REPUBLIC OF THE GAMBIA

MINISTRY OF AGRICULTURE

PEST/VECTOR MANAGEMENT PLAN (PMP)

FOR THE MINISTRY OF AGRICULTURE

PROPOSED REGIONAL RICE RESILIENT VALUE CHAIN DEVELOPMENT PROGRAM (REWARD) AT THE GAMBIA

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JUNE, 2024

Document code; 130624

Document Details	
Document Title	Pest/Vector Management Plan (PMP) for Regional Rice Resilient Value Chain Development Program (REWARD), the Gambia
Document Subtitle	Final Report
Document Code	130624
Date	13 June 2024
Version	5.0
Author	Richflood Team
Client Name	Ministry of Agriculture, the Gambia

Document History

				Approval to issue		
Version	**Revision**	**Author**	**Reviewed by**	**Name**	**Date**	**Comments**
Preliminary Draft	1.0	Richflood Team	Richflood Quality Control Team	Dr. Comfort Asokoro-Ogaji	23 February 2024	Addressing internal QC comments
Working Draft	2.0	Richflood Team	Richflood Quality Control Team	Dr. Comfort Asokoro-Ogaji	16 April 2024	Addressing RVCTP comments
Draft	3.0	Richflood Team	Dr. Adeola Adewale-Olajugbagbe	Dr. Comfort Asokoro-Ogaji	09 May 2024	Addressing AfDB comments
Draft Final	4.0	Richflood Team	Dr. Adeola Adewale-Olajugbagbe	Dr. Comfort Asokoro-Ogaji	24 May 2024	Addressing NEA comments
Final	5.0	Richflood Team	Dr. Adeola Adewale-Olajugbagbe	Dr. Comfort Asokoro-Ogaji	13 June 2024	

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LIST OF ACRONYMS

AES	Agricultural Engineering Services
AfDB	African Development Bank
ANR	Agriculture and Natural Resources Policy
AOI	Area of Influence
BCAs	Biological control agents
CILSS	Committee for Drought Control in the Sahel
CPCU	Central Project Coordinating Unit
CRR-N	Central River Region North
CRR-S	Central River Region South
CSP1	The Sahelian Pesticide Committee
CVS	Civil Society
DoA	Department of Agriculture
DoF	Department of Forestry
DWR	Department of Water Resources
ECOWAS	Economic Community of West African States
EHS	Environment Health and Safety
ESAP	Environmental and Social Assessment Procedures
ETL	Economic Threshold Level
FAO	Food and Agriculture Organization
FSQA	The Food Safety and Quality Act
GEAP	Gambia Environmental Action Plan
GHE	Gambia Horticulture Enterprises Co
GNAIP	The Gambia National Agricultural Investment Plan
GoTG	Government of the Gambia
INSAH	Institut Du Sahel
IPM	Integrated Pest Management
IVM	Integrated Vector Management
IWRM	Integrated Water Resources Management
JMPM	Joint Meeting on Pesticide Management
LMICs	low- and middle-income countries
MECCNR	Ministry of Environment Climate Change and Natural Resources

MoA	Ministry of Agriculture
MOFEA	Ministry of Finance and Economic Affairs
MOENV	Ministry of the Environment
MOH	Ministry of Health
MOTIE	Ministry of Trade, Industry, Regional Integration and Employment
MSDS	Material Safety Data Sheet
NARI	National Agricultural Research Institute
NAPA	National Adaptation Plan of Action
NEA	National Environment Agency
NGOs	Non-Governmental Organizations
NMCP	National Malaria Policy
PIU	Project Implementing Unit
PMP	Pest/Vector Management Plan
PPS	Plant Protection Services
RAD	Regional Agricultural Director
RC	Regional Coordinator
REWARD	Regional Rice Resilient Value Chain Development
RVCTP	Rice Value Chain Transformation Project
SWMS	Soil and Water Management Services
TSN	Technical Services Network
URR	Upper River Region

ES 1 Introduction

The Regional Rice Resilient Value Chains Development (REWARD) Programme is being implemented by the Government of The Gambia (GoTG) through the Ministry of Agriculture to contribute to food and nutrition security, reduce rice imports, and stimulate economic growth, with specific goals of increasing rice production, promoting market-driven farming, and enhancing the role of the private sector in the rice value chain.

The Program which will be implemented in 2 regions of the country will be used as an instrument to implement the National Rice Development Strategy (NRDS II, 2022-2030) and the Continental Investment Plan for Self-Sufficiency in Africa (CIPRiSSA, 2019-2029), which seeks to attain rice self-sufficiency in Gambia by 2030. The main objective of the REWARD program is to help attract more investments and upscale successful models with the view to increasing rice productivity, production, processing, and marketing, bridging the rice self-sufficiency gap, reducing import bills, and creating gainful employment, particularly for women and the youth within the ECOWAS region by 2028, with increased regional networking and cross-border market opportunities.

This Pest/Vector Management Plan (PMP) has been developed in direct response to the risk of pests and diseases and to guide the operation of the REWARD Programme 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 four components namely:

- Development of sustainable climate-resilient rice production systems to ensure adequate production of quality rice paddy to supply millers
- Development of rice processing clusters, agribusiness, and market links for trade facilitation
- Support to policy/regulatory reforms and harmonization at the regional/national level to ensure a competitive rice value chain for imports
- Program Coordination and Management

ES 2 Rationale of the PMP

In The Gambia, several major pests and diseases have been documented affecting rice cultivation. These include rice stem borers, which are associated with the disease known as blast. Rice leafhoppers are linked to sheath blight, while the rice gall midge is known to cause bacterial leaf blight. Additionally, the rice bug is associated with brown spot disease, and armyworms are known to cause narrow brown leaf spots. Grasshoppers have been identified as vectors for the rice yellow mottle virus. Therefore, the objective of the REWARD-PMP is to address the concerns of relevant stakeholders with regard 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 REWARD to sustain the adoption of IPMP techniques.

ES 3 Policy, Regulatory and Legal Framework for Pest Management

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

- The Gambia Environment Action Plan, GEAP III (2021-2030)
- The Agriculture and Natural Resources Policy (ANR 2017-2026)
- The National Nutrition Policy 2010-2020
- Food Safety and Quality Act, 2011
- The Gambia National Water Policy (2006)
- The National Climate Change Policy, (2016-2025)
- National Adaptation Plan of Action (NAPA) on Climate Change (2007)
- The National Health Policy, 2021-2023
- National Malaria Policy, 2020–2025
- 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
- Environmental and Social Assessment Procedures (ESAP)
- The Permanent Interstate Committee for Drought Control in the Sahel (CILSS-Comité permanent Inter-états de Lutte contre la Sécheresse dans le Sahel.)
- International Conventions
- Food and Agriculture Organization (FAO) International Code of Conduct on the Distribution and Use of Pesticides
- FAO Guidelines on Good Practice for Ground Application of Pesticides (2001)
- FAO Guidelines on Management Options for Empty Pesticide Containers (2008)
- FAO/WHO International Code of conduct on pesticide management, guidelines for personal protection when handling and applying pesticides (2020).

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

- National Environmental Management Act, 1994
- Hazardous Chemicals and Pesticides Control and Management Act, 1994
- Hazardous Chemicals Regulation, 1996
- Pesticides Licensing Regulation, 1994
- Pesticides Registration Regulation, 1994

- Environmental Quality Standards Regulation, 1999
- Environmental Impact Assessment Regulations, 2014
- Environmental Discharge Regulations, 2001
- Local Government Act, 2022
- Plant Importation and Regulation, Act
- Public Health Act, 1990

ES 4 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: REWARD CPCU/PIU, implementers partners (MOA, PPS, NEA, MECCNR), Regional Technical Advisory Committees (TACs), Representatives of Central River Region (CRR) North; Representatives of Central River Region (CRR) South; Representatives of the Upper River Region (URR); CPCU Coordinating Members, National Farmers Platforms, NGOs and Community representatives. Subsequently, meetings were held at various communities.

During stakeholder engagement, several issues were identified by stakeholders aiming to enhance the PMP. These include incidence of pests and plant diseases, lack of awareness about overusing pesticides, including smuggled and expired pesticides, lack of adequate pesticide storage on the farm, lack of knowledge of withholding period before harvest, application of pesticides without proper personal protective equipment (PPE), lack of pesticide management knowledge (type, time, doses, etc.), spread of pesticide odours and sprays to the adjacent neighbourhood and bad handling and disposal of pesticides.

Monitoring is also a major concern for stakeholders, encompassing issues such as the shortage of personnel and equipment for assessing pesticide impacts, the inaccessibility of approved pesticides by farmers, and the lack of efficient treatment and waste disposal systems at rice fields. Farmers have also expressed concerns about the lack of regular training on pesticide use, management of empty containers, inadequate information regarding the dangers associated with pesticide use, and the illiteracy of the farmers.

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.

ES 5 Potential Impacts and Challenges Associated with the REWARD Program

The use of various agrochemicals especially pesticides is a common feature of rice production activities across the country and is expected to intensify during the implementation of the REWARD Program. The PMP assesses the potential risks/impacts associated with the

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

- Improper choice of pesticides;
- Damage, leakage/spillage, and contamination during storage, handling and disposal;
- Exposure of aquatic life and wildlife to intoxication;
- Spillage and pollution of water resources and aquatic resources from pesticide use;
- Poisoning from improper use or administration of the pesticides;
- Impact from improper disposal of pesticide containers (drums);
- General health and safety of communities and environmental hazards.

The mitigation measures include (non-exhaustive):

- Preventive Strategy which consists of permanently monitoring pests in their primary habitats to allow for early warning and early reaction with well-targeted control operations;
- The pest control measures start with the selection of proper and recommended pesticides.
- Active ingredients should be listed among those pesticides for which effective doses against pest control are verified by the Pesticide Referee Group (PRG) and the national registration authorities.
- Private sector companies providing pesticides should be trained on poisoning and accident prevention and dealing with emergencies such as spillage or fire.
- Implementation of the Integrated Pest Management approach.
- Environmental and Human Health Monitoring and Management, including: (i) quality of the control operations and calibration of the spraying equipment; (ii) occupational health monitoring; environmental health monitoring; (iii) provision of sufficient and qualitative Personal Protective Equipment (PPE); (iv) consumer health monitoring; and (v) pesticide empty containers management and treatment efficacy assessments.

ES 6 Integrated Pest 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, and environmental impact assessment of agricultural development projects such as the REWARD Program 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 Management (IPM) Action Plan addresses the various impacts and challenges that are likely to be associated with the implementation of the Program regarding pest 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.

Programme to meet PMP Requirements

REWARD will adopt the following specific strategies to achieve an effective pest 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

PMP Implementation Budget

The breakdown of the costs for the activities identified in the PMP implementation is provided in the PMP Report. The estimated budget for the implementation of the PMP is USD 238,000.

ES 7 Conclusion and Recommendation

The Regional Rice Resilient Value Chains Development (REWARD) Programme represents a significant effort by the Government of The Gambia to enhance food security, reduce rice imports, and stimulate economic growth through improved rice production and market integration. The Pest Management Plan (PMP) is a critical component of this program, addressing the risks associated with pests and diseases, and ensuring compliance with national and international regulations. The successful implementation of the PMP will be instrumental in achieving the REWARD Programme's goals. It is recommended that continuous monitoring and evaluation mechanisms be established to assess the effectiveness of pest management strategies. Additionally, enhancing farmer education and training on safe pesticide use and integrated pest management practices is essential. Strengthening institutional capacities and ensuring the availability of resources for pest management will further support the sustainability and impact of the REWARD Programme. By adopting these recommendations, The Gambia can make significant strides towards rice self-sufficiency and improved agricultural productivity.

CHAPTER I:

INTRODUCTION

1.1 Background of the Project

The Government of The Gambia (GoTG) through the Ministry of Agriculture plans to undertake the Regional Rice Resilient Value Chains Development (REWARD) Programme with support from the African Development Bank (AfDB) in the rice fields and valleys of the Central River Region (CRR) and Upper River Region (URR). The project seeks to contribute to food and nutrition security, reduce rice imports, and stimulate economic growth, with specific goals of increasing rice production, promoting market-driven farming, and enhancing the role of the private sector in the rice value chain.

The cultivation and processing of rice for the Regional Rice Resilient Value Chains Development (REWARD) program at the selected intervention sites may directly or indirectly require the use of pesticides and fertilizers to improve the yield and the quality of the rice as well as for the control of pests. However, the uncontrolled use of certain chemical products and fertilizers, particularly pesticides in the control of endemic contexts or migratory pests (depending on their nature or mode of use) may cause socio-economic and environmental damages that may be permanent if precautions are not taken, thus compromising the achievement of the objectives of REWARD program. It is from this standpoint that this Pest/vector Management Plan (PMP) has been developed to mitigate the impacts associated with the use of fertilizers and pesticides.

In addition, concerning the activities and investments that will be funded within the framework of this project, the REWARD operational policy dealing specifically with pest management is activated. Thus, in accordance with the policy of the Africa Development Bank (AfDB) and Gambia's regulations on environmental and human health protection, this PMP has been prepared to allow the rational use of chemical products (fertilizers, pesticides,) in the implementation of this project and especially to encourage integrated management with less dangerous consequences on the environment, human and animal health.

1.2 Pest/Vector Management Plan (PMP) Approach

The African Development Bank Operational Safeguard 4 (Pollution prevention and control, hazardous materials and resource efficiency) and FAO guidance document for Pest/Vector Management in Field Projects have been used to prepare this Pest/Vector Management Plans (PMP) for the REWARD Project. Similarly, the World Bank Policy on Pest Management (OP 4.09) promotes the use of biological or environmental control methods and reduces reliance on

synthetic chemical pesticides. Therefore, the Pest/vector Management Plan (PMP) describes the strategy and activities to ensure compliance with international best practices.

The methodological approach adopted in the preparation of the PMP was based on data collection, fieldwork, assessment of the impacts and risks associated with pesticide use practices and the proposal of measures. The required data was obtained in two (2) ways, namely: literature review and interviews with the various stakeholders to deepen some aspects and understand the pests prevalent in the intervention areas. The literature review covered the works relating to pest control and pesticide management, environmental protection and water resources management, legislative and regulatory texts, project documents and environmental impact assessment reports carried out in the same area and for similar types of activities.

These data were supplemented and consolidated by interviews with actors in the field to:

- Obtain biophysical data (soil map, geomorphological map, vegetation or occupation map, description of the fauna, climatic data, various waterbodies maps, etc.)
- obtain the existing management plan for Pest/Vector;
- obtain information on the main rice pests in the project intervention areas and the control methods commonly used;
- Specify the political, legal and institutional framework of the study with regard to the management of Pests/Vectors on the one hand, and identify the mandates of the different actors concerned at both national and local levels on the other hand.

This approach made it possible to describe and analyse the current conditions of pesticides used in the Gambia and to describe and analyse the current state of the agricultural environment and the hydro-agricultural development areas. The development of good practice measures was based on:

- identification of pests and predators in the project area;
- identification of current methods and strategies for controlling pests;
- choice of alternative methods;
- measures to protect water, soil, fauna and flora against the pesticides;
- community and participatory management by residents, communal authorities, etc.;
- Identification and analysis of the current state of the agricultural environment and the hydro-agricultural development areas.

1.3 Objectives of the Pests/Vector Management Plan (PMP)

1.3.1 General Objectives

The purpose of this document is to describe a Plan[1] by which the project can promote and support safe, effective, and environmentally sound pest management in agricultural interventions undertaken under REWAD. The overall objective of this Pests/Vector Management Plan (PMP) is to ensure that proper measures will be implemented for adequate storage and use of fertilizers and pest management to mitigate any potential risks to farmers or community health and safety. And to enable stakeholders involved in the REWARD Project to monitor and mitigate any negative potential environmental and social impacts associated with the use of pesticides and fertilizers.

The World Bank's Operational Policy 4.09 defines integrated pest management as a mix of farmer-driven, ecologically based pest control practices that seek to reduce reliance on synthetic chemical pesticides. It involves:

- Managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them;
- Relying, to the extent possible, on non-chemical measures to keep pest populations low; and
- Selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment.

1.3.2 Specific Objectives

A Pest/Vector Management Plan (PMP) is a broad ecological approach to pest control (insects, diseases, weeds, rodents etc.) employing all methods and techniques viz. cultural, mechanical, genetic, regulatory, biological and chemical in a compatible manner to keep pest population below the economic threshold level (ETL).

The specific objectives of this PMP are to provide insights into the following issues:

- Environmental and Social Consequences of Pest Management Practices
- Current approaches to pest management in the agricultural sector in the Gambia

[1] The PMP draws upon the World Bank Group's Environment, Health and Safety Guidelines for Annual Crop Production.

- Current issues in the use and management of synthetic chemical pesticides in the Gambia and the agricultural sector
- Circumstances of use of pesticides and competence to handle chemical products
- Controlling the distribution and use of pesticides and chemical fertilizers
- Ability to manage/ dispose of obsolete pesticides and polluted pesticide containers
- Raise the institutional capacity of the country to promote and support safe, effective, environmentally, and socially sound pest management practices and provide appropriate technical assistance for the successful implementation of the PMP for the REWARD.
- Promote the use of alternative methods of pest management. (e.g. bio-pesticides)
- Define the institutional arrangements for monitoring and surveillance to be taken before, during and after the applications of the pesticides to mitigate the related environmental and social impacts.
- Ensure compliance with national laws, regulations, World Bank safeguards policies and standards and Gambia Guidelines on pesticide and fertilizers use.
- Ensure taking special precautions at all stages of agriculture production, i.e., before, during and after pest control and fertilizer cycle including insecticide selection, updating contingency plans, ordering personal protective equipment, organization of monitoring of human health, and the environment and training.

1.4 Report Structure

This report is structured around the following:

- a full description of the project highlighting the objectives and the project components;
- an analysis of the profile of the areas of intervention, in terms of biophysical and human characteristics;
- an analysis of the legal framework likely to be applied to the project that integrates policies and sub-regional instruments and structures for control and regulation;
- an assessment of the impacts associated with the use of uncontrolled pesticides;
- a proposal for a pest control and pesticide management plan that integrates measures of good pesticide management practices;
- An organizational mechanism for implementing and monitoring the PMP.

1.5 Brief Description of the REWARD Program

The Gambian Ministry of Agriculture proposes to implement the Regional Rice Resilient Value Chain Development Project (REWARD) in Gambia funded by the African Development Bank (AfDB), and the Government of the Gambia (GoTG). The Project will be implemented by the Central Project Coordinating Unit (CPCU) through the Project Implementing Unit (PIU) within the context of food sufficiency/sovereignty/security, the country's fertilizer policy and seed policy. The REWARD Program is a standalone program that is to build on the existing structures and improve the gains from Phase I of the Rice Value Chain Transformation Project (RVCTP). REWARD will focus on delivering key interventions such as developing as well as expansion of new areas, rehabilitation of existing irrigation schemes, land preparation, mechanization along the value chain, improved post-harvest management and a streamlined seed system which will set the pace for a sustainable rice production system in the Gambia.

The Gambia REWARD Program is very crucial in ensuring food sufficiency, economic empowerment of farmers and the overall national economy. The project will be executed in communities situated in the rice fields and valleys of the Central River Region North (CRR-N), Central River Region South (CRR-S) and the Upper River Region (URR).

Development, rehabilitation and overhauling of irrigation channels, mechanization and capacity improvements of farmers are being conceived to promote national sufficiency and export promotion, enhancing the country's potential to serve as a major export for food within the West African markets. The REWARD Program seeks to contribute to food and nutrition security and enhance economic growth by reducing rice importation. The specific objective is to increase rice production by moving from subsistence rice farming towards commercialized market-driven.

The project also aims at enhancing the private sector and other stakeholder's participation in the value chain, thereby improving incomes and employment opportunities for all stakeholders, especially youths and women in the country. The overall objective of the project is to help improve nutritional and food security and reduce poverty across the country. Its specific objective is to ensure sustainable recovery of the rice value by improving productivity, strengthening infrastructure, ensuring resilience to climate change, sustainably managing natural agricultural resources and reducing gender inequality.

Generally, the Gambian REWARD implementation will consist of four (4) components, which are described below:

- Development of sustainable climate-resilient rice production systems to ensure adequate production of quality rice paddy to supply millers
- Development of rice processing clusters, agribusiness and market links for trade facilitation
- Support to policy/regulatory reforms and harmonization at the regional/national level to ensure a competitive rice value chain for imports
- Program Coordination and Management

1.5.1 Project Sites and Locations

The choice and selection of the project sites have primarily been based on the production potential (availability of fresh water throughout the year) as well as the high potential in pump irrigable lands that will enhance agricultural production in the country and thus prioritizing investment in areas with high market potential as well as areas with low risk of crop failure and high market potential.

The project sites cover two (2) administrative regions comprising three agricultural regions (Figure 1.1), namely:

- Central River Region North (CRR-N)
- Central River Region South (CRR- S)
- Upper River Region (URR)

There are two (2) intervention sites identified in each of the regions. The sites include:

- Upper River Region (URR): Dampha Kunda and Limbambulu Bambo
- Central River Region North (CRR-N): Sanguley and Safalu
- Central River Region South (CRR- S): Keserr Kunda

1.6 Field Survey (Environmental Assessment and Stakeholder Engagement)

A field survey of the project intervention areas was carried out between January and February, 2024 by the Richflood specialists. The detailed field study of the Project sites was carried out, to have available reliable, up-to-date information as to the environmental and social components inherent to the Project. These resulted in a qualitative and quantitative analysis of the biophysical

environment and ecosystems, as well as public consultations. Consultations were held with the main community authorities to establish an overview of the socio-economic conditions and social dynamics.

The various aspects of the baseline information are based firstly on national, regional and local information. The analysis of physical and biological environmental issues also considers the local context in the area in which the Project is located, utilizing a description of the baseline of the Project area. The project's area of influence (AOI) is identified and described for each aspect, based on the relevant parameters.

While the results of the total pesticides and herbicides analysis of groundwater, surface water, and soil samples at the project sites are presented in Annex 6 of this PMP Report, a detailed description of the environmental and socio-economic conditions of the project intervention areas is provided in the ESIA (Environmental and Social Impact Assessment) report of the project.

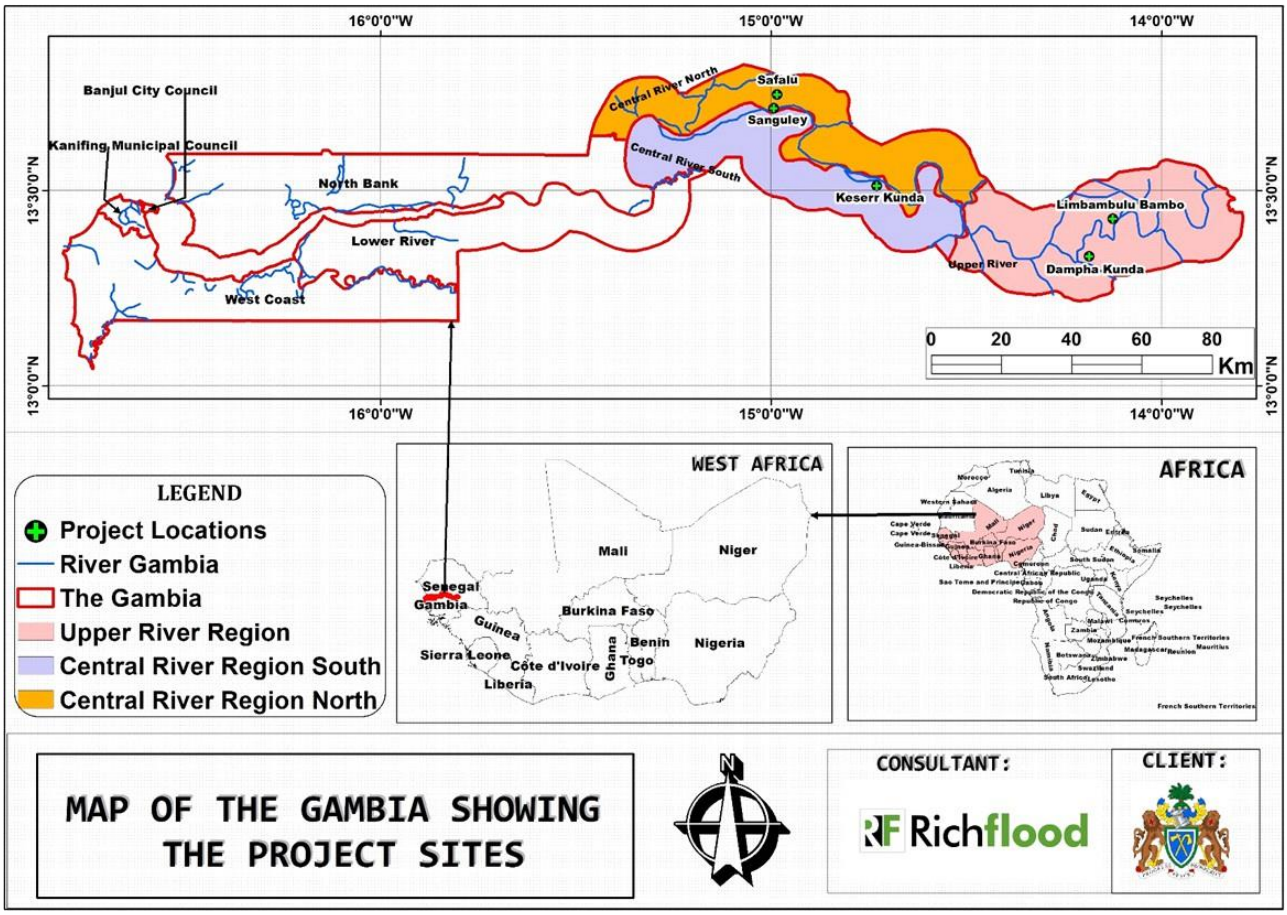


Figure 1.1: Map of the Gambia Showing the five project locations
Source: *Richflood GIS Unit, 2024*

1.6.1 Stakeholder Consultation

Two broad levels of consultation were adopted for the REWARD PMP:

Institutional Consultation: This level of consultation is intended to engage relevant regulatory authorities, and government and non-governmental institutions based on their concerns about the proposed project. The stakeholders consulted for this project are; Plant Protection Services (PPS) National Environment Agency (NEA), Department of Parks and Wildlife Management (DPWM), Department of Forestry (DoF); Department of Water Resources (DWR); Soil and Water Management Services (SWMS) of the Department of Agriculture; Agricultural Engineering Services (AES); Ministry of Gender and Children Affairs; Ministry of Trade and Employment, Department of Labour, Representatives of Central River Region (CRR) North; Representatives of Central River Region (CRR) South; Representatives of the Upper River Region (URR); CPCU Coordinating Members, NGOs.

Primary Stakeholders Consultation: The procedure employed in the primary stakeholders' consultation includes a participatory approach, where public meetings were held with the community members and traditional rulers of the host communities (i.e. the Dampha Kunda, Sanguley, Safalu, Limbambulu Bambo), and members of the technical advisory committee at the regional level. The primary stakeholders are members of the host communities which will be directly affected by the proposed project within the regions.

A series of meetings were held between the 23rd and 30th of January, 2024 and on the 21st of March, 2024 with the different categories of stakeholders (Annex 1). In participation were REWARD CPCU/PIU, implementers partners (MOA, PPS, NEA, MECCNR), Regional Technical Advisory Committees (TACs), National Farmers Platforms, NGOs and Community representatives. Subsequently, meetings were held at various communities. The outcomes of the consultations were as follows:

Challenges Identified:

- Lack of awareness about overusing pesticides, including smuggled and expired pesticides;
- Lack of adequate pesticide storage on the farm;
- Lack of knowledge of the withholding period before harvest;
- Application of pesticides without proper personal protective equipment (PPE)

- Lack of pesticide management knowledge (type, time, doses, etc.)
- Absence of sanitary facilities in rice fields.
- Mixing of pesticides with bare hands and mixing more than one type of pesticides
- Lack of waiting shelters in rice fields.
- High costs are associated with technical requirements and agricultural inputs.
- Incidence of pests and plant diseases.
- Spread of pesticide odours and sprays to the adjacent neighbourhood;
- Limited access of farmers to mechanized farming systems.
- Insufficient availability of pumping machines for irrigation needs.
- Poor handling and disposal of pesticides
- Water scarcity issues.
- Inadequate expertise in maintaining irrigation networks and modern techniques.
- Risks of flash floods from upstream water sources affecting project areas.
- Mosquito infestation in rice fields during the rainy season impeding work.
- Grazing conflicts between farmers and nomadic cattle herders.
- Physical strain during ploughing, particularly for women due to the absence of tractors.

Key Expectations:

- Good practice of handling and disposal of pesticides
- Provision of Personal Protective Equipment (PPE) for machine operators and farmers, especially during fertilizer applications.
- Training on the use of safe and available pesticides
- Support on procurement of pesticides.
- Support with quality seedlings, farming maintenance, and machinery.
- Incorporation of local knowledge in designing the irrigation system and other project infrastructure.
- Stakeholders expect the project to enhance foreign exchange savings
- Establishment of stable markets for local farmers to ensure consistent outlets for produce.
- Stimulating business growth and development within the locality.
- Anticipated increase in rice production and subsequent enhancement of food security.
- Improvement in food security and availability.

- Enhancement of efficiency, which will lead to higher yields of premium quality rice.
- Creation of employment opportunities and income generation for members of host communities.
- Promotion of quality rice production within The Gambia.

1.7 PMP Institutional Arrangement and Coordinating Mechanisms in The Gambia

1. National Level: The Department of Agriculture in The Gambia offers technical support and training to personnel on pest/vector management through its Plant Protection Service.

2. Private Sector: The National Environment Agency issues licenses for private service providers. These pesticides are primarily used in urban areas to manage household pests.

3. Non-Governmental Organizations: NGOs with agricultural mission statements also supply pesticides.

4. Government Projects: The government also provides pesticides and pest control equipment.

CHAPTER II:

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK FOR THE MANAGEMENT OF PEST/VECTOR IN THE GAMBIA

2.1 Policy Framework

2.1.1 The National Policies

The Banjul Declaration of 1977 was the first policy instrument to focus on the need for environmental conservation. In 1981, the Environment Unit was established. Thereafter in 1994, the GoTG aware of the need to protect the environment following decades of severe environmental degradation with the potential dangers posed by pesticides and chemicals to human health and the environment enacted the National Environment Management Act. In 1994 the National Environment Agency (NEA) was set up to coordinate the implementation of the Gambia Environmental Action Plan (GEAP 1993-1998), which was adopted in 1992.

2.1.2 The Gambia Environment Action Plan, GEAP III (2021-2030)

The Plan provides the overall policy framework for sound environmental management in The Gambia. It seeks to promote and implement sound environmental policy. The GEAP emphasizes environmental management, pollution, and nuisances and the necessity to safeguard the well-being of the populations. The country's first integrated environmental and natural resources management policy framework provides an overview of the existing environmental situation. It outlines approaches to the problems, including institutional changes and other required actions. National Environment Agency implements the Gambia Environment Action Plan and all relevant institutions, including the Private Sector and NGOs. All the Environmental Laws operate under the GEAP.

2.1.3 The Agriculture and Natural Resources Policy (ANR 2017-2026)

The Ministry of Agriculture formulated and adopted the ANR Policy 2009-2015 and The Gambia National Agricultural Investment Plan (GNAIP) as its Medium-Term (2011-2015) Strategic Plan. The Medium-Term ANR (1998-2002) and the FAO-supported National Agricultural Development–Horizon 2010 provided the policy framework of the sector for the period 1995-2008 with the following areas of concentration: forestry, livestock, land & water, rural water supply and sanitation, cooperative development, crop production, and rural finance.

The 2017 – 2026 ANR Policy is designed as a significant departure from the development emphasis and thrusts of the last twenty years and is therefore, founded on a vision for the creation of a marketed-led commercialized, efficient, competitive, and dynamic ANR sector in the context

of sustainable development. The Policy will be guided by the attainment of the over-arching objective of maximization of poverty reduction and enhancement of food, income, and nutrition securities through the optimal utilization of the resources of the sector consistent with safeguarding the integrity of the environment.

2.1.4 The National Nutrition Policy 2010-2020

This is a policy document that outlines the government's vision of "a Gambia free of malnutrition" and aims to optimize the nutrition requirements of the Gambian population to ensure a healthy and sustainable livelihood. The policy has several objectives, including reducing the morbidity and mortality rates related to iron deficiency anaemia in all age groups, improving the food control system in The Gambia, and promoting optimal infant and young child feeding practices.

The Nutrition Policy has helped greatly in placing nutrition high on the agenda of the Government of the Gambia for national development. It has also provided the necessary legal and institutional framework for nutrition planning, implementation, monitoring evaluation, and coordination in the country.

2.1.5 Food Safety and Quality Act, 2011

The Food Safety and Quality Authority of the Gambia (FSQA) is established by the Food Safety and Quality Act, of 2011, under the Office of the President. It is the sole National Competent Authority with powers of delegation mandated to officially control the safety and quality of all foods (including water and beverages) and animal feed whether locally produced, imported, or destined for export. The FSQA has the responsibility of protecting public health by reducing the risk of foodborne diseases and providing food safety education and information to consumers.

2.1.6 The Gambia National Water Policy (2006)

The Gambia National Water Policy (2006) is a comprehensive planning and management framework for providing the people of The Gambia with secure water resources. It was developed to strengthen governance frameworks, and better apply basic principles for resource conservation, environmental protection, and equitable distribution. The policy subscribes to the principles of integrated water resources management (IWRM) outlined in the Dublin Statement, 1992, which asserts that fresh water is a finite and vulnerable resource, essential to sustain life, development,

and the environment. The policy calls for institutional restructuring and the development of an implementation strategy and regulatory framework.

The policy also aims to meet basic water needs sustainably while conserving resources and preserving the environment for future generations. It also aims to maintain an equitable balance between universal access to water supplies and the needs of individual users, strengthen and develop human capital and build the economy of the country, and negotiate and discharge international responsibilities in a spirit of goodwill and cooperation.

2.1.7 The National Climate Change Policy, (2016-2025)

This policy provides the framework for managing climate risks and building institutions, capacities, and opportunities for climate-resilient development. It is a policy document that outlines the country's commitment to respond to the emerging climate threats and climate change effects, including increasing average temperatures and unpredictable rainfall regime, flooding and related damages to roads and infrastructure, decreased agricultural production, reduced food security, and threats to people's health due to increasing heat and dryness.

The policy outlines institutional arrangements and a new integrated approach to resource mobilization, and focuses on priorities in four key thematic clusters, thus emphasizing the links between climate change adaptation and disaster risk reduction, and improving an integrated approach to climate change issues:

- climate-resilient food systems and landscapes;
- low emissions and resilient economy;
- climate-resilient people;
- coastline management under a changing climate

The policy outlines a summary of climate impacts and vulnerabilities in the various sectors, such as declining soil fertility, reduced productivity of crops such as maize, groundnut, and millet, forest degradation due to consumption of woody biomass, decline of fish resources due to increasing fishing intensity and irresponsible fishing practices, risk of flooding, coastal erosion, creation of new wetland areas, and increased salinization due to rising sea level.

The policy is based on the following principles and objectives:

- Polluter pays principle;
- Sustainable development;

- Inter-generational equity;
- Community participation;
- Promotion of access to climate information and early warning of climate risks;
- Ensuring adequate climate change research;
- Coordination of national and international financial resources; and
- Effective integration of climate change into all sectors of the country's economy.

2.1.8 National Adaptation Plan of Action (NAPA) on Climate Change (2007)

The National Adaptation Plan of Action (NAPA) on climate change was developed by the Gambian government in 2007. The policy is a multi-sectoral national policy that aims to address urgent and significant climate threats through actions that deliver immediate adaptation benefits, contribute to building local and national adaptive capacities, and create awareness and build foundations for maximizing long-term adaptation benefits. The policy document was developed by evaluating the impacts of climate change on the relevant sectors, including agriculture and food security (livestock, fisheries, and crops), energy and water, human health, natural resources, and wildlife.

2.1.9 The National Health Policy, 2021-2023

The vision of the policy is to attain accessible quality health care for the Gambian population. It is mandated to protect the public and environmental health, including nuisance and other risks associated with this Project. It has a mission to ensure quality healthcare services within an enabling environment, delivered by appropriately trained, skilled, and motivated personnel at all levels of care. The mission will be accomplished with the involvement of all stakeholders to ensure a healthy nation. The fundamental guiding principles of the policy are equity, health system reform, and partnerships.

2.1.10 National Malaria Policy, 2020–2025

The Gambia’s National Malaria Control Program (NMCP) under the Ministry of Health and Social Welfare highlight specific malaria control strategies and interventions. The key strategies are Management and Partnership Building; Malaria Case Management; Prevention and Control of Malaria in Pregnancy; Integrated Vector Management (IVM), Advocacy, Social mobilization and Communication; Surveillance, Monitoring and Evaluation and Operational Research.

2.2 Legal Framework

2.2.1 International Legal Framework

The Government of the Gambia (GoTG) intending to harmonize and fulfil its national, regional and international obligations relative to Environmental Management has ratified the conventions in Table 2.1 below:

Table 2.1: International Convention and its Relevance to the PMP

Convention	Topic/Theme	Relevance to Pest/Vector Management Plan
Rome FAO International Plant Protection Convention, 1951	Plant protection	Establishes standards and measures to prevent the spread of pests and diseases globally
Rio Convention to Combat Desertification 1992	Combatting desertification	Addresses land degradation, which can affect pest habitats and agricultural productivity
Basel Convention on Transboundary Movement of Hazardous Waste, 1997	Hazardous waste management	Controls the movement of pesticides and hazardous waste, preventing environmental contamination
Bamako Convention on Prohibiting Imports on Hazardous Waste, 1999	Hazardous waste import prohibition	Aims to prevent the import of hazardous waste, including pesticides, into Africa
Rotterdam Convention on the PIC of Pesticides, 2001	Pesticide distribution and use	Regulates the international trade of hazardous pesticides, ensuring safe handling and use
Stockholm Convention on Persistent Organic Pollutants, 2001	Persistent organic pollutant management	Targets the elimination or restriction of the use of persistent organic pollutants, including certain pesticides
Minamata Convention on Mercury, 2022	Mercury pollution prevention	Addresses the use of mercury in agriculture, including its presence in some pesticides
Convention on Common Regulations for Pesticide Regulation in the Sahel	Pesticide regulation in the Sahel region	Establishes common regulations for pesticide use in the Sahel, promoting safe and effective pest management
International Plant Protection Convention (IPPC) of FAO, 1952	Plant protection	Sets standards for plant health, including measures to prevent the spread of pests
United Nations Framework Convention on Climate Change, 1992	Climate change mitigation and adaptation	Climate change can affect pest populations and distribution, impacting pest management strategies

Convention	Topic/Theme	Relevance to Pest/Vector Management Plan
World Food Security and the Plan of Action, 1996	Food security	Ensures access to safe and nutritious food, which includes effective pest management

2.2.2 National Legal Framework

The legal framework that has a direct and/or indirect relation with pest/vector management calls for several legislative and regulatory texts at the national level as well as international Agreements, Treaties and Conventions ratified by countries. As of now, the legal and regulatory instruments in force in the Gambia, relative to chemicals, pesticide management and environmental protection are as follows: -

- National Environmental Management Act, 1994
- Hazardous Chemicals and Pesticides Control and Management Act, 1994
- Hazardous Chemicals Regulation, 1996
- Pesticides Licensing Regulation, 1994
- Pesticides Registration Regulation, 1994
- Environmental Quality Standards Regulation, 1999
- Environmental Impact Assessment Regulations, 2014
- Environmental Discharge Regulations, 2001
- Local Government Act, 2022
- Plant Importation and Regulation Act
- Public Health Act, 1990
- Anti-littering Regulation, 2007

2.3 Institutional Framework

The Executive Director of NEA, in accordance with his mandate and the provisions made in Part II Section 3 of the HCPMCA, has established an institutional framework for the management of chemicals and pesticides, under coordination with the Directorate of the Technical Services Network (TSN) with the following structures:

- appointed a Multi-Sectoral Board for the administration of the Act,

- appointed the Registrar of Chemicals and Pesticides to manage the Pesticides Field Inspectorate,
- appointed Pesticide Inspectors from collaborating national institutions for the enforcement of the Act, and
- established a Pesticide Formulation Laboratory to test pesticides and chemicals imported into the Gambia.

- ***Ministry of Agriculture (MOA)***

The Ministry of Agriculture is the line ministry of the Government of the Gambia (GoTG) whose responsibilities are the Central Projects Coordinating Unit (CPCU), all projects bilateral or multilateral related to agriculture. All projects have their accounts lodged at the Central Bank of the Gambia under the Ministry of Finance and Economic Affairs. MOA presents all its projects to the National Assembly for Approval. MOA which works directly with the Office of the President of the Republic, is Headed by a Minister who is assisted by a Permanent Secretary (PS).

- ***Ministry of Finance and Economic Affairs (MOFEA)***

MOFEA negotiates and represents the GoTG in the financial and economic affairs of the Gambia. The REWARD program will be handled by this ministry and finally, it will open an account with the Central Bank of the Gambia on behalf of MOA.

- ***Ministry of Trade, Industry, Regional Integration & Employment (MOTIE)***

The Ministry of Trade, Industry, Regional Integration and Employment (MOTIE) is mandated to formulate and implement trade, investment and industrial policies that promote investment in the productive sector for increased production and export. MOTIE also formulates and implements employment, competition and labour matters, promulgates national standards and takes a lead role in trade negotiations in collaboration with other stakeholders to enhance competitiveness.

- ***Ministry of Health (MOH)***

MOH is responsible for the general health and welfare of the country. In the event of any risk or cases of poisoning, they would provide the antidotes for victims. MOH is directly in charge of the control measures against epidemics and pandemics as well as pesticide-related health issues that may arise.

- ***Ministry of the Environment (MOENV)***

The NEA is lodged under this ministry and is responsible for all matters relating to the environment nationally and internationally. All the Laws of the Gambia on the environment are drafted in collaboration with the Ministry of Justice and tabled before the National Assembly for promulgation.

- ***Ministry of Information and Communication Infrastructure (MOICI)***

This ministry is highly implicated in the public sensitization of pesticides and other poisons. MOICI therefore will be involved in the REWARD program. The print, press, audiovisual and electronic media are under the supervision of MOICI.

- **The National Environment Agency (NEA)**

The NEA is responsible for ensuring compliance with laid down EIA procedures in the Gambia according to the NEMA Act 1994 and its amendment. The NEA will be responsible for overall monitoring of the implementation of the Pest/Vector Management Plan. NEA is responsible for issuance of license in the Gambia.

- **The Plant Protection Services (PPS)**

Plant Protection has a major role to play in the implementation of this Pest/Vector Management Plan (PMP) as it relates to the use of pesticides and inorganic fertilizers in the rice fields. With the introduction of PMP for addressing pests and pesticide issues, this institution will lead the implementation of PMP activities as is its mandate. The institution will provide technical support on PMP principles and practices. The institution will build the capacity of beneficiary farmers in improved crop protection techniques, including pest monitoring, use of resistant varieties, and minimal use of pesticides with emphasis placed on traditional and good cultural practices.

- **The National Agricultural Research Institute (NARI)**

The National Agricultural Research Institute was established in 1993, by an act of parliament of the Republic of The Gambia. NARI evolved from the department of agricultural research, of the then Ministry of Agriculture and Natural Resources. NARI was established to provide technological solutions to the problems of producers and inform policymakers on options to increase agricultural production and productivity by Conducting applied client-oriented and adaptive research in agriculture and natural resources, to inform policy-makers on options to

increase agricultural productivity and production without detriment to the natural resource base and the environment and to study, supervise and control the production of nucleus, foundation and certified seeds of the major seeds grown in the Gambia.

- **The Health Services**

The MoH is responsible for overall policy formulation, planning, organization and coordination for health in The Gambia. The public health laboratories serve at a national level, providing overarching support and instituting quality control systems. Key functions include the establishment of norms and standards, emergency and outbreak responses, high-end technology testing that is not cost-effective at other levels of the healthcare system, targeted training to improve and strengthen human resources, surveillance, and operational research.

Public health service in The Gambia is delivered at one of three different levels:

- Primary level (village health services and community clinics)
- Secondary level (minor and major health centres and district hospitals)
- Tertiary level (general, teaching and specialised hospitals and the National Public Health Reference Laboratories)

- **National Malaria Control Programme**

The National Malaria Control Programme (NMCP) of the Gambia plays a vital role in malaria prevention and control within a country. It begins by monitoring the incidence and prevalence of malaria through surveillance activities The NMCP implements preventive measures such as distributing insecticide-treated bed nets and indoor residual spraying to reduce mosquito breeding sites. Additionally, it ensures that accurate diagnostic tools and effective treatment are accessible to those in need, promoting the use of rapid diagnostic tests. The NMCP fosters partnerships and coordination with various stakeholders to mobilize resources and align efforts toward the common goal of reducing the burden of malaria.

- ***Civil Society (CVS)***

These (CVS) will be engaged only if there are fundamental cases of litigation against companies that introduce harmful or prohibited pesticides which could cause or lead to the poisoning of users.

2.4 Regional Aspects of the Management of Pests and Pesticides

In the area of the exercise of their missions and mandate, the following regional institutions support the national structures charged with implementing the PMP.

2.4.1 Economic Community of West African States (ECOWAS)

During the 60th session of the ECOWAS Council of Ministers in May 2008 at Abuja Nigeria, a new law C/REG.4/05/2008 was passed on the Homologation of Pesticides in West Africa. This was aimed at the harmonization of legislation for the registration of pesticides in West Africa. ECOWAS will intervene in the PMP backed by this Regulation. ECOWAS aims to create a unified framework for pesticide regulation throughout the region and seeks to ensure that the requirements and procedures for pesticide registration are consistent across member states. ECOWAS's intervention implies active involvement in coordinating efforts among member states, providing technical assistance, facilitating capacity-building initiatives, and monitoring compliance with the regulations. This will facilitate trade, promote agricultural development, and enhance environmental protection by ensuring that approved pesticides meet established safety and efficacy.

2.4.2 Environmental and Social Assessment Procedures (ESAP)

The policy is a tool developed by the African Development Bank (AfDB) to support the integration of environmental, climate change, and social considerations in projects and programs of the Bank and its borrowers. The ESAP describes the assessment procedure for different project types and across the full lifecycle from country programming to post-completion. The adoption and implementation of the ESAP help enhance the environmental and social performance of the Bank's operations and improve project outcomes. The ESAP applies to all sectors and is open source. The ESAP was developed in 2015 by the AfDB. The ESAP can be used to ensure that the environmental and social impacts of a project are assessed and managed effectively. The ESAP can also help ensure that the project is aligned with the national environmental and social policies and regulations.

2.4.3 The Permanent Interstate Committee for Drought Control in the Sahel (CILSS-Comité permanent Inter-états de Lutte contre la Sécheresse dans le Sahel.)

CILSS was created in 1974 by nine countries and as of 2022 has 13 member states, namely: Burkina Faso, Cape Verde, Gambia, Guinea Bissau, Mali, Mauritania, Niger, Senegal, Chad,

Togo, Benin, Guinea Conakry and Ivory Coast. Guinea, Togo, Ivory Coast and Benin joined in 2014. The main objective of this Common Regulation was to combine the expertise on pesticide evaluation and management of all CILSS Member States for pesticide registration. The Sahelian Pesticide Committee (CSP1), the common pesticide registration body, became operational in 1994. It assesses registration dossiers submitted by the agrochemical industry and grants sales permits valid for all its Member States.

The Member States of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS),

- Taking into account Resolution N° 7/27/CM/92 of the 27th ordinary session of the CILSS Council of Ministers regarding phytosanitary control and pesticide registration, which adopted the Regulations on phytosanitary control and registration of pesticides, and more particularly the Common Regulation for the Registration of Pesticides in the CILSS Member States,
- Taking into account Resolution N° 10/29/CM/94 of the 29th ordinary session of the CILSS Council of Ministers regarding the enforcement of the Common Regulation for the Registration of Pesticides
- Taking into consideration the FAO International Code of Conduct on the Distribution and Use of Pesticides,
- Taking into consideration the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade,
- Aware of the potential hazards of the use of pesticides for Sahelian populations and the environment,
- Recognizing the need to re-examine the existing text from the perspective of developments and experiences gained in the field of pesticide registration by CILSS Member States,

CILSS is one of the regional institutions implicated in the establishment of the PMP through its two institutions.

- Institut Du Sahel (INSAH) is a specialized CILSS institution responsible for coordinating, harmonizing and promoting study, research and Capitalization for Development actions in Agro-socio-economics and on Population issues, Demographic Dividend, Gender and

Empowerment of Women and Youth in the CILSS Member States. INSAH also promote and facilitates exchanges between national systems involved in the fields of agricultural research and population and development, to stimulate a dynamic of cooperation and propose catalytic actions supporting productive agriculture and better management of natural resources to create the conditions for sustainable and competitive production.

- The AGRHYMET Regional Center, a specialized institution of the Permanent Interstates Committee for Drought Control in the Sahel (CILSS), was created in 1974 in the aftermath of the severe droughts that affected this region in the early 1970s. The mission assigned to the Center was to train personnel, provide adequate equipment for the meteorological and hydrological stations networks, and set up regional and national multidisciplinary working groups to monitor the meteorological, hydrological, crops and pasture conditions during the rainy season. Throughout the years, AGRHYMET developed, in collaboration with international research organizations, models and methodologies based on ground and satellite observations to monitor rainfall, food crop water requirements satisfaction and prospective yields, the progress of vegetation front and its seasonal and inter-annual variations.

The registration of pesticides is the responsibility of the CILLS Sahelian Pesticides Committee (CSP), as The Gambia has ratified the CILLS Common Pesticides Regulation.

The post-registration of pesticides is the responsibility of the National Pesticides Management Board of the NEA. The rationale of post-registration activities provides a means of measuring the validity of predictions based on registration data, regarding the efficacy, safety and environmental effects of a particular pesticide. Thus, the post-registration activities conducted by the NEA are elaborated below:

a. Monitor and control, the manufacture, import, export, distribution, storage and use of chemicals and pesticides by licensing and any provisions made in the Supplementary
b. Regulations for illegal importation of pesticides.
c. Test the quality of Pesticide formulations authorized and pesticide residue levels in food, plants, water and soils, and applicators of pesticides.
d. Conduct various monitoring activities to monitor the impacts of pesticides on plants, food, human and animal health, and the environment.

e. Conduct training programs on the safe use and management of pesticides, including transport, storage and disposal, for all stakeholders.
f. Raise public awareness of the risks associated with pesticides and safety measures.
g. Enforcement of legislation/regulation and providing suitable control measures, to control imports, adverts, labelling and re-packaging of pesticides.
h. Information exchange in accordance with FAO Code of Conduct (Article 9), to decision-makers, contracting parties, users, businesses and applicators, importing and exporting countries. This helps ensure compliance with the regulations in force.
i. Operate Licensing Schemes for Pesticide Applicators and Companies.

2.5 International Guidelines on Use of Pesticides

- **FAO Guidelines on Good Practice for Ground Application of Pesticides (2001)**

These guidelines are aimed at decision-makers, managers, field supervisors and spray operatives. However, it must be emphasized that in some countries, legislation is already in place to control safe and efficient pesticide use and application. Accordingly, local legislation or voluntary codes must be the first point of reference with this set of guidelines offered as additional information. This is an important point, as compliance with local legislation may have legal significance in the event of a claim against the poor field performance of a pesticide.

- **FAO Guidelines on Management Options for Empty Pesticide Containers (2008)**

These guidelines provide advice on the management of one-way pesticide containers following the deployment of their contents. Unless empty pesticide containers are managed correctly, they are hazardous to both mankind and the environment. There is a danger that empty containers could be reused for storing food and water, which could result in pesticide poisoning. Containers abandoned in the environment can lead to pesticide pollution in soil and groundwater. A container management scheme can minimize these risks and is part of the "life-cycle concept" as addressed in the International Code of Conduct on the Distribution and Use of Pesticides.

A container management scheme should ensure that:

- ✓ the containers are decontaminated directly following the use of their contents.
- ✓ inappropriate use of empty containers is prevented, and

- ✓ the project will procure drum cleaners and crushers to ensure the cleaning and crushing of empty containers immediately after use.

The safety of pesticide users and the public is of paramount importance when designing a container management scheme.

Successful container management schemes around the world have been achieved only with the engagement and support of all stakeholders in the supply chain for pesticides. These stakeholders include government bodies, manufacturers, users, distributors and suppliers, recyclers and disposers, NGOs, and trade unions. This guideline identifies how each of these stakeholders can contribute to a container management scheme. The guideline considers the role of manufacturers in the design of the containers and the formulation of the product as well as their responsibility for product stewardship.

- ➢ **FAO/WHO International code of conduct on pesticide management, guidelines for personal protection when handling and applying pesticides (2020)**

These guidelines were prepared by the FAO/WHO Joint Meeting on Pesticide Management (JMPM) to provide further guidance on the provisions of the FAO/WHO International Code of Conduct on Pesticide Management that are related to the personal protection of pesticide users. These guidelines update and replace the 1990 *FAO guidelines on personal protection when working with pesticides in tropical climates*. They reflect the joint FAO/WHO approach to pesticide management, thus addressing the personal protection of both agricultural and public health operators and applicators, the latter being engaged in using insecticides for vector control.

These guidelines are intended to guide pesticide risk reduction through reduced exposure by effective personal protection with special attention to the use of Personal Protective Equipment (PPE). First, they provide technical information on personal protection and the selection and use of PPE. Second, in line with the FAO/WHO International Code of Conduct on Pesticide Management, they address policy issues and recommend measures to improve personal protection and specifically the use and availability of adequate quality and affordable PPE.

They are primarily aimed at government authorities in charge of pesticide management and risk reduction but are also considered useful to public and private sectors such as the pesticide industry, non-governmental organizations (NGOs) and other relevant entities. More specifically, these guidelines are targeted at stakeholders in low- and middle-income countries (LMICs) where it is acknowledged that there is limited legislation, compliance and enforcement, and PPE availability.

CHAPTER III:

COMMON PESTS OF RICE, CONTROL METHODS AND THE ASSOCIATED POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

3.1 Introduction

This section describes the main pests of rice in the project areas, the pesticides used to control them and the impacts of their uncontrolled and improper use. Based on the literature reviews, the major pests and diseases of rice in the Gambia were documented by Katie Shaw et al. (1995) and Phillipa J. Mansfield *et al*. (1995), Sonko, Trawally and Secka, (2006), also Gambia Horticulture Enterprises Co. (GHE) documents were reviewed and consultations conducted, the identified pests and diseases common in the project intervention areas are presented in Table 3.1 below:

Table 3.1A: Major Pests and Diseases of Rice in The Gambia

Pest	Disease	Damage caused	Control
Rice Stem Borers	Blast	• Dead hearts (central leaves) • Whiteheads (inflorescence)	• Use resistant rice varieties • Apply appropriate fungicides if necessary • Remove and destroy infected plants - Practice good field sanitation • Maintain proper plant spacing to reduce humidity and disease spread • Monitor weather conditions and apply fungicides preventatively • Implement sustainable weed management
Rice Leafhoppers	Sheath Blight	• Leaf and sheath lesions • Rotting of stems and panicles	• Monitor and use chemical control if necessary • Apply fungicides preventatively • Ensure proper drainage and water management • Utilize resistant rice varieties and seed treatments • Conduct regular scouting and monitoring for early detection
Rice Gall Midge	Bacterial Leaf Blight	• Wilting and drying of leaves • Yield reduction	• Use resistant rice varieties • Apply appropriate bactericides if necessary • Ensure proper irrigation and drainage • Avoid overhead irrigation • Maintain field hygiene by removing crop residues

Pest	Disease	Damage caused	Control
			• Conduct regular field inspections and disease monitoring
Rice Bug	Brown Spot	Brown lesions on leaves and panicles	• Use resistant rice varieties • Apply appropriate fungicides if necessary • Ensure proper water management • Ensure proper water management • Utilize trap crops to reduce pest populations • Implement proper weed management to reduce pest habitat • Use insecticides judiciously and consider their impact on beneficial organism
Armyworms	Narrow Brown Leaf Spot	Brown, necrotic lesions on leaves	• Monitor and use chemical control if necessary • Apply fungicides preventatively • Ensure proper field drainage and irrigation • Implement early planting to avoid peak pest populations • Promote plant health through proper fertilization and irrigation • Conduct regular field monitoring and scouting for pest activity
Grasshopper	Rice Yellow Mottle Virus	Yellowing and mottling of leaves	• Use virus-free seeds • Control insect vectors such as leafhoppers • Remove and destroy infected plants • Implement cultural practices such as deep plowing to disrupt overwintering sites • Utilize resistant rice varieties and plant early to avoid peak vector activity

Table 3.1B: Major Vertebrate Pests of Rice in the Gambia

Vertebrate Pest	Damage Caused	Control
Village weaver Bird	- Nesting in rice fields can damage crops and reduce yield	• Install scarecrows or reflective tape in rice fields to deter birds • Utilize netting or bird repellents around rice paddies • Implement noise deterrents such as bird distress calls
Quelea quelea	- Massive flocks can consume rice grains, leading to significant crop losses	• Implement bird-scaring techniques such as loud noises or visual deterrents in rice fields • Use chemical repellents or bird traps in severe infestations
Hippos	Extensive consumption of rice plants	• Implement non-lethal deterrents such as acoustic devices or lights to deter hippos from entering agricultural areas. • Establish buffer zones or barriers to limit hippo access to rice fields. • Introduce alternative food sources or habitat modifications to reduce hippo pressure on rice crops. • Collaborate on community-based conservation efforts involving farmers, conservation organizations, and local authorities. • Develop and implement effective mitigation strategies to minimize hippo damage while promoting the long-term coexistence of hippos and humans in shared landscapes.

Rice stem borer (*Scirpophaga incertulas*)

Village Weaver (*Ploceus cucullatus*)

Rice bug (*Leptocorisa acuta*)

Red-billed quelea (*Quelea quelea*)

Plate 3.1: Common Pests of Rice found in the Gambia

Table 3.2: Rice Pesticides in The Gambia and their Hazard Classification (toxicity levels)

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
Insecticides			
Deltamethrin25EC for rice	Deltamethrin 25g/L	II	It is an insecticide that belongs to the pyrethroid class, known for its effectiveness against a wide range of pests including rice pests like rice stem borers, rice leaf folders, and rice bugs. It's often applied as a foliar spray to control these pests and protect rice crops from damage.
Abamectin 1.8EC	Abamectin 18g/L	1b	Abamectin is a widely used insecticide and acaricide derived from the soil bacterium Streptomyces avermitilis. It is effective against a variety of pests including mites, leafhoppers, and certain types of caterpillars that commonly infest rice crops. Abamectin is typically applied as a foliar spray to target pests and protect rice plants from damage.
Dimethoate	Dimethoate 40% EC	II	Systemic organophosphate insecticide and acaricide with contact and stomach action are suitable for the control of a wide range of sucking and chewing pests including aphids, whiteflies and mites on rice,
Cypermethrin	Cypermethrin 10% EC	II	It belongs to the synthetic pyrethroid class of insecticides, which are known for their effectiveness against a broad spectrum of pests including insects such as rice stem borers, rice leaf folders, and rice bugs.

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
Karate 5EC	Lambadacyhalothrine (50 g/l)	II	Karate 5EC is used as a pesticide in various crops, including rice, to control pests such as rice leaf folders, stem borers, and leafhoppers.
Karate 2.5EC	Lambadacyhalothrine (25 g/l)	II	Karate 2.5EC is used as a pesticide in various crops, including rice, to control pests such as rice leaf folders, stem borers, and leafhoppers.
Cyhalone 10 EC	Cyhalonthrine (100g/l)	II	It belongs to the pyrethroid class of insecticides and is effective against a wide range of pests including rice stem borers, leaf folders, and other insects that commonly infest rice crops.
Dursban 450ULV	Chlorpyrifos-ethyl (450 g/l)	II	Dursban, also known as chlorpyrifos, is an insecticide that has been used in various agricultural settings, including rice cultivation, to control a variety of pests such as rice water weevil, stem borers, and leafhoppers.
Elsan 50 EC	Phenthoate 500g/l	II	Insecticide/ovicide to control insects of rice
Furadan	Carbofuran	II	It is a broad-spectrum insecticide that is effective against a variety of pests, including rice pests like stem borers and leaf folders
Dursban 4 EC	Chlorpyrifos-ethyl (480 g/l)	II	It is effective against a wide range of insect pests including rice stem borers, leafhoppers, and leaf folders

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
Durban 5% DP	Chlorpyrifos-ethyl (50 g/Kg)	III	It contains the active ingredient chlorpyrifos, which is effective against a variety of insect pests commonly found in rice fields, such as stem borers, leafhoppers, and leaf folders.
Dursban 5G	Chlorpyrifos-ethyl (50g/ Kg)	III	It is effective against a wide range of insect pests including rice stem borers, leafhoppers, and leaf folders
Dursban 240 EC	Chlorpyrifos-ethyl (480 g/l)	II	It is effective against a wide range of insect pests, including rice stem borers, leafhoppers, and leaf folders.
Dexban 48% EC	Chlorpyrifos 48%	II	It is commonly used to control a variety of insect pests in different crops, including rice. Deltamethrin is effective against a wide range of pests such as rice stem borers, leafhoppers, and leaf folders.
Chorsban 480 EC	Chlorpyrifos-ethyl	II	Chlorpyrifos" is the active ingredient in "Chorsban 480 EC," and it is indeed an insecticide commonly used in rice cultivation.
Decis 25 EC	Deltamethrin (25 g/l)	II	Decis 25 EC is an insecticide that contains the active ingredient deltamethrin. It is commonly used in rice cultivation to control a variety of insect pests, including rice leaf folder, rice stem borer, and rice bug.
Dimethoate	Dimethoate 40% EC	II	Dimethoate is an insecticide commonly used in rice cultivation. It is effective against a variety of pests that attack rice

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			plants, including rice leaf folders, rice stem borers, and rice leafhoppers. Dimethoate works by inhibiting the activity of acetylcholinesterase, an enzyme necessary for the proper functioning of the nervous system in insects. This leads to paralysis and eventually death of the targeted pests.
Spithoate 300 EC	Dimethoate	1b	Insecticide and acaricide with contact and stomach action suitable for control of sucking and chewing pest aphids, whiteflies and mites on rice
Cypermethrin	Cypermethrin 10% EC	II	Cypermethrin is an insecticide commonly used in rice cultivation. It belongs to the pyrethroid class of insecticides and is effective against a wide range of insect pests that attack rice plants, including rice stem borers, rice leafhoppers, and rice leaf folders. Cypermethrin works by disrupting the nervous system of insects, leading to paralysis and eventual death.
Cypermet	Cypermethrin	III	Cypermethrin belongs to the pyrethroid class of insecticides and is effective against a wide range of insect pests that attack rice plants, including rice stem borers, rice leafhoppers, and rice leaf folders.
Alphacal	Alphacypermethrin 100g/l	II	Alphacypermethrin is indeed an insecticide that can be used in rice cultivation. It belongs to the pyrethroid class of insecticides, which are effective

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			against a wide range of insect pests, including those that commonly affect rice crops such as stem borers, leafhoppers, and leaf folders.
K-Othrine 250 WG	Deltamethrin (250 g/kg)	III	K-Othrine 250 WG is a wettable granule insecticide that contains the active ingredient deltamethrin. Deltamethrin is a pyrethroid insecticide commonly used to control a wide range of insect pests, including those that affect rice crops. It is effective against pests like rice stem borers, leafhoppers, and leaf folders.
Finical 3 DP	Fenitrothion	II	It belongs to the organophosphate class of insecticides and is effective against a wide range of insects, including those that commonly infest rice crops. It's often applied to rice fields to control pests such as rice stem borers, rice leaf rollers, and rice bugs
Fenical 400UL	Fenitrothion	II	It belongs to the organophosphate class of insecticides and is effective against a wide range of insects, including those that commonly infest rice crops. It's often applied to rice fields to control pests such as rice stem borers, rice leaf rollers, and rice bugs
K-Optimal	Lambda-cyhalothrine (15 g/l)/ acetamipride (20 g/kg)	II	Lambda-cyhalothrin is commonly used as an insecticide in rice cultivation. It belongs to the pyrethroid class of insecticides and

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			is effective against a wide range of insects that infest rice crops, including rice stem borers, rice leaf rollers, and other pests.
Actellic 50 EC	Pirimiphosmethyl (50 g/l)	III	Actellic 50 EC is an insecticide commonly used in rice cultivation. It contains the active ingredient pirimiphos-methyl, which belongs to the organophosphate class of insecticides. Actellic 50 EC is effective against a variety of insect pests that infest rice crops, including rice weevils, rice bugs, and storage pests.
Actellic 300 CS	Pirimiphosmethyl (300 g/l)	III	Actellic 50 EC is an insecticide commonly used in rice cultivation. It contains the active ingredient pirimiphos-methyl, which belongs to the organophosphate class of insecticides. Actellic 50 EC is effective against a variety of insect pests that infest rice crops, including rice weevils, rice bugs, and storage pests.
Actellic Super Dust	Permethrine (3 g/kg) / Pirimiphosmethyl (50 g/l)	II	Actellic Super Dust is an insecticide used in rice cultivation. It contains the active ingredient pirimiphos-methyl, which is an organophosphate insecticide effective against a variety of pests commonly found in stored rice, such as weevils, beetles, and moths. Actellic Super Dust is often applied to rice grains during storage to protect them from insect infestation and damage.

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
Actellic Gold Dust	Pirimiphosmethyl (16 g/l) / Thiamethoxam (3.6g/kg)	III	It contains the active ingredient pirimiphos-methyl, which is an organophosphate insecticide effective against a variety of pests commonly found in stored rice, such as weevils, beetles, and moths. Actellic Super Dust is often applied to rice grains during storage to protect them from insect infestation and damage.
Dimet 400 EC	Dimethoate	II	It belongs to the organophosphate class of insecticides and is effective against a wide range of pests that infest rice crops, including aphids, leafhoppers, planthoppers, and thrips. Dimethoate works by inhibiting the activity of acetylcholinesterase, an enzyme essential for the proper functioning of the nervous system in insects. This disruption leads to paralysis and eventual death of the pests.
Pacharr 25 EC	Acetamipride 1g/l + Lambdacyhalothrin 1g/l	II	Acetamiprid is a neonicotinoid insecticide effective against a broad spectrum of pests including aphids, leafhoppers, thrips, and whiteflies. It acts on the nervous system of insects, disrupting neurotransmission, and ultimately causing death. Lambda-cyhalothrin, on the other hand, is a pyrethroid insecticide that targets a wide range of insect pests such as rice stem borers, rice leaf rollers, and other chewing

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			and sucking insects. It works by affecting the sodium channels in the nervous system of insects, leading to paralysis and death.
Tiger benzoate	Emamtectin	II	Emamectin benzoate is indeed an insecticide that is used in rice cultivation. It is effective against a variety of pests, including caterpillars, leafhoppers, and other chewing insects that can damage rice crops. Emamectin benzoate works by disrupting the nervous system of insects, leading to paralysis and eventual death. It is commonly applied to rice crops in various formulations such as liquid concentrates or granules.
Herbicides			
Yuperstar	Propanil 360g/L P	II	Propanil is used to control various kinds of weeds and grasses especially effective for cockspur grass, barnyard grass, broadleaves weeds on rice fields
Pendimethalin 33 EC	Pendimethalin 33%	II	It primarily targets annual grasses and certain broadleaf weeds by inhibiting their cell division and growth processes. Pendimethalin can effectively control a wide range of weeds in rice fields, including grassy weeds like barnyard grass, crabgrass, and broadleaf weeds like pigweeds and certain sedges. It's typically applied as a pre-emergent herbicide,

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			meaning it's applied before weed seeds germinate or shortly after rice seedlings are transplanted to the field. This helps prevent weed competition and ensures better yields for the rice.
Londox 60 DF	Bensulfuran methyl 600g/l	III	Herbicide selective for irrigated rice to control Cyperus weeds and effective against Dicotyledons weeds.
Stomp 33 EC	Pendimethalin 33%	III	For the control of annual, perennial, and aquatic weeds on rice
Quizar super	Quizalofop-PEthyl 100g/L	II	Quizalofop-P-ethyl is indeed an herbicide that is commonly used in rice cultivation. It belongs to the aryloxyphenoxypropionate class of herbicides and is effective against grass weeds in rice fields. Quizalofop-P-ethyl works by inhibiting the enzyme acetyl-CoA carboxylase, which is essential for lipid synthesis in grass weeds. This inhibition disrupts the growth and development of grass weeds, ultimately leading to the death of the plant
Propanil	Primagold	II	Used as a selective post-emergence herbicide in the control of grasses and broad leaves in rice
Rival 360 SL	Glyphosate (360 g/l)	III	It is particularly effective against grass weeds such as barnyard grass, watergrass, and signal grass, as well as some broadleaf weeds like smartweed. Rival 360 SL is

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			typically applied post-emergence to control weeds in rice fields
Roundup Biosec 68 SG	Glyphosate (680 g/kg)	III	It is a broad-spectrum herbicide effective against a wide range of weeds, including both grasses and broadleaf weeds. Glyphosate works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.
Roundup 360 K	Glyphosate (360 g/kg)	III	It is a broad-spectrum herbicide effective against a wide range of weeds, including both grasses and broadleaf weeds. Glyphosate works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.
Roundup 450 Turbo K	Glyphosate (450 g/kg)	III	It is a broad-spectrum herbicide effective against a wide range of weeds, including both grasses and broadleaf weeds. Glyphosate works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
Roundup Powermax	Glyphosate (540 g/l)	II	It is a broad-spectrum herbicide effective against a wide range of weeds, including both grasses and broadleaf weeds. Glyphosate works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.
Roundup	Glyphosate	II	It is a broad-spectrum herbicide effective against a wide range of weeds, including both grasses and broadleaf weeds. Glyphosate works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.
Glyphosate 41%SL	Glyphosate 41%	III	It is a broad-spectrum herbicide effective against a wide range of weeds, including both grasses and broadleaf weeds. Glyphosate works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.
Glyphadarr 360 g/l	Glyphosate	II	Used in the control of green annual weeds grasses and broad leaves. Glyphosate

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			works by inhibiting the enzyme EPSP synthase, which is essential for the synthesis of certain amino acids in plants. This inhibition disrupts the growth and development of weeds, ultimately leading to their death.
Camix 500 SE	Mesotrione (83.3 g/l) / smetolachlore (416.7 g/l)	III	Mesotrione: This herbicide belongs to the group of HPPD inhibitors (4-hydroxyphenylpyruvate dioxygenase inhibitors). It primarily targets broadleaf weeds and can be effective against various weeds commonly found in rice fields, such as water hemp, pigweed, and nightshade. Smetolachlor: Smetolachlor is a selective herbicide belonging to the chloroacetanilide chemical family. It is primarily used for pre-emergence control of grasses and some broadleaf weeds.
Codal Gold 412-5 DC	Prometryne (250 g/l) / smetolachlore (162.5 g/l)	III	This herbicide is a member of the triazine chemical family and acts as a selective herbicide primarily targeting broadleaf weeds. It inhibits photosynthesis in susceptible plants, leading to chlorosis and eventually plant death.
Corignena 500 EC	Metachlore 333 g/l Terbutryne 167 g/l	III	Metachlore, also known as Metolachlor, is a selective herbicide belonging to the chloroacetanilide chemical family. It is primarily used for pre-emergence control of grasses and some broadleaf weeds.

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			Terbutryne is a selective herbicide used for pre-emergence and early post-emergence control of grasses and some broadleaf weeds.
Cotonet 500 EC	Metolachlore (333 g/l) / terbutryne (167 g/l)	III	Metolachlor, primarily targets grasses and some broadleaf weeds. Metolachlor inhibits weed seedling growth by affecting lipid synthesis in the plants. Terbutryne is a selective herbicide used for pre-emergence and early post-emergence control of grasses and some broadleaf weeds
Oxanet 250 EC	Oxadiazon (250 g/l)	III	Oxadiazon is an herbicide commonly used in rice cultivation. It belongs to the chemical class of oxadiazole herbicides. Oxadiazon primarily acts as a pre-emergent herbicide, meaning it is applied to soil before weed seeds germinate to prevent weed emergence.
Callistar 250 EC	Oxadiazon (250 g/l)	III	Oxadiazon works by inhibiting the growth of weed seedlings by interfering with the synthesis of carotenoid pigments, which are essential for photosynthesis. It effectively controls a wide range of annual grasses and broadleaf weeds.
Oxariz 250 EC	Oxadiazon (250 g/l)	II	Oxadiazon is a herbicide commonly used in rice cultivation. It belongs to the chemical class of oxadiazole herbicides. Oxadiazon primarily acts as a pre-

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			emergent herbicide, meaning it is applied to soil before weed seeds germinate to prevent weed emergence.
Fungicides			
Prochlor super	Prochloraz 25% N	III	Prochloraz is effective against a wide range of rice diseases including blast (caused by the fungus Magnaporthe oryzae), sheath blight (caused by the fungus Rhizoctonia solani), and leaf smut (caused by the fungus Pyricularia grisea). Prochloraz works by inhibiting the growth of fungi and disrupting their ability to reproduce, ultimately leading to the control of fungal diseases. It's typically applied as a foliar spray or seed treatment to protect rice plants from fungal infections and to prevent yield losses.
Dithane M 45	Mancozeb (800 g/kg)	U	Dithane M-45 is a fungicide that is commonly used in rice cultivation. It contains the active ingredient mancozeb, which belongs to the group of dithiocarbamate fungicides. Mancozeb is effective against a wide range of fungal diseases that can affect rice crops, including blast (caused by the fungus Magnaporthe oryzae), sheath blight (caused by Rhizoctonia solani), and leaf spot diseases. It works by interfering with various enzymes and processes within the

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
			fungal cells, ultimately leading to their death.
Coga 80 WP	Mancozeb (800 g/kg)	U	Mancozeb is effective against a wide range of fungal diseases that can affect rice crops, including blast (caused by the fungus Magnaporthe oryzae), sheath blight (caused by Rhizoctonia solani), and leaf spot diseases. It works by interfering with various enzymes and processes within the fungal cells, ultimately leading to their death.
Dithane, R	Mancozeb	II	It contains the active ingredient mancozeb, which belongs to the group of dithiocarbamate fungicides. It works by interfering with various enzymes and processes within the fungal cells, ultimately leading to their death.
Yuhomil	Metalaxyl 8% + Mancozeb 64%	II	Metalaxyl is a systemic fungicide that belongs to the group of phenylamide fungicides. It is effective against diseases caused by oomycetes, such as damping-off, seedling blights, and root rots.
Seedox	Imidachlorpride 10% + metalaxyl 10% + carbendazine 10%	II	Seed treatment is effective in preventing and killing Nephotettix cincticeps, Delphacidae, Phytophthira, Drosophila, weevils, rice borer, Bemisia tabaci etc. in rice,

Name of Product	Active Ingredient (s)	Hazard Classification	Uses
Calthio C 50 WS	Thirame (250 /kg) / chlorpyrifos ethyl (250 g/kg)	II	Thiram is a broad-spectrum fungicide and seed treatment agent. It is effective against a wide range of fungal diseases such as damping-off, seedling blights, and various soil-borne diseases. Thiram works by inhibiting fungal growth and preventing the establishment of fungal infections. Chlorpyrifos ethyl is an insecticide belonging to the organophosphate class. It is effective against a broad range of insect pests, including rice stem borers, leafhoppers, and other chewing and sucking insects
Calthio C 1350 FS	Imidacloprid (250 g/l) Thirame (100 g/l)	II	Imidacloprid is a systemic insecticide belonging to the neonicotinoid class. It is effective against a wide range of sucking insects, including aphids, leafhoppers, and whiteflies. It is effective against various fungal diseases such as damping-off, seedling blights, and soil-borne diseases. Thiram works by inhibiting fungal growth and preventing the establishment of fungal infections.

Hazard Classification (toxicity levels): 1a – Extremely Hazardous; 1b – Highly Hazardous; II – Moderately Hazardous; III – Slightly Hazardous; U – Unlikely to present acute hazard

Source; National Environment Agency (NEA) The Gambia - Hazardous Chemicals and Pesticides Programme, 2022; The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification, 2019

3.2 Pest Control Methods

Rice, a staple food faces numerous threats from pests that can significantly impact yield and quality. Therefore, effective pest control methods are essential for ensuring sustainable rice production. Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

The IPM techniques will include all possible solutions to manage the available pests and avoid using chemical pesticides. Below are the main techniques that will be promoted and used during the implementation of the REWARD Project activities:

3.2.1 Biological Control

Biological control is a method of controlling pests using living antagonistic organisms, called biological control agents. This method can be effective and poses less threat to human health, plant health and the environment. Biological control is not to be viewed as a method that will replace or eliminate the use of chemical pesticides. The indiscriminate use of pesticides has upset the natural balance between the pest and natural enemy population leading to an upsurge of pest populations. Therefore, many minor pests have also attained the status of major pests due to changes in the agro-ecosystem. The judicious use of pesticides considering their safety to natural enemy fauna will reduce the ill side effects. Genetic improvement of natural enemies through selective breeding and hybridization will greatly enhance the effectiveness of natural enemies in PMP programmes. Biological control of important crop pests is given below.

Biological Control Agents (BCAs) include:

i. Predatory insects and mites eat their prey. Predatory insects and spiders prey and feed on more than one insect during their lifespan and provide effective control of different insect pests in various crops. The predator *Cyrtorhinus lividipennis* (Reut.) and *Lycosa spp* is found against Bollworms, *Pectinophora gossypiellla*, *Earias insulana*, *E. vitella*, *Helicoverpa armigera* which affects rice.

ii. Parasitoids are insects with an unattached adult stage and a larval stage that parasitizes another insect. Among the egg parasitoids, only *Trichogramma japonicum* (Ashmead) and *T. fasciatum* (Perkins) could partially parasitize the eggs of the yellow stem borer, *Scirpophaga incertulas* (Walker). The inundative releases of *Trichogramma* (spp.) attempted at weekly intervals @ 50,000 parasitoids/ha by the Central Biological Control Stations resulted in a significant reduction in the stem borer infestation. The main limitation in adopting inundative release of *Trichogramma* against yellow stem borer is that none of the species is capable of attacking all eggs of the egg mas. For the control of leaf folder release of *T. chilonis* @ 50,000/ha/week for 3 weeks is recommended. Five inundative releases of *T. japonicum* @ 50,000 to 1,000,000/ha/week starting from 30 DAT (days after transplanting) during rabi effectively suppress yellow stem borer.

iii. Microbial parasites and pathogens, such as nematodes, fungi, bacteria, viruses and protozoa cause fatal infections. Microbial control agents are naturally occurring microorganisms causing natural suppression of the insect population. These agents possess high host specificity and thus selectivity protects the non-target organisms. Many of the microbial agents are compatible with insecticides and can be effectively used in Pest Management.

iv. Key parasitoids and predators of rice insect pest


Egg parasitoid emerging from YSB egg mass

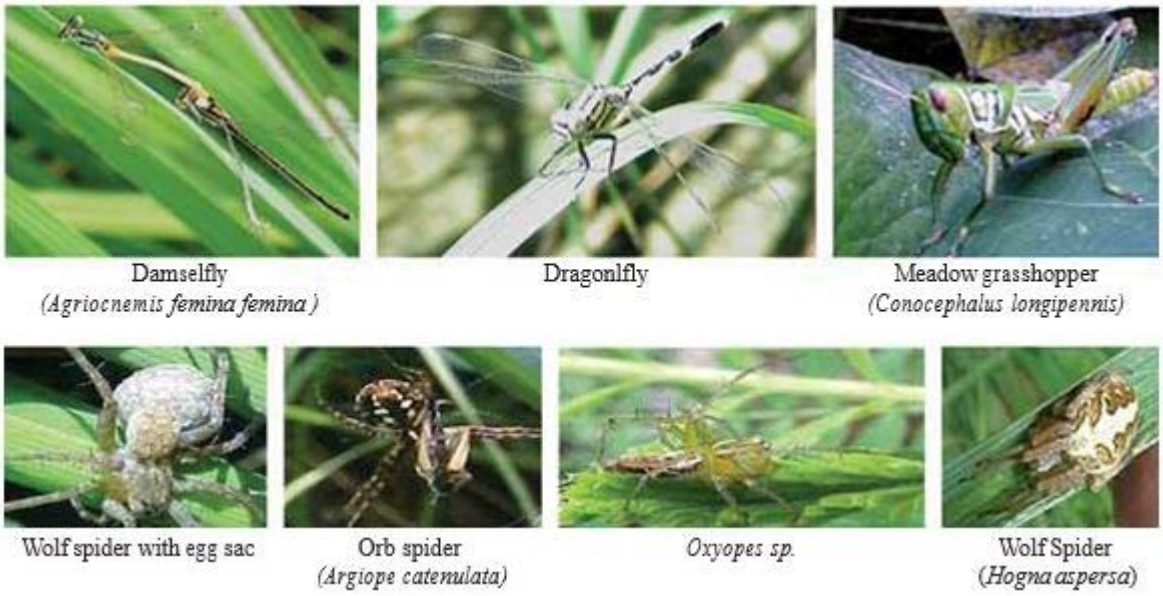

Egg parasitoid, *Trichogramma chilonis*


Cocoons of larval parasitoid, *Cotesia flavipes*


Coccinella septumpunctata


Micraspis hirashimai


Cheilomenes sexmaculatus



v. Use of Neem-based pesticides: Neem, *Azadirachta indica* A Juss (Family: Meliaceae) is an evergreen tree, that had its origin in the Indian sub-continent. It is currently grown in Africa and other continents. Neem is bitter in taste due to an array of complex compounds called Limonoids. The Limonoids in neem belong to nine basic structure groups: azadirone (from oil) amoorastaitin (from fresh leaves) vepinin (from seed oil), vilasinin (from green leaves) gedunin (from seed oil and bark), nimbin (from leaves and seed) nimbolin (from the kernel), salannin (from fresh leaves and seed) and the aza group (from neen seed). More than 100 bioactive compounds have been isolated from various parts of the neem tree, and still more are being isolated. Neem derivatives have now been reported as pesticides (including antifeedant metamorphosis disruptor, growth disruptor/juvenilizing, ovicidal/oviposition deterrent, anti-fecundity, anti-reproduction etc.) and pesticide adjuvants against over 250 insect species all over the world. However, the neem is reported non-toxic to man or animals and non-polluting to the environment. Prolonged and non-judicious use of a few insecticides has led to the development of insect resistance against them. Adaptive research trials on neem and other botanicals for promoting their use either alone or as a part of the Pest/Vector Management Plan system need to be undertaken. Several neem-based formulations have been developed. Some of them are quite effective in controlling the serious pests of different crops. These are being used alone or in

combination with synthetic insecticides and have given good control of target pests and also sometimes resulting in higher yields.

In the localities concerned by the project, the biological control method is known and will be reinforced and promoted within the framework of this project. By way of example, Green Muscle and *Habrobracon hebetor* are examples of biological control agents that have been successfully used in The Gambia. Indeed, Green Muscle is an entomopathogenic fungus specific to locusts that sporulates in the body of the infected insect and becomes a source of contamination for other congeners. Against the earworm, the use of *Habrobracon hebetor* has been satisfactory in the south bank of The Gambia with high millet production. Ants are often among the most important predators of the larvae and pulp of the armyworm (Perfecto, 1980).

3.2.2 Mechanical Control

Mechanical control methods for pests of rice involve physical measures to manage pest populations without the use of chemicals. These methods are particularly suitable for sustainable agriculture practices and can be effective in reducing pest damage. This method of control consists of reducing the population of males or females by using pheromone traps mixed with insecticides. Attracted males are killed once in contact with the lure.

- Handpicking: Manual removal of pests such as larvae, eggs, or adults from rice plants can be labour-intensive but effective for managing certain pests, particularly in small-scale farming.
- Flooding: Certain rice pests, such as rice water weevils, are susceptible to drowning. Controlled flooding of rice fields can help drown eggs, larvae, or adult pests, thereby reducing their populations.
- Flooding: Certain rice pests, such as rice water weevils, are susceptible to drowning. Controlled flooding of rice fields can help drown eggs, larvae, or adult pests, thereby reducing their populations.
- Traps and Barriers: Various traps and barriers can be deployed to capture or deter pests. Examples include sticky traps for insects, pheromone traps to attract and trap specific pests, and physical barriers like nets or screens to prevent pest access to rice fields. The trap must be suspended from a post or branch, placed at the edge of the field always above the height

of the plants at 30 cm. The trap should be set up regularly according to the growth of the plants. One trap should be placed every 0.5 to 2 ha.

3.2.3 Physical Control

Physical control methods for pests of rice involve using physical barriers or manipulating the environment to prevent pest access, disrupt their life cycles, or directly eliminate them. The method consists of regularly monitoring crop fields, at least twice a week, to locate eggs and young caterpillars on the plants, collect them and crush them manually. This method is easy to apply on small farmer plots. This option is the most economically and ecologically viable but can only be effective on small farms.

- Netting and Screens: Installing nets or screens over rice fields can prevent flying insects, birds, or other pests from accessing the crops. This method is particularly effective against birds and certain insects like rice leaf folders.
- Mulching: Applying mulch around rice plants can help suppress weed growth, which in turn reduces habitats for pests and their access to the rice plants. Additionally, certain mulch materials may have repellent properties against pests.
- Water Management: Manipulating water levels in rice fields, such as draining or flooding, can disrupt the life cycles of certain pests like mosquitoes, rice water weevils, and stem borers.

3.2.4 Cultural Control

The need for ecologically sound, effective and economic pest control methods has prompted renewed interest in cultural methods of pest control. Cultural control of insect pests has been defined as the tactical use of regular farm practices to delay or reduce insect pest attacks. It involves the manipulation of the environment to make it less favourable for insect pests and more favourable for crop growth.

- Crop Rotation: Rotating rice with non-host crops can disrupt the life cycles of pests that are specific to rice. This practice reduces pest buildup in fields and helps maintain soil health.

- Intercropping: Planting rice alongside other crops can create diverse habitats that attract natural enemies of rice pests, such as predators and parasitoids. Intercropping also reduces the risk of pest outbreaks by decreasing the uniformity of the crop environment.
- Varietal Selection: Choosing rice varieties that exhibit natural resistance or tolerance to pests can help reduce pest damage. Resistant varieties can withstand pest attacks better, reducing the need for chemical pesticides.
- Timing of Planting and Harvesting: Adjusting planting and harvesting dates to avoid peak pest activity periods can minimize pest damage. Early planting can help avoid pest infestations, while timely harvesting prevents pests from utilizing rice straw for shelter and reproduction.
- Sanitation Practices: Proper field sanitation, such as removing crop residues and weeds, can eliminate overwintering sites and breeding grounds for pests. It also reduces the likelihood of pest outbreaks in subsequent rice crops.
- Water Management: Proper water management, such as maintaining optimal water levels in rice fields, can affect the development of certain pests like mosquitoes, rice water weevils, and stem borers. Flooded fields can drown insect pests and disrupt their life cycles.

3.2.5 Chemical Control Method

Chemical control methods for pests of rice involve the use of pesticides to manage pest populations and reduce damage to rice crops. While chemical control can be effective, it should be used judiciously and in conjunction with other pest management strategies to minimize negative impacts on human health, the environment, and non-target organisms.

- Insecticides: Insecticides are used to control a wide range of insect pests in rice fields, including stem borers, leafhoppers, planthoppers, and rice water weevils. They can be applied as foliar sprays, seed treatments, or soil treatments to target specific pests at different stages of their life cycle.
- Herbicides: Herbicides are used to control weeds in rice fields, which compete with rice plants for nutrients, water, and sunlight. Herbicides can be applied before planting (pre-emergence), after planting but before weed emergence (pre-emergence), or after weed emergence (post-emergence) to suppress weed growth and minimize competition with rice crops.

- Fungicides: Fungicides are used to control fungal diseases such as blasts, sheath blight, and brown spots that can affect rice plants and reduce yield. Fungicides are typically applied as foliar sprays to protect rice plants from infection and minimize disease spread.
- Rodenticides: Rodenticides are used to control rodent pests such as rats and mice that can damage rice crops by feeding on seeds, seedlings, and mature plants. Rodenticides are often applied in bait stations or dispersed in rice fields to reduce rodent populations.
- Molluscicides: Molluscicides are used to control mollusk pests such as snails and slugs that can damage rice seedlings and young plants. Molluscicides are typically applied as baits or granules to target mollusks in rice fields.
- Seed Treatments: Pesticide-treated seeds are coated with insecticides or fungicides to protect rice seeds from pests and diseases during germination and early growth stages. Seed treatments can provide systemic protection against pests and diseases for a limited period.

3.3 Integrated Pest Management (IPM) and its Sustainability Benefits

Sustainable agriculture is meant to help farmers use resources more efficiently, protect the environment and preserve rural communities. Sustainable agriculture may be described as any system that provides for the profitable production of crops while minimizing adverse environmental impacts and utilizing natural resources to ensure agricultural production indefinitely. In other words, sustainable agriculture is a system that can evolve indefinitely towards greater human utility, greater efficiency of resource use, and a balance with the environment that is favourable to humans and other species.

The basic approach for pest regulation is consistent with the primary goals of sustainability. Thus, IPM employs ecologically based management processes developed with an understanding of natural cycles and natural regulators to these species that compete with humans for resources in agricultural production systems. Therefore, successful IPM programs are those that enhance agricultural enterprises and protect the environment.

IPM and sustainable agriculture share the goal of developing agricultural systems that are ecologically and economically sound. From an IPM perspective, the concept of sustainable agriculture provides a platform for launching IPM to higher levels of integration. Therefore, future developments and successes in IPM are quite important to the sustainability of agriculture. The contributions of IPM are critical to meet the economic, environmental and social mandates in assuring the sustainability of agricultural systems.

Economic Mandate

IPM emphasizes the necessity of economically viable practices that promote long-term sustainability in agriculture. At its foundation, IPM recognizes that maintaining low population densities of pests is essential for ensuring the profitability and sustainability of rice production. This principle stems from the establishment of economic injury levels and thresholds, which guide decision-making processes. By systematically sampling to monitor pest prevalence and employing economic thresholds as decision criteria, IPM not only supports sustainable agriculture but also ensures the economic viability of production systems.

Environmental Mandate

In the IPM approach, Sustaining ecosystems requires that off-farm inputs like agrochemicals, which hold the potential to be pollutants, and farming practices such as tillage operations, which can exacerbate soil erosion, be utilized in a manner that preserves soil and water quality. IPM has championed the prudent use of chemical pesticides in agricultural systems. This approach is designed to:

i. Safeguard natural control agents, and beneficial microorganisms.
ii. Minimize the unintended mortality of various non-target organisms, including wildlife species.
iii. Limit the accumulation of toxic residues in the environment.

The integration of environmental sustainability in IPM promotes a harmonious relationship between agricultural productivity and environmental preservation.

Social Mandate

Meeting the country's demand for a secure food supply necessitates the development of agricultural practices that integrate pest management with profitability while safeguarding the environment and human health. Integrated Pest Management (IPM) offer a safe and efficient approach to minimizing damage from pests of all kinds, but it also plays a crucial role in mitigating both chemical and microbial contamination risks in rice production. In addressing societal concerns, it's clear that ensuring health and prosperity requires a safe and sustainable food system, one that prioritizes both environmental preservation and the well-being of rice field workers.

3.3.1 Sustainability Benefits of Integrated Pest Management (IPM)

Economic benefits

Integrated Pest Management (IPM) reduces farmers' reliance on costly chemical pesticides, ensuring crop health and resilience while lowering production expenses and increasing profitability. By promoting soil health and sustainability, IPM also reduces the need for expensive soil remediation measures. Through capacity-building activities, IPM improves farmers' knowledge and skills, leading to more cost-effective pest management practices and higher agricultural productivity. Moreover, IPM mitigates risks associated with pest outbreaks and pesticide resistance, enhancing farmers' resilience to market fluctuations and environmental pressures, and ensuring long-term economic stability in rice production.

Ecosystem benefits

Integrated Pest Management (IPM) safeguards biodiversity and ecological balance by preserving the natural harmony of ecosystems. By reducing chemical contamination of soil, water, and air, IPM protects aquatic and terrestrial organisms from harm, promoting a healthy environment. IPM fosters soil health and fertility through sustainable practices like reduced tillage, preserving soil productivity and mitigating erosion. This approach also helps conserve freshwater resources by minimizing pesticide runoff into water bodies and maintaining the ecological balance of wetland habitats associated with rice cultivation. IPM encourages landscape diversity by incorporating natural habitats into agricultural landscapes, providing refuge and food for beneficial insects and wildlife. By integrating multiple pest control methods, IPM plays a crucial role in mitigating pest resistance to pesticides, reducing the selective pressure on pest populations and maintaining the effectiveness of chemical pesticides. This holistic approach prevents widespread pest outbreaks and ecosystem disruptions, ensuring a balanced and thriving ecosystem.

Environmental Benefits

Integrated Pest Management (IPM) offers a sustainable approach to rice production, safeguarding both the environment and crop health. IPM reduces chemical contamination, preserving biodiversity and ecological balance. This reduction in chemical usage not only minimizes harm to non-target organisms like beneficial insects, birds, and aquatic life but also helps maintain the effectiveness of available control measures by delaying the onset of pesticide resistance. Furthermore, IPM plays a crucial role in protecting water quality. Unlike conventional rice

farming, where chemical pesticides can leach into water bodies, contaminating surface and groundwater, IPM practices mitigate this pollution by reducing chemical inputs. This safeguarding of water quality ensures the health of aquatic ecosystems associated with rice cultivation. In addition to environmental benefits, IPM promotes soil health and fertility. Chemical pesticides can disrupt soil ecology and fertility, but IPM practices prioritize non-chemical control methods such as habitat manipulation, and biological control agents. By employing targeted application methods and alternative pest management techniques, IPM reduces the risk of pesticide drift and its associated environmental impacts.

Social Benefits

Integrated Pest Management (IPM) in rice production has a profound impact on social benefits, leading to healthier communities, economic stability, and empowerment among farmers. By reducing chemical pesticide use, IPM promotes healthier living conditions, minimizing exposure to harmful toxins and resulting in improved health outcomes and reduced risks of pesticide-related illnesses and accidents among farmers, farmworkers, and nearby residents. This, in turn, enhances overall well-being and community health. IPM also contributes to economic stability in rural areas by reducing input costs and increasing yields, resulting in higher profits for farmers. Sustainable pest management strategies and reduced pesticide expenses improve the economic resilience of farming households, reducing poverty and enhancing livelihoods within rural communities. Moreover, IPM fosters empowerment and education among farmers through participatory approaches and access to information on sustainable practices. This enables farmers to make informed decisions about pest management, enhancing their confidence and agency, and leading to increased engagement in agricultural activities and strengthened stewardship of the land.

The adoption of IPM also encourages collaboration and knowledge-sharing among farmers, fostering strong social networks and community cohesion.

3.4 Pesticide Management Methods

Pesticide management in rice production involves various strategies aimed at effectively controlling pests while minimizing adverse effects on human health, the environment, and non-target organisms.

Table 3.3: Guidelines for Pesticides Management

Management Practices	Recommended Actions	Responsible Parties
Procurement/ purchase	Complying with the registration process of NEA and the CSP in force. The WHO and FAO guidelines for pesticides and vector control should be adhered to. The Procurement Guidelines of the African Development Bank and The Gambia Public Procurement Authority should be adhered to.	NEA, PPS, CPCU, and PIU
Testing the Quality of the Product	Testing the Product Quality is essential for the quality and efficacy of the treatments to be conducted.	PPS, CPCU, PIU , MOH, NARI and NEA
Labelling	Ensure that the Pesticides are properly packaged and labelled according to WHO Standards, and written in English and should indicate the content, safety instruction warning and action to be taken in case of accident. The Pesticide should remain in its original container and its label	NEA, PPS, NARI and PIU
Storage and Transportation	Appropriate precautionary measures should be taken and protective gear worn for protection. Compliance with the National Legislation is a must. Pesticides should be stored properly under lock and key, the store must be well-ventilated and located away from residences. The store must have a fire extinguisher and detergents.	NEA, PPS, CPCU, and PIU
Use	1. The operator must follow the instructions written on the label. Protective gear must be worn and follow the recommended guidelines.	5. NEA, PPS, NARI, CPCU, PIU and farmers

Management Practices	Recommended Actions	Responsible Parties
	2. Avoid applying pesticides during windy conditions. 3. To reduce the impact on the beneficial insects, apply pesticides in the evening or early in the morning. 4. Ensure that only the required dose is applied.	
Disposal	All the empty containers of pesticides must be gathered and stored at NARI awaiting for suitable recommendation from NEA for proper disposal	NEA, NARI, PPS and PIU
Monitoring Applicators Pesticide Exposure Levels and keeping records.	Monitoring of exposure levels of pesticide applicators is recommended before the season, and regularly during the season, to determine the levels of exposure to applicators to ensure their health and safety.	PPS, CPCU, PIU , MOH, NARI and NEA
Training of all actors involved in the implementation of the research programs	Training of all Actors and Collaborators in Pesticide Management	PPS, CPCU, PIU, NARI and NEA

3.5 Negative Impacts of Uncontrolled Use of Pesticides

The uncontrolled use of pesticides has negative repercussions across various fronts. It leads to environmental pollution by contaminating water, soil, and air, endangering ecosystems and biodiversity. Non-target species suffer as pesticides harm beneficial organisms, disrupting the natural balance. Additionally, pesticide residues on crops pose health risks to consumers, while overuse fosters the development of resistance in pest populations. Human health is jeopardized through exposure, with risks ranging from respiratory issues to cancer. Soil quality deteriorates,

impacting fertility and agricultural sustainability. Water sources become contaminated, endangering aquatic life and human health. Disrupted natural predator-prey relationships further exacerbate pest problems. Pesticide-induced harm to pollinators like bees threatens agricultural productivity.

3.5.1 The Risk Associated with Pesticides

In Rice cultivation, the use of pesticides is important, However, their extensive application brings forth a myriad of risks that demand careful consideration and proactive management. The emergence of pesticide-resistant pests poses a formidable challenge to effective pest control strategies. With concerns ranging from the potential health implications of pesticide residues in rice grains to the environmental ramifications of ecosystem disruption and water contamination.

1. **Health Risks**
    - Pesticide residues can remain on rice grains even after washing and cooking, leading to potential ingestion by consumers. Chronic exposure to these residues has been linked to various health issues such as cancer, reproductive problems, and neurological disorders.
    - Farmers and agricultural workers who handle pesticides are at high risk of exposure through skin contact, inhalation, or ingestion. Without proper protective gear and training, they are susceptible to acute poisoning and long-term health effects.
2. **Environmental Risks**
    - Pesticides used in rice fields can leach into groundwater or runoff into nearby water bodies, contaminating water sources. This pollution not only affects aquatic ecosystems but also poses risks to drinking water supplies.
    - Pesticides often harm beneficial insects, birds, and other wildlife, disrupting ecosystems and reducing biodiversity. For example, the decline of pollinators due to pesticide use can threaten the pollination of rice and other crops.
3. **Resistance and Pest Outbreaks**
    - Overreliance on pesticides can lead to the development of resistance in pest populations, rendering the chemicals less effective over time. This necessitates the use of higher doses or more potent pesticides, exacerbating environmental and health risks.
    - Pesticide application can disrupt natural predator-prey relationships, leading to outbreaks of secondary pests. This creates a vicious cycle where more pesticides are needed to control the

resurgence, further escalating the risks.

4. **Sustainability Concerns**
    - Continuous use of pesticides can degrade soil quality by killing beneficial microorganisms and disrupting nutrient cycling. This diminishes the long-term productivity and sustainability of rice fields, necessitating additional inputs to maintain yields.
    - Excessive pesticide use can eliminate natural predators and biological control agents that help regulate pest populations. This dependence on chemicals undermines the ecological balance within rice ecosystems, making them more susceptible to pest outbreaks.

3.5.2 Effects of Pesticides on the Environment

The use of pesticides in rice cultivation has both immediate and long-term effects on the environment. While pesticides are intended to control pests and diseases, they often have unintended consequences on non-target organisms and ecosystems. Pesticide runoff from rice fields can contaminate nearby water bodies, leading to water pollution. This contamination can harm aquatic organisms, disrupt ecosystems, and pose risks to human health if the water is used for drinking or irrigation. Pesticides can accumulate in the soil, affecting soil biodiversity and microbial communities. This can disrupt nutrient cycling processes and reduce soil fertility over time. Pesticide use can harm beneficial insects such as pollinators and natural predators, leading to imbalances in insect populations and ecosystem dynamics. There are concerns about the development of pesticide resistance in pest populations, which can lead to the need for higher pesticide doses or the use of more toxic chemicals, exacerbating environmental impacts.

3.5.3 Effects of Pesticides on Humans

Exposure to pesticides can have various adverse effects on human health, both directly and indirectly. Direct exposure to pesticides during application or through consumption of contaminated food can lead to acute poisoning. Symptoms may include nausea, vomiting, dizziness, and in severe cases, organ damage or even death. Long-term exposure to low levels of pesticides, which can occur through dietary intake of residues on rice and other foods, has been linked to chronic health problems. These may include developmental disorders, reproductive issues, neurological damage, and certain types of cancer. Pesticide residues can accumulate in the

body over time, posing risks to vulnerable populations such as pregnant women, infants, and children, whose developing bodies may be more sensitive to the effects of toxic chemicals. Moreover, pesticide drift and runoff can contaminate air, water, and soil in agricultural areas, leading to indirect exposure for nearby communities. This can pose health risks through inhalation of airborne pesticides, consumption of contaminated water, or ingestion of contaminated soil or dust.

3.5.4 Effects of Pesticides on Wildlife

Pesticides used in rice farming can seriously harm wildlife and upset the natural balance of ecosystems. They can directly hurt animals when they eat, breathe, or touch them. Birds, mammals, amphibians, and water creatures can suffer sickness or even death if they come in contact with pesticides. These chemicals can also destroy or pollute the food sources of wildlife, causing hunger or making it harder for them to have babies. When pesticides are used, plants and homes for animals can get damaged or destroyed, leading to animals losing their homes or being forced to move. Over time, pesticides can build up in animals' bodies. This can be especially dangerous for top predators like birds of prey, as they might eat other animals with high levels of pesticides. This build-up of toxins in animals higher up the food chain is called bio-magnification and can be harmful. Many pesticides, especially ones meant to kill insects, can also harm important pollinators like bees and butterflies. These little creatures are super important because they help plants, including rice plants, make new seeds. If their numbers drop, it can mess up the whole ecosystem and make it harder for crops to grow. Pesticides may alter the balance of nature by reducing the variety of plants and animals in an area and changing how they interact. For instance, getting rid of certain insects with pesticides can make it harder for animals that eat those insects to find food, or it might make other pests more common.

3.5.5 Effects of Pesticides on Vulnerable Populations

Plant protection agents and populations (producers and local residents) are the most exposed. Indeed, field agents (phytosanitary agents) involved in treatment operations are the most directly exposed. In addition to them are drivers and individuals in the food chain. The farmers who carry out the treatments themselves are exposed to the harmful effects of pesticides during and after the treatment operations. The lack of application of hygiene measures and good practices related to

the use of pesticides (use appropriate PPE) exposes them dangerously to the negative effects of pesticides. In addition, these empty containers are used to serve meals, and drinks, preserve food, etc., which increases the risk of contamination of the population.

The groups most vulnerable to the adverse effects of pesticide use are:

1) **Children:** Because their immune systems are not fully developed, children are particularly vulnerable to the harmful effects of pesticide exposure. They are exposed through breastfeeding if their mothers have been poisoned by pesticides.
2) **Women:** Among women, several physiological, socio-cultural and economic factors are at the root of their vulnerability. These include:
    - Women's skin absorbs pesticides more easily than men's;
    - The abundance of fat in women promotes longer retention of pesticides than in men.
    - Estrogen (present only in women) increases the effects of pesticides on the nervous system;
    - Some harvesting and storage activities are the responsibility of women.
3) **Elderly people:** they represent a fragile layer due to their advanced age leading to a decrease in their body's ability to defend itself against various external attacks (microbes, viruses, dangerous products, etc.).

The main risks associated with the handling, transport, storage and use of pesticides relate to the contamination of components of the biophysical environment and human aspects. The use of pesticides affects the health of populations and domestic animals. As for the biophysical environment, the main components affected are soils, water resources (surface and groundwater) and wildlife. The main risks associated with pesticide use are summarized in Table 3.4 below.

Table 3.4: Potential Risks Associated with Pesticides

Activities		Risks	
		Human Environment	**Biophysical Environment**
Transport	Use of public transportation vehicles for people and goods	• Passenger contamination • Inhalation of product vapours • Inhalation of contaminated dust • Skin burns from contact	Accidental spills and contamination of soil and groundwater resources through leaching in the event of a traffic accident
Storage	• Non-compliance with national regulations and FAO standards on pesticide storage and/or obsolete stocks • Lack of training of pesticide traders.	• Odour nuisances • Contact with the skin during handling • Bioaccumulation of pesticides .	*In the event of an uncontrolled spill or Leak:* • Soil contamination • Surface Water Contamination • Impairment of ambient air quality
Distribution	• Insufficient training and awareness-raising activities for authorized distributors • Lack of supervision of phytosanitary agents and producers.	• Inhalation of vapours; • Dermal contact by splash during preparation	• Contamination of water sources by washing containers. • Accidental spills and contamination of soil and groundwater resources. • Harm to non-target species and pollinators. • Air pollution when applied in windy conditions.

Activities		Risks	
		Human Environment	**Biophysical Environment**
			• Resistance development. • Habitat destruction.
Packaging management	• Failure of the empty packaging management system (storage, collection, transport, rinsing and compaction) • Lack of appropriate equipment for the disposal of empty packaging.	• Health concerns related to the ingestion of pesticide residues when reusing empty containers (plastic cans and metal drums) that have not been properly cleaned • Dermal and respiratory conditions • Chronic intoxication of personnel in the distribution chain	• Spill of product funds on soils • Groundwater contamination
Container washing	Information and awareness system failure	Low level of public awareness of the health risks associated with handling pesticides	• Acute poisoning of fish and other crustaceans • Pollution of points (wells) and water bodies (ponds) • Water contamination by runoff or wind action
Control	• Absence of phytosanitary police • Failure of the control systems set up by the Ministry in Charge of Agriculture	• Presence on the market of non-approved products and of approved but obsolete products	More acute toxic effects in the food chain

CHAPTER IV:

PESTS/VECTOR MANAGEMENT PROCEDURES

4.1 Introduction

Pest/Vector Management Plan (PMP) is the holistic approach of integrating different control methods such as biological, biotechnological, chemical, physical (mechanical), and cultural measures to control pests. It is based on ecological principles and involves the integration and synthesis of different components/control tactics into a pest management system. To effectively implement PMP, the methods used must be compatible, environmentally friendly and cost-effective. It must also take into account the entire cycle of the pest and timely intervention.

Integrated pest management advocates for employing a variety of control methods simultaneously, aiming to minimize or even eradicate the reliance on synthetic chemical pesticides. By blending cultural practices, biological controls, and the application of bio-insecticides, a balanced approach can effectively suppress pest populations without resorting to pesticides. In situations involving pests like nematodes or diseases such as bacterial wilt, this holistic strategy may prove indispensable, either due to the risks or costs associated with chemical interventions or the absence of suitable pesticides for controlling these specific threats. This project will embrace integrated pest management methods. Drawing on the collective experiences and capabilities of relevant stakeholders, this approach will facilitate the collaborative implementation of integrated strategies to combat pests.

4.2 Pest/Vector Management Approaches

In each region, a screening checklist will be developed for major pests and diseases associated with the rice in the project-targeted areas. A draft screening checklist is attached in Annex 4. Accordingly, the PMP will serve as a guide to the field supervisors, agriculture engineers, facilitators, trainers and farmers during the implementation of the project interventions by adapting it to the local knowledge and indigenous experience of local farmers. And will be monitored and updated throughout the project lifecycle.

The project measures will start with providing advice and training for targeted farmers on the following issues to minimize the risk of using pesticides:

- Making decisions to use pesticides
- Selection of proper and recommended pesticides
- Transport, storage, handling, distribution of pesticides and disposal.
- Risks in the handling and use of pesticides
- Managing pests with traditional and indigenous techniques (IPM)

- Managing risks and pesticide poisoning
- Protective gear use and maintenance
- Public awareness on the safe use of pesticides, extension, radio talks, etc.
- Pesticide emergency plan.

During the project implementation, specific simplified updated PMPs will be prepared for activities involving the use of pesticides to ensure the application of proper measures for procurement, transport, handling, storage, and training on pesticide management. The plans will involve simple, realistic and relevant measures, mainly in the intervention areas of the REWARD program The Integrated Pests/Vector Management Plan includes:

1) Intervention principles;
2) Strengthening of the legislative framework for pesticide management;
3) Capacity building for stakeholders through training/awareness-raising;
4) The applicable technical measures;
5) Promoting the use of safer alternatives.
6) Good practices to adopt before, during and after pesticide application
7) Appropriate health and safety measures to be taken in case of exposure
8) Monitoring and evaluation plan

4.3 PMP Intervention Principles

The following internationally recognized basic principles will be applied in ensuring effective pests and pesticide management for the REWARD Program:

Principle 1: Obtain and grow quality plant material;
Principle 2: Choose fertile soils and places suitable for planting;
Principle 3: Adopt good nursery practices;
Principle 4: Adopt appropriate planting methods;
Principle 6: Adopt good soil conservation practices;
Principle 7: Adopt proper water management practices;
Principle 8: Regular weeding;
Principle 9: Inspect fields regularly;
Principle 10: Maintain field sanitation;
Principle 11: Control pests effectively;

Principle 12: Conservation of natural enemies

Principle 13: Minimize the application of chemical pesticides;

Principle 14: Adopt good harvesting practices;

Principle 15: Adopt clean and good-quality storage facilities.

4.4 Challenges Associated with the Implementation of Pest/Vector Management

According to the analysis made on the management of pests and pesticides based on the literature review and interview conducted, the following are some of the problems associated with Integrated Pest/Vector Management.

4.4.1 Insufficient Application of Good Practices in Pesticide Management

The insufficient application of good practices in pesticide management presents a significant threat to global agricultural sustainability. Without strict adherence to established guidelines and regulations, the indiscriminate use of pesticides can result in severe consequences for both human health and the environment. Inadequate monitoring and control measures further compound these risks, potentially leading to water contamination, soil degradation, and harm to non-target organisms. These lapses undermine efforts to promote sustainable agriculture and compromise food security goals. Some of these challenges include:

- A lack of clear guidance and understanding among stakeholders
- Insufficient storage facilities may increase the risk of spillage, contamination, and unauthorized access to pesticides.
- Limited training and awareness programs contribute to mishandling and exposure risks among farmers and pesticide handlers.
- Improper waste management practices pose environmental and health hazards, necessitating improved disposal mechanisms.

4.4.2 Insufficient Means of Alternative (non-chemical) Pest/Vector Management

The deficiency in promoting alternative (non-chemical) pest/vector management methods presents a critical challenge to sustainable agricultural practices. Despite the pressing need for eco-friendly alternatives, the pace of experimentation with these methods remains sluggish. Additionally, there is a glaring lack of individuals trained in integrated pest and production management, hindering the dissemination and implementation of alternative approaches. This

gap is further compounded by the non-implementation of existing alternative methods of pest control.

- The slow pace of experimentation hinders the development and adoption of eco-friendly pest management alternatives.
- The shortage of trained individuals impedes the dissemination and implementation of alternative approaches in agricultural practices.
- Despite existing alternatives, the failure to implement them perpetuates reliance on chemical pesticides, exacerbating environmental and health risks.

4.4.3 Weak Capacity for Intervention, Control and Monitoring of Actors

Insufficient capacity for intervention, control, and monitoring of actors represents a notable challenge in pest management. This deficiency undermines effective governance and regulation within the sector, impeding the enforcement of policies and regulations. Stakeholders may exploit loopholes and evade compliance, exacerbating pest-related risks. Limited intervention capacity restricts the government's ability to address emerging issues promptly and effectively. Additionally, inadequate control mechanisms fail to regulate actors' behaviour within prescribed frameworks, leading to the potential misuse of pesticides. Other related challenges are:

- The lack of personnel hampers local intervention efforts and oversight in plant protection activities.
- Inadequate resources limit the effectiveness of plant protection agents in carrying out their duties.
- Lack of coordination leads to disjointed efforts, reducing the effectiveness of interventions and regulatory measures.
- Without proper training and awareness, pesticide users may misuse or mishandle chemicals, posing risks to human health and the environment.
- Traders may operate outside regulatory frameworks due to a lack of understanding of administrative procedures, leading to unregulated sales and distribution of pesticides.
- Insufficient awareness leaves the population vulnerable to pesticide-related health risks and poisoning incidents.
- Health personnel may lack the necessary skills and knowledge to effectively manage pesticide poisoning cases, compromising the quality of care provided.

- The absence of protective gear exposes individuals to health hazards when handling pesticides, increasing the risk of poisoning and accidents.
- Inadequate protocols for pesticide poisoning cases may result in delays or inadequate treatment, exacerbating health outcomes for affected individuals.

4.4.4 Deficiency in Environmental and Social Monitoring Control and Analysis

The failure to control and analyse the environmental and social monitoring system poses a significant obstacle in pest management. Inadequate oversight undermines the capacity to effectively track and evaluate environmental and social impacts, posing risks to ecosystems and communities. Without robust control mechanisms, activities with potential environmental and social repercussions may go unregulated, leading to degradation and harm. Moreover, the lack of thorough analysis inhibits the understanding of these impacts, hindering informed decision-making and mitigation efforts. Key areas that require attention include:

- Weak oversight of product distribution and vendors increases the risk of unauthorized sales and misuse of pesticides.
- Insufficient monitoring of pesticide usage contributes to the risk of overuse or misuse, leading to adverse environmental and health impacts.
- Failure to analyse pesticide residues hinders the identification of contamination hotspots and the implementation of remedial measures.
- The absence of comprehensive environmental monitoring limits the understanding of ecosystem health and the identification of emerging threats.
- Inadequate monitoring of pesticide applicators and producers' health compromises occupational safety and health standards, posing risks to human well-being.

4.5 Factors Facilitating the Smooth Implementation of PMP

Given all the above, it is compulsory to set up efficient pest control mechanisms and rational use of pesticides and, above all, to promote alternative control methods and integrated management. It is within this framework that this action plan has been drawn up, the main thrusts of which are as follows:

- The promotion and development of alternative control methods to chemical control.
- The promotion of good pesticide management practices.
- Capacity building (training, awareness-raising, institutional support).
- Control, monitoring and evaluation.

4.5.1 Promotion and Development of Non-Chemical Methods of Pest Control

The main aim of the non-chemical approach is to reduce the use of chemical pesticides while intensifying production and sustainably increasing rice yields through improved farming practices. This will help farmers to become aware of the negative consequences that are caused by poorly adapted management methods, such as the use of highly toxic pesticides and the lack of balanced fertilization, and at the same time to present many alternative management methods, positive, feasible and both sustainable and profitable.

To contribute to the reduction in the use of pesticides and chemical fertilizers in the project intervention areas, there will be the need to establish farmer field schools, hence reducing the risks of environmental pollution. The Farmer Field Schools will emphasize the practice of improved methods of production and methods of alternative control for pest control. The Farmer Field School is a structured group made up of 25 to 30 producers who meet regularly during a growing season (cycle) in their field (learning ground) in the presence of Researchers and extension workers, to learn how to solve problems relating to the management of their environment and their farms, following a program resulting from a diagnosis previously developed by themselves, with the support of a facilitator and using tools and methods of non-formal adult education.

The use of non-chemical approaches will be promoted and encouraged for pest management. However, applied research actions must be initiated by the plant protection services, in collaboration with sub-regional research and advisory support institutes (AGRHYMET, ICRISAT) and universities, to specify the best approaches and methods of application. This will avoid any risk of phytotoxicity.

To guarantee an effective non-chemical method, the following should be ensured:

- Identification of the best non-chemical control methods and their improvements;
- Dissemination of proven control methods.

4.5.2 Encourage Good Pesticide Management Practices

This will be done through compliance with phytosanitary regulations (in particular the FAO directives) on the use of pesticides, the improvement of transport and storage conditions, and on good management of empty containers and obsolete stocks.

Compliance with Regulations: All pesticides introduced or produced in the Gambia must comply with the list of products authorized in the CILSS area and benefit from a provisional or final authorization for sale activities.

Improvement of Transport Conditions: Improvement of the transport conditions for pesticides at the project intervention areas must be ensured. At the level of the other actors, awareness-raising actions must be carried out, in particular for approved distributors, so that the transport of pesticides is carried out using specialized vehicles, failing this, avoiding associating pesticides with people or with other goods. The following must be ensured:

- Provide the regional directorates of agriculture of the regions concerned, with material and financial means to regularly maintain the car parks used for the transport of chemicals (pesticides and fertilizers);
- Sensitize authorized distributors and producers on the conditions of transport of pesticides and fertilizers.

Improvement of Storage Infrastructure: The three regions of intervention should have standardized stores for the storage of the pesticides. All the stores in the three (3) regions must have been upgraded to FAO pesticide storage standards. To achieve this, the following must be ensured:

i. Build pesticide storage stores at FAO standards in the project localities;
ii. Draw up an inventory of the phytosanitary warehouses;
iii. Build new warehouses for certain (if applicable);
iv. Train warehouse managers and approved distributors on pesticide management.

Safe Use of Pesticides: Measures to reduce the use and efficient use of pesticides must be taken before any intervention. These include early detection of areas at risk of infestation, maintenance and proper calibration of treatment equipment. Egg surveys to detect areas with high concentrations of viable eggs of embryonic diapause locusts, preventive surveys to locate any threatening aggregations of gregarious locusts, maintenance of application equipment and materials and capacity building of applicators, and the use of bio-pesticides on young locust stages are necessary to reduce pesticide use.

To mitigate the negative effects of pesticides on water, wildlife and flora, it would be advisable to take the following measures:

- The rational and safe use of pesticides to minimize their discharge into water. Also, these waters must be analysed periodically to monitor their quality;
- Reducing the use of pesticides will also minimize contamination of aquatic fauna and flora. Thus, animal health could be better improved in the project area.

Measures to reduce and efficiently use pesticides must be taken before any intervention. It is about early detection of areas at risk of infestation, maintenance and proper calibration of treatment devices.

4.6 Pesticide Risk Management

Pesticide Risk Management involves strategies and practices aimed at minimizing the potential risks associated with pesticide use. This includes measures to mitigate environmental contamination, reduce human health hazards, and prevent harm to non-target organisms. Effective risk management entails careful consideration of pesticide selection, application methods, and regulatory compliance. It also involves monitoring and surveillance to assess the effectiveness of risk reduction measures and to identify emerging risks. The following measures are required to avoid and or reduce the risks associated with the use of pesticides:

i. Distribution of the updated list of pesticides registered by the CILSS to producers and PIU;
ii. The extension and promotion of practices to reduce the use of pesticides (biological control and use of bio-pesticides);
iii. The establishment of a management system for obsolete stocks of pesticides;
iv. The establishment of a system for the collection, storage and disposal of obsolete chemicals;
v. The development of a database on pesticide use;
vi. Support and advice for users in the acquisition of PPE;
vii. The development and implementation of health and safety measures in the workplace (awareness-raising on the wearing of PPE, first-aid kit, staff representatives, internal regulations, etc.);
viii. The implementation of incentives for the recovery of pesticide packaging;
ix. The promotion of the use of integrated pest management alternatives. To do so, this promotion of the use of alternative strategies must be achieved through the

strengthening of learning mechanisms in the field, extension/advisory support and information;

x. Capacity building of project beneficiaries, to equip them for the effective use of integrated pest management practices. The Integrated Pest Management approach is to be adopted in this project through the training of workers from the plant protection services concerned. These technicians should in turn train farmers at the project site level.

4.6.1 Measures and Practices in Pesticide Management

Measures and Practices in Pesticide Management encompass a range of strategies aimed at ensuring the safe and responsible use of pesticides while minimizing risks to human health and the environment. These measures include guidelines for handling, storage, and application of pesticides, as well as protocols for monitoring and mitigating potential hazards. Also, by implementing best practices such as proper use of personal protective equipment, adherence to storage and disposal procedures, and careful monitoring of environmental impacts, stakeholders can promote the effective management of pesticides while safeguarding both human well-being and ecological integrity. The following tables outline the practices that should be applied during the pesticide use activities.

Table 4.1: Measures Required to Reduce the Risks Associated with Pesticides

Signs of intoxication	Appropriate care
Eye contamination (pain or irritation)	• Flush with plenty of tap water • Consult a doctor if it gets worse
Skin irritation (tingling and burning sensations)	• Wash the contaminated part with soapy water • Apply a soothing cream • Consult a doctor if this does not calm
Feeling tired, headache or dizziness	• To rest • Do not start again before feeling completely rested • Consult a doctor if this does not calm
Respiratory problems	• Stay under the shade; • Put under medical supervision.

Table 4.2: Risk Mitigation and Best Practices in Pesticide Management Activities

Activities	Risks	Good practices
Transport and Handling	• Contamination of people (inhalation of the product by steam, burns); • Contamination of water sources by washing containers; • Soil contamination following accidental spills	• Use of PPE; • Use of appropriate mechanical devices to transport and unload products; • Have a permit (authorization) for the transport of dangerous products, issued by the Ministry in charge of the environment in collaboration with the other technical Ministries concerned. • Carry only chemicals (pesticides), not mix them with food or animals.
Storage	• Odor nuisances; • Food contamination and exposure to CMRs • Contamination of soil and surface water due to accidental spillage during wind action ; • Alteration of ambient air quality.	• Storage of the products in a room in conformity with FAO standards; • Storage of products in their original packaging; • Regular inspection of stored products to ensure their condition; • Identifying and isolating products classified as CMR (Carcinogenic, Mutagenic and Toxic for Reproduction).
Equipment maintenance	• Soil contamination following accidental spills; • Risk of contamination if PPE is not worn (inhalation of the product by steam, burns).	• Regularly change the filters of the gas masks and wear the appropriate PPE; • Periodically check the rubber distribution pipes and the nozzles; • Scrupulously respect the manufacturer's instructions during maintenance; • Use equipment adapted to the type of treatment; • Use a non-return valve to avoid any siphoning of the tank; • Revise the equipment before use to monitor for the presence of leaks.

Activities	Risks	Good practices
Preparation of porridge	• Alteration of the ambient air quality; • Odor nuisance for manipulators; • Soil contamination following accidental spills; • Dermal contact by splash during preparation.	• Wear suitable personal protective equipment; • Prepare the spray mixture in a sealed place provided for this purpose to avoid contamination of the soil in the event of accidental spillage; • Use only products that are labelled; • Monitor the filling to avoid any overflow and use devices to avoid any risk of accidental pollution (intermediate tank, non-return valve, flow meter…); • Calculate the volumes in advance and adjust the doses of products; • Only reserve the tools used for this purpose (funnel, measuring jug, etc.); • Rinse the cans 3 times then let them drain and dry.
Phytosanitary and end-of-application treatments	• Soil contamination following accidental spills; • Contamination of nearby surface water by runoff or by wind actions; • Alteration of the ambient air quality; • Odour nuisance for manipulators and local residents; • Risks of intoxication of local populations, manipulators and even animals (domestic and fauna) by inhalation of steam;	• Require phytosanitary agents to wear PPE (outfit, gloves, muffler, boots, helmets) and wash those that can be reused at the end of the application and rinse the tank; • Organize awareness sessions on the risks to human and animal health of phytosanitary treatments; • Inform local residents beforehand of the day of application; • Take into account the weather conditions (temperature, humidity, wind, high heat) before phytosanitary treatments; • Avoid as much as possible the drift phenomenon and choose the application nozzles well; • Avoid phytosanitary treatments at the edge of watercourses and comply with regulations relating to the protection of biodiversity and spreading doses; • End the application by rinsing the tank;

Activities	Risks	Good practices
	• Destruction of certain elements of biodiversity, the "non-target"; • Risk of phytotoxicity	• Provide advance nozzles and gloves and/or provide a compressed air pump in the event of blockage; • Organize training sessions on cleaning equipment at the end of the application and on the risks linked to maintenance to avoid blowing or sucking in a nozzle; • Require agents to wear PPE when cleaning spray equipment and filters; • phytosanitary agents must take a shower at the end of the application and change their clothes; • Treat cleaning water as hazardous waste
Packaging Management	• Product Ingestion Related to the Reuse of Empty; • Containers (Plastic Cans and Metal Drums); • Spillage of product bottoms on the ground; • Groundwater contamination from the burial of empty packaging; • Chronic intoxication of personnel and local residents.	• Prohibit the dumping of leftovers on the ground ; • Rinse the canisters 3 times, then let them drain and dry; • Never submerge or introduce empty packaging (plastic cans, metal drums, bags, boxes, containers) in irrigation channels, rivers or lagoons to wash them; • Do not burn or bury empty packaging; • Collect all empty packaging in special bags before their transport by the plant protection services; • Set up an operational system for the management of empty packaging (storage, collection, transport, rinsing and compacting); • Organize periodic training and awareness-raising sessions for plant protection agents and producers on the management and harmful effects of empty pesticide packaging.

4.8 Capacity Building

Improvement and capacity building of actors at all levels (technical services, support and advisory agents, producers, authorized distributors and civil society) are necessary for the promotion of good pesticide management practices and non-chemical control methods. Within

the framework of this project, to cover the largest number of stakeholders in the handling of pesticides, awareness sessions, and training sessions will be included in the project.

❖ ***Strengthening the intervention capacities of institutional actors and farmers***

It will be a question of equipping the players with the means of prospecting and intervention in the event of infestations, but also with personal protective equipment. The various activities that will be taken to ensure this include:

- Provide the plant protection services with logistical means (motorcycles) for monitoring and surveillance for the early detection of pests;
- Provide training on the uses and maintenance of the provided equipment to the farmers

❖ ***Training of Actors involved in the Management of Pests and Pesticides***

To guarantee the effective integration of environmental concerns in the implementation of the project, there is the need to implement a capacity-building program (training and awareness) for all stakeholders which should be articulated around the following:

- Operationalize the pesticide management strategy;
- Foster the emergence of expertise and professionals in pesticide management;
- Raising the level of user responsibility in the management of pesticides;
- Protect the health and safety of populations and applicators.

The training will help the participants:

i) To acquire the necessary knowledge on the content and prevention methods,
ii) To be able to assess their working environment to improve it by reducing risk factors,
iii) To adopt the precautionary measures likely to reduce the risk of poisoning,
iv) To promote the use of protective equipment and correctly apply the procedures to be followed in the event of accidents or intoxication.

The activities that will form part of the training include:

- Train producers on spraying techniques;
- Train plant protection officers on pest surveillance, spraying techniques, measures to protect people and the environment;
- Train the handlers (phytosanitary crossing points, storekeepers) on the safe management of pesticides;

- Train the applicators on all the parameters allowing an efficient and risk-free spreading of pesticides;
- Train health personnel on the management of intoxication cases.

The training modules will cover risks related to the handling of pesticides, ecological management methods (collection, disposal, storage, transport, and treatment), appropriate behaviour and good environmental practices, maintenance of installations and equipment, protective measures and measures to be adopted in the event of poisoning, etc. Particular emphasis will be placed on the requirements for safe storage, to avoid mixing with other common household products, but also on the reuse of empty packaging.

It is recommended to train the trainers (within the framework of the Farmers' Field Schools), by getting them to produce themselves a good practice guide for Pesticide Management, rather than instructing them passively.

An indication of the contents of the training modules is described below.

Some training themes:

- Pest Recognition.
- Packaging and storage of pesticides.
- Prospecting, phytosanitary spraying.
- Hazards of pesticides to man and the environment.
- Importance of personal protective equipment in the handling of pesticides.
- Technical requirements and preconditions for pesticide application.
- Training on risks and health and safety advice.
- Basic knowledge of procedures for handling and managing pesticides.
- Wearing protective and safety equipment.
- Risks related to the transport of pesticides.
- Handling, loading and unloading procedures.
- Health and safety in relation to operations.
- Emergency and rescue procedures.
- Equipment maintenance and emission control.
- Management of poisoning cases.

4.9 Information and Awareness-Raising of the Population in the Intervention Areas

The use of pesticides in communities requires information and sensitization of all stakeholders. Health education and communication should aim at raising awareness, understanding and behavioural change to gain support for the effective and efficient use of pesticides. It is therefore essential to develop active programs to communicate accurate information on vector control activities. In this regard, a communication plan should use multimedia communication channels to inform the population about the importance of pesticide use and the possible risks, as well as what could happen if pesticides are not used, and to disseminate information throughout the project (not only at the start of the control operations).

Activities to be carried out include:

- Raising awareness of the regulatory frameworks.
- Raising awareness among farmers on the rational use and management of pesticides.
- Raising awareness among populations and producers on the harmful effects of pesticides.
- Raising awareness among authorized distributors on the importance of specialized infrastructures.
- Raising public awareness of the dangers of pesticide exposure.

Information and awareness-raising programs, especially aimed at the general public and decision-makers in particular, are essential to reduce the risks of disease and pesticide poisoning, and ultimately to bring about a real behaviour change. Such programmes should be multifaceted and multi-media-based. They should be delivered by community-based organizations, NGOs and Agricultural Producer Associations/Groups; community health structures should also be involved in sensitizing the population.

4.10 Emergency Response Plan

This plan provides the list of equipment and information required by pesticide users to respond appropriately to any accidental or inadvertent discharge of chemicals onsite. The REWARD emergency response plan includes:

- The provision of professional pesticide handling training for all pesticide users on the project site.
- The provision onsite of personal protective equipment, including:

- ✓ Chemical-resistant gloves.
- ✓ A chemical-resistant apron is required for the pesticides being handled.
- ✓ Coveralls.
- ✓ Chemical-resistant boots.
- ✓ Eye protection.
- ✓ Respiratory protection, when indicated on the MSDS.
- ✓ A first aid kit that meets, and
- ✓ An emergency eyewash or emergency shower.

- Ensuring that the current and readily available MSDS and pesticide labels for all pesticides being used or stored are available onsite.
- Ensuring spill clean-up materials, including, but not limited to the following are kept onsite in a safe and accessible location:
  - ✓ Absorbent materials, as specified on MSDS or by the pesticide product label or manufacturer.
  - ✓ Neutralizing materials as specified on MSDS or by the pesticide product label or manufacturer.
  - ✓ Brooms and shovels.
  - ✓ Containers with lids for waste material or leaking containers, and
  - ✓ Labelling materials to identify the contents of waste containers.

Clean-up of Small Spills

- Put on safety gear and mop up the spill using the available absorbent materials.
- Use a shovel to remove impacted soil.
- Store the contaminated materials in the appropriate container for disposal at an approved waste management site.
- Report the incident to the project manager and environmental officer.

Clean-up of Large Spills

- Put on safety gear. Ask someone to call for assistance from designated environmental and emergency response agencies s
- Clear the area of all non-essential persons and stop the leak if it can be done safely.
- Create a berm or trench around the spill to help minimize spread.
- Clean up the spill with the available equipment and dispose of the waste appropriately.
- Report the incident.

4.11 Record Keeping

The farmers must account for pesticide use by keeping accurate and timely pesticide use records. There shall be records that workers will be required to complete after each pesticide application.

4.11.1 Material Safety Data Sheet (MSDS)

An MSDS is a document containing important information about a hazardous chemical and must state the following:

i. The hazardous substance's product name
ii. The chemical and generic names of certain ingredients
iii. The chemical and physical properties of the hazardous substance
iv. Health hazard information
v. Precautions for safe use and handling
vi. The manufacturer's or importer's name, address and telephone number.
vii. The MSDS provides employers, self-employed persons, workers and other health and safety representatives with the necessary information to safely manage the risk from hazardous substance exposure.

Everyone in the workplace must know how to read and interpret an MSDS. A folder containing the MSDS for all chemicals used on site must be kept in a safe place accessible to all workers on the project site.

4.12 First Aid

Exposure to pesticides may cause acute or chronic responses. The following are some of the symptoms experienced when exposed:

- Fatigue;
- Shortness of breath;
- Dizziness;
- Headache;
- Vomiting;
- Chest pain and stomach cramps;
- Rash and skin burn;
- Itchy runny eyes; and
- Slurred speech;

Report any exposure to pesticides to the necessary authorities whether or not you feel ill. Immediately flush your eyes with clean water for about 15 minutes. Report the incident.

Removing Pesticide from the Skin: If the skin does not burn, remove clothes that contact with the pesticide. Wash the area with soap and clean water. If the skin is burnt, leave the clothing on for a while. Brush off the pesticide if it is a powder. Wash the contacted skin thoroughly with water and soap if exposed to a liquid pesticide.

Pesticide Burn: Pour clean water into the area while removing clothing. Cover the burn slightly with a clean cloth. Report the issue. Don't use soap, or burst blisters, touch the area or put ointment or lotion on the area if burns.

Swallow pesticides: Call for help immediately. Do not induce vomiting. Call the hospital or ambulance service. Take the pesticide label and MSDS to the doctor.

4.13 Control and monitoring-evaluation of PMP Implementation

The aim is to ensure health, ecological and environmental control and monitoring in the project's intervention areas. To ensure this, the following activities will be carried out:

- Check the conformity of the products sold and used.
- Analyse the formulation of products.
- Analyse pesticide residues in natural resources (water, soil and vegetation) and on livestock.
- Carry out health monitoring of pesticide handlers (phytosanitary brigadiers, storekeepers, producers).
- Monitor the implementation.
- Evaluate the implementation of the PMP at mid-term and at the end of the project.

Table 4.3: PMP Action Plan

Components	Results	Activities	Indicators	Responsible Party
Promotion of good pesticide management practices	The texts regulating the use of pesticides are respected and applied.	Updating and dissemination of frameworks regulating the use of pesticides	Number of copies updated and distributed	PPS PIU, NARI and NEA
	The storage conditions for chemicals are improved and comply with the standards	Construction of pesticide stores and warehouses (agricultural input shops) for intervention communities, in accordance with FAO standards.	Number of warehouses built, meeting FAO standards.	
	The management of empty packaging is ensured	Collect and centralize empty packaging at specialized centres (plant protection services).	Number of tonnes of packaging recovered after each farm and by the municipality.	
Promotion of non-chemical control methods	Alternative control methods are developed and popularized	Organize workshops, seminars and training sessions on the use of biopesticides.	• Number of beneficiaries • Number of hectares treated	PPS, NARI, Farmers, PIU
Capacity building	The intervention capacities of institutional actors and producers are strengthened.	Provision of plant protection services with logistical means (motorcycles) for the early detection of pests	Number of motorcycles supplied per intervention commune	PPS, CPCU, PIU, NARI, Farmers Association,
		Provision of spraying equipment and PPE kits to the handlers (phytosanitary officers and producers).	Number of spraying devices and PPE kits supplied	

Components	Results	Activities	Indicators	Responsible Party
	The capacities of the Technical Services are strengthened	Training of supervisors on pest surveillance, spraying techniques, protective measures and preventive surveys (locusts and other pests).	Number of agents trained	
		Training of handlers (phytosanitary officers, storekeepers) on the safe management of pesticides.	Number of agents trained	
		Training of the staff of the health centres concerned by the intervention of the project, on the management of cases of intoxication	Number of agents trained	
	The capacities of authorized distributors are strengthened	Training of authorized distributors on the importance of specialized infrastructure	Number of authorized distributors/resellers trained	
	Farmers' capacities are strengthened	Training and supervision of producers on the rational use of pesticides and spraying techniques.	Number of producers trained and monitored	
	The beneficiary populations are made aware of the risks linked to the use of pesticides	Sensitization of populations and producers on the harmful effects of pesticides	• Number of awareness sessions; • Percentage of population affected;	

Components	Results	Activities	Indicators	Responsible Party
Control, monitoring and evaluation of the implementation of the PMP	The quality of natural resources and the health of the beneficiary populations are monitored.	Laboratory analysis of pesticide residues in natural resources (water, soil and vegetation) and on livestock Rehabilitate the capacities of the pesticide residue laboratory of actors.	• Number of samples analysed; • Physico-chemical characteristics of soils and waters.	PPS, MOH, MOA, NEA, PIU, NARI
		Carrying out an annual health assessment (health monitoring) of pesticide handlers (phytosanitary agents, storekeepers and producers).	• Number of agents monitored; • Annual epidemiological profile of the intervention commune.	
		Enforcement of laws and policies	• Compliance rates • Enforcement Actions taken	
	The products used are checked.	Regular monitoring of products sold and used, in accordance with FAO and CILSS standards.	Number of products controlled	
		Laboratory analysis of the formulation of chemical products.	Number of products analysed.	
	The implementation of the PMP is monitored and evaluated.	Monitoring and evaluation of implementation of the PMP.	Reports of monitoring missions carried out by partner technical services.	
Feedback	Effective feedback mechanisms established	Implementing feedback systems for stakeholders	Number of feedback mechanisms implemented	PPS, CPCU, PIU, NARI and NEA

CHAPTER V:

ORGANIZATIONAL MECHANISMS FOR THE IMPLEMENTATION AND MONITORING OF THE PMP

5.1 Organizational Mechanisms

This section outlines the organizational mechanisms necessary for effectively implementing and monitoring the measures detailed in the PMP, recognizing the diverse roles and responsibilities held by different institutions with their respective mandates. To facilitate the efficient execution of the PMP, the formation of a working group is imperative. This working group will comprise representatives from the Ministry of Agriculture, the National Environmental Agency (NEA), relevant government Ministries, Departments, and Agencies, as well as Non-Governmental Organizations (NGOs), and stakeholders from the private sector engaged in the import and distribution of pesticides, as well as farmers' organizations. Through the establishment of this collaborative framework, the aim is to foster transparent communication, robust coordination, and concerted action among these stakeholders to effectively implement the PMP.

In this perspective, the following institutional arrangements are proposed with regard to the implementation and monitoring of this PMP:

- **The Project Implementation Unit (PIU)**: It will coordinate the implementation of the PMP and will act as an interface with other stakeholders. It will coordinate capacity building and training for agents' agricultural producers and other technical structures involved in the implementation of the PMP.

  The PIU will recruit an environmental expert who will coordinate the monitoring of environmental and social aspects within the framework of the implementation of project activities. They are responsible for the implementation and monitoring of the execution of all rational management measures within the project.

- **Plant Protection Services (PPS):** This is a service unit under the Department of Agricultural Extension in the Gambia. It is tasked to provide expert service in the fight and prevention of plant pests and diseases. The PIU will closely work with this unit to build the capacity of rice value chain actors in pest management.

- **The Regional Coordinator (RC) and Regional Agricultural Director (RAD)** will supervise the "agricultural" component of the implementation of the PMP and will support the capacity building of field agents.

- **The National Environmental Agency (NEA)**: will ensure regulatory control of the implementation of the PMP and will support capacity building of field agents.

- **The Non-Governmental Organizations (NGOs):** will participate in raising the awareness of the population and in social mobilization activities. They will also participate in the supervision and external monitoring of the implementation of the measures recommended under the PMPP.

- **Farmers' Organizations:** They must have and apply procedures and good environmental practices for the safe and ecological use and management of pesticides.

5.2 Estimated Budget for PMP Implementation

REWARD Project Implementation Unit (PIU) will be responsible for the implementation of the PMP. The estimated budget for the implementation of the PMP is US$ 252,800. Details are provided in the table below

Table 5.1: Cost of activities for the implementation of the PMP for the REWARD Project in the Gambia

Line Item	Description	Unit cost, US $
1. Capacity building and Awareness		
PMP Orientation workshops	Orientation workshops on PMP/IPM within project beneficiary regions	5,200
Training of Trainers (ToT)	Monitoring, prevention and control, technologies, safe use of pesticides	7,000
Farmer Group training (beneficiary training)	Monitoring, prevention and control, technologies, Capacity building of farmers on the use of agrochemicals	8,800
Support to PMP research and development	Analysis of samples of water, soils, crops and livestock to ascertain exposure levels.	5,000
Pesticide distributors registration	Registration and training of all interested pesticide distributors/resellers under the Project	6,600
Field guides/ PMP materials	Development of brochures on targeted Pesticides for use (Field guides/ IPM materials)	8,000
Field visit for training	Field visits conducted as part of training sessions	6,600
Training on proper use and storage of pesticides	Purchase of samples of certified sprayers or applicators to reduce the exposure	16,200

Line Item	Description	Unit cost, US $
Personal Protective Equipment (Hand gloves, mask, safety boot, overall wear etc.)	Samples of appropriate personal protective equipment for pesticide handling during training sessions	12,200
Chemical Neutralizer and First Aid	Supplies for chemical neutralization and first aid in case of pesticide exposure	10,500
Monitoring and Evaluation	Pesticide monitoring in and around project areas	13,800
Reviews and reporting	Development of Guidelines - Training and Dissemination of Findings	10,200
2. Operational Cost		
Procurement of pesticides	Purchase of pesticides for project use	17,300
Training of Spray teams	Training sessions for spray teams on pesticide application techniques	16,200
Procurement of PPE's	Purchase of personal protective equipment for project staff, farmers etc.	18,500
Procurement of ICT equipment	Purchase of information and communication technology equipment for project use	15,700
Pest/vector Surveillance, Monitoring and Evaluation	Surveillance activities targeting pests and vectors	10,000
Procurement refined fuels and lubricants for transport	Purchase of fuels and lubricants for project transportation	10,000
Procurement of general office supplies (papers, pencils, forms, small office equipment	Purchase of general office supplies for project administrative needs	12,000
Contracted professional services	Fees for professional services contracted for project needs	8,000
Consultations	Fees for consultations related to project activities	15,000
Contingencies/ Emergency response support	Funds allocated for emergency response and contingencies	20,000
Total		**252,800**

5.3 Monitoring and Evaluation of PMP Implementation

5.3.1 Follow-up

To measure the effectiveness of the Pest/Vector Management Plan (PMP), the recommended actions should be monitored and evaluated. The monitoring plan is subject to the planned activities. Monitoring is supported by data collection and analysis to check whether the

implementation of activities is proceeding as planned and to make immediate adjustments, if necessary.

It is therefore an evaluation activity focused on the short term, to allow for real-time action. The frequency of monitoring will depend on the type of information needed, however, it will be continuous during the implementation of the action plan. Monitoring will be organized through periodic field visits and will consist of assessing the level of implementation of the following activities of the operational plan:

- The application of good practices in relation to the use and management of pesticides in the project area.
- The application of non-chemical methods of crop pest control by growers at production sites.
- The effectiveness of the capacity-building programme for the various actors, both managers and members of agricultural cooperatives.
- Methods of mitigating the adverse effects on the biophysical and human environment of pesticides used up to the point of packaging.

5.3.2 Evaluation

Achieving the objectives of this plan requires a mid-term evaluation which will make it possible to gauge the level of implementation of the action plan. The results of this evaluation will be made available to technical and financial partners who may be able to contribute to its conduct.

To get feedback after the implementation of this plan, a final evaluation is necessary. The final evaluation will consist of measuring the effectiveness of its implementation and performance and identifying the lessons learned. This evaluation will be integrated into the final evaluation of the project.

5.3.3 Monitoring indicators

To ensure monitoring, it is necessary to have indicators which are pre-identified signals expressing changes in certain conditions or results linked to specific interventions. These are areas whose use provides quantitative or qualitative information on the environmental and social impacts and benefits of this project. The monitoring indicators will help in the implementation of mitigation measures, monitoring and evaluation of the entire project to assess the effectiveness of these activities.

The indicators for monitoring a risk/hazard assessment are:

Health and Environment

- Quantity available of personal protective equipment;
- Level of knowledge of good management practices (pesticides, empty packaging, etc.);
- Occupational safety level for people handling and using pesticides;
- Percentage of manipulative personnel having undergone a medical checkup;
- Level of residue concentration on non-targets;
- Level of impact on domestic animals, aquatic organisms, flora and fauna;
- Level of toxicity of the decomposed substances;
- Level of contamination of water resources;
- Annual epidemiological profile of the intervention municipalities;
- Physico-chemical characteristics of water resources and soils of valued sites.

Storage conditions/management of pesticides and empty packaging

- Percentage of storage facilities available and in compliance with FAO standards;
- Percentage of users complying with pesticide storage and use measures;
- Number of products not registered by CILSS used by producers;
- Number of accidents/intoxications recorded per year as a result of transport, storage and use of chemicals;
- Percentage of producers trained in spraying processes;
- Number of tonnes of empty packaging recovered after each crop year and per district;
- Existence of waste management systems (pesticide residues and empty packaging).
- The available quantity of appropriate spraying equipment; and
- Percentage of empty packaging recovered;

Staff training - Information/awareness of the population

- Number of legal texts regulating the use of pesticides updated and disseminated;
- Number of training modules and guides developed;
- Number of training sessions organized;
- Number of IEC tools developed;
- Number of actors trained by category;
- Percentage of the population reached by awareness campaigns;
- Level of knowledge of users on products and associated risks;

- Level of knowledge of traders/distributors about the products sold;
- Number of producers made aware of the harmful effects of pesticide use;
- Number of supervision operations carried out by the plant protection services;
- Number of supervision operations carried out by the plant protection services.

The summary of the Monitoring Plan is presented in Table 5.1 below.

Table 5.2: Pest/Vector Monitoring Plan

Component	Monitoring Elements	Indicators And Items To Collect	Means Of Verification	Monitoring Frequency	Responsible Parties
Water and soil	Water quality (surface and underground water) and soils	i. Presence rate of organ chlorines (pesticide residues); ii. Physio-chemical characteristics of water resources (surface and underground water) and soils of valued sites.	Analysis reports from laboratories and research centres.	A year (Annual)	
Biodiversity	Number of non-target fauna, flora, fishery resources and livestock.	i. Rate of presence of toxic residues in plants, crops, fish, and livestock; ii. Number of non-target fauna and flora destroyed following phytosanitary treatments.	i. Analysis reports from laboratories and research centres; ii. Reports of environmental monitoring and follow-up missions.	Every six months (Semi-annually)	PIU PPS NEA Ministry of Health Farmers Association Private sector
Biophysical and human environments	i. Living environment (Hygiene and sanitation conditions);	i. Number of products not approved by CILSS, used by farmers; ii. Percentage of pesticide storage sites compliant with FAO standards; iii. Percentage of users respecting the storage and use of pesticides;	i. Analysis reports from laboratories and research centres; ii. Environmental monitoring and	Every six months (Semi-annual)	

Component	Monitoring Elements	Indicators And Items To Collect	Means Of Verification	Monitoring Frequency	Responsible Parties
	ii. Pollution and nuisance; iii. Health and security at work.	iv. Number of accidents/poisonings recorded, related to pesticides; v. Existence of waste management system(pesticide residues and empty packaging); vi. Percentage of users respecting the wearing of PPE; vii. Number of producers made aware of the harmful effects of the use of pesticides; ii. Number of supervision operations carried out by plant protection services.	follow-up mission reports; iii. Inventory report; iv. Field control report v. Control in health centres; vi. Monitoring and environmental monitoring mission reports		

5.4 CONCLUSION

The Pest/vector Management Plan (PMP) made it possible to identify the shortcomings and deficiencies related to the use of pesticides in The Gambia and phytosanitary products in general. These shortcomings include non-compliance with the legislative framework for pest control and environmental management. Thus, the priority axis of the REWARD Program as regards PMP will be to strengthen the capacities of the phytosanitary services, through capacity building and the revitalization of the institutional framework as well as the monitoring of environmental components.

Investment in capacity building will make it possible to limit the impact of pests on health as well as the environmental risks associated with treatments. The Project will give high priority to environmental monitoring of the various environmental and social components in its intervention localities. This monitoring is to be carried out by the PIU in collaboration with the National Environmental Agency (NEA), PPS, the Ministry of Health, the private sector and the farmers.

In light of the above, the effective implementation of this Pests/Vector Management Plan (PMP) will make it possible to reduce the risks of degradation of the physical and human environment linked to the misuse of chemical products applications for rice for the REWARD project.