest and the lowest use of 11 % and 1 %, respectively (see Figure 3). Assessment of the 12 post-harvest activities showed that 6 out of the 12 cumulatively gave 71.41 % contributions to the ICMPs (Table 4). These activities are Bd12, 5, 10, 9, 4 and 6. This implied that the intensive use of the 6 activities rather than the 12 could help achieve the objectives of the ICMPs that is, to minimize the problem of pest and disease, declined yield, and low or poor quality produce. Similarly, the percentage use of the 6

activities more or less followed the same trend as their percentage contributions to ICMPs, denoting that the farmers use more of those activities that gave them greater return to the ICMPs than those that had fewer contributions. Such Findings are inconsistent with those of *Olujide and Adeogun (2006)* who stated that few farmers appear to be adopting farm hygiene and management techniques to minimize the problem of pest and disease, declined yield, and low or poor quality produce. This is, however, a desirable trend that should be encouraged beyond the study area for higher and widespread cocoa quality production in the country.

**Contributions of some selected activities to**

Table 3  
Percentage Contributions of Harvesting Activities to ICMP

Harvesting activities	% Contribution to ICMP	Cumulative %	% Use
Bc 4	43.91	43.91	20
Bc 1	21.10	65.01	20
Bc 3	18.07	83.09	20

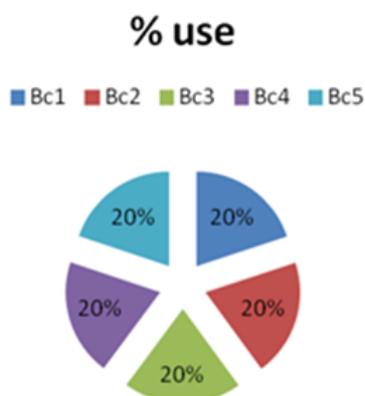


Figure 2. Percentage Use of the Various on Farm Activities by the Farmers

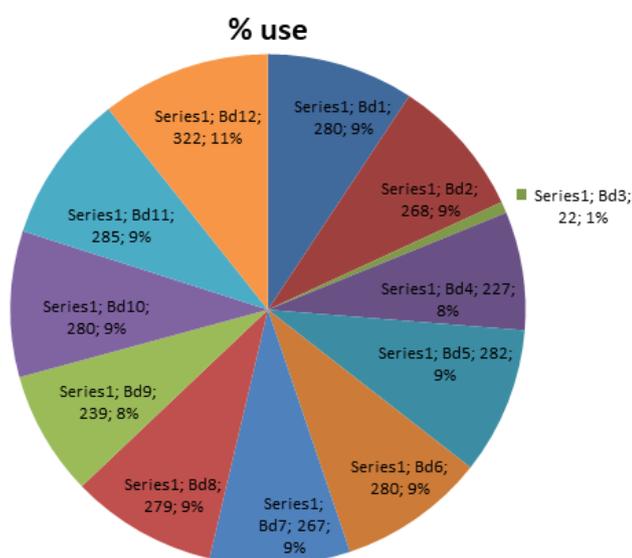


Figure 3. Percent Use of Post-Harvest Activities

Table 4  
Contributions and Use of Some of the Post-Harvest Activities to ICMP

Post-Harvest activities	% Contribution to ICMP	Cumulative %	% Use
Bd 12	18.55	18.55	11
Bd 5	13.97	32.52	9
Bd 10	11.91	44.44	9
Bd 9	10.09	54.53	8
Bd 4	9.13	63.65	8
Bd 6	7.76	71.41	9

Table 5  
Percentage of Contributions of Some Selected Activities to ICMP and their % Use

Post-Harvest activities	% Contribution to ICMP	Cumulative %	% Use
Ba 1 or 11	15.72	15.72	2
Bc 4	10.65	26.36	3
Bb 13	8.17	34.53	1
Bb 8 or 7	6.47	41.00	3
Bb 6 or 17	5.49	46.50	3
Bb 14	4.57	51.07	2
Ba 8	4.57	51.07	<1
Bd 11	3.96	58.67	3
Bd 1	3.94	61.62	3
Bb 11	2.77	64.39	1
Bd 8	2.56	66.94	3
Bb 15	2.30	69.24	1
Bb 4	2.21	71.45	3
N0=13			Sum=28

**ICMPs and their % use.**

Figure 4 showed that cocoa farmers of the study area practiced 47 activities recognized as ICMP be it nursery, on-farm, harvesting or post-harvest activities. The overall percentage use of any of these activities was 3 % while the least being <1 %. The principal component analysis of these activities to determine those activities that played the major role in achieving the objectives of the ICMP revealed that 13 out of 47 activities achieved 71.45 % of these objectives (Table 5). The highest contributors among the 13 activities were Ba1 and Ba11 while the least was Bb4. As at the time of this study, the % use of each of the 13 % activities ranged from < 1 – 3 %. Table 5 also indicated that the cumulative % use of these 13 activities identified was 28 %. Due to the relatively low use of the major activities, their net benefits from ICMP could as well be low. This study has however demonstrated that though the farmers practiced 47 activities recognized as ICMP, their net return was low

because 13 out of these activities could actually achieved the objectives of the ICMP. This study is a response to the opinion of Tony (2004) that government of cocoa producing countries, the cocoa industry, international donors and other

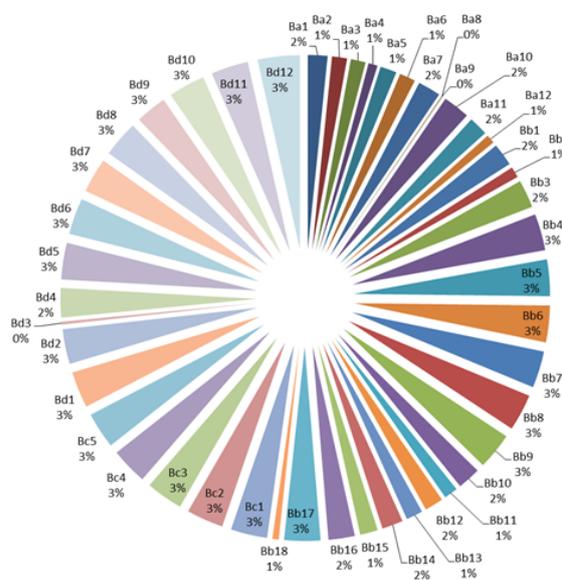


Figure 4. Percent Use of All Activities

stakeholder to invest in research into better, non-chemical management system to control pest and diseases. Farmers could therefore raise their productivity and their cocoa quality, by concentrating on those 13 activities identified in this study rather than the 47 activities currently in practice.

### CONCLUSION

This paper recognized that cocoa farmers in West Africa particularly Nigeria continually produced poor quality cocoa beans with very low premium price despite the introduction and some level of adoption of the improved cultural management practices (ICMP). The study, therefore, made attempts to analyze the percentage farmers' use of the ICMP and then quantifies the contributions of each of the activities to the overall ICMP. Juxtaposing these two levels of analyses, it was found that among the recommended 47 ICMPs in cocoa farming system, only 13 activities played the major role, whereas their current farmers' cumulative use is 28 %. Efforts to intensify the use of these 13 activities rather than the 47 activities should be encouraged among farmers for sustainable and high quality cocoa beans production.

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