STDF Standards and Trade Development Facility

ANNEX I : PROJECT DOCUMENT STDF/PG/634

Project Title	**Asia Pesticide Residue Mitigation through the Promotion of Biopesticides and Enhancement of Trade Opportunities.**
Objective	Increase awareness of how pesticide residue issues impact trade and develop methods for overcoming these trade barriers.
Budget requested from STDF	USD $ 899,586
Total project budget	USD $ 1,269,603
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*Note that the proposal was developed by Michael Braverman, Ravi Khetarpal and Jason Sandahl in consultation with cooperating countries. This request is based upon their letters of support.

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I. BACKGROUND & RATIONALE

1. Relevance for the STDF

1. There is a plethora of problems in SPS that limit developing countries' access to markets, which limit trade and development. Significant economic losses have occurred due to shipments being rejected for pesticide residue violations, because farmers cannot comply with established (or non-existent) international standards. Maximum Residue Limit (MRL) issues are one of the main SPS issues raised in the SPS Committee and affecting agri-food trade. This project is very relevant for the STDF because it responds to specific SPS issues affecting trade, it promotes regional collaboration and synergies across relevant government agencies and the private sector in ASEAN and South Asian countries, as well as with selected STDF partners and donors, and it will apply an innovative approach and develop new knowledge that can have wider relevance and benefits globally. The STDF funded between 2012 and 2017 three regional projects to support selected countries in ASEAN countries (STDF/PG/337), Africa (STDF/PG/359) and Latin America (STDF/PG/436) to meet pesticide-related export requirements based on international (Codex) standards. The External Evaluation of these three projects (July, 2019) further highlights the importance of MRLs in trade and the related capacities that needs to be developed with an innovative approach.

In the light of this, the project proposal has been developed to mitigate pesticide residues and facilitate trade of Asian countries, based on a collaborative and regional approach. It aims to mitigate pesticide MRL export violations through the use of microbial based biopesticides to control key pests especially at the end of the crop growing period (the period when pesticides mostly contribute to residues at the time of harvest). Hence, the purpose of the project is to apply an innovative approach with a scientific rationale towards SPS related technical capacity development and evaluation.

Biopesticides include microorganisms (such as fungi and bacteria), and biochemicals (such as plant extracts, minerals, pheromones, etc.). Biopesticides are different from synthetic pesticides in that they have natural origins and most do not produce residues and therefore, exempt from MRLs. IR-4 has developed a global harmonization list of biopesticide based active ingredients exempt from MRLs. This effort was a combined effort of Chile and the US and was recently approved to move forward at the 51st CCPR meeting in Macau. Utilization of biopesticides late in the growing season, as an alternative to conventional pesticides, is one way to mitigate residue violations in export markets while providing pest control during the pre-harvest interval (PHI). For some lower income economies, biopesticide production using local strains may also help to spur cottage industries for new microbial biopesticides and alternative measures.

This project will develop decline residue data and a better understanding of how time, IPM production practices and end of season mitigation impact residues. All available IPM tactics will be utilized to determine how to best avoid residue trade issues. The FAO has been involved in the development of IPM programs and has been successful in encouraging reduced pesticide use, but there are still problems with pesticide residues. While IPM successes have been encouraging; there is no clear organized effort on how to promote the inclusion of biopesticides into IPM programs in a way to directly reduce residues and increase trade. IPM practices during crop production are good; however, pesticide residues are primarily determined by the last application, therefore simply including a biopesticide in a rotation is not likely to result in lower residues of conventional products and will not help trade. A purely biopesticide program would result in lower residues but may not be sufficient alone to control the pest or be financially viable. This project is distinctive in that it will balance the advantages of conventional pesticides (generally lower cost and generally greater efficacy) with the advantages of a biopesticide at the end of the season (to result in lower residues while providing sufficient extension of pest control caused by extending the PHI of the conventional product). This project is also innovative in that it combines an IPM approach of avoiding pest resistance at the end of the season while simultaneously addressing the SPS issue of residue export violations.

This project builds upon the successes of the previous ASEAN STDF Project PG337 teams and methods for developing high quality residue data with improving GLP quality and helping some countries graduate from observer to participating status. This is in line with the STDF programme goal and the STDF vision of sustainable economic growth, poverty reduction, food security and environmental protection in developing countries. The project also aligned with the Sustainable Development Goals 1, 2, 3, 10, 12, 15, 17.

2. SPS context and specific issue/problem to be addressed

(i) Food and agricultural trade flows

Many less developed economies in Asia still face increasing challenges in conforming to CODEX and other trade partner pesticide maximum residue limits (MRLs), either because these MRLs are not established or because the MRLs are too low to reasonably comply with real-world use patterns by farmers. A previously funded STDF pesticide residue data generation project with technical direction by IR-4, USDA-FAS and ASEAN Secretariat, did help to strengthen national capacity to generate Codex MRLs.

(ii) Institutional framework for SPS management

According to "Regional Trade Standards Compliance Report - East Asia 2013" of the United Nations Industrial Development Organization (UNIDO), the potential of East Asian trade is significantly constrained by rejections due to food safety issues such as pesticide MRLs being exceeded for permitted pesticides, presence of prohibited pesticides, presence of quarantine plant pests and pathogens and food-borne pathogens.

This project will facilitate the integration of biopesticides as a good agricultural practice of tropical crops. The common practice of intercropping complicates conventional pesticide practices, in that residue labeled uses and MRLs for understory crops often differ significantly, from tree crops, resulting in off-target applications and unintended residues on understory crops. This is especially true for Vietnam, which has adopted a policy of only using Global Health Standard level 5 pesticides in fruit crops. Therefore, the use of biopesticides will have ancillary risk benefits by reducing chemical residues on off-target crops.

(iii) SPS priorities or issues identified

This project will develop and test a new approach to overcome trade barriers caused by either a lack of an MRL, or an MRL that is lower than that resulting from current use of conventional pesticides. This approach is based on the strategic use of non-residue producing biopesticides following conventional pesticides.

The Codex Alimentarius is the globally recognized body responsible for setting food safety standards to help in the facilitation of international trade in safe foods. The SPS Agreement of the World Trade Organization (WTO) encourages WTO Members to harmonize or base their national measures for food safety on the international standards, guidelines and recommendations developed by Codex. Participation of Asian nations in the Codex Committee on Pesticide Residues (CCPR) has significantly increased in recent years. Additionally, Association of South East Asian Nations (ASEAN) has developed harmonized guidelines on the regulatory review of bio-control agents, including biopesticides, while in least developed economies of South Asia (Nepal and Bangladesh) the

registration of biopesticides is presently in active discussion.

As an outstanding agenda item of the CCPR, specialty crops and tropical crops have been a major priority to most Asian countries because of the high value and vast market including niche markets of EU and other parts of Asia for these commodities. Among the specialty crops considered within Codex, tropical fruits and vegetables dominate the list of Asian exports and a broad survey of farming practices across the Asian region show that the Asian rural farming communities rely on tropical fruits as the primary source of income. If Asian producers are unable to meet export market requirements, market access is impeded, resulting in loss of income for subsistence farmers. Hence, building capacity in this regard is critical to achieving poverty alleviation in rural Asia. In terms of international standards, there are still no Codex MRLs for many tropical crops exported from Asia. This is largely because of lack of economic interest by pesticide registrants to generate the residue data needed to establish Codex MRLs. As a result, many governments/regions are establishing "minor use" programs to help fill these data gaps and take a more active role in identifying, registering, and setting trade standards to support their agricultural sectors.

The project is not expected to establish new Codex MRLs. Nevertheless, the project will include some work on residue decline studies of synthetic pesticides to develop a relationship between pesticide residues and time, which is essential to determine the timeframe for switching to a biopesticide based pest management program. These studies will help indirectly to build the capacity of the participating countries to develop residue data. Building the capacity of developing countries to generate residue data that are mitigated through the adoption of biopesticides will effectively enhance access to newer, low-toxicity biopesticides for farmers, an important priority for Asia.

Over the past several years, many Asian countries have participated in pesticide-related training programs led by the United Nation's Food and Agricultural Organization (FAO), the U.S. Department of Agriculture (USDA), the IR-4 Project, CropLife Asia, and other organizations. Many Asian countries are now demonstrating a better understanding of the process of pesticide MRL establishment and assessment of the risk from dietary intake of residues. The next logical step to support Asian countries is to work toward implementing concrete actions to address specific barriers to expanding trade.

Specific problem to be addressed

One of the key lessons learned from the STDF/PG/337 was that there are two ways to resolve these trade issues:

1) Develop new MRLs: This is not always possible in LDCs and Developing Countries because they lack the sophisticated equipment to conduct that type of research, and manufacturers have less economic incentive to register new products. As a result, these countries are usually stuck with older chemistries that do not have MRLs, and trading partners are unlikely to support new MRLs on older chemistries.

2) Residue mitigation. This alternative approach provides a way for LDCs and Developing Countries to help themselves. They are also countries that tend to have more residue problems and trade issues which disproportionately impacts trade and their economies.

Additional approaches are needed to have a variety of strategies to meet MRL issues. Therefore, this project will utilize biopesticides as a mitigation tool for residue trade issues facing countries in Asia. Stakeholders involved in the STDF PPG decided to select the residue mitigation option (see Appendix 7). In pursuing the residue mitigation approach, ASEAN and SAARC country representatives, growers, regulatory authorities, IR-4, USDA-FAS and international pesticide manufacturers and biopesticide manufacturers were consulted to help develop a list of potential pesticides and crops for the project.

This project will engage a number of Least Developed Countries (LDCs), Other Developing Countries and more advanced economies in ASEAN and South Asia in a collaborative and regional project to address these issues (see table 1). Developed countries with more capable SPS systems and expertise (e.g. Singapore, Malaysia and Thailand) will serve as regional mentors in a train the trainer model, promoting ASEAN-SAARC cooperation with LDCs and other Developing Countries in and across the two regions. This will enhance regional sustainability of the project and will enable LDCs and Developing Countries to benefit, even with their older analytical equipment. To be noted

that APAARI will sub-contract relevant authorities in Singapore1[1] (which have the necessary technical capacity on good laboratory practices and lab facilities) to support the project implementation, including delivery of regional trainings, on-site assistance with sample analysis in the beneficiary countries, and to serve as a regional reference laboratory for the beneficiary countries. Singapore not receive STDF funds to conduct its own research or to implement project activities for the benefit of Singapore. Any project funds provided by APAARI to authorities in Singapore will be used to cover the costs of services and expertise they provide as a regional partner to support APAARI to implement the project for beneficiary countries.

This project has been developed through an STDF PPG, approved by the STDF Working Group in 2018. In consultation with all the stakeholders involved in the PPG work, including researchers, extension and commodity groups, it has been decided which crops will be included. During the STDF-funded PPG meeting in Singapore and subsequent meetings, a hierarchal system was used to determine the project as follows:

1. What are the primary crop export concerns? What are the conventional products
2. causing trade irritants?
3. What is the current Pre-Harvest Interval (PHI)[2] to see if extension of the PHI is feasible? The retreatment interval will be considered to understand the likely length of control from the last application of a conventional product.
4. Target pests in last application: What is the reason the conventional pesticide was applied?
5. Are there biopesticides to manage the late season pests?

The pesticides to be included in work under this new project application were selected for the following reasons:

1. These chemicals are known to result in residues causing trade problems.
2. There are biopesticides that can control the late season pests.
3. These chemicals do not currently have Codex MRLs established for many specialty crops grown in the ASEAN and SAARC regions.
4. Since the aim is to meet existing MRLs, no review is needed by JMPR, CODEX, or other regulatory authority. The pesticide manufacturers pledged to work with the countries in seeking ways to mitigate residues and biopesticide companies are interested in engaging new registrations.
5. The FAO, OECD, GIZ, and IR-4 and other governments have promoted the use of biopesticides, and greater support from these organizations will exist for the project.

[1] Singapore is not part of the OECD/DAC list of eligible ODA recipient countries.

[2] The PHI is related to the use of the synthetic pesticide. The PHI of the synthetic pesticide will be extended until it reaches a level to allow for export and then pest control during this extended PHI will be supplemented through the use of biopesticides. The decline curves will determine the amount of time needed until the residues are below current MRLs. The amount of time needed to wait is an extended form of a PHI.

Table 1: Summary matrix of planned country participation in project

Country	Steering Committee Meeting and Inception Workshop	GLP Capacity Building	Residue mitigation studies	Biopesticide Manufacturing and Development	Biopesticide Regulatory Harmonization	Final Results and Disseminatio n Planning
Bangladesh	√	√	√	√	√	√
Cambodia	√	√	√	√	√	√
Indonesia	√	√	√	√	√	√
Lao PDR	√	√	√	√	√	√
Malaysia	√	**HF**	√	O	√	√
Nepal	√	√	√	√ **H**	√	√
Sri Lanka	√	√	√	√	√	√
Thailand	√**-H**	**HL**	√	O	√ **H**	√
Vietnam	√	o	√	O	√	√
Singapore	√	**HL**	O	O	√	√

H: Meeting Host
HF: Host and Trainer in the Field (Malaysia)
HL: Host and Trainer in the lab (Singapore and Thailand) 0: Not involved in this activity

The following table provides detailed information for each of the participating countries on the targeted crops, pests, chemical pesticides currently used and alternative biopesticides. The intended reduction in pesticide reduction will be added as well.

Country where studies would be conducted	**Crop**	**Target pests**	**Chemical Pesticides Currently used causing residue issue.**	**Biocontrol alternatives for pest control and end of season residue mitigation**
Malaysia, Sri Lanka Thailand Indonesia	Chili pepper	Thrips Aphids Whitefly	Imidacloprid, acephate, abamectin, fipronil, profenophos, methomyl, diazinon, chlorpyrifos, acetamiprid, prochloraz, amitraz.	*Beauveria bassiana*, capsaicin oleoresin with canola oil, mineral oil, sticky traps with lures
				Beauveria bassiana sticky traps, mineral oil, potassium salts of fatty acids, *Burkholderia spp*., *Isaria fumosorosea*
				Beauveria bassiana, capsaicin oleoresin with canola oil, sticky traps, *Encarsia formosa*
Bangladesh-and Nepal	Greens	Aphids Whitefly Grasshopper Diamondback moth	acetamiprid, imidacloprid and malathion	*Beauveria bassiana sticky traps, mineral oil, potassium salts of fatty acids, Burkholderia spp., Isaria fumosorosea* *Beauveria bassiana, capsaicin oleoresin with canola oil, sticky traps, Encarsia formosa*

				Beauveria bassiana, Metarhizium anisopliae *Bacillus thuringiensis kurstaki*
Laos and Cambodia	Basil	Aphids Whitefly	chlorpyrifos and cypermethrin	*Beauveria bassiana sticky traps, mineral oil, potassium salts of fatty acids, Burkholderia spp., Isaria fumosorosea* *Beauveria bassiana, capsaicin oleoresin with canola oil, sticky traps, Encarsia formosa*
Vietnam	Dragon fruit	Bipolaris Anthracnose	metalaxyl, hexaconazole and propiconazole	*Bacillus subtilis, Bacillus amyloliquefaciens* *Bacillus subtilis, Potassium bicarbonate*
Cambodia	Rice	*Panicle blast*	tricyclazole	*Potassium silicate and Bacillus amyloliquefaciens*

The following table is a list of the top concerns of the exporting countries and a list of current MRLs related to trade issues with specific crops. Shaded rows are pesticides causing residue trade issues. Where present, rows without shading are other pesticides with MRLS, not known to cause trade issues in that crop. The columns indicate major importing markets for the crops. One overriding observation is that China does not have any MRLs for a majority of the crop/pesticide combinations.

Table 2: Key concerns of exporting countries related to current MRLs

Current MRLs CHILI PEPPER (NON-BELL)								
– Exports from Thailand, Malaysia, Indonesia and Sri Lanka								
Residue issue	CODEX	US	EU	China	HK	Taiwan	Japan	Korea
Chlorpyrifos	0.005	0.07	0.01	-	0.02	0.02	0.2	0.2
Imidacloprid	1.0	1.0	1.0	-	1.0	0.5	5	1
Acephate	-	4.0	0.01	1.0	1.0	1.0	0.7	3.0
Abamectin	0.005	0.07	0.07	-	0.02	0.02	0.2	0.2
Acetamiprid	0.2	0.2	0.3	-	0.2	1.0	2.0	2.0
Current MRLs GREENS								
– Exports from Bangladesh and Nepal								
Residue issue	CODEX	US	EU	China	HK	Taiwan	Japan	Korea
Acetamiprid	*	15	1.5	-	1.2	2.0	5.0	3.0
Imidacloprid	-	3.5	0.5	-	3.5	1.0	5.0	5.0
Current MRLs BASIL								
– Exports from Lao PDR and Cambodia								
Residue issue	CODEX	US	EU	China	HK	Taiwan	Japan	Korea
Chlorpyrifos	-	-	-	-	-	-	-	-
Cypermethrin	-	-	-	-	-	-	-	-
Bifenazate	-	300	40	-	-	-	40	0.01
Etofenprox	-	5.0	3.0	-	-	-	0.7	0.01
Imidacloprid	20	48.0	2.0	-	8	1.0	15	2.0
Methoxyfenozide	-	400	4.0	-	-	-	30	0.01
Spinetoram	-	22	4.0	-	-	-	8.0	0.01
Spinosad	-	22	15	-	3.0	10.0	10.0	0.01
Current MRLs DRAGON FRUIT								
– Exports from Vietnam								

Residue issue	CODEX	US	EU	China	HK	Taiwan	Japan	Korea
Metalaxyl	-	-	-	-	-	-	-	-
Propiconazole	-	-	-	-	-	-	-	-
Hexaconazole-	-	-	-	-	-	-	-	-

Azoxystrobin	0.3	2	0.01	-	-	1.0	5	0.01
Cyprodinil	-	2	0.02	-	-	1.0	2	0.01
Difenconazole	0.15	1.5	0.1	-	-	0.5	2	0.01
Fludioxanil	-	1.0	0.01	-	-	1.0	15	0.01
Current MRLs RICE								
Exports from Cambodia								
Residue issue	CODEX	US	EU	China	HK	Taiwan	Japan	Korea
Tricyclazole	-	-	-	-	-	-	-	-
Azoxystrobin	5.0	5.0	5.0	0.5	5.0	5.0	0.2	1
Propiconazole	-	7.0	1.5	0.1	-	1.0	0.1	0.7
Trifloxystrobin	5.0	3.5	5.0	0.1	5.0	0.2	2.0	0.01

Most biopesticides by their nature are not subject to MRLs, and the residues of microorganisms used for pest management are therefore not subject to regulatory enforcement by importing countries. It is anticipated that the primary type of biopesticide to be utilized in residue mitigation would be microbial products. Using biopesticides as a last application of the growing cycle can help reduce residues of many conventional pesticides. Substituting the last application with biopesticide would be cheaper and faster than generating residue data and submitting new MRL packages to Codex. National residue programs should have the ability to establish MRLs when needed, but also the ability to develop alternative options when complying with export market MRLs is too problematic.

The project has been developed in a way that any possible unforeseen plant health concerns will be fully considered and addressed, through attention to the relevant standards of the International Plant Protection Convention (IPPC), which also address the export, shipment, import and release of bio-control agents. Notably, the project preparation work took into account the guidance provided in ISPM 3 (Guidelines for the Export, Shipment, Import and Release of Biological Control Agents and Other Beneficial Organisms) and ISPM 11 (Pest risk analysis for quarantine pests).

In regard to product safety, some of the more common ingredients expected to fit within the mitigation strategy are *Beauveria bassiana, Bacillus thuringiensis* and *Metarhizium*. These organisms have been used for decades without any adverse environmental effect on crop plants or other organisms since they are strictly insect pathogens. They are already registered in the participating countries so do not represent any new exposure. Any other organisms that would potentially be included would be reviewed under the ISPM Code of Conduct for the Import and Release of Exotic Biological Control Agents. At a minimum, the product should already be registered and been reviewed by another internationally recognized competent regulatory authority with a robust data package. In addition, the import must follow any regulations and or quarantine procedures within the specific country the organism is being imported into.

In brief, the ultimate expected benefits of the proposed project will be:

- Facilitation of access to, and use of, biopesticides to mitigate residues of conventional pesticides, which is a unique way to permit compliance with MRLs.
- Overcoming hindrances to export (and regulated domestic) markets access due to the absence of corresponding pesticide trade standards for specialty crops (fruits and vegetables) and other tropical crops of importance to Asia.
- Reduced exposure of farmers and consumers to higher-risk synthetic pesticides in cases where proper handling practices are not followed.
- A sense of accomplishment and empowerment by increasing the capacity of developing countries to manufacture their own microbial biopesticides and simultaneously reduce the

cost to growers, expanding adoption and helping to spur cottage industries.

- Increased technical expertise concerning residue analysis and monitoring in laboratories as well as a better understanding of residue decline over time.

- A sustainable process for regional data generation required for the registration of biopesticides for Asia's priority crops, such as leafy brassicas, chili peppers, and dragon fruit.

- Regional cooperation and regulatory harmonization on MRLs within and across member states of ASEAN and SAARC.

3. Links with national/regional development plans, policies and strategies

The South and South East Asian countries Asian countries continue to face numerous challenges in meeting the growing demand of food for its increasing population due to inherent challenges of the region. It is estimated that the region could lose 10-50% of crop production by the end of the century due to global warming. These countries are at various stages of compliances to SPS Agreement of WTO. The Phytosanitary Capacity Evaluation tool of the International Plant Protection Convention (IPPC) has contributed significantly to identifying the areas of capacity development in the region. The FAO Regional Office for Asia-Pacific (FAO RAP) and Asia Pacific Plant Protection Commission (APPPC) are supporting these countries through its programs on Good Agricultural Practices and integrated pest management (IPM), which all contribute towards SPS compliances.

The South Asia Sub-regional Economic Cooperation (SASEC) member countries have signed and implemented 52 ADB-financed investment projects worth more than $11 billion in the transport, trade facilitation, energy, and economic corridor sectors. Of these three projects worth $698 million are for economic corridor development and two projects worth over $68.6 million are for trade and one for ICT (worth $17.1 million. SASEC seeks to strengthen multimodal cross-border transport networks that boost intraregional trade and open up trade opportunities with East and Southeast Asia. In 2016, the SASEC countries approved the SASEC Operational Plan 2016-2025, a 10-year strategic roadmap, which introduced Economic Corridor Development as an area of focus, to promote synergies and linkages between economic corridors across SASEC countries.

The South Asian Association for Regional Cooperation (SAARC) is the regional intergovernmental organization, which promotes development of economic and regional integration. It launched the South Asian Free Trade Area in 2006. SAARC maintains permanent diplomatic relations at the United Nations as an observer and has developed links with multilateral entities, including the European Union. The Asian Development Bank (ADB) has estimated that inter-regional trade in SAARC region possessed the potential of shooting up agricultural exports by $14 billion per year from existing level of $8 billion to $22 billion. The uncaptured potential for intra-regional trade is therefore $14 billion per year, i.e. 68%.

The SAARC Agricultural Center (SAC) was established to promote Agricultural Research and Development as well as technology dissemination initiatives for sustainable agricultural development and poverty reduction in the Region. SAC now has an enhanced mandate for agricultural research and development, policy planning, and knowledge management to deal with all sub-sectors /allied disciplines of agriculture e.g. crops, fisheries, livestock and horticulture. The outputs of SAC activities feed into the objectives of SASEC for promotion of good agricultural practices leading to indirect compliances to SPS Agreement of WTO.

ASEAN has built an economic community, which will be a single market and production base, a competitive economic region with more equitable economic development and one that is connected with the global economy. The contribution of food, agriculture and forestry component, which appear as Measure A.7 of the ASEAN Economic Community (AEC) Blueprint, encompass a wide range of strategic objectives, among other: enhancement of intra- and extra ASEAN trade and long-term competitiveness of ASEAN's food, agriculture and forestry products/commodities. Minimization of pesticide use through the harmonization of MRLs in accordance with international standards/guidelines to improve marketability of agriculture products is one of the targets to realize this objective.

ASEAN has implemented numerous cooperation projects in food, agriculture and forestry sectors, which cover a wide spectrum of activities ranging from exchange of information, crop production,

postharvest handling, training and extension, research and development as well as trade promotion in the areas of crops, livestock, fisheries, and forestry. In order to respond to trade globalization and to support the realization of ASEAN Economic Community by 2015, ASEAN Cooperation in Food, Agriculture and Forestry is now more focused on the enhancement of food, agricultural and forestry products competitiveness in international markets, while sustaining agricultural production. Harmonization of quality standards, assurance of food safety, and standardization of trade certification are amongst the priorities being addressed, building upon the experience of some Member States and existing international standards.

The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, Bangkok) also works to address some of the greatest challenges facing the region through result oriented projects, technical assistance and capacity building to Member States in many areas including Trade and Investment. It looks at non-tariff barriers (TBT and SPS) as playing a significant role in blocking trade. Additionally, the Commission provides a forum to promote regional cooperation and collective action in pursuit of the 2030 Agenda for Sustainable Development.

This proposed project with the STDF for building SPS capacity and aimed at poverty reduction and economic growth fully compliments the strategies of FAO, UNESCAP and other global agencies in the region. The ASEAN and SAARC members will contribute towards higher goals of sustainable development by working toward pesticide management and regulatory harmonization and enhancing their competitiveness in international markets.

4. Past, ongoing or planned programmes and projects

This project builds and expands on some of the successes of STDF's regional MRL project in ASEAN (STDF/PG/337), which developed new MRLs on modern chemistries. The national study teams established under PG/337 will be utilized wherever possible to benefit from and build on existing knowledge and skills. One of the main learnings under STDF/PG/337 was that real progress will be made if projects build confidence, empower national authorities and facilitate capacity development, that takes into account and responds to their challenges and limitations. This project has been designed with this lesson clearly in mind. In particular, it will enable countries without advanced analytical capabilities to work with other countries in the region to address the challenges they face related to pesticide MRLs. For instance, almost all newer crop protection products require an LC-MS/MS for analysis (which costs approximately $500,000 US dollars, a huge investment) and even developing countries that have an LC/MS-MS have to pay a large service contract. The small market of LDC means they do not have the best equipment service technicians. This project offers a different strategy to overcome the lack of MRLs, that will engage and benefit countries without advanced equipment.

All the conventional products to be utilized in the project are already registered and the countries have the equipment needed to analyse for them. Therefore, they will be able to build their research capacity and learn about Good Laboratory Practices directly. Although more developed countries like Malaysia and Thailand have more modern analytical capabilities, they still face other challenges (such as companies not willing to invest in registering products on specialty crops) and are committed to participate in this project and to act as mentors to authorities in other parts of the region.

The project partners will seek to work closely with FAO, including FAO's Asia Regional IPM program for sustainable intensification of agricultural production, in implementation of this project. IR-4 has consulted FAO on the best IPM practices, including under the FAO project entitled "Support for Capacity Building for International Food Safety Standard Development and Implementation in ASEAN Countries" (which was partly developed based on STDF PG/337) and will seek to build upon the results of the FAO project.

This project also has synergies to work supported by Germany in Southeast Asia, including projects funded by the Federal Ministry for Economic Cooperation and Development (BMZ) and engaging the German Development Agency (GIZ), which introduced and evaluated newer biopesticides and pheromones, which are being promoted among the growers, private sector and extension agencies in the region. GIZ has previously hosted regulatory Harmonization workshops on "ASEAN Guidelines on the Regulation, Use, and Trade of Biological Control Agents (BCA)". This project will build on the results and experiences of this work, expanding this approach from ASEAN onto the South Asian countries, and creating new opportunities and mechanisms for cross-regional cooperation and learning.

GIZ has supported good progress on biopesticides in ASEAN countries in that most have incorporated some or all of the recommendations into their national legislation. For example, Vietnam and Indonesia have adopted a great part into their new pesticide regulation. Indonesia has been quite pro-active in promoting use of biocontrol/biopesticides. In the last years there was an annual bidding process for Indonesian governmental purchase of biologicals and have facilitated pheromone due to regulatory support (waivers, classification as non-hazardous), Laos and Cambodia have adopted most of the guidance, yet, they don't know or have the financial capabilities to implement regulation and compliance monitoring Therefore the GIZ model in ASEAN will be adopted to extend to SAARC countries.

There is still additional help needed. At regulatory departments there is lack of knowledge of the technical issues (e.g. mode of action, concept of a living a.i. unfamiliar) linked to biologicals, which are fundamentally different to synthetics. Approaches to risk assessment follow the old 'tox' testing approach, which is also useless for many non-killing actives/products (repellents, lures, growth-promoting microorganisms etc.). There is also a lack of knowledge of fundamentals of good agricultural practice (e.g. sanitation), ignorance of (original) IPM principles and practice (e.g. thresholds). In order to promote harmonization, better knowledge is required at all levels (regulator, farmer, company). Price is not an issue (application is in most cases cheaper in terms of usage/area/year; people often look at price tag only). Adoption clearly depends on knowledge.

This project will also strengthen the cooperation and benefit from IR-4's domestic US program. For example, IR-4 has already conducted residue studies with cypermethrin on basil and determined residues at 1 day after application were from 0.8 to 3.6 ppm in fresh basil and 3.5 to 18.3 ppm in dried basil. IR-4 will be able to combine its data with the data generated in this project in Laos to get a new CODEX MRL.

APAARI has recently been involved in implementing the FAO/EU project on Capacity Development for Agricultural Innovation System (CDAIS, https://cdais.net/home/) which engaged key stakeholders in pilot countries to assess capacity development needs with the aim of promoting innovation that meets the needs of small farmers, small and medium-sized agribusiness and consumers. The functional skills developed in the CDAIS pilot countries, and the experience and expertise developed will support and strengthen this project.

5. Public-public or public-private cooperation

This project will implement a collaborative process to coordinate field research, promote work sharing, and work towards the harmonization of pesticide MRL standards. The project will involve collaboration between government regulatory officials, and laboratory and field technicians of some of the ASEAN and SAARC countries, as well as with the private sector. Private sector partners include multinational pesticide and biopesticide manufacturers, local agricultural commodity export organizations, industry associations, and farmers of specialty crops.

The success of the project relies on the close coordination and partnerships between all of these stakeholders. These stakeholders have committed to work together closely and agreed to contribute resources to support project implementation. The budget includes $370,017 in-kind matching funds with $127,000 in kind matching funds from companies, industry organizations and USDA-FAS.

In the formation of this proposal there were consultations with the registration authorities within the region to help finalize the assignments of crops/pesticides/countries for the project, taking into consideration the national needs, specific pests to be controlled, registration issues, and market considerations.

Once the project is underway, the private sector partners will, in parallel with the technical aspects of the project, work toward fulfilling registration requirements of the countries where the trials will be conducted. This is expected to include in-kind contributions for conducting additional efficacy trials and determining the most appropriate good agricultural practices (GAPs), considering potential use patterns across multiple global regions.

The private sector partners (Marrone Bio Innovations, Corteva, Certis, Bayer, FMC, Syngenta, Valent, etc.) have also offered in-kind support to provide test substances for field residue and efficacy trials, analytical standards for laboratory analysis. In some cases, the pesticide manufacturers have offered to provide training, in-kind, to the analytical laboratories to help validate methods and ensure testing

proficiency by staff. Finally, the private sector partners will help to develop a long-term priority list and implementation strategy, based on the experience and lessons learned from this project.

Industry umbrella organizations, including CropLife Asia, International Biocontrol Manufacturers Association (IBMA), Pesticide Manufacturers and Formulators Association of India (PMFAI) - have also committed to collaborate in this project. For instance, they have offered to help organize meetings, participate in harmonization workshops and to assist in dissemination of results into a program approach, resulting in the integration of conventional products and biopesticides. Many of the individual manufacturers have made similar commitments.

Other private sector partnerships will be developed, including with export organizations and local farming operations. The exporting organizations would provide input on crop/pesticide priorities, and the local farming organizations will be asked to donate field trial sites for the project. The project has letters of support from one importing and one exporting company. Additional exporter and importer cooperation will be sought at the project inception stage. A baseline survey will be conducted at the inception workshop.

As mentioned earlier, this project also promotes cooperation between governments within the Asia region, as well as cooperation across regions, to establish common work protocols and coordinate work sharing and responsibilities, where applicable.

6. Ownership and stakeholder commitment

This project has local ownership and commitment from the government and private sector partners to be involved. The project will engage Bangladesh, Cambodia, Lao PDR and Nepal (Least Developed Countries); Indonesia, Sri Lanka and Vietnam (Lower Middle Income Countries), as well as Malaysia and Thailand (Upper Middle Income Countries).3 In addition, Singapore will cooperate as a laboratory resource. This mixture of Asian countries will facilitate development of a framework for conducting coordinated studies to mitigate conventional pesticide residues through the incorporation of biopesticides into national IPM programs.

This project is based on needs identified by the beneficiary countries (see above). Through the STDF PPG, government authorities were actively consulted and engaged on the specific residue problems they face, and a research plan was developed on how to understand the risks of application of conventional pesticides and develop plans for overcoming them. This was accomplished during a meeting in Singapore. Prior to the Singapore meeting research, extension and growers submitted a total of 218 pesticide residue issues causing trade irritants. Potential projects were ranked as to importance, potential for regional cooperation, and current capabilities of facilities.

The following government agencies participated in the PPG workshop and/or the subsequent ASEAN Expert Working Group Meeting and helped develop a framework for establishing a collaborative biopesticide project with commitments from participating agencies. Letters of support are included in Appendix 4.

- **Bangladesh** – Department of Agricultural Extension
- **Cambodia** – Ministry of Agriculture and Fisheries (MAFF)
- **Indonesia** – Horticulture Directorate
- **Lao PDR** – National University of Laos and Department of Agriculture
- **Malaysia** – Malaysian Agricultural Research and Development Institute
- **Nepal** – Ministry of Agriculture and Livestock Development
- **Sri Lanka** – Department of Agriculture
- **Thailand** – Science Research and Development Division Department of Agriculture
- **Vietnam** – Ministry of Agriculture and Rural Development
- **Singapore** – Singapore Food Agency

Several other partners support this project application. FAO was consulted and engaged as part of the project development process, and the project partners expect to cooperate with FAO, and develop linkages to relevant FAO work, in project implementation.

Other organizations providing letters of support represent the grower, industry and export/import organizations, pesticide and biopesticide manufacturers, as well as allied industry organizations. Even

[3] OECD DAC list.

companies representing conventional products are supportive as they recognize their stewardship responsibilities and are aware that growers need income to buy their products.

These include:

Import/Export
- ☐ Dragonberry Produce Inc. (US Importer)
- ☐ Lanka Fruit and Vegetable Producers, Processors and Exporters Association

Conventional and Biopesticide Manufacturers
- ☐ Corteva Agriscience
- ☐ Green Innovative Biotechnology Co. Ltd. - Thailand
- ☐ Certis USA
- ☐ Marrone Bio Innovations
- ☐ Valent USA
- ☐ Bayer U.S. Biologicals R&D
- ☐ Bayer Crop Science (Conventional Products)
- ☐ FMC
- ☐ Syngenta
- ☐ BioSafe Systems
- ☐ BASF

Cooperating International Agencies
European Minor Uses Coordination Facility/Chair of the Expert Group of the Organization for Economic Co-operation and Development (OECD) on Biopesticides
- ☐ Minesterio de Agricultura, Chile
- ☐ GIZ/International Rice Research Institute (IRRI)

Industry Trade Organizations
- ☐ CropLife Asia
- CropLife International
- International Biocontrol Manufacturers Association
- ☐ Dunham Trimmer –International Bio Intelligence
- ☐ Pesticide Manufacturers and Formulators Association of India

This project also has the support of the Pesticide Manufacturers and Formulators' Association of India. India is a significant source of biopesticide products in the region. During the STDF PPG work, some consideration was given to the inclusion of India in this project. However, as a much more developed country, it was concluded that India has fewer capacity building needs in this area, and inclusion of India would increase the complexity. Nevertheless, India is recognized as a significant source of biopesticide manufacturing and has existing regulatory infrastructure, which will be referenced during the project.

Commitments to provide technical support for this project have come from the U.S. Inter-regional Research Project (IR-4)1, the United States Department of Agriculture (USDA) and APAARI. Contacts for these organizations are listed below. In addition, a letter of support is included from industry groups (CropLife Asia and International Biocontrol Manufacturers Association)

II. PROJECT GOAL, OBJECTIVE, OUTPUTS & ACTIVITIES (LOGICAL FRAMEWORK)

Project Goal / Impact

The overall goal of the project is to improve compliance with pesticide MRLs of Codex and trading partners and facilitate trade.

Developing countries frequently encounter market access obstacles related to compliance with international trade standards, and there is very little support or specific strategies provided to address this problem. This project will develop a process for identifying and prioritizing residue trade barriers, then establishing a methodology for mitigating those barriers, coordinated regionally and globally. This process will aim to increase understanding and compliance with Codex MRLs, ensuring growers access to important export markets. Furthermore, through this process, this will increase the availability, and decrease the costs and barriers, to biopesticide availability. This will also

contribute to broader development goals of improved human and environmental health (reducing risk to consumers, pesticide applicators, and the environment). In summary, this project will therefore contribute to the higher development goals of poverty reduction and economic growth, with technical capacity building delivery as a means to achieve these higher-level development goals.

Target Beneficiaries

The primary beneficiaries of the project will be national pesticide regulatory authorities, farmers, industry associations, agri-food export companies, and domestic consumers. Specific benefits include increased availability of IPM tools for farmers to better protect crops and mitigate pest resistance; increased worker, environmental, and consumer safety by reducing residues and increased economic output by accessing lucrative international markets.

A risk and cost-benefits analysis will be determined to quantify the benefits of this project on trade. For the MRL data that is generated, the relationship between time and the decline in residues will be calculated. From the mean MRL data, the risk (probability) of exceeding the MRL will also be calculated. As the chance of exceeding the MRL decreases, a greater percent of the crop will be available for export.

Therefore, it will be possible to calculate how this project is impacting the percent of the crop available for export. The differences in input costs with and without the biopesticide will be compared with the difference in domestic versus export crop values to determine how the residue mitigation impacts economic returns. The risk of increase crop damage from pests will also be considered based on the ability of the biopesticide to maintain effective pest management.

Gender-related issues

Women play a key role in the global value chains for many agri-food products and face particular challenges in the context of compliance with international trade standards for pesticides. The specific constraints faced by women in pesticide use and IPM will be assessed at the beginning of the project through a baseline study. Priority will be given to development of their capacities to use biopesticides and increase their compliance with Codex MRLs. In addition to technical capacities related to the project objectives, women's functional capacities (soft skills) will be developed (this will be integrated into technical events) to enable them to harness and manage their newly acquired knowledge, build and maintain partnerships, and navigate the political dimensions of their local and partner organizations. This is envisioned to greatly empower women farmers and producers in the ways they lead their local farms and agribusinesses, and engage with stakeholders, including other producers, regulatory authorities, associations, traders and consumers.

The capacity development of women (those trained directly through the project, and those trained by the trainers of the project) will be supported through the dissemination of information, use of information and communication technologies (ICTs) facilitating access to resources relating to compliance, as well as documentation of good practices in mainstreaming gender in capacity development for compliance with Codex MRLs. Finally, the project activities involving women will be delivered in a manner that facilitate the participation of women and minimizes their burden, as they traditionally need to attend to households and childcare activities. Several of the activities of field training, workshops and capacity building will bring in the value chain sector, such as farmers, workers in food business operations, exporters or importers, which will help to identify if there are any gender specific issues that will be considered at the inception, as well as review and dissemination of the information.

Project objective, outputs and activities (including logical framework and work plan)

Consistent with the logical framework of this project (Appendix 1), the objective of this project is to increase regional collaboration and capacity to generate and evaluate pesticide residue data (that combines conventional pesticides with biopesticides) to resolve trade concerns due to MRLs.

The problem to be addressed by the project is the hindered access to export markets due to a lack of strategies to comply with existing MRL trade standards. A purely biopesticide program would result in lower residues but may not be sufficient alone to control the pest or be financially viable. This project aims to balance the advantages of conventional pesticides (generally lower cost and generally greater efficacy) with the advantages of a biopesticide at the end of the season (to result in lower

residues while providing sufficient extension of pest control caused by extending the PHI (Pre-Harvest Interval – time between last application and harvest) of the conventional product).

Under this project, a process will be implemented, under the guidance of FAO, to determine the best approaches for incorporating biopesticides to agricultural production that reduce residues to a level meeting Codex and importing countries MRLs.
To achieve its objectives, the project will deliver technical and functional capacity development, including a series of trainings, workshops, and consultations, each building upon the other, which will culminate in the conduct of actual field trials, data generation, sample analysis and registration of new products.

Technical Capacity Building: Some ASEAN Member States such as Malaysia, Thailand and Singapore already have laboratories that operate near the level of Good Laboratory Practices (GLP) or "GLP-like" and have been through the training and data development through PG-337. As noted in table 1, some of the capacity building has been proposed to be conducted in a train-the-trainer model. Other ASEAN Member States and South Asian states that are less advanced in their technical capacity (Cambodia, Bangladesh, Lao PDR, Nepal and Sri Lanka) will be able to have additional assistance from these regional trainers. Technical guidance (via a Study Director consultant) will be provided to other countries through group training and initiated through direct oversight. Singapore will support the project by providing technical expertise in regional trainings or serve as a regional reference laboratory. The aim will be to assist countries in conducting actual trials under a supervised field trial operation. Therefore, even though the focus of this project is on residue mitigation, it will also prepare the new countries to conduct magnitude of residue trials for setting new CODEX MRLS in the future.

Functional Capacity Building: The project recognizes that developing the overall capacity of the project stakeholders should focus not only on the competencies needed to achieve technical results but also on what it takes to build more effective and dynamic relationships among multiple actors. As such, both technical and functional capacities (soft skills) are essential for individuals and organizations to achieve the objectives of this project. Functional capacities are the skills, knowledge, attitudes and behaviour needed to apply, organize and coordinate technical capacities so that individuals and organizations can work effectively. They may include, for example: strategic planning, ability to formulate and implement relevant policies and norms, capacity to harness and manage knowledge, ability to build and maintain partnerships, strong leadership or the ability to navigate the political dimensions of organizations.

The project will integrate functional capacity development into the technical programme, including the inception, harmonization and final workshop, based on the outcomes of the capacity needs to be identified in the baseline study and throughout the project. The integration will take place by using various Knowledge Management and capacity development tools and processes developed under the EU-funded "Common Framework on Capacity Development for Agricultural Innovation Systems" project (CDAIS), implemented by a global partnership led by Agrinatura and FAO and involving APAARI.

By using the CDAIS framework, the project will create an environment in which the project participants analyse internal and external context, bring various perspectives to bear through interaction, reflection and learning; access, create as well as take advantage of opportunities, in order to co-create and use knowledge, learn and chart the future. Through the process, innovation capacities will be built through improved analytical skills to navigate complexity, and willingness to collaborate, learn and reflect in the area of harmonization of regulations, use of biopesticides, and residue mitigation. Furthermore, the project participants will be able to improve the ability of vulnerable groups, such as small agricultural producers to engage in political processes with regard to safety of production and consumption of agri food produce.
Functional capacity development will be incorporated in the inception workshop, biopesticide regulatory workshop and final results workshop. This is particularly important since a shift in mind-sets, attitudes and behaviour of producers and all value chain actors will be required to understand the change process and the system for the use of biopesticides that the project will aim to create, and relationships among the parts of this system. Secondly, since many different actors are planned to be involved in the project, enhancing their capacity to collaborate will help them understand each other's perspectives and manage conflicts and diversity that on the other hand will boost partnerships between them.

The project will promote and encourage coordination between the participating countries – and across

public and private sector stakeholders – will be achieved through collaboration at the domestic, regional and international levels.

1) Domestic: farmers, exporters, researchers, pesticide control authorities
2) Regional: ASEAN Member States via the EWG MRLs
3) International: FAO, GIZ, OECD, SAARC Countries, regional organizations, national governments, pesticide and biopesticide manufacturers

Upon completion of the project, it is anticipated that a work-sharing framework will be established that will facilitate the identification of regional pesticide residue concerns for key export crops and technical expertise will be in place to help lead data generation efforts. Ultimately, this will lead to new IPM tools for local farmers, increased export opportunities as a result of MRL compliance, increased safety for field workers, and an increased safety of the food supply.

For issues involving regional harmonization of data requirements for registrations and creating incentives for minor-use support, this project will provide a platform to learn about models existing in other parts of the world, to explore future national/regional partnership opportunities and to identify the actions needed to develop such programs.

The project will center capacity development around the following three outputs, with their own sets of activities:

Output 1: New MRL data and improved knowledge to interpret this data on the use of biopesticides (combined with conventional pesticides) to mitigate pesticide residues

This output represents the major component of the project. It will focus on conducting supervised field trials and laboratory analysis of pesticide magnitude of the residue studies, using a train the trainer model. This will be in preparation for conducting residue decline studies utilizing biopesticides to mitigate residues to meet MRL trade requirements.

Several activities will be carried out under this output, as summarized in the logframe and described in more detail below.

Training and Capacity Development

This project will support Cambodia, Lao PDR, Bangladesh, Nepal and Sri Lanka to strengthen their GLP capacity and participate in residue mitigation studies, which will require intense capacity development and trainings in both field and lab. Authorities and scientists from Malaysia, Thailand and Singapore will provide support and mentoring during this process, promoting South-South and regional cooperation. .

Initial lab training will be conducted by IR-4. The facilities in Singapore will initially host a group laboratory training for Cambodia, Laos, Bangladesh, Nepal and Sri Lanka. The group training will compare analysis on older analytical equipment such as GC-ECD and NPD, and GC-MS, which they have in the less developed countries and also compare with LC/ MS-MS which they do not have, so they are also prepared for the future. Simultaneously, Thailand and Singapore will be involved in a Train the Trainer model and will take the lead on mentoring less advanced countries. After the training by IR-4, Thailand and Singapore will provide oversight and support to their neighbouring countries to support them in work under the project. This will also help strengthen the Thai and Singapore labs as regional leader laboratories for future training, enhancing a more sustainable effort.

Similarly, group field training will be held in Malaysia and agriculturists from Malaysia will then become trained trainers. Malaysia will then provide field trial oversight in the less developed countries (Bangladesh, Cambodia, Indonesia, Laos, Nepal and Sri Lanka).

Residue mitigation through the use of biopesticides

It is anticipated that up to 15 residue trade irritant situations can be resolved through studies for the commodities selected for the project. This number could significantly increase since representative commodities, such as chili pepper have the same problems as bell pepper and since the smaller size chili pepper is a worst-case scenario, the strategies can be adopted for bell pepper and other fruiting vegetables as well. These somewhat follow crop grouping strategies, but unlike new MRLs, compliance with MRLs does not require JMPR review and CODEX approval. This project will therefore provide and test a process, which could be replicated for other crops/products and/or in other regions in the future.

This project will focus on chili pepper, greens, basil, dragon fruit, and rice. Residue mitigation studies will be conducted based on two different scenarios:

1. Situations where there is an MRL, but the MRL is exceeded, causing trade problems. In these cases, the residue will be mitigated by extending the PHI and supplemented by biopesticides.
2. Situations where there is no MRL for the pesticide causing trade problems. In these cases, a different conventional pesticide that does have an MRL will be needed as an intermediary and it will be determined if the intermediary product also needs to be mitigated.

In all cases, proper IPM practices will be used, in line with FAO's guidance and recommendations. These include sanitation, utilizing pest free transplants, pest scouting, preservation of beneficial insects, utilizing pesticides only when the pest is present, following economic thresholds when known and crop specific practices to avoid or manage pests. For more specific information on the proposed residue mitigation strategy, see Appendix 8: Additional details on Residue Mitigation Strategies for Each Crop Residue Trade Issue.

Field and laboratory preparations: The first year will be spent getting critical field and laboratory preparations in order – SOPs, establishment of QA system, documentation, data management, facilities, etc. A joint meeting will be conducted at the beginning of the project with the Technical Director consultant, laboratory staff, field staff, and national Principal Investigators to review the analytical requirements and provide guidance on setting the foundation for their operations. The Technical Director and Project Manager will follow up with each of the countries and provide assistance throughout the year to monitor progress, and ensure that the countries are adequately prepared to initiate the studies. Field residue trials will not be initiated until the Technical Director is confident that the countries are prepared.

Field residue mitigation studies: Once all preparations are in order, the Technical Director will initiate the first series of trials with all national Principal Investigators present, increasingly handing over responsibilities. The Study Director consultant (Technical Director) will provide assistance in-country. Those countries that are less advanced in their technical capacity will be have access to additional guidance through Malaysia (playing the role of a trainer in a 'Train the trainer type model) on an as-needed basis.

Sample analysis: Upon completion of the fieldwork, samples will be prepared and analysed under supervision of the Technical Director. Again, the mentor will be present during the first series of analyses, and will increasingly transfer responsibilities and oversight to national Principal Investigators. Those countries that are less advanced in their technical capacity will have Thailand or Singapore as additional resources (Trainers as mentioned above) of analytical assistance on an as needed.

Efficacy studies with biopesticides: After the initial series of residue decline data are developed, the incorporation of biopesticides into the system will be included to determine the ability of different products to maintain pest control while allowing for residue decline.

Report writing: Once a study is complete, the Technical Director and consultant will assist in the preparation of a final report. National Principal Investigators will increasingly assume responsibilities of the report preparations and complete them in their own countries.

Output 2: Increased knowledge and skills on improved practices to manufacture microbial pesticides

The second output of the project will be increased knowledge and skills on improved practices to manufacture microbial pesticides. During the PPG work, there were comments from several of the participating countries about the availability of biopesticides, their cost and whether growers would be interested in using them. This output was developed to address these issues, and result in a more holistic approach.

During the PPG work, it was also discovered that Nepal has a fledgling biopesticide production facility involving production of Trichoderma viride. However, this facility has no monitoring of the concentration of what is manufactured and there are many aspects of their system where efficiency could be improved. Even with these inefficiencies, grower demand is exceeding production capacity.

There are also opportunities to extend production into microbial insecticides, as well as increase capacity. More specifically, culturing and testing of microorganisms.

The main activity under this output is the delivery of a Training workshop (in Nepal) on manufacturing of microorganisms on a small-scale for local growers. This workshop would be targeted at participants from Bangladesh, Cambodia, Indonesia, Lao PDR, Nepal and Sri Lanka. This training would also cover how to set up test facilities, enumeration and small-scale microbial production of Beauveria (one of the most frequently cited products for residue mitigation – see tables above) and Metarhizium. The facility in Nepal provides a unique opportunity for practical learning about manufacture of biopesticides on-site in developing country context. In addition to benefitting the future operations and efficiency of the Nepalese facility, it will also enable scientists from other developing countries in the region to learn from Nepal's experiences and improve their knowledge and skills. This activity will promote increased availability and access biopesticides through a local and low cost sustainable supply. By working with locally isolated strains, they will maintain the ecological balance of foliar and soil flora.

Output 3: Enhanced capacities for regulatory harmonization

In many parts of the world, including Asia, there is little harmonization of requirements for the registration of biopesticides. Even for conventional pesticides, there is lack of products available for 'minor use' crops. Differences in regulatory landscapes in Asia have made it more of a challenge to companies seeking registration. In some cases, there is lack of harmonization and in others, biopesticides are not given a separate regulatory track and follow more complex system utilized for conventional chemistry. This project will provide strategic expertise and training to enhance capacities for regulatory harmonization in ASEAN and South Asia.

The main activity under this output will be a regional workshop for ASEAN and South Asian countries on regulatory harmonization. The regulatory harmonization workshop will cover: (i) Biopesticide regulatory frameworks and potential impact for trade cooperation; (ii) How to conduct Efficacy Studies and successes with biopesticides; and (iii) How to conduct and evaluate toxicology studies for microorganisms. It will take account of and build on previous ASEAN regulatory workshops, as well as ASEAN Guidelines on the Regulation, Use, and Trade of Biological Control Agents (BCA) and the Regional BCA Expert Working Groups on Application and Regulation.

The workshop – targeted at government officials and relevant private sector stakeholders – is expected to address the following topics:

- Background and terminology including definitions about biological control agents, and their role in IPM. More specific examples will be included for registered bacteria, fungi, protozoa as well as beneficial insects. It will also include biochemical biopesticides such as semiochemicals, plant extracts and other natural products.
- Registration requirements will be discussed and compared with existing frameworks in ASEAN and South Asian countries. Each country will have an opportunity to discuss their current systems to understand opportunities for cooperation of regulatory and efficacy data requirements.
- A discussion on a framework for simplification of exemptions from MRLs for biopesticides.
- Future needs, opportunities and constraints.

This workshop would facilitate public-private dialogue and help to identify opportunities for future collaboration. The Biopesticide industry will have an opportunity to participate and share their perspectives on the process and how this has impacted product development. They will also be able to interact with government officials to learn where the greatest needs are including pest problems without solutions, biosafety concerns and quality control. This will help to establish contacts between the regulatory bodies and the biopesticide industry in a more informal setting. It will also enable registrants to better understand the regulatory systems in Asia and is expected to promote new partnerships between the public and private sector.

A biopesticide regulatory communications e-mail network will be set up to promote increased knowledge and harmonization on relevant regulations, and facilitate regional exchange of experiences, etc.

A detailed work plan indicating the start and completion date of the project, as well as sequence in which activities will be carried out is shown in Appendix 2.

The Terms of Reference (TORs) for key national and international experts to be involved in

implementation of activities included in the work plan can be found in Appendix 6. This section includes information on specific tasks and responsibilities, duration of assignments, number of missions (if appropriate), and qualifications/experience in the detailed CVs.

4. Environmental-related issues

By substituting the last application of a conventional pesticide with a biopesticide, it is anticipated that this will have a positive environmental impact by reducing pesticide use. A majority of the data will simply be a comparison of the substitution away from the conventional pesticides that are in the database but the validity of the model will be improved since data generated directly in this study can contribute to the accuracy of the pesticides half-life. A training session on the use of this model will be included in the training so that countries can utilize this to evaluate impacts of future work.

While some IPM projects have assumed a reduction in residues, they have not been quantified. The equations used to calculate the impact are well established. What is unique about this project is the application of a quantitative measure on both a residue – MRL standpoint and an environmental impact. The project outputs will thus lead to building of capacities that would contribute towards reduced use of chemical pesticides and promote use of non toxic biopesticides and adoption IPM systems all of which are bound to contribute for environmental protection. Besides, none of the activities in the project will have negative impact on the environment.

For further details on the proposed equation to evaluate the environmental impact, see Appendix 9 A quantitative measure of the impact will be determined using a model described in Eshenaur et al. www.nysipm.cornell.edu/publications/EIQ.

A risk and cost-benefits analysis will be determined to quantify the benefits. For the MRL data that is generated, the relationship between time and the decline in residues will be calculated (a first order degradation model is anticipated). From the mean MRL data, the risk (probability) of exceeding the MRL will be calculated. As the chance of exceeding the MRL decreases, a greater percent of the crop will be available for export. Therefore, it will be possible to calculate how this project is impacting the percent of the crop available for export. The differences in input costs with and without the biopesticide will be compared with the difference in domestic versus export crop values to determine how the residue mitigation impacts economic returns. The risk of increase crop damage from pests will also be considered based on the ability of the biopesticide to maintain effective pest management. Potential risks have been identified, as well as proposed measures to manage risks. Possible risks and steps for mitigation as necessary are presented in the table below.

Table 3: Possible risks and steps for mitigation

Risk	Impact	Probability	Prevention/Mitigation
Even with mitigation, the residues do not fall below MRLs.	High	Low	a. The project team is working with a large number of active ingredients and spans of time. It is expected that in a majority of cases, the active ingredients selected are likely to decline sufficiently with an extended decline period.
The biopesticides are not effective in controlling the pest at the end of the season.	Medium	Low	a. The mitigation based pest management is not only dependent on Biopesticide alone. It is expected that the conventional pesticides will provide a high level of control during the season and the residual activity of the last conventional application will cover part of the period until harvest. Therefore, it will not be necessary for the Biopesticide to control an intense population and the period of time will be brief. b. As in the IPM philosophy, the goal is not perfect control, but below an economic threshold. It also varies by pest. For example, an aphid or thrips infestation is critical during crop development and flowering, but very close to harvest there is

			not so much of an impact. On the other hand, an infestation of leaf chewing insects such as diamondback moth larvae on leafy vegetables is serious. However, Bt is widely known as an effective Biopesticide product for controlling caterpillars.
Risk	**Impact**	**Probability**	**Prevention/Mitigation**
Biopesticides are too expensive and growers will not want to use them.	Medium	Medium	a. Even if the biopesticides are more expensive, this will be partially offset by using less of a conventional pesticide and increasing the value of the crops by making them eligible for export markets. b. The Biopesticide manufacturing training will enable local manufacturers to reduce costs. This will also result in a more reliable source of biopesticides and greater competition in the Biopesticide market. Nepal is one of the poorest countries involved in this project yet they already have a fledgling Biopesticide manufacturing program that cannot meet current demand. c. Harmonization of regulations will result in greater ease and speed of registration, which should also increase competition and reduced costs. d. All trends point to a large increase in this market. One of the keys is developing an effective model program to demonstrate the utility of biopesticides coupled with an economic incentive, which is the basis of this project.
Uptake/adoption of project outputs by the national authorities due to lack of political will or proper compliance by project partners.	High	Low	This will be overcome by bringing various stakeholders of the countries at one platform, bringing awareness on the importance of work for IPM and for trade, and getting their commitments. There will be knowledge management and dissemination on the activities and the practical utility of the scientific rationale in promoting biopesticides. Development of both technical and functional skills will also facilitate the uptake/adoption of the outputs.

5. Sustainability

The project is based on national demand and priorities. It has been developed in a way that develops technical and functional capacity in the countries, based on South-South cooperation and regional collaboration, to encourage and promote sustainability.

The proposal is actively supported by relevant stakeholders of the Asian countries such as government agencies responsible for SPS management, and the private sector through letters of support. Besides, the role and involvement of APAARI which is working for sustainable agricultural development in Asia Pacific countries further adds strength on the sustainability of the project outputs through APAARI's Knowledge management programmes and knowledge management focal points in its member countries. It is envisaged that even after the project period is over APAARI will continue to network with all project partnering countries for monitoring the appropriate utilization of capacities developed, and on further resources and follow-up needed in the countries participating. It is also expected that the project outputs will lead to development of certain best practices and protocols on effective use of biopesticides in the IPM programmes and in MRL detection capacities which can be regularly used by not only the partnering countries but also for regional scaling up of the outputs.

The IR-4 Project has a continuing successful record of accomplishment in developing capacity, including with stakeholders in several developing countries. To illustrate, several government authorities in Asia, Africa and Latin America that benefitted from STDF's now completed regional MRL projects continue to be engaged with IR-4 on additional residue studies and further partnerships, building and scaling up the experiences and results achieved under these STDF projects.

The residue mitigation strategy is an additional strategy alongside the conventional magnitude of residue studies and utilized much of the same skill set. Therefore, the entire infrastructure that has been established in Global Minor Use Summits and priority setting workshops and Minor Use Foundation will also be incorporating the mitigation strategy. As priority needs arise, it will be determined if it makes more sense to solve a given problem by a conventional residue –MRL setting strategy, or a mitigation strategy. Project managers will identify key national decision-makers and stakeholders, determine the role they are to play in the project, and develop strategies to get and keep them on board at critical points before, during and after the project. In order to achieve stability, the development of functional capacities will result in policy change so that the mitigation approach becomes part of the country standard for dealing with MRL related trade issues. Surveys and interviews highlighted the importance of involving the private sector (growers, exporters and/or their associations), universities and extension services (where they exist), in the interest of sustainability.

The sustainability of the project is further enhanced through the partnership approach that underpins the whole project.

A produce exporting company (Lanka Fruit and Vegetable) and importing organization (Dragonberry Produce) has been brought onto our Project Steering Committee to help develop a push-pull model of demand for crops grown under this residue mitigation system. A grower oriented marketing plan and some type of branding will be developed along with an in country implementation plan under a 'Residue Mitigation GAP'.

APAARI through its regular interaction with member partners in Asia on various platforms will monitor and facilitate the sustainability by advocating this as an important priority for the region.

This project is being supported by the IR-4 Program and USDA which will provide technical guidance as well as sharing data, whenever possible. The project will also be assisted by FAO, which will provide advice on the project inception, IPM practices and regulatory harmonization guidance. CropLife Asia will provide general guidance and training support, and the participating pesticide manufacturers (possibly Bayer, Certis, Corteva, FMC, Green Biotechnology, Marrone Bio Innovations, Valent, etc) will provide technical support of field trials, laboratory analyses (including test and analytical standards If applicable, the data generated under this project could also be utilized for other purposes, such as requesting import tolerances in other countries/regions.
Biopesticide organizations will help disseminate the results and will incorporate it as a strategy in integrating biopesticides into conventional systems. Part of the KM strategy of the project will be a framework for engaging the project's stakeholders in existing similar initiatives and relevant multi-actor networks at national and regional levels, to secure the long-term sustainability of project outputs, knowledge and lessons from its experience.

In addition, the sustainability plan has been built into the dissemination plan. The results and how to utilize the information will be posted on the IR-4 Minor use portal and the extension website of each country residue mitigation as part of GAP guidance. A video will be produced and posted on YouTube to cover the field capacity building programs and explain how to utilize residue mitigation as a strategy to avoid trade issues. An example of a video that IR-4 has previously posted on an international residue study can be found here https://www.youtube.com/watch?v=o23QUBJm7rc . Furthermore, knowledge materials will be shared on the STDF platform to provide a wider access of stakeholders to project outputs.

Pamphlets will be developed in the local language explaining the importance of pesticide residues in trade and specific strategies for the crops we develop data for. We will encourage each country to form an FAO-like extension model involving both group extension and individual extension.
We have also arranged to publicize this in the professional arena by presenting the results at the biocontrol meeting in Asia (Location to be determined- See letter of support from Dunham Trimmer) and other professional meetings. This will help engage others in the Biopesticide market to take on this approach as part of their own marketing strategy outside the program. In the future, we foresee the larger companies of having a systems package whereby one of their conventional products is used during part of the crop and finished off with a biopesticide to avoid residues.

III. BUDGET

Budget estimate

APAARI will lead the logistical implementation and engage IR-4's technical expertise through a sub-contract, and USDA and country technical experts through direct consultation. This project will facilitate the development of details and arrangements for project implementation. All partners will ensure that the PPG is used to develop a project that links to similar and related efforts in the target countries including FAO, CropLife Asia, pesticide manufacturers, exporter organizations, etc.

The project will call upon expert knowledge of minor use research by IR-4, USDA and technical country experts. This will involve the selection of field trial locations, crops/biopesticides, development of trial protocols to demonstrate biopesticide efficacy, and coordinating efforts for data reports and utilisation. The project will aim to demonstrate efficacy of biopesticides and to promote their use through increased commercialisation and thus availability to producers.

A detailed breakdown of the total project budget is included in Appendix 3. It has been prepared on the basis of the outputs identified above, and the resources needed to complete the specified activities. The budget includes expenditures for expertise, travel, training, workshops, minor equipment items, project management, general operating expenses, etc. The total amount requested from STDF is USD $899,586 out of the total project cost of USD $1,269,603. The matching funds include USD $370,017 of contributions from several sources, $127,000 of which are from industry and USDA.

Cost-effectiveness

There are nine countries involved in this project so the per-country cost of this project is actually very low. Several of the primary contact points (from Cambodia, Indonesia, Laos, Malaysia, Thailand and Vietnam) are members of the ASEAN EWG on MRLs and attend their annual meeting. In order to reduce travel costs, some meetings will be organized to coincide with the ASEAN meetings. This was successfully accomplished during the PPG-planning meeting, and this pattern will continue during the full project

The aim of this project is to establish a process that promotes adherence to of MRL standards across the region. Some of the more widely grown crops such as chili will be conducted cooperatively across multiple countries. This will create a more robust data set without over taxing the capacity of any single country. This project seeks to coordinate work, harmonize practices and standards as much as possible, and ultimately conserving valuable resources. Additionally, by harmonizing regulatory approaches across the region, it will increase registration efficiency.
Through this coordinated and strategic approach, it is estimated that a savings of over 90% can be achieved as compared to conducting individual field trials for each crop/pesticide combination that only result in a single MRL. In addition, by targeting the most restrictive exiting MRLs, not only will these meet CODEX MRLs but also produce crops that are unrestricted for trade across a disharmonious set of different MRLs from different regulatory bodies. In addition, by aiming for 0.01 ppm or not detectable there may be an indirect benefit of meeting some secondary standards imposed by retailers.

In addition, while some country specific research on honey in Nepal will be conducted, the problems with residues on chili, greens, basil, dragon fruit and rice are broader problems that exist and are therefore applicable across all the ASEAN and SAARC countries

IV. PROJECT IMPLEMENTATION & MANAGEMENT

Implementing organization

APAARI will be the lead agency in implementing the project, in close collaboration with the U.S. Inter-regional Research Project (IR-4)4, which will provide technical expertise and coordination. The USDA Foreign Agricultural Service (USDA/FAS) will also provide technical advice (in-kind) to the project at

4 The IR-4 Project was established in 1963 as a partnership between USDA and the state agricultural experiment stations to assist specialty crop growers by developing data that is necessary to support the registration of safe and effective crop protection chemicals (pesticides) on fruits, vegetables, herbs, and other specialty horticultural crops.

no expense to the project.

Written consent and CVs from implementing organizations are attached in Appendix 5.

Project management

APAARI will designate one of its staff to be the Project Manager from the inception of the project who will look after the stakeholder's routine communications and all the operational matters. In addition, the Project Manager will, organize the various need-based workshops and capacity building programs, application of a knowledge management strategy for stakeholders, keep track of the progress and in firefighting with routine operational matters. Besides, the Project Manager will keep IR 4, APAARI and USDA regularly informed about the progress and issues and will seek technical and managerial advice on regular basis. This will help the key technical players well informed and will allow them to play their technical and advisory role in a much efficient manner and the project steering committee will get updated information on progress and problems. The project manager will be someone with project management skills across various countries and a sound background to understand the technical matters with ease.

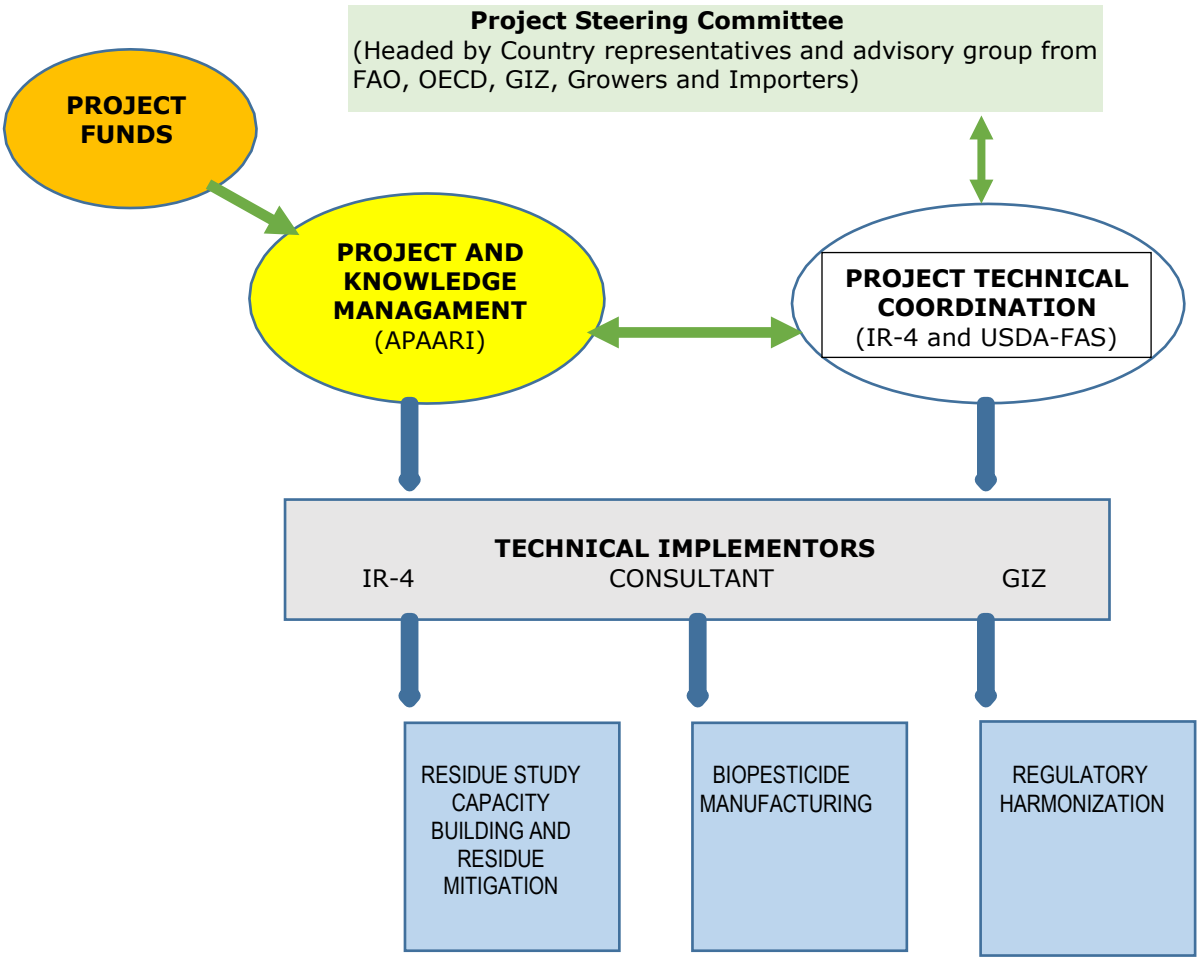
The logistical and financial aspects of the projects will be managed by the APAARI. A project staff will be tasked with daily operational activities and housed at APAARI. The daily operational activities are not limited to administration, but will also include signing of sub contracts with project partners, making preparation for trainings such as purchase of airline tickets, contracting with hotels, arranging local transportation, etc. For field trial work, the project staff will help make funding transfers to the relevant, participating country agencies or institutions. The project staff will work under the supervision of the APAARI Executive Secretary and should work closely with the Technical Coordinator and other collaborators. The project staff will prepare quarterly, annual, and final financial reports with support from the Technical Coordinator (IR-4).

For each country conducting field trials or hosting regional trainings, APAARI will make financial transfer to relevant agencies/ institutions which were appointed by the respective participating countries. The transferred funds should be used for the purchase of materials and supplies, for establishment of contracts, and for other necessary reimbursements. Recipient agencies or institutions will provide itemized expenses to the APAARI at the earliest reasonable time upon purchases or upon completion of services.

A **Project Steering Committee** (PSC) will be formed from a combination of each countries contact point, IR-4, APAARI and USDA-FAS. The FAO, OECD Expert Group on Biopesticides, at least one grower from inside the region and at least one importer from outside the region will serve as ad- hoc advisory roles. A majority of the members are also active on the Expert Working Group on Harmonization of MRLs of Pesticides among ASEAN Countries (ASEAN EWG), and SAARC member countries so these organizations will be represented by default. The PSC shall meet at least once annually as part of their regular meeting schedule (usually the end of January sponsored by CropLife) and correspond electronically between scheduled meetings. The technical coordinator (IR-4), with the assistance of APAARI and USDA-FAS, will report on the progress of the project to the PSC.

To the extent possible, administrative support will be drawn from APAARI and technical expertise will be drawn upon primarily from IR-4, but also from within ASEAN. In some cases, outside consultants will be necessary to perform the highest level of technical guidance. However, all of the actual work will be done by the ASEAN and SAARC member states themselves and any outside consultants or experts will only provide supervisory roles – the work and outcomes of this project will be that of the ASEAN and SAARC member states.

Below is a proposed management scheme:



Program Management and Knowledge Management (KM): APAARI will be responsible for the management of the project, as well as coordination of KM activities. The IR-4 and USDA Foreign Agricultural Service (FAS) will provide assistance in coordinating technical activities for meetings to coincide with the ASEAN EWG on MRL and other stakeholders. The USDA-FAS Technical Coordinator will make every effort to obtain technical expertise from partner foreign governments, the FAO, private industry, etc.

Logistics: Participating countries will help, as much as possible, to provide the logistical support for the project. For example, if a country volunteers to host a regional training, a point person from that country will help identify and secure training facilities, make arrangements for local transportation, identify lodging possibilities, etc. in cooperation with APAARI.

Technical Consultants:

- IR-4 and USDA will lead work under the residue mitigation objective. Dr. Michael Braverman of IR-4 will be the overall technical lead. Jason Sandahl of USDA-FAS will provide technical expertise as an in-kind contribution (not as part of the STDf contribution).
- Dr Wayne Jiang, an IR-4 Chemist from Michigan State will provide laboratory analysis training.
- For the biopesticide manufacturing activity, Dr. Stefan Jaronski, a recently retired insect pathologist with USDA will provide technical expertise.
- For the Regulatory Harmonization output, a knowledgeable professional will provide technical expertise.
- Ms Martina Spisiakova, APAARI, will be responsible for functional capacity building activities.

V. REPORTING, MONITORING & EVALUATION

Project reporting

Reporting will be done in line with the work plan schedule. Each quarter and/or 6 months, a progress report of the activities and outputs will be generated. Reports of workshops and other activities implemented during this period will also be incorporated.

The project staff will work closely with the Technical Coordinator and other collaborators to prepare comprehensive interim progress reports and final project report that monitors project indicators and measures. In addition to progress reports submitted to the STDF, a progress status will be presented and discussed at the annual ASEAN EWG meetings and the project Steering Committee. The project Steering Committee will consider any modification to the project plan and advise on alternatives.

Monitoring and evaluation, including performance indicators

It is already anticipated that countries involved in STDF Project PG-337 will have greater capacities in conducting residue trials than the newer countries. A baseline survey will be performed on abilities and perceptions of confidence in being able to conduct residue trials from a field and lab perspective so that we have a starting benchmark. A post study survey will also be conducted to determine how the lesser-developed countries are advancing in relation to the more developed countries. For those countries becoming trainers, their ability and confidence in being able to become regional mentors. Recipients of training from the regional trainer countries will also be surveyed by a teaching evaluation.

A simple M&E plan will be developed by APAARI for monitoring activities and evaluating outcomes/impact of the project. Monitoring will focus on activities and outputs, on whether they are on track, and whether there were unplanned or unintended changes. Evaluation will focus on the outcome and impact, on whether the outputs made progress towards the desired outcomes/impacts; what changes has occurred; whether there were unintended or unplanned changes; whether there will continue to be impacts over time. The performance indicators will be derived from the logical framework. APAARI will also monitor and evaluate the KM and functional capacity aspects of the project. Finally, a project website will be developed on Facebook along with a Facebook messenger group to facilitate communications; this will later lead as a forum to disseminate results.

There will be two key points of reference in the monitoring and evaluation of the project, which includes capacity building and the residue data generation.

The Technical Coordinator will also play a key role in the monitoring and evaluation of the project. The Coordinator will also be responsible for establishing monitoring and evaluation methods to ensure project progress is made against agreed baselines and targets per the project work plan. The FAO guidelines for evaluation methodology will be followed (FAO, 2011). At the project mid- point, the Technical Coordinator will conduct a follow-up survey to measure progress. At the end of the project, the Technical Coordinator will consult with the trainers and experts to identify progress made and determine if the countries are prepared to initiate future projects on their own. This will be the ultimate measure of the project's capacity building success.

(a) Indicators of Success

- Improved knowledge/skills of governments in the areas of: data generation, data evaluation in regard to residue MRL mitigation.
- Increased knowledge on how to integrate biopesticides as part of an IPM systems approach.
- Enhanced regional technical ability to conduct high quality residue research and studies that would be accepted by international standard setting bodies, such as Codex, or by other national governments for the establishment of MRLs (good laboratory practices (GLP), or similar criteria)
- Improved capacity to manufacture their own biopesticides using native strains
- Increased collaborations with regulatory authorities working toward biopesticide

regulatory harmonization
- Improved soft skills (functional capacities) to collaborate, communicate, and innovate in the area of biopesticides.

(b) Measures of Success

The success will be measured by:
- Trained field trial personnel ensure strict adherence to study protocol and gain a 20% increase in data generation competencies.
- Laboratory personnel exhibit improved precision and accuracy in analytical results = more reliable data = greater confidence.
- Improved laboratory technique will serve to incrementally advance laboratories toward ISO Certification or GLP recognition
- Residue mitigation data successfully provides solutions to MRL issues and broadens the range of markets that produce can be eligible for export based on meeting the MRLs.
- Establishment or expansion of microbial biopesticide manufacturing.
- Development of communications network to discuss regulatory harmonization on a regional basis, greater engagement of biopesticide registrants in pursuing registrations in participating countries.
- Development of functional capacities across various actors of the project.

Dissemination of the projects results

The project will develop a KM Strategy that will include five main pillars to disseminate the project results. The strategy will take care of information management, facilitation of stakeholder engagement, soft skill development, communication and outreach, and dissemination of project results to the project partners and other relevant stakeholders in the region. More defined activities, indicators and expected outputs will be developed at the inception workshop, and refined by the results of the baseline study.

The following five areas will be the key pillars of the project KM strategy to facilitate dissemination of the project results, changes in mind-sets and transition towards mitigation of pest residues and the use of biopesticides:

1. **Information management:** Coordinating knowledge outputs based on the project's collected data, information, and analytical activities through the generation of knowledge products, such as information leaflets on safe trade and consumption, practical guidelines on biopesticides and tools in local languages, and policy briefs targeting different stakeholders groups of the project e.g. farmers, national pesticide regulatory bodies, industry associations and export companies, and consumers.

2. **Engagement:** Creating interactive face-to-face and online learning environment for project stakeholders and the drivers for change in pest management with opportunities to share good practices, experiences, and lessons learned in compliance with existing MRL trade standards; learn about new technologies, their application and evaluation; and explore new markets for biopesticides. For example, webinars will be used for online discussions, and innovative knowledge-sharing techniques will be integrated in technical events to promote learning and collaboration.

3. **Capacity development:** Integrating the development of functional capacities, such as interpersonal and communication skills, entrepreneurial skills, and KM and analytical skills to the planned technical and knowledge-sharing events, to enable: (i) participating producers to better utilize the newly acquired technical skills in pest management by empowering them to negotiate better contracts, interact with other value chain actors and engage in political process regarding safety of agri-food production and consumption; (ii) industry actors to better manage industrial relations with farmers and government bodies and enhance their collaboration; and (iii) policymakers and regulators to better understand (navigate the complexity of) the evidence and knowledge created through the project's pesticide residue mitigation efforts and related policy implications. Various KM tools and processes developed through the EU-funded Capacity Development for Agricultural Innovation Systems (CDAIS) project will be used to develop these capacities in the context of the planned technical events.

4. **Communication and outreach:** Developing a more supportive knowledge-sharing

infrastructure to speed up the dissemination of project-generated information and knowledge. This will be done through creating a webpage devoted to the project activities and outputs on the APAARI website and using APAARI Social Media (including Facebook, Twitter and Linked In) as the project's main tools for outreach and public communication. A new online newsletter related to the project will also be designed and disseminated to all project stakeholders with project news, activities and results on a six-monthly basis. The project resources will be linked with knowledge and communication tools of the project partners and other relevant existing networks of biopesticide users to enable increased outreach and learning. Press releases will be prepared on key project events for a widespread outreach, and short videos of farmers using safe biopesticide techniques, as well as field and laboratory training sessions; will be developed as testimonials supporting the project's advocacy efforts.

5. **Dissemination of project results:** The results, and how to utilize the information will be posted on the IR-4 Minor Use Portal and the extension website of each country as part of GAP guidance. A video will be produced and posted on YouTube to cover the field capacity building programs and explain how to utilize residue mitigation as a strategy to avoid trade issues. An example of a video that IR-4 has previously posted on an international residue study can be found here https://www.youtube.com/watch?v=o23QUBJm7rc. Pamphlets will be developed in the local language explaining the importance of pesticide residues in trade and specific strategies for the crops we develop data for. Each country will be encouraged to form an FAO- like extension model involving both group extension to farmers and commodity groups, individual extension to farmers and distributing information at agricultural trade shows. Arrangements have been made to publicize the results in the professional arena by presenting the results at the biocontrol meeting in Asia (Location to be determined, ref. letter of support from Dunham Trimmer) and project successes will be presented at other professional meetings too. This will help engage others in the biopesticide market to take on this approach as part of their own marketing strategy outside the program. In the future, it is envisioned that the larger companies will adopt a systems package whereby one of their

A fourth Global Minor Use Priority Setting Workshop is being planned for 2020. This will facilitate additional awareness building about the project and provide opportunities for input. In about another 2-3 years, which would be about 2022, an additional summit is anticipated. This would facilitate the reporting of project results to all the major organizations involved in MRL issues globally. The Summit will also be a forum by which to perpetuate the process of updating the needs assessment

ATTACHMENTS

Appendix 1: Logical framework (see attached template)

Appendix 2: Work Plan (see attached template)

Appendix 3: Project Budget (see attached template)

Appendix 4: Letters of support from organizations that support the project request

Appendix 5: Written consent from an STDF partner that agrees to implement the project ***OR*** evidence of the technical and professional capacity of another organization proposed to implement the project.

Appendix 6: Terms of Reference for key staff involved in project implementation

Appendix 7 Logic for the residue mitigation strategy

Appendix 8 Additional details on Residue Mitigation Strategies for Each Crop Residue Trade Issue

Appendix 9. Environmental Impact Quotient

APPENDIX 1: Logical Framework

	Project description	Measurable indicators	Sources of verification	Assumptions and risks
Goal	Improved compliance in participating ASEAN and SAARC member states with pesticide MRLs of Codex and trading partners	10% increase in exports of targeted crops from participating ASEAN and SAARC countries within five years of project completion 50% increase in the percent of produce grown under a residue mitigation system to comply with MRLs	ASEAN Statistic Yearbook SAARC Statistic Yearbook This data will enable us to determine if the export of specific commodities has increased or if market access has improved. Online information such as EU rapid alerts and other information relating to pesticide residue MRL violations will be monitored to see if the particular problems still appear as trade issues.	Target markets accept Codex or currently established MRL standards. Target biopesticide products are available in participating countries. Regulatory authorities agree to update biopesticide registration requirements and processes in participating countries.
Immediate objective / Result	Increased regional collaboration and capacity to generate and evaluate pesticide residue data (that combines conventional pesticides with biopesticides) to resolve trade concerns due to MRLs	Decline residue data Increased understanding among regulatory authorities of how time, IPM production practices and end of season mitigation impact residues Regional work-sharing framework for the identification of regional pesticide residue concerns for key export crops		• Increased local availability and access to biopesticides

	Project description	Measurable indicators	Sources of verification	Assumptions and risks
Output 1:	New MRL data and improved knowledge to interpret this data on the use of biopesticides (combined with conventional pesticides) to mitigate pesticide residues	Up to 15 field residue mitigation studies on specific pesticides / commodities		• In-kind and financial contributions provided by relevant stakeholders • Normal growing season devoid of significant inclement weather or any other confounding factors that would render the field trial data unacceptable • Scientists available to attend trainings and apply knowledge gained in follow-up
Activities	Capacity building workshops, trainings and consultations to empower beneficiaries with the knowledge and skills to conduct supervised field trials and lab analysis using a ToT model Field and lab preparations Field residue mitigation studies Sample preparation and analysis Efficacy studies that include biopesticides SOP refinement and protocol development End-of-project workshop to discuss and disseminate project results, experiences, and longer-term sustainability	• Increase in knowledge of participants attending training workshops • Assessment by technical director of country's preparedness to initiate field trials • Improved SOPs	• Pre and post-workshop surveys and evaluations of trainees' knowledge • Meeting reports • Knowledge products with testimonials of trainees	

	Project description	Measurable indicators	Sources of verification	Assumptions and risks
Output 2	Increased knowledge and skills on improved practices to manufacture microbial pesticides	20% average increase in production efficiency of manufacture of microbial pesticides in participating countries	Records of production facilities	Facilities are able to find and culture local strains Risks related to possible use of foreign organisms are managed effectively
Activities	Training workshop on manufacturing of biopesticides Development of new knowledge products			
Output 3:	Enhanced capacities for regulatory harmonization	Government authorities in X countries have a regulatory system in place specific for biopesticides Ongoing dialogue between government authorities and other regional bodies on the harmonization of their systems New partnerships developed between regulators in targeted countries and registrants	Pre/post workshop surveys New biopesticide regulatory guidelines and other knowledge products	• National regulations at a higher level enable progress in harmonizing MRL regulations • Time required to determine the impact of policy changes on the number of products registered • Participation of private sector
Activities	Regulatory harmonization workshop with ASEAN and SAARC member states to improve understanding and knowledge about biopesticide regulations and strengthen capacity to create uniformity of regulations Development of policy briefs to facilitate informed decision-making on harmonization of biopesticide regulations			

APPENDIX 2: Work Plan[4] from March 2020 to March 2023

Activity	Responsibility	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
I. Inception Workshop, Survey and First Steering Committee Meeting.	Project Manager, Michael Braverman, Jason Sandahl, Ravi Khetarpal Martina Spisiakova	X											
II. Steering Committee Meeting	Project manager, Michael Braverman, Jason Sandahl	X		X		X		X		X		X	
III. Reports to STDF (Inception Report is part of first 6-month report. Subsequent reports are on a 6-month schedule.)	Michael Braverman, Jason Sandahl, Project Manager		X		X		X		X		X		
Output 1: New MRL data and improved knowledge to interpret this data on the use of biopesticides (combined with conventional pesticides) to mitigate pesticide residues. Scientists are able to conduct residue mitigation studies and data is generated													
Activity 1.1 Conduct GLP Training Field	Michael Braverman Malaysia		X	X									
Activity 1.2 Conduct GLP Training Lab	Wayne Jang Singapore		X	X									
Activity 1.3 Follow up oversight Field and Laboratory activities	Michael Braverman, Malaysia, Singapore, Thailand				X	X	X	X	X				
Activity 1.4 Generate Residue Decline data	Michael Braverman			X*	X	X	X	X					
Activity 1.5 Generate Biopesticide Efficacy studies	Michael Braverman				X	X	X	X	X				

*More advanced countries will be able to start the residue mitigation trials before others because they do not need the field or lab training before starting

Activity	Responsibility	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Output 2: Microbial Manufacturing – Government scientists will have the capacity to efficiently manufacture native microorganisms for use as biopesticides													
Activity 2.1 Conduct workshop on small scale microbial Biopesticide manufacturing	Michael Braverman, Stefan Jaronski				X	X							
Output 3: Enhanced capacities for regulatory harmonization – Government authorities will have a regulatory system in place specific for biopesticides and communicate with other regional bodies on the harmonization of their systems.													
Activity 3.1 Conduct Biopesticide regulatory harmonization workshop	Michael Braverman, Additional Regulatory Expert, Martina Spisiakova							X	X				
IV. Final Meeting to discuss results	Michael Braverman, Martina											X	
V. Dissemination Agricultural Extension type efforts-Knowledge management	Project Manager, Michael Braverman, Martina Spisiakova										X	X	X

APPENDIX 3: Budget (US$)[5]

The following table presents a budget summary based on the outputs identified in the logical framework and the activities needed to achieve these outputs.

	Unitary cost	**STDF**	**In-kind /Other**
OUTPUT 1: New MRL data and improved knowledge to interpret this data on the use of biopesticides (combined with conventional pesticides) to mitigate pesticide residues			
Capacity Building – Participants will be trained how to conduct field and laboratory residue studies.			
IR-4 Consultants			
Jerry Baron (senior management) 10 days	$ 636	$ 6,360	
Michael Braverman (Technical Director) 200 days	$ 537	$107,400	
Wayne Jiang (laboratory expert) 111 days	$ 500	$ 55,500	
Travel M. Braverman		$ 20,000	
W. Jiang		$ 16,000	
Consultant Time and travel subtotal		**$205,260**	
Activity 1.1 Project preparations			
First steering committee meeting, Inception and Functional Capacity Workshop Bangkok			
Approximately 45 total attendees			
Venue costs		$ 4,050	
Air travel costs		$14,000	
Hotel		$ 8,400	
Per diem		$ 7,000	
Incidental (visa/terminals)		$ 5,250	
Workshop Subtotal		**$38,700**	
Other: Meeting costs offset by CropLife joint meeting with ASEAN EWG MRLs			$ 12,000
Other: USDA funds for participants to attend 2020 GMUS			$ 25,000
Activity 1.2 GLP Lab training (GROUP) Singapore			
Bench fee to host		$ 2,000	
Air travel costs		$ 2,000	
Hotel		$ 3,750	
Per diem		$ 3,000	
Incidental		$ 750	
Local transportation		$ 1,500	
Expendable supplies		$ 3,000	
Training Subtotal		**$16,000**	
In-kind: Host institution (Singapore) staff time for training, local logistics, printing $2.000			$ 2,000
Activity 1.3 GLP lab Individual Training (One-on-one)			
Air Travel costs		$ 4,500	
Hotel		$ 4,000	
Per diem		$ 7,500	
Incidental		$ 1,500	

Expendable supplies		$ 2,000	
*Honorarium		$ 15,000	
Training Subtotal		**$ 34,500**	
**Trainers from Thailand and Singapore*			
In-kind: Host institutions' staff time for training, local logistics, printing $2.000			$ 2,000
Activity 1.4 GLP Field Residue training (GROUP) Malaysia			
Bench fee		$ 1,000	
Air Travel costs		$ 2,400	
Hotel		$ 1,920	
Per diem		$ 3,600	
Incidental		$ 900	
Local Transportation		$ 1,200	
Expendable supplies		$ 500	
Training Subtotal		**$ 11,520**	
In-kind: Host institution (Singapore) staff time for training, local logistics, printing			$ 2,000
Activity 1.5 GLP Field Individual Training (One-on-one)			
Air travel costs		$ 4,800	
Hotel		$ 3,840	
Per diem		$ 7,200	
Incidental		$ 1,800	
Local transport		$ 1,200	
Expendable supplies		$ 500	
*Honorarium		$ 14,400	
Training Subtotal		**$ 33,740**	
**Trainers from Malaysia*			
In-kind: Host institutions' staff time for training, local logistics, printing			$ 2,000
Activity 1 Sub-Total		**$134,460**	**$ 45,000**
Activity: Data Generation- Residue mitigation through the use of biopesticides			
Activity 2.1 Live field trials, efficacy and sample analysis			
Field multi-residue decline studies		$ 45,000	
Multi-residue decline studies – Analysis		$ 36,000	
Specific residue decline studies		$ 45,000	
Specific residue – Efficacy evaluations		$ 18,000	
Specific residue – Analysis		$ 36,000	
Equipment (Grinders and dry ice makers)		$ 30,000	
Research Subtotal		**$210,000**	
In-kind: Field and Laboratory equipment use fees and maintenance contracts, use of hoods and physical space, administrative oversight costs.			
Nine countries	$ 6,750		$ 60,750
Other: Private sector contribution (efficacy trials, test substances, analytical standards, analytical training, registration fees)			$ 30,000
Activity 2 Sub-Total		**$210,000**	**$ 90,750**
OUTPUT 1 Subtotal		**$549,720**	
OUTPUT 2: Increased knowledge and skills on improved practices to manufacture microbial pesticides			

Michael Braverman (Technical Director) 30 days	$ 537	$ 16,110	
Michael Braverman-Travel		$ 5,000	
Consultant subtotal		**$21,110**	
Capacity building workshop on the manufacturing of Microbial Biopesticides			
Venue (Nepal)		$ 1,050	
Air travel costs		$ 2,800	
Hotel		$ 2,800	
Per diem		$ 6,300	
Incidental		$ 1,050	
Local Transportation		$ 1,500	
Expendable supplies		$ 3,000	
Bench fee		$ 3,000	
Consultant (Dr. Stefan Jaronski)			
Consultant travel		$ 5,000	
Consultant time		$10,000	
Training Subtotal		**$36,500**	
In-kind: Host institutions' staff time for training, local logistics, printing			$ 2,000
OUTPUT 2 SUBTOTAL		**$57,610**	**$ 2,000**
OUTPUT 3: Regulatory Harmonization and Project Finalization Workshops			
Jerry Baron (senior management) 8 days	$ 636	$ 5,088	
Michael Braverman (Technical Director) 40 days	$ 537	$21,480	
Michael Braverman -Travel		$10,000	
Consultant subtotal		**$36,568**	
Capacity-building workshop on the harmonization of biopesticide registration requirements in ASEAN and SAARC countries. (Will include Functional Capacity as part of the workshop) conducted in Bangkok			
Venue		$ 2,760	
Air travel costs		$ 6,400	
Hotel		$ 6,400	
Per diem		$ 4,000	
Incidental		$ 2,400	
Consultant Time		$ 5,000	
Training Subtotal		**$26,960**	
In-kind: Host institutions' staff time for training, local logistics, printing			$ 2,000
End of Project Workshop: Finalization and dissemination planning workshop (Will include Functional Capacity)			
Venue		$ 2,700	
Air travel costs		$ 14,000	
Hotel		$ 8,400	
Per diem		$ 5,250	
Incidental		$ 5,250	
End of project Subtotal		**$ 35,600**	
OUTPUT 3 Sub-Total		**$ 99,128**	**$ 2,000**
APAARI administrative staff for project logistics (air tickets, hotels, contracting, communications, etc.)			

APARRI senior staff for overall management of project: office space for project staff, attending meetings/ trainings, communication			
Ravi Khetarpal (Executive Secretary) 54 days	$ 432	$23,328	
Martina Spisiakova (KM Coordinator) 30 days	$ 300	$ 9,000	
Project Manager for 30 days	$ 300	$ 9,000	
Ravi Khetarpal -Travel		$ 1,500	
Project Manager -Travel		$ 1,500	
Martina Spisiakova -Travel		$ 3,000	
APAARI subtotal		**$47,328**	
Other in kind			
In-Kind: Time and travel by APAARI ($38,552)and IR-4: ($55,056)			$ 93,608
Other: Administration, time and travel (in-kind) by ASEAN and SAARC $60,000			$ 60,000
Other: Time and travel (in-kind) by USDA $60,000			$ 60,000
Other in kind subtotal			**$ 213,608**
End of Project Independent Assessment (Time and travel)		$ 15,000	
Publications-printing, video, communications		$ 24,500	
Sum OUTPUT 1, 2 and 3, APAARI subtotal, assessment and publications		$ 793,286	
Contingency funds (5%)		$ 39,664	
Project Total		**$832,950**	
APAARI Overhead @8% APAARI overhead 2% in-kind contribution		$ 66,636	$ 16,659
Total STDF Request		**$899,586**	
Partner matching contributions			**$ 370,017**
Grand total (Requested plus matching)		**$ 1,269,603**	

[5] Use the headings in the budget table above as a basis to prepare a budget table, preferably as an Excel chart.

Detailed description of budget line items are provided below. The project will be comprised of three major components:

1 Capacity building in field residue decline trial and laboratory, and actually conducting the field residue decline trial, Biopesticide efficacy and laboratory analysis.

2. A workshop on small-scale isolation and production of native microorganisms for pest management.

3. A workshop on biopesticide regulatory harmonization

Contracts:

- ☐ At APAARI, an administrative assistant will be hired and located at the APAARI Secretariat to provide project management support. Other administrative support for the project, including organizing travel, training logistics, contracts, and funds transfers will be covered by project overhead. A knowledge management expert that will also include sessions on functional capacity and will be hired at 10days per year for a total of 30 days. The knowledge management will cover identifying, capturing, evaluating, retrieving, and sharing all the information generated in this project. Monitoring and Evaluation will be handled by the Project Manager at APAARI will be hired for 10 days per year for a total of 30 days to develop the M and E implementation plan and also assist in project operations as and when required.
- ☐ Technical Management (IR-4)will be contracted to provide overall guidance, mentorship, and direction for the project. The Technical Manager will advise on the final selection of crop/pesticide/country assignments, develop field trial protocols, and provide training and guidance for conducting the field trial work. It is anticipated that this will be a 90 days/year contract.
- ☐ A laboratory consultant will be contracted to ensure that national laboratories are proficient in methods and procedures required for the project. The analytical consultant provide training to national laboratory technicians, and provide overall guidance to technicians when conducting project analyses. It is anticipated that this will require 37 days/year over 3 years.
- ☐ ** USDA will support a project coordinator to help identify capacity-building needs, recommend appropriate technical experts, and serve as a liaison between the project consultants, the FAO, and other project stakeholders.*
- ☐ A technical expert to improve capacity on the production of microorganisms will be included. This will include time for the workshop itself, plus preparation. This is a total of 15 days.

  Technical experts to help lead a workshop to help build capacity and establish cooperative communications networks to enable harmonization of regulations and promote communications between regulators and the manufacturers. This will include time for the workshop itself, plus preparation. This would involve an expert at 10 days.

Travel and DSA:

- ☐ Participant airfare: for training events are anticipated in order to prepare national experts for field trial and laboratory analysis work. The trainings will be held in parallel with actual field trial preparations in order to provide participants with actual, hands-on experience. National experts will include Principal Investigators, field technicians, and laboratory technicians. Travel funds will support participation of national experts to relevant training events.
- ☐ Contractor airfare: the Technical Director consultant, Microbial consultant, and laboratory consultant will travel to provide training/guidance for relevant events.
- ☐ Local travel: this includes transportation of groups to rural field sites for training and trial work that is not covered under general DSA.
- ☐ *USDA will provide own travel funds to participate in training events. USDA will also support travel for addition technical experts for special cases. For example, the project may be enhanced with participation of, African or other national/regional experts to coordinate the project across regions.*

Training:

- ☐ Capacity building: it is anticipated that the contracted Technical Director, and laboratory consultants will deliver the required training necessary to conduct the project work. Costs for participants to attend the trainings are included in previous budget section, so no additional costs are anticipated in this section.
- ☐ Project work: major costs for field trial work include compensation for field trial sites, field

technician services, transportation and laboratory testing, data analysis, and professional services for trial personnel.

- Field trials: costs include professional services of local field technicians (ideally government staff from national research facilities); field trial sites (although in-kind contributions will be sought from local or government managed farms), transportation costs. Costs of trials depends on the crop being tested, location of sites, number of trials required, etc. Costs for trials are anticipated to be low, as public-sector staff and equipment would be utilized as much as possible. The project is budgeting the field portion of the trials. This includes two phases. At first a multi residue trial followed by a specific product and combined with efficacy evaluations
- Laboratory analysis: costs include professional services of residue laboratories (preferably, these will be national or university labs), reagents and supplies.
- Data analysis and publication this budgetary item is included under contracts.

* *Project partners will provide in-kind contributions to the field trials as follows: pesticide manufacturers will provide test substances and analytical standards, and some training on analytical method validation and testing proficiency. The private sector will also provide assistance in the final selection of crop/Biopesticide /country assignments and guidance in protocol development.*
* *USDA will provide in-kind assistance to coordinate technical training programs, and supplement technical trainers, if needed.*

Other meetings, workshops:

* *USDA will provide up to $25,000 travel assistance for up to ten participants to join the fourth Global Minor Use Summit (Location TBD, Probably USA) in the fall of 2020. This will serve as an opportunity for the Asia region participants to discuss the project in more depth with IR-4, pesticide manufacturers, representatives from other regions, and other stakeholders in order to best coordinate efforts in Asia and other regions.*
* *CropLife Asia annually supports the ASEAN EWG meetings, often supplementing the main meeting with an additional day or two for specific training requests. CropLife will support this project by allocating the additional meeting days for a project Steering Committee meeting and other meetings to receive updates and guidance on the project work, in addition to providing targeted training for project related topics. CropLife already supported the venue costs and some of the meals for the Project Planning Grant meeting in Singapore.*

IT/ laboratory equipment:

- ☐ It is anticipated that only small equipment purchases will be made to support the project, such as grinders and dry ice generators, and shipping costs, as needed to carry out field trial and laboratory work.

Project management:

- ☐ Overall project management will be provided by APAARI and the Technical Coordinator.
- * *USDA will provide in-kind support for the overall coordination of the project.*

Inputs

Input		Output
Personnel	• Project Coordinator (USDA in-kind contribution) • National Principal Investigators (ASEAN and SAARC Member States in-kind contribution) • ASEAN and SAARC project staff	Capacity Building: Trained technical personnel (laboratory, field trial experts, others) in the lessor developed ASEAN countries and SAARC countries with the ability to conduct high quality residue research and studies.
Contracted organizations	• Study Director • Field and laboratory analytical experts	
Supplies and services	• analytical supplies • printing materials	
Travel and per diem	• Economy airfare • lodging, meals • local transportation	
Personnel	• Project Coordinator (USDA in-kind contribution) • ASEAN and SAARC Project staff	Residue Data Generation: Pesticide data generated Test pesticides registered for use in participating countries
Contracted organizations	• Study Director • laboratory analytical experts	
Equipment	• equipment purchases for lab work – only that which is critical for the project	
Supplies and services	• analytical supplies • printing and labelling materials • shipping • storage materials	
Travel and per diem	• airfare • lodging, meals • local transportation	
Personnel	• Project Coordinator (USDA in-kind contribution) • National Principal Investigators (ASEAN and SAARC Member States in-kind contribution) • ASEAN and SAARC Project staff	Capacity to produce Microbial Biopesticides
Contracted organizations	• Individual consultants	
Travel and per diem	• Economy airfare • lodging, meals • local transportation	Regulatory Harmonization for Biopesticide Registration

APPENDIX 4 – Letters of Support

The letters of support received for the project from various organizations, including private and national public organizations, as well as various experts. With the large number of letters, it was not possible to post the letters directly so they are being sent **under a separate e-mail**

- **Bangladesh** – Department of Agricultural Extension
- **Cambodia** – Ministry of Agriculture and Fisheries (MAFF)
- **Indonesia** – Horticulture Directorate
- **Laos PDR** – National University of Laos and Department of Agriculture
- **Malaysia** – Malaysian Agricultural Research and Development Institute
- **Nepal** – Ministry of Agriculture and Livestock Development
- **Sri Lanka** – Department of Agriculture
- **Thailand** – Science Research and Development Division Department of Agriculture
- **Vietnam** – Ministry of Agriculture and Rural Development
- **Singapore** – Singapore Food Agency

Additional organizations have provided letter of support, which represent the grower, industry and export/import organizations, pesticide and biopesticide manufacturers, as well as allied industry organizations. Note that even companies representing conventional products are supportive as they recognise their stewardship responsibilities and are aware that growers need income to buy their products.

Import/Export

- ☐ Dragonberry Produce Inc. (US Importer)
- ☐ Lanka Fruit and Vegetable Producers, Processors and Exporters Association

Conventional and Biopesticide Manufacturers

- ☐ Corteva Agriscience
- ☐ Green Innovative Biotechnology Co. Ltd. - Thailand
- ☐ Certis USA
- ☐ Marrone Bio Innovations
- ☐ Valent USA
- ☐ Bayer U.S. Biologicals R&D
- ☐ Bayer Crop Science (Conventional Products)
- ☐ FMC
- ☐ Syngenta
- ☐ BioSafe Systems
- ☐ BASF

Cooperating International Agencies and Industry Trade Organizations

- ☐ European Minor Uses Coordination Facility/Chair of the Expert Group of the Organisation for Economic Co-operation and Development (OECD) on Biopesticides
- ☐ Minesterio de Agricultura, Chile)
- ☐ CropLife Asia
- ☐ CropLife International
- ☐ International Biocontrol Manufacturers Association
- Dunham Trimmer –International Bio Intelligence
- ☐ Pesticide Manufacturers and Formulators Association of India

Additional cooperating experts**:**

- ☐ Dr. Wayne Jiang, Michigan State University

- ☐ Dr. Stefan Jaronski, MycoSystems Consulting

APPENDIX 5: Letters of consent

United States Department of Agriculture

August 20, 2019

Marlynne Hopper
STDF Secretariat
World Trade Organization
Centre William Rappard
Rue de Lausanne 154
CH-1211 Geneva, Switzerland

RE: Development and Cooperation on the proposal: **Asia Pesticide Residue Mitigation through the Promotion of Biopesticides and Enhancement of Trade Opportunities.**

Dear Marlynne Hopper:

The United States Department of Agriculture (USDA) expresses interest and commitment in providing necessary input and support for the residue mitigation project which will work toward reducing trade barriers related to pesticide residues. We also anticipate that this project will work toward strengthening the registration process of biopesticides in partnering countries, which is an important component of Integrated Pest Management agricultural programs.

Supporting the unique needs of specialty crops remains a top priority at the USDA. As you well know, pesticide residues associated with agricultural commodities can impede trade, and this is a particular, and growing, problem for specialty crops since residue data, and their corresponding maximum residue levels (MRLs), are not always available. When MRLs do exist, there is often a dis-harmonization between the standards established by national governments or international bodies that can also impede trade.

USDA recognizes that working cooperatively with other countries and regions to overcome these challenges is critical for success. USDA supports the residue mitigation project in cooperation with the partnering member countries, building regional capacity to address residue trade barriers, and strengthen registration systems based on science.

USDA will make every effort in continuing to provide technical support and coordination of the project and will provide this support in-kind to the implementation of the project. We look forward to the initiation of work under the residue mitigation project.

Thank you very much.

Jason Sandahl, Ph.D.
Senior Program Manager
OCBD/FAS/USDA
Washington, D.C. 20250
Jason.Sandahl@fas.usda.gov, (703) 201-4108

APPENDIX 6: Terms of Reference (TOR) for key staff involved in project implementation and their CVs

PROJECT AND KNOWLEDGE MANAGEMENT: Ravi Khetarpal (project leader), Thansita Tanaphatrujira (admin assistant), Norah Omot (project management), and Martina Spisiakova (KM and functional capacity development)

The APAARI Executive Secretary will take the lead in the project, supported by Project Manager, KM Coordinator, and admin assistant. Under the technical guidance of key Technical Coordinators of the Project from IR-4 and USDA, and administrative and operational guidance from APAARI, the Project Manager with demonstrated project management experience across various countries and a sound science background of plant protection will carry out the following activities:

- ☐ Assist with communications with stakeholders.
- ☐ Ensure smooth functioning of all operational matters, including procurement, such as purchase of equipment by various partners.
- ☐ Organize logistics for various workshops and capacity building programs and assist in preparing a report of the events organized.
- ☐ Ensure the development and proper application of a KM strategy for stakeholders.
- ☐ Keep track of the progress of each project team members, support them in firefighting with routine operational matters and seek managerial advice on regular basis.
- ☐ Prepare a project update every 3 months of the progress of the project and share with Technical Coordinators.
- ☐ Support APAARI Secretariat (Finance Coordinator) in release of funds to the partners based on their activities and outputs and assist in keeping track of the utilized budget.
- ☐ Perform any other activity as may be required by Technical Coordinators for smooth functioning of the project in different countries.

The KM Coordinator will develop the project's KM Strategy, and will coordinate its implementation, including the development of functional capacities to be integrated in the technical program.

TECHNICAL COORDINATORS (Michael Braverman and Jason Sandahl)

The Technical Coordinators will develop all training materials and deliver all trainings with support of additional experts. They will undertake the following specific duties:

- ☐ Provide advice to the Project Steering Committee, Project Management and the hired experts and project staff on the selection of contracted organizations.
- ☐ Assist the Project Management and hired experts in optimizing the project finances by identifying collaborators to the Project, and providing general advice on budgeting.
- ☐ Prepare technical reports on the project progress for submission to the Project Steering Committee.
- ☐ Assist the Project Manager and APAARI Secretariat in the preparation of reports required by financial contributors.
- ☐ Conduct the training and oversee the initiation, progress and results of the actual research.

PARTICIPATING COUNTRIES

The countries participating in the project will:

- ☐ Actively engage in the inception meeting and Project Steering Committee Meetings.
- ☐ Conduct the residue mitigation trials.
- ☐ Participate in training session regarding small-scale microbial production (for countries participating in that activity).
- ☐ Participate in Biopesticide Regulatory Harmonization Workshop.
- ☐ Submit reports on the progress of the trials to the Technical Coordinator, copied to the APAARI Secretariat.
- ☐ Submit the financial report on the use of funds upon completion of the services.
- ☐ Perpetuate the utility of the project through active utilization of the training, acquired knowledge and information to feed into the KM outputs, and a strategy for meeting MRL requirements.
- ☐ For countries hosting training events, a point contact from the country will assist the Project Staff and Technical Coordinator in planning, organizing, and implementing events.

1. CV: Ravi Khetarpal

Executive Secretary, Asia Pacific Association of Agricultural Research Institutions (APAARI), Bangkok, Thailand, ravi.khetarpal@apaari.org

Education and qualifications

GB Pant University of Agriculture and Technology, Pantnagar, India	1977	MSc (Agriculture) in Plant Pathology
University of Paris, France	1989	PhD in Life Sciences (Plant Pathology – Specialization in Plant Virology)

*Also Mini-MBA from Oxford University, UK 2010 and PRINCE 2 from APMP Group, UK 2010.

Professional experience

Thailand 2017 (August-cont.)	**Executive Secretary, Asia Pacific Association of Agricultural Research Institutions – Thailand** Responsible for preparing the Association's work plan and budget and develop new programmes and activities in collaboration with other regional and international organizations. Ensure coordination of activities among the 80 members (countries, International organizations higher education sector and sug regional fora)and partners in the thematic areas of natural resources management, risk mitigation (including SPS issues), pro-poor value chain and policy and advocacy for achieving sustainable development goals in Asia and the Pacific.. Executing projects supported or funded funded by of FAO, EU, IFPRI, ACIAR and Council of Agriculture, Tawan.
India 2015 – 2017	**Regional Advisor, CABI South Asia Centre – India** Responsible for developing strategic science partnerships and policies in South Asia with major thrust on science business development through programmes and projects (with governments, academia, private and international agencies such as FAO, World Bank, UNEP-GEF, SAARC, Unilever, ICAR, etc) and building regional teams. Developing a Regional Science Strategy (for South Asian countries) aligned with Global Strategy of CABI and in tune with SDG goals. Strenghthening CABI - ICAR relationship with science projects for establishment of CABI - ICAR Joint Microbiology Laboratory at IARI. Exploring opportunities of partnership with ICAR to work in South Asian countries. Addressing policy issues for germplasm exchange under ABS mechanism of Nagoya Protocol under Covention of Biological Diversity.
India 2010 - 2015	**Regional Director, CABI South Asia Centre – India** Responsible for strategic and operational management of CABI South Asia centre. Developing a Strategy Plan Document for (2014-16) for CABI South Asia. Enhancing CABI's profile and developing a long term business plan by networking with relevant Ministries in the region and the potential donor agencies.Co-ordinating / executing / monitoring / exploring opportunities for international development projects on trade facilitation, Plantwise (plant clinics), Direct to Farm (use of mobile in agro-advisory services), invasive species, market linkages for small farmers and plant health knowledge management in India, Nepal, Sri Lanka and Bangladesh.
India 1978 - 2010	**Scientist, Senior Scientist, Principal Scientist (1978-1999) then Head (1999-2010), Plant Quarantine Division, National Bureau of Plant Genetic Resources, Indian Council of Agricultural Research (ICAR), New Delhi** Executed research and capacity building projects in areas of plant protection, plant virology, plant quarantine and biosafetuy in India sponsored by ICAR, Ministry of Agriculture, Department of Biotechnology, Bhabha Atomic Research Centre, World Bank-funded National Agricultural Technology Project and DFID / CABI.Established of *state of the art* National Containment Facility (CL-4). Developed strategy for expediting germplasm processing in quarantine and modalities for exchange of transgenic germplasm. Represented India in global agriculture platforms in Brazil, Cambodia, Canada, Chile, China, France, India, Indonesia, Italy, Mauritius, Nepal, Pakistan, UK, Uruguay and USA. Contributed significantly at national and global platforms in policy issues and capacity building in fields of SPS/WTO, Cartagena Protocol of Biosafety and also in areas of plant

	genetic resources for biodiversity. Organizing Secretary for various national / international workshops including SAARC, FAO, Professional Societies etc.
France 1994 - 1997	**Visiting Scientist, INRA, Versailles** Post-doctoral experience in a EU-sponsored collaborative research project between France, UK and Denmark on integration of conventional and molecular resistance in pea to pea seed-borne mosaic virus.

Assignments in international agencies

Agency / Role	Duration	Key Areas Addressed
USDA : Phytosanitary Capacity Evaluation of Bangladesh, **Bangladesh**	1.5 months July 2017 to May 2018	Phytosanitary capacity evaluation though 13 modules stipulated by International Plant protection Convention, Rome.
World Bank : International SPS Consulant under *Nepal India Regional Trade and Tansport project* implemented by World Bank and Ministry of Commerce, **Nepal**	1.5 months Feb – May 2016	Review, Capacity building and Policy issues related to SPS/WTO Agreement, , Report writing
WTO : Developing Country Expert from Asia Pacific Countries on SPS in STDF/WTO Working Group in **Geneva, Switzerland**	Meetings Jan 2016 - Dec. 2017	Review and sanctioning of projects through donor's portfolio of WTO on SPS matters from Asia Pacific Countries
World Bank : International SPS Specialist in World Bank Cooperative Programme. Economic Sector Work on Sources of Growth in Agriculture. Pre-Investment Mission in **Nepal**	1.5 months Aug – Oct 2015	Review of nationa legislative and inrestruture facilities for boosting ginger export, Agreement, Organizing workshop with national stakeholders, Report writing
FAO : Expert member in STDF-funded project of IPPC/FAO in developing Manual of Global Standards for NPPO Establishment and Operations. IPPC meeting held at **Hanoi, Vietnam.**	1 week Aug 2013	Development of Standards published by FAO (2015); Establishing a National Plant Protection Organization. Version 1.1, 39 pp Operations of a National Plant Protection Organization. Version 1.1, 35 pp.
FAO : Team Leader - (International Biosecurity Consultant) in FAO project, *Strengthening quarantine for Invasive alien species in* ***Indonesia*** (TCP/INS/3203D)	6 months Nov 2009 - Dec 2011	Review and revision of plant protection and biodiversity legislation, capacity building in pest risk analysis, Organizing workshop with national stakeholders, Report writing
APPPC / FAO: Consultant contracted by FAO, Bangkok to draft a document: *Transboundary Movement of Pests in Asia and Pacific: Emerging Problems, Challenges and Opportunities*, for FAO Regional Conference of APPPC , FAO, **Bangkok, Thailand**	1 month June 2011	Developed a white papere for APPPC, FAO, Bangkok on Transboundary Movement of Pests in Asia and Pacific: Emerging Problems, Challenges and Opportunities, to be used by DG, FAO for an FAO Regional Conference.
FAO / STDF: Consultant (SPS specialist - Phytosanitary Measures) under the STDF-sponsored FAO project, *Preparation of a Sanitary and Phytosanitary Action Plan for* ***Cambodia*** (MTF/CMB/032/STF)	3 months Nov 2009 - Jan 2010	Review of various SPS related international projects in Cambodia and addressing issues for boosting rice export, in-country partnership among relevant stakeholders, Report writing
FAO : Consultant (TCDC: Pest Risk Analyst) under the FAO/TCP project *Strengthening Sanitary and Phytosanitary Services in* ***Cambodia*** (TCP/CMB/3104)	3 months July 2008 – Mar 2009	Review and revision of plant protection legislation, capacity building in pest risk analysis, pest reporting and survey and surveillance, Organizing workshop with national stakeholders, Report writing

USDA : Team Leader from India for Indo-US SPS Knowledge exchange under Agriculture Knowledge Initiative Programme organized by **USDA, Washington, DC**	1 week June 2007	Addressing bilateral SPS issues and identifying areas for knowledge management, Report writing
Indo-US Trade: Team member (technical) of Indian delegation of Ministry of Agriculture for negotiating wheat import of 5 million tonnes with US counterparts (USDA, Wheat Board etc) based on pest risk analysis and international standards of WTO.**USDA, Washington DC**	1.5 weeks May 2007	Technical Negotiation with USDA team and US Wheat Board on pest risk analysis as per WTO norms for wheat import from US to India, and US wheat was found unfit to be imported. Involved field visits, discussions with stakeholders, and Report writing.
FAO : Consultant (TCDC: Phytosanitary Training) under the FAO/TCP project, *Strengthening Plant Quarantine Facilities in* ***Nepal*** (TCP/NEP/2903 A)	2 months Feb – Sept, 2005	Development of import and export certification protocols, Capacity building in pest risk analysis, survey and surveillance, and strengthening quarantine laboratoties.
FAO : Consultant (TCDC: Expert-Plant Virology) under the FAO/TCP project, *Strengthening Plant Health Management Capability in Seed and Plant Certification Schemes in* ***Mauritius*** (TCP/MAR/0165 A)	4 months Mar- Sept, 2003	Survey for viruses in vegetable and horticultural crops in Mauritius, capacity building for detection of viruses and development of standard operarting procedures for quarantine operations.
UNDP : Consultant under the UNDP project (IND/92/032), *Strengthening and Development of Plant Quarantine in the Post-WTO Scenario*: fact-finding tour to **Canada, Chile and Uruguay** to develop recommendations for India.	2 weeks Feb, 2001	Comparative studies made on policies and operational infrastructure of quarantine measures of three countries and suitable recommendations made for Government of India through Report writing.
FAO : National Consultant under the FAO/TCP project, *Need Assessment and Project Formulation for the Development of an Integrated Quarantine Service in I****ndia*** (TCP/IND/8925).	3 months Mar – Dec, 2001	Identification of risk for import of major commodities and review of existing infra structure and legislative measures. organized national workshops, identified equipments needed and capacity building for quarantine on operational measures.

Publications summary:

- Review and Policy Articles – 17: Research Articles- 110; Books – 18;
- Book Chapters – 59; Popular Science Articles - 8; Manuals – 5.
  (Plus a large number of Reports, Technical Bulletins, Abstracts > 300, etc)

2. CV: Martina Spisiakova

Knowledge Management Coordinator, Asia Pacific Association of Agricultural Research Institutions (APAARI), Bangkok, Thailand, m.spisiakova@apaari.org

Education and qualifications

2008-2011 **Master in Business Administration (MBA)**, Robert Kennedy College, Zurich, Switzerland / University of Wales (distance). Dissertation: 'The challenge of developing a knowledge culture: a culture that embraces learning, sharing, changing, and improving through the collective intelligence and knowledge of people – comparative analysis of public and private sectors'

2002-2006 **BSc (Hons) in Social Sciences with Economics (First-class)**, The Open University (UK) (distance learning), Project (2005): 'The impact of social segregation on cities' – Grade A (distinction)

2006 **Diploma in Economics**, The Open University, UK (distance learning)

2004 **Diploma in Environment and Development**, Open University, UK (distance learning) University project (2003): 'How effectively does community-based fisheries management, as implemented under the IFAD-supported Aquaculture Development Project, benefit the local environment and communities in Bangladesh' – Grade A (distinction)

Short training courses (2015-2018): gender (UN Women), project management (ESCAP), resource mobilization (ESCAP), ethics (ESCAP), KM (IFAD), negotiations in tough situations (Learning Tree International), training of trainers (MDF), mind-mapping (IFAD), high-performance teamwork (IFAD), security awareness (WFP), executive media coaching (IFAD), moderation skills (IFAD), editing and sub-editing (London College of Communication and Institute of Development Studies).

Professional experience

2019-now **ASIA-PACIFIC ASSOCIATION OF AGRICULTURAL RESEARCH INSTITUTIONS (APAARI)**, Bangkok, Thailand ***Knowledge Management Coordinator***

2019 **EUROPEAN COMMISSION (EC),** Brussels, Belgium ***Evaluator of the Horizon 2020 proposals***

2018-2019 **APAARI**, Bangkok, Thailand ***Project Development Consultant***

2015-2017 **APAARI**, Bangkok, Thailand ***Knowledge Management Coordinator***

2014-2015 **CENTRE FOR ALLEVIATION OF POVERTY THROUGH SUSTAINABLE AGRICULTURE (CAPSA), UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA-PACIFIC (ESCAP),** Bogor, Indonesia – **Consultant** – *KM, communications, and monitoring, evaluation and learning (MEL) of the Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia) – EU-funded project*

2012-2014 **CAPSA/UNESCAP, Bogor, Indonesia *Knowledge Management Officer* for the SATNET Asia Project**

2005-2012 **INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT (IFAD), ASIA AND THE PACIFIC DIVISION,** Rome, Italy *(Acting)* ***Knowledge Management and Communication Officer***

2000-2005 **IFAD, ASIA AND THE PACIFIC DIVISION,** Rome, Italy ***Programme Assistant*** *for various Country Programme Managers responsible for Afghanistan, Bangladesh, Bhutan, Central Asia, Democratic People's Republic of Korea, India, Iran, Maldives, Nepal, Sri Lanka, Pakistan and the Philippines (on rotational basis).*

Other information:

Slovak national with over 18 years international development experience in agricultural and rural development in Asia-Pacific – programme and project management, knowledge and network management, project development, strategic planning, capacity development and learning, monitoring and evaluation (M&E), and resource mobilization.

Lived three years in the UK, twelve years in Italy, two and a half years in Indonesia, 1.5 years in Thailand, and one year in Austria. **Travelled and worked widely through Asia (short development missions)**: Bangladesh, Cambodia, China, India, Indonesia, Lao People's Democratic Republic, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, South Korea, Thailand and Viet Nam.

Languages: Working knowledge of English, Italian, and Spanish, basic Indonesian, Malay and Russian. Mother tongue: Slovak.

3. CV: Norah Omot

Coordinator of the Agricultural Science and Technology Indicators (ASTI) Project, APAARI, Bangkok, Thailand, norah.omot@apaari.org

Education and qualifications

- PhD (Economics), 2010, University of Canberra, ACT, Australia. Long Distance Marketing of Sweet Potato from the Highlands of Papua New Guinea: An Analysis of Consumer Preferences and Supplier Responsiveness.
- MAg (Agricultural Economics), 2002, The University of Sydney, Australia
- BSAg, 1995, University of Technology, Lae, Papua New Guinea.

Employment Record/History

- APAARI: ASTI Coordinator 2017 until current period. Coordinate agricultural science technology and indicator (ASTI) project in Southeast Asia and Pacific.
- National Agricultural Research Institute, Papua New Guinea.
  Director of Enabling Environment Programme 2010-2017; Economist 2002-2006.
- Department of Agriculture and Livestock, Papua New Guinea.
  Research Assistant, 1996-1999.

Experiences in:

- Project management
- Socio-Cultural-Economic Assessments
- Markets/Marketing Systems/Value Chain Assessments
- Impact Assessments
- Innovation Systems Assessments
- Strategic Planning (Programmes and Projects)
- Project Reviews and Assessments

Affiliation to the PNG Women in Agriculture Development Foundation 2007-2017

- Worked closely with the National Office of the PNG Women in Agriculture Development Foundation (PNGWiADF). Advices the President of PNGWiADF on regular basis on matters related to the functioning of PNGWiADF and agricultural research.

4. CV: Michael Paul Braverman

Manager Biopesticide, Organic and International, Capacity Building Programs, IR-4 Project, Rutgers University, 500 College Road East, Suite 201W, Princeton, New Jersey 08540

EDUCATIONAL BACKGROUND:

A.S.	1979	Ornamental Horticulture	Valencia Community College
B.S.	1981	Agriculture(Soils)	Murray State University
M.S.	1984	Agronomy(Weed Sci.)	University of Arkansas
Ph.D.	1989	Horticulture(Weed Sci)	University of Florida

PROFESSIONAL EXPERIENCE:

2017-Present: **Manager Biopesticide, Organic and International Capacity Building Programs** IR-4 Project, Rutgers University, Princeton, New Jersey. Manage an organic and biopesticide regulatory and efficacy program leading to EPA registration of new biopesticide active ingredients with the US Environmental Protection Agency. Organize and conduct international training programs involving Good Laboratory Practices, pesticide residues and supervise pesticide residue research projects to generate new global standards for international trade of food commodities
2002-2017: **Biopesticide and Organic Support Program Manager** IR-4 Project, Rutgers University, New Jersey. Manage a national organic and biopesticide efficacy program in cooperation with about 20 university scientists annually. Routinely submit registration packages to EPA to register new biopesticides which have organic applications

1999- 2001: **Associate Coordinator.** IR-4 Project, Rutgers University, North Brunswick, New Jersey

1996-1999: **Director of Field Research.** EPL BioAnalytical Services. Clermont, Florida

1991 - 1996: **Assistant Professor**, Weed Science. Department of Plant Pathology and Crop Physiology. Focused on weed control in rice. Louisiana State University, Baton Rouge, LA.

1989-1991: **Extension Vegetable Specialist**, Texas Agricultural Extension Service Weslaco, Texas.

1985-1989: **Graduate Assistant**, Vegetable Crops Department, Univ. of Fla. Supervisor: Dr. Sal Locascio

1984-1985: **Fulbright Scholar** to Thailand, Kasetsart University,
Bangkok, Thailand. Opium Substituted Crops Project.

1981-1984: **Research Assistant**, Pesticide Residue Laboratory, Altheimer Lab, Univ. of Arkansas. Supervisor: Dr. Terry Lavy

OTHER PROFESSIONAL TRAINING:

2002 **Sabbatical -** Environmental Protection Agency (EPA) Washington D.C. Six month training program in the Biopesticide and Pollution Prevention Division

AWARDS

2005	Arizona Cotton Growers Association –Registration Assistance for AF36.
2001	US Environmental Protection Agency – Excellence in Teamwork- Minor Use Registration2000
	Rutgers University- Team Award- Cook College

5. **CV: Jason Sandahl**

USDA Foreign Agriculture Service, Email: Jason.Sandahl@fas.usda.gov

Education

1998 – 2003 Ph.D. Environmental and Molecular Toxicology. Oregon State University, Corvallis, Oregon: Work included research of agricultural pesticides runoff and impacts native fish; laboratory water quality testing; interpretation and analysis of quantitative data in relation to water quality standards; publication of technical reports in professional scientific journals; and public outreach to present technical findings at local and international meetings.

1988 – 1993 B.S. Chemistry. Oregon State University, Corvallis, Oregon: Specialty areas included research on the chemistry of natural and agricultural products.

Work History

09/04/2005 – present **International Program Manager. U.S. Department of Agriculture / Foreign Agricultural Service, Washington DC:** I plan, develop, and coordinate international agricultural trade capacity building programs in Africa, Asia, Central and South America, and Eastern Europe by providing senior level scientific guidance. This includes the following; write and review proposals for program funding by identifying current agricultural trade and international regulatory SPS needs; plan long-term development strategies by corresponding with State Department and USDA foreign service officers, U.S. regulatory agencies, foreign governments, and U.S. industries and exporters; implement technical assistance training activities; prepare final program progress reports; manage financial agreements with U.S. funding agencies and contractor organizations; prepare briefing reports to senior staff; and ensure that programs support agency goals and objectives. Work requires inter-agency cooperation and scientific exchanges between USDA Agricultural Affairs Officers, the Environmental Protection Agency, Food and Drug Administration, U.S. Agency for International Development, U.S. Trade Representatives, and the Department of State. I regularly participate in international outreach efforts to select highly qualified candidates for agricultural capacity building programs.

The technical assistance programs aim to strengthen international compliance with the rules and regulations of the World Trade Organization (WTO) and the international standard setting bodies, such as Codex Alimentarius. Conducting this level of work has required an understanding of current international trade agreements, U.S. food safety trade policies and regulations, the roles of U.S. regulatory agencies and the U.S. Trade Representatives in international agricultural trade, and the Agency Strategic Pillars. Programs require negotiating and establishing cost-reimbursable agreements with U.S. Land Grant Universities Minority Serving Institutes, and international organizations.

Programs have required frequent international travel, working with the various international economic organizations to better understand the science-based food safety regulations and policies used in the United States. This has required analysis of U.S. and foreign government food safety policies related to international trade, and responding to new developments in trade actions, such as following and helping to progress specific free trade agreements. This also requires presenting technical programs to supervisors and senior management, describing technical assistance strategies, and selecting appropriate training providers. It also requires representing USDA at meetings and conferences with foreign government representatives and U.S. industries. To accomplish these goals, I lead project teams to implement science-based programs, developing strategic work plans and reporting results.

08/01/2004 – 05/01/2005 **Assistant Professor. University of Swaziland, Swaziland, Africa (U.S. Fulbright Scholar):** I participated in a scientific exchange program where I taught courses ranging from introductory laboratory chemistry to upper-level special topics in environmental pollution and agricultural toxicology. Research projects included investigations of heavy metals, agricultural pesticides, and contaminants in local rivers, in collaboration with local agricultural industries, including the sugarcane

growers. Biological research tested the efficacy and safety of pesticides and natural products on animals. Quantitative results and an analysis of the regulatory implications of the findings were presented to the agricultural industries, regulatory agencies, and U.S. Embassy staff, at both local meetings and in a final technical report, where I provided guidance to staff on scientific and agricultural exchange programs.

01/10/2004–
07/10/2004

Fisheries Toxicologist. Hokkaido University, Field Science Center for the Northern Biosphere, Sapporo, Japan (Post-doctoral Researcher): I participated in a scientific exchange program where I led a laboratory research project that investigated the efficacy and safety of copper, used as a chemical treatment for diseases in Japanese hatcheries, on salmon. Quantitative results and treatment options and recommendations were provided to local hatchery senior-level managers, a final technical report was published in a professional scientific journal, and the findings were presented at an international fisheries conference. The entire program involved negotiating scientific methods to be used in the study, resolving complex analytical procedures with Japanese Fisheries Agency counterparts, and resolving problems related to the interpretation of data with senior staff.

06/01/2002–
08/01/2003

Aquatic Toxicology Consultant. Labat-Anderson Inc., McLean, VA: I wrote technical sections of Risk Assessments, Proposed Actions and Alternatives, Environmental Impact Statements, and Biological Assessments that dealt with pesticides and endangered salmon. This involved a comprehensive review and analysis of technical data related to the impacts of agricultural pesticides and contaminants on endangered salmon species. I provided final report options and recommendations to the U.S. National Marine Service, the U.S. Environmental Protection Agency, and the Oregon Bureau of Land Management (BLM). As the technical expert on the issue, I also participated in public outreach and public hearings to present and defend the controversial conclusions. The entire program involved participating in highly contentious inter-agency negotiations between the BLM and the U.S. federal regulatory agencies on a very sensitive issue.

10/01/1998–
06/01/2002

Toxicology Information Specialist. National Pesticide Information Center, Oregon State University (funded by U.S. Environmental Protection Agency), Corvallis, OR: I developed and maintained a public database of pesticide toxicology information for the center. The data, which related to human and animal heath and safety, was gathered from U.S. and international government publications, scientific journals, and non-government sources. The data was screened and analyzed for scientific quality and relevance, then presented in an electronic database for rapid access. The center's telephone hotline specialists used this database to communicate sensitive toxicological information to the concerned public.

APPENDIX 7 **Logic for the residue mitigation strategy**

The table below provides pros and cons of a strategy to mitigate residues of existing registered products in comparison with developing MRLs for new products.

MRL compliance through mitigation of conventional residues with biopesticides	**Development of new product MRLs like under PG 337**
Pro: Develops a new and alternative strategy.	Con: This work is continuing anyway through cooperation with the more developed ASEAN member states and has existing funding.
Pro: Lesser-developed countries without the most modern analytical equipment can still participate in this project.	Con: Only more developed countries. There is the option of shipping samples but that is risky, very expensive and not sustainable. It also denies the lessor developed countries from the capacity building aspects.
Con: This system works with older chemistries that are mitigated, but does not progress newer and safer products. While these older chemistries might not be compatible with IPM programs, the biopesticide components are.	Con: While cooperation with manufacturers of synthetic chemistries companies is always welcome, some products would not be supported on all crops, especially minor crops. Registration of the newest products is often not supported in the least developed countries.
Pro: The mitigation of residues to meet existing MRLs does not require company approval or approval from JMPR, CODEX, or other regulatory authorities.so is more rapidly achieved.	Con: Requires company and regulatory approval. It also depends on a good synchronization with the JMPR review cycle and JMPR is overloaded. Approval by CODEX usually is adopted by the EU, but not necessarily other markets and in the end, different bodies or countries may still end up issuing a different MRL based on their own perceived dietary risk.
Pro: Older synthetic products are generally cheaper than newer products and have a broader spectrum. Con: Biopesticides tend to be more expensive but would only be required at the end of the season. This issue will also be reduced by enabling low cost local biopesticide production.	Con Developing new product MRLs means having to use products that are more expensive.
Pro: A multiple of product choices can be developed simultaneously and more rapidly.	Con: A new MRL is only developed for one active ingredient.at a time.
Con: Will require extension education efforts similar to IPM programs to get farmers to adopt these strategies. Many biopesticide companies are small companies, without the means to extensively promote their products. However, this is changing since the major manufacturers are now becoming more involved in biopesticides too. This is evident by the letters of support of major agrichemical corporations.	Pro: Once the farmer knows about the new product, adoption will be easier since the major manufacturer will help promote the use of the product.
Con: There might not be a biopesticide to control every pest, so this needs to be part of the selection process. However, once the proper PHI for the conventional is known, this strategy can be expanded.	Pro- Most pests have a conventional product to control them.
Con: For very persistent products it may not be practical to extend the harvest interval long enough to fall below the MRL.	Pro: Newer products tend to have shorter pre-harvest intervals but not all.
Pro: The world trend in new products are biopesticides and access to higher priced export	Con: This approach continues to rely on conventional chemistry. There are less new

MRL compliance through mitigation of conventional residues with biopesticides	Development of new product MRLs like under PG 337
markets would help promote adoption of biopesticides. Biopesticides are less prone to resistance so is a more sustainable approach.	conventional products coming on the market and are more prone to resistance problems.
Pro: Use of biopesticides during the later flowering and fruiting stages would be more beneficial to pollinators.	Con: Some conventional products first thought to be environmentally friendly such as the neonicitoids have come under increased restrictions due to pollinator concerns.

One of the aforementioned purpose of this project is to enable a strategy that countries that do not have more sophisticated analytical equipment to implement a *long-term, sustainable process* for meeting export markets the best and in some cases, the only way to accomplish this is by developing a mitigation strategy. **Hence, Option 1 for residue mitigation was selected for this project**.

APPENDIX 8 Additional details on Residue Mitigation Strategies for Each Crop Residue Trade Issue

Chili Pepper: For Chili Pepper, residue decline studies will be conducted in Malaysia, Sri Lanka, Thailand and Indonesia. There are problems with residues of Imidacloprid, acephate, abamectin, fipronil, profenophos, methomyl, diazinon, chlorpyrifos, acetamiprid, prochloraz, amitraz. Most of these pesticides do have MRLs. Therefore, decline studies will be conducted on all eleven active ingredients to understand the relationship between days from last application to harvest and residue levels. Based off these studies, a risk analysis profile will be established. Depending on the length of time required to reach acceptable MRLs a subset will be selected. Selection will be based on those that have a dissipation rate conducive to mitigation. As a benchmark, the target goal will be that they can attain a level below the MRL within 35 days. A subsequent study will be a residue decline study coupled with the inclusion of biopesticides to help manage the late season pests. The table below provides target pests for Chili Pepper and biocontrol alternatives for pest control.

Table 4: Target pests for Chili Peppers and biocontrol alternatives

Target pests for Chili Pepper	**Biocontrol alternatives for pest control and end of season residue mitigation**
Thrips	*Beauveria bassiana*, capsaicin oleoresin with canola oil, mineral oil, sticky traps with lures
Aphids	*Beauveria bassiana* sticky traps, mineral oil, potassium salts of fatty acids, *Burkholderia spp*., *Isaria fumosorosea*
Whitefly	*Beauveria bassiana*, capsaicin oleoresin with canola oil, sticky traps, *Encarsia formosa*

Greens: For greens, residue decline studies will be conducted in Bangladesh-and Nepal There are problems with residues of acetamiprid, imidacloprid and malathion. Most of these pesticides do have MRLs. Therefore, decline studies will be conducted on all three active ingredients to understand the relationship between days from last application to harvest and residue levels. Based off these studies, a risk analysis profile will be established. Depending on the length of time required to reach acceptable MRLs a subset will be selected. Selection will be based on those that have a dissipation rate conducive to mitigation. As a benchmark, the target goal will be that they can attain a level below the MRL within 35 days. A subsequent study will be a residue decline study coupled with the inclusion of biopesticides to help manage the late season pests. For greens, there is an important difference between the situation in Bangladesh and Nepal. In Bangladesh, the greens are grown for their leaves. In Nepal, the mustard oil is grown for its greens and oil. In addition, the flowers are an important source of pollen and nectar for honeybees. Therefore, the contamination of these pesticides in honey will also be studied. Honeybee hives will be placed in treated fields treated at different number of days after application and the residues in honey will be tested. As such, in relation to Nepal the table below shows MRLs under consideration.

Table 5: MRLs under consideration for Nepal

MUSTARD SEED(OILSEED)								
	India	US	EU	China	HK	Taiwan	Japan	Korea
Imidacloprid	0.01	0.05	0.05	-	0.05	-	5	0.01
Malathion	-	-	-	-	-	-	-	-
Spinosad	0.01	0.02	0.02	-	-	-	10	0.01
HONEY								
	India	US	EU	China	HK	Taiwan	Japan	Korea
Imidacloprid	-	-	-	-	-	-	-	-
Malathion	--	-	-	-	-	-	-	-
Spinosad	0.01	0.02	0.05	-	-	-	0.01	0.01

Imidacloprid has a few MRLs in mustard seed oil but not honey. Malathion does not have MRLs in either crop. India is a key market and Nepal's crop often passes through India and is resold. Spinosad is a biochemical product originally from a microorganism. It has some MRLs in both Mustard seed oil and honey. In addition, it tends to degrade rapidly, therefore is a logical choice to at least partially mitigate residues. Studies will be conducted using these pesticides and mitigated as needed with biopesticides. The table below provides target pests for greens and biocontrol alternatives for pest control.

Table 6: Target pests for greens and biocontrol alternatives

Target pests for greens	Biocontrol alternatives for pest control and end of season residue mitigation
Aphids	*Beauveria bassiana* sticky traps, mineral oil, potassium salts of fatty acids, *Burkholderia spp*., *Isaria fumosorosea*
Whitefly	*Beauveria bassiana*, capsaicin oleoresin with canola oil, sticky traps, *Encarsia formosa*
Grasshopper	*Beauveria bassiana, Metarhizium anisopliae*
Diamondback moth	*Bacillus thuringiensis kurstaki*

Basil: For basil, **r**esidue decline studies will be conducted in Laos and Cambodia. There are residue problems with chlorpyrifos and cypermethrin that impact trade. Currently there are no MRLs for either pesticide. There are 2 approaches to overcoming these trade issues. The US has similar needs and IR-4 has just completed residue studies involving cypermethrin on fresh and dried basil. The IR-4 data and data combined under this project could be combined to pursue a new CODEX MRL. For chlorpyrifos, residues could be mitigated with spinosad. Additional biopesticides could be utilized for mitigation if there are pests that spinosad does not control. The table below provides target pests for basil and biocontrol alternatives for pest control.

Table 7: Target pests for basil and biocontrol alternatives

Target pests for basil	Biocontrol alternatives for pest control and end of season residue mitigation
Aphids	*Beauveria bassiana* sticky traps, mineral oil, potassium salts of fatty acids, *Burkholderia spp*., *Isaria fumosorosea*
Whitefly	*Beauveria bassiana*, capsaicin oleoresin with canola oil, sticky traps, *Encarsia formosa*

Dragon fruit: For dragon fruit, residue decline studies will be conducted in Vietnam. There are problems with residues of metalaxyl, hexaconazole and propiconazole. This is situation type II since there are no MRLs on dragon fruit for any of these three pesticides. Azoxystrobin will be utilized for management of anthracnose. Therefore, decline studies will be conducted on all four active ingredients (metalaxyl, hexaconazole, propiconazole and azoxystobin) to understand the relationship between days from last application to harvest and residue levels. Based off of these studies, a risk analysis profile will be established. Azoxystrobin will be used in efficacy studies and anthracnose control will be supplemented with biopesticides to mitigate azoxystrobin residues. The table below provides target pests for dragon fruit and biocontrol alternatives for pest control.

Table 8: Target pests for dragon fruit and biocontrol alternatives

Target pests for dragon fruit	Biocontrol alternatives for pest control and end of season residue mitigation
Bipolaris	*Bacillus subtilis, Bacillus amyloliquefaciens*
Anthracnose	*Bacillus subtilis, Potassium bicarbonate*

Rice: For rice, residue decline studies will be conducted in Cambodia. Tricyclazole is also a residue problem in Vietnam and there are no international MRLs for tricyclazole in rice. Azoxystrobin does have MRLs and will be utilized as a late season treatment. In addition, blast incidence can be reduced through the application of silicates. A commercial product containing potassium silicate is available. If possible, the organism Bacillus amyloliquefaciens strain D747 may be included if needed. The use of B. amyloliquefaciens would depend on the ability to utilize this product for research purposes. It is already registered for management of rice blast in the US. The table below provides target pests for dragon fruit and biocontrol alternatives for pest control.

Table 9: Target pests for rice and biocontrol alternatives

Target pests for rice	Biocontrol alternatives for pest control and end of season residue mitigation
Panicle blast	Potassium silicate *and Bacillus amyloliquefaciens*

APPENDIX 9. Environmental Impact Quotient

The following is from: Environmental Impact Quotient: "A Method to Measure the Environmental Impact of Pesticides." The formula for determining the EIQ value of individual pesticides is listed below and is the average of the farmer, consumer, and ecological components

EIQ={C[(DT*5)+(DT*P)]+[(C*((S+P)/2)*SY)+(L)]+[(F*R)+(D*((S+P)/2)*3)+(Z*P*3)+(B*P*5)]}/3

- DT = dermal toxicity
- C = chronic toxicity
- SY = systemicity
- F = fish toxicity
- L = leaching potential
- R = surface loss potential
- D = bird toxicity
- S = soil half-life
- Z = bee toxicity
- B = beneficial arthropod toxicity
- P = plant surface half-life.