



Ministry of Food and Agriculture

**Savannah Agricultural Value Chain
Development Program (SADP)**

Pest Management Plan (PMP)

Summary of PMP

1.0 Introduction

The Savannah Agricultural Value Chain Development Program (SADP) is being implemented to serve as part of post COVID-19 reconstruction efforts aimed at addressing disruptions in food systems in Ghana. It seeks to build on successes under the Savannah Zone Agriculture Productivity Improvement Project (SAPIP) and Savannah Investment Programme (SIP) that have so far expanded the production of maize and soybean from 80 hectares in 2018 to 14,000 hectares in 2021. This program is expected to build on the achievements made and to further expand production of rice, soybean and maize by an additional 8,000 hectares by 2026.

The Program which will be implemented in 9 districts located in 5 regions of the country will be used as an instrument to implement the Planting for Food and Jobs (PFJ) to address key constraints in food security and the poultry and livestock feed industry. This support is to allow medium scale commercial farmers and their out-growers to expand areas under cultivation for rice, soybean and maize under PFJ, which feeds into the poultry value chain under Rearing for Food and Jobs (RFJ). This integrated approach will support elements of growing at scale and provision of market outlets for smallholder farmers, especially women and the youth.

This Pest Management Plan (PMP) has been developed in direct response to the risk of pests and diseases and to guide the operation of SADP to achieve compliance with applicable national regulations and AfDB Operational Safeguard 4 - Pollution Prevention and Control, Hazardous Materials and Resource Efficiency.

The proposed program will have three components namely:

- Component 1: Production Development,
- Component 2: Integrated Agribusiness and Value Chain Development, and
- Component 3: Project Management and Institutional Support.

2.0 Rationale of the PMP

The objective of the SADP-PMP is to address concerns of relevant stakeholders with regards to pests and pesticides. It stresses the need to monitor and mitigate negative environmental and social impacts of the Program including the use of pesticides and promote ecosystem management with the human health risk being the underlying principle from seed usage, through planting and growth stage as well as post-harvest issues including safe crops for consumption. It emphasizes the need for an integrated approach to the management of pests in line with the country's policy on Integrated Pest Management (IPM) as well as AfDB's requirements on pest management and makes provision for adequate measures to enable SADP sustain the adoption of IPMP techniques.

3.0 Policy, Regulatory and Legal Framework for Pest Management

The following sectoral policies, both national and international, are relevant to the performance and success of SADP as they relate to agriculture, land, water, environmental protection, irrigation and pests and other ancillary activities:

- Ghana's Food and Agriculture Sector Development Policy (FASDEP)
- Ghana 's Medium Term Agriculture Sector Investment Plan (METASIP)
- National Irrigation Policy, Strategies and Regulatory Measures, June 2010
- Guidelines for the National Plant Protection Policy, June 2004
- National Land Policy
- National Water Policy, June 2007
- National Environment Policy
- Environmental Protection Agency Act, 1994 (Act 490)
- Environmental Assessment Regulations, 1999 (LI 1652) and its Amendment of 2002, (LI1703)
- Plants and Fertilizer Act, 2010 (Act 803)
- Water Resources Commission Act, 1996 (Act 522)
- Food and Drugs Act, 1996 (Act 523)
- AfDB Integrated Safeguard System (OS 4 – Pollution Prevention and Control, Greenhouse Gases, Hazardous materials and Resource Efficiency).

- ECOWAS Regulation on the Harmonization of the Rules Governing Pesticides Registration
- International Conventions
- Food and Agriculture Organization (FAO) International Code of Conduct on the Distribution and Use of Pesticides
- World Bank (WB) Environmental and Social Standards (ESS 3 – Resource Efficiency and Pollution Prevention and Management)

The Government of Ghana (GoG) has over the years developed specific legislations and the institutional framework to govern concerns of environmental pollution, plant protection, irrigation, and pest and pesticide management. The applicable laws that pertain to the SADP include the following:

- Environmental Protection Agency Act, 1994 (Act 490)
- Environmental Assessment Regulations, 1999 (LI 1652) and its Amendment of 2002, (LI1703)
- Plants and Fertilizer Act, 2010 (Act 803)
- Water Resources Commission Act, 1996 (Act 522)
- Food and Drugs Act, 1996 (Act 523)

Ghana is a signatory to many conventions on the protection of the environment, which have relevance to the PMP. Some of these conventions ratified by Ghana pertaining to the SADP include:

- International Code of Conduct for the distribution and use of FAO pesticides. AfDB also recommend the use of this Code.
- The Basel International Convention on the Transboundary Movement of Hazardous Waste of March 22, 1989;
- Convention concerning protection against the risks of poisoning due to benzene, adopted in Geneva in 1971;
- The Rotterdam Convention on Prior Information and Contentment Principle (PIC)
- Bamako Convention on the Prohibition of the Import into Africa of Hazardous Wastes and on the Control of Transboundary Movements and the Management of Hazardous Wastes Produced in Africa, adopted in Bamako on 31 January 1991;
- The Basel Convention on Persistent Organic Pollutants (POP's), adopted in Stockholm 22 May 2001;
- International Standards for Phytosanitary Measures (ISPM) FAO;
- The Montreal Protocol on Substances that Deplete the Ozone Layer, adopted on 16 September 1987;
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, adopted on 10 September 1998;
- Vienna Convention for the Protection of the Ozone Layer, adopted on 22 March 1985;
- International Plant Protection Convention adopted on 6 December 1951 and entered into force on 4 April 1991.
- Ramsar Convention on Wetlands for Wetlands of International Importance, adopted on February 2, 1971 and entered into force in 1972.

The enactment of laws and policies particularly the EPA Act of 1994 (Act 490) by Government of Ghana shows its commitment towards the sound management of pesticides. Consequently, the EPA established a pesticide management scheme, which involves the management of pesticides from cradle to grave. However, challenges still exist with regards to effective implementation of the established laws and policies. This has been attributed to the absence of a full complement of relevant regulations to give effect to some of the provisions of the law. There is therefore the need to address the gap in the legal framework and other legislative inadequacies by reviewing and enacting the relevant regulations to enhance compliance. The implementation and enforcement of the established policies and laws have been hindered as a result of low human and institutional capacity. Institutions involved with pesticides regulation or management do have experts with the necessary qualifications. However, issues of institutional concerns include:

- Inadequate experts to handle the enormity of the task involved;
- Poor remuneration and motivation in most state institutions for experts; and
- Inadequate logistics and funds to carry out post registration and licensing monitoring activities on pesticides.

4.0 Environmental and Social Baseline Conditions

All the 9 project beneficiary districts are located within the 5 northern regions which constitute the Northern Savannah Ecological Zone (NSEZ) of the country. They are also known as the Savannah Regions (based on climatic and vegetation characteristics), quite distinct from the recently created Savannah Region. The Northern Savannah Ecological Zone (NSEZ) forms more than half of the total Ghana land surface cover of about 239,000 square kilometres (23.9 million ha). The beneficiary regions lie between latitudes 8° and 11° N and longitude 1° E and 3°W. Togo bounds it to the east, Burkina Faso to the north, Cote d'Ivoire to the west and the high forest ecological zone to the south. The economy of the NSEZ is based mainly on agriculture, which is the basis of livelihood for much of the population. The small-scale family holding is the basic unit of production. A study published by the Northern Presbyterian Agricultural Services (NPAS) and its Partners (ICCO Netherlands and Christian Aid, UK) in 2012 on *Ghana's Pesticide Crisis*, argued that Ghanaian farmers who use chemical pesticides to control insects and diseases on their crops are potentially exposed to pesticides through the skin, or the eyes or through inhalation or ingestion, with key risks being death, cancer, birth defects and damage to the nervous system.

The Ghana Census of Agriculture (GCA), 2017/18 report revealed that agricultural activities in the country remain rural and rudimentary with little mechanisation, innovation, or modernisation. Most agricultural holders use traditional tools and equipment for production whereas the use of modern ones such as tractors, shellers, power tillers, hatchery/incubator, meat processing equipment and milking equipment are negligible. While fertilizer is not used by most holders, the use of pesticides is highly prevalent among holders. Crop cultivation is predominantly dependent on rain and mortality in livestock is high. The sector is characterised by the consumption of own produce. Agricultural production is largely small-scale with most parcels of land used for the cultivation of crops smaller than 2 acres. The level of education among agricultural holders is low with males dominating the sector. In addition to this, the youth, generally, find agribusiness unattractive.

The five beneficiary regions of the Project fall within the Guinea and Sudan Savannah climatic zones (also known as the Tropical continental or savannah climatic zones). The climate is influenced by the movement of two air masses: Northeast Trade Winds and the Southwest Monsoons. These air masses converge at the inter-Tropical Boundary (ITB) which, depending on the season determines the rainfall pattern over the district. The Northern Savannah Ecological Zone is mainly drained by the White Volta and its tributaries Morago, Red Volta, Atankwinda and Asibelika in the Upper East Region (UER), Kulpawn with its tributary, Sisili in the Upper West Region and the Black Volta, Nasia and Oti in the Northern Region. All the principal branches of the Volta flow permanently during the wet periods. In the dry season the volume of water in the rivers of the two upper regions reduce considerably, breaking into pools or drying up at the peak of the dry period. The Upper East and the Upper West regions are underlain by granitoids of post Birimian age while the NR is underlain by sandstones, shales and limestones of the Voltaian system fringed at the west part by the post Birimian granitoids. The granitoids include granitic and gneissic rocks of grey colours and shades of pink. The Savanna High Plains have a gently rolling plain with average heights between 180 and 300 metres above sea level (ASL). Small, rounded hills or inselbergs of Birimian origin can be found occasionally. The most extensive soil type in the study area is the Groundwater Lateritic Soil which covers approximately 75% of the area. The Savannah zone includes the grassland of the north and the derived savannah on the fringes of the forests. The interior savannah contains 1,519 vascular species known to be indigenous or naturalized to the savannah zones of Ghana. The Guinea Savannah consists generally of fire tolerant, deciduous, broad-leaved trees interspersed in a ground flora of mainly grass, sometimes more than 1.5m high. The Sudan Savannah occurs mainly in the Bawku East, Bawku West and Bolgatanga municipalities at the extreme north-eastern corner of the Northern Savannah Zone. Many of the large wildlife species, which are common to tropical Africa, are also found in Ghana. They live mostly in the savannah ecosystem. Populations of many wildlife species found in the savannah have dwindled as a result of human-induced interventions, mainly through over hunting, inappropriate agricultural practices and expansion of agricultural land, road construction and bush burning. Wild animal movement between reserves, groves and sanctuaries in the northern savannah may be limited because these are either fragmented or interspersed with farmlands. Communities outlying protected areas have occasionally had their farms and property destroyed by wild animals mainly elephants that move outside the reserves, particularly in the dry season, in search for water and food.

The main source of energy or fuel for lighting in the Savannah regions is electricity generated by means of hydropower and provided by the Volta River Authority's (VRA) Northern Electricity Distribution Company (NEDCo). According to NEDCo, most households are unable to pay for the electricity and therefore affects revenue generation and expansion of distribution networks. Most households in the NSEZ rely heavily on wood, charcoal and crop residue for cooking and heating. The commonest sources of drinking water in the old Northern Region are borehole/tube well (35.1%), river/stream (17.4%), pipe-borne outside dwelling (12.2%), pipe-borne inside dwelling (8.7%), dugout /pond /lake /dam /canal (7.6%), public tap/standpipe (6.9%), protected well (5.6%) and unprotected well (4.2%). In the Upper West Region, the use of borehole/pump/tube well was the most common, accounting for almost two-thirds (64.2%) households in the region.

Livestock rearing is the second most important agricultural activity after crop farming in the Savannah Zones. The dominant livestock reared in the project areas include cattle, goats, sheep, chicken, Guinea fowl and pig. Livestock production has been practised over the years on free range systems by households and herdsman in the project area. With respect to aquaculture and fishing, the major rivers such as the Red, Black and White Volta run through the area and their potential for inland fisheries is very significant. Commercial poultry production in Ghana can be categorized into large-scale (over 50,000 birds), medium-scale (10,000 – 50,000 birds) and small-scale (less than 10,000 birds) enterprises. Domestic commercial farms are privately owned by individuals or a family. However, they form only about 20% of the total poultry sector, producing mainly eggs. The medium-scale and the small-scale categories comprise 80% of the poultry sector and rely on hatcheries for their day-old chicks and feed mills for their feed. The medium-scale category also produces primarily eggs. Included in the small-scale category are backyard poultry producers who mainly produce broiler birds. In terms of annual average values, imports of poultry meat rank highest recording a value of \$88,284,107 for the years 2016-2020. Similarly, poultry meat ranks topmost in terms of local production within the livestock sector. Ghana's poultry feed industry has shifted to producing layer feed due to the drop off in domestic broiler production. About 80% of feed produced by commercial feed millers is layer feed. Broiler feed is primarily purchased by small-scale backyard poultry producers. The average amount of compound feed produced in Ghana is about 10,000MT annually in the past few years, with the greatest being produced from Soya bean and Copra cake. The Animal Production Directorate (APD) and the Veterinary Services Directorate (VSD) of the Ministry of Food and Agriculture (MoFA) have the oversight responsibility of the Poultry sector and other animals/livestock. While APD oversees production issues, VSD takes care of health. Their roles are to ensure effective and efficient implementation of government policies on livestock and poultry. Formal training in livestock production and health is provided by agricultural colleges run by the Human Resources and Manpower Development Directorate of MoFA and the Universities. Some Technical Universities and newly established universities provide training in aspects of animal science. Each of the Savanna regions consists of at least three ethnic groups and spoken languages are varied accordingly. Islam is the dominant religion in all 5 Northern Regions, whereas Traditional and Christian religions are prominent in the Upper East and Upper West Regions respectively.

5.0 Existing and Anticipated Pest and Disease / Management Practices

5.1 Major Pests and Diseases of Cereals, Pulses/Grain Legumes

The use of highly persistent and toxic chemicals will be avoided and prohibited in pest management during the PMP implementation for the SADP. Natural pest control methods would be employed to effectively reduce or eliminate pest or disease infestation without harming humans, crops and other organisms like chemicals sometimes do. The PMP describes the major pests and diseases associated with the major crops targeted under this program i.e. grains (maize), pulses / grain, legumes (soya bean/soybean) and cereals (rice) which involve the application of agro-chemicals and inputs such as fertilisers, herbicides, insecticides, nematicides and fungicides.

5.2 Major Pests and Diseases in Livestock Production (Poultry)

Activities related to poultry production would involve the use of pesticides and vaccines to avoid infestation and infection. The PMP describes the major pests and diseases associated with poultry production. The VSD has used various strategies across the country to control and contain outbreaks of diseases. These included spatial strategies such as movement prohibition, quarantine, restriction, regulatory services, and encouragement of community participation and non-spatial strategies of animal health programs such as immunization and prophylactic treatments. Lice infestations in poultry production can cause up to 100%

drop in egg production in layers. They equally infest humans most especially personnel working in the poultry farms and with unhygienic conditions in their homes (they are sometimes brought on them in their clothes to the house or when their local chicken in their houses are infested). The ectoparasites cause irritation on the bird, interfere with the feed consumption and thus are associated with emaciation, anaemia and eventually loss of production, hence the control and management plan of these ectoparasites in the poultry industry. Over the years, diseases such as *Newcastle*, *Infectious Bronchitis*, *Coccidiosis*, *Avian Influenza* etc. have been detected as the most prevalent poultry diseases in various poultry farms across the country. The recent outbreak of the Avian influenza affected 554,638 birds and 2,548 crates of egg destroyed as at December 2021 (MoFA, 2022). This was attributed to the lack of farmers' adherence to biosecurity measures. The under-listed diseases and pests are the most frequently observed diseases in livestock (poultry) by the VSD:

5.3 Pest Problems and Control Practices

Some of the common pests envisaged in the SADP targeted areas include rodents and migratory and outbreak of pests such as locusts, borers, caterpillar, nematode, aphid, mealy bug. IPM strategies are recommended and used by some farmers as long as it is possible because there is no one control practice that can provide acceptable control of the target pest. Rodents, particularly the field rats (*Rattus rattus*), the small house mice (*Rattus norvegicus*) and the multimammate or shamba rat, (*Mastomys natalensis*) are key pests of food crops. Zoonotic diseases are caused by harmful germs like viruses, bacteria, parasites, and fungi. These germs can cause many different types of illnesses in people and animals, ranging from mild to serious illness and even death. Some zoonotic diseases associated with rodents and of public health importance include leptospirosis, Lassa Fever, Rat Bite Fever, Salmonellosis and many more which are of bacteria and of viral origin. They are either transmitted through the bite or scratch wound from an infected rodent, by eating or drinking food or water that is contaminated by rat feces or by breathing in dust that is contaminated with rodent urine or droppings. Diseases spread by fleas and ticks are transmitted when these insects (pests) feed on the blood of a host (human, cat, dog or ruminants). Fleas and ticks are externally parasitic to dogs, cats, humans and many small mammals. Different species of fleas and ticks are vectors of specific viruses, bacteria or protozoal parasites. Some of the diseases of zoonotic importance are Parasitic Dermatitis, Parasitic Dermatitis, Bartonella, Erlichiosis, Meningoencephalitis, Rickettsiae and Tapeworms.

The most affected crops are the orange-fleshed sweet potato (OFSP), soybeans, pawpaw and cabbage. The damage caused by rodents starts at early booting and continues through the mature stage as well as the storage stage. The key migratory and outbreak pests of economic significance in Ghana are armyworms (*Spodoptera exempta*), birds, and the red locusts. Locusts live and breed in numerous grassland / savanna plains / zones. The African armyworm (*Spodoptera exempta*) is a major threat to cereal production in many African countries. It is a major pest of cereal crops (maize, rice, sorghum, and millets) as well as pasture (grass family) and therefore a threat to food security and livestock. The problem with armyworms is that they are highly migratory so that larval outbreaks can appear suddenly at alarming densities, catching farmers unawares and unprepared. Invasive alien species such as Witch weeds, Siam weed, Water hyacinth and the Invasive Fruit fly have become a problem in diverse ecosystems in Ghana. They affect both savannahs and tropical forests and they are found on land, in freshwater systems and along the coast in the country and have had a huge adverse effect on the production of cereals such as maize and rice. Climate change, trade liberalization, and agricultural intensification (increased fertilizer use, introduction of new crops and varieties, changes in land use and landscape etc) could cause the occurrence of new pest problems.

5.4 IPM Strategy for Pest Control

The EPA generates and publishes a list of approved and registered chemical pesticides for use by farmers. Additionally, there is a list of banned pesticides. This list is updated periodically with the last update in 2021. These pesticides are tested to improve the quality of the pesticides used i.e., the reduction of the toxicity and the increase of the efficacy. The integrated pest management is the adopted strategy for the fight against pests in Ghana. However, the use of the integrated combat is not widespread despite the efforts undertaken. The use of pesticides is increasing despite the high cost of the products relative to the financial capacity of majority of farmers. Research Institutions in Ghana have had some good results regarding the efficient use of botanical or organic products. The Plant Protection & Regulatory Services Directorate

(PPRSD) of MoFA through the support of international development partners including the German Development Cooperation (GTZ) and United States Agency for International Development (USAID), has developed separate booklets and manuals to serve as extension guides on integrated pest management practices for food production.

The national IPM approaches developed for cereals and pulses are largely based upon 15 principles, practices and what happens in each case. Preventive Fight Methods are usually applied for pests such as locusts whereby regulatory bodies collaborate with international partners during the indicated periods of the year in order to follow the evolution of the situation of the populations. Surveillance of other agricultural pests is the responsibility of farmers. However, plant protection services also identify pests to determine areas at risk of infestation that compromise food security. The use of drones for pest management is also a method the PPRSD is looking forward to using to make pest control/management easier and faster. The curative fight methods require that locust invasions are managed at the national or even sub-regional level. Farmers encountering pest problems usually rely on competent MoFA extension services to receive control advice that they will apply in the field. Additionally, the decentralization of the PPRSD offices across the country plays a very important advisory role at this level. Neem grains and other pesticide mixtures help control the diseases and pests identified in the target crops. Additionally, sub-regional initiatives led by Institut Togolaise de Recherche Agronomique (ITRA) and Institut de Conseil d'Appui Technique (ICAT) in Togo have led to convincing results. The use of chemical pesticides is being replaced by biocidal plant extracts such as "neem" (*Azadirachta indica*), *Lannea microcarpa*, red pepper, cow dung, etc., which are used as a natural pesticide.

5.5 Alternatives to Pesticides

Over the years, efforts have been made particularly by the research institutions to develop alternative products to the use of agro-chemical products especially containing POPs (Persistent Organic Pollutants) with the aim of reducing the use of pesticides in agriculture and the areas of use of these pesticides. These alternatives include cultural control, physical control, genetic control, integrated pest management, biological control, the use of bio-pesticides, the use of pesticides of the organophosphorus family, carbamates, pyrethroids, etc. During the consultative processes for the development of this PMP, farmers demonstrated knowledge and understanding of alternative products to pesticides. They indicated practices such as the use of neem grains, or bark of cailcédrat as bio-pesticides; the use of oxen or goats' excrement to protect crops against ruminants; sands, ashes, chilli powder for the preservation of corn, and others (powders of mahogany bark, neem leaves) as alternatives to pesticides application. Farmers are also aware of cultural techniques such as cultural association, crop rotation, transplanting, organic manure, etc. Nonetheless, they indicated their preference for chemical pesticides due to their efficacy, and accessibility to treat large areas as compared to the alternative approaches.

6 Key Pests and Recommended Management Practices

One important aspect of the IPM approach is the role of natural enemies, or beneficials. Natural enemies are the predators and parasites, parasitoids and beneficial micro-organisms that attack crop pests and disease organisms. The PMP report provides information on the major natural enemies and the pests they feed upon, and provides recommended IPM practices for the cereals, pulses / grain and legumes targeted under the SADP.

Appropriate IPM strategies have also been identified by the PMP to minimise losses due to:

- damage caused by the larger grain borer, weevils, rats/rodents, aflatoxins, and grain moths. Biological control of the Large Grain Borer (LGB) using *Teretriosoma nigrescens* (*Tn*) to minimise infestation from wild sources will be beneficial once appropriate strains of the *Tn* are identified and validated; and
- damage caused by post-harvest pests of pulses including the storage weevil for cowpea and soybean and the storage beetle and grub for groundnuts.

The PMP also identifies several considerations for the application of pesticides for cereals and pulses. These include the following:

- A decision to use chemical pesticides should be taken only as the very last resort and should also be based on conclusions reached from an agro-ecosystem analyses (AESAs).
- All pesticides should be EPA-approved and PPRSD recommended.
- If it is necessary to spray crops with pesticides use selective rather than broad-spectrum pesticides.
- All herbicides should be applied using knapsack sprayers.
- All the insecticides for storage pests of cereals/pulses are in dust form and therefore used as supplied without mixing with anything else.
- The list of pesticides can change as new products are recommended and/or some of the chemicals are withdrawn. Therefore, always consult the retailer/stock list, the nearest PPRSD extension worker if in doubt and/read the label.

6.1 Controlling Pesticides used in Crop Protection

To ensure the efficient use of the pesticides for the fight against crop pests/diseases, the maximum residue limits (MRL) have been defined by European markets/EU standards. Where undefined, the Food Code / Codex Alimentarius” (a collection of international standards, guidelines and codes of practice to protect the health of consumers and ensure fair practices in the food trade) is considered. Ghana is required to comply with sanitary and phytosanitary measures (SPS) and especially the pesticides residue values available in farm products that should not exceed the acceptable maximum residue limit, otherwise produce from Ghana will be banned. Every pesticide produced in Ghana and imported is expected to be subjected to approval.

In West Africa, there are no industrial units ensuring the synthesis of active materials through branded laboratories. Thus, the production of pesticides in the proper way is not effective in the whole of these countries. Finished products are rather imported notably through mother companies represented at the national level or active matters for formulation purposes. The distribution channel is entirely private. Suppliers who import the products feed the market through distributors, and retailers who supply traders and they display for sale. Certain distribution spots – sales point- are well kept and abide by commercial rules; in general, the products are well displayed on shelves. However, at the level of many retailers and traders who display for sale there are great risks. Because of the low financial capacity of local farmers / peasants and other buyers, some of the products are sold in retail. This practice is carried out without caution notably with decanting. The management of pesticide containers is under the responsibility of resellers and farmers because of the retail sales system. However, facilities for the treatment of large empty containers are not known to be installed or in use in the country now.

6.2 Pesticides and their Use for Livestock Pest Management

The principles of integrated pest management (IPM) apply to the operational practice of pest control for animals, whether the pests are on the animals or in the environment the animals occupy. Establishing an IPM program for pests of animals under SADP therefore will be guided by the following five standard steps for managing any pest (weeds, diseases, etc.). These five (5) principal elements of the process include: Detection; Identification; Economic Significance; Control Method Selection; and Evaluation. SADP anticipates that the following classes of Insecticides / Acaricides will be used: Chlorinated hydrocarbons; Organophosphates, and others such as carbamates, synthetic pyrethroids, lime sulphur, botanicals, etc.

Insecticides and acaricides formulations vary widely and must be selected to fit the situation or need. The PMP has identified the various formulations that may be used but their applications must be based on effectiveness, practicality, cost and relative safety to humans, the animal being treated and the environment. The main pests and diseases discussed in the PMP are lice, mites, chiggers, fowl ticks, bed bugs, flies, as well as the Newcastle disease, Infectious Bursal Disease (IBD) / Gumboro, fowl pox, Chronic Respiratory Disease, and Coccidiosis. Some female ticks lay eggs on the host, others on the ground. Depending upon the species of tick, somewhere between 1,000 and 18,000 eggs are released. The eggs will hatch in the summer, thus beginning the larvae stage again. The tick and flea life cycle typically lasts around 12 days, and this informs why the control programme (dipping of pets/livestock and acaricide application on the infested premises) requires forth nightly (every two weeks) application for about a month.

7 Stakeholder Engagement Planning and Outcomes

Stakeholders in the field of pest and vector management were engaged to obtain the full support of key actors within the sector to promote the effective implementation of the PMP. Stakeholder involvement in

the development of the PMP was a participatory process involving interactions between technical resource persons and various stakeholders including:

- Government institutions directly or indirectly involved in pest or vector management;
- Anchor farmers and their out-growers;
- Agricultural importers and exporters organizations;
- Non-Governmental Organizations;
- Agrochemicals industry;
- Private crop protection advisory firms;
- Producers of biological control agents; and
- Bilateral and multilateral development partners.

A Stakeholder Identification Matrix (SIM) was used to help identify and elicit inputs from the various stakeholders with respect to their relevance for involvement in the engagement/consultation processes. The review of the relevant legislation of incorporation and institutional mandates also defined the relevance of the identified stakeholders to the assignment and their areas of interest in order to identify the key issues of engagement. The key stakeholders identified have been listed under the respective category in the Table below:

Government Ministries (Sector Oversight)/Actors	NGOs /Civil Society/ Associations
<ul style="list-style-type: none"> ➤ Ministry of Food and Agriculture (MOFA): • Directorate of Agricultural Extension Services (DAES) • Directorate of Crop Services (DCS) • Plant Protection & Regulatory Services Directorate (PPRSD) ○ Crop Pest and Disease Management Division ○ Pesticides and Fertilizer Regulatory Division ○ Ghana Seed Inspection Division ○ Plant Quarantine Division • Veterinary Services Directorate (VSD) • Animal Production Directorate (APD) • Anchor Farmers-Out Growers (AnFoG) 	<ul style="list-style-type: none"> ➤ CropLife Ghana (CLG) ➤ Ghana Agri-Input Dealers Association (GAIDA) ➤ Pesticides Importers Association (PIA) <div style="background-color: #f4a460; padding: 2px;">Enforcement Agencies</div> <ul style="list-style-type: none"> ➤ Customs Division (CD) of the Ghana Revenue Authority (GRA) ➤ Ghana Police Services (GPS) <div style="background-color: #f4a460; padding: 2px;">Regulatory Institutions</div> <ul style="list-style-type: none"> ➤ Environmental Protection Agency (EPA) ➤ Ghana Standards Authority (GSA) ➤ Food and Drugs Authority (FDA)

During the stakeholder engagement, several issues were identified and prioritized by stakeholders to improve pest and pesticide management. At the institutional, legislative and regulatory level, issues such as porosity of national borders which allow for the influx of banned chemicals into the country; non-compliance with the regulations; insufficient regulation; lack of database on diseases in animal production; lack of quarantine infrastructure (station); need for capacity building; lack of awareness / absence of confirmation of farm animal diseases by the VSD; inadequate human resources, equipment logistics and financial resources for the field monitoring of IPM approaches were identified as the main concerns. Monitoring is also a major concern for stakeholders with issues such as lack of personnel and equipment in assessing the impacts of pesticides and insufficient control over the use of pesticides identified. Inaccessibility of approved pesticides near farmers, lack of efficient treatment and waste disposal systems at the farms and insufficient extension of alternative methods to pesticides and integrated pest management were also identified as concern by farmers. Farmers also raised concerns on issues regarding lack of regular training for farmers on pesticide use and management of empty containers, inadequate information on the dangers related to the use of pesticides and illiteracy of the populations.

8 Potential Impacts and Challenges Associated with SADP Interventions

The use of various agro-chemicals especially pesticides is a common feature of crop and animal production activities across the country and is expected to intensify during the implementation of the SADP

interventions. The PMP assesses the potential risks / impacts associated with the procurement, transport, storage, use / handling and disposal of pesticides. The PMP also discusses into detail the major risks and impacts likely to be associated with the use of pesticides under interventions envisaged as part of the SADP. These include the following:

- Impact of pesticides on waterbodies;
- Impact of pesticides on poultry birds;
- Impact of pesticides on aquatic life;
- Public health concerns from water-borne or water-related diseases;
- Mycotoxin poisoning from poor maize drying;
- Improper pesticide-use and disposal of pesticide containers;
- Abuses in pesticide supply and sales; and
- Production losses and food security concerns from Armyworm and other crop pests and disease outbreaks.

9 Integrated Pest and Pesticide Management Action Plan

The main purpose of the plan is to protect the biophysical and human environment through the promotion of the use of integrated pest management methods, capacity building of farmers, destruction of obsolete stocks, environmental impact assessment of agricultural development projects such as the SADP likely to use a considerable quantity of pesticides, the management of empty containers and the supply of protection and spraying equipment to farmers. The Integrated Pest and Pesticide Management Action Plan addresses the various impacts and challenges which are likely to be associated with the implementation of the Program regarding pest and pesticide management issues. Appropriate mitigation measures and implementation tools as well as monitoring indicators required to be instituted to contain any adverse impact or risk assessed and discussed are identified as well in the PMP. The key actors to be involved in the implementation of the IPMP have been identified as well.

9.1 Programme to meet PMP Requirements

SADP will adopt the following specific strategies to achieve an effective pest and pesticide management process:

- Formation of a Safeguards Team
- Registration and training of all interested pesticide distributors/resellers
- PMP Communication and Orientation Workshop
- Education and Awareness Creation
- Participatory Pests Inventory and Monitoring Measures
- Stakeholder Consultation and Involvement
- Prevention of new Pest Infestations
- Management of established Pests
- IPM Capacity Building
- Institutional Arrangements and Training Responsibilities
- Participatory Monitoring and Evaluation
- Sustainability Issues
- Monitoring
- Management Reviews
- Institutional arrangements for the implementation and monitoring of the PMP

9.2 PMP Implementation Budget

A breakdown of the costing for activities identified in the PMP implementation over a tentative 5-year period is provided in the full PMP Report as a guide. It is estimated that an amount of about USD613,500.00 will be required to implement the PMP over the 5-yr period, with an average yearly investment requirement of about USD122,700.00.

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