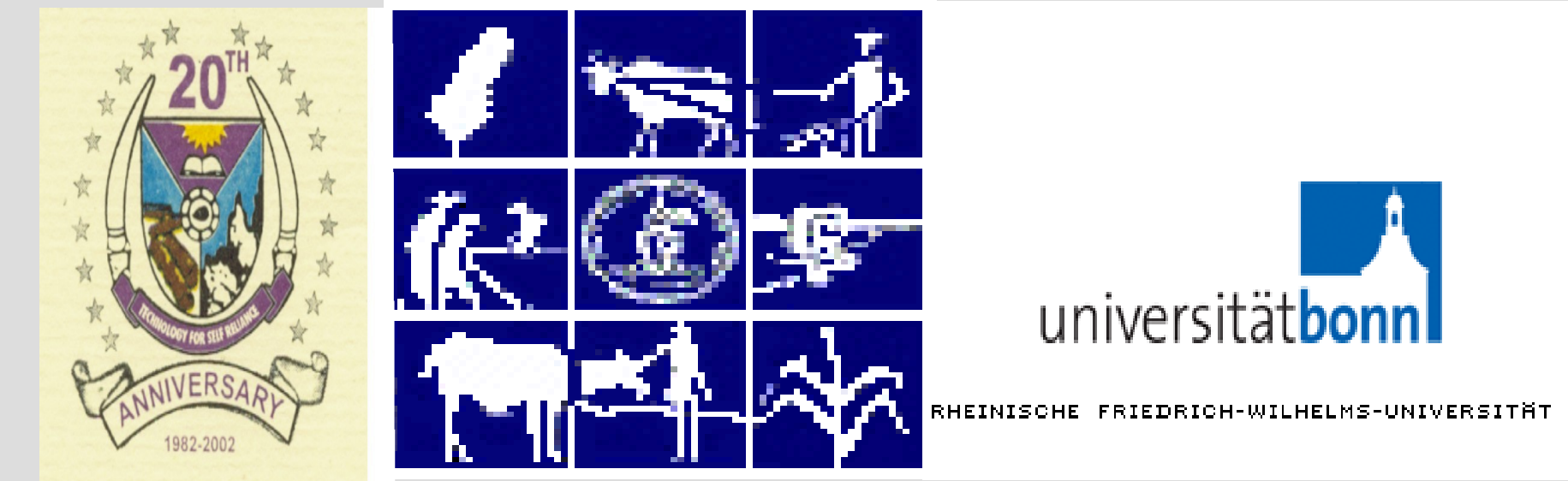




Quality Deterioration and the Role of Rehabilitation of Cocoa Production Chain in Nigeria

Opeyemi Anthony Amusan^{1,2}, Olusola Amusan³, Oguntunde P.G²

(1)University of Bonn, Agricultural Sciences and Resource Management in the Tropics & Sub-tropics – ARTS, Germany (2) Federal University of Technology Akure, Agricultural Engineering Department, School of Engineering & Engineering Technology (SEET), Ondo State, Nigeria (3) University of Port Harcourt, Faculty of Social Sciences, Rivers State, Nigeria



Summary

The goal of obtaining good income for Cocoa cultivation is intrinsically connect to the sustainability of this sector. This on the other hand cannot be realized without a well – laid out plan to attain quality in all various management aspects in the long cocoa production chain. Over 90% of Nigeria – cocoa is produced in the cocoa – belt of the Southwestern Region which is located in the Derived – savannah Agro – ecological zone of Nigeria. Many of the existing cocoa trees were planted under cleaned or thinned primary forest that was then in abundant supply. Reserves of suitable soils no longer exist and so future cocoa plantings are likely to be on soils that have already been exploited, hence, a downward trend is noticed in cocoa production. There is therefore need to search reasons and make recommendation for improved cocoa quality management. In this study, we investigate bio – physical, climatic and management factors of selected cocoa farms in Southwestern – Nigeria and estimate their effect on the overall quality in the cocoa production chain. We analyzed 16 soil samples for basic cations, NPC and pH. Information on factors affecting cocoa quality was elicited by interviewing 60 households on their farm using standardized questionnaires. We discover certain nine (9) primary activities in the production chain that contribute to overall quality of production as seed choice, nursery, transplanting, young plantation, field production, harvesting, primary processing, storage – bagging, and marketing. Primary processing, harvesting, and seed choice are the first three activities with the highest percentage of contribution to cocoa quality. Restoration of cocoa yield to its peak level is possible by systematic replacement of inferior trees. We recommend a viable, well – informed and well – equipped extension services that will enhance the practice of good husbandry, especially among the smallholder cocoa farmers.

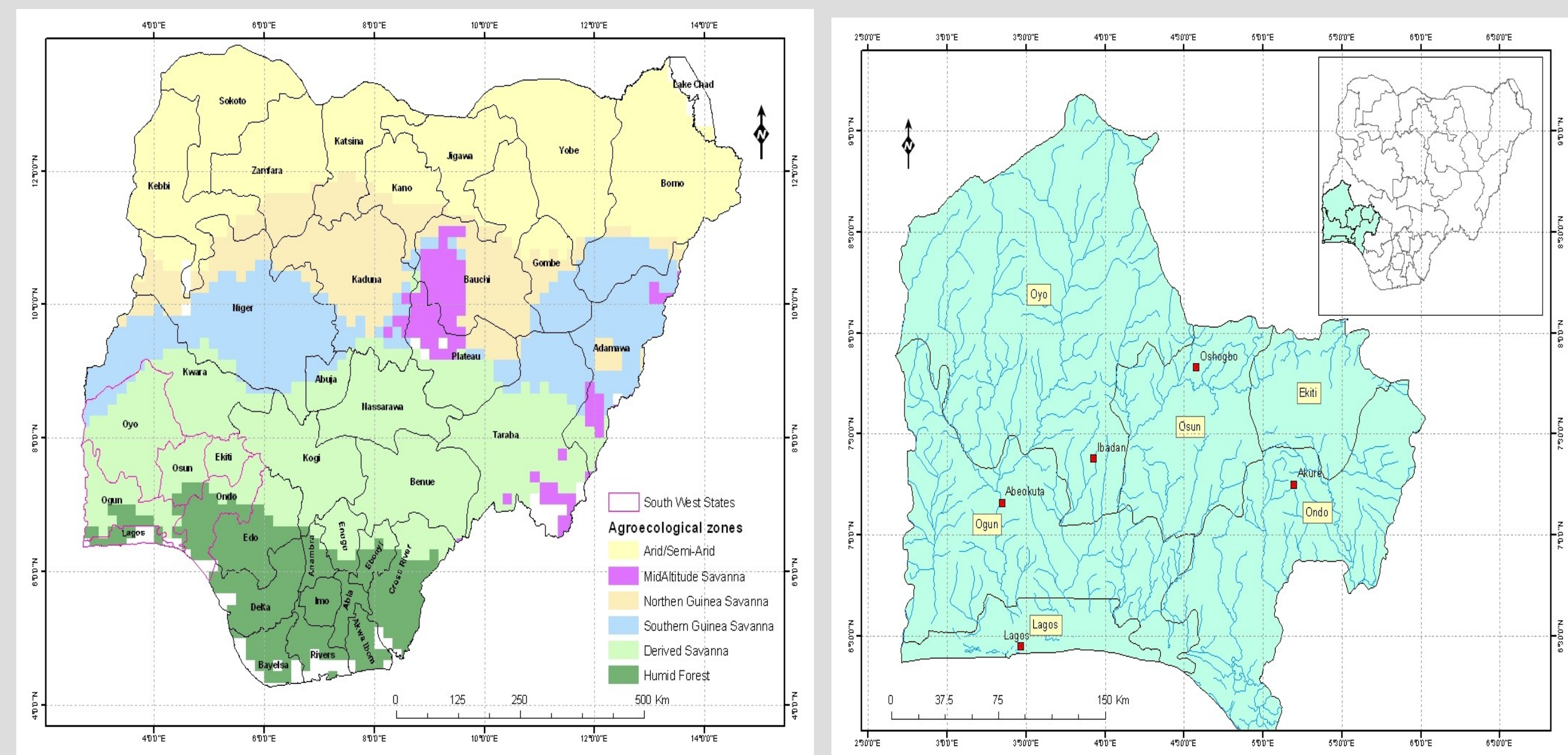


Figure 1 & 2: The map of Nigeria indicating the Agro-ecological zones and the Southwestern Region Source: IITA, Ibadan, Nigeria

Study Hypotheses

- Adoption of good management practices by farmers and efficient management of biophysical and socio – economic resources improves cocoa quality, yield and farm income.
- Primary activities which are identified in the production chain as contributing to overall quality of production also help to reduce the gap between potential and actual cocoa quality and yield.

Methods and Material

The analysis presented in this paper is based on primary data, which were collected by surveys of farm households, farm managers, etc. The Cocoa farm household samples (classified by farm size) were selected from three locations having similar agro – ecological features, namely Ibadan, Ife and Akure. The primary data from the socio – economic surveys were used to elicit information on farm – farmers characteristics as well as constraints to cocoa. Soil sampling and analysis were carried out to examine the role of soil properties in crop yield. Socio – economic and soil data were thereafter integrated to study their influence on crop yield. For the estimation of soil properties we collected 16 soil samples from three locations with similar agro-ecological conditions in SW-Nigeria. We analyzed basic cations (determined in 1N NH₄OAc), total N (Kjedahl), available P (Bray P), Organic C (Walkey-Black wet oxidation) and pH (0.1 M CaCl₂). We interviewed 60 households of farmers using questionnaires to get information about managing factors. Information on factors affecting crop yield was elicited by interviewing farmers on their farms using standardized questionnaire.

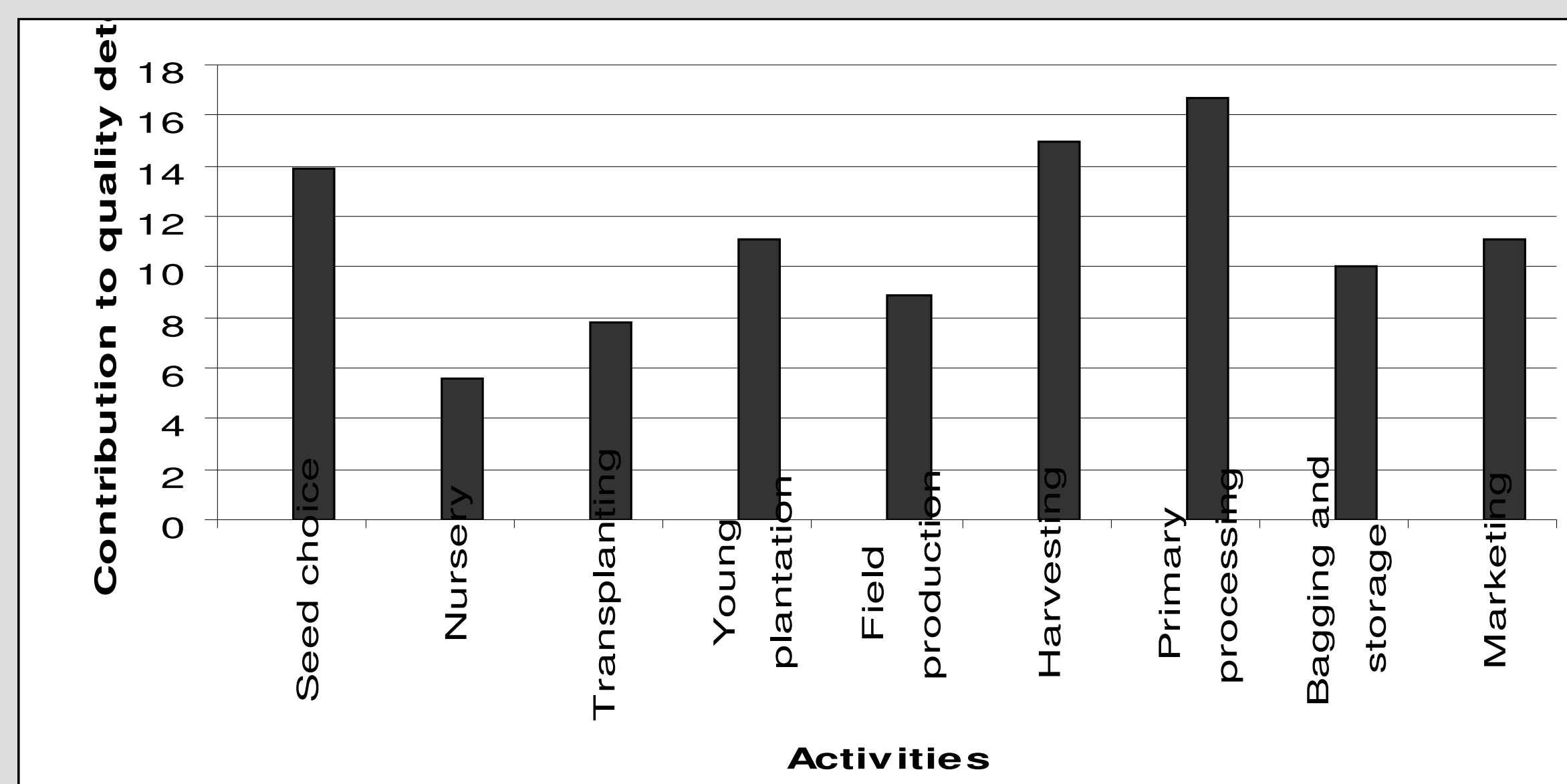


Fig 3: Factors contributing to Quality deterioration in the Cocoa Production Chain. Source: Own Computation.

Results

Certain primary activities can be identified in the production chain as contributing to overall quality of production (Figure 1). These activities could be used as control instruments in the planning of efficient management on cocoa farms.

Figure 3 indicates the potential of each activity on quality “deterioration”. A discussion of each of these factors follows:

Seed Choice

All cultivated cocoa is classified into a single species, *Theobroma cacao*. The three main recognised groups are Criollo, Amazonian Forastero and Trinitario. The West Africa Amelonado (“Lower Amazonians”) cultivated in Nigeria belongs to the Forastero groups; despite the relatively bitter and often acidic taste of the processed beans, its high level of homogeneity is much appreciated by manufacturers. A general purpose variety- F3 Amazon-belonging to the “Upper Amazonians” was successfully introduced into Nigeria about 1950 and is found to be superior to Amelonado in establishment, vegetative vigour, yield, etc. The processed product of the criollo types has a fine aroma and only a slightly bitter taste, thanks to its low tannin content. It is used for luxury chocolate products however they are not very productive, grow slowly and are less hardy than Amelonado. The Trinitario groups consist of hybrid populations of very different types. Cultivars of the F3 Amazon cocoa which are tolerant to Cacao Swollen Shoot Virus (CSSV) and Phytophthora Pod Rot have been developed under various breeding programmes at the Cocoa Research Institute of Nigeria (CRIN). The choice of less improved seeds/varieties for replacing old trees by farmers account for up to 14% deterioration of quality in the cocoa production chain.

Nursery and Transplanting

A nursery is here defined as an intensive plant-care centre. The intensive care practices start with the selection of appropriate nursery site and the provision of the correct type of recommended or approved planting materials. Cocoa produces recalcitrant and generally viviparous seeds. They are short-lived and normally lose viability rapidly even within 2 years. The propagation therefore depends heavily on the operation of very good nurseries and nursery practices. The level of successful establishment of cocoa farm starts long before the field operations are set in motion. The selected nursery site must be flat and well drained to prevent surface erosion and seasonal water logging. The site is cleared, levelled and beds 15.25m x 1.82m x 10cm high are prepared across the slopes. Artificial shade, which can be easily adjusted as required, must be erected over the beds and they are fenced round with wire netting (1.2cm mesh) to prevent rodents, millipedes, frogs and reptiles from damaging the plantings. High quality (heavy and plump), good seeds are selected for sowing. Seedlings are gradually hardened off when shade materials, for example palm fronds, naturally dry out and they are due for transplanting between 5 and 6 months of age. Transplanting on to the field starts late in May and is completed latest by mid-July. The soil dug out of the hole should preferably be returned and compacted round the ball of earth and the seedling roots. The base should run-off water away from the seedling base so as to avoid water logging. Each seedling thus successfully transplanted should be supported with a 30 – 40cm stick preferably a fresh *Glyricidia* stick. Since cocoa farmers are generally provided with high quality seedlings at subsidised price (40% of market price), nursery practices contribute to only about 6% deterioration of quality in the cocoa production chain in Nigerian Transplanting operations are often not well carried out and could contribute up to 8% deterioration of overall quality.

Primary Processing

The processing of cacao beans is still based on traditional methods. It involves natural fermentation and drying, followed by a final sorting which is simpler and more economical than that for other perennial crops. Fermentation alters the organoleptic properties of the beans. It leads to the separation of the beans from the surrounding pulp, causes reduction of cocoa astringency by making the tannins partially insoluble, develops the aroma of cocoa and help detach the cotyledons from the seed-coat with a view to their separation for chocolate making. Drying continues these modifications and ensures bean conservation. The processed product is called cocoa. Fermentation of cocoa beans is usually done in trays and can be completed in 4 days. These trays are of 2 sizes: SMALL, which is about 75cm x 75cm and 7.5cm deep and a BIG size of 120cm x 90cm, 7.5cm deep; with capacities for about 23kg and 41kg-wet beans respectively. Trays can be stacked up to 10 in number or any convenient height, depending on the volume of harvest. The first tray is put on a raised wooden platform to facilitate drainage and aeration. The top tray is covered with banana or plantain leaves and sacks to retain the heat. The advantages of this latest method of fermentation over the previous ones the BOX fermentation and the farmer’s traditional methods of HEAP and BASKET fermentation include: quicker and more uniform fermentation, leading to good quality beans after drying and less labour requirement (no mixing of beans required). During drying, internal fermentation continues to refine the taste and develop the characteristic flavour of cocoa. Drying takes place either on racks or mats at ambient temperature or in a hot-air drier.

The purpose of drying is to lower the moisture content of the fermented beans from about 60% to less than 8%, in order to inactivate enzymatic reactions and preserve the processed cocoa. Sun drying on concrete slabs is still the most economic and practised method during the dry season. The size of the slabs depends on the production capacity of the cocoa farmer and is usually supplemented with tarpaulin, which is used to protect the cocoa at night, especially from dew and attack by rodents. In the rainy season the tarpaulin is also essential to keep rain away from cocoa being dried on concrete slabs. The beans are stirred regularly, particularly during the initial stages of drying so that water can evaporate and dry mucilage detaches itself from the beans, which becomes clean and shiny. The duration of sun-drying varies from 8 to 15 days, depending on weather conditions. Well-dried beans will crack when squeezed between the fingers, and when cut through with a knife, the cotyledons separates easily. The primary processing of the cocoa is the most critical activity in terms of contribution to quality decline, which is put at about 17%.

Harvesting

Seasonal fluctuations occur, sustained by a clearly differentiated wet and dry season, although cacao fruits all the year round. A production peak is observed during the period with least rainfall. The main October-November harvest (80% of total production) begins in the middle or towards the end of the rainy season and continues until the middle of the dry season (December to mid-January). The smaller harvest (20% of total production) takes place in the period April-June. Harvesting of the pods, which is done at regular intervals of 10 to 15 days, commences when they have completely ripened. Green pods turn yellow when maturing while maintaining a light green colour at the base. It is at this point that the aqueous sweet mucilage, essential to successful fermentation of the beans is most developed to produce beans of best quality. Over-ripe and under-ripe pods produce beans of low quality. During periods of low yield, less frequent harvesting can be practised. The peduncle of the pod is cut with a sharp blade (harvesting hook or a sharp cutlass), attention being paid not to damage the flower cushion in which the peduncle is developed. Damage to this flower cushion, always a risk when removing pods, may compromise future productivity. A little stub should therefore always be left behind after cutting off the pod. Diseased or insect-infested pods should be gathered separately at the same time as the ripe fruit is harvested. Other precautions that should also be taken to avoid yield reduction in subsequent years include: (i) harvesters must not climb the cocoa trees to avoid rubbing (or bruising) flowering cushions and (ii) should not pull (or tear) off cocoa pods by hand. A smooth object, preferably wooden, rather than cutlass should be used to break pods if bashing one pod against another cannot break them. This is to avoid injuring the beans and thus creating access for infections. Pods should not be kept for more than 2 days before breaking as longer periods affect fermentation and consequently, the development of the desired chocolate flavour. The contribution of bad harvesting practices to deterioration of quality in the cocoa production chain is about 15%.

Bagging and Storage

Moisture level must be kept below 8% after drying, otherwise cocoa could become spoiled due to mould development. Once dry, the cocoa beans are placed in jute bags and stored for sale. Proper storage prior to sales is as important as any of the earlier stages, even if the storage in this case is for only a relatively short term compared to storage by the exporters and chocolate manufacturers, which is long term. It is necessary to preserve the bean quality and prevent any deterioration. Storage is usually in jute bags that are properly sealed and stacked on wooden supports on a concrete floor. Old bags that have been used to store maize or other foodstuff should be avoided while cocoa should be kept away from other produce and smoke. In short it is important to avoid any source of contamination during storage. Beans should therefore not be exposed to hazards such as mould development, rodent attack, bacterial activity and unfavourable storage environment, fat degradation, insect infestation and contamination by other stored products. The cocoa should be sold to buyers or export firms as soon as possible. There is no advantage in keeping cocoa in the house where it is liable to deteriorate in quality. This practice by price speculators should be discouraged. The estimated contribution of bagging and storage practices to quality decline in the cocoa production chain is about 10%.

Marketing

Cocoa is an internationally traded commodity with its price determined by supply and demand. Producers need to avoid selling on open market (truck buyers) and fetch a price for quality through contractual type of cocoa farming which enables good price for quality and compensations, for example with fertilizers. The contribution of bad marketing practices to quality decline in the cocoa production chain is about 11%.

Conclusion

Primary processing, harvesting, and seed choice are the first three activities with the highest percentage of contribution to cocoa quality. Restoration of cocoa yield to its peak level is possible by systematic replacement of inferior trees. We recommend a viable, well – informed and well – equipped extension services that will enhance the practice of good husbandry, especially among the smallholder cocoa farmers.