# GOOD AGRICULTURAL PRACTICES TO MAINTAIN THE RECOMMENDED MAXIMUM RESIDUE LEVELS (MRLs) IN COCOA BEANS AND PRODUCTS : THE NIGERIAN EXPERIENCE<sup>1</sup>

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# ABSTRACT

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In agricultural production, most farmers use pesticides to control insect pests, diseases and weeds, to ensure the quality standards imposed by buyers and processors. Residues from these pesticides may remain in the products even after processing. Foods and products containing residues that comply with the Maximum Residue Levels (MRLs) are "toxicologically acceptable". However, exceeding the MRLs can indicate over-use of pesticides but it is not regarded as safety level. The MRLs are crop-pesticide specific, which means that maximum limits for one pesticide may vary depending on the crop it is used on. For instance, the MRLs of a cocoa pesticide can differ from the MRLs of that same pesticide on kola, cashew, coffee or tea. The MRLs are determined on the basis of Good Agricultural Practices (GAP). Besides the level determined on the basis of GAP, also scientific data showing toxicology of the substance and its effects on human health are taken into account. The new EU harmonized pesticide residue legislation introduced limits that could severely affect cocoa exports, which will adversely affect cocoa production. The cocoa sector as a whole needs to act immediately to ensure that the appropriate MRLs are in place or else the cocoa economy of Nigeria could dwindle further, ultimately affecting the livelihoods of the individuals and families in the business.

Key words: Food safety, Maximum Residue Levels, Good Agricultural Practices

## **INTRODUCTION**

Nigeria used to be the number one cocoa producer in the world, until the turn of events. In the 1950's, 80% of the foreign exchange generated in the country was from cocoa (FGN, 2007). The trend however changed from 1980's to date, with a sharp decline in production resulting in decreased foreign exchange generation. Nigeria is currently the 5<sup>th</sup> world producer of cocoa with an estimated production figure of 165,000 metric tons in 2006/07 (ICCO, 2007; FAO, 2007). The sharp decline in Nigerian production could be attributed to a number of causes, including advent of the petroleum sector, which led to the neglect of agriculture; policies and activities of the Nigerian Cocoa Board (1978 – 1986); non-availability and high cost of cocoa production inputs; activities of middlemen; insect pest and diseases; over-aged and low yielding trees; non remunerative prices; non-availability of farm labour and old agronomic practices; low nutrient status of cultivated land and finally lack of credit (FGN, 2007).

Agriculture in the 21<sup>st</sup> Century is faced with three main challenges; improving food security, rural livelihoods and income; satisfying the increasing and diversified demands for safe food and other products and conserving and protecting natural resources (FAO, 2003). These challenges can be tackled in part through Good Agricultural Practices (GAP). GAP could be defined as agricultural practices which produce a quality crop while protecting, sustaining or enhancing the environment with regard to soil, water, air animal and plant life (CORESTA, 2005). The concept of GAP covers a wide range of on farm and post farm activities resulting in safe and healthy food while taking into account the economical and environmental impacts of agriculture, various social objectives including health and welfare of agricultural workers (Wikipedia, 2008). GAP aims at applying recommendations and available knowledge to addressing environmental, economic and social sustainability for on-farm and post-production processes resulting in safe and quality food and non-food agricultural products (FAO, 2003). GAPs may be applied to a wide range of farming systems and at different scales. They are applied through sustainable agricultural methods, such as integrated pest management, integrated fertilizer management and conservation agriculture. They rely on four principles (FAO, 2003; Wikipedia, 2008):

- Economically and efficiently produce sufficient (food security), safe (food safety) and nutritious food (food quality)
- Sustain and enhance natural resources;
- Maintain viable farming enterprises and contribute to sustainable livelihoods;
- Meet cultural and social demands of society.

<sup>&</sup>lt;sup>1</sup> This paper is an articulation of strategies that will ensure that the country meets up with the EU Regulations through Good Agricultural Practices (GAP) for improved cocoa production

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Maximum Residue Levels (MRLs) are defined as the maximum concentration of pesticide residue (expressed as milligrams of residue per kilogram of food/animal feeding stuff) likely to occur in or on food and feeding stuffs after the use of pesticides according to GAP, i.e. when the pesticide has been applied in line with the product label recommendations and in keeping with local environmental and other conditions (ECA/CAOBISCO, 2006; PRC, 2008). MRLs are the maximum allowed concentrations of pesticide residue in or on food products or the legal level of pesticide residue that can be present in food. MRLs ensure that pesticide residues in foodstuffs do not constitute an unacceptable risk for consumers (CBI, 2008).

Generally, the issue of food safety is very much on the consumers mind nowadays. A consumer wants to know how safe is the food he or she is eating, especially in terms of pesticide residues. In addition they want to know whether some practices, which they find offensive, such as child labour are practiced on cocoa farms (Salleh, 2007; FGN, 2007). The European Union recently harmonized pesticide residue legislation (Regulation 149/2008/EC), which applies to imported cocoa beans. This regulation, which came into force by September 1, 2008 introduced limits, which could severely affect cocoa imports unless the cocoa sector as a whole acts quickly to ensure that appropriate MRLs are in place (COPAL, 2008).

Initially, temporary EU MRLs was set based on existing EU member state national and/or Codex MRLs. However, where there are no national or codex MRLs in place, the EU MRL will be set at the default limit of detection (LOD) ie the lowest concentration of a pesticide residue that can be measured using routine analysis (ECA/COABISCO PWG, 2006). This was very important for cocoa since many pesticides currently used on the crop has no EU member state or codex MRLs in place. For such pesticides a default LOD MRLs will be assigned to them and if a residue of such a pesticide is detected, it would be considered illegal, even though it would not necessarily pose any threat to consumer safety. There are very few codex and EU member state national MRLs set specifically for cocoa, and it is likely therefore that default LOD MRLs will be set for many of the pesticides currently used on the crop, and for the more modern pesticides, which are coming on to the market for use on cocoa (ECA/COABISCO PWG, 2006). It is therefore essential that the appropriate EU MRLs and import tolerances are established for all the pesticides likely to be encountered as residue on cocoa consignments to avoid disruption to trade, supply and the economies of producing countries like Nigeria.

# STAKEHOLDERS IN A GAP APPROACH

GAP evolved in the context of a rapidly changing and globalizing food economy and as a result of the concerns and commitments of a wide range of stakeholders regarding food production and security, food safety and quality, and the environmental sustainability of agriculture. These stakeholders represent actors from the following:

- 1. Supply dimension (Farmers, farmers' organizations, exporters, transporters, labourers etc).
- 2. The demand dimension (Retailers, importers, processors and consumers).
- 3. Institutions and services that support and connect demand and supply and who seek to meet specific objectives of food security, food quality, production efficiency, livelihoods and environmental conservation in both the medium and long term (education (universities etc), research, extension, certifiers, credit organizations, NGOs, IGOs (FAO, WHO, WTO) and policy makers.

## GAP FOR ACHIEVING RECOMMENDED MRLs

For a GAP approach to succeed in achieving recommended MRLs, it must meet the demands within a broad range of agro-ecologies and socio-economic circumstances as follows:

**Soil:** The physical and chemical properties and functions, organic matter and biological activity of the soil are fundamental to sustaining agricultural production and determine, in their complexity, soil fertility and productivity. Appropriate soil management aims to maintain and improve soil productivity by improving the availability and plant uptake of water and nutrients through enhancing soil biological activity, replenishing soil organic matter and soil moisture and minimizing losses of soil, nutrients and agrochemicals through erosion, run off and leaching into surface or ground water. This affects livestock and associated species including predators and bio-control agents. Good agricultural practices related to soil include:

- Maintaining soil cover to provide a conductive habitat for soil biota, minimizing erosion losses by wind and/or water.
- Application of the right agrochemicals (insecticides, fungicides, herbicides, fertilizers) in amounts and timing and by appropriate spraying equipment.

**Crop Protection:** Maintenance of crop health is essential for successful farming for both yield and quality of produce. Any measure for crop protection particularly those involving substances that are harmful for humans or the environment, must only be carried out with consideration for potential negative impacts and with full knowledge and appropriate equipment. Therefore good practices related to crop protection include:

- Use of resistant cultivars and varieties.
- Cultural practices that maximize biological prevention of pests e.g. farm sanitation, pruning, and sanitary harvesting.
- Regular monitoring to maintain regular and quantitative assessment of the balance status between pests.
- Adoption of organic control practices where and when applicable e.g. use of botanicals.
- Apply pest forecasting techniques where available.
- Judicious use of agrochemicals, which involves; identification of the pest problems, determination of the economic threshold, knowing the right pesticide to use, application of pesticides at the appropriate rate, timings, pre harvest intervals, wearing protective clothing and application with appropriate equipment.
- Gang spraying of contiguous cocoa farms to avoid reintroduction from neighboring farms especially for black pod disease and mirids that could easily be spread by rain splashes and wind.
- Pesticides should be applied by specially trained and knowledgeable persons; children and women are not allowed to apply pesticides.
- Maintain accurate records of pesticide use.

**Harvest and On-farm processing and Storage:** Product quality also depends upon implementation of acceptable protocols for harvesting, storage and where appropriate, processing of farm products. Good practices related to harvest, on farm processing and storage includes:

- Harvesting following relevant pre-harvest intervals
- Sorting of pods after harvesting
- Avoid breaking of pods and fermenting cocoa beans inside the farm
- Clean and safe handling of produce
- Drying of beans to a low moisture content
- Storage in clean environment
- Avoid application of pesticides during drying or storage
- Packing of produce in clean hydrocarbon free jute bags.
- Avoid storage of produce in rooms with pesticides
- Store in well ventilated houses.

**Waste management:** This is also a component of sustainable production system to mitigate pesticide residues. Good practices related to waste management include:

- Storage of pesticides in secured places until when needed.
- Disposal of pesticides and containers in areas where there is no danger of the chemical getting to the water supply system or near the cocoa farms. This is to minimize the risk of pollution and pesticide persistence in the soil.
- Rinsing empty containers severally and adding the water to the spray tank load.

**Human welfare, health and safety:** The social and economic welfare of farmers, farm workers and their communities depends upon farming. Health and safety are also important concerns for those involved in farming operations. Good practices include:

- Adherence to safe work procedures
- Wearing of personal protective equipment (hat, face visors, overalls boots etc).
- Avoid using your mouth to clean nozzles
- Avoid using faulty sprayers

- Do not spray against the wind, as the pesticides will be carried to non target sites
- Purchase of only approved pesticides for use on cocoa.

## **IDENTIFIED BAD AGRICULTURAL PRACTICES**

Below are some critical bad agricultural practices in cocoa production in Nigeria that will lead to unacceptable MRLs.

- a) The use of banned and adulterated agrochemicals: Banned and adulterated agrochemicals are still been sold in this country. These come in through porous borders. Farmers patronize these chemicals because they are cheaper than the approved ones. Government should set up an enforcement agency to address this issue.
- b) Sun drying of beans on tarred roads: Some farmers are of the habit of drying cocoa beans on tarred roads especially if such farmers are close to urban areas. The danger such activities pose to the cocoa beans is the emission of hydrocarbon gasses into the cocoa beans thereby affecting their quality, especially the aroma.
- c) The use of spent dry cell batteries as insecticide: In view of the need to reduce the infestation of termite attack on cocoa trees some farmers practice a control method of spraying their farms with the contents of the dry cell batteries after dissolving it in water. Though the process may be effective in the control of termites, soil sample studies and bean quality from such areas have shown that such materials are often high in lead (Pb) deposit which is harmful to human health.
- d) Mixing of several pesticides together to form new compounds: Field observation has shown from different parts of Nigeria that a basic practice of some farmers over the years has been the mixing of several different pesticides which are sprayed on cocoa farms as a single dose pesticide expected to work "magic" on all insect pests/diseases associated with cocoa. A pertinent problem of such a practice is not only creating a compound of unknown composition but more importantly having serious environmental implication both on the farmer, environment, cocoa tree and bean quality.
- e) Use of improper packaging materials such as fertilizer bags: A common practice by farmers in the country is the use of old bags such as fertilizers bags for the packaging of cocoa beans for transportation and storage. Some of these bags have not been properly treated for use as a packaging material, hence may contaminate cocoa beans based on the prior contents.

# ACTIONS TO CUSHION THE EFFECTS ON THE COCOA SECTOR

The European Cocoa Association (ECA) and the Association of the Chocolate, Biscuit and Confectionery Industries of the EU (CAOBISCO) have invited representatives from cocoa producing countries (including Nigeria), research institutions (including Cocoa Research Institute of Nigeria) and pesticide manufacturers to join them to form a Pesticide Working Group (PWG). The PWG has entered into discussion with the European Commission (Directorate General for Development and Directorate General for Health and Consumer Affairs) to explain how these changes in legislation will impact on the cocoa sector. The PWG also invited representatives of the European Pesticide Manufacturers Association for their wealth of experience in the process of submitting data packages for pesticide approvals/import tolerances (ECA/CAOBISCO PWG, 2006).

With support from the Ministry of Agriculture, Nature and Food Quality of the Netherlands, via the Dutch Subsidy Scheme for the Sustainable Development of the Cocoa and Chocolate sector, the ECA/CAOBISCO are co-funding a project entitled the "Safe cocoa, sustainable production: A concerted programme by cocoa and chocolate industries to understand and address market changes regarding pesticide acceptability". The project was led by CAB International working in conjunction with their partners in the National Cocoa Programmes of Nigeria, Ghana, Cote d' Ivoire and Cameroon. This project was focused on West Africa since the region is the main source of cocoa beans for the European cocoa – chocolate industry. The main objective of the project was to gather information on current pesticide usage on cocoa in each of these countries and conduct an analysis of pesticide residues in cocoa beans so that critical points for contamination in the supply chain are identified. The project will provide support for producer countries in raising awareness of pesticide issues in their farming communities, including operator safety, elimination of illegal usage of non-approved pesticides and development and establishment of viable alternatives (ECA/CAOBISCO PWG, 2006).

In Nigeria, the Sustainable Tree Crops Programme (STCP) and the CropLife International Training of Trainers Programme is working in close contact with ECA/CAOBISCO to raise awareness of safe pesticide use and integrated pest management. STCP is currently organizing Farmers Field Schools throughout the cocoa producing states, where farmers are given best practices guidance on pesticide use and alternative methods of pest control. The Common Fund for Commodities (CFC) Project in Nigeria is tremendously contributing to plant breeding initiatives to ensure that farmers have access to new cocoa tree varieties, which are early maturing and more pest and disease resistant.

The federal Government of Nigeria through its Ministry of Agriculture and in conjunction with all stakeholders in cocoa (National Cocoa Development Committee, Cocoa Association of Nigeria, Golden Cocoa Growers

Association of Nigeria, Cocoa Farmers Association of Nigeria, All Farmers Association of Nigeria, Crop Life International, and various cocoa processors) have embarked on the auditing of current quantities of cocoa beans and pesticides in stock in the various local markets, warehouses and seaports. This was with a view of retrieving all unallowed pesticides in circulation and to substantiate their case before the EU/ECA/CAOBISCO for a buffer time period to allow for total conversion and compliant to the use of only approved pesticides. The argument here is that in 2008 cocoa season, most of the farmers still used the general pesticides in their cocoa farms up to August before they became fully aware of the ban. A period of conversion (2-3years) is therefore needed to allow for total biodegradation of these pesticides in the farms. However, the government has already put machinery in motion to make sure that farmers use only the approved pesticides in their farms.

#### DISCUSSION

GAP can contribute immensely to implementing sustainable agriculture and rural development while addressing the demand priorities, the supply side priorities together with institutions and services that are bridging supply and demand. GAP ensures the interest of small holder cocoa farmers for safe, economic and sustainable domestic production and livelihoods security. GAP helps guide debate on national policies and actions and on the preparation of strategies to ensure that all stakeholders participate in and benefit from its application in the food chain (FAO, 2003). The concept of GAPs has changed in recent years because of a rapidly changing agriculture, globalization of world trade, food crisis (mad cow disease and recent melanin milk taint in China), nitrate pollution of water, appearance of pesticide resistance, soil erosion etc. GAPs applications are being developed by governments, NGOs and private sector to meet farmers and transformers needs and specific requirements. However, many think these applications are only rarely made in a holistic or coordinated way (Wikipedia, 2008).

Foods and products containing residues that comply with the Maximum Residue Levels (MRLs) are "toxicologically acceptable". However, exceeding the MRLs can indicate over-use of pesticides but it is not regarded as safety level. The MRLs are crop-pesticide specific, which means that maximum limits for one pesticide may vary depending on the crop it is used on (CBI, 2008). For instance, the MRLs of a cocoa pesticide can differ from the MRLs of that same pesticide on kola, cashew, coffee or tea. The MRLs is not a health-based exposure limit, and exposure to residues in excess of MRLs does not necessarily imply a risk to health. This is because a use of a pesticide would not be allowed if the proposed MRLs resulted in long-term and short-term exposure of pesticide residues in the human diet above safety limits i.e. the Acceptable Daily Intake (ADI) and Acute Reference Dose (ARfD), which are calculated before any pesticide approval is given. The MRL is not linked to the ADI or ARfD, and could result in dietary intakes considerably below these safety levels. MRLs are intended primarily as a check that the pesticide is being used correctly (i.e. that the GAP is being observed) and to assist international trade in produce treated with pesticides (PRC, 2008; ECA/CAOBISCO, 2006).

In the European Union (EU), legislation has been laid down regulating the presence of pesticide residue in food products by setting Minimum Residue Levels (MRLs). As of September 1, 2008, the regulation was fully harmonised, which means that the MRLs requirements are now same in all EU member states (CBI, 2008; COPAL, 2008). However, when new information for specific MRLs becomes available, on for example GAP or residue trials, these MRLs can be reconsidered (CBI, 2008). The European cocoa industry strongly encourages efforts to avoid using pesticides that are not approved for use in the EU as the MRLs for most of these are set at the detection limits of 0.01mg/kg (Oyeleye, 2008).

Most of the produce sold in the market contains more than one type of pesticide residue as a result of usage of different mixture of pesticides. Unfortunately, very little research has been conducted on the safety of these pesticide mixtures. Every year the Government's Pesticide Residue Committee (PRC) of each country tests a small proportion of agricultural food produce (cocoa beans inclusive) sold in the markets for pesticide residues. The Government sets legal limits on the levels of these pesticide residues that can be present in food – the Maximum Residue levels (MRLs). Conventionally, the occurrence of pesticide residues in cocoa beans should be routinely monitored throughout the supply chain or, at minimum, checked prior to a consignment being shipped as a means of risk assessment and quality control. However, the situation is not same in Nigeria where lack of suitable laboratory facilities and monitoring protocols are major constraints (Oyeleye, 2008).

#### **Demand side actors**

- Processors can send signals to stakeholders that a GAP approach is preferred by paying premium price for compliance and outright rejection for non compliance.
- Provide a preferred supplier status to farmers.
- Provide capacity building to ensure "buy in" by suppliers.
- Retailers can provide market access.

- Demonstrate responsibilities toward both producers and consumers through enlightenment campaigns.
- Provide necessary information regarding practices.
- Consumers and citizens can exercise their right to know by asking for verification and transparency.

#### Support side actors

- Building capacity for connecting demand and supply e.g. engaging multiple stakeholders.
- Providing education to all stakeholders.
- Government should create and enforce policies that will ensure quality standards.
- Government should set up central laboratory facilities in each producing state to monitor quality of produce before shipping.
- Development of IPM package by research section.
- Creation of demonstration plots for GAP for the purpose of training and extension.
- Input suppliers should ensure product availability (emphasis should be on availability of measuring instruments, calibrated spraying equipment and supply of pesticide in sachets or liquid form containing dose sufficient for each knapsack load).

## Supply side actors:

- Farmers, workers and others can more easily implement GAP where there is:
- Financial support in terms of reduced input costs. Exchange of banned pesticides in farmers' custody with approved chemicals at designated points.
- Longer term access to credit on better terms.
- Increase in market access which will lead to increase in income
- Improved labour health and quality through provision of basic infrastructure.
- Capacity building of farmers.
- Involvement of farmers in developing what constitutes good practices.

## RECOMMENDATIONS

This has to do with stakeholder responsibilities (the supply – support – demand dimensions) relevant to incentives and institutional contexts and with an emphasis on benefiting small scale farmers.

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