



Republic of Ghana

NATIONAL SEED POLICY



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FOREWORD

Seeds are the basic unit of plant propagation and as such they are the most crucial input in agricultural production. Certified seed usage and matching applications of other simple agricultural technologies can lead to doubling of current crop yields and enable Ghana's agriculture to play its food security role more creditably. The continued dependence of the majority of our farmers on farm-saved seeds and seeds from local markets, which may simply be grain, cannot be the way forward towards achieving increased agricultural productivity.

We need to rebuild our seed industry to ensure that the superior germplasm produced by the research institutions will be available to all farmers, and used on all crop lands where the varieties are suited. This will assist to increase crop yields and enhance overall production, combat pests and diseases, widen crop adaptation, improve crop quality and suitability for agro-industry, and minimize the effects of drought and other calamities. In addition, improved varieties will lead to increases in the incomes of our farmers, enhance the nutritional status and quality of life of our rural people and minimize the rural-urban drift.

In recent years seed issues have assumed great national and international dimensions of critical political, social and economic importance and it is the goal of Government that, while Ghana's seed industry develops and takes on modern features, our national interests should at the same time be preserved.

Experiences around the world indicate that addressing the infrastructure and other hardware needs of the seed industry may not be enough to ensure success in seed industry development. Also needed are good policies which will guide the actions of responsible agencies and foster the needed partnerships between the public and private sectors. In order to holistically address the inequities that have plagued the national seed programme and hindered the full achievement of agricultural goals, MOFA, with the support of development partners, decided to formulate a National Seed Policy which shall guide all future interventions in the seed industry. The policy has evolved through a comprehensive process of relevant stakeholder participation and step-wise validation. Therefore, apart from ensuring consistency with the overall national agriculture sector policy, it also reflects the best effort and expert opinion of all of Ghana's seed industry experts and farmers.

The policy creates an environment conducive for the orderly growth and comprehensive and balanced development of the seed industry. It provides guidance to all seed industry participants, enabling them to conduct their roles in a coordinated manner.

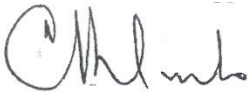
The policy provides strategies to encourage the growth of the private seed sector in line with Government's overall strategy to encourage the private sector to assume command of the commercial components of the seed industry. At the same time, the goal of seed security has been set, implying that Government will aim at eventually assuring all farmers of the continuous availability of quality seeds at prices they can afford. Public sector institutions will play their collaborative roles, particularly in research, extension, seed quality assurance as well as oversight, all with a view to growing the private sector.

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The policy seeks to address issues relating to the facilitation of the informal sector, so as to incorporate the interests of small-holder on-farm seed production practices into a modern seed programme.

If we are to succeed in our seed sector plans, all the relevant institutions and stakeholders will be required to display a high sense of commitment to this policy and to effectively translate the seed policy into practical activities to build a valued seed industry worthy of our agricultural and food security aspirations. Judging from the enthusiasm which characterized stakeholder consultations during the formulation process, I have no doubt that all seed industry actors will give of their best during the implementation of this policy.

My special thanks go to all the national and international experts, stakeholders, farmers and development partners who have assisted us in this process and I know I can count on them in the steps ahead of us.



HON. CLEMENT K. HUMADO (MP)
MINISTER OF FOOD AND AGRICULTURE

ABBREVIATIONS AND ACRONYMS

AFSTA	African Seed Trade Association
AGRA	Alliance for Green Revolution in Africa
APPP	Agricultural Productivity Promotion Program
BNARI	Biotechnology and Nuclear Agriculture Research Institute
CBOs	Community Based Organizations
CDI	Centre for Development Innovation
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CIMMYT	International Maize and Wheat Improvement Centre
CP	Cartegena Protocol
CRI	Crop Research Institute
CRIG	Cocoa Research Institute of Ghana
CSIR	Council for Scientific and Industrial Research
DAES	Directorate of Agricultural Extension Services
DCS	Directorate of Crop Services
DUS	Distinctiveness, Uniformity and Stability
ECOWAS	Economic Community of West African States
EPA	Environmental Protection Agency
ERP	Economic Recovery Programme
FAO	Food and Agriculture Organization of the United Nations
FASDEP II	Food and Agricultural Sector Development Policy II
FBOs	Farmer Based Organizations
FONG	Farmers' Organization Network of Ghana
GADD	Ghana Agro-dealer Development Project
GAIDA	Ghana Agro-Input Dealers Association
GAIMs	Ghana Agricultural Input Markets
GAINs	Ghana Agro Input Networks
GAPs	Good Agricultural Practices
GGDP	Ghana Grains Development Project
GIPC	Ghana Investment Promotion Centre
GIZ	German International Aid

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GLDB	Grains and Legumes Development Board
GMOs	Genetically Modified Organisms
GoG	Government of Ghana
GSC	Ghana Seed Company
GSID	Ghana Seed Inspection Division
GTZ	German Technical Cooperation
IARCs	International Agricultural Research Centres
IFAD	International Fund for Agricultural Development
IFDC	International Centre for Fertilizer and Agricultural Development
IITA	International Institute of Tropical Agriculture
IPRs	Intellectual Property Rights
IRRI	International Rice Research Institute
ISF	International Seed Federation
ISTA	International Seed Testing Association
KNUST	Kwame Nkrumah University of Science and Technology
LMOs	Living Modified Organisms
MESTI	Ministry of Environment, Science, Technology and Innovation
METASIP	Medium Term Agriculture Sector Investment Plan
MIR Plus	Market Inputs Regionally Plus
MOFA	Ministry of Food and Agriculture
MOF	Ministry of Finance
NGOs	Non-Governmental Organizations
NSC	National Seed Council
NSP	National Seed Policy
NSS	National Seed Service
NVRRC	National Variety Release and Registration Committee
OECD	Organization for Economic Cooperation and Development
PGRFA	Plant Genetic Resources for Food and Agriculture
PGRRI	Plant Genetic Resources Research Institute
PPMED	Policy Planning Monitoring and Evaluation Directorate
PPRSD	Plant Protection and Regulatory Services Directorate
QPM	Quality Protein Maize

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RTIMP	Roots and Tuber Improvement and Marketing Programme
RTIP	Root and Tuber Improvement Project
SARI	Savanna Agricultural Research Institute
SEEDPAG	Seed Producers Association of Ghana
SIDO	Seed Industry Development Office
SMU	Seed Multiplication Unit
SRID	Statistical Research and Information Directorate
SRR	Seed Replacement Rate
UCC	University of Cape Coast
UDS	University of Development Studies
UEW	University of Education, Winneba
UG	University of Ghana
UN	United Nations Organization
UPOV	Union for the Protection of New Varieties
USAID	United States Agency for International Development
VCU	Value for Cultivation and Use
WAAPP	West Africa Agricultural Productivity Programme
WACCI	West Africa Centre for Crop Improvement
WACRI	West African Cocoa Research Institute
WSP	World Seed Project

PART A: INTRODUCTORY CHAPTERS

1.0 BACKGROUND

1.1 Introduction

Quality seeds are a prerequisite to successful agriculture and constitute a major pathway for the achievement of national food security goals. Particularly for countries such as Ghana, where agriculture is the prime mover of the national economy, there is great need to ensure the availability and widespread utilization of quality seeds adapted to the crop lands where the varieties are to be grown. Equally important, the institutions and structures required to support the implementation of the seed industry activities should be streamlined and properly equipped to ensure that the seed programme plays its required role in agricultural development.

In Ghana's agricultural development efforts, quality seed is considered to be one of the basic inputs for increasing agricultural productivity and achieving food self-sufficiency. In view of that, it is the expectation of Government that the national seed programme should be so developed as to provide the required support towards the realisation of national agricultural goals. Currently, due to the dominance of small scale holders, the use of quality seed is very much limited. If not checked, this trend will lead to a continuous diminishing of agricultural productivity and compromise the cherished national goal of food security.

The underlying factors of low utilization of quality seeds are as follows:

- i. production and distribution of quality seed is insufficient;
- ii. the seed sub-sector which is mainly private sector-led in its commercial components, has not received the needed support;
- iii. a national seed policy, which should drive the seed sector development agenda, including the application of the existing Seed Law and ensuing regulations, has been absent.

In line with lessons learnt from past efforts in seed programme development, as well as current successes and constraints, and in consideration of future national goals and needs, Government has given priority to the formulation and implementation of a national seed policy, which will provide a defined and stable framework for the development of an effective and sustainable seed system. The policy should create an environment, which will foster support from both Government and development partners for all activities which relate to seeds.

A national seed policy is a statement of intent by government and its partners regarding the short, medium and long term development and management of the seed sector. It establishes a road map by which all plans, strategies and actions will be guided. It states priorities and allocates roles and responsibilities to identified partners. It identifies key issues to be addressed as well as the most suitable options for addressing the issues.

1.2 The Seed Policy Formulation Process

The National Seed Policy has been achieved through a participatory process. First, a group of experts assembled all available and relevant seed industry expert papers on Ghana and analysed them to obtain a collection of pertinent issues and possible options for addressing them. Expert papers on key seed industry topics were then prepared by selected resource persons and presented at a National Seed Forum in Kumasi. The wide range of stakeholders represented at the forum was as follows:

- MOFA policy experts
- MOFA technical directorates (PPRSD, DCS, DAES, PPMED, WIAD)
- Research Institutes (CRI, PGRRI and SARI)
- Food and Agriculture Organization
- Centre for Development Innovation, Wageningen University and Research centre
- Development Partners (IFDC, AGRA, ACIDI-VOCA, USAID, etc.)
- Farmers
- Seed Producers
- Private seed sector
- Public sector seed producers
- Agro-input dealers
- Agro-industry
- Financial Institutions
- Investment experts
- Universities

The forum participants deliberated upon the expert papers and issued, via working group methodology, a set of seed forum recommendations for the broad areas of research, seed production and marketing, seed legislative framework and private seed sector development.

The recommendations were subsequently considered by a Seed Policy Drafting Taskforce, which eventually elaborated on them to achieve a draft National Seed Policy. The draft seed policy went through a validation process involving presentations to two stakeholder workshops in Tamale and Accra where opinions were gathered which were then addressed in the subsequent drafts.

The final document, following the validation process and revisions, was then presented to the Minister of Agriculture for the necessary internal government clearances, revisions and eventual adoption as The National Seed Policy of the Republic of Ghana.

1.3 Thrust of the National Seed Policy

The thrust of the National Seed Policy is, firstly, towards confirming and elaborating on the seed-related policy environment contained in MOFA's overall agricultural policy and plans. Secondly, the policy seeks to propel attention to and action in hitherto neglected areas especially those areas which hold the key to rapidly transforming Ghana's seed industry to meet the needs of a modern agriculture and the attainment of a credible national food security, which MOFA has as goals.

1.4 Style of the Policy document

While the document is meant first and foremost as a policy statement, it is meant also to bring awareness of pertinent seed issues to the general public. In spite of the general awareness that quality seed plays a critical role in assuring food security for the nation, there is inadequate appreciation of the developmental, technical and programme issues relating to it. The policy document therefore presents opportunity to assemble alongside the policy statement itself, a collection of seed sector issues, facts, opportunities, challenges, mandates and principles etc which will assist the general public to gain a better understanding of the seed sector. The achievement of a wide ranging awareness is important since a large part of the public will directly or indirectly participate in the seed sector: as researchers, producers, farmers, processors or consumers; as traders, as administrators or managers; as instructors, as students etc.

The document is divided into three parts: Part A: Introductory Chapters, Part B: Policy Statements and Part C: Implementation Guidelines. The document opens with Introductory Chapters made up of Foreword, Background and The Agricultural and Seed Industry Context which establish the background and environment of the seed policy. Particularly, the historical perspectives of current activities and institutional arrangements as well as current situations and thinking on policy issues are captured here.

Introductory Chapters is followed by Policy Statements which contains chapters devoted to Objective, Scope and Strategy by which the policy rationale and overall goals are established. As well, statements on responsibility, administration and oversight arrangements are presented in this part. The last portion of Policy Statements is devoted to policy statements on the key elements which make up the seed industry: from research and variety development, through seed production, quality control extension to marketing, seed security etc. The policy statements on the key elements are treated as follows:

- Firstly, a statement on the guiding principles and challenges related to the topic is presented.
- Secondly, the objective of the policy statement is stated.
- Thirdly, the policy action required to address the challenges and meet the objectives is pronounced.

Implementation Guidelines is the final part of the document and is devoted to an outline to guide in the preparation of a National Seed Plan and to provide guidance in the general approach towards the implementation of the policy. The proper and effective implementation of a policy requires a matching implementation plan which will translate the intentions and philosophy of the policy into actionable projects, programmes and activities. The national seed plan will propose the activities to be instituted, the implementing partners, the modalities and objectives, the resources required, expected outputs and time frame. The Implementation Guidelines suggests steps by which the group of experts that will prepare the plan will be guided. Additionally, important guidelines are provided which will directly aid in the implementation activities.

1.5 Issues of Seed Development in Past and Current Agricultural Policies

The recognition that quality seeds can make an overwhelming contribution to agriculture has long been evident in the overall agricultural policy statements issued by Government. From the 1950's when formal seed multiplication activities were started up to the present, agricultural policy documents of MOFA have contained statements on the expected role of the national seed programme, its objectives, plans and expected outputs. The statements have also stated the mandates of participating agencies and other stakeholders. It can therefore be seen that the key elements of a national seed policy have long existed and indicated the pride of place, among agricultural factors of production, that the Government has always accorded quality seed. Elaborating these elements into a fully-fledged national seed policy document enables achievement of broader goals as follows:

- clear pronouncement on all relevant aspects of the seed sector
- broadening the ownership of the policy by incorporating the consensus opinion of all relevant stakeholders
- removing ambiguities through formalized documentation
- putting on record goals and objectives in order to survive staff turnovers
- revisiting inappropriate or restrictive regulatory and other arrangements which hinder the participation of pertinent national and international stakeholders in the seed industry
- enhancing the confidence of international collaborators

The intentions enshrined within the MOFA agricultural policy documents will form the basis of the National Seed Policy. The National Seed Policy will therefore strengthen and elaborate on the seed components of the agricultural policy and ensure that the latter provide the basis for measuring the contribution that the seed policy makes towards fulfilling the broad intentions contained in the agricultural policy.

1.5.1 Policy Indications in FASDEP II

The current agricultural policy document named “Food and Agricultural Sector Development Policy II” (FASDEP II) states the goals of the crop sub-sector development as including the enhancement of the competitiveness and profitability of crops through access to improved technological packages for increased productivity. The main improved technology in crop production is quality seed and the major issues or challenges relating to the use of quality seeds are mentioned in FASDEP II as being the following:

- Limited availability of improved technological packages, especially planting materials and certified seed usage by farmers.
- Low productivity at farm level.

1.5.2 Strategies to be adopted

FASDEP II contains strategies proposed for addressing the issues of the seed sector as follows:

- Supporting production of certified seeds/planting materials and increased farmer usage through intensification of awareness campaigns.
- Intensifying dissemination of updated crop production technological packages.
- Facilitating the development of high-yielding, disease and pest-resistant varieties and increased supply of certified planting material.
- Ensuring that operators of urban agriculture are reached with the needed information technology and inputs.

These strategies complement those already outlined under the six agricultural policy objectives, stated in FASDEP II, for:

- Productivity enhancement;
- Sustainable land management;
- Expansion of production and market/trade infrastructure;
- Promotion and enforcement of standards; and
- Engagement of the private sector,

The major industrial crops such as cashew, citrus, cotton, coconut, oil palm, and rubber share similar constraints, which include unavailability of high-yielding planting material, poor agronomic practices, and cultivation of smallholdings. The objectives in the medium term are to increase the availability of improved planting material, improve adoption of improved agronomic practices and expand average farm size per holder.

1.5.3 Access to agricultural Inputs

The component of seed marketing, together with the marketing of the allied farming inputs, is extremely important as the main driving force behind the seed industry. The Ministry's policy is that efforts will be geared towards improving access to inputs and profitability of their use. As well, principles of competitiveness and cost-reduction in input markets will be promoted. Regular revision of laws and regulations on agro-inputs is to be pursued to create an enabling environment for the private sector.

The strategies that will be used in addressing issues regarding agricultural inputs include the following:

- Advocating the passage and enforcement of laws and regulations and fostering an enabling environment to enhance trade in and use of inputs.
- Facilitating the creation of an enabling environment for the establishment of input shops in the districts.
- Strengthening surveillance of agricultural input trade and use.
- Creating awareness on usefulness and benefits of agricultural inputs.
- Encouraging local production and re-packaging of agricultural inputs to reduce cost.

1.5.4 Strengths and Opportunities of the Sector

In pursuing the development of a modern seed industry, Ghana has several strengths and opportunities such as a well-established agricultural research system, which has been successful in crop improvement (e.g. for cassava, maize, cowpea) and a large array of public seed industry infrastructure some of which may be available for use by the private sector under suitable arrangements.

1.5.5 Medium Term Agriculture Sector Investment Plan (METASIP) of MOFA

The Medium Term Agriculture Sector Investment Plan (METASIP) is the accompanying document of the FASDEP II document. METASIP contains programme proposals meant to guide in the implementation of the policy intentions contained in FASDEP II. It is noted in METASIP that crop production statistics suggest that most agricultural growth has been mainly due to land area expansion as opposed to yield increases. MOFA aims to rather push for productivity enhancement to achieve increased production and hence the premium to be put on the use of quality seed.

The low yields consistently being achieved by farmers is due to, among others, the low use of high yielding varieties since a major determinant of crop productivity is the use of quality seeds and planting materials. Most crop yields are less than 60% of achievable yields. For example, for the priority staple crops – maize, cassava, rice, yam and cowpea, the following are percentages of actual yields in relation to achievable yields:

- Maize - about 37%
- Cassava - 55%

- cowpea - 25%
- rice - 42%
- yam - 36%

MOFA considers improvement in yields to be highly feasible and aims to pursue that goal. There are problems constraining the wider usage of quality seeds and these include high seed cost; limited seed availability in remote production areas; adulteration of seeds which lowers confidence of users of seeds and other inputs. But in spite of these problems, opportunities exist to increase crop yields through intensive methods such as use of certified seeds and Good Agricultural Practices (GAPs).

1.5.6 Plan Proposals in METASIP

The following are some of the key plan proposals in METASIP reflecting the broad programmes of the agricultural sector for which the National Seed Policy will need to give direction.

a) Development Issues

There are major developmental issues which need to be addressed to properly move the seed industry forward:

- **Low Seed Use**

Use of inputs by smallholder men and women farmers is low (5 – 10% fertilizers, 30% Quality seeds).

This would be addressed as follows:

- Identifying, updating and disseminating existing technological packages
- Introducing improved crop varieties (high yielding, short duration, disease and pest resistant and nutrient fortified)
- Strengthening surveillance of agricultural input trade and use (including capacity of PPRSD)
- Expanding infrastructure for seed/planting materials production, processing, storage and marketing to facilitate private sector seed/planting material production.
- Reviewing the role of the various institutions involved in the seed industry to improve interface management.
- Advocating for a regional seed/planting material policy under WAAPP

- **Emergency Preparedness**

METASIP also calls for the development of an Early Warning System and Emergency Preparedness which will include the following:

- Constructing vulnerability maps to support targeting of food searching and emergency preparedness interventions
- Establishing a National Seed Security stock for emergencies

- **Capacity Development**

Proposals covering the urgent need for capacity enhancement include the following:

- Building capacity of nursery operators in all tree crop growing areas and supporting them (certify and assist to obtain resources) to expand and improve quality of seedlings
- Building capacity of certified seed growers and supporting them (to obtain resources) to expand and improve quality of seed
- Strengthening the capacity of PPRSD and allied institutions for monitoring and certification of seed and seedlings

- **Development of value chains**

METASIP contains plans for strengthening value chains which in the seed industry are of critical importance, considering both the coordination and collaboration/synergy required in both the seed value chain and the commodity value chain and the interactions required between the two value chains.

The following intentions have been proposed:

- To establish regional core teams for value chain development backstopping
- To undertake market feasibility studies to promote demand for the selected commodities
- To facilitate linkage to market for the selected commodities

- **Enhancing Adoption of Quality Seeds**

Observing that the progress of the seed sector is impeded by low adoption of agricultural technology, plans are mentioned to make the following interventions in research:

- To conduct participatory research work that is informed by needs of new technology users along the value chain
- To conduct on-farm research into low cost appropriate technologies and deliver them as packages
- To intensify field demonstrations/field days/study tours to enhance adoption of improved technologies

2.0 THE AGRICULTURAL AND SEED INDUSTRY CONTEXT

2.1 Agriculture in Ghana

2.1.1 General

The Republic of Ghana is located between latitudes (4° 44'N and 11° 11'N) and longitudes (3° 11' W and 1 ° 11'E) respectively. Ghana's population was estimated to be 25.28 million in 2011, with an annual growth rate of 2.5 percent. Total land area in Ghana is 23,853,900 ha. Total agricultural land occupies 13,628,179 ha (57.1%) while the cultivated agricultural land is 7,311,500 ha (54.7% of agricultural land). Agricultural irrigated land is 29,804 ha (0.2%). About 65% of the active labour force is employed in the agricultural sector. Agriculture accounts for over 40 percent of exports, and provides over 90 percent of the food needs of the country. The principal agricultural exports include cocoa, timber, horticultural products, fish/sea foods as well as game & wildlife. The agricultural sector contributed about 30.0% and 25.6% of the Gross Domestic Product (GDP) in 2010 and 2011 respectively.

Agriculture sub-sectors in Ghana include Crops, Forestry, Fisheries and Livestock. The Ministry of Food and Agriculture (MOFA) has oversight responsibility over the crops and livestock subsectors. MOFA has three technical line Directorates in the crop-subsector and these are Directorate of Crop Services, Plant Protection and Regulatory Services Directorate and Agricultural Engineering Services Directorate.

2.1.2 Main Crops

The main crops produced in Ghana are as listed and categorized below:

Cereals:	Rice, Maize, Millet, Sorghum
Legumes:	Cowpea, Groundnut, Bambara groundnut
Fruits:	Pineapple, Citrus, Bananas, Mangoes, Pawpaw
Vegetables:	Tomato, Pepper, Okra, Egg Plant, Onion, Shallots, Exotic vegetables, Leafy vegetables
Industrial:	Cocoa, Oil Palm, Coconut, Cotton, Kola, Rubber, Shea, Soybean, Cashew

2.1.3 Agro-ecological Zones

The main agro-ecological zones are: Coastal Savanna, Forest agro-ecology, Transitional agro-ecology, Guinea Savanna and Sudan Savanna.

The mean annual rainfall and the growing period (days) for the agro-ecological zones are shown in Table 1 as quoted by SRID, MOFA (*Agriculture in Ghana: Facts & figures, 2011*),

Table 1: Average annual rainfall and growing period in agro-ecological zones of Ghana

Agro-ecological Zone	Mean annual Rain (mm)	<u>Growing Period (Days)</u>	
		Major season	Minor season
Rain Forest	2,200	150 – 160	100
Deciduous Forest	1,500	150 - 160	90
Transitional	1,300	200 - 220	60
Coastal	800	100 – 110	50
<u>Northern Savanna:</u>			
Guinea Savanna	1,100	180 - 200	*
Sudan Savanna	1,000	150 – 160	*

Source: Meteorological Services Department, Accra.

Rainfall distribution is bimodal in the forest, transitional and coastal zones, giving major and minor growing seasons. Elsewhere (Guinea Savanna and Sudan Savanna), the unimodal distribution gives a single growing season.

The Coastal Savanna belt covers the Coast - Winneba Plains, the Accra Plains and the Ho-Keta Plains. The Coastal Savanna is characterized by grassland, shrub and thicket. The major crops grown are cereal, fruit and vegetable crops. Livestock and poultry production is prominent in this zone.

The Forest Agro-ecology is further to the north of the Coastal Savanna. It is made up of evergreen rain forest and deciduous forest. The major crops grown are cocoa, rubber, citrus, maize, oil palm, coconut and fruit and vegetable crops.

The Transitional Zone is a mixture of forest and grassland and is located to the north of the Forest Zone. The major crops grown are cereals, legumes, cashew and vegetables.

The Guinea Savanna Zone is to the north of the Transition Zone. It is made up mainly of grassland with few trees. Major crops grown are cereals, legumes, vegetables, cotton and shea. Livestock production is very prominent.

Sudan Savanna is further to the north of Guinea Savanna zone and has less vegetation. Main crops grown are cereals, legumes, vegetables, cotton and shea. Livestock production is widespread.

2.1.4 Farming Systems

The major farming systems in Ghana are based on the agro-ecological zones that essentially established the systems. The farming systems include rotational bush fallow, permanent tree crop, compound farming, mixed

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farming and special horticultural farming system. These farming systems, as listed below, have peculiar characteristics which have various impacts on the environment.

a) The Rotational Bush Fallow System

This is characterized by clearing and burning of the vegetative cover. It is the dominant farming system throughout Ghana. This normally exposes the soil to erosion and leaching leading to soil infertility. Although the soil fertility is expected to be restored through long fallow periods to allow the soil to regenerate, the fallow periods have drastically decreased owing to population pressure.

b) The Permanent Tree Crops Farming System

This is characterized by the cultivation of permanent tree crops, usually a mono-crop such as cocoa, citrus, oil palm, avocado, rubber, coffee and mango. Cocoa is however the most extensively cultivated tree crop in this farming system. This system of farming generates a number of positive environmental impacts that include soil erosion prevention or restoration, groundwater recharge, watershed and catchment area protection, air quality improvement through carbon sequestration, and beautification of the rural landscape.

c) Compound Farming Systems

These are practised mainly in the interior savanna zones where most farms are cultivated within close vicinity of villages. Several generations of farming and inheritance have led to land fragmentation. The compound farms symbolize permanent agriculture with soil fertility often maintained. Crops grown here include tree crops such as cashew, plantain and cassava intercrops and food crops such as yam, maize and cassava. Vegetable cultivation comprising tomato, okro, pepper and garden eggs is also important. In addition to the crops, animal husbandry is also a very common characteristic of this farming system.

d) The Mixed Farming Systems

These integrate the rotational bush fallow system and the permanent tree crop system. This farming system is mainly practised in the high rain forest and the semi-deciduous forest zones. Typical crop mixtures are cocoa with food crops or oil palm with food crops.

e) Horticultural farming systems

Horticultural farming systems in Ghana are dominated by crops such as pineapples, pawpaw and exotic vegetables, which are mainly grown for export. The cultivation of these crops entails clearing large hectares of land and application of fertilizers. These processes generate negative environmental impacts such as soil erosion and eutrophication.

Agriculture is predominantly on a smallholder basis in Ghana. About 90% of farm holdings are less than two hectares in size. There are however some large farms and plantations, particularly for rubber, oil palm and coconut and to a lesser extent, rice, maize and pineapples. Main system of farming is traditional. The hoe and cutlass are the main farming tools. There is little mechanized farming, but bullock farming is practiced in some

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places, especially in the northern parts of the country. Agricultural production varies with the amount and distribution of rainfall. Soil factors are also important. Most food crop farms are intercropped. Mono cropping is mostly associated with larger-scale commercial farms.

Ghana is self-sufficient in many key staple crops, recording growth in the key staple crops of about 13% in 2010. There is excess demand in other critical commodities including rice, tomato, sugar, which have to be met by imports. Ghana currently produces less than 30% of the raw materials needed by its agro-based industries. Aside from cocoa, horticulture and industrial crops also contribute to Ghana's agricultural export earnings. In the past two years, exports have declined in both volume and value. For instance in 2010, the volume and value declined by 13.6% and 0.8% respectively.

2.1.5 The Seed Sector

Ghana has a significant seed industry that combines both the formal and informal seed production and delivery systems. The industry covers seeds and planting materials of several crop varieties developed, released and registered by Ghanaian institutions and produced and marketed across the country. There are seed exports, though largely informal, to other countries in West and Central Africa and beyond.

The Ghana seed industry started in 1958 with the establishment of a Hybrid Maize Seed Multiplication Unit within the then Ministry of Agriculture. The Unit produced only hybrid maize seed until 1961 when it was converted into a Seed Multiplication Unit (SMU) which included other crop seeds in its portfolio.

By the close of the sixties the SMU had adopted a contract growers' system, whereby contract growers were used to produce all the certified seed requirements of the country. The SMU eventually became the Ghana Seed Company (GSC) in 1979 with the mandate to produce all classes of seed except breeder seed which was under the mandate of research centres. The food crops serviced by the seed industry at the time were maize, rice, groundnuts, cowpea and imported vegetables. Concurrent with these, other predominantly public sector institutions and parastatals (Cotton Development Board, Bast Fibre Development Board, Grains and Legumes Development Board) were set up and charged with the production and marketing of seeds of specific commodities, particularly cash crops.

As part of actions under the Economic Recovery Programme (ERP), the Government of Ghana adopted the privatization option and dissolved the Ghana Seed Company (GSC) in September 1989, paving the way for a new Ghana Seed Programme in which the private sector would take over the commercial components of the seed industry while the public sector would continue its responsibility for the activities having a service nature.

It was expected that the private sector would usher in a period of efficient, widespread and profitable seed programme. The realization of that goal has been slow. Today less than 5% of Ghanaian farmers are able to access certified seeds from approved sources. Increasingly, farmers are sliding back to the age-old practice

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of on-farm seed saving, a practice which has a potential of reducing farm productivity across the country and reversing the food security gains made in the past.

Although, overall, significant gains have been made in Ghana's seed development, the absence of a clear cut seed policy has robbed the national programme of the required success. The failings are manifested in weak institutional linkages and unclear mandates, inadequate collaboration among participating partners, poor oversight arrangements, and inadequate resources particularly in support of private sector efforts. In spite of commendable initial efforts in the privatization drive, most of the developmental initiatives have stalled.

The informal seed sector is very significant with about 80% of the major seeds used in the country emanating from that sector. The formal sector provides far less quantities of seeds than is desired. For example, in 2011, of the total certified seed requirement for maize and rice of 22,500 and 12,800 tons respectively, only 4,600 and 4,112 tons respectively were produced representing 20.4% and 21.7% of the total requirements. Corresponding figures for sorghum, cowpea, groundnut and soybean are 0.93%, 0.83%, 0.05 and 11% respectively.

The seed sector faces several challenges including the following:

- low key investments in the seed sector
- Poor credit availability, especially from banking institutions
- Inadequate seed production, processing, storage and quality assurance capacity
- Despite a fair-paced variety development and release system, dissemination and adoption of new varieties have been slow.
- Research institutes and other public sector servicing institutions such as GLDB, GSID are under-funded and this limits their critical roles in seed multiplication.
- There are serious human resource limitations, in terms of numbers and skills.
- Support to the private seed sector, in terms of seed promotion and marketing, is lacking or limited.
- Very low Agricultural Extension Agents (AEAs) to farmer ratio (1:1,500).
- Inadequate use of demonstration plots to promote use of quality seeds in farming communities
- Obsolete and low capacities of processing facilities cause delays in the processing of seed sometimes resulting in poor quality.
- Inadequate knowledge and skills among the seed value chain actors
- Inadequate logistics and motivation for seed inspectors, extension staff and other stakeholders to carry out their duties in promoting the adoption and use of improved certified seeds
- Inadequate logistics and motivation for plant breeders to develop new improved varieties

Recently, the status of the Ghana seed industry has been enhanced by the passage of the Plants and Fertilizer Act, 2010 (Act 803).

2.1.5.1 Private Seed Sector Development

Government's intention that the private sector should take over certified seed production and marketing as well as other commercial components of the seed industry following the closure of the Ghana Seed Company has been slow in being realized. It is clear that innovative and concerted efforts must be made to enhance the growth of the private seed sector especially in view of the fact that Government has already withdrawn from certified seed production of the main cereal and legume crops and no alternative sources of certified seeds currently exist.

During the restructuring of the seed industry in the aftermath of the Ghana Seed Company closure, a National Seed Service (NSS) was established within MOFA for the purpose of serving as the development and monitoring agency of the seed industry (both public sector agencies and the private seed sector). However, the NSS has not developed as expected. The inactivity of the NSS has denied the seed industry of the all-important facilitation required for its development along private sector lines and there is the need to re-establish such a body, although current thinking is that it would be better placed within the private sector itself.

Serious bottlenecks face the growth of the private sector and the sector will need the assistance of Government and partners to overcome them. Major bottlenecks relate to low certified seed demand; inadequate infrastructure, low capacity and insufficient training; weak marketing arrangements; inadequate access to institutional credit; and lack of seed industry data. The seed policy must clearly address these bottlenecks and provide the way forward regarding how the private sector will overcome these bottlenecks and launch itself on the path toward effective domination of the formal sector seed production and marketing.

The initiatives of The Alliance for a Green Revolution in Africa (AGRA) by which some start-up seed companies were awarded incentives by way of grants to encourage their establishment and growth, point towards a direction which Government and partners may seriously consider.

2.1.6 Agricultural Research in Ghana

Formal agricultural research activities were absent in the pre-colonial era. The only research-related activity was the intermittent introduction of plant genetic materials into the country by traders, missionaries, sailors and soldiers. Food crops and ornamental plants originating in other parts of the world were introduced. Some important introductions which were made include: cocoa, rubber, sugarcane, cotton, tobacco etc, for industrial uses; and plantain, maize, cassava, tomato, pepper, garden egg, sweet potato, orange, mango, coconut, cocoyam for food and fruits. Farmers who grew these crops unconsciously selected superior lines for their use, and these lines became established as the land races or better known as the local varieties.

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During the colonial era, Agricultural Stations were set up mainly for the multiplication of some of the introduced plants for distribution to farmers. Some of the Agricultural Stations were at Asuansi in the Central region, Bunso in the Eastern region, Mampong in the Ashanti Region, Ohawu and Kpeve in the Volta Region, Babile in the Upper West Region and Manga in the Upper East Region. Wenchi in the Brong Ahafo, Aiyinase in the Western region and Pokuase in the Greater Accra Region. Some of the stations are still being operated by the Directorate of Crop Services with the original mandate of planting material multiplication and adaptive trials, among others.

Serious agricultural research (both basic and adaptive) started after independence in 1966. A number of research institutions were set up under the Council for Scientific and Industrial Research. The relevant institutions, as they are currently named, as well as their mandates, are as listed below:

- Crops Research Institute: maize, rice, root and tuber crops, plantain, grain legumes, local vegetables,
- Savanna Agric Research Institute: All crops suitable for the savanna agro-ecology.
- Oil Palm Research Institute: Oil palm and coconut
- Cocoa Research Institute: cocoa, kola, cashew, and shea tree,
- Ghana Atomic Energy Commission: All crops
- Plant Genetic Resources Research Institute: Collection and conservation of all crops.
- Soil Research Institute: All crops.
- Besides the research institutes, there are five public universities that undertake both basic and adaptive research in agriculture. These are Kwame Nkrumah University of Science and Technology, University of Cape Coast, University of Ghana, University of Education, Winneba (Mampong campus), and University of Development Studies. The Universities are not restricted to specific mandate crops.

Agriculture research in general and plant breeding in particular has always been recognized by policy makers as essential to any effort to attain food security. The search for new cultivars with superior traits like high yields, disease, pest and drought tolerance, adaptation to various agro-climatic conditions and high consumer preference, has in recent times been a key agenda in all agricultural projects.

The main research institutions that undertake plant breeding are not under the jurisdiction of the Ministry of Agriculture (they are currently under the Ministry of Environment, Science, Technology and Innovation (MESTI). Other ministries with capacity for plant breeding are: Ministry of Education, through the Universities and the Ministry of Energy, through BNARI.

However there is a very good working relationship between the Ministry of Food and Agriculture and other agencies involved in agriculture research. In all donor funded projects managed by the Ministry of Food and Agriculture (MOFA), research is undertaken by the relevant research institutions. MOFA therefore has direct influence in the determination of research topics including plant breeding objectives.

In the design and implementation of relevant crop improvement projects, variety development is clearly defined and specific funds allocated to various research institutions. Unfortunately plant breeding efforts under the projects have not been sustained after the projects have concluded, due to inadequate budgetary support.

Ghana has not developed local private sector plant breeding capability. This may be attributed to the fact that there are no seed companies who can reward such private efforts on the basis of expected profits from seed sales.

2.1.6.1 Commodity Areas

Attention of most of the research institutes has been on their mandate commodities. Consequently, the root and tuber crops, cereals and legumes have enjoyed lots of attention among the food crops, while cocoa, oil palm and coconut have received good attention among the tree crops. Other crops that require some attention but receive very little include: local vegetables such as tomato, pepper, okro, pepper, and garden egg; and fruit crops such as citrus, mango, pawpaw, avocado etc,

2.1.6.2 Variety Development Options

The main types of varieties available in Ghana are as follows:

a) Synthetic/Open Pollinated Varieties

Most of the released varieties fall in this category. The main advantage to the farmer, relating to use of open-pollinated varieties, is that the farmer can save seed from his harvest up to the third generation, at least, after obtaining the initial certified or quality seed. Further, open pollinated seeds are cheaper to purchase due to their simple mode of production as compared to the complex methodology of hybrid production. It has thus been a preferred option for Ghana's variety development effort and the developing seed industry.

b) Hybrids

Although formal seed multiplication started in 1958 with maize hybrids, that technology was quickly replaced with synthetics and open pollinated procedures due to technical difficulties in both production and utilization of the hybrids. Recently, as the industry attains more commercialization, maize hybrids are appearing on the seed market and utilization is gradually increasing. There is as yet no significant local production of these hybrids and almost the bulk of the hybrids used have been imported. There have been difficulties in the utilization of the hybrids as well as questions regarding adaptability, costs and output expectations. These point to the need for farmer education on the effective use of hybrid seed to realize their full potentials.

c) Local varieties

Local varieties are given very little attention by researchers except that they sometimes rely on them as sources of germplasm for their breeding programmes

d) Introduced Varieties

Seeds of exotic vegetables and other crops, whose seeds cannot be produced locally, are imported for distribution. The private seed sector has successfully adopted this area, turning it into a very profitable business which efficiently keeps the horticultural sector well supplied with its seed needs. Research plays a key role with variety trial support by which suitable varieties are identified for the guidance of importers.

2.1.7.3 Funding For Research

Funds for most of the infrastructural development, and salaries of staff at the research institutes, are provided by Central Government. Externally-funded programmes have often assisted with additional funds for logistics and other inputs required for effective implementation of research activities.

PART B: POLICY STATEMENTS

3.0 THE NATIONAL SEED POLICY: RATIONALE AND OVERALL GOALS

3.1 Preamble

Agriculture is the driving force behind the economy and food security needs of Ghana and quality seeds constitute the most critical input for agricultural development. The seed sector is therefore required to be on a sound footing to be able to enhance the role of agriculture in meeting the national goals. Therefore, the Government of Ghana:

- Recognizing the critical role of quality seeds in agricultural development,
- Mindful of the need to develop a national seed programme that would support the economic and food security goals of Ghana,
- Aware that a comprehensive and effective seed industry is required to ensure the timely availability and use of quality seeds at the right place, in the right quantities, of the appropriate qualities and at affordable prices,
- Realizing that a good seed policy, as a blue print for development, is required to complement the complex set of technological and organizational structures to ensure an effective seed industry,
- Having considered the views and recommendations of all relevant stakeholders in a fully participatory process,
- In line with existing policies and legislations and
- In conformity with internationally accepted practices and processes,

hereby adopts a National Seed Policy by which Government would harness the advantages of both the public and private seed sectors to ensure the most effective use of limited resources to effectively develop and deploy all available structures which would assure all farmers of a continuous access to and use of quality seeds suited to their crop lands and their farming circumstances.

3.2 Main Objective

The main objective of the National Seed Policy is to support the development and establishment of a well-coordinated, comprehensive and sustainable private sector-driven seed industry through systematic and strategic approaches which would continuously create and supply new improved varieties for use by farmers and, further, support successful seed production, certification, marketing and seed security systems which will form the basis for food security and support the overall development of the agricultural sector.

3.3 Scope

The National Seed Policy will have two dimensions with regard to scope. Firstly, with regard to technical principles and guidelines, it will have applicability to seeds of all crops grown in Ghana, including both true seeds and vegetative planting materials and covering all crops, including ornamentals, forest trees, cash crops etc. This implies that, irrespective of the crop type, the application of the technical principles enshrined in the policy, will derive positive benefits.

Secondly, the policy will have operational and programme applicability to all crops that are listed as priority crops of the seed sector as follows:

Cereals: Maize, Rice, Sorghum, Millet

Legumes: Groundnut, Cowpea, Soybean

Root and Tubers: Cassava, Yam, Cocoyam, Sweet Potato

Tree and Industrial Crops: Mango, Orange, Cashew, Oil Palm, Coconut, Rubber, Cotton, Shea etc.

Fruits and Vegetables: Pineapple, Plantain, Papaya, Banana, Tomato, Pepper, Onion, Okra, Garden Egg

This implies that available national resources will be used to support mainly the stipulated priority crops in the actionable interventions proposed by the policy.

3.4 Overall Strategy of the Policy

The strategy followed in the early part of the seed sector development was based on public sector investment and subsidized seed supplies to farmers. The public investment and subsidies involved in that approach was based on Government's desire to achieve widespread use of quality seeds in order to enhance agricultural productivity and an escalation, both qualitative and quantitative, in crop production, particularly of the main cereals (maize and rice) and of the main legumes (groundnut and cowpea).

The change in strategy which started in 1990 with the closure of the Government parastatal, Ghana Seed Company, started a gradual shift to a new approach by which the private sector, which includes seed companies, seed producers, farmer based organizations (FBOs) and Community Based Organizations (CBOs), would be encouraged and supported to lead in the commercial operations of the seed industry.

Although the pace of development expected in the new strategy has been rather slow, Government is still committed to it and will adopt all measures enshrined in this policy that will hasten the private sector domination of all the components of the seed industry which lend themselves to commercial operations. Towards that objective, Government will create an enabling environment, institute incentive arrangements and strengthen public sector agencies which are responsible for services to the seed industry in areas such as research, early generation seed production, quality assurance and extension. Government's role in the seed

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industry will eventually be limited to providing support and services in the areas which are of service nature and in which the private sector is presently not adequately developed to make a contribution.

Government is aware that the private sector development will span a considerable period and will therefore moderate the pace of the strategy change to avoid undue gaps in seed availability to farmers. Further, there are important seed types which will not be attractive to the private sector but which Government would aim to provide quality seeds for. Consequently, Government's intention would be that public sector operations in research, seed quality assurance, extension and seed security should be strengthened to adequately support both public and private seed sector operations.

Government will continue to encourage the takeover by the private sector of foundation seed production, and marketing and will ensure that public sector operations in these activities are progressively minimized to avoid such public sector operations clashing with, and acting as disincentives to the private sector seed development. The public sector's continued operations in seed production and marketing will only be allowed in situations where the private sector is not sufficiently active. It is also the intention of Government that, even for the areas traditionally considered domains for the public sector, the private sector should be encouraged to progressively partner Government. Thus, the goal will be to encourage private sector investment in variety development and early generation seed production.

A further goal would be an increased support by MOFA's agricultural extension to the seed industry education and promotion effort. However, Government looks forward to the emergence of a strong pluralistic agricultural extension as the private sector develops capability and capacity to eventually take up its expected responsibilities in seed promotion and farmer education alongside the public sector effort.

Although seed quality assurance is an important public sector activity, in modern trends it is possible to achieve a licensed seed quality assurance regime by which the private sector is able to provide a mutually benefitting partnership with the public sector certification agencies, to reduce the cost of operations in this important component. Government will therefore assist the private sector to progressively develop internal seed quality assurance structures which will aid seed companies to participate in licensed seed quality assurance in due course.

The criteria for assessing the seed policy and the national seed programme should be the net benefit of the overall seed industry to farmers (both men and women), the contribution to overall national food security, the economic sustainability of public sector activities at minimum recurrent cost, the sustained profitability of the private sector-led business components and the absence of any adverse environmental impacts.

3.5 Responsibility and Legal Basis

The responsibility for the national seed policy shall rest with the Minister of Food and Agriculture under whose authority and oversight the policy has been formulated and eventually adopted by Government. The responsibility of the Minister through the Directorate of Crop Services will cover the overall dissemination of the policy to the general public, especially seed industry stakeholders; public education and awareness creation; implementation of specific interventions arising out of a national plan which will be prepared to provide practical effect of the provisions of the seed policy; monitoring and evaluation of compliance and impact; as well as a process of updating, as provided for in the policy.

This policy shall not have force of law. Nevertheless, in view of the overall beneficial impact which it should bring to all stakeholders, it shall be the expectation of Government that all stakeholders shall abide by the tenets enshrined in the policy. Although the policy does not itself have force of law, it forms the basis of several ensuing legislations, including the seed and plant protection laws, plant breeders right legislation, farmers rights legislation etc. Though the seed policy should ideally precede its ensuing legislations, Ghana has already passed seed and plant protection laws (Parts I and II of the Plants and Fertilizer Act, 2010 (ACT 803). However, the seed policy provisions are not in conflict with the provisions of the seed components of the Act. In due course, when the two laws are up for revisions, opportunity will be taken to fine tune the relationship between the ensuing laws and the seed policy. In the cases of other legislations not yet enacted, the provisions of the seed policy will form the initial basis for their drafting.

4.0 ADMINISTRATION OF THE SEED POLICY

4.1 National Seed Council

Under the Plants and Fertilizer Act, 2010 (ACT 803), a National Seed Council (NSC) has been established to act as the main oversight body of the national seed industry. With the coming into force of this policy, the NSC will be given additional responsibility to act as the adviser to MOFA and Government on all matters relating to the National Seed Policy and all ensuing legislations and protocols as well as seed industry planning and implementation. In line with the strategy of developing the private seed sector as a credible partner to Government in seed development and in order to ensure a level playing field, MOFA will always ensure adequate private sector representation on the NSC membership.

4.2 National Variety Release and Registration Committee

The long years and large investments made to develop a new variety can only yield corresponding dividends in crop production when the new variety is released to start the seed multiplication chain. Variety release is the stepwise process which formally allows a new variety into the seed industry and a variety release committee is the responsible oversight entity. The Plants and Fertilizer Act, 2010 (ACT 803) has established a National Variety Release and Registration Committee which is answerable to the NSC, to be responsible for recommending variety release, registration and withdrawal. MOFA will ensure that the membership of that sub-committee also reflect balanced participation of the public and private sectors in the variety release processes in order that private sector interests are seen to be taken account of.

4.3 National Seed Service /Seed Industry Development Office

The functions of the National Seed Service (NSS), which was established under the Seeds (Certification and Standards) Decree, 1972 (NRCD100), relating to secretariat duties for the NSC and NVRRC have been taken over by a new secretariat which services the three components of the Plants and Fertilizer Act, 2010 (ACT 803). But the important functions of aiding in the growth of the private seed sector which were mandated to the NSS still remain to be catered for. Government will respond to this need by assisting the private sector itself to establish a Seed Industry Development Office within a National Seed Association (an association of private seed companies). It is the expectation of Government that the Seed Industry Development Office, with the support of MOFA and other partners, will perform the following functions:

- It shall provide direct support, guidance, and assistance to any private-sector agency or persons interested or participating in any activities of the seed industry.
- It shall serve as a focal point for the provision of assistance from relevant donors and agencies to seed industry actors and act as key lobbyist of the private sector in relevant circles.
- It shall gather such seed industry intelligence and data as will be required by the seed industry, particularly the private sector.

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- It shall carry out training activities, particularly for the private sector, and provide all seed stakeholders with the required assistance in their planning and operations.

4.4 Directorate of Crop Services

The responsibility of the Minister, as established in chapter 3.5, relating to awareness creation, education and implementation of ensuing interventions etc. shall largely be carried out by the Directorate of Crop Services. The Directorate of Crop Services will act as the lead implementing agency for all field actions needed to be undertaken by MOFA, though other Directorates will be required to play specific roles in line with their mandates.

5.0 RESEARCH AND VARIETY DEVELOPMENT

5.1 Principles and Challenges

The growing human population requires that crop production be enhanced to provide food, feed and other plant products for domestic and industrial uses. Dwindling agricultural land coupled with biotic and abiotic stresses, including the challenges of climate change, demand that new crop varieties, capable of coping with the stresses, should be released regularly to ensure that food production keeps pace with population escalation.

The development of new improved varieties with the requisite quality, stress tolerance and yield that will meet the aspirations of end users is therefore essential. The development of a new variety marks the start of the process of seed multiplication, from Breeder Seed to Foundation Seed to Registered Seed and eventually to Certified Seed which is sold to farmers for growing the commodity crop. Government has borne the full cost of variety development, which has been considered to be basically of a service nature, with intermittent assistance from development partners. The cost to the national budget can be considerably reduced when the private sector develops capability and capacity in variety development and the modern trend is towards that objective.

In the process of variety development, the researcher/breeder creates genetic variability within the plant population and uses various means to select superior genotypes out of the population. By far the strategy so far used in Ghana is the adaptive research strategy by which researchers' source promising lines from collaborating international research centres to reduce cost and the period of variety creation. But in some instances, basic research is important in exploiting indigenous germplasm to address specific adaptability and utilization issues for which local germplasm may provide the best answers; hence the importance of local PGRFA and local gene banks in this context.

The selected materials are tested on-station for yield, quality attributes, tolerance to biotic and abiotic stresses and other checks, for a number of years. The potential varieties have to undergo a process of multi-locational/on-farm trials with the participation of farmers to establish their adaptability to the targeted agro-ecological zones and their suitability for the stipulated end uses. Superior materials that satisfy the various tests are released as varieties.

The major challenge of variety development is that it is an expensive process and may take a long time from start to the end of the variety development process depending on crop life cycle and the breeding strategy adopted. Further, special skills are required to undertake the exercise and the skills are not always available due to a high attrition rate of breeders. Additionally, breeding centres in Ghana have intermittently lacked resources to undertake effective breeding work as well as maintenance breeding on released varieties.

5.2 Policy Objective

The objective of the policy on research and variety development is to enhance the support to research in the areas of upgraded human, physical and financial resources to undertake both basic and adaptive research in collaboration with partners, both internal and external, in order to derive new varieties which are most suited to the Ghanaian agro-ecologies and end use and to ensure that processes of variety testing, release and registration as well as issues of ownership and other rights are adequately addressed as per international norms and standards.

5.3 Policy Actions

In order to meet the objectives of the seed policy regarding the research and variety development function, and to effectively address the identified challenges, the following policy actions will be pursued by Government:

- The Plant Genetic Resources Research Institute of CSIR (PGRRI) will be adequately resourced to collect, document, characterize, conserve and enhance germplasm of crops grown in Ghana and make such materials available to breeders on request.
- Research stations and breeders will be required to deposit samples of all released varieties at CSIR-PGRRI for documentation and conservation.
- Government will create an enabling environment (infrastructure and budgets) for effective breeding and release of varieties relevant to the country and to the West African Sub-Region. While the primary responsibility for variety development falls on government, research institutions should make themselves more visible to policy makers and the general public through the creation of awareness about their activities and their achievements to gain more public support and cooperation.
- Further, because of limitation in public resources, research should explore possibilities in self-help which may include judicious commercialization of some research activities, royalties and consultancies. Public sector breeding and foundation seed institutions will be supported (review of mandate) to have a commercial mindset (for example addressing needs and demands of potential customers such as pharmaceutical and beverage industry) in the context of aiming to address the demands of various sectors of the economy (i.e. 'client-orientated breeding') as opposed to breeding for table only.
- Government will support the human resource capacity development in crop improvement (for both research and technical staff).
- As per current and future legislation, appropriate public sector agencies will be required to address issues of ownership and rights of plant breeders as per international norms and standards.
- Sponsoring research stations and breeders will be required to produce adequate breeder seeds and ensure these seeds are made available to relevant mandated stakeholders as well as any others as per laid down procedures of the Plants and Fertilizer Act, 2010 (ACT 803).

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- Sponsoring research stations and breeders will also be required to undertake maintenance breeding to ensure that existing varieties in the system are sustained.
- Breeding stations will be required to meet the breeder seed needs of the private sector under suitable arrangements. Government, as well as the breeding communities, will create conditions within the research environment to facilitate the entry of the private sector into the breeding programme as development partners.
- Research institutes are encouraged to embark on participatory breeding programmes to promote adoption of new improved varieties.
- Government will encourage research institutions to develop capacity for variety improvement for some non-traditional crops such as okra, pepper, onion, tomato, papaya, cucumber, water melon and indigenous leafy vegetables.
- In recognition that vegetative planting materials lag behind true seeds in seed industry development, and in consideration of the critical food security roles played by some vegetatively propagated crops, all efforts will be made to reduce the existing gap. As a start, MOFA Agricultural Stations will be supported to establish strategic planting material centres which shall serve as a source of vegetative planting materials for fruits, vegetables, root and tuber crops and tree crops which have been developed by research or derived from acclaimed local germplasm.
- Government accepts that with increasing advances on some farms, hybrid technology potentially has a vital productivity-enhancing role to play in Ghana's agriculture. Government considers that if the challenges of technology and cost attendant to hybrid seed production and utilization are overcome, immense benefits will accrue to Ghana's seed industry and Ghana's agriculture. Therefore Government will encourage the seed industry to adopt the hybrid technology, initially for maize, to run alongside the more familiar open-pollinated variety techniques.
- The current hybrid initiatives will be supported and assisted to gradually increase to keep pace with advances in the seed industry and farming technology. As far as possible, the development of hybrid parents and the production of hybrid seed should be via in-country effort in order to ensure optimum adaptability, enhance the capacity of indigenous seed growers, ensure seed security and minimize cost. In some cases, companies may need to import stocks of hybrid seeds from external sources to develop the market and in principle such introductory marketing will not be hindered. However, the seeds will require to be tested in compliance with the Plants and Fertilizer Act, 2010 (ACT 803) to ensure the hybrid has gone through the mandatory process of testing and release as suitable for Ghana's agro-ecology(ies), meets the stipulated standards of varietal and physical qualities and the seeds cleared by the plant quarantine service.
- Government draws attention of the research community and extension to the fact that the potential of open-pollinated varieties is currently far from being realized by farmers, and therefore there should be greater emphasis laid on enhancing farming techniques to improve farm productivity. This will

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eventually also enhance the growth of the hybrid seed market as farmers strive to obtain further yields beyond the potential of open-pollinated varieties.

6.0 BIOTECHNOLOGY IN CROP IMPROVEMENT

6.1 Principles and Challenges

Biotechnology is defined as “any technological application that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for specific use”. (UN Convention on Biological Diversity). There are several forms of biotechnology applications, one of which is Genetic Engineering, or recombinant DNA technology. Genetic Engineering allows for gene exchange between unrelated organisms that are not sexually compatible. The process does not normally occur in nature, and the products are referred to as Genetically Modified Organisms (GMOs).

Currently, several varieties of crop plants have been genetically modified for the following attributes: resistance to pests (insects) and diseases (viruses), tolerance to stress (drought, salinity, cold, low soil nutrient levels, etc), herbicide tolerance, and high quality. It is also possible to introduce genes for the above-mentioned attributes into already existing varieties for value addition.

Tissue Culture is another type of biotechnology application and it does not involve the introduction of foreign hereditary materials into crop plants. Tissue culture is used extensively for rapid multiplication of clean planting materials, germplasm conservation and storage, transfer of germplasm across borders, and for embryo rescue.

Conventional methods of variety development take a long time to achieve desired results, and most often, end results are not specific. In view of rapid population growth, declining water and land resources, coupled with the increase in biotic and abiotic stresses due to climate change, conventional methods of breeding may soon not be able to sustain the world’s population. GMO technology is one of the possible tools for the enhancement of variety development for addressing the food security gap that threatens mankind.

Strict regulations on the production and release of GM varieties, seed production and distribution as well as marketing of GMOs, once in place, ensure that materials released are safe, and the consumer is protected should there be any bio-danger exposed in future.

In Ghana, a Biosafety Act, 2011 (Act 831) which allows research into GM crops has been passed, and currently, there are three impending confined field trials on GM rice and sweet potato by CRI, and GM cowpea by SARI. This opens the door for the country to cultivate GM crops on a commercial scale. Secondly, Ghana is a signatory to the Cartagena Protocol which ensures that all biosafety regulations with particular reference to GMOs are enforced.

As hinted, there are currently some controversies over the use of GMOs. Especially, there is fear of possible human health risks as well as environmental, social and ethical concerns about the fact that some of the procedures used are not natural. Additionally, the cost of development of GMOs and the production of GM seeds are high, hence there is fear that the seed trade may be controlled by only a few multinational companies

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who can afford to produce such seeds. Further, special skills and facilities are required for GM variety development and seed production and currently such facilities are lacking in the country.

6.2 Policy Objective

To progressively create the necessary platform for safe and effective use of biotechnology applications and GM crops in the national seed industry as a means of rapidly attaining the national food security goals.

6.3 Policy Action

In order to achieve the objective of gradually and judiciously adopting some aspects of biotechnology and GMO technology and mindful of the need to observe all the possible bio-safety protocols and guidelines, Government will carry out the following policy actions:

- Government will task the appropriate national institutions to identify specific biotechnology applications and materials that are relevant to the economy and well-being of Ghanaians, for adoption in national research and seed programme activities.
- Government will adopt the precautionary principle under the Cartagena Protocol (CP) which enjoins parties to conduct in-country testing under confined field trials to assess GM products based on scientific and socio-economic considerations. In that respect, partners interested in introducing GM materials into the country or developing them locally must follow strictly the procedures established in the national bio-safety legislation.
- Government will support the training of all categories of staff (research and technical) in biotechnology applications as well as observance of laid down bio-safety measures.
- Government, through the appropriate channels, will provide infrastructural and logistic support required to undertake both basic and applied research in biotechnology, and for seed multiplication and distribution of GM materials.
- Government will aim at setting up laboratories in the appropriately mandated agency, for the testing of food products to ensure compliance with the regulations on labelling of GM foods and other products.

7.0 SEED PRODUCTION

7.1 Principles and Challenges

The principle of seed production is that new varieties developed by research are only useful when the limited quantities of nucleus seed have been progressively increased to meet the requirements of farmers in all the areas that the new varieties have been proven to be adaptable and widely distributed to be grown. Seed multiplication is the more visible part of the seed production effort. It is the step-wise controlled increase of initial seed of a higher class in order to achieve targeted volumes of a lower class without unduly compromising on the inherent quality values passed by quality assurance and originally selected by the breeder.

The steps involved in the multiplication chain are Breeder Seed (produced by the breeder), Foundation Seed (produced by GLDB) which is the result of the multiplication of Breeder Seed, Registered Seed (produced by seed growers) which is obtained by multiplying Foundation Seed and Certified Seed which is realized from multiplying Registered Seed. The mode of production of the certified class may involve either a company's own production or via a contract with out-growers usually called seed growers. Specific standards of variety and physical qualities have to be observed for all the classes. A major challenge is the need to rapidly increase the quantity of breeder seed to sufficient quantities of foundation seeds to meet the needs of the seed industry following the release of a new variety. Thus in Ghana the responsibility for early generation seed multiplication has been entrusted to the Grains and Legumes Development Board. In spite of best efforts by the Board, there are intermittent shortages of foundation seed of some species and varieties due mainly to lack of coordination by stakeholders.

Certified seeds are now produced by private seed growers. So far, farming techniques used by a large number of seed growers in certified seed production are just marginally better than those practised on ordinary farms and low seed yields render seed production only marginally profitable and foundation seed use inefficient.

Although insufficient quantities of certified seeds are currently being produced, inadequate market intelligence and demand forecast result in substantial certified seed carry-overs in some locations while in other locations there may be shortages. Further, the low seed demand which has hindered the growth of the seed industry is traced to inadequate farm income which discourages farmers from procuring quality seeds for planting their commodity crop.

Whereas local seed production has been largely based on open pollinated varieties which require production technologies just slightly more elevated than required for grain, the industry has of late become interested to adopt the hybrid technology. The hybrid technology is more complicated but if properly mastered and deployed can introduce a large measure of demand stability into the seed market and improve the marketing prospects of formal sector seeds. This is because farmers using hybrids have to buy new seed every growing season.

The challenge will be the extent to which research will be able to develop appropriate parental lines and train seed growers on how to carry out the crosses on seed farms. Another challenge will relate to achieving and sustaining high adoption rates considering that hybrids will call for much higher prices. Eventually, it is the extent to which hybrid users will elevate their farming technologies and practices to be able to realize required levels of the yield potential of the hybrid which will determine continued patronage, and thus the future of the hybrid technology in Ghana.

7.2 Policy Objective

The main policy objective is to ensure that public services devoted to the production of the early classes of seed are optimized to form a strong foundation for the seed industry and to strongly support the private sector to take up responsibility for the production of the certified seed class, initially assisting them with the outputs from the public sector mandated agencies and cushioning them to progressively develop their own breeder and foundation seeds as soon as possible.

7.3 Policy Action

In line with the objective of establishing a strong basis for the seed production effort by the private sector, the Government will adopt the following steps:

- Government will urge a good system of consultation and collaboration among all stakeholders, on an annual basis, to ascertain the demand levels of all species and varieties actively in demand in the seed market with a view to establishing the quantities of the various classes for the production planning of the classes of seed by mandated public sector agencies and the private sector.
- Government will continue to support the public research institutes and the GLDB in their efforts to produce breeder seed and foundation seed respectively to meet the expressed demand of all seed producers including the private seed companies. Conditions under which publicly produced breeder seed can be accessed by private producers will be determined by the Government. Where the private sector has been successful in developing and releasing their own varieties, they can produce their own classes of seed from breeder to certified seed, at their option.
- Production of foundation seed by public seed producing entities will be supported by government and access to public breeder seed by such public entities shall not be impeded.

8.0 THE INFORMAL SEED SECTOR

8.1 Principles and Challenges

The informal sector, as represented by farmer-saved seeds, on-farm seed multiplication, seed exchanges etc., is the predominant source of seeds particularly covering traditional crops and others not found commercially attractive for the formal sector. These farmer-based traditional seed initiatives which are unregulated and unconnected with modern crop improvement procedures, have their origin in the age old traditional seed saving methods by which African farmers have in the past met their seed needs. The practice is by and large still the dominant seed source in Africa today. The informal seed sector makes up over 80% of the entire seed sector in Ghana.

The informal sector therefore presents a huge entry point and opportunity for quality seed production and supply to meet the seed needs of farmers. The following issues should be considered in developing necessary approaches:

Considering the immense importance of the informal sector to farmers, it is unfortunate that it has not been accorded the recognition it deserves and, following from that, it has not received the necessary attention and support that would enable it to enhance its role in agriculture. The first step in addressing the needs of the informal sector is to accord it recognition and appreciation for its role of meeting an overwhelming farmers' need.

However, it should also be recognized that a significant proportion of the informal sector has advanced to the level that it can benefit from the modern practices of variety change, seed multiplication and quality assurance practices. Therefore, while preserving its important features, it is also possible that a significant portion of the informal sector can progressively gain incorporation into the formal sector and contribute to the widening of the formal sector.

Limitation in extension support, limited access to technical know-how in improved methods of seed production and absence of quality assurance processes need to be addressed.

8.2 Policy Objective

The policy objective is to support the informal seed sector to integrate with the formal sector and systematically upgrade some of its practices with a view to portions of it eventually evolving into the formal seed sector and enhancing the growth of the formal sector.

8.3 Policy Action

In line with the above policy objective, Government embarks on policy actions as follows:

- Government recognises the essential role of the informal seed sector in meeting the seed needs of food security crops, especially crops that are not catered for by the formal seed sector; and which serves as the main source of seed for a large majority of small farmers, particularly those who cannot afford to buy seeds in the formal sector.
- MOFA and partners will work towards incorporating modern processes of variety selection, seed production and quality assurance to enable relevant informal sector participants to systematically evolve into formal sector entities, thereby contributing to the further growth of the formal sector seed industry and gaining the benefits of modern variety development, seed technology and entrepreneurship.
- Government activities, controls and support will be tailored to the needs of the informal sector to help it operate efficiently and best serve the needs of farmers while ensuring the maximum seed quality which is economically feasible.
- In order to strengthen the contribution of the informal sector, MOFA and its development partners will mobilize resources to support the informal sector in the following areas:
 - supporting extension service delivery
 - farmer training schemes
 - support to participatory strategies for on-farm management of plant genetic resources maintained by farmers through participatory plant breeding, protection of traditional knowledge, community seed banking, establishment of community seed fund and other community seed initiatives
 - support with pure starter seed stocks (local cultivars or adapted research releases)
 - support to germplasm conservation
 - support with seed quality assurance facilities
 - sourcing of emergency seed stocks
 - farmers' rights legislation (at the appropriate time)
 - farmers' participation in decision making at national level (e.g. National Seed Council, National Variety Release and Registration Committee)
- MOFA and its development partners will support the promotion of formal-informal seed sector interactions to capture the multiple opportunities offered by their complementarities to develop a well integrated seed sector. The formal seed sector can build on the informal sector farmers' capacities and knowledge of local conditions, seed selection and traditional mechanisms of seed exchange to address more effectively seed demands of small-scale farmers. The informal system on the other hand can be significantly strengthened through the introduction into it of improved genetic materials and the adaptation of formal quality assurance into its practices.

9.0 SEED CONDITIONING AND STORAGE

9.1 Principles and Challenges

Raw seeds, fresh from harvest, potentially have very short life as viable, healthy and manageable products. To prolong their valued qualities, they require to be safely and rapidly transformed from their perishable state into dry, clean, treated and graded material to survive the long period of storage until they are used and to conform to the specifications of planters where required. Modern seed conditioning equipment and appropriate storage systems are necessary to safely prepare and hold the large quantities of certified seed that are produced as end products of the seed chain. Seed conditioning and storage constitute the most technological components of the seed sector and considerable costs are involved in the construction of required structures and the procurement and installation of such equipment as dryers, cleaners, graders, treaters, baggers, air-conditioners etc.

In the early days of the national seed programme, Government made heavy investments in seed conditioning plants in Central, Volta, Ashanti, Northern and Upper East Regions. Although these are still being used by public sector agencies such as GLDB and GSID, they do not seem to fit into the current individualized small scale operations of seed growers. Although in some cases, seed growers are being serviced by these centres on rental basis, there is a challenge relating to the best way to fully deploy these seed plants.

It should be noted that adequate seed conditioning and storage facilities are also needed to meet the needs of breeders and the public sector foundation seed agency. Beyond this, the private sector will need incentives and soft credits to design and procure seed plants suited to their own commercial needs. An additional challenge relates to assistance required by the informal sector to improve on traditional methods of seed conditioning and storage, incorporating appropriate low cost technological improvements.

9.2 Policy Objective

The main objective of Government regarding the technological core of the seed industry is first to ensure that past investments in seed conditioning and storage are adequately protected, maintained and efficiently deployed to meet the needs of existing public sector agencies involved in breeder and foundation seed production. Secondly, the objective would be to utilize the spare capacity of existing seed plants to service the needs of the emerging private sector, work towards privatizing any redundant seed plants and encourage the private sector to invest in this area to meet their own specific needs.

9.3 Policy Action

Recognizing the need to provide seed conditioning and storage support to existing public sector entities and mindful of the urgent need to ensure development of similar assets by the private sector to meet the large quantities of certified seeds that are envisaged, the Government will adopt the following steps:

- Government will make adequate annual budgetary allocations to ensure the proper upkeep and operations of all current public seed processing and storage facilities at both research and seed production levels.
- Government will also seriously consider official requests for additional public sector investments in seed conditioning and storage, particularly for breeding stations and foundation seed centres, provided ample justification illustrating the clearly positive contribution to the seed sector of such additional facilities is advanced.
- While it is the intention of Government that public sector seed plants should allocate excess capacity on rental basis to the private sector, a higher goal to which the Government is committed is to encourage the private sector to eventually develop their own seed conditioning plants which are most suited to their own operations. Necessary incentives will be developed to cushion the private sector as it takes on this challenge.
- MOFA will undertake studies leading eventually to assisting the informal sector seed operators to upgrade their own seed conditioning and storage practices and to acquire, in some cases, simple mechanized equipment to enhance their own traditional methodologies.

10.0 SEED REGULATORY FRAMEWORK

10.1 Seed Quality Assurance

10.1.1 Principles and Challenges

A system of quality monitoring, standards adherence and enforcement, referred to as quality assurance, is a basic feature of an effective seed industry. Quality assurance permeates the entire spectrum of the seed programme from field production, processing, packaging, storage to marketing. Seed quality assurance gives credibility to the seed as a specialized commodity since it empowers farmers to have confidence in the product. Inspection and evaluation processes in both field and stores, representative seed sampling procedures, laboratory seed testing, etc., as per laid down standards, are some of the steps in seed quality assurance. The ultimate aim of the steps is to ensure that the industry generates only quality seeds that have high varietal and physical purity, high germination ability and vigour, meet the minimum requirement of seed moisture content and have a sound health.

To promote the growth of various stages of development of the seed sector, from the informal to the formal seed sector, various schemes of seed certification are generally used, as listed below:

- Minimum standards, under which mandatory minimum standards are set for the different classes of specific crops (mainly to protect the interest of traditional farmers).
- Truth in labelling (used in more advanced set-ups, where the producer is only required to truthfully label the contents of the seed package)
- Quality Declared Seed system (developed by FAO for use by seed programmes which lack adequate resources for comprehensive certification systems and also for use under some emergency situations)
- own internal quality control under general supervision
- Licensed or delegated seed quality control (usually empowers private seed companies to conduct their own quality control under general supervision by the government regulatory body)

Ghana operates the Minimum Standards Certification and the crops covered are: Cereals such as maize, rice, sorghum, millet; legumes such as cowpea, groundnuts, bambara groundnuts, and soybean; vegetables such as garden egg, onion, tomato, pepper and okra; roots & tubers such as cassava, yam and sweet potato and cocoyam; and fruit & tree crops such as mango, citrus and pineapples. Ghana's seed certification has provisions for situations where the Quality Declared system can be applied.

Seed quality assurance in Ghana is under the mandate of the Ghana Seed Inspection Division (GSID) established within the Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture. GSID provides technical support for the development of internal and external quality assurance systems. The GSID operates a National Seed Testing Laboratory at Pokuase, near Accra, and has regional satellite laboratories sited in six locations in the country.

From the foundation seed stage up to the sale of certified seeds, seed industry quality standards are enforced through regulations by the GSID. The responsibilities of GSID include;

- Register seed growers and dealers for the production and marketing of seeds.
- Inspect seed fields, processing and storage facilities.
- Sample, test and evaluate seeds produced by seed growers
- Sample and test imported seeds
- Certify seed produced by growers.
- Conduct pre and post control verifications.
- Monitor sales outlets to ensure suitability of storage premises and seed viability and
- Enforce seed laws and regulations.

The challenge facing quality assurance and seed legislation in general is that the institution required to lead in the quality assurance function and implement the recently introduced seed legislation is yet to attain adequate level of resources and structures to be able to conduct an effective nation-wide and industry-wide quality assurance programme. Examples of the areas of inadequacy are:

- There is inadequate mobility, ill-equipped regional satellite laboratories, limited number of trained personnel (inspectors, samplers, analysts) to undertake various quality assurance activities
- Inadequate knowledge, by some law enforcement agencies like the police, customs officials, of the current Plants and Fertilizer Act, 2010 (ACT 803) and its Regulations.
- Inability to prosecute violators of the Act including those involved in physical and verbal threats on quality assurance officers.
- Inadequate awareness and sensitization of stakeholders on the Plants and Fertilizer Act, 2010 (ACT 803) and its Regulations.
- Absence of quality assurance systems in breeder seed production.

10.1.2 Policy Objective

The objective of the policy is to enhance the maintenance of high quality seeds of crop varieties at the points of production, handling and also moving in commerce.

10.1.3 Policy Action

Government recognizes that the use of poor quality seed results in low yields and possibly the proliferation of diseases and pests. Therefore in line with the objective of maintaining high seed quality standards, Government will adopt the following steps:

- Government will strengthen GSID to implement the seed legislation activities. Particularly, GSID will receive full support by way of provision of training, facilities and transport and adequate number of

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seed testing stations with the goal of eventually upgrading all existing seed testing stations to ISTA standards.

- Government will encourage the seed industry to progressively work towards the development of licensed certification arrangements whereby the private sector is able to carry out self-certification activities under supervision by the central certification agency, to reduce cost.
- Law enforcement agencies like the police and customs officials will be trained and sensitized on the Plants and Fertilizer Act, 2010 (ACT 803) and accompanying Regulations.
- Quality assurance officers will, where necessary, be given police protection during inspection activities especially at sales outlets and storage depots.
- MOFA will arrange activities and functions devoted to creation of awareness and sensitization of stakeholders on the Plants and Fertilizer Act, 2010 (ACT 803) and accompanying Regulations.
- In order to enhance Ghana's participation in regional seed sector harmonization as well as derive benefits from internationally recognized seed associations and to facilitate Ghana's participation in international seed trade, efforts will be made to ensure that the national seed testing laboratories are accredited to the International Seed Testing Association (ISTA)

10.2 Variety Release

10.2.1 Principles and Challenges

The purpose of Varietal Release is to regulate the entry into the seed market of newly developed varieties, ensuring that such varieties, developed by research, are superior in their performance and characteristics as compared with existing varieties on the market. Variety Release can also prevent the use of varieties that might have a negative impact on agriculture such as those susceptible to major diseases that could create the risk of significant production loss.

Several procedures are involved in Variety Release. These include application by the breeder, inspection of the potential new variety in the field at the vegetative and reproductive stages in a testing context, evaluation process etc. The scientist(s)/institution proposing the new variety is expected to give a detailed presentation on the attributes of the new variety during the release hearing. The whole process of Variety Release is under the oversight of the National Variety Release and Registration Committee which is provided for under the Plant and Fertilizer Act 2010 (Act 803).

In order to assure that introduced varieties are adapted to the agro ecological conditions of the new growing locations, it is generally accepted that a period of testing, variety release and registration is required when externally developed varieties are to be introduced. Depending on the source or origin of the variety, the period of testing can be brief or follow the regular national time frame. Thus materials submitted under the ECOWAS harmonized protocol or emanating from a collaborating research station may be relatively brief.

The challenge facing variety release relates to limitation in the resources required for the testing procedures which are therefore abridged. Further, there is lack of collaboration between institutions leading to duplication of efforts. On the technical side, uniqueness of proposed varieties is not ascertainable with the current methods. As well, data presented by scientists at release meetings cannot be independently verified.

10.2.2 Policy Objective

The policy objective is to ensure that materials emanating from research and eventually proposed to be introduced into the seed market as new varieties are sufficiently screened as per laid down procedures and to ensure that adequate capacity and resources have been provided to mandated institutions to conduct the variety release process efficiently and effectively.

10.2.3 Policy Action

It is the intention of Government that the long years and heavy investments made in variety development should be satisfactorily concluded by having a good and effective Variety Release system. Therefore the Government adopts the following steps:

- Government will provide adequate resources to public sector scientists and institutions undertaking variety development to enable adequate testing of new cultivars.
- Scientists and institutions will be encouraged and resourced to have regular interactions to avoid duplication of efforts
- A fully funded public entity with responsibility for Variety Registration will be established. It will, among others, test for distinctiveness, uniformity and stability (DUS) and also verify the value for cultivation and use of all new proposed varieties. All released varieties will have molecular identification to ensure that they are unique. The new public entity may be realized by expanding the resources and mandate of the GSID but the final decision on the type of entity will be based on thorough studies to be conducted under the auspices of MOFA and with collaboration from research and other relevant partners.
- Varieties developed externally which are to be introduced for commercialization in Ghana should be subjected to laid-down validation and registration processes by the National Variety Release and Registration Committee.
- Scientists and farmers will be encouraged and supported to test and release popular local landraces as official varieties.

10.3 Intellectual Property Rights (IPRs) (Plant Breeders' Rights and Farmers' Rights)

10.3.1 Principles and Challenges

Intellectual Property Rights (IPRs) for plant varieties provide a means for plant breeders (either from the public or private sector) to obtain a return on investment made in the development of new varieties. Thus IPRs reward the scientist for developing a new variety and a temporary exclusive right to the breeder in the commercialization of that variety.

In providing incentives for plant breeders (public and private sector) on one hand and farmers on the other hand, there is a need to balance the rights of the two groups. This can be achieved through differentiated systems of variety protection, which reflect the actual situation and needs in different crops. Commercial varieties require robust protection measures while traditional varieties and landraces need more farmers' rights provisions.

Farmers' rights are "rights arising from the past, present and future contributions of farmers in conserving, improving and making available plant genetic resources, particularly those in the centres of origin/diversity". These rights are laid out in the International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA) as follows: "Farmers have the right to save, exchange, sell their seed with neighbours and at local markets, to participate in national decision making process, to share the benefits from commercial use of their traditional varieties and to protect their traditional knowledge".

The establishment of IPRs and Farmers' Rights has become a contemporary issue which has engendered intense debate in the seed industry. The seed policy is therefore required to reflect the country's position on IPRs and Farmers Rights in order to avoid possible constraints for the development of the seed industry.

The main challenges facing the IPR and Farmers' Rights relate to:

- high transaction cost in developing IPRs and Farmers Rights
- lack of up to date register of available adequately characterized varieties and the breeders who produced them
- the varieties ownership dichotomy: Research Institutions (employer) versus the individual/group breeders (employed)
- benefit sharing between institutions and breeders
- Inadequate stakeholder (breeders, farmers, implementing agencies) knowledge of and Farmers' Rights
- Lack of baseline data on available genetic resources both at the breeder and farmer levels as well as available indigenous/local knowledge in the seed sector
- Lack of a tracking system for assessing the contributions of farmers in conserving improving and making available local plant genetic resources

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- Difficulty in establishing the authentic ownership of a known genetic resource at the farmer level to facilitate channelling of benefits.
- The constraint of the dispersed nature of farmers and lack of identifiable credible individuals or farmer groups involved in genetic resource development at the local level.
- The seed exchange mechanisms associated with the informal sector constrain the establishment of the original sources of genetic materials.

10.3.2 Policy Objective

The policy objective is to support the development and implementation of a well structured and targeted IPR legislation (PBR and Farmers' Rights) which will encourage breeders and farmers in their work to rapidly develop and release improved varieties, enhance seed accessibility and protect plant genetic products.

10.3.3 Policy Action

- Government recognizes the significant role of plant breeders (both public and private sector) and farmers in developing new varieties to satisfy the seed needs of farmers and the need to reward them with incentives for continued investment in varietal development.
- Government is of the opinion that in view of the difficulties in establishing individual or group ownership of protected or patented products or both, which have emanated from specific farmer action, Farmers' Rights in Ghana will be addressed by strengthening and upgrading the informal seed sector; promoting participatory on-farm management strategies relating to plant genetic resources; increased farmer participation in decision-making bodies at national level; sharing benefits from the commercial use of traditional varieties; and developing appropriate legislation.
- Aware that the development of IPRs (Breeders' Rights and Farmers' Rights) provides an opportunity to protect Ghana's genetic resources and to benefit from any economic incentives that will accrue from ensuing patented products which will arise from forward linkages, government may designate a body to work out the details of the above farmer incentives in relation to Farmers' Rights.
- MoFA and partners will mobilize resources to support the following:
 - development of baseline data on available genetic resources and a tracking system for the development of new varieties
 - training programmes on IPRs (Plant Breeders' Rights and Farmers' Rights) for stakeholders in the seed sector
 - development of implementation procedures

11.0 AGRICULTURAL EXTENSION

11.1 Principles and challenges

Agricultural Extension is a very important ally of the seed industry. By its unique role of connecting research and variety developers, seed producers and marketers to farmers and agro-industries, extension assists in variety development, seed marketing, promotion and adoption and utilization of quality seed. It is also the avenue through which other beneficial technologies reach farmers.

In Ghana, the Directorate of Agricultural Extension Services of the Ministry of Food and Agriculture is the leader in agricultural extension. But the private sector, which at the moment is represented mostly by NGOs, FBOs, CBOs, is increasingly becoming active in providing extension to their own membership and to other farmers. It can therefore be stated that there exists a pluralistic extension delivery and the challenge is that it needs to be coordinated and regulated to ensure that this mix of extension providers achieves jointly developed objectives.

The critical challenge facing Extension relates to awareness creation, education and promotion among farmers which will ensure a rapid increase in the seed demand base without which the basis for rapid seed industry growth will remain thin.

Other challenges which face extension and limit its effectiveness in providing the required support to the development, promotion and adoption of quality seed include the following:

- Inadequate personnel
- Inadequate knowledge and skills in seed technology
- Insufficient resources and logistics for public sector extension providers
- Inadequate of seed promotion procedures
- Weak coordination among organisations and stakeholders in extension service delivery.
- Inefficient seed marketing and distribution structures
- Inadequate field demonstrations on released varieties

11.2 Policy Objective

To create an enabling environment and develop adequate capacities for a pluralistic extension system to play its critical roles in seed production, delivery and use.

11.3 Policy Action

In line with the objective of adequately resourcing and empowering extension to play its proper role as an indispensable ally of the seed industry, Government will adopt the following steps:

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- MOFA will promote/facilitate the use of mass extension methods e.g. farmer field school, nucleus farmer out-growers, extension field days, demonstration of newly released varieties, mass communication through radio and television, communication vans and dissemination through farmer groups, with the aim of enhancing seed demand levels needed for profitable seed industry investment.
- The extension services of MOFA will be expected to step up its farmer training aimed at improving agronomic practices. This is expected to contribute to the general standard of farming and lead to enhanced quality seed demand levels.
- In line with the above, production of hand books, pamphlets, factsheets and leaflets on seed production and utilisation will be pursued.
- Government has taken note of the need to build capacity of all actors in extension delivery e.g. MOFA extension staff, NGO's FBO's and CBO's to facilitate delivery of seed extension services. Further, Government will contribute towards the enhancement of the capacities of input dealers and seed growers, in collaboration with the private sector, in the marketing of seeds to enhance off-take by farmers.
- MOFA and relevant Directorates under it will create a platform to enable public and private sector extension providers to have joint programme planning and regular interaction and, further, create a platform for all actors along the seed value chain for coordination of efforts and relationship building.

12.0 SEED MARKETING

12.1 Principles and Challenges

Seed marketing forms the very core of a successful seed industry. Marketing links up producers with the users of the seed through a continuum of intermediaries. It provides a two-way channel – a forward linkage from breeders and seed producers to the farmer, serving to relay the response of research and extension to farmer needs; and a backward linkage - serving to send the feedback from the users of the variety to the breeder, seed producers and extension on the usefulness or otherwise of the product.

In a privatized seed industry, marketing defines and drives all the steps. The ‘seed distribution’ bias, characteristic of public seed programmes, whereby the interest is to ensure the rapid and wide coverage of improved varieties per se, has to give way, in the privatized industry, to the situation where seed demand establishes the justification and limits of all seed industry interventions.

Seed demand establishes the actual levels of seed to be requisitioned by farmers and depends on adoption rate and seed replacement rate (SRR). In view of seed saving practices, it is important to annually determine the seed adoption rate and SRR and side by side with expert opinion, sales records and trends in previous years, to determine the demand levels which will then form the basis of all corporate and service dimensions, including production levels, inputs required, training activities, credit etc. Any expansion in the size of the seed industry should start first with enhancing the demand levels otherwise ensuing quantitative increases may only lead to frustrating loss-making seed carryovers.

On the other hand farmers’ satisfaction and consequent sustainability of a vibrant seed market can be based on a number of attributes including but not limited to:

- the price of the seed,
- timeliness of availability,
- appropriateness of the size and packaging,
- varietal and physical qualities,
- need for and availability of complementary services, and
- yield potential of the variety.

The long years of subsidized seed sales were to end with the privatization of the seed marketing effort which began in 1990. Although this has not been fully achieved, that objective still remains an important goal. Subsidies are generally not sustainable and act as disincentives to the full entry of the private sector into the mainstream seed industry. The recently introduced seed subsidy is not a reversal of the goal of free market pricing of seeds. It is rather aimed at giving a boost to seed demand and encouraging a more widespread utilization of quality seed among small scale and poor farmers. In the long run, when beneficiary farmers have

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tasted the benefits of use of quality seed, their resultant enhanced patronage will contribute to elevating quality seed demand even when more realistic price levels are charged.

A direct relationship exists between seed demand and the price of the farmer's produce. Good grain prices lead to increased patronage of quality seeds in the ensuing year. On the other hand when prices of harvested produce are unduly low, as happens following a good grain harvest (partly made possible by the use of quality seeds), farmers become disillusioned and therefore are likely to purchase less quality seeds in subsequent seasons. Therefore addressing commodity pricing is an important action to boost seed demand.

Another contributory factor to low demand relates to loss of confidence by farmers due to the adulteration of seeds in the market by unscrupulous players and this is a serious threat to formal sector marketing which should be checked by a combination of education, awareness creation, good packaging and product preparation as well as quality assurance processes.

Challenges in seed marketing in Ghana include the following:

- Absence of a mechanism for assessing periodic seed demand and supply, by species and variety, in the country.
- The rate of variety introduction into the market is assessed to be good and the problem rather is how to properly market the new varieties and create awareness of them in their areas of best adaptation.
- The special problem of ensuring seed availability in remote regions and how to address this.
- Absence of a coherent seed dealer network to ensure efficient and widespread marketing.
- Absence of a well-defined strategy for access to credit (and repayment methods) by individuals and groups in seed production and marketing.
- Lack of requisite education on identification of seed from grain as no established system for identification, (eg colour coating/dyeing) exists.
- No established seed promotion procedures or processes at suitable times of the year to bring seed information to seed industry participants.
- The unavailability of good (unadulterated) certified seeds at locations convenient to farmers.
- Inadequate storage facilities specifically built or modified for seed storage
- Lack of coordination among institutions in the seed sector to ensure appropriate delivery of seed to farmers
- Inadequate enforcement of regulations and lack of accountability among the actors in the sector
- Inadequate personnel and logistical support to promote effective monitoring of seed inspection and certification.
- Inadequate information flow and database on the location of supplies and deficit areas leading to unused stocks in one area and shortage (leading to the use of uncertified seeds) in other locations within the country.
- Lack of stability in seed and grain prices

12.2 Policy objective

The main policy objective in seed marketing in Ghana is to ensure, in a manner consistent with prudent free market economics and other national goals, the regular availability of quality seed for seed users in the form, time and place they need it to guarantee crop production for food security and national development.

12.3 Policy Action

In line with the objective to vigorously support the private seed sector to conduct the seed marketing functions in Ghana and for the private sector to do so in a manner that meets the goals of Government as expressed in the overall agriculture policy, Government adopts the following policy actions:

- Recognising that seed-related education and promotion in Ghana is low, Government will make judicious provisions in MOFA's annual budget to support enhanced seed extension, media participation in seed promotion, demonstration plots, and publications.
- In order to improve coordination among seed industry actors, Government will encourage the proper development of support linkages between seed value chain actors and the formation of relevant associations among seed producers, farmers, dealers and agro-industry to enhance seed production and marketing.
- Government will satisfactorily maintain and enhance, where necessary, public seed infrastructure that services the marketing component of the seed industry by making adequate annual budgetary allocations for seed processing, seed testing laboratories, seed storages and packaging systems, encouraging the private sector to also enhance investments to support their own structures required for seed marketing.
- In order to improve on the current state of seed accessibility, Government will encourage the private sector to develop distribution outlets for marketing of seeds at the local level. The collective deployment of a large number of such seed outlets by the private sector will mark the start of a truly national seed outlet network which forms the basis of proper and effective seed marketing.
- Government's thinking on the issue of seed prices is in line with the axiom: "Quality Seed Does Not Cost – It pays" and will generally opt for seed prices to be established by free market forces. However in view of the critical role of seed as a vital and strategic input for the millions of farm families, many of who are poor, Government will closely watch the seed price level with a view to eliminating any incidences of abuse and other unfair practices.
- Since the price of certified seed can often discourage some farmers from using quality seed, Government will, as demanded by circumstances, consider the introduction of 'smart subsidies' for specific seed kinds, in specific locations and accompanied by appropriate exit strategies, in consultation with other stakeholders in the seed sector.

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- Government and the private sector will collaboratively develop a monitoring and evaluation process to regularly review and improve on the performance of the seed sector.
- Government is aware that seed demand is critical in maintaining a buoyant seed industry and farmers' commodity prices and prices of agro-inputs are important factors in determining quality seed demand levels. Therefore, Government will support the stabilization of prices of agricultural inputs through prudent economic management and, further, aim at ensuring that fair prices are awarded for farmers' produce through encouragement of commodity stabilization processes including grain warehousing, buffer stock purchases, guaranteed prices operations etc. which contain surplus-mopping operations to ensure fair and stable grain prices which in turn ensure stable seed patronage.

13.0 SEED IMPORT AND EXPORT

13.1 Seed Export

13.1.1 Principles and Challenges

Seed export becomes an important feature of the national seed industry when it serves as avenue for the sale of surpluses. On the other hand even where surpluses have not been achieved, identified export niches which do not unduly pose problems for the local industry can be exploited by seed companies to gain extra foreign exchange revenue for the country. Due to the high levels of regulations in the international seed market, export successes invariably imply a good level of creditability in the local seed industry. Though formal seed exports have as yet not become a regular and recorded feature of the national seed industry, there is a good potential for seed exports to countries in the sub region which needs to be tapped. The recently enacted seed law of Ghana positions the country well to develop an export capability since a regulatory framework enhances the export activity. The framework will be strengthened with the soon to be acquired accreditation of Ghana's central seed laboratory by the International Seed Testing Association (ISTA) which will endow the national seed industry with the necessary quality assurance credibility required on the export market.

Due to the infant level of seed industry development, with certified seed stocks barely meeting even the local seed demand levels, the prospects for an immediate seed export drive are rather dim. Nevertheless, it is prudent to prepare the grounds for future exports in order to be ready when the time is ripe.

Some serious challenges facing the export potential are as follows:

- Unavailability of data on demand/supply
- Lack of collaboration between stakeholders in the value chain
- Frustrations in export documentation
- Lack of information on external markets
- Possibility that exports will create seed shortages in the country
- Difficulty to meet the volumes and quality that may be required due to local constraints

13.1.2 Policy Objective

The main objective is to consult with all pertinent stakeholders with a view to encouraging the national seed industry to aim at producing excess seeds beyond immediate national requirement and to exploit niche markets for the export of seeds to external markets to increase foreign exchange earnings and to enhance incomes and livelihoods of producers/stakeholders along the seed value chain.

13.1.3 Policy Action

In view of the objective of developing an export component of the national seed industry, Government, its agencies and partners will carry out the following steps:

- MOFA, in collaboration with all relevant partners, will conduct studies aimed at exposing the full dimensions of the export potential of Ghana's seed industry with recommendations on how this is to be fully and practically exploited.
- In line with the recommendations of the seed export study, Government will make judicious allocations of resources, if called for, and call on other stakeholders to join it in systematically growing the export component of the seed industry to serve as one further source of foreign exchange for the nation as well as assist the private sector to earn extra income which may help in advancing the national seed industry in its entirety.
- Government will call on relevant responsible agencies to conduct regular education on seed quality to meet international standards. Government will also provide adequate resources to official regulatory bodies to conduct regular checks on seeds to meet international standards and to streamline certification processes to avoid undue bureaucracy.
- At the appropriate time Government will encourage investment in storage and other handling facilities which will be required to support the export drive.
- Even ahead of achievement of local surpluses in seed, Government will favourably consider applications from companies who specifically wish to establish for seed export purposes. Such companies may be granted necessary permissions to meet their export obligations provided the operation of their export content does not conflict with the national provisions for germplasm protection and phytosanitary regulations

13.2 Seed Imports

13.2.1 Principles and Challenges

Research and variety development regularly require the importation of germplasm for the development of new varieties. Further, there is a whole range of vegetables which are widely consumed in Ghana but which do not set seed under tropical conditions. As such the seeds of these crops must be regularly imported into the country for the production of such vegetables. This importation programme has so far been dominated by the private sector in what can be considered a fairly satisfactory component of the seed industry.

In recent times, some private sector seed companies have imported hybrid maize seed stocks into the country to develop the hybrid maize seed market. Also, although a rare occurrence, under emergency situations where the national seed system has been seriously compromised, seed imports have become necessary.

A quality seed import programme to meet regular (non-emergency) needs, must be based on the following:

- a vigorous testing and demonstration process to identify adaptable and superior varieties and growing conditions
- compliance with existing seed and plant quarantine legislations
- conformity with international and regional protocols for seed trade
- seed must be accessible and affordable for farmers
- imported seeds must only complement locally produced stocks and not displace them

The main challenge in seed importation is that if it is not appropriately regulated it can negatively affect the local seed Industry, corrupt existing germplasm, introduce new pests and diseases and constitute a drain on scarce foreign exchange.

13.2.2 Policy Objective

The policy objective is to minimize the over reliance on imports by encouraging the local seed industry to develop their output potential; to resource/strengthen national seed regulatory bodies to undertake their responsibilities, in line with facilitative international seed trade norms and acting within the West African seed trade harmonization protocol; and to particularly encourage the national seed industry to come up with new varieties which can compete favourably with imports.

13.2.3 Policy Action

Mindful that international competition will present a healthy challenge for the development of a strong and credible national seed sector but mindful also of the need to ensure maximum seed security through the establishment of a strong local seed industry, Government will adopt the following steps:

- Government will encourage the local production of seeds on the basis that it offers the best safeguards for germplasm adaptability and plant health and holds better economic prospects for the nation. Nevertheless, Government will not institute barriers against seed imports, but will act to prevent dumping of untested seeds on the local seed market.
- Consequently, all seed imports will need to conform to laid-down provisions in the Plants and Fertilizer Act 2010 (Act 803) and to other seed industry provisions which may be announced from time to time.
- Government will encourage all seed companies who have to resort to imports of certified seeds of field crops, including hybrids, to have a short duration import programme aimed at growing the market for their released variety(ies) and hybrids and to, as soon as possible, develop in-country production of such variety(ies) and hybrids to substitute for the imports.

14.0 PRIVATE SEED ENTERPRISE DEVELOPMENT

14.1 Principles and Challenges

In Ghana, the seed sector was predominantly a public sector activity from its inception until it was privatized in 1990 to pave the way for private sector involvement in seed production and marketing. While the private sector was eventually to take over the certified seed production and marketing components of the industry, the foundation seed production function was assigned to the Grains and Legumes Development Board (GLDB).

It is generally accepted that the private sector is more efficient in the delivery of goods and services to the public. The decision for the privatization of the seed industry was therefore based on the premise that production of certified seed and planting materials for sale to farmers should be a private sector commercial activity. Small and medium scale seed enterprises, which include small-scale farmers as well as commercial firms, have been encouraged to produce and sell seeds and planting materials, whilst direct public sector seed production and marketing has been terminated. Small and medium scale seed growers and dealers are registered and trained annually, in production and marketing to produce and market seeds in Ghana.

A strategic plan to strengthen the private sector, aimed at establishing and strengthening key institutions vital to its growth and development was to be followed. In spite of initial good efforts, the private seed sector has experienced a very slow growth. Reasons relating to uneven playing field, inadequate access to seed industry data and information, poor infrastructure and inadequate funding arrangements, have been cited for this. Other reasons are low technical capacity, inadequate business skills and non-representation of the private sector in high level decision making.

With Government committed to the privatization option, the challenge relates to the means and speed by which the private sector can be assisted to assume its assigned role. Unless this challenge is overcome, a yawning gap exists in seed production and supply which encourages the proliferation of inferior and adulterated materials on the seed market and threatens the maintenance of Ghana's food security credentials.

A policy clearly stating the degree of support that the private sector can expect from Government is important in encouraging investment from not only local entrepreneurs but also overseas seed concerns who may be seeking to invest in Africa and who would determine that the Ghanaian seed investment climate accords them distinct advantages over others. For both local and overseas investors incentives relating to facilitation of market access; grants for unprofitable operations e.g. seed conditioning and storage; distribution in remote locations and difficult terrains; and tax reliefs will be important in facilitating their entry.

Chapter 2.1.5.1 in the Introductory Chapters discusses the initial efforts and current status of the private seed sector and the seed policy will need to also respond to the challenges identified in that chapter.

14.2 Policy Objective

The policy objective is to rapidly promote the development of an active and efficient private seed sector through the creation of an enabling environment which will include effective collaboration between public and private seed enterprises and agencies, facilitative investment incentive packages and infrastructural development.

14.3 Policy Action

In line with the objective of rapidly evolving the private sector to take over the commercial dimensions of seed production and marketing, the Government will follow the following steps:

- Government will accelerate its efforts towards the establishment of structured private seed companies including PPP in seed enterprise development (e.g. provision of infrastructure, utility services, shareholding, etc.)
- By this policy, Government confirms its strategy of relinquishing the responsibility for certified seed production and marketing to the private sector where the latter has interest and capacity. Consequent to that and as stated in other chapters of this policy, the private sector will have access to breeder and foundation seed produced by the public sector, under suitable arrangements. Furthermore, the private sector will be free to produce their own breeder and foundation seeds in conformity with established quality assurance processes.
- Government will progressively create an enabling environment to encourage private sector investments in the seed value chain (through tax incentives, duty concessions, provision of infrastructure, utilities support, royalty payments) in line with the existing investment laws.
- Government will cooperate with the banking sector to enhance credit availability to the private sector as it moves to invest in the seed industry. Credit accessibility will be prioritized for such seed industry participants as conditioning and storage providers, in order to ensure reliable availability of high quality certified seeds for farmers.
- Government is of the view that seed industry associations are important conduits for seed industry development. While supporting the existing seed associations to mature further, Government will vigorously promote the establishment and growth of an association of private seed companies which will not only foster the development of their members but will also be able to effectively partner Government in its seed development efforts.
- In addition to the existing incentives that are allowed by existing laws, Government, through the appropriate agencies, will consider special incentive packages to enhance the growth of the private seed sector. As an example, Government will seriously consider outright grants to a number of progressing seed companies in the main agro-ecologies as a contribution towards their rapid growth to overcome the seed supply gap which has persisted for far too long. Government, through MOFA will undertake necessary studies aimed at establishing the full modalities of this concept, including

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the minimum number to be supported, size and outputs projections required, crops involved, locations, minimum facilities at onset and minimum further facilities to be acquired, market catchment area, ease of access to supportive public sector agencies etc. Active private sector seed associations will be involved in this study. As well, development partners are encouraged to assist in this special incentive operation.

- MOFA through the Directorate of Crop Services, will support the private seed sector association(s) to establish a Seed Industry Development Office (SIDO) (as mentioned in Chapter 4.3), as an illustration of the commitment of Government to the privatization option. Government will encourage that SIDO be located within the offices of the association of private seed companies and carry out the functions originally mandated to the National Seed Service of MOFA. SIDO will also collaborate with MOFA to ensure that information on investment opportunities within the seed value chain is constantly produced and updated to attract more investors, both local and foreign. Specifically, the Seed Industry Development Office will perform the following functions:
 - It shall provide direct support, guidance, and assistance to any private-sector agency or persons interested or participating in any activities of the seed industry.
 - It shall serve as a focal point for providing assistance from relevant donors and agencies to seed industry actors.
 - It shall gather such seed industry intelligence and data as will be required by the seed industry, particularly the private sector.
 - It shall carry out training activities, particularly for the private seed sector
- While Government is anxious that the private seed sector should be rapidly developed, it will at the same time strive to ensure fair and healthy competition among private sector participants.
- Further, it is the expectation of Government that as soon as the private sector is sufficiently entrenched, it will itself contribute to the further development of the seed industry and reduce the overall Government expenditure on the seed sector by contributing to the pluralistic extension services, seed certification under licensing arrangements and eventually to research and variety development.

15.0 VALUE CHAIN

15.1 Principles and Challenges

Seed value chain refers to the entire sequence of actors and actions necessary to create, sell, and deliver quality seed to end users. In the seed sector, collaboration and coordination are very important for growth and development. Hence value chain strengthening is very important to be considered in a seed policy.

There are two main value chains of relevance to the seed sector. These are the seed value chain per se and the commodity value chain. The seed value chain includes researchers, seed producers, conditioners, storage, quality assurance, input dealers, extension and farmers. The Commodity value chain includes farmers, input dealers, extension, marketers (aggregators), millers and consumers.

The main challenges in the value chain context are as follows:

- Interaction between actors along the seed value chain is loose.
- No platform exists for seed value chain actors to share ideas.
- There is a weak link between the two relevant value chains: the seed value chain and the commodity value chain
- Inequities in the commodity value chain and its inadequate linkage with the seed chain contribute immensely to the problem of low seed demand, the most serious hindrance to seed industry development in Ghana, as previously stated.

15.2 Policy Objective

To develop the seed sector through the enhancement and integration of the seed value chain and commodity value chain.

15.3 Policy Action

Recognizing that the proper development of the seed value chain and its linkage to the commodity value chain and the collaboration of key seed industry actors lead to coordinated actions required for a balanced and orderly development, Government will act as follows:

- Government will encourage collaboration among the actors in the seed chain and in diverse ways endeavour to create conditions for enhancing such collaboration including the creation of necessary platforms for actors to share information.
- Government is aware that a successful commodity value chain exerts positive impact on the seed value chain and therefore serious attention will be made to ensure a successful commodity value chain, particularly supporting such actors as traders and agro-industry and further to create conditions for collaboration between the two value chains.

16.0 NATIONAL SEED SECURITY

16.1 Principles and Challenges

The increasing spate of emergencies requiring seed interventions has brought to the fore the importance of establishing arrangements and processes by which affected populations can obtain relief and disruptions in national agriculture ameliorated. These arrangements have traditionally been referred to as emergency seed interventions.

In recent times, a more inclusive tag of ‘seed security’ is being used to reflect a higher goal of continuous access by farmers to the seeds that they need at all times, both good and bad. The recognition that seed is a prime input without which there can be no crop production puts seed in a high profile in emergency interventions in agriculture and generally receives considerable support from donors.

Seeds and planting materials are often among the first inputs to be delivered in response to agricultural emergencies. Usually alone or allied with tools and fertilizers, they are aimed at quickly restoring the productive capacity of rural populations.

Agricultural disasters affecting seed availability and access on a nationally significant scale are rare in Ghana. There has so far not been a deliberate policy-driven seed relief mechanism instituted to meet the needs of vulnerable communities following disasters although FASDEP II sets the establishment of emergency seed relief mechanism as one of the national agricultural goals.

Seed security processes have been conducted on an ad hoc and intermittent basis and to date Ghana does not have a credible seed disaster risk management arrangement in place to meet seed related emergencies. The fact that Ghana has not been regularly prone to such emergencies should not serve as justification to perpetuate this situation. Preparedness is the cardinal principle in dealing with emergencies and in seed security, the situation is no different. Often, it is found that disasters wreak less havoc on populations which are very prone but are constantly prepared than on populations which are less prone and are inadequately prepared for disasters.

Critical issues to consider are:

- Inadequate or insufficient or lack of preparedness for dealing with risks.
- Lack of recognition of the value and opportunities for resilience in germplasm, crops and seed sources and strategic seed reserves.
- Poor arrangements for forecasting.
- Absence of long term mitigation plans for response to climate change.
- How to secure seed supply even in situation of crisis, climate change and food price crisis.
- Potential conflicts between seed security projects and seed sector development.

16.2 Policy Objective

The objective of a seed security policy is to encourage and promote the development of steps and processes aimed at quickly restoring the productive capacity of rural populations affected by disasters so that as soon as possible, they are able to recover their livelihoods and curtail or reduce their dependence on food aid. A higher goal of this policy is to enhance the continuous availability of and access to quality seeds under all conditions, both good and bad.

16.3 Policy Action

Recognizing the need to protect Ghana's agriculture and rural farm livelihoods in the event of disasters and in line with existing agricultural policy on emergency seed preparedness, Government will take the following steps:

- The mission of seed security interventions will be clearly defined by MOFA in collaboration with other partners in emergencies.
- MOFA will give clear guidance and work with relevant partners to develop strategies for responding to crisis and emergencies - disaster risk management framework – which contain components of preparedness, response and transition to development.
- MOFA will elaborate the technical dimensions of preparedness and response which should be well defined in a comprehensive seed sector plan so that the seed interventions are in tune with and do not conflict with regular developmental activities. The technical details will, among others, cover the following:
 - A well planned seed buffer stock arrangement will be installed in partnership with the private sector and other seed industry actors in a manner that will minimize expense and ensure also protection of breeder seed stocks and foundation seed which will be needed to restore the seed systems, if necessary, in the aftermath of distress.
 - Conduct a Seed System Security Assessment that provides analysis on the national seed system and specific data collection in vulnerable regions of the country.
 - Early warning systems could also be established in order to determine as quickly as possible when actions are needed.
 - Actions to secure the stability of seed production even in situations of crisis, by strategic deployment of irrigation facilities for part of the foundation seed production.
- Government will cooperate with other members of ECOWAS to develop a regional context for emergency seed assistance, enabling neighbours to stand ready to assist each other in times of need. This makes it possible for collaborating countries to develop familiarity with each other's varieties, quality control regimes and pest profiles and to harmonize systems, which would enhance safe seed movements. Government has noted that the recently adopted ECOWAS Regional Seed Harmonization provides a good technical basis to develop the regional seed security context.

17.0 CAPACITY BUILDING

17.1 Principles and Challenges

The human resource and physical development and institutional capacity building are critical for the development of the seed industry. Capacity building areas that are important for the development of the industry are variety development and release, seed production, seed quality assurance, seed extension and seed security management. For example, breeding stations are not adequately resourced with laboratory equipment, consumables, cold rooms, conditions for controlled environment work etc; foundation seed operations face shortages in both production and handling equipment and seed growers and outlets are yet to begin assembling their own capital requirements to tackle their role of sole certified seed producers and marketers.

The presence of a stable cadre of subject matter expertise is critical to the development of the seed sector. In Ghana most of the trained manpower which resulted from the donor-assisted training programmes in the sixties to the eighties have retired. In addition there has been a high attrition rate which still continues. In the area of variety development and release, there is inadequate human and infrastructure capacity. Only a few scientists are available to work on a wide range of crops. Crops such as the cereals and legumes, tree crops (cocoa and oil palm), root and tubers have some limited number of scientists. Other crops like local vegetables, fruit crops, ornamentals have few or no breeders. Therefore there is the need train more scientists to handle some of these non-traditional crops. In addition to breeders, technical and field staff who work together with the breeders also need training. Inadequate facilities exist in Ghana for training of scientists in some special skills in breeding and therefore such trainings have to be arranged externally. It is encouraging that rudimentary seed technology courses have been started in some public university and these provide the basis for full seed technology and other seed industry courses which will not only serve the needs of the growing national seed industry but also be useful to other countries in the region and beyond.

The need for re-orientation of training methods is being felt in many developing countries, particularly the need to make training more relevant to the type of agriculture as well as the priorities and to give more emphasis to seed industry middle level staff and artisans, develop better seed growers and reach larger numbers of farmers in seed awareness

Training needs also exist for the other institutions involved in seed production such as GLDB, GSID, Private Seed Companies. The scientists, technical field staff and farmers involved in the various operations need to keep abreast with the latest expertise and developments in their field and must constantly ensure the grooming of the next batch of national staff to take over from them.

Another group of players requiring seed training are agricultural extension officers. The role of the agricultural extension agents encompasses all areas of agriculture and their initial training does not place emphasis on seed. Consequently, these agents are not initially adequately knowledgeable on seed matters for effective transfer of technologies on seed to farmers. They require to be given additional training to properly position

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them for extension and seed education and promotion. There is also a need to complement the training effort with the provision of farmer training materials (brochures, fact sheets on released varieties) for seed technology transfer.

17.2 Policy Objective

The policy objective relating to capacity building is to identify the infrastructural, institutional and human resource development that will be necessary to implement a comprehensive seed industry and to act in concert with all stakeholders and development partners to ensure that the required capacities exist in all the seed industry components for orderly and balanced growth of the industry.

17.3 Policy Action

- Government will ensure that all public sector institutions (Research, GLDB, GSID, Seed Producers, Input Dealers, Security Services) progressively are adequately provided their required needs in physical vehicles, buildings, laboratory and seed plant equipment, supplies etc.) and human resources (including training) consistent with their mandates and seed industry objectives to enhance their operations.
- Government will encourage the mainstreaming of important seed industry modules into the curricula of agricultural educational institutions, both academic and vocational, to provide the new generation of agriculturists with a clearer understanding of seeds in the context of plant breeding, seed technology and input supply/agribusiness.
- Further, Government will seriously support any initiatives by the public universities to develop a seed technology learning centre with a comprehensive and up-to-date curriculum to meet the needs of the seed industry of Ghana and also serve the needs of other African countries.
- Government will place particular emphasis on the training of extension staff and input dealers on the proper means of communication with farmers to ensure proper technology transfer and awareness on quality seed. Further to that, extension officers and researchers will be required to collaborate to produce appropriate fact sheets and brochures on seed production and utilization by farmers.
- Among the areas of infrastructure that required to be improved, Government will pay particular attention to the availability and deployment of cold storage facilities for seed and will pursue the installation of cold room facilities for medium term seed storage in three agro-ecological zones: (Northern, middle belt and coastal savanna) for foundation and certified seeds.

18.0 NATIONAL FUNDING MECHANISMS

18.1 Principles and Challenges

Seed industry development on a national scale calls for considerable resources. The considerable bill that the development entails is as a result of the need to have balanced development. This means that almost all the components of the industry need to be attended to at the same time. Ghana already has made good investments in the basic areas and what will be needed will largely be for investments that will grow the hitherto low key private sector participation and also investments in public sector support structures that will be needed to support the emerging private sector.

The national commitment should be clearly evident in the extent of national resource allocation made to the seed industry development effort. Special funding mechanisms can be explored in the various current funding arrangements which have a connection with the seed industry and also a special seed industry fund can be considered as suggested in Section 62 of the Plants and Fertilizer Act, 2010 (ACT 803) which makes provision for the formation of a seed fund with sources as follows:

- a) Moneys provided by Parliament
- b) Donations, grants and gifts that do not compromise the interest of Ghana and
- c) Any other moneys that are approved by the Minister responsible for Finance

The challenge will be the extent to which Government will display its own continued commitment to funding the growth of the national seed industry which then should send inviting signals to its donor partners for complementary support.

18.2 Policy Objective

The policy objective is to ensure that, in implementing the National Seed Policy, adequate resources are marshalled, first and foremost from the national resources as a clear indication of the commitment of Government to the overall objective in seed industry development.

18.3 Policy Action

In line with the objective of ensuring that adequate resources are marshalled to ensure the full and effective implementation of the National Seed Policy, the Government will act as follows:

- Through the National Budget and other fiscal actions including possibilities under existing agriculture-related schemes, Government will continue its commitment to acting as the prime source of the funding required to develop the national seed industry. Government will lead in raising awareness of the critical importance of the seed industry in all relevant quarters in order to obtain the

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support of the general public and all relevant authorities and stakeholders in mobilizing national resources for the seed industry.

- Appropriate fees shall be charged for services such as variety registration, seed testing and certification and Government will give serious consideration to allowing the mandated agencies to lodge the funds so collected in a revolving fund to meet part of the recurrent cost of operations and to avoid periodic funding gaps.
- Government will initially support the private sector to properly develop and attain the anticipated status as the industry leader in the commercial components but with the expectation that eventually the private sector will attain the position of serving as partner with Government in providing the necessary resources required for the further growth of the seed industry.

19.0 REGIONAL AND INTERNATIONAL COOPERATION

19.1 Donors

19.1.1 Principles and Challenges

There are huge challenges, both technical and fiscal, in evolving the national seed source from the age-old traditional methodologies to the modern scientific and industrial complexity that is termed the seed industry. International assistance has been important in seed industry development in developing countries. Assistance from countries who are leaders in this industry can shorten the gestation period of the national effort so that a rapid transformation can be achieved.

There is long history of donor support in the seed development effort almost from its inception, although Government itself has been the main supporter of the processes through annual budgetary allocations and subventions. For strategic reasons of seeing Ghana maintain its national food security status and attain surpluses in food production, it is envisaged that donors will assist Government to implement the National Seed Policy.

USAID's close connection with and support to the erstwhile Seed Multiplication Unit in the sixties and seventies and its immense contribution to and mentoring of the former Ghana Seed Company were instrument in laying the basis for the seed industry of Ghana. The German Government, through GTZ, was similarly instrumental in developing the seed infrastructure and programme of the Seed Multiplication Unit in the northern parts of Ghana. On the crop improvement side, CIDA made a huge investment in maize breeding by sponsoring the Ghana Grains Development Project (GGDP) from 1978-1997 and many of the current maize and cowpea varieties have resulted from that era. Contributions in other areas have been made by FAO, Sasakawa Global 2000, The World Bank, AGRA, IFDC and IFAD.

The experiences gained by both Ghana and the donors from the early years of assistance should lead to a more pragmatic view of the current needs of Ghana's agriculture, particularly the role of the informal sector, institution building, private sector development and the importance of manpower development.

While Ghana continues to enjoy the goodwill and support of donors the challenge relates to making a good case for continued support to the seed sector. For donors, food security in Ghana will doubtless be a proud goal in seed development but beyond that, a food secure Ghana should be a good partner to donors in emergency food and seed operations in the event of emergencies in the sub-region.

19.1.2 Policy Objective

The policy objective is to demonstrate serious national commitment to growing a vibrant private sector-led seed industry and to encourage the donor community to provide partnership with Government in the donors' various areas of experience and interest in order to achieve a rapid transformation of the national seed industry into an efficient and effective entity.

19.1.3 Policy Action

In line with the objective of laying a good basis for partnership with donor partners in growing the national seed industry, the Government will take the following steps:

- MOFA will arrange a special launching of the National Seed Policy to the donor community in Accra with a view to raising the necessary level of awareness regarding Government's current thinking and commitment and to obtain their general support.
- Donors' technical experts will be invited to participate in the planning of major interventions where they clearly have the potential and interest to make a contribution.
- Government will from time to time extend invitation to relevant donors requesting their assistance and investment in particular segments of the seed industry where Government needs assistance beyond the national resources.
- Government will maintain dialogue with all donors on how the national seed industry can be helpful to other countries in the sub region where the donors have intentions to offer assistance, in training, emergency seed relief, research and variety development etc.

19.2 International Seed Associations and Institutions

19.2.1 Principles and Challenges

There are a good number of international associations and institutions who have mandates to assist developing countries with their developmental needs in agriculture including the seed sector. The main challenge is how the opportunities offered by the international associations can be taken advantage of by developing countries. The main agencies in this context are as follows:

19.2.1.1 International Agricultural Research Centres (IARCs)

Developing countries need to make better use of the opportunities presented by IARCs, especially in obtaining advanced lines of new varieties. IARCs offer countries the chance to accelerate their national breeding programmes at much reduced cost, by providing advanced lines which can directly go into national multi-locational trials or be crossed with local germplasm. Ghana already has good collaborative links with several IARCs such as CIMMYT, IRRI, IITA etc and many current varieties have emanated from those links.

19.2.1.2 International Seed Development Agencies

Apart from FAO of which Ghana is a member of long standing, many other international seed development agencies provide assistance to member countries to enhance seed trade, enhance seed movements and confer credibility to seed programmes. Examples are ISF, ISTA, AFSTA, UPOV and OECD. Although these agencies associations are mainly trade-oriented and can extend benefits mainly to matured seed industries, it is wise for even infant seed industries to maintain good contacts with them since their contributions will become more relevant as the seed industry matures. With ISTA, for example, early contacts is recommended since their advisory input will be useful in the rapid development of a comprehensive quality assurance programme.

A recent development in the Ghanaian seed development assistance is the proposed World Seed Project (WSP) under which FAO, International Seed Federation (ISF), Organization for Economic Cooperation and Development (OECD), International Seed Testing Association (ISTA) and International Union for the Protection of New Varieties (UPOV) will act together to assist Ghana and some other African countries implement a series of projects in a programme to advance their seed industries. The approach is based on the premise that, in seed development assistance, a balanced and coordinated approach is required to ensure that the different components of the seed industry develop in tune with each other and to avoid serious gaps.

The aim of WSP is to provide a framework to facilitate the development of new plant varieties and the delivery of high quality seed to farmers to enhance crop productivity and food security in the selected countries. It will also contribute to the achievement of Millennium Development Goal One (eradicating extreme poverty and hunger). Through the combined efforts of FAO, ISF, ISTA, OECD Seed Schemes and UPOV, the project will assist these countries in the development and implementation of a regulatory framework for sustainable development of the seed sector, which will provide food security and economic development through the provision of quality seed of improved varieties to small farmers.

When the project is commenced, it should mark the start of close collaboration between Ghana and the five international seed development agencies.

19.2.2 Policy Objective

The policy objective is to foster healthy collaborative links with relevant international seed associations and institutions, with a view to obtaining relevant technical and organizational expertise which will shape the development of the seed industry.

19.2.3 Policy Action

In line with the objective of benefitting from the technical and organizational assistance provided by international seed sector associations and institutions, the Government will take the following steps:

- Following the adoption of this policy, Government will quickly make the policy document available to the relevant institutions and associations and eventually request their participation in the conversion of relevant parts of the policy into a National Seed Plan, in line with their mandates and interests.
- Government will discuss the eventual implementation of specific segments of the seed plan with relevant associations with a view to benefitting from their specialized knowledge.
- The current process of achieving accreditation and membership of UPOV and ISTA will be speeded up to ensure that the evolution of the national seed industry fully benefits from the contributions that these agencies can make. Further, dialogue will be established with ISF, OECD and African Seed Trade Association (AFSTA) relating to future collaboration and relationship with the three organizations at the appropriate time.

19.3 Regional Seed Sector Cooperation

19.3.1 Principles and Challenges

ECOWAS as the sub-regional economic integration body has been supportive of seed industry/sector development in the countries of West Africa. As far back as 1987, ECOWAS proposed and prepared to implement a programme of ECOWAS Community Foundation Seed Farms in selected member countries. Although budgetary constraints and other hindrances have not allowed the programme to take off, ECOWAS has continued its interest in regional seed development. Chief among ECOWAS' recent interventions in that regard is the process of harmonization of seed legislations of member states. The harmonization protocols which have emanated from the ECOWAS harmonization processes have been of great help in preparing the Ghana's Seed Law and Regulations and will enhance the movements of seed in trade across national borders in the sub region.

The purpose of the ECOWAS Regulation on Seed Harmonization is to harmonize the rules governing quality control, certification and marketing of plant seeds and agricultural plants in Member States. The harmonization is intended to ensure good seed quality and determine the origin of the seeds of plant species and varieties listed in the West African Catalogue of Plant Species and Varieties, as defined in Article 9 of the Regulation.

While conforming to the provisions of the harmonization protocol, there is also the need to maintain seed sector cooperation with sister countries in the Region on bilateral basis. Such cooperation, which in some cases has long existed, is important in aiding germplasm and seed exchanges, training and emergency seed interventions.

The real challenge in regional cooperation relates to rapid ratification of protocols and the institution of implementation structures in order to rapidly implement the adopted processes.

19.3.2 Policy Objective

The policy objective in regional cooperation is to act with member countries of ECOWAS in developing and implementing facilitative seed industry protocols and agreements which will offer mutual benefits and contribute to the development of Ghana's seed industry.

19.3.3 Policy Action

In line with the objective of cooperating with sister countries in West Africa in seed industry development and operations, Government will take the following actions:

- Government will act in concert with the other ECOWAS countries, within the context of the ECOWAS Regulation on Seed Harmonization and other bilateral and multilateral protocols, to foster a high degree of seed industry cooperation in the West African Region which will offer mutual benefits to all the countries.

19.4 Continental Seed Cooperation: The African Seed and Biotechnology Programme

19.4.1 Principles and Challenges

In July 2005, The Ordinary Session of the Assembly of the African Union (AU) in Sirte, Libya, requested the African Union Commission to lead a continental effort to compose an African Seed and Biotechnology Programme (ASBP), which will serve as a blueprint for the development of Africa's seed sector, considered as holding a vital key in addressing Africa's food security problems.

After a lengthy and thorough process of expert consultations involving experts from the entire AU membership, the final programme was approved by the African Union Assembly during its eighth ordinary session in Addis Ababa, Ethiopia, in January, 2007. ASBP is aimed at providing a comprehensive and strategic approach to overcome current barriers and obstacles to seed industry development in Africa and to further enhance the development of the seed sector which is considered as a critical element in achieving food security in Africa.

Efforts are currently under way to establish the ASBP Secretariat within the African Seed Network, which would act as Surrogate Agency of the AU in exercising general oversight over the ASBP implementation. Challenges exist in relation to full participation of in ASBP by African countries as well as resource mobilization; the initial steps regarding fund raising and start-up of the Secretariat will provide a good indication of the future prospects of the programme.

19.4.2 Policy Objective

To position the seed programme of Ghana to participate in and take full advantage of the ASBP as a programme and a framework in order to effectively collaborate with other African countries and African institutions in seed sector development as a pathway towards the food security goals of Ghana and Africa.

19.4.3 Policy Action

Towards preparing for participation in ASBP, Government will adopt the following position:

- Having acted in partnership with other African countries in ushering in ASBP, Government is of the belief that an effective ASBP can make a major contribution to seed development in Africa. Therefore Government will continue to act with all ASBP partners in starting up the programme, mobilizing the required resources and systematically executing the stipulated programmes and projects at national, regional and continental levels to the benefit of Ghana and Africa.

20.0 REVISION AND UPDATING OF THE POLICY

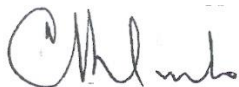
It is the intention of Government that this policy, though of long term relevance with regard to the basic principles and philosophy it establishes, should nevertheless be dynamic and adapt to changing situations in the future. Dynamic consultative processes similar to the ones which have resulted in this policy will be used for any review exercise. Reviews, which will be periodic, will be based on the expressed need of the stakeholders and as found to be necessary by the periodic measurements of success. It is expected that consultations that are part of the annual MOFA planning meetings, National Seed Council meetings and annual meetings of Seed Associations will be the primary fora for proposing and discussing modifications needed to be made to this policy.

Arising out of these consultations, The National Seed Council will make recommendations to the Minister of Food Agriculture stating the issues which have emerged and the consensus expert opinions on possible policy change and the way forward. The Minister will consider such recommendations, discuss them with stakeholders and authorize a revision process leading to the necessary modifications in the National Seed Policy to bring it in line with current conditions without changing its long-term intent and validity.

21.0 EFFECTIVE DATE OF THE POLICY (ENTRY INTO FORCE):

The National Seed Policy of the Republic of Ghana takes effect from 1st August, 2013

ISSUED this 11th day of July, 2013



HON. CLEMENT K. HUMADO (MP)
MINISTER OF FOOD AND AGRICULTURE

PART C: IMPLEMENTATION GUIDELINES

22.0 IMPLEMENTATION GUIDELINES

22.1 Introduction

Speedy, effective and comprehensive implementation of the National Seed Policy is critical if the stated objectives and outputs are to be achieved. Unless the policy is implemented, it remains a collection of statements of intentions and exerts no influence. It should be pointed out that many aspects of the policy are already receiving some level of attention. For some of those areas implementation will just mean that there will now be more conscious realization of their importance or critical role in the overall seed industry apparatus they will and therefore be granted additional urgency and support. Other aspects will require new support initiatives in which relevant partners will be expected to act as sponsors and implementers side by side with government effort.

In the planning of implementation activities a full range of timeframes will be encountered due to the differing developmental efforts and gestation periods which give rise to the following categories of timeframes:

- Continuous indefinite
- Short term
- Medium term
- Long term

While it is accepted that the implementation of the policy will call for additional resources from Government and partners beyond currently committed levels, it is necessary to re-echo that when the additional resources are effectively deployed, the outputs from the interventions have potential benefits overwhelmingly in excess of the resources invested. Use of quality seed should result in about 40% yield increment when used alone and about 70% when used in combination with fertilizers and GAP. Therefore, when quality seed usage is widespread, Ghana will achieve the desired agricultural productivity that consolidates national food security, and with less need to open up new agricultural land.

22.2 National Seed Plan

The first stage in the implementation of the National Seed Policy is the conversion of the policy statements and direction into a comprehensive National Seed Plan which consists of methodologies and programmes for implementing the actionable portions of the National Seed Policy. The National Seed Plan will also give guidance on how non-actionable portions are to be addressed.

The following chapter headings are provided to guide the preparation of the National Seed Plan:

a) Background

To establish the connection with the National Seed Policy (NSP) and existing Agriculture Sector Policy and plan documents.

b) Review of Seed Sector Performance

To establish the current status, progress and problems of the seed sector and industry. Identification and prioritization of programmes and projects emanating from the NSP.

c) Programme/Project Results

To provide a list of expected Programme/Project, objectives, outputs and activities

d) Implementation Mechanism

To show a detailed description of modalities, methodologies and strategies for implementing the programmes/projects including institutional arrangements and partnerships.

e) Implementation Cost

To show cost of identified programmes/projects, funding sources

f) Financial and Economic Analysis

To establish the financial and economic feasibility and other benefits of the programmes/projects.

g) Monitoring and Evaluation

Description of a system to monitor and evaluate the progress of implementation.

h) Risk Assessment and Sustainability Analysis

To contain a brief summary of risks likely to be faced during implementation and an analysis of the sustainability of the various programmes and projects.

22.2.1 Activity Categories

The National Seed Plan will categorize all the envisaged activities, both new and on-going, that have been given rise to by the NSP. The main categories of activities are as follows:

- i. No-cost intensification of current activities
- ii. Ongoing budget-based public activities
- iii. New budget-based initiatives
- iv. New projects/programmes:
 - Sponsored by Government alone
 - Sponsored by Government and partners
 - Sponsored by private sector alone
 - Sponsored by private sector and partners
- v. Government Incentive packages

22.2.2 Details of the Activity Categories

i) No-cost intensification of current activities

The seed policy contains many statements which call for intensification or prioritization of actions which are already part of the routine activities of mandated agencies. Implementation of such ‘call to arms’ statements does not call for appropriation of additional funds but rather, in many cases, attitudinal changes, greater awareness of issues and a more sustained action to achieve desired results within a stipulated time frame. Research methodology changes, extension interventions in the informal sector, GSID implementation of some quality assurance interventions are a few examples in this category. The National Seed Plan will identify all the areas belonging in this category as a guide to responsible agencies in the seed industry to incorporate those areas into their work plans and activities.

ii) On-going budget-based public activities

This category is made up of public sector initiatives for which responsible agencies annually present budget estimates for Government funding under the Consolidated Fund. Research agencies, GLDB, DAES, DCS, GSID etc are in this group of agencies. In this case, in line with National Seed Policy implementation, the additional treatment to the regular budget process is suggested as follows:

- Firstly, the mandated agency should flag the specific budget item and insert a statement to indicate that it is part of the NSP implementation and indicate also the requested extra funding that has resulted from the linkage to the National Seed Policy.
- Secondly, the Minister will provide clearance as to his agreement and support
- The Ministry of Finance (MOF) is then to consider the estimate in the appropriate context that it forms part of a Government sponsored programme of implementing a priority national commitment.

Since a time frame and overall total indicative budget for a particular activity would have been prepared, it is possible to monitor the budgetary requests over time in order to determine when the special treatment is to be curtailed.

iii) New budget-based initiatives

New Budget-Based Initiatives (both capital and recurrent) are initiatives that are being proposed in the estimates for the first time and these arise from entirely novel interventions proposed by the National Seed Policy. When approved, they become regular features in the government budget for the medium or long term. For this category, a strong narrative and investment proposal is therefore required as part of the estimates. The proposal should normally be initiated by the responsible agency, validated/cleared by the relevant Directorate, endorsed by the NSC and given support by the Minister.

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During budget hearing, the linkage to the appropriate portions of the National Seed Policy should be mentioned and given special attention by the Ministry of Finance in the same manner as in ii) above.

iv) New projects/programmes

Project and programme-type initiatives are specific activities which require extra-budget or special funding. These initiatives are not likely to become regular features in the government estimates and the funding is curtailed as soon as the overall output and objectives have been achieved. The initiatives are mainly capital in nature. They are funded by Government alone or with support from partners or funded by the private sector alone or with partner support.

Examples of projects and programmes that lie in this category are as follows:

- Accelerated development of the private seed sector
- National seed use promotion project
- Special support to public sector seed infrastructure
- Development of a National Emergency Seed Preparedness

v) Government Incentive packages

Government incentive packages will comprise support inputs that government will grant to specific players in the seed industry, mainly in the private sector, with a view to encouraging their specific activities that will inure to the overall health of the seed industry. The incentives may be by way of concessions such as tax and duty reliefs, subsidies, facility allocation, soft credits or outright grants. The National Seed Plan will, based on the provisions of the National Seed Policy, propose the various incentive packages and how they are to be executed. In some cases the incentives proposed may not be in line with existing laws and regulations and there will therefore be a need to devise ways and means to enable execution.

22.2.3 Investment Profiles

In the cases of new initiatives, by both Government and partners, the National Seed Plan will present project or investment profiles in a standardized format which will have the following features:

- Title of Activity
- Objectives
- Responsibilities or executing agencies and partners
- Time Frame
- Summary of Activities
- Resources Required/budget
- Expected Outputs (targets, results)
- Monitoring and Evaluation arrangements

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The purpose of the investment profile is to provide an indication of the investment requirement to both Government and partners and to serve as basis for interest and adoption by potential sponsors. Following indication of interest and sponsorship intent, the profile can then be elaborated into a fully-fledged project document.

22.2.4 Modalities of Implementation

The National Seed Plan will also contain the institutional arrangement that will be in place at various stages of development. A workplan of the implementation, risks and assumptions, sustainability framework and partnership will need to be prepared for each investment activity.

22.3 Profiles of Participating Agencies and Stakeholders

The National Seed Plan will present a wide array of agencies and stakeholders who will be required to carry out the plan in a coordinated manner. The agencies and stakeholders will therefore need to actively participate in the preparation of the National Seed Plan to engender ownership and for smooth and effective implementation. Brief profiles on the key stakeholders who have contributed to the seed industry in the past and are likely to show interest in this policy are shown in Annex 3.

Annex 1**CHRONOLOGY OF IMPORTANT STEPS IN THE POLICY FORMULATION PROCESS**

Date	Activity
20.09.2012	MOFA writes to request FAO assistance for the formulation of a National Seed Policy
23.01.2013	FAO approves a TCPF for MOFA including the posting of a consultant to guide the policy process
15 to 28.01.2013	Analysis of seed industry data and information and preparation of seed policy formulation process
15.01 to 12.02.2013	Preparation of agenda, discussion papers and other modalities for National Seed Forum
19 to 22/02/2013	National Seed Forum, as part of the stakeholder's consultation process held in Kumasi
11 to 15.03.2013	Seed Policy drafting Task Force prepares first draft of National Seed Policy
20.03.2013	CDI joins FAO in sponsorship to widen stakeholder consultation
26.03.2013	Validation workshop on first draft Seed policy document held in Tamale
23 to 24.04.2013	Validation workshop on second draft of seed policy document held in Accra
21 to 22.05.2013	Finalization of draft seed policy document by Seed Policy Drafting Taskforce
12.06.2013	Final draft of seed policy document presented to Minister of Agriculture for internal clearances, revisions and validation
11.07.2013	National Seed Policy approved and adopted by Government

MEMBERS OF THE SEED POLICY DRAFTING TASK FORCE

No.	Name	Institution
1.	Prof. Jonathan Padi Tetteh	University Of Cape Coast
2.	Prof. Charles Quansah	KNUST
3.	Dr. Simon Fialor	KNUST
4.	Mr. Stephen Debre	GIPC
5.	Dr. King David Amoah	FONG
6	Mrs. Felicia Owusu-Nyantakyi	GAIDA
7.	Mr. Samuel Yao Adzivor	GSID
8.	Mrs. Josephine Quagraine	PPMED
9.	Mr. John Wobil	GLDB (retired Chief Executive)
10.	Mr. Samuel Yaovi Dotse	DCS (Project Coordinator)
11.	Mr. Solomon Gyan Ansah	DCS
12.	Mr. Rowland Addo	DCS
13.	Mr. Josiah Wobil	International Seed Consultant
14.	Mr. Mark Offei	FAO Facilitator

PROFILES OF PARTICIPATING AGENCIES AND STAKEHOLDERS**1.0 Policy, Oversight and Coordination****The Ministry of Food and Agriculture (website: www.mofa.gov.gh)**

The Ministry of Food and Agriculture (MOFA) is responsible for the initiation of policies, and guides the orderly growth and development of the national seed programme. Furthermore, MOFA contains various oversight, control and coordinating agencies which will have responsibility for translating the policy statements into specific activities and outputs. The key agencies are as follows:

- a) **The Plant Protection and Regulatory Service Directorate (PPRSD):** PPRSD has responsibility for all plant protection and quarantine issues relating to the seed industry and through the GSID for overall quality assurance of the seed industry.
- b) **The Directorate of Agricultural Extension Services (DAES):** DAES has responsibility for seed extension and promotion activities as well as assistance in the informal sector interventions.
- c) **Directorate of Crop Services (DCS):** DCS has responsibility for coordination and facilitation of interventions in the crop subsector including technical services on improved planting material enhancement and productivity through adoption of appropriate technologies.
- d) **Policy, Planning, Monitoring & Evaluation Directorate (PPMED):** PPMED has responsibility for monitoring and evaluation of the seed policy and plan and the programmes and projects that will result from them as well as assisting the NSC to undertake the process of periodic review of the National Seed Policy and assess the impact of programmes emanating from it.
- e) **National Seed Council (NSC):** A National Seed Committee was established under the 1972 Seed Decree. Presently renamed the National Seed Council, it has been reactivated to ensure overall coordination and development of the seed industry. The functions of the council include the following:
 - To establish policies that stimulate the development of the private sector.
 - To review and if necessary revise the seed law.
 - To establish the criteria for the release of new varieties.
 - To develop seed production standards and guidelines and monitor work undertaken by the Ghana Seed Inspection Division.
 - To develop linkages between agencies involved in the production and marketing of various classes of seed.
 - To develop guidelines that would facilitate the importation and exportation of seed.

The composition of the NSC, chaired by the Minister of Food and Agriculture, is made up of Agricultural Research Institutes, University Faculties of Agriculture, Extension Directorate of MOFA, Directorate of Crop Services of MOFA, Foundation Seed Producers, Representatives of Commercial Seed Producers, Seed Dealers and Farmers.

f) National Variety Release and Registration Committee(NVRRC): The National Varietal Release and Registration Committee (NVRRC) has been established as a sub-committee under the National Seed Council to undertake the release of new crop varieties and also to delete obsolete varieties from the Variety List according to laid down procedures approved by the NSC. The membership of the NVRRC consists of Research Institutes, Public University Representative, Ghana Seed Inspection Division (GSID), Agricultural Extension Services Directorate (DAES), the Directorate of Crops Services, Women in Agriculture Development (WIAD), the Grains and Legumes Development Board (GLDB) and Representatives of Farmers, Seed Producers and Dealers.

g) National Seed Service: The National Seed Service (NSS) was created to provide leadership and technical support for the development of the seed industry and to foster the development of private seed enterprises, small and medium seed producers/sellers and dealers. It was also to coordinate the activities of institutions, organizations and individuals engaged in production, distribution and marketing of seeds. The NSS was also to serve as the secretariat of the National Seed Committee now National Seed Council. The NSS has not developed as expected and is presently almost non-operational and its mandate largely assumed by other public agencies. As per the provisions in this policy, MOFA will now support an association of private seed companies to set up a Seed Industry Development Office to pursue the seed development goals previously entrusted to the National Seed Service (NSS).

2.0 Plant Genetic Resources, Crop Research and Variety Development

2.1 The Plant Genetic Resources Research Institute of CSIR (PGRRI)

The PGRRI does not undertake any plant breeding activities. Its main function is to serve as a germplasm bank for breeders to access materials for selection, evaluation and crossing. It is also responsible for characterization of all germplasm in its gene bank. However the capacity for PGRRI to perform its core functions is very limited.

Molecular characterization at PGRRI is very challenging because the laboratories are poorly equipped and basic reagents difficult to acquire. Most of the breeding institutions do not collect germplasm from PGRRI but rather prefer to receive materials from CGIAR institutes. The breeders in other CSIR institutes claim most of PGRRI's local collections lack variation/characteristics they need as they are mainly land races. On the other hand breeders from external organizations frequently request for materials from the PGRRI. Requests are also received from universities, mainly for work in connection with graduate student research (*contact: info@pgrri.csir.org.gh*).

2.2 Agricultural Research Institutes

The major institutions having mandate and capacity to undertake plant breeding in cereals, legumes, roots and tubers, and vegetables in Ghana are:

CSIR-Crops Research Institute (CRI)

CSIR-Savanna Agriculture Research Institute (SARI)

University of Ghana (UG)

University of Development Studies (UDS)

Kwame Nkrumah University of Science and Technology (KNUST)

University of Cape Coast (UCC)

Ghana Atomic Energy Commission's Biotechnology and Nuclear Agriculture Research Institute (BNARI)

However, active plant breeding for the above listed crop types has been more or less restricted to CRI, SARI and the three public Universities (UG, KNUST and UCC) over the past 10 years.

CRI has been the pioneer plant breeding institution with activities spanning the past 40 years and more.

SARI was part of CRI until it became a fully-fledged institute in 1994.

The breeding activities of SARI have concentrated on traditional savanna crops (grain legumes, rice, sorghum, millet, yams).

Breeding activities at KNUST are closely linked to teaching and learning at the Crop Science Department. The high proportion of resources allocated to root and tubers may be attributed to the Root and Tuber Improvement Programme (RTIP) which supported KNUST to develop new varieties from 1998-2004.

The University of Ghana's capacity to undertake research in plant breeding has recently been enhanced by the award of a project support grant by the Alliance for a Green Revolution in Africa (AGRA) to train breeders. Under this programme, UG and Cornell University have jointly established the West Africa Centre for Crop Improvement (WACCI). WACCI is to train 40 plant breeders with PhDs over a period of 10 years. About a quarter of the students are selected from Ghana with the remaining being selected from other West African countries.

The University of Cape Coast has been involved in multiplication/testing of cassava accessions made up of mainly local land races. Two cassava varieties were released by the University in 2005. Also some cowpea segregating populations were generated through irradiation.

The Ghana Atomic Energy Commission established the Biotechnology and Nuclear Energy Institute (BNARI) to promote food security using biotechnology and nuclear techniques as tools. BNARI pioneered tissue culture propagation especially for pineapple and plantain. The institute has had very qualified staff over the years. However financial resources to undertake crop improvement have been very limited. Breeding activities for rice, maize, cassava and vegetables are insignificant.

3.0 Seed Production and Marketing

3.1 Grains and Legumes Development Board (GLDB)

GLDB was established to undertake the production of foundation seed of cereal and legume crops from breeder seed obtained from the research institutes and the universities. Although by law the GLDB is mandated to undertake other activities, its main activity now is foundation seed production.

3.2 Private Seed Producers

Private seed producers are registered seed growers either as self-contained units or contracted to grow seed for seed outlets. They are loosely held together by an umbrella body called Seed Producers Association of Ghana, (SEEDPAG). As the main conduit for certified seed supply their contribution in terms of certified seed production has been very modest so far. Their contribution is expected to rapidly grow to cover the yawning gap in certified seed supply but a good development in enhancing quality seed demand should contribute to this expectation.

3.3 Seed Outlets

Seed outlets are made up mainly of private sellers of farm inputs who have come together as Ghana Agro Input Dealers Association (GAIDA) (gaidasecretariat@yahoo.com).

3.4 Directorate of Agricultural Extension Services

The Directorate of Agricultural Extension Services, MOFA is the main agency responsible for the promotion of use of quality seed alongside other agricultural technologies. This is done through training of its staff and farmers, field days, demonstration farms, and the development and dissemination of extension materials.

4.0 SEED QUALITY ASSURANCE

4.1 The Ghana Seed Inspection Division

The GSID was established within the Plant Protection and Regulatory Services Directorate of the Ministry of Food and Agriculture. It provides technical support for the development of internal and external quality assurance systems. It is located at Pokuase, a suburb of Accra, where it operates a National Seed Testing Laboratory. Satellite laboratories are sited in five strategic regional locations in the country. From the foundation stage up to the sale of certified seed, standards are enforced through seed regulations operated by the GSID. Seed growers engaged in the production of foundation, registered, and certified seed have to apply to the GSID for approval to commence production. Following approval, certification processes, including field inspections and laboratory seed testing, are undertaken by GSID. The legal basis for the enforcement work of the GSID is the recently passed Plants and Fertilizer Act, 2010 (ACT 803). GSID also monitors seed sales outlets to ensure suitability of storage premises, seed viability and purity.

5.0 PRIVATE SECTOR DEVELOPMENT

5.1 AGRA Sponsored Units

AGRA sponsored units are budding seed enterprises which are being assisted under an AGRA seed enterprise support programme. Their progress has so far been modest but they have established the potential for private sector development which can be further built upon (info-Accra@agra-alliance.org).

6.0 Donors/Development Partners

The seed programme has since its inception received support from several donor agencies. The main agencies are USAID, the World Bank, Sasakawa Global 2000, GTZ (now GIZ), the International Fund for Agricultural Development (IFAD), International Centre for Fertilizer and Agricultural Development (IFDC), Root and Tuber Improvement and Marketing Programme (RTIMP) and AGRA.

a) **The United States Agency for International Development, USAID:** In support of Government's initiatives to achieve food security, USAID has consistently supported the Seed Industry under various programmes from its early beginnings. It advocated for and eventually provided support to the privatization of the seed industry in 1990.

Over the years, USAID has assisted the seed programme with equipment supply, vehicles and training of Ghanaian counterparts in short and long term courses in Seed Technology at the Mississippi State University, in the United States. It provided start-up funds for the implementation of the private sector seed industry project which started in 1990. Operational vehicles were provided by USAID under projects named Agricultural Productivity Promotion Program and PL480 respectively. The National Seed Laboratory was also constructed with funds under APPP, (and eventually furnished with funds from the World Bank under the Agricultural Sector Rehabilitation Project) (*contact: 0302-741-200*).

b) **CIDA:** In 1979 the GoG sought the assistance of the Canadian Government and on the basis of a bilateral agreement the Ghana Grains Development Project, funded by Canadian International Development Agency (CIDA), was established. The purpose of the project was to develop and diffuse improved technologies for maize and grain legumes. The project was headquartered at the Crops Research Institute, Kumasi with CIMMYT as an executing partner, with GLDB and MOFA as ancillary partners. Between 1979 and 1997, the project trained and built the capacity of several scientists and technicians from the CRI, GLDB and MOFA through long (post graduate) and short courses. The project also promoted the organization of an integrated national strategy for technology generation, testing and diffusion that involved the participation of several institutions. A strong linkage between farmers, researchers and extension was established which made on- farm trials easier. This led to the development and release of many new crop varieties of maize, cowpea, and groundnuts. The project produced breeder seed of all the released varieties emanating from research.

Within the period of the project life it had developed several open pollinated maize varieties including the Quality Protein Maize (QPM) and its hybrids (www.psu-ghana.org).

c) **The Sasakawa Global 2000 Project:** From its initial objective of strengthening the Extension Services of MOFA to promote the adoption of underutilized released crop varieties, the SG2000 expanded its program to cover research, seed production, extension, processing, capacity building, and equipment supplies.

The Sasakawa Global 2000 has contributed significantly to the development of the Ghana Seed Industry since its inception in 1990. Its activities covered training and capacity building, seed promotion, study tours, equipment supplies and a credit facility to seed growers and dealers. It also supported the CRI with maize research and varietal development.

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Its major contribution to research has been the funding of the programme on open pollinated Quality Protein Maize (QPM) variety named Obatampa and the accompanying hybrids MAMABA, DADABA and CIDABA respectively. A quality control laboratory of international reputation was funded at the CRI to test the tryptophan and lysine levels of the QPM seeds. After the release of the Quality Protein Maize varieties, the SG2000 initiated a research project into the effects of feeding children on QPM with normal maize as the control.

On the seed production front, quality control and certification activities, field days, seed promotion activities, planning and review workshops, training of seed growers and dealers undertaken by the GSID, were funded by the SG2000.

Under the Sasakawa Funds for Education (SAFE) program, technical staff of the DAES, were supported to pursue under-graduate and graduate studies in various universities.

d) German Agency for Technical Cooperation (GTZ): The GTZ (now GIZ) supported the seed and fertilizer industries in Ghana under the Ghanaian/German Agricultural Development Project, a bilateral Ghana/Germany cooperation programme. Between the years 1970-1990, the seed sector in the northern sector was supported with technical counterpart staff from Germany, in-country and outside country training of Ghanaian counterparts, seed conditioning and laboratory equipment, storage facilities and vehicles. Under the same program, research activities of the Savanna Agricultural Institute were supported through training of staff, equipment and funds to conduct research. This resulted in the release of maize, rice, sorghum groundnut, and cassava and soybean varieties primarily for use in the northern parts of Ghana.

Under the West African Seed Development Project (1996-2002), a series of programmes were planned to enhance seed production and marketing in Ghana and the West African sub region. The project concentrated on cereals, legumes and vegetative propagated materials, such as cassava, yams and sweet potato. Training workshops were organized on seed production, marketing, quality control, seed production planning including development of business plans. Prototype seed processing equipment with dryers were installed at the CRI to demonstrate to farmers, seed growers and dealers, the importance of drying seed to a safe moisture level for longer storage periods. The project encouraged networking of the seed sector in the sub-region by introducing a monthly newspaper on latest developments in the seed sector in West Africa (giz-ghana@giz.de).

e) International Centre for Fertilizer and Agricultural Development (IFDC): The International Centre for Fertilizer and Agricultural Development has since 2001 assisted the seed industry, especially towards the development of the private sector. An Action Plan for Developing Agricultural Input Market in Ghana was developed through a collaboration with MOFA, Environmental Protection Agency (EPA), SG2000 and USAID. A programme entitled Ghana Agricultural Input Markets (GAIMs) was also implemented with

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the support of USAID. It was a project designed to train and develop the capacity of seed producers and dealers in marketing.

IFDC, in cooperation with a wide range of donor partners, sponsored workshops, both regionally for West Africa and nationally, aimed at enhancing the regulatory framework for seed production as well as seed marketing. Current IFDC support includes assistance to seed grower and dealer organizations under the Ghana Agro-dealer Development Project (GADD), Ghana Agro Input Network (GAINS) and Marketing Inputs Regionally Plus (MIR Plus).

f) International Fund for Agricultural Development (IFAD): IFAD is the main sponsor of the Root and Tuber Improvement and Marketing Programme (RTIMP), (formerly RTIP) in collaboration with CRI, SARI and PPRSD in MOFA. The project is developing, producing and certifying improved planting materials of cassava, sweet potatoes, and yams for distribution to farmers. Several cassava varieties most of which originate from International Institute for Tropical Agriculture (IITA), have been developed and distributed to farmers. Field Inspection and Quality Control Standards and protocols were developed with the support of RTIMP and field inspection teams were formed to ensure compliance with certification requirements. The field inspection role is now transferred to GSID. RTIMP also facilitates production of quality products, marketing and distribution.

g) Alliance for a Green Revolution in Africa (AGRA): This is a recent initiative funded by the Bill and Melinda Gates foundation, chaired by Kofi Annan, the former General Secretary of the UN, to boost agricultural production in Africa to ensure food security in Africa. The programme is designed to build capacities of the human resource base of African countries to engender technology generation and dissemination in agriculture. Through the West Africa Centre for Crop Improvement, AGRA is training agricultural scientists in plant breeding and seed technology to take up the challenge of breeding and release of suitable varieties for the various ecological zones. It has supported the private sector with credit to improve the seed delivery system. This has been complemented with training and capacity building of seed entities.

DEFINITIONS OF TERMS USED IN THIS DOCUMENT

Basic seed: The progeny of pre-basic seed and the source of certified seed, so produced as to retain the specific identity and purity of a variety. It is sometimes called foundation seed.

Biotechnology: Any technological application that uses biological systems, living organisms or derivatives thereof to make or modify products or processes for specific use.

Certified seed: The progeny of pre-basic, basic or certified seed of previous generations, so produced and handled as to maintain satisfactory genetic identity and purity.

Early Generation Seed: Refers to the classes of seed from breeder seed up to foundation seed which are used as inputs for the production of certified seeds.

Genetic engineering: The manipulation of genes, composed of DNA, to create heritable changes in biological organisms and products that are useful to people, living things, or the environment.

Genetically Modified Organism (GMO): An organism whose genetic makeup has been changed by any method including natural processes, genetic engineering, cloning, mutagenesis, or others.

Germplasm: The sum total of all hereditary material in a single (interbreeding) species.

Hybrid: The progeny of a cross between two different species, races, cultivars, or breeding lines.

Land Race: Local plant material, which contains a range of genotypes, derived as a result of selection pressures under local conditions.

Pre-basic seed: Seed of the generation preceding basic seed and may be of any generation between parental material and basic seed.

Registered Seed Grower: A specialized farmer specifically registered or contracted for the production of a class of seed usually certified seed.

Seed Certification: A service involving inspections and laboratory testing, developed to maintain and make available to the public high quality seed and propagating material of improved crop varieties.

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Seed Conditioning: The process of safely and rapidly transforming freshly harvested seed from their perishable state into dry, clean, treated and graded material to survive a period of storage until they are needed and to conform to desired additive and planter specifications.

Seed Quality Assurance: A system of quality monitoring, standard adherence and enforcement involving field inspections, laboratory seed testing and trade monitoring as part of seed certification and other quality schemes established for the seed industry

Seed Security: The continuous access by farmers to the seeds they need at all times (both good and bad times).

Seed: A mature plant part, usually an embryo, which under optimum conditions will develop into a full-grown plant. May be used to mean both true seed and vegetative planting material

Variety: A group of similar plants that by structural features and performance, can be identified from other groups within the same species. It is sometimes called cultivar.