STDF | STANDARDS and TRADE DEVELOPMENT FACILITY

International Centre for Genetic Engineering and Biotechnology

Harmonising regulations and mitigating pesticide residues in the SADC region

STDF/PG/694

END OF PROJECT REPORT

November 2024

PROJECT INFORMATION

STDF/PG/694
Title Harmonising regulations and mitigating pesticide residues in the SADC region
Implementing agency International Centre for Genetic Engineering and Biotechnology (ICGEB)
Partners Technical implementation partner: Ag Aligned Global. Other partners: Asia-Pacific Association of Agricultural Research Institutions (APAARI), CropLife Africa and Middle East, Rutgers University, South African Bioproducts Organisation (SABO), Southern Africa Network for Biosciences (SANBio), Southern Africa Pesticides Regulators Forum (SAPReF), United States Department of Agriculture (USDA), Food and Agriculture Organisation of the United Nations (FAO), The African Union Inter-African Phytosanitary Council (AU-IAPSC)
Start date 01/03/2021
End date 31/08/2024 (Initial project end date was 29 February 2024; however, a 6-month No-Cost Extension (NCE) - to implement outstanding activities - was approved by the STDF on 20 December 2023; extending the project's end date to 31 August 2024.)
Beneficiary/ies Botswana, Mozambique, Tanzania, Zambia, Zimbabwe, South Africa, and Kenya
Budget Project Total Value: USD 1,459,278 STDF contribution: USD 798,480 Other contribution: USD 660,798

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LIST OF ACRONYMS AND ABBREVIATIONS

APAARI	Asia-Pacific Association of Agricultural Research Institutions
ASEAN	Association of Southeast Asian Nations
AU-IAUPSC	African Union - Inter-African Union Phytosanitary Council
BBRM	Biopesticide-Based Residue Mitigation System
CLAME	CropLife Africa and Middle East
DALRRD	Department of Agriculture, Land Reform and Rural Development
EAC	East African Community
EU	European Union
FAO	Food and Agriculture Organisation
GAP	Good Agricultural Practice
GRP	Good Regulatory Practice
ICGEB	International Centre for Genetic Engineering and Biotechnology
IICA	Inter-American Institute for Cooperation on Agriculture
IPM	Integrated Pest Management
KEPHIS	Kenya Plant Health Inspectorate Service
MRL	Maximum Residue Level
PAB	Project Advisory Board
PSC	Project Steering Committee
SABO	South African Bioproducts Organisation
SADC	Southern African Development Community
SANBio	Southern Africa Network for Biosciences
SAPReF	Southern African Pesticide Regulators Forum
SPPTC	SADC Plant Protection Technical Committee
SPS	Sanitary and Phytosanitary
STDF	Standards and Trade Development Facility
TPHPA	Tanzania Plant Health and Pesticides Authority
TWG	Technical Working Group
USDA	United States Department of Agriculture

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1. EXECUTIVE SUMMARY

The regional project entitled "Harmonising regulations and mitigating pesticide residues in the SADC region" was approved by the Standards and Trade Development Facility (STDF) at its meeting in October 2020 and implementation by the International Centre for Genetic Engineering and Biotechnology (ICGEB) began on 01 March 2021. The original end date for the project was 29 February 2024. However, a 6-month No-Cost Extension - to implement outstanding activities - was approved by the STDF on 20 December 2023; extending the project's end date to 31 August 2024. The approved STDF financial contribution to the project was USD $798,480. The total project budget – including in-kind contributions from ICGEB and project partners – was USD $1,459,278.

The primary project stakeholders included national (bio)pesticide regulatory authorities and policymakers, national plant protection organisations, researchers, farmers and farmer group representatives and industry associations. The main stakeholders involved in project implementation and delivery included individuals from both the public and private sectors of the six participating Southern African Development Community (SADC) member states (Botswana, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe), as well as Kenya, who participated as a key partner for the residue mitigation studies - as it was considered a main exporter which had the capacity to carry out the residue studies, from which the other project countries could derive learnings. A representative of Malawi was included in the Technical Working Group (TWG) that was formed to develop the harmonised guidelines for the registration of biopesticides and biological control agents in the SADC region. The USA provided technical support both for the regulatory harmonisation (largely through the United States Department of Agriculture [USDA], which covered most of the costs of the regulatory expert who was involved in the development of the draft harmonised guidelines) as well as the residue mitigation component of the project (through a technical team – details in Section 3 - from Ag Aligned Global).

The project sought to address the trade challenges SADC member countries face on account of their inability to meet Sanitary and Phytosanitary (SPS) Standards and Maximum Residue Level (MRL) requirements due to their agricultural producers' excessive reliance on or inappropriate use of synthetic chemical pesticides. To overcome this problem, a strategy was developed through the project to facilitate registration - and innovative use of - biopesticides for late-season pests in key export crops, in order to reduce reliance on synthetic chemical pesticides, enhance compliance with MRL limits, and facilitate trade. The long-term goal of the project was to increase crop exports from the six participating countries through enhanced compliance with residue standards, to be achieved using biopesticides for residue mitigation. Outcome 1 thus focussed on interventions aimed at enhancing the registration of biopesticides, i.e. harmonising the biopesticide regulations for selected SADC countries, while outcome 2 focussed on increasing the usage/adoption of biopesticides for specific residue challenges in two out of the six countries (Tanzania and Kenya).

Key outputs included:

- The draft of "*Harmonised Guidelines for the Registration of Biopesticide Products and Biological Control Agents in Southern Africa*" developed with inputs from and consultations with regulatory officials from the participating SADC project countries, as well as the Southern African Pesticide Regulators Forum (SAPReF), legal advisors, and an international regulatory expert. The draft guidelines document then received support from all sixteen SADC member states represented in SAPReF in addition to the six beneficiary countries of the project, which was a very positive unexpected result. The harmonised SADC regional regulatory framework, when approved by the SADC Council of Ministers[1], will facilitate the registration and regulation of biopesticides and biocontrol agents, as well as promote reciprocal product registrations in SADC countries through mutually acceptable standards of biopesticide regulation. As a concrete step to promote the adoption of this regional framework, five (Botswana, Mozambique, Tanzania, Zambia and

[1] The draft guidelines were presented to the SADC Plant Protection Technical Committee (SPPTC) for review during a virtual meeting held on 23–24 July 2024. The next steps involve the SPPTC submitting the document to the SADC Food, Agriculture, and Natural Resources (FANR) Directorate, followed by vetting by the SADC legal department. The SADC FANR Directorate will then submit the document to the relevant sectoral ministers in May 2025, after which it will be presented to the SADC Council of Ministers for approval, once translated into the SADC official languages (French and Portuguese).

Zimbabwe) of the beneficiary countries develop roadmaps for domestication of the guidelines, with the sixth (South Africa) opting for a parallel in-country review process of their guidelines.

- Another key output of the project was the generation of residue data and improved knowledge to interpret this data related to the use of biopesticides (combined with conventional pesticides in an Integrated Pest Management [IPM] strategy) to mitigate pesticide residues. Two residue mitigation studies were conducted in avocados and mangoes, to assess the efficacy of two biopesticides, Neem oil and Cryptogran in mitigating the residue of two conventional pesticides (carbendazim and methoxyfenozide) while satisfactorily protecting the target crops from late-season pest damage. The analysis of the results from both studies indicated that replacing the final pesticide application with a biopesticide achieved the same level of pest control as using conventional pesticides exclusively throughout the season. Moreover, this substitution led to a product with lower pesticide residues (up to 50% reduction) compared to using conventional pesticides alone over the entire growing period. These residue mitigation studies have facilitated the development of a potential residue mitigation system (biopesticide-based residue mitigation [BBRM] system), that could ultimately be offered to growers to use. A total of 78 farmers (53 for Tanzania and 25 for Kenya) whose farms were used for these studies are motivated to use the system. Furthermore, responses of a survey posed to farmers of the participating project countries indicated that 80% of growers are satisfied with biopesticides and willing to continue implementing their use. To achieve this output in-person technical training of laboratory and field scientists on Good Agricultural Practices (GAP) and Good Laboratory Practices (GLP), was provided to 30 people in the seven countries (21 male, 9 female), along with functional capacity development ("soft skills").

- A third outcome achieved by the project was the development of an IPM strategy/tool-kit: "*Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes*" and creation of GAP guides for growers. The simple and user-friendly IPM toolkit will assist farmers in determining the suitability of a biopesticide as part of an IPM programme in various circumstances. The GAP guides developed include info sheets on benefits of biopesticide use, as well as factsheets on key pest /crop combinations – namely those investigated through the residue mitigation studies of the project: anthracnose fungi on mango and false codling moth on avocado. These materials were developed in consultation with project partners and disseminated widely to key project stakeholders, e.g., growers and farmer groups. National workshops were held in five of the six project countries addressed to representatives of farmer groups on this toolkit, training 216 people (134 males, 82 females). The project also contributed to having information available and accessible on 166 biopesticides through the CABI BioProtection Portal (14 products registered in Mozambique, 40 in South Africa, 27 in Tanzania and 85 in Zimbabwe).

During project implementation, several challenges were experienced. These included: the impact of COVID-19 on travel and in-person activities, where the project seamlessly transitioned to virtual events to ensure continued progress; instances where partners or stakeholders exhibited delayed responses, when project management then conducted regular follow-ups through email or phone calls to encourage timely responses; and delays with procurement of necessary chemicals and consumables for the residue mitigation studies, where laboratory analyses of samples were conducted later than anticipated. Additionally, as this was a regional project, a lot of time was required for negotiations and dialogue to agree on pertinent issues.

Key learnings included the value of the partnership established between this project and the STDF-funded and Asia-Pacific Association of Agricultural Research Institutions (APAARI) implemented STDF/PG/634 (Asia biopesticides project) - aligning goals, sharing lessons learned for mutual support and enhancement of overall impact; proactively engaging with organisations with complementary mandates (e.g. the Food and Agriculture Organisation of the United Nations [FAO]), hence ensuring strategic value addition and preventing duplication; using the strengths of complementary entities (e.g. APAARI contributed to soft skills development within the project, and FAO and CABI provided valuable input on the project's IPM toolkit); and the need for establishing positive relationships with regulators and policymakers, whose strategic collaboration provided essential insights into the regulatory landscape, ensured alignment with national processes and secured vital support from

statutory bodies. Overall, the success of a project such as this requires flexibility, adjusting plans to accommodate logistical challenges; need for relationships with regulatory bodies and policymakers; and maintaining robust and proactive communication with project partners and countries.

The post-project sustainability plan can be summarised as follows:

- Through the consolidation of the biopesticide products registered in each of the participating project countries, and the publication of these lists on the publicly available CABI BioProtection Portal (with a link to the portal also included on the ICGEB website), the project has connected CABI to the respective regulators to ensure that the databases are updated and kept current beyond the life of the project.
- The ICGEB Biopesticides Group will continue conducting capacity building activities on biopesticide research, development and regulation.
- A second season of the residue mitigation trials will be supported through the ICGEB's Collaborative Research programme (Kenya and Tanzania have been requested to submit proposals on the same for consideration) to help facilitate the development of concrete recommendations for growers.
- There is already collaboration with industry to support the requisite in-country processes necessary for the domestication and implementation of the harmonised guidelines. For instance, in partnership with CropLife Africa Middle East (CLAME), a workshop will be organised in Zambia (at a yet-to-be-determined date in early 2025) to finalise the drafting of local regulations in line with the harmonised guidelines.
- Including additional stakeholders, such as the media, in pertinent engagements related to project outcomes. For example, the media should be invited to events/meetings/workshops that are organised in relation to sustaining some of the project outcomes. This will include, for instance, follow-up in-country workshops (such as two already being planned for Zambia – this year – and Tanzania – in February 2025).

The actionable recommendations targeted at relevant stakeholders include the following:

- SAPReF to monitor the domestication process in various countries SADC countries.
- Countries to provide reports of progress towards domestication during the SAPREF Annual General Meetings.
- Industry to support the process of domestication of biopesticides in the various project countries. This would include funding domestication workshops (as is planned for Zambia), and knowledge-sharing initiatives, such as training programs, seminars, or workshops for farmers, regulators, and other stakeholders.
- ICGEB to support additional residue mitigation studies to generate more data to facilitate concrete proposals to be made to growers
- ICGEB to partner with other stakeholders to provide more capacity building training on biopesticide regulation. Funding for one such workshop, due to be held in February 2025 in Tanzania, has already been provided by ICGEB.
- FAO has an on-going project[2] which will support the domestication process in Zimbabwe.

[2] Building capacity related to Multilateral Environmental Agreements in African, Caribbean and Pacific countries. Phase 3 ongoing. Phase 4 to commence on 01 October 2025. Budget € 9,9 million. Duration 2019 - September 2025.

2. OVERVIEW

Although agricultural exports[3] are a major contributor to the economies of member states of the Southern Africa Development Community (SADC)[4], some countries in the region experience significant economic losses due to the rejection of agricultural produce exports, due to non-compliance with relevant residue standards. The Southern African Pesticide Regulators Forum (SAPReF)[5] attributes this to the lack of effective and fully operational pesticide regulation systems in many countries in the region. Widespread overuse, misuse, mishandling and mismanagement of pesticides is, therefore, rampant; contributing to residue violations in export markets. Exceedance of established maximum residue limits (MRLs) is particularly common, especially for crops in which synthetic chemical pesticides are used to control late-season pests. Use of biopesticides[6] could significantly mitigate pesticide residues, since most of these pest control products (except for biochemical derivatives) are not subject to MRLs within importing countries. However, despite the advantages of biopesticides, their widespread adoption and use is affected by challenges in respect of their research, development, registration and commercialisation.

Countries in the SADC region have varying (or non-existent) policies regarding the registration and application of biopesticides. Most do not have well established biopesticide regulatory frameworks; and are, therefore, reliant largely on processes better suited to conventional pesticides. This was made evident during the development of the legal assessment[7] of the biopesticide regulatory frameworks in the six participating Southern African countries. In recent years, there has been increasing consensus that the disparity in SADC countries' regulations adversely impacts their import-export transactions. It was thus foreseen that harmonisation of regulations has the potential to reverse this trend, contributing substantially to the promotion of trade. To this end, some efforts towards the harmonisation of SADC-region pesticide regulations were undertaken, such as the formation of SAPReF mandated to, *inter alia*, i) promote regional collaboration and harmonisation of pesticide regulation; and ii) implement the objectives of the Plant Protection Technical Committee and the SADC Sanitary and Phytosanitary Annex to the SADC Protocol on Trade, which requires member states to take necessary measures to facilitate the simplification and harmonisation of trade documentation and procedures.

In addition to the harmonisation of biopesticide regulations, identifying, prioritising and addressing specific residue trade barriers through regional coordination – and mitigating such challenges – would go a long way towards enhancing both regional and international trade. Increased understanding and compliance with Codex MRLs could boost agricultural producers' ability to access important export markets. The project, therefore, sought to address the trade challenges SADC member countries face on account of their inability to meet Sanitary and Phytosanitary (SPS) standards and MRL requirements; attributable to their agricultural producer's excessive reliance on synthetic chemical pesticides. To overcome this problem, a strategy was developed to enable registration - and promote the use - of biopesticides for late-season pests in key export crops to reduce reliance on synthetic chemical pesticides, enhance compliance with MRL limits, and facilitate trade; ultimately boosting economic development of these developing countries while meeting food safety, animal and plant health requirements.

Through the project, a draft of the "*Harmonised Guidelines for the Registration of Biopesticide Products and Biological Control Agents in Southern Africa*" was developed with input from and

[3] About 70% of the SADC region's population also depends on agriculture for food, income and employment. The performance of this sector, therefore, has a strong influence on food security, economic growth, social stability and poverty reduction.

[4] Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia and Zimbabwe.

[5] SAPReF is a sub-committee under the Plant Protection Technical Committee of the SADC Sanitary and Phytosanitary (SPS) Annex VIII to the SADC Protocol on Trade, Article 14 (6) working on pesticides and pesticide-related issues. SAPReF has the role of promoting regional information exchange and collaboration on pesticide and pest management as well as regulation. With a membership which includes pesticide regulators and/or Designated National Authorities of the Rotterdam Convention, pesticide risk managers from diverse backgrounds and disciplines from all the SADC countries it seeks to achieve sound management of pesticides and biopesticides.

[6] A generic term generally applied to a substance derived from nature, such as a microorganism or botanical or semiochemical, that may be formulated and applied in a manner similar to a conventional chemical pesticide and that is normally used for short-term pest control. http://www.fao.org/3/a-i8091e.pdf

[7] Legal review of the biopesticide regulatory frameworks in selected countries in Southern Africa. International Centre for Genetic Engineering and Biotechnology (ICGEB), 2022.

consultation with regulatory officials from the participating SADC project countries, as well as SAPReF, legal advisors, an international regulatory expert. Views on the draft were also sought from the Chile-led OECD biopesticides project, an initiative of the Codex Committee on Pesticide Residues aimed at developing international reference guidelines for biopesticide regulation. This harmonised SADC regional regulatory framework will fundamentally facilitate the registration and regulation of biopesticides and biocontrol agents, as well as promote reciprocal product registrations in SADC countries through mutually acceptable standards of biopesticide regulation.

Another key step towards addressing the inability of SADC countries in meeting SPS standards and MRL requirements was the generation of residue data through residue mitigation studies of two target pest/ crop combinations. The data from the studies was to inform the promotion of the use of biopesticides (combined with conventional pesticides in an IPM strategy) to mitigate pesticide residues in order to meet the MRL standards of key export markets. Essentially, the two residue mitigation studies were conducted to assess the efficacy of replacing the final application of a conventional pesticide with a biopesticide to mitigate the residue of the pesticide while satisfactorily protecting the target crops from late-season pest damage. These studies facilitated the development of a residue mitigation system (biopesticide-based residue mitigation [BBRM] system), to be ultimately offered to growers to use.

Alongside the recommendations from the residue mitigation studies, several IPM-related materials were developed through the project to support the decision-making of growers. The simple and user-friendly "IPM toolkit" (*Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes*) will assist farmers in determining the suitability of a biopesticide as part of an IPM programme in various circumstances. The GAP guides include info sheets on benefits of biopesticide use, as well as factsheets on key pest /crop combinations – namely those investigated through the residue mitigation studies if the project: anthracnose fungi on mango and false codling moth on avocado. These materials were developed in consultation with project partners, and disseminated widely to key project stakeholders, e.g., growers and farmer groups.

The project was rooted in the understanding that the current overreliance or misuse of synthetic pesticides resulted in high levels of chemical residues in harvested produce, which often violated international MRLs and hindered trade. By adopting biopesticides at the end of the crop season, the project sought to mitigate these challenges, while recognising that various regulatory constraints, a lack of harmonisation across SADC countries, and insufficient capacity in biopesticide research and regulation were significant barriers to progress.

The project operated under several key assumptions. First, it acknowledged that existing regulatory frameworks presented substantial barriers to the adoption of biopesticides, necessitating the development of harmonised guidelines. Second, it posited that improved access to biopesticides would help reduce farmers' reliance on synthetic pesticides, thereby decreasing instances of residue violations and enhancing trade opportunities. Finally, the project emphasised that enhancing the skills and knowledge of key personnel involved in biopesticide regulation would facilitate the successful implementation of guidelines and improve regulatory processes.

The project was structured around one goal, two outcomes and three main outputs. The goal of the project was to promote biopesticides to mitigate pesticide residues, thereby promoting international trade. The two project outcomes were: 1) enhancing the registration of biopesticides through harmonising the biopesticide regulations for selected SADC countries and 2) increasing the usage/adoption of biopesticides for specific residue challenges in two out of the six countries (Tanzania and Kenya).

The first output focused on regulatory harmonisation. This involved collaborating with various stakeholders to assess existing regulations and develop harmonised guidelines for biopesticide registration across SADC countries. The expected outcome of this effort was streamlined regulatory processes that would lead to increased biopesticide approvals, thereby reducing trade barriers and facilitating market entry. In the long term, improved regulatory frameworks were anticipated to encourage greater adoption of biopesticides, decreasing reliance on synthetic pesticides and minimising residue violations.

The second output addressed pesticide residue mitigation. The project conducted studies to identify effective biopesticide alternatives for late-season pests that contributed to residue violations. The project aimed to enhance compliance with MRLs and facilitate trade by increasing knowledge and availability of these biopesticides.

The third output focused on focused on establishing IPM strategies and GAP for key pest/crop combinations and incorporating biopesticides. A guidance document was developed to support the selection of biopesticides for use in IPM programs, along with fact sheets covering various aspects of using biopesticides in IPM. Additionally, a database of biopesticides registered in four of the project countries was created to provide information on registered products available for use.

In addition, the project recognised that integrating functional skills training into all activities was vital for achieving its objectives. By targeting key personnel involved in biopesticide regulation and application, the project aimed to enhance the capacity of stakeholders, which would improve the effectiveness of regulatory processes and facilitate the successful implementation of biopesticide guidelines. In the long term, a knowledgeable workforce was expected to help sustain momentum for biopesticide adoption and ensure ongoing compliance with international standards.

The project also emphasised the importance of cross-fertilisation of strategies with the related STDF-funded Biopesticide Residue Mitigation Project in Asia. The exchange of ideas and technical knowledge fostered innovation and improved the overall effectiveness of project implementation.

3. PROJECT IMPLEMENTATION

Project timeframe

The project grant was approved by the STDF on October 2020 and implementation by the ICGEB began on 01 March 2021. The original end-date for the project was 29 February 2024. A 6-month No-Cost Extension (NCE) - to implement outstanding activities - was approved by the STDF on 20 December 2023; extending the project's end date to 31 August 2024.

Formalised agreements with project partners are summarised below, in Table 1.

Table 1. Roles and responsibilities of project partners.

Partner	**Purpose** (*Roles and responsibilities*)	Agreement type	Agreement term
SAPReF	Ensure that relevant technical personnel and decision makers are involved in project implementation and also be the link between the Project and SADC, the regional body that would ultimately ratify the draft guidelines developed under the project. SAPREF also take the lead in working with countries to ensure domestication of provisions of the harmonised guidelines.	Collaboration based on discussions that began during project proposal formulation. No signed document	Indefinite
SANBio	Ensure active involvement of SADC to facilitate the uptake of Project outputs by member countries, integrate them into national plans, and promote coordination. Participate in key committees and workshops, while advocating for political will to implement guidelines and contributing to meeting discussion points.	Collaboration Agreement	01/07/2021 - 29/02/2024
Ag Aligned Global	Technical support for Regulatory Harmonisation and Residue Mitigation-related activities	Memorandum of Understanding (MoU)	01/08/2021 - 29/02/2024
APAARI	Providing strategic input on project governance, contributing to key project workshops and meetings; leading the development of the Knowledge Management Strategy; conducting capacity-building surveys, delivering training programs, and offering technical support to ensure high-quality implementation of capacity development efforts; sharing relevant experiences from APAARI's projects.	Letter of Agreement (LoA)	17/01/2022 - 29/02/2024
KEPHIS	Residue mitigation study (mango) – conduct field trials for residue decline and biopesticide efficacy studies and conduct related laboratory analyses and interpretation of results	Memorandum of Understanding (MoU)	28/02/2022 - 29/02/2024
TPHPA	Residue mitigation study (avocado) – conduct field trials for residue decline and biopesticide efficacy studies and conduct related laboratory analyses and interpretation of results	Memorandum of Understanding (MoU)	13/06/2022 - 29/02/2024
CABI	Hosting the Biopesticides Database for the six project countries on the CABI BioProtection Portal	Annual Sponsorship Agreement	Years 1-3: 12/09/2022 – 11/09/2025

Project management

The ICGEB was the implementation partner for this project. To support the ICGEB's Project Manager, a Programme Specialist and Administrative Assistant were employed by the ICGEB from 01 September 2021, completing the project management team. The Administrative Assistant, however, was unsuccessful in meeting the needs of the project during their 3-month probation period and their contract was thus terminated. The Programme Specialist agreed to take on the duties of the Administrative Assistant and their contract was subsequently amended accordingly.

Ag Aligned Global provided the technical support for the project - providing expertise in the areas of pesticide regulations, pesticide standards, pesticide field research, and biopesticide efficacy studies. The Ag Aligned Global technical team was comprised of the following a project lead, a pesticide research expert, a pesticide residue laboratory expert, a biopesticide efficacy expert and a pesticide regulatory expert (Annex 5).

The team's overall role in the project included coordinating the planning and implementation of project activities, providing technical resources to ensure personnel are trained and capable of conducting research and planning and developing protocols, data recording, and reporting within agreed timelines. They were also responsible for monitoring and guiding the proper functioning of field and laboratory studies and working closely with the local team to ensure the consultant project team remained on-task. This involved adhering to schedules, planning, organising, and completing trainings, submitting reports on time, and ensuring that all project documentation and responsibilities were fulfilled.

The project saw the continued input and support from the appointed technical working group (TWG), the project's advisory board (PAB) and the steering committee (PSC) throughout the project period (Annex 6). The TWG comprised regulatory officials from the participating project countries, as well as a representative from Malawi, the SAPReF Chairperson and Administrator, and an international regulatory expert. Malawi was included due to the need to not only tap into his experience, having been part of the process of developing harmonised guidelines for the regulation of biopesticides in the East African Community (EAC), but also to ensure greater alignment between the SADC and EAC guidelines. Lawyers from Malawi and Uganda were contracted to carry out a legal review to not only gain a better understanding of the regulatory landscape in the project countries but also determine what would be required to domesticate the harmonised guidelines. The PSC included representatives of key regional and international organisations and the project managers of the Asia and Latin America STDF projects. The PAB comprised several key stakeholders from the participating project countries, as well as Kenya and SAPReF. The TWG met regularly between August 2021 and June 2022. The PAB and PSC met virtually for bi-annual meetings in January and July of each year. The PAB meetings proved useful not only in ensuring that suggestions of key stakeholders were taken into account during project implementation but also that there was the necessary buy-in and ownership of project outcomes by the various countries. The PSC meetings offered guidance to the project team to ensure that the project remained on track to ensure it met its overall goals.

The private sector was engaged and involved in the project through representation on the Project Steering Committee of a representative from the South Africa Bioproducts Organisation, Crop Life Africa Middle East and the Citrus Growers Association of South Africa. Representatives of various companies were included in the PAB (Annex 6.2).

4. ACHIEVEMENT OF RESULTS

The summaries below of results achieved during project implementation are made with reference to the project Logical Framework (LogFrame); Annex 1.

4.1 Project goal and outcome level results

The goal of the project was an "Increased export of mango and avocado from the six project countries". Towards this goal were two outcomes: Outcome 1 "Harmonised biopesticide regulations for selected SADC countries" and Outcome 2 "Increased usage/adoption of biopesticides by the private sector in six countries". The intended target for the project was for at least a 10% increase in quantity of exports (to both new and existing markets) of targeted crops from participating

countries by the end of the project. Whilst the project goal was to increase export volumes of mangos and avocados from the six participating countries, dealing with policies and procedures takes much time in order to gain all the necessary approvals and the three-and-a-half years of the project was not sufficient to establish this. Being a regional project also meant a lot of negotiations and dialogue that would need more time. Nevertheless, the fact that the harmonised regional biopesticide registration guidelines were developed and approved by SAPReF means an increase in future exports of these crops from the project countries is very promising - if these guidelines are adopted and implemented. Progress is particularly likely for Tanzania, as it was reported that farmers could see an opportunity in increasing the volumes of avocados produced and exported due to intervention brought about by the residue mitigation studies. Moreover, there is reported interest in Tanzania to adopt the strategic use of biopesticides in mangoes, grapes and banana following the pilot study on avocados. This interest shows the potential to increase trade in these value chains while protecting human, animal and environmental health.

4.1.1 Outcome 1: *Harmonised biopesticide regulations for selected SADC countries*

A draft of the "*Harmonised Guidelines for the Registration of Biopesticide Products and Biological Control Agents in Southern Africa*" was developed with inputs from and consultations with regulatory officials from the participating SADC project countries, as well as SAPReF, legal advisors, and an international regulatory expert. Reference was also made to the STDF GRP guide, a document which recommends steps for countries in the development of regulations (SPS measures). Based on the STDF guidance document, several key steps were implemented in the development of the draft guidelines. These included reviewing existing (bio)pesticide regulatory processes, forming a technical working group, and assessing internationally recommended data requirements and regulations from organisations such as OECD and FAO. Additionally, steps were taken to plan for the domestication and national implementation of the regulations.

The draft guidelines document received support not only from the six participating countries but from all sixteen SADC member states represented in SAPReF. The harmonised SADC regional regulatory framework will facilitate the registration and regulation of biopesticides and biocontrol agents, as well as promote reciprocal product registrations in SADC countries through mutually acceptable standards of biopesticide regulation. Whilst the project has effectively completed the activity of developing mutually acceptable standards of biopesticide, the draft guidelines were presented to the SADC Plant Protection Technical Committee (SPPTC) during a virtual meeting held on 23-24 July 2024. The SPPTC is currently reviewing the guidelines, following which they will be submitted to the Document, which is then submitted to the SADC Food, Agriculture and Natural Resources (FANR) Directorate and then the SADC legal department for vetting. SADC FANR will then submit the document to the SADC Council of Ministers for approval (estimated to be by January 2025). After approval by the Ministers, the document is submitted back to SAPReF for implementation by Member States that either lack or have incomplete regulatory frameworks for the registration and use of biopesticides and biocontrol agents for their countries.

The process towards developing the draft guidelines involved several virtual and in-person meetings/workshops of the TWG, reviews of the existing regulatory policies for South Africa (*Guidelines for the data required for registration of biological/ biopesticide remedies in South Africa*), Zimbabwe (*Zimbabwean pesticide regulations*) and the East African Community (*EAC harmonised guidelines for the registration of biopesticides and biocontrol products for plant protection*). The dates and gender disaggregation of the TWG meetings and workshops is summarised in Table 2.

Table 2. List of Technical Working Group (TWG) meetings and workshops, disaggregated by gender.

Date	Virtual/ In-person attendance	No. Participants [Male : Female (Total)]
09 September 2021	Virtual	16 : 12 (28)
29 October 2021	Virtual	9 : 7 (16)
29 November 2021	Virtual	9 : 7 (16)
07 March 2022	Virtual	7 : 5 (12)
23-24 June 2022	In-person	13 : 7 (20)
11-12 July 2023	In-person	17 : 18 (35)

Further to this, the project was represented at SAPReF general and executive committee meetings, where the draft harmonised regional biopesticide registration framework was presented and/ or discussed.

Regarding the target of six new biopesticide registrations, Tanzania reported to have had more than six new biopesticide registrations during the project duration, although other participating countries did not report any new registrations. Even though a direct link cannot be established between the project and new biopesticide registrations (as the harmonised regional biopesticide registration guidelines were only approved by SAPReF towards the end of the project in July 2024) and the domestication and implementation by SADC member states is expected to begin in 2025, after the end of the project), Tanzania reported that '*The media publicity created by the avocado team inspired the companies to register more products for use in avocado and this extended to other crops such as cashew and cotton'*. This was due to the fact that the studies being undertaken in Tanzania were shown on local TV stations. The Project Manager also gave an interview on a local TV station on the studies being carried out in the project. Additionally, since the project had not started implementing the registration guidelines by the end of the project. So, any SPS non-compliance alerts/notifications cannot be directly attributable to the project. However, Tanzania provided the following figures on SPS alerts: 2021-2022 (45), 2022-2023 (38), 2023/June 2024 (25). Zimbabwe did not have this data, while South Africa reported no non-compliance alerts. The other countries did not provide this information.

At the time of compiling this report, market penetration data had only been obtained from Tanzania who reported that in October 2023, 400 litres of Neem oil was sold, while in March 2024, 1500 litres were sold, an increase of >26%.

4.1.2 Outcome 2: *Increased usage/adoption of biopesticides by the private sector in 2 out of the 6 countries (Tanzania and Kenya)*

Kenya and Tanzania were selected to undertake the residue mitigation studies. Tanzania as it is a SADC Member State with significant international market export volumes and thus contends with SPS and MRL challenges due to pesticide residue; and Kenya as it is also a main exporter with the capacity to carry out residue studies (the Kenya Plant Health Inspectorate Service [KEPHIS] is a well-equipped and resourced agency that has experience with conducting similar studies). Furthermore, Kenya has laboratories that operate at the level of GLP, and laboratory personnel from Tanzania and Kenya received training on Pesticide Residue Data Generation through STDF/PG/359. It was thus anticipated that the participation of these two countries in the residue mitigation studies would further strengthen their GLP capacities.

Overall, this outcome showed good progress, with high adoption rates of biopesticides among Tanzanian farmers and positive feedback from growers across the region. Early indicators suggest a significant impact of the potential biopesticide based residue mitigation strategy on dealing with residue challenges. Additional studies might be needed to better define the combined approach to be used by growers.

At the time of compiling this report, information from Kenya on the number of growers using biopesticides was not yet available. In Tanzania, however, approximately 60% of avocado farmers now use biopesticides, whereas they previously relied solely on pheromone traps. The biopesticides currently in use include SnowMarobaine (a neem-based product) and Cryptogran.

The second indicator, which was meant to track the number of growers using the biopesticide-based residue mitigation system (BBRM) to comply with MRLs, cannot yet be reported as at least one more season of studies is needed. However, preliminary results have motivated the growers whose farms were included in these studies (n=78; 25 in Kenya and 53 in Tanzania) to consider adopting the system. Seven growers (35% of a target of 20) have already started using the BBRM system under development to comply with MRLs.

Furthermore, a survey conducted among farmers in the participating project countries revealed that 80% of growers are satisfied with biopesticides and are willing to continue using them, aligning with the fourth indicator.

4.2 Output 1: *Government authorities in 6 countries have a regulatory system in place specifically for biopesticides*

The project surpassed key targets for this output. Additionally, significant strides have been made toward aligning national biopesticide regulatory standards with international guidelines, laying a solid foundation for streamlined regulatory processes across the region.

The first indicator, number of dialogues (seminars, workshops, courses) between government authorities and other regional bodies on the harmonisation of their systems, had a target of 10. This was successfully achieved as the project held more than 10 meetings/workshops that brought together various stakeholders, e.g. a 5-day continent-wide meeting in March 2024 brought together regulatory professionals, researchers, industry experts and representatives, policymakers, and other players (48 males: 35 females [83 total]). Similarly, the project exceeded the target of six new partnerships developed between regulators in targeted countries and registrants; specifically relating possible engagements having been made between the regulators (SAPReF) and registrants across all six project countries. The partnerships, even though not formalised, involved direct engagements between regulatory bodies such as agriculture and environment ministries (e.g., the Zambia Environmental Management Agency, South Africa's Department of Agriculture, Forestry and Fisheries) and biopesticide registrants (e.g., pesticide manufacturers, local distributors, and product developers) in discussion pertaining to streamlining of the product registration process. These engagements took place during the several meetings and workshops hosted by the project, including during the country-organised workshops at which regulators, industry and other key sectors were represented.

The third indicator, relating to the number of national biopesticide regulatory standards harmonised with international standards, was attained at 80% as five of the six SADC project countries have developed roadmaps for domestication or incorporation of provisions of the guidelines into their national regulatory processes. The sixth country, South Africa, opted for a parallel process to review its guidelines, even though the drafting of the harmonised guidelines borrowed heavily from the provisions of the existing South African guidelines, indicating that there may be a great deal of alignment between the national guidelines and the ones developed under the project.

Draft harmonised guidelines for the registration of biopesticides and biological control agents were developed as were domestication roadmaps (in five of the six countries) to facilitate incorporation of provisions of the harmonised regional guidelines into national regulatory processes.

4.3 Output 2: *New residue data and improved knowledge to interpret this data related to the use of biopesticides (combined with conventional pesticides) to mitigate pesticide residues*

Overall, the data generated through the two residue mitigation studies conducted during the project validated the assumption that the strategy of substituting the last application of a conventional pesticide with a biopesticide mitigates the residue of the pesticide while satisfactorily protecting the target crops from late-season pest damage (in the case of the two target pest/ crops investigated).

Two residue mitigation studies were conducted - each with two components (residue decline and biopesticide efficacy), meeting the target of four. The study in Kenya (done in one farm) compared the use of only a conventional chemical pesticide (carbendazim) and the replacement of the last application of the conventional pesticide with a biopesticide (neem oil) for the control of anthracnose fungi on mango. Results from the residue decline field trial (conducted from late May to early September 2022) showed that carbendazim did not violate any MRL standards/requirements (namely of Codex, EU, and Japan). Analyses of samples from the biopesticide efficacy field trial (conducted from February to late March 2023) indicated that there was no difference between the treatments (i.e. use of carbendazim alone vs. use of neem oil to replace the final application of carbendazim), suggesting that neem oil was as effective as carbendazim in protecting against pest damage to mango fruits or leaves *and* the pesticide residue met the MRL standards.

The study in Tanzania compared the use of methoxyfenozide pesticide only and the replacement of the last application of methoxyfenozide with the *Cryptophlebia leucotreta* biopesticide for the control

of false codling moth on avocado. Results from the residue decline field trial (conducted from late November 2022 to January 2023) found that methoxyfenozide residues (0.011ppm) for 40-day PHI samples declined well below the MRL standards of the export markets (EU, US, Japan) and Codex standards (0.6-0.7 ppm). These preliminary results suggested that replacing the last application of methoxyfenozide with the biopesticide, *C. leucotreta* was as effective as using methoxyfenozide for the entire season in protecting avocado fruits against pest damage with pesticide residue levels meeting the MRL standards.

Despite the positive initial results achieved within the lifespan of the project (in which up to 50% reduction in pesticide residue was observed following replacement of the last pesticide application with a biopesticide), the biopesticide expert who oversaw the residue studies recommended that an additional season of studies be conducted, to better define the combined approach to be used by growers.

Related activities to this output were an in-person technical training of laboratory and field scientists from the project countries on Good Agricultural Practices (GAP) and Good Laboratory Practices (GLP), as well as functional capacity development ("soft skills"). The week-long in-person training workshop, hosted by KEPHIS, was held in Nairobi, Kenya from 31 October – 4 November 2022 and was titled: *Key Elements of Pesticide Residue Decline Assessment and Biopesticide-Based Residue Mitigation*. The technical training was conducted by experts through one of the project's partners (Ag Aligned Global); and the functional capacity development training was led by the project's Programme Specialist and assisted by two TWG members, all who received training from APAARI in March 2022. The technical training, which included both theoretical and practical sessions, encompassed aspects of the residue decline and mitigation studies. The 30 trainees (21 male: 9 female) were scientists from key governmental institutions of the seven project countries (including Kenya). Following suggestions from the PAB, two PAB members also participated in the meeting as observers (Emily Osena: Head of Fruits and Nuts, Horticulture Division – Kenya Ministry of Agriculture, Livestock, Fisheries and Cooperatives; and Eric Kimunguyi: Chief Executive Officer - Agrochemicals Association of Kenya). The trainees were subsequently involved as trainers for their respective in-country regulatory workshops in order that they are able to transfer the skills to colleagues and other stakeholders.

4.4 Output 3: *Established IPM strategies and GAP for key pest /crop combinations and using biopesticides*

The project has successfully delivered a comprehensive suite of knowledge products, including IPM strategies and GAP guides, and populated a biopesticide database and hence contributed towards effectively supporting growers in adopting biopesticides as part of a sustainable pest management strategy.

The initially targeted five knowledge products (IPM strategies, GAP guides) were developed by the project for growers. These included the development of an IPM strategy/tool-kit: "*Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes*" and creation of GAP guides for growers. The simple and user-friendly IPM toolkit aims to assist farmers in determining the suitability of a biopesticide as part of an IPM programme in various circumstances. The GAP guides developed include info sheets on benefits of biopesticide use, as well as factsheets on key pest /crop combinations – namely those investigated through the residue mitigation studies of the project: anthracnose fungi on mango and false codling moth on avocado. These materials were developed in consultation with project partners, and shared with key project stakeholders, e.g., growers and farmer groups, during the in-country workshops.

Info sheets:

- Biopesticide Classification and Applications
- Biopesticides: Benefits and Challenges
- Biopesticides and IPM
- Promoting the Use of Biopesticides by Smallholder Farmers in Africa
- Biopesticide Production, Commercialization and Availability in Africa

Factsheets: Biology and control of anthracnose fungi and False codling moth - the two target pests for the pesticides and biopesticides that were investigated during the project.

Policy brief: Promoting safe trade in Southern Africa: Steps to harmonizing guidelines for the registration of biopesticides and biological control agents.

One of the activities undertaken pursuant to this outcome was the development of a database of biopesticides products registered in all project countries, and made available through the ICGEB website and CABI's BioProtection Portal. Four (Mozambique, South Africa, Tanzania and Zimbabwe) of the six project countries' information has been published on the CABI BioProtection Portal and the project is in possession of the information for Zambia and Botswana, but does not as yet have permission statements from the relevant regulatory authorities which are a prerequisite for publication of the lists on the BioProtection Portal. Once finalised, all six countries' information will be published on the ICGEB website. Through the project, the ICGEB has an existing sponsorship arrangement with CABI that ends in September 2025. The project team can thus continue working with CABI on finalising and publishing the data for Botswana and Zambia at least until the conclusion of this agreement term. Additionally, the ICGEB intends to continue supporting the database – that will be hosted on their website - through other funding streams. The IPM Toolkit and link to CABI Portal are on ICGEB website. The other documents will be shared on social media and through the SAPReF, SABO, and SANBIO networks and mailing lists.

Finally, each of the six beneficiary countries was expected to organise and host a workshop on regulatory guidelines, IPM and GAP. Five of the six countries successfully held these workshops. South Africa however did not. Nevertheless, South Africa is in the process of reviewing their existing national registration guidelines. The dates and gender disaggregation of the in-country workshops is summarised in Table 3.

Table 3. In-country regulatory workshops, disaggregated by gender.

Date(s)	Country	No. Participants [Male : Female (Total)]
03-05 October 2023	Tanzania	20: 7 (27)
25-26 October 2023	Zimbabwe	41: 34 (75)
14-15 March 2024	Mozambique	27: 19 (46)
6-7 June 2024	Zambia	22: 8 (30)
12-13 August 2024	Botswana	24: 14 (38)
	Total	**134: 82 (216)**

4.5 Other unexpected results

The Project Manager participated at the Fourth Global Minor Use Summit that was held from 5-9 February 2024 in Madrid, Spain where he shared the BBRM concept developed under the project . This generated interest from the Avocado Producers Association of Mexico who asked the Project Manager to share the ideas with avocado farmers in Mexico. The Project Manager subsequently travelled and made a presentation on the BBRM approach at the Annual General meeting of the Avocado Producers and Exporters Association of Mexico attended by 650 people. It is an approach that is receiving very positive reactions and one that could undoubtedly go a long way in helping growers deal with residue issues and, hence, be able to access a larger export market.

Additionally, the project was instrumental in a workshop on developing continental guidelines for biopesticides, held from 4 – 08 March 2024 in Cape Town, South Africa and attended by 294 participants (83 [44 male; 39 female] in person; 211 joining virtually) from 23 countries. The regional project workshop was initially to be fully funded by the ICGEB (but however, ultimately, co-funded to the tune of 88% by various partners, including STDF, USDA, FAO, CABI, CropLife Africa Middle East and the Africa Food Safety Initiative). In addition to discussing the sub-regional guidelines, the workshop provided a platform for discussions on developing continental guidelines — a process now being led by the IAPSC in liaison with other partners who engaged during the workshop.

As already mentioned, Tanzania reported that '*The media publicity created by the avocado team inspired the companies to register more products for use in avocado and this extended to other crops such as cashew and cotton*'. The new products registered were Biosuperneem (0.03% EC), Bioneem

oil extracts (100%); Bisuf Neem Oil (100%). Snow Mwarobaine (0.03% EC) has also been registered (label extensions) in avocado, coffee and cotton. Snow Mwarobaine was initially registered for grapes. Byter Tembo has also been registered (in 2022) for Tuta absoluta in tomato and stalk borers in maize while Snow Verde has also been registered for Spider Mites, Caterpillars and Tuta absoluta in tomato (same company that registered Snow Mwarobaine). The new products registered were Biosuperneem (0.03% EC), Bioneem oil extracts (100%); Bisuf Neem Oil (100%). Snow Mwarobaine (0.03% EC) has also been registered (label extensions) in avocado, coffee and cotton. Snow Mwarobaine was initially registered for grapes. Byter Tembo has also been registered (in 2022) for *Tuta absoluta* in tomato and stalk borers in maize while Snow Verde has also been registered for Spider Mites, Caterpillars and *T. absoluta* in tomato (same company that registered Snow Mwarobaine). The number of biopesticide products registered in Tanzania is now up from 37 to 42.

FAO is implementing a project[8] in Zimbabwe that will both support the domestication process and encourage the use of biopesticides. This initiative is an unexpected but positive result of the extensive interactions the project has had with the FAO team in Zimbabwe and represents a significant step toward ensuring the sustainability of the project's outcomes.

5. CROSS-CUTTING

5.1 Gender

Since its inception, the project recognised that agricultural systems in Africa are disproportionately reliant on women for the performance of associated tasks. Where synthetic chemical pesticides are funding used, women are exposed, on a regular basis, to potentially dangerous substances. Concern is not restricted solely to their direct exposure, since these chemicals can be transferred to children, the entire household and proximate communities more broadly. The reduction of off-target application of conventional pesticides, therefore, directly and indirectly improves the livelihood of women and their families in target countries by reducing unintentional synthetic chemical pesticide exposure and increasing the exportability and trade of smallholder crops.

The STDF Gender Action Plan, which guided some of the project's gender-responsive approaches, outlines actions to ensure women's equal participation in SPS capacity-building activities, focusing on creating inclusive policies and removing gender-related barriers in trade. To incorporate these considerations, project management held meetings with the STDF Gender Consultant to ensure gender issues were addressed in implementation and to design surveys for collecting relevant gender-related metrics. For instance, the capacity development of women was prioritised at every opportunity of the project. Women were proactively sought out for participation in the different training programmes, meetings, surveys, and also through the dissemination of information via brochures, pamphlets and videos – developed under the project (distributed by the ICGEB, SAPReF through the country focal points, and key project partners such as the South African Bioproducts Organisation [SABO] and the Southern Africa Network for Biosciences [SANBio]). This facilitated access to compliance-related resources, ensure the mainstreaming of gender responsive practices, and enhancing women's capacities on Codex MRL compliance. For example, stipulated in the terms of reference (TORs) for the in-country regulatory workshops, was a clause stating that, "Organisers are strongly encouraged to promote gender balance when selecting speakers and participants." The participants for each training programme, workshop and survey were disaggregated by gender (male/female), and these were reported in the relevant bi-annual progress report to the STDF. The overall total of which was 222 women (42%) and 312 men (58%).

As a way of exploring the change in attitudes and behaviours of growers towards adopting biopesticides in their pest management programmes, the project conducted surveys to assess which (if any) biopesticides are currently being used. Through key project partners, including the PSC, PAB, and TWG members, as well as identified farmers' associations, these surveys were disseminated to

[8] Capacity Building Related to Multilateral Environmental Agreements in African, Caribbean and Pacific regions. Phase 3 ongoing. Phase 4 to commence on 01 October 2025. Budget € 9,9 million. Duration 2019 - September 2025.https://www.fao.org/in-action/building-capacity-environmental-agreements/activities/africa/zimbabwe/en/

growers and agro-dealers/distribution agents. By way of gender analysis, the surveys included questions related to gender.

The surveys had female representation as follows: one of five respondents (20%) for the Growers survey, and 22 of 44 respondents (50%) for the Agro-dealers/distribution agents survey. Both surveys included inquiries around challenges (if any) respondents face in relation to pesticide use and IPM, such as a limited role in decision-making, limited access to capital, limited access to credit, and lack/ limited access to education, information or training on IPM. Around suggestions on how these challenges could be addressed, 20% of respondents said increased awareness of pest management options and products, and to empower women to develop biopesticides using locally available resources such as plants with pesticide properties. A larger proportion (40%) suggested affordability of bio-/pesticides and other control options, availability of bio-/pesticides and other control options, training on use of bio-/pesticides and other control options, and increased knowledge of the safety of using biopesticides over chemical pesticides. Two-thirds of respondents indicated that they will be more likely to use/ continue to use biopesticides if they received training on the use of biopesticides (in conjunction with chemical pesticides as part of a pest control programme).

5.2 Environment, Biodiversity and Climate Change

Entities and individuals responsible for the environment were part of the project implementation team. This included a representative of the Department of Forestry, Fisheries and the Environment in South Africa as well as the Zambia Environmental Management Agency. These individuals and entities were able to share with various project stakeholders the key linkages between the project and the Nagoya Protocol on Access Benefit Sharing. In summary, the project aligns with the Nagoya Protocol by promoting biopesticides derived from natural resources, fostering biodiversity conservation and ecological sustainability. By reducing reliance on conventional pesticides, the project helps protect sensitive species, such as bees and supports human and environmental health. Awareness activities, like IPM toolkits and brochures, aim to increase biopesticide demand, contributing to the Protocol's goals of fair benefit-sharing and sustainable resource use in agriculture.

By reducing the use of conventional pesticides in horticultural crops and reducing off-target applications, exposure to bees and other sensitive species in the environment will decrease. Although conventional pesticides are safe when used appropriately, in reality, good agricultural practices are not often followed in developing countries – such as those of the SADC region. In these cases, use of lower-risk biopesticides serves to protect not only those administering pesticides, but also the environment, providing ecological sustainability by conserving natural enemies and biodiversity. Through various activities (such as the residue mitigation studies and development of brochures and an "IPM toolkit"), the project expected to stimulate increased demand for biopesticides, which would contribute to the attainment of the broader development goals of improved human and environmental health (including reduced risk to consumers, pesticide applicators, and the environment).

The unique point of the residue mitigation component of this project is its intended application of a quantitative measure on residue, MRL standpoint, as well as environmental impact(s). Together with the two residue mitigation studies, the project conducted in-person training on GAP and GLP to enhance the capacities of scientists from the project countries to conduct such studies; contributing to reduced chemical pesticide use and the promotion of non-toxic biopesticide use as well as the adoption of IPM systems – all of which are bound to contribute to environmental protection. It should also be noted that caution was taken to ensure that no project activities had a negative environmental impact.

The data generated through the two residue mitigation studies conducted during the project validated the assumption that the substitution of the last application of a conventional pesticide with a biopesticide would have a positive environmental impact through a reduction of pesticide usage when combined in an IPM strategy. The studies found that this strategy mitigates the residue of the pesticide while satisfactorily protecting the target crops from late-season pest damage (in the case of the two target pest/ crops investigated).

Additionally, a simple and user-friendly IPM strategy/tool-kit: "*Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes*" developed through the project will assist farmers in determining the suitability of a biopesticide as part of an IPM programme in various circumstances. Finally, GAP guides created include info sheets on benefits of biopesticide use, as well as factsheets on key pest /crop combinations – namely those investigated through the residue mitigation studies of the project: anthracnose fungi on mango and false codling moth on avocado.

6. FINANCIAL OVERVIEW

The approved STDF funder contribution to the project was USD 798,480. The total amount received (comprising disbursements, interest generated, and tax refunds to ICGEB) was ZAR 12,379,291.58. Of this, ZAR 11,916,007.75 was spent, representing 96% of the total received. As a result, ZAR 463,283 will be reimbursed to the STDF. However, when considered against the approved STDF contribution alone—excluding interest and tax refunds—the estimated project expenditure of USD 621,175.40 represents 78% of the original funding. The lower percentage of expenditure relative to the total disbursement is primarily due to the weakening of the South African rand—from an initial exchange rate of ZAR 14.1 to approximately ZAR 18.50 against the US dollar by the end of the project. Additionally, the project generated significant interest on the STDF funds and, being tax-exempt, benefited from tax refunds—both of which further contributed to the reduced proportion of funds spent. Please note that figures provided in this table in USD are only estimations.

Table 4 provides an overview of the initial project budget, amounts received, interest on funds received and total expenditure.

Table 4. Financial overview for the project. (*Estimated according to the exchange rate of 19,183 rands per USD on 15 April 2025).

	STDF	In kind / Other	Total
Total project budget (US$)	USD 798,480.00	USD 660,798.00	USD 1,459,278.00
Total amount received to date	ZAR 11,915,469.51 (Corresponding to USD 718,632.00 disbursed by the STDF)		
Interest on funds received	ZAR 439,193.35		
VAT refunds	ZAR 24,628.72		
Total income	ZAR 12,379,291,58		
Total expenditure to date	ZAR 11,916,007.75 (Corresponding to USD 621,175.40*)	USD 660,798.00	
Funds to be reimbursed to the STDF	ZAR 463,283.83 (Corresponding to USD 24,150.75*)		

The total project budget – including in-kind contribution from the ICGEB and project partners was USD $1,459,278. In-kind funds were used to cover participatory costs for the international regulatory expert in activities related to developing the harmonised SADC regional biopesticide registration guidelines (most of the consultant's costs were covered by the USDA) and to cover the costs of the project manager and other ICGEB personnel involved in, time spent by project beneficiaries in

implementing various in-country activities. ICGEB, USDA, FAO, CABI, CLAME and the Africa Food Safety Initiative provided additional direct financial support to the project.

7. CHALLENGES, RISKS & MITIGATION

During project implementation, several challenges were experienced and through these lessons were learned. Key challenges and their mitigating actions included the following:

1. External challenges

- **COVID-19 impact on travel and in-person activities**

  Challenge: The COVID-19 pandemic restricted travel and limited in-person activities.

  Mitigation: The project quickly resorted to virtual events, ensuring continuity and keeping all stakeholders engaged without compromising timelines.

- **Currency exchange rate fluctuations**

  Challenge: The South African Rand (the currency on which the project account is maintained to the dollar) significantly weakened throughout the project period, from an initial dollar to rand exchange rate of 14.1 at project inception to about 18.50. This, at times, resulted in marginal overspends on some budgeted items, especially where foreign payments were involved.

  Mitigation: Budget flexibility was achieved by underspending on guideline development (with most consultant costs covered by USDA funds), which helped offset increased costs due to currency fluctuations.

- **Airline strike impacting workshop travel**

  Challenge: Return flights for 18 attendees of the in-person training workshop in Kenya were cancelled by Kenya Airlines on the morning of their travel. This unforeseen event was due to airline pilots commencing with strike action and resulted in the need for flights to be rebooked with other airlines at short notice, with Kenya Airlines later refunding only 50% of the cancelled flights, thus resulting in the higher than anticipated spend for travel.

- *Mitigation:* Alternative flights were booked immediately to minimise delays, with budget adjustments made for unexpected travel expenses.

2. Technical implementation and project management challenges

- **Delayed responses from partners or stakeholders**

  Challenge: Delays in stakeholder responses occasionally impacted project schedules.

  Mitigation: Project management conducted regular follow-ups through emails and calls to obtain responses and keep activities on track.

- **Delayed start of Tanzanian residue mitigation study**

  Challenge: The agreed test substance was unavailable locally, delaying the study's start.

  Mitigation: The study director sourced an alternative test substance with a nearly identical formulation, allowing the study to proceed as planned within the desired growing season.

- **Biopesticide efficacy field trial rescheduling**

  Challenge: The Tanzanian biopesticide efficacy field trial was initially set for mid-2023, a period that did not align with the peak flight season of the false codling moth (December-April). The studies could, therefore, not be conducted within this period.

  Mitigation: The field trial was moved from November 2023 to January 2024 to coincide with the peak flying season of the false codling moth, with subsequent laboratory analyses scheduled for early 2024 to ensure relevant data collection.

- **Delayed procurement of chemicals for the Tanzanian study**

  Challenge: Procurement delays pushed back laboratory analyses of samples for the residue mitigation study.

Mitigation: The biopesticide efficacy trial proceeded independently of the residue decline trial. All samples were processed and analysed concurrently once chemicals arrived, minimising further delays.

3. Organisational and staffing challenges

- **Administrative assistant transition**

  Challenge: The administrative assistant hired in September 2021 did not pass the probation period.
  Mitigation: Responsibilities were transferred to the programme specialist (PS), with STDF's approval, starting in December 2021. The project organogram was updated, and due to the additional tasks thus taken on by the PS, her salary was adjusted accordingly from March 2022.

- **Programme specialist relocation**
  Challenge: The PS moved from South Africa to New Zealand in August 2022

  Mitigation: The PM agreed to retain the PS even though she now had to work remotely, and she adapted her schedule to meet time-zone differences, ensuring minimal impact on duties.

- **Resignation of programme specialist in 2024**

  Challenge: The PS resigned at the end of January 2024, leaving a gap in the project's management team.

  Mitigation: The PM and short-term fellow assumed additional responsibilities to maintain project momentum. In June 2024, the PM entered into a short-term agreement with the former PS for assistance with financial report reviews, progress reporting, and final workshop logistics.

4. Situational and political context in participating countries

- **Time required for regional negotiations and dialogue**

  Challenge: As this was a regional project, significant time was needed for negotiations and dialogue among participating countries to reach agreements on key issues.

  Mitigation: To streamline negotiations, the project held regular meetings with in-country stakeholders, which helped establish a framework for clear communication and consensus-building. This approach helped accelerate decision-making processes and allowed for timely resolutions of critical matters. A Project Advisory Board Meeting comprised of representatives of all key sectors in the various countries (academia, regulators, industry representatives, extension personnel and researchers) also help the project management quickly reach consensus on key issues.

8. COMMUNICATIONS AND OUTREACH

Activities

Updates on project-related activities (upcoming, progress and results) were regularly provided on several on-line platforms: the dedicated project website, and the ICGEB's social media platforms (LinkedIn, Facebook, Instagram and Twitter).

Materials

The following informational materials were developed and shared widely through various networks, platforms (e.g. extension services, ICGEB Biopesticides Group website, social media) and project partners (including CLAME, FAO, SANBio, SABO, SAPReF, and AU-IAPSC).

Quarterly project newsletter:

Nine issues of a quarterly project newsletter, featuring updates on project implementation as well as news and upcoming events in the biopesticide sector, was developed and disseminated (via email

[directly to 98 recipients on the mailing list], the project website and social media pages) throughout majority of the project period: Issue 1 (October to December 2021); Issue 2 (January to March 2022); Issue 3 (April to June 2022); Issue 4 (July to September 2022); Issue 5 (October to December 2022); Issue 6 (January to March 2023); Issue 7 (April to June 2023); Issue 8 (July to September 2023); Issue 9 (October to December 2023).

IPM Toolkit and Info/Factsheets:

The simple and user-friendly IPM toolkit *"Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes* will assist farmers in determining the suitability of a biopesticide as part of an Integrated Pest Management (IPM) programme in various circumstances.

Info sheets:

- Biopesticide Classification and Applications
- Biopesticides: Benefits and Challenges
- Biopesticides and IPM
- Promoting the Use of Biopesticides by Smallholder Farmers in Africa
- Biopesticide Production, Commercialization and Availability in Africa

Fact sheets on the biology and management of the two specific pests investigated during the project: anthracnose fungi and False codling moth.

Policy document: Steps to harmonizing guidelines for the registration of biopesticides and biological control agents in Southern Africa.

Quotes from key project stakeholders

"A key stumbling block to reducing over-reliance on synthetic chemical pesticides in many countries in Southern Africa is the lack of effective policy frameworks to promote the inclusion of sustainable alternatives, such as biopesticides, in pest control programmes. The Southern Africa Biopesticides Project is playing a significant role in the development of such policy frameworks at a regional and, ultimately, country level." - Mr Kenneth Chipere (Principal Research Officer: Pesticide Registration, Research Services Division, Ministry of Agriculture, Mechanization and Irrigation Development, Zimbabwe; and member of the Southern Africa Biopesticide Projects' Technical Working Group)

"Growers within the tropics are faced with a delicate balance between producing crops free of pests and meeting elusive MRL requirements for various markets. The Southern Africa Biopesticides Project provides homegrown innovative solutions to promote the registration and adoption of biopesticides-through the elimination of regulatory barriers and the promotion of good agricultural practices. This initiative would not only reduce MRL violations but immensely contribute to the growth of global and regional trade, food safety and environmental sustainability." - Mr Eric Kimunguyi (Chief Executive Officer, Agrochemicals Association of Kenya, and member of the Advisory Board of the Southern Africa Biopesticide Project)

"*The issue of harmonisation of regulatory guidelines is close to the heart of anyone responsible for registration of biopesticide products. Lack of harmonisation creates frustration at many levels, and we view with gratitude the attention given by ICGEB to this important project. We look forward to the day when registration of these important components of sustainable agriculture is facilitated across political borders for the benefit of farmers, consumers and the environment."* - Debbie Perry (Regulatory Affairs Officer at Andermatt PHP [APHP][9] – a representative of the industry of biopesticide manufacturers)

"For years, we've struggled to find pest control options that protect our crops without jeopardising market access due to strict residue limits. The project activities mitigation measures of pesticide residues using biopesticides conducted by the Tanzania Plant Health and Pesticides Authority has given us hope of reducing pesticide residues on avocado. We are now able to produce avocados using fewer chemical pesticides, followed by biopesticides while still maintaining high levels of pest control, reducing pesticide residues on avocado, and hence better able to comply with market requirements.

[9] A privately owned company developing and producing biological solutions for crop protection and pest management.

It is an exciting time for avocado producers in the country". Mr. Emmanuel Nko (Farmer, Kilimanjaro, Tanzania)

"The mangoes (Kent variety) that were sprayed with the biopesticide combination of Rodazim (Carbendazim) and Nembicidine (Neem oil) had reduced infestations of anthracnose on leaves as well as fruits, compared to the adjacent crop of mangoes which were not sprayed, the fruits were more marketable hence fetched better prices. This was uncommon because Kent mangoes variety are off-season crops and, therefore, are more susceptible to both pest and anthracnose infestation. I was so reassured of reduced MRL levels due to spraying of neem oil at the end of the mango growing season". Mr. Zachary Kareru Kabugi (Farmer, Kirimiri location, Muranga county, Kenya)

9. SUSTAINABILITY & FOLLOW-UP

Output 1: Government authorities in 6 countries have a regulatory system in place specifically for biopesticides

The involvement of SAPReF is fundamental for the sustainability of this project, as SAPReF is involved in promoting regional collaboration and harmonisation of pesticide regulations among pesticide regulators in the SADC region. SAPReF will continue monitoring the progress that the various countries are making towards the domestication of provisions of the draft harmonised guidelines. Even though in the initial project document, a suggestion had been made to form a project outcomes implementation committee to oversee this process, it became apparent that SAPREF (given its mandate) was best placed to take this role, with ICGEB joining the regular SAPREF calls. Furthermore, the approvals at a regional level by the SADC Council of Ministers, which is expected to be done in January 2025, will support the processes of domestication and implementation of the guidelines, as there will now be the necessary political muscle to get things implemented in the various countries.

It has also been reported that FAO is implementing another project that will not only support the domestication process in Zimbabwe but also promote the use of biopesticides. This, therefore, means that the SADC project has set in motion more work that will be sustained in the future. Collaboration with industry stakeholders is also a focal point of the follow-up strategy. For instance, in partnership with CropLife Africa and the Middle East, a workshop is planned in Zambia to finalise the drafting of local regulations that align with the harmonised guidelines established during the project. This collaborative approach helps facilitate the domestication and implementation of guidelines, ensuring that local practices align with regional standards. By involving industry players, the project supports the necessary in-country processes for effective regulation and promotes the broader adoption of biopesticides.

Additionally, Mozambique and Zambia have committed national resources to implement the roadmaps, and SAPReF can oversee their progress. Ongoing engagement and resource allocation by these countries will assure long-term success and scaling up of the project's outputs.

Output 2: New residue data and improved knowledge to interpret this data related to the use of biopesticides (combined with conventional pesticides) to mitigate pesticide residues

A request will be made to both Tanzania and Kenya to submit a call for support under the ICGEB Collaborative Research Programme for a second season of the residue trials. Once completed, it will then be possible to develop concrete proposals for growers, helping them understand and implement effective practices in biopesticide application. By engaging growers directly and providing them with practical insights, the project not only ensures that they can benefit from the advancements made but also encourages the adoption of best practices that can lead to improved agricultural outcomes.

Output 3: Established IPM strategies and GAP for key pest /crop combinations and using biopesticides

The African Union (AU), through the Inter-African Phytosanitary Council (AU-IAPSC), is actively supporting African countries in adopting biopesticides by spearheading the harmonisation of

regulatory frameworks for both pesticides and biopesticides across the continent. This includes facilitating discussions to develop cohesive guidelines tailored to specific regional pest challenges and fostering collaboration among key stakeholders. Building on the groundwork laid by the STDF project, these efforts aim to sustain and expand current initiatives.

With the consolidation of biopesticide products registered in each participating country and the publishing of these lists on the publicly available CABI BioProtection Portal and the ICGEB website, the project created a vital resource that connects CABI with the relevant regulatory bodies. This ongoing relationship is crucial for ensuring that the databases are not only updated but also maintained beyond the project's life. Regular communication with regulators will facilitate the integration of new data and promote the long-term accessibility of this information, allowing for continuous monitoring and adaptation of biopesticide practices.

In addition, the ICGEB Biopesticides Group will be conducting ongoing capacity-building activities focused on biopesticide research, development, and regulation. These initiatives are designed to empower local stakeholders, including researchers, regulators, and farmers, with the knowledge and skills necessary to effectively utilise biopesticides. By fostering a culture of learning and adaptation, these capacity-building efforts will enhance local expertise and promote the sustainable use of biopesticides over time.

Finally, recognising the importance of public awareness and engagement, additional stakeholders, including media representatives, are being included in pertinent discussions related to the implementation of project outcomes. Engaging the media not only helps disseminate information but also raises public awareness about the benefits of biopesticides and sustainable agricultural practices. This broader engagement is essential for building community support and ensuring that the project's successes are communicated effectively, fostering an environment conducive to the continued adoption of biopesticide technologies.

10. LESSONS LEARNED

- **What worked well/Elements of success:**

Regular meetings: There were bi-weekly sessions of the project technical team. These meetings were instrumental in maintaining focus and effectively tracking progress. Additionally, the biannual meetings with the PSC and PAB provided a vital platform for continuous feedback and open discussions, ensuring that all stakeholders remained engaged and informed. Similarly, the regular meetings with SAPReF were instrumental in ensuring acceptance of the guidelines beyond the project countries.

Stakeholder engagement: Active involvement of public sector representatives through workshops and advisory committees not only ensured their commitment but also allowed for valuable input that shaped project management. Similarly, clear communication of the project's benefits to the private sector fostered a sense of ownership among partners such as SABO and CLAME.

Flexibility and adaptability: The STDF's willingness to accommodate requests allowed for timely adjustments in response to unforeseen developments. Notably, the project's ability to transition seamlessly to virtual events during the COVID-19 pandemic ensured that progress continued uninterrupted, illustrating the team's resilience and commitment.

Collaboration: Strategic partnerships with organisations like APAARI, FAO, and CABI not only leveraged complementary strengths but also prevented duplication of efforts, thereby enhancing overall impact. Furthermore, the inclusion of key regional (IAPSC, SANBio, EAC, ECOWAS, APAARI) and international organizations (USDA, FOA) in the Project Steering Committee helped ensure that the project remained relevant to the needs of various stakeholders. Collaboration with APAARI (who implemented the Asia biopesticides project) was invaluable to this project. Continued correspondence with their Executive Secretary and Project Manager (not only through the PSC) aided in maintaining alignment of project goals, sharing lessons learned for mutual support and enhancement of overall impact. Moreover, APAARI facilitated the soft skills element of the project – through attendance and engagement during various workshops and training events, and the co-development of the Knowledge Management and Capacity Development Strategy. Additionally, proactively engaging with

organisations with complementary mandates (e.g. FAO and CABI) ensured strategic value addition and prevented duplication of efforts, and FAO provided valuable input on the project's IPM toolkit.

Communication: Regular follow-ups through emails and phone calls underscored the importance of feedback, leading to more timely responses and a stronger sense of collaboration. Maintaining visibility on various platforms further ensured that the project's unique value proposition was communicated effectively, aiding in alignment with other interventions.

Relationship building: The project also benefited from the establishment of positive relationships with regulators and policymakers, which provided essential insights into the regulatory landscape and facilitated alignment with national processes.

- **What did not work so well/Constraints faced:**

Delayed responses: One significant issue was the delayed responses from in-country beneficiaries. At times, it took an inordinate amount of time to receive urgently needed feedback, which required frequent follow-ups and ultimately affected project timelines.

Personnel challenges: The underperformance of the Administrative Assistant led to a redistribution of her/his tasks to other team members, including the Programme Specialist and Project Manager. While this ensured project continuity, it placed additional demands on their workloads. This problem became especially acute during the process of putting together the final project report, as the Programme Specialist (having already resigned earlier) could only provide limited support to the project. This experience highlights the importance of ensuring adequate staff to maintain optimal efficiency across projects of such magnitude.

Supply chain issues: Unanticipated delays in obtaining specific chemicals and consumables for laboratory analysis led to setbacks in various project activities, demonstrating the importance of meticulous planning and timely procurement processes.

Feedback mechanisms: While training initiatives for farmers were well-received, there was a noticeable gap in the feedback mechanisms designed to gauge the effectiveness of these trainings. Strengthening these feedback loops would have provided more nuanced insights into training success and farmer adoption rates.

Virtual engagement: Limitations of virtual engagement during the pandemic were evident. Although the transition to online platforms was successful in maintaining momentum, it inherently restricted the depth of interaction compared to in-person engagements, particularly in fostering relationships and trust among stakeholders.

Language barriers: The primary language for the project was English, yet most project beneficiaries' home language is not English, which limited communications at times. This challenge was somewhat reduced when other participants, whose understanding of English was greater, could assist their fellow countrymen with translations.

11. RECOMMENDATIONS

1. Industry

- **Support the domestication process in various countries**: Industry players, including manufacturers and distributors of biopesticides, should actively engage in national regulatory processes to adapt and implement international or regional standards for biopesticides. This would involve participating in advocacy, providing technical expertise, and sharing market data that may influence policy decisions. In South Africa, the South African Bioproducts Organisation (SABO) could lead this process. It would be beneficial for the other countries to create a similar body to SABO, who could lead this in their respective country: a centralised entity comprised of members from different manufacturers, importers and research institutions and who could represent industry when engaging with regulatory authorities or regional policy makers on behalf of their members. ICGEB, in its engagement with its Member States, will promote this initiative.

2. International Centre for Genetic Engineering and Biotechnology (ICGEB)

- **Support additional residue mitigation studies**: The ICGEB should conduct or coordinate further studies on residue mitigation to generate robust data that can inform recommendations to growers. These studies will be undertaken through Collaborative Research Projects (to be considered for funding following submission of project proposals by the various countries) between ICGEB and the Project countries. These studies could address how biopesticides can be used to minimise chemical residues in crops, thereby enhancing safety and regulatory compliance.
- **Collaborate with stakeholders for capacity building**: The ICGEB should partner with regulators, researchers, and industry stakeholders to provide more training on the regulation of biopesticides. Capacity-building efforts could focus on understanding regulatory frameworks, best practices for registration, and risk assessment of biopesticides. Additionally, the ICGEB could look into having the materials developed by the project translated into different languages, specific to the project countries (e.g. Portuguese for Mozambique and Swahili for Tanzania and Kenya).

3. Food and Agriculture Organisation (FAO)

- **Support the domestication process in Zimbabwe**: FAO should work closely with Zimbabwean government agencies and other relevant actors to adapt and implement international standards for biopesticides within the local regulatory framework. FAO could provide technical assistance, facilitate policy dialogues, and help build institutional capacity to ensure the successful adoption of biopesticide regulations. Zimbabwe is the only project country (of the six participating SADC project countries) covered by the FAO Programme.

4. Standards and Trade Development Facility

- **Develop assessment metrics:** STDF has funded biopesticides projects in various part of the globe. It may be helpful if it could support the development of a system to be able to of to assess the overall effectiveness of developing biopesticide regulations in reducing synthetic pesticide use and improving market access. This could further help identify best practices and areas needing further interventions.
- **Case studies:** STDF can use the preliminary results of the residue studies as case studies to highlight the potential of biopesticide-based residue mitigation strategies for residue mitigation and, hence, trade promotion.
- **Knowledge sharing:** STDF can share the resources developed under the project with relevant entities it is funding, in order that the knowledge developed under the project is available and can be beneficial to other projects and regions.
- **Other residue mitigation strategies:** Residue issues continue to pose significant barriers to trade, highlighting the need for more integrated residue management strategies to facilitate commerce. Approaches such as microbial-based pesticide bioremediation, which uses microbes to degrade pesticide residues and precision application technologies (more targeted pesticide application) can play a key role. The STDF could consider supporting projects focused on these innovative solutions to enhance residue management and trade opportunities.

5. Other Stakeholders and Partners (e.g., Government Agencies, Growers, NGOs)

- **Collaborate with the ICGEB for training and capacity building**: Government agencies, research institutions, and grower organisations should collaborate with the ICGEB and other partners to enhance understanding of biopesticide regulations. This may involve organising workshops, technical training, and seminars tailored to different stakeholders.
- **Provide input during domestication**: National governments and regional organisations should ensure they are engaged in the process of adapting biopesticide regulations, contributing local insights and needs to ensure the regulations are context-appropriate and enforceable.

- **Use of products (materials) developed under the project**: Growers and Growers Associations are encouraged to make use of the materials developed by the project, to ascertain the suitability of a biopesticide as part of an IPM programme in various circumstances and improve their understanding of biopesticides and their use; namely:
  - Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes (also referred to as the "IPM Toolkit")
  - Info sheets: Biopesticide Classification and Applications; Biopesticides: Benefits and Challenges; Biopesticides and IPM; Promoting the Use of Biopesticides by Smallholder Farmers in Africa; and Biopesticide Production, Commercialization and Availability in Africa
  - Factsheets: Biology and management of Anthracnose fungi; and Biology and management False codling moth.

12. ANNEXES

1. Logical framework matrix

2. Financial report

3. List of key documents produced under the project (e.g. training manuals, codes of good practice)

   3.1 Draft harmonised biopesticide registration guidelines for the SADC region

   3.2 Legal review of the biopesticide regulatory frameworks in selected countries in Southern Africa

   3.3 Guidance Document for Evaluating the Usefulness of Biopesticides in Integrated Pest Management Programmes (also referred to as the "IPM Toolkit")

   3.4 PowerPoint presentations (equivalent to informal training manuals) on Good Agricultural Practice (GAP) and Good Laboratory Practice (GLP); produced by technical experts for the Residue Mitigation in-person training in Nairobi, Kenya (30 October – 4 November 2022)

   3.5 Info sheets:

      3.5.1 Biopesticide Classification and Applications;

      3.5.2 Biopesticides: Benefits and Challenges;

      3.5.3 Biopesticides and IPM;

      3.5.4 Promoting the Use of Biopesticides by Smallholder Farmers in Africa;

      3.5.5 Biopesticide Production, Commercialization and Availability in Africa

   3.6 Factsheets:

      3.6.1 Biology and management of Anthracnose fungi;

      3.6.2 Biology and management False codling moth

   3.7 Report on findings from the residue mitigation studies

   3.8 Policy brief: Promoting safe trade in Southern Africa: Steps to harmonising guidelines for the registration of biopesticides and biological control agents

   3.9 Video on perspectives of a researcher on the project.

4. List of key training workshops, outreach events, study tours, etc. organised under the project including dates, location, number of persons (M/F)

   4.1 Training workshop on key elements of pesticide residue decline assessment and biopesticide-based residue mitigation, held in Nairobi, Kenya from 31 October – 4 November 2022: 30 trainees [21 male; 9 female]

   4.2 Training workshop on application of the harmonised SADC regional biopesticide registration guidelines, held in Cape Town, South Africa from 11-12 July 2023: 35 participants [17 male; 18 female]

   4.3 Tanzania in-country regulatory workshop, held in Dodoma, Tanzania from 03-05 October 2023: 27 participants [20 male; 7 female]

   4.4 Zimbabwe in-country regulatory workshop, held in Harare, Zimbabwe from 25-26 October 2023: 75 participants on Day 1 [41 male; 34 female] and 66 participants on Day 2 [37 male; 29 female]

   4.5 Mozambique in-country regulatory workshop, held in Maputo, Mozambique from 14-15 March 2024: 46 participants [27 male; 19 female]

   4.6 Zambia in-country regulatory workshop, held in Lusaka, Zambia from 06-07 June 2024, yielded 30 participants [22 male; 8 female]

4.7 Botswana in-country regulatory workshop, held in Gaborone, Botswana from 12-13 August 2024: 37 participants [14 male; 23 female]

4.8 Regional workshop on Advancing Regulatory Harmonisation and Biopesticide Innovation in Africa", was held in Cape Town, South Africa from 04-08 March 2024: 294 participants including virtual. 83 in person: [44 male; 39 female]

4.9 End-of-project workshop, held in Cape Town, South Africa from 27-28 August 2024 [24 male; 21 female]

5. List of key persons (including names and contact details) involved in the project from the implementing organisation, other partners, and project country representatives.

6. Project stakeholder groups (list of people, contact name, organisation, email for each one of these bodies)

   6.1 Technical Working Group

   6.2 Project Advisory Board

   6.3 Project Steering Committee