Integrated Pest Management Collaborative Research Support Program (IPM CRSP)

Pesticide Evaluation Review and Safe Use Action Plan (PERSUAP) for the IPM CRSP Southeast Asia Program

Submitted by the Management Entity of the Integrated Pest Management Collaborative Research Support Program (IPM CRSP)

on behalf of
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Table of Contents

I. Pesticide Evaluation Review ..............................................................................5
   A. Introduction ........................................................................................................ 5
   B. Program Description ............................................................................................7
   C. Southeast Asia Program Activities Requiring Pesticide Use ......................... 8
   D. Expected Benefits and Beneficiaries .................................................................10
   E. Pesticide Information ..........................................................................................10

II. Safe Use Action Plan .......................................................................................53
   A. Ensuring Safe Use .............................................................................................. 53
   B. National Pesticide Regulation ............................................................................55
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I. Pesticide Evaluation Review

A. Introduction

Activity Title: Ecologically-Based, Participatory IPM for Southeast Asia

Country/Region: Indonesia, the Philippines

Award amount: total award – $200,000/year. Indonesia host country component – approximately $48,000/year. Philippines host country component – approximately $49,000/year.

The IPM CRSP and USAID Strategic Objectives

The Integrated Pest Management Collaborative Research Support Program (IPM CRSP) is an initiative of USAID’s Bureau of Economic Growth, Agriculture, and Trade (USAID/EGAT). The overall purpose of the IPM CRSP is to develop and implement a replicable approach to IPM that will help reduce: (a) agricultural losses due to pests, (b) damage to natural ecosystems including loss of biodiversity, and (c) pollution and contamination of food and water supplies. By combining strong regional IPM programs with work on critical global cross-cutting themes, the goals of the IPM CRSP are to measurably reduce crop and animal losses due to pests, increase farmer income, reduce pesticide use, reduce residues on export crops, improve IPM research and education program capabilities, improve ability to monitor pests, and increase the ability of women in IPM decision making and program design. By reaching these goals, the results of the IPM CRSP program was designed to contribute to the Strategic Objective of the Land Resources Management Team (LRMT) of EGAT/NRM to increase the capacity of USAID and its partners to advance land resource management practices that provide long term social, economic, and environmental benefits. In 2007, the IPM CRSP was moved to EGAT’s Agriculture Technology Generation Outreach Team (EGAT/ATGO). The IPM CRSP complements the objectives of ATGO: providing assistance on the improvement of yields in crops and livestock systems for reducing production costs, increasing profits, improving nutritional quality or other consumer benefits, reducing variability in output such as those due to weather and pest attacks.

The goals of the IPM CRSP are to: 1) reduce crop and animal losses due to pests; 2) increase farmer income; 3) reduce pesticide use and substitute safer pesticides when non-pesticide alternatives cannot be found; 4) reduce pesticide residues on food; 5) improve IPM research and education program capabilities; 6) improve ability to monitor pests; and 7) increase the involvement of women in IPM decision making and program design.

In pursuing these goals, the IPM CRSP program directly contributes to the strategic objective of the Land Resources Management Team (LRMT) of EGAT/NRM to increase the capacity of USAID and its partners to advance land resource management practices that provide long-term social, economic, and environmental benefits.
The IPM CRSP has four program objectives:

1. Advance IPM science, and develop IPM technologies, information, and systems for sound land resource management;
2. Improve IPM communication and education, and the ability of beneficial practitioners to manage knowledge, resulting in widespread adaptation, adoption, and impact of ecologically-based IPM technologies, practices and systems;
3. Provide information and capacity building to reform and strengthen policies and local/national institutions that influence pest management; and
4. Develop and integrate sustainable resource-based local enterprises into national regional and global markets.

A categorical exclusion was made on May 21, 2004 covering EGAT activities related to Strategic Objective 9 “Strengthen Agriculture’s Contribution to Broad-based Economic Growth, Better Health, and Effective Natural Resources Management”. The activities of the IPM CRSP fall under SO9 as long as plant protection products are not used. Pursuant to the SO9 PERSUAP categorical exclusion, research plans that involve the use of pesticides (defined broadly) are submitted to the USAID Environment Officer in the form of an Initial Environmental Examination (IEE). Research on pesticides has been determined necessary in the course of implementing IPM CRSP activities in the program described below.

IPM is an approach to pest management in which economically rational treatment decisions are made from among environmentally sound options. Pesticides are used only when necessary, in as small a quantity as possible, and in a manner that poses the least risk to humans and the environment. IPM also considers, as much as is practical, the relationship of a pest with other crops and the relationship of a farmer’s different crops to an overall pest management strategy. Identifying economic alternatives to pesticides is a fundamental activity of each regional program.

Finding alternatives that are effective, economical, and safer than currently used pesticides is done through collaborative research with host country institutions. Most of the IPM CRSP activities do not involve pesticides. Those activities that do involve pesticides often involve comparing newer, safer pesticides with farmer common practice. In the countries where the IPM CRSP works, pesticides in common use are often older and more toxic than newer products not as widely known. Such experiments can also involve comparing biological control products such as microbial biopesticides. Research in farmers’ fields sometimes involves monitoring farmers who agree to reduce the number of their pesticide applications to test the ability of fewer applications to achieve equivalent levels of control. In such cases the IPM CRSP does not purchase pesticides. For the majority of pesticide research conducted by the IPM CRSP, experiments are conducted with small quantities of products (<5L).

Once improved IPM packages are developed by the IPM CRSP, the project undertakes technology transfer activities to promote farmer adoption.
B. Program Description

The pest management problems encountered in Southeast Asia are the result of excessive indiscriminate use of synthetic chemical pesticides to control agricultural pests. Both Indonesia and the Philippines have undertaken successful efforts to provide IPM training to farmers, but these efforts have largely focused on rice. Vegetables and other crops have much more complex pest problems than rice, and synthetic pesticide use by vegetable farmers are much more intense than for rice. Therefore, the IPM CRSP Southeast Asia program is focused on vegetable crops. Vegetable IPM is important because it can lead to beneficial economic and environmental impacts.

For example, tomato and eggplant are the top two vegetables produced in the Philippines, grown on 37,000 hectares with a total annual production of 340,000 metric tons and a value of 360 million dollars. Karo, one of the focal regions of the Southeast Asia program, is the most important agricultural area in the province of North Sumatra, Indonesia. Both vegetables and citrus produced there are important export crops to Malaysia, Singapore, Japan and other parts of Indonesia. Agriculture contributes 63% of Karo’s economic productivity of which horticulture contributes 48%. The total estimated value of vegetables from the Karo region exceeded 12 million U.S. dollars in 2003. It is estimated that 40% of the pesticides used in North Sumatra, are used in Karo.

Chemical pesticides are becoming more expensive (especially new chemistries) and add significantly to production costs. Pest resistance and elimination of natural enemies are common problems. In addition, inadequate attention to proper application and disposal techniques leads to direct health impacts on farmers and farm laborers. Contaminated water supplies endanger rural communities and downstream ecosystems. Rural social structure is affected by health problems, and the effect of agricultural chemical use on women’s roles in farming and farm communities are a significant concern. Pesticide residues present health problems for consumers and restrict marketing options, especially for potentially lucrative international trade markets. These problems are well understood and the benefits of effective IPM systems to change this pattern of behavior are well documented. With these concerns in mind, there are four technical objectives under which the Southeast Asia program activities are organized:

1. to develop IPM knowledge with smallholder farmers producing vegetables and other high-value crops in Southeast Asia;
2. to improve IPM communication and education leading to widespread adaptation, adoption, and impact of IPM approaches in Southeast Asia;
3. to enhance the capacity of Indonesian and Philippine institutions to support research and extension of IPM systems; and
4. to enhance the capability of smallholder farmers to produce and market high quality products for local, national, and international markets.

The program’s goal is to provide reliable pest management systems that do not rely on synthetic chemical pest control for vegetable farmers in the Southeast Asia region.
C. Southeast Asia Program Activities Requiring Pesticide Use

In the current workplan there are 34 discrete activities. Only 14 involve use of plant protection products. Of these 14 activities, all but one either focus on or include incorporating biopesticides to replace synthetic chemicals or attempt to solve a problem for which there are currently no satisfactory treatments.

Indonesia:

Anticipated activities in Indonesia are:

In West Java, field trials on green onion will be done in several farmers' fields. Treatments in plots of 500m² will include farmer practice and IPM practice. The IPM package includes the use of *Spodoptera exigua* Nuclear Polyhedrosis virus (SeNPV) to control *Spodoptera exigua*.

Field trials on carrots will be replicated in several farmers' fields. Treatments in plots of 500m² will include farmer practice and IPM practice. The IPM package consists of: (1) use of broccoli plant residues to control root knot nematodes and (2) application of botanical insecticides to control caterpillars and other pests.

In South Sulawesi, field studies will be carried out to control vascular streak dieback in cocoa in South Sulawesia. Field testing of clones and use of *Trichoderma* fungus to control VSD will also be part of the studies.

In North Sulawesi a team studies the relationships of mirid bugs on tomato. These will include training for the use of *Trichoderma* fungus and *Bacillus thuringiensis* (Bt) as biocontrol agents in potato.

In Karo, North Sumatra the program will conduct follow-up studies on IPM for vegetables including use of Vesicular arbuscular mycorrhizae (VAM) and *Trichoderma* fungus against soil diseases, and protein baiting for fruit fly control in citrus.

Demonstration plots will be established for shallot in Larangan, Brebes, and Central Java. These include use of SeNPV virus to control *Spodoptera exigua* (beet armyworm). The activities will be carried out by the Institute of Health and Agriculture.

Three Biotic Agents Service Posts, “Pos Pelayanan Agens Hayati” (Posyanti), have been established by local farmer groups in collaboration with scientists and graduate students from Bogor Agricultural University. These are farm-based facilities for production of biological control agents. Farmers are trained by BAU staff in proper propagation techniques. They then produce and distribute biocontrol agents to other farmers in their area. The capacity of these posts to produce SeNPV, *Trichoderma harzianum*, and *Beauveria bassiana* will be improved through their collaboration with the IPM CRSP.
Philippines:

The Philippine Rice Research Institute (PhilRice) in the Philippines and the Bogor Agricultural University in Indonesia are the implementing host country partner institutions.

In the Philippines, IPM activities at PhilRice from the previous phase of the IPM CRSP emphasized impact assessment and technology transfer. Activities include host plant resistance and grafting for management of bacterial wilt of eggplant, characterization of Ralstonia solanacearum strains from eggplant, research on management of anthracnose (Colletotrichum gleosporoides) of onion, and management of soil-borne diseases of onion in rice-based systems. Weed management research will be conducted in Central and Northern Luzon. The objectives of the weed research activities are: 1) to identify major weed problems in vegetables and rice-based cropping systems, 2) to evaluate efficacy of ecologically-based practices to manage weeds in these areas and develop sustainable and cost-effective weed management technologies in vegetables and rice-based cropping systems in participatory IPM studies; 3) to deliver and disseminate information on weed management strategies to farmers in various cropping systems (including rice-based systems); and 4) to train farmers and extension workers on various weed management strategies developed through ongoing and previous IPM CRSP weed research.

In the Philippines on-station screening of potential component technologies to manage pests in tomato and eggplant are planned. The IPM CRSP will continue to conduct demonstrations of IPM and organic agriculture at the University of the Philippines Los Baños, agri-park.

PhilRice will conduct bioefficacy tests for more entomophagous fungi or bacteria against flea beetles and other problem insect pests.

In Nueva Ecija and Nueva Viscaya, the program will conduct Farmer Field Schools (FFS) for onion and eggplant as well as collaborate with local and provincial governments to expand information on IPM in the region. The onion work will focus on mass production and use of VAM and Trichoderma.

Also in Nueva Viscaya, the IPM CRSP team at PhilRice will: 1) study the effect of no-tillage and rice straw mulch on natural enemies and insect pests of leaf onion; 2) survey larval parasitoids of leaf miners on vegetables and weeds; 3) investigate improved management of the tomato fruitworm, Heliothis armigera, using pheromone traps; 4) study improved management of whiteflies in rice-based dry-season vegetable systems; 5) assess the feasibility of the local, artisanal commercialization of VAM and Trichoderma and; 6) develop storage techniques for multiplier onion.
D. Expected Benefits and Beneficiaries

The Southeast Asia program is a farmer-centered program with research done on demonstration plots and farmer fields rather than on research stations. This approach follows the tradition of pest management research in Indonesia, where the Farmer Field School (FFS) approach was pioneered by The UN Food and Agriculture Organization (FAO). In the Philippines, PhilRice has been doing participatory farm-based research since its earliest work in the first phase of the IPM CRSP.

A focus on field-level phenomena provides the most realistic environment to understand pest relationships to local ecology and the most robust means of testing whether proposed improvements actually work. Under an FFS model and with the IPM CRSP focus on on-farm research, the farmer is in direct contact with researchers. She or he receives benefits directly from the knowledge generated. Larger populations of farmers benefit from improved pest management as research results move to the technology transfer phase.

Research activities are designed to improve the pest management outcomes while reducing synthetic chemical use whenever possible. Higher incomes and reduced risk of environmental damage are benefits of the research agenda put forth by the IPM CRSP Southeast Asia program.

E. Pesticide Information.

Table 1 presents the plant protection products that are proposed for use during the project. The table distinguishes how a product will be used (research or extension recommendation), whether the product will be purchased or produced using IPM CRSP funds, as well as an approximation of how much of each material will be used in a year. Detailed descriptions of each product are presented in Section E. The pesticides described in Table 1, designated for comparison, were selected because they are widely used by vegetable farmers in Indonesia.

Table 2 presents the plant protection products in accordance to their Re-Entry Interval in hours, the Post-Harvest Interval in days, and the Resistance Class.
<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Product</th>
<th>Research justification</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insect Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bacillus thuringiensis</em> (Bt)</td>
<td>Bt</td>
<td>I</td>
<td>Indonesia</td>
</tr>
<tr>
<td>cartap hydrochloride</td>
<td>Padan 50SP</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td>chlorpyrifos</td>
<td>Dursban 20EC</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td>cypermethrin</td>
<td>Ripcord 5EC</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td>deltamethrin</td>
<td>Decis 2.5EC</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td>emamectin benzoate</td>
<td>Proclaim 5SG</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td>nuclear polyhedrosis virus (seNPV)</td>
<td>Nuclear polyhedrosis virus (seNPV)</td>
<td>I</td>
<td>Philippines, Indonesia</td>
</tr>
<tr>
<td>profenofos</td>
<td>Curacron 500 EC</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td>sex pheromones</td>
<td>Sex pheromones of <em>Spodoptera litura</em>, <em>S. exigua</em>, <em>Helicoverpa armigera</em> and <em>Leucinodes orbonalis</em></td>
<td>I</td>
<td>Philippines</td>
</tr>
<tr>
<td>rotenone (<em>tephrosia extract</em>)</td>
<td></td>
<td>I</td>
<td>Indonesia</td>
</tr>
<tr>
<td><em>Toona surani</em> extract</td>
<td></td>
<td>I</td>
<td>Indonesia</td>
</tr>
<tr>
<td>λ-cyhalothrin</td>
<td>Matador 25 EC</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td><strong>Disease Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bacillus subtilis</em></td>
<td></td>
<td>I</td>
<td>Indonesia, Philippines</td>
</tr>
<tr>
<td>mancozeb</td>
<td>Dithane</td>
<td>C</td>
<td>Philippines, Indonesia</td>
</tr>
<tr>
<td>propineb</td>
<td>Antracol 70WP</td>
<td>C</td>
<td>Indonesia</td>
</tr>
<tr>
<td><em>Pseudomonas fluorescens</em></td>
<td></td>
<td>I</td>
<td>Indonesia, Philippines</td>
</tr>
<tr>
<td><em>Trichoderma spp.</em></td>
<td>T5 IPM CRSP isolate in Philippines</td>
<td>I</td>
<td>Philippines, Indonesia</td>
</tr>
<tr>
<td>vesicular arbuscular mycorrhizae (VAM)</td>
<td></td>
<td>I</td>
<td>Philippines</td>
</tr>
<tr>
<td><strong>Weed Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glyphosate</td>
<td>Round Up</td>
<td>plant maintenance</td>
<td>Philippines, Indonesia</td>
</tr>
</tbody>
</table>
Table 2. Pesticides Proposed for the IPM CRSP Southeast Asia Research and Extension Activities.

<table>
<thead>
<tr>
<th>Active Ingredient (Illustrative Trade Names)</th>
<th>Illustrative Re-entry Interval (REI) (hours)</th>
<th>Illustrative Pre-harvest interval (PHI) (days)</th>
<th>Resistance Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus subtilis</em></td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><em>Bacillus thuringiensis</em> (Bt)</td>
<td>4</td>
<td>0</td>
<td>IRAC 11B</td>
</tr>
<tr>
<td>cartap hydrochloride</td>
<td>-</td>
<td>-</td>
<td>IRAC 4C</td>
</tr>
<tr>
<td>chlorpyrifos</td>
<td>24 (certain vegetable crops)</td>
<td>Varies (for many vegetables 30 days- for onions no more than 1 application per crop.</td>
<td>IRAC 1B</td>
</tr>
<tr>
<td>cypermethrin</td>
<td>12</td>
<td>Varies (for many bulb vegetables (onions) PHI is 7 days)</td>
<td>IRAC 3</td>
</tr>
<tr>
<td>deltamethrin</td>
<td>12</td>
<td>21 days</td>
<td>IRAC 3</td>
</tr>
<tr>
<td>emamectin benzoate</td>
<td>48</td>
<td>7 days</td>
<td>IRAC 6</td>
</tr>
<tr>
<td>glyphosate</td>
<td>12</td>
<td>8 weeks</td>
<td>HRAC 9</td>
</tr>
<tr>
<td>mancozeb</td>
<td>48</td>
<td>7</td>
<td>FRAC M3</td>
</tr>
<tr>
<td>nuclear polyhedrosis virus (NPV)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>profenofos</td>
<td>72 hours where rainfall is less than 25 inches per year</td>
<td>14 days</td>
<td>IRAC 1B</td>
</tr>
<tr>
<td>propineb</td>
<td></td>
<td>3 days cucurbits, 14 days onions</td>
<td>FRAC M3</td>
</tr>
<tr>
<td><em>Pseudomonas fluorescens</em></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>rotenone (<em>Tephrosia</em> extract)</td>
<td>12</td>
<td>1 day</td>
<td>IRAC 21</td>
</tr>
<tr>
<td>sex pheromones</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><em>Toona surani</em> extract</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><em>Trichoderma spp</em></td>
<td>1 hour as foliar spray</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>vesicular arbuscular mycorrhizae (VAM)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>$\lambda$-cyhalothrin</td>
<td>24</td>
<td>up to 45 days depending on crop</td>
<td>IRAC 3</td>
</tr>
</tbody>
</table>
Unique information on each plant protection product is presented in Table 3. The letters A-L in the tables represent required information items a-l under “Pesticide Procedures” in USAID’s Environmental Compliance Procedures 216.3(b)(1). Information applicable to the program rather than particular pesticides is presented under the Safe Use Action Plan in part II of the report.

Some IPM CRSP activities are trials to replace synthetic chemical pesticides with non-chemical alternatives or reduce the frequency of use of synthetic pesticides. Some pesticides proposed for use in the project are not well fitted to an IPM program. These chemicals, because they represent farmer practice, are required as controls to compare alternatives. Pesticide use is expected to decrease among target producers as a result of IPM CRSP efforts.
Table 3. Pesticide Use list for IPM CRSP Southeast Asia Activities in Indonesia and Philippines.

**Bacillus subtilis** (rhizobacteria)

<table>
<thead>
<tr>
<th>A. The registration status of the requested pesticide (USEPA and host country).</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are several products containing <em>Bacillus subtilis</em> registered with the U.S. EPA such as Rhapsody (Registration No. 69592-19) (QST 713 strain of <em>Bacillus subtilis</em> 1.34%). <em>Bacillus subtilis</em> is a Toxicity Class III bioinsecticide with the signal word Caution and is accepted for use in organic farming. It is registered in the Philippines (Virtouso AS) and proposed for use in both Indonesia and the Philippines. <em>Bacillus subtilis</em> is not required to be registration in Indonesia because it is produced locally by farmers. Because it is not registered in the Indonesia, it is proposed for use under the experimental pesticide use permit for research purposes only.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. The basis for selection of the requested pesticide and the proposed methods of application.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus subtilis</em> is a bacterium that acts as a biological fungicide. It is a naturally occurring soil bacterium effective against fungal infections and is accepted for use in organic farming. It is not expected to have any adverse effects on nontarget organisms. It is proposed as an environmentally preferred alternative to other more toxic pest management techniques.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus subtilis</em> as a non-toxic biocontrol product that will be tested as a potential primary pest control component in an IPM program. It is a good biopesticide to be incorporated into an IPM program among a range of fungicides that will extend the disease control achieved with seed treatments, reducing the volume of fungicides applied per season. It is a possible replacement for more harmful chemical pesticides that are commonly used.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D. Proposed method or methods of application, including availability of appropriate application and safety equipment.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus subtilis</em> is proposed for use as a seedling treatment. If approved, seedlings will be dipped in the bacterial solution for four hours before planting to provide protection against foliar and soil-borne pathogens such as <em>Pythium</em>, <em>Rhizoctonia</em>, <em>Fusarium</em>, <em>Phytophthora</em>, and <em>Erysipha</em>. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, shoes and socks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E. Acute and long-term toxicological hazards and risk avoidance.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus subtilis</em> is essentially non-toxic to mammals (rat oral $LD_{50}&gt;5000$ mg/kg) (rabbit acute dermal $LD_{50} &gt;5000$ mg/kg). Direct contact with skin or eyes or through inhalation may cause slight to mild irritation. While not expected to cause any environmental or severe bodily harm, the use of personal protection equipment can eliminate possible harm to applicator. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F. The effectiveness for the proposed use.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus subtilis</em> will be tested for its effectiveness in the climate and conditions.</td>
</tr>
</tbody>
</table>
### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.

*Bacillus subtilis* provides protection against foliar and soil-borne pathogens such as *Pythium, Rhizoctonia, Fusarium, Phytophthora,* and *Erysipha.* It does not pose a risk to nontarget organisms. Tests on aquatic and terrestrial vertebrates and invertebrates indicate it is non-toxic to these organisms. It is acceptable for organic farming in the United States.

### H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.

*Bacillus subtilis* is proposed for use as a seedling treatment against foliar and soil-borne pathogens such as *Pythium, Rhizoctonia, Fusarium, Phytophthora,* and *Erysipha* in both Indonesia and the Philippines.

### I. Availability and effectiveness of other pesticides or nonchemical control methods.

*Bacillus subtilis* is the preferred nonchemical alternative to the harsher chemical pesticides.

### J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.

(See Section II B, Safe Use Action Plan)

### K. Provisions made for training of users.

(See Section II A, Safe Use Action Plan)

### L. Provisions made for monitoring the use and effectiveness.

Assessing the effectiveness of *Bacillus subtilis* is the objective of the proposed research. Monitoring will be conducted routinely by designated personnel.

### M. Mitigation of possible adverse effects.

No adverse effects are expected.

### N. Restricted Use Status.

*Bacillus subtilis* is not a U.S. EPA Restricted Use Pesticide.
**Bacillus thuringiensis** (Biobit, Novodor, Dipel, Agree, Xentari)

<table>
<thead>
<tr>
<th>A. The registration status of the requested pesticide (USEPA and host country).</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the United States there are sixteen registered formulations of <em>Bacillus thuringiensis</em> (Bt) under thirteen trade names (e.g. Biobit, Registration No. 73049-54; Dipel DF, Registration No. 73049-39; Agree WG, Registration No. 70051-47, <em>Bacillus thuringiensis</em> subspecies aizawai Strain GC-91 50%). The active ingredient is a Class IV substance but formulations can vary from Toxicity Class III to IV with the signal word Caution. In the U.S., it is accepted for organic farming and registered for many field and greenhouse vegetables and is classified with an insecticide resistance IRAC 11B. It is registered and proposed for use in Indonesia, but not in the Philippines.</td>
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<thead>
<tr>
<th>B. The basis for selection of the requested pesticide and the proposed methods of application.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bt is a naturally occurring soil bacterium used as an insecticidal biopesticide, derived from insect pathogenic bacteria. Formulations of Bt contain either whole bacteria or their crystalline endotoxin proteins. It is the variety of crystalline endotoxin proteins found within the bacteria that have insecticidal properties. Bt is a stomach insecticide and must be ingested to work. Once ingested, the crystalline proteins cause disintegration of the gut membrane, resulting in cessation of eating and eventually death. These toxins are specific to insects; they do not have a toxic mode of action on vertebrates and other invertebrates. Different strains of Bt have different host ranges, leaving other insects unaffected. Bt is a bioinsecticide commonly used to protect a variety of vegetable crops. It was selected as part of a possible replacement for Dursban 20EC (chlorpyrifos) and will also be compared to hand picking of insects to control diamondback moth (<em>Plutella xylostella</em>) and the cabbagehead caterpillar (<em>Crocidolomia binotata</em>) on cabbage and broccoli and the mirid bug in potatoes.</td>
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</tbody>
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<tr>
<th>C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Because of Bt’s narrow host range within single orders of insects, it is an ideal product to incorporate into an IPM program. Using Bt has the potential to save time spent on hand picking pest insects as well as reduce the amount of synthetic pesticides used to kill pests when hand picking is not possible. It is approved for organic farming and is practically non-toxic to humans.</td>
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</table>

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<tr>
<th>D. Proposed method or methods of application, including availability of appropriate application and safety equipment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bt is applied as a foliar spray. Because it must be ingested, it is essential that it be applied so as to obtain good coverage of the upper and lower surfaces of foliage. Bt has a REI of 4 hours. The PHI is 0 days. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>E. Acute and long-term toxicological hazards and risk avoidance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Bt poses low risk to humans (oral LD$<em>{50}$rat &gt;5000 mg/kg, dermal LD$</em>{50}$rat &gt;2000 to &gt;5000 mg/kg depending upon formulation). It has been sold since the 1960s in the United States, and has an excellent safety record. Some dry formulations can produce a dust that can be a mild respiratory irritant. Side effects with this product are mild and include slight dermal and eye irritation. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and follow all label instructions, adverse effects to people and the environment can be avoided.</td>
</tr>
</tbody>
</table>
**F. Effectiveness for the proposed use.**

*B. thuringiensis kurstaki* is effective as a stomach poison against surface feeding Lepidoptera larvae.

**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**

*B. thuringiensis* kurstaki is effective as a stomach poison against surface feeding Lepidoptera larvae.

*B. thuringiensis* has practically no bird or aquatic toxicity. It is non-toxic to honeybees (LD$_{50}$ > 0.1 mg/bee). It is accepted for use in organic farming.

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**

*B. thuringiensis* (Bt) will be used as a biocontrol agent against the mirid bug in potatoes and against the diamondback moth and cabbage-head caterpillar on cabbage and broccoli in Indonesia.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**

When conditions favor its economical use, Bt should be an insecticide of first recourse. It should be part of an IPM program based on scouting for economic significant pest populations. Cultural techniques can discourage the build-up of economically damaging populations of target organisms. Crop rotation, use of resistant varieties, and good field sanitation can also discourage pest build-up. Bt is appropriate to rotate within an insect resistance management plan.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**

(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**

(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**

Assessing the effectiveness of Bt is the purpose of this research. Monitoring will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**

No adverse effects are anticipated while using Bt.

**N. Restricted use status.**

Bt is not classified by the U.S. EPA as a Restricted Use Pesticide.
**Cartap Hydrochloride**

### A. The registration status of the requested pesticide (USEPA and host country).

Cartap hydrochloride is not registered with the U.S. EPA. It is registered in Indonesia under the trade name called Padan 50 SP (Registration No. RI. 43/10-201/T). Cartap hydrochloride was developed in Japan by Takeda Chemicals Industries and is now registered in Japan, India, Vietnam and other Asian countries. In formulation, it is a Toxicity Class II broad spectrum thiocarbamate insecticide with the signal word Warning, and has an insecticide resistance classification of IRAC 4C. Cartap hydrochloride is proposed for use in Indonesia but not in the Philippines.

### B. The basis for selection of the requested pesticide and the proposed methods of application.

Cartap hydrochloride is an acetylcholine receptor inhibitor that is used to control chewing and sucking insects at almost all stages of development on a wide range of crops. It is an effective control agent of the *Liriomyza huidobrensis* (leaf miner) on green onion farmer plots and will be compared with the use of yellow sticky traps in an IPM program on green onion farm plots.

### C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.

Cartap hydrochloride is currently used in Indonesia for the protection of green onion; it is not proposed as part of an IPM program. This research seeks to find alternatives for cartap hydrochloride that are more appropriate to IPM objectives.

### D. Proposed method or methods of application, including availability of appropriate application and safety equipment.

Cartap hydrochloride is proposed for use as a foliar spray. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

### E. Acute and long-term toxicological hazards and risk avoidance.

Cartap hydrochloride has a moderate acute toxicity (oral LD$_{50}$rat $\approx$ 250mg/kg) and a moderate to low acute dermal toxicity (acute dermal LD$_{50}$mouse >1000 mg/kg). It has an inhalation LC$_{50}$ (6h) rats > 0.54 mg/L. It does not cause irritation to skin or eyes in rabbits. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.

### F. Effectiveness for the proposed use.

Cartap hydrochloride is known to be effective against pests of green onion. It will be used in this study as a control to be compared against less toxic pest control techniques.

### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.

Cartap hydrochloride is very toxic to aquatic organisms (LC$_{50}$ *Moina macrocopa* $\approx$ 12.5 – 25 mg/L, LC$_{50}$ carp (24h) = 1.6 mg/L, LC$_{50}$ (48h) = 1.0 mg/L) and moderately toxic to honeybees. Because of its toxicity to aquatic organisms, steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to surface water or in situations favoring runoff.

### H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.

If approved, cartap hydrochloride will be used against pests of green onion in smallholder fields in Indonesia.
I. Availability and effectiveness of other pesticides or nonchemical control methods.
Cartap hydrochloride is a control against which other nonchemical control methods will be tested. If results prove other pesticides to be equal to, or more effective than cartap hydrochloride, then it will be replaced and removed from general use.

J. Requesting country's ability to regulate or control the distribution, storage, use, and disposal.
(See Section II B, Safe Use Action Plan)

K. Provisions made for training of users.
(See Section II A, Safe Use Action Plan)

L. Provisions made for monitoring the use and effectiveness.
Cartap hydrochloride is known to be effective against pests of green onion. Assessing the effectiveness of alternatives to cartap hydrochloride is the objective of this research. Monitoring will be conducted routinely by designated personnel.

M. Mitigation of possible adverse effects.
The use of personal protection equipment will help minimize applicator exposure. By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to water, or under circumstances which would favor drift, runoff, or through irrigation systems.

N. Restricted Use Status.
The cartap hydrochloride is not a U.S. EPA Restricted Use Pesticide since it is not registered by the U.S. EPA. Supplemental information source: International Program on Chemical Safety http://www.inchem.org/documents/ehc/ehc/ehc76.htm#SectionNumber:1.1
### chlorpyrifos

**A. The registration status of the requested pesticide (USEPA and host country).**

There are several formulations of chlorpyrifos registered by the U.S. EPA, such as Dursban Pro (Registration No. 62719-166; chlorpyrifos 23.5%). It is classified with an insecticide resistance of IRAC 1B and is a Toxicity Class II - III insecticide with the signal words Warning and Caution depending on the formulation. It is registered in Indonesia as Dursban 20 EC for use on vegetable and estate crops (Registration No. RI.6/5-2006/T). It is proposed for use in Indonesia, but not in the Philippines.

**B. The basis for selection of the requested pesticide and the proposed methods of application.**

Dursban 20 EC is an organophosphate. It is commonly used in Indonesia to control the diamondback moth (*Plutella xylostella*) and the cabbage cluster caterpillar (*Crocidolomia pavonana*). It works by inhibiting acetyl cholinesterase. Until 2004, chlorpyrifos was one of the most widely used agricultural and home insecticides in the United States. After review under the Food Quality Protection Act (FQPA), the EPA cancelled some commonly used chlorpyrifos registrations in June 2001 due to concern of cumulative exposure to multiple organophosphate pesticides by many routes. The decision was not based on specific acute risks of chlorpyrifos. Home use was one of the cancellations. It can now only be bought and used under the direct supervision of certified applicators.

**C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.**

Chlorpyrifos is commonly used in Indonesia for the protection of vegetable plants. It is not proposed for use as part of an IPM program. The proposed research seeks to find alternatives for chlorpyrifos that are less toxic and more appropriate to IPM objectives, and thus remove chlorpyrifos from general pest management practices in the region. Chlorpyrifos is proposed for use as a comparison with the combination of Dipel WP biopesticide (Bt formulation) plus hand picking on cabbage farm IPM plots.

**D. Proposed method or methods of application, including availability of appropriate application and safety equipment.**

Chlorpyrifos is used as a foliar spray. By ensuring that all applicators and handlers are properly trained and adhere to label information, adverse effects to people and the environment can be avoided. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, chemical resistant gloves, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

**E. Acute and long-term toxicological hazards and risk avoidance.**

Chlorpyrifos is moderately toxic to mammals (acute oral toxicity LD$_{50}$ rat $\approx$ 623 mg/kg) as a 23% concentrate. It is practically non-toxic dermally (dermal LD$_{50}$ rat $>$ 2000mg/kg). Excessive exposure may produce organophosphate type cholinesterase inhibition. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.

**F. The effectiveness for the proposed use.**

Dursban 20 EC is effective against many arthropods. Its proposed use against *Crocidolomia pavonana* is reasonable. It is commonly used in Indonesia. It is therefore a reasonable choice for efficacy comparison with new products.
G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
Chlorpyrifos is toxic to aquatic organisms (LC$_{50}$ (48h) *Daphnia* = 1.7 µg/L), highly toxic to fish (LC$_{50}$ (96h) bluegill sunfish 0.002-0.010, rainbow trout 0.007-0.051 mg/L) and toxic to birds (acute oral LD$_{50}$ mallard ducks = 490, house sparrows = 122, chickens 32-102 mg/kg). It is toxic to bees (oral LD$_{50}$ ≈ 360 ng/bee; contact = 70 ng/bee) and other insects. There is moderate danger of bioaccumulation. Photolysis (when the chemical is broken down by light) half-life in water is 3-4 weeks. Chlorpyrifos will not be applied near surface water to minimize exposure to aquatic organisms. Extra caution will be used when birds are present. Chlorpyrifos will not be applied near surface water to minimize exposure to aquatic organisms and extra caution will be used when birds are present.

H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
Chlorpyrifos is proposed for use against *Crocodolomia pavonana* in vegetable and estate crops in Indonesia.

I. Availability and effectiveness of other pesticides or nonchemical control methods.
Other pesticides are available. This research seeks to find effective alternate methods to control *Crocodolomia pavonana* with the intention of reducing the use of chlorpyrifos.

J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.
(See Section II B, Safe Use Action Plan)

K. Provisions made for training of users.
(See Section II A, Safe Use Action Plan)

L. Provisions made for monitoring the use and effectiveness.
Assessing the effectiveness of alternatives to chlorpyrifos is the object of this research. Monitoring will be conducted routinely by designated personnel.

M. Mitigation of possible adverse effects.
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to water, or under circumstances which would favor drift, runoff, or through irrigation systems.

N. Restricted Use Status.
Chlorpyrifos is a U.S. EPA Restricted Use Pesticide because of its broad toxicity to nontarget organisms.
**cypermethrin**

**A. The registration status of the requested pesticide (USEPA and host country).**
There are several formulations of cypermethrin registered with the U.S. EPA, such as Ammo 2.5 EC (Registration No. 279-3027-AA-5905) of Ammo (cypermethrin 30.6%). Cypermethrin is a Toxicity Class III insecticide, with the signal word Caution. It has an insecticide resistance classification of IRAC 3. It is also registered in Indonesia as the product Ripcord 5 EC (Registration No. RL.376/10-2001/T) for use on vegetable and estate crops. It is proposed for use in Indonesia, but not for use in the Philippines.

**B. The basis for selection of the requested pesticide and the proposed methods of application.**
Cypermethrin is a pyrethroid. It is a neuron disruptor that acts through the sodium channels. It is a non-systemic insecticide exhibits anti-feedant action upon contact or when ingested. It controls a wide range of insects. In this project it is proposed for use against cutworm (*Agrotis* sp.) on cabbage farmer plots. It was selected because it is a common pest control method in the host country. If approved for use it will act as a control compared with the alternative of using rice husks as a mechanical barrier to the pest in an IPM plot.

**C. Extent to which the proposed pesticide is part of an Integrated Pest Management Program.**
Cypermethrin is currently used in Indonesia for the protection of vegetables. It is not currently part of an IPM program. This research seeks to find alternatives for cypermethrin that are less toxic and more appropriate to IPM objectives, and thus remove cypermethrin from general pest management practices in the region. It is proposed for use against cutworm in cabbage field plots of Indonesia.

**D. Proposed method or methods of application, including availability of appropriate application and safety equipment.**
Cypermethrin is proposed for use as a foliar spray. By ensuring that all applicators and handlers are properly trained and adhere to all advisory information in the label, adverse effects to people and the environment can be avoided. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, chemical resistant gloves, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

**E. Acute and long-term toxicological hazards and risk avoidance.**
Cypermethrin is toxic to mammals orally (acute oral toxicity LD$_{50}$ mice $\approx$ 138 mg/kg), (LD$_{50}$ rat $\approx$ 250-4150 mg/kg). It is moderately toxic dermally (LD$_{50}$ rabbit $> 2000$ mg/kg), and practically non-toxic through inhalation (LC$_{50}$ rat $2.18$ mg/L/4h). Side effects include mild skin and eye irritation, lethargy, convulsions, and lack of coordination. Formulations contain aromatic hydrocarbons and may cause headaches, dizziness, or liver or kidney damage. The use of PPE will help alleviate the risk to the applicator. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.
F. The effectiveness for the proposed use.
Cypermethrin is effective against vegetable insect pests. Cypermethrin is toxic to cutworms, as well as other agricultural pests such as weevils, fleahoppers, armyworms, bollworms, flies, budworms, and thrips. Cabbage farmers in Indonesia currently use Ripcord 5 EC for the control of cutworm (Agrotis sp.). In this research it is proposed for use as an efficacy comparison for possible replacement with a less toxic alternative.

G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
Cypermethrin is practically non-toxic to mallard ducks (acute oral LD$_{50}$ mallard ducks > 10,000 mg/kg), but moderately toxic to chickens (chickens > 2000 mg/kg). It is highly toxic to fish (LC$_{50}$ (96h) rainbow trout ≈ 0.69 µg/L). Locating and avoiding application near surface water minimizes exposure to fish and aquatic organisms. It is highly toxic to honeybees in laboratory tests. However, if used according to the label, bees are not at risk (LD$_{50}$ (24h) (oral) ≈ 0.035 µg/bee; (topical) = 0.02 µ/bee). To minimize exposure to bees do not spray directly on bees or on blooming crops or weeds and avoid applying at the times of day when bees forage.

H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
Cypermethrin will be used to control cutworm in cabbage farm plots of Indonesia.

I. Availability and effectiveness of other pesticides or nonchemical control methods.
There are other pesticides available. This research seeks to test those alternate control methods with the intention of replacing cypermethrin and removing it from general use.

J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.
(See Section II B, Safe Use Action Plan)

K. Provisions made for training of users.
(See Section II A, Safe Use Action Plan)

L. Provisions made for monitoring the use and effectiveness.
This research seeks to test those alternate control methods with the intention of replacing cypermethrin and removing it from general use. Assessing the effectiveness of alternatives to cypermethrin is the objective of this research. Monitoring will be conducted routinely by designated personnel.

M. Mitigation of possible adverse effects.
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to water, or under circumstances which would favor drift, runoff, or through irrigation systems.

N. Restricted Use Status.
Cypermethrin is a U.S. EPA Restricted Use Pesticide due to its toxicity to fish and aquatic organisms.
### Deltamethrin (Decis 2.5 EC)

| A. The registration status of the requested pesticide (USEPA and host country). |
| Several deltamethrin products are registered with the U.S. EPA, such as Decis 0.2 EC (Registration No. 264-1007), (deltamethrin 2.86%). It has an insecticide resistance classification IRAC 3 and a Toxicity Class III with the signal word Caution. Decis 2.5 EC is a deltamethrin product registered in Indonesia for use on vegetable and estate crops (Registration No. RI.387/11-2002/T). It is proposed for use in Indonesia, but not in the Philippines. |

| B. The basis for selection of the requested pesticide and the proposed methods of application. |
| Deltamethrin is a synthetic pyrethroid that inhibits the function of sodium channels, consequently stopping nerve impulse transmission. It is a fast-acting non-systemic insecticide with contact and stomach action. It is proposed for use against black aphids (*Neotoxoptera formosana*) on green onion plants. It was chosen because it is a commonly used insecticide against black aphids on green onion plants in Indonesia. Decis 2.5 EC is proposed for used as a control in comparison with the use of detergent on IPM farm plots. |

| C. Extent to which the proposed pesticide is part of an Integrated Pest Management program. |
| Deltamethrin is a product commonly used by farmers in Indonesia for the protection of vegetables. It is not currently used by farmers as part of an IPM program. The proposed research seeks alternatives for deltamethrin that are less toxic and more appropriate to IPM objectives. |

| D. Proposed method or methods of application, including availability of appropriate application and safety equipment. |
| Deltamethrin is commonly used as a spray. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, PVC gloves, shoes and socks, and a face shield. PPE will be provided as necessary by the project for its on-station and on-farm research. |

| E. Acute and long-term toxicological hazards and risk avoidance. |
| Decis 0.2 EC is toxic to mammals orally (rat oral LD$_{50}$ > 445 mg/kg), moderately toxic dermally (LD$_{50}$ rabbits > 2000), and practically non-toxic by inhalation (LC$_{50}$ rat (4h) > 2.69 mg/L (aerosol). It is non-irritating to skin and only mildly irritating to eyes (rabbits). It is non-mutagenic and non-teratogenic (mice, rats, and rabbits). Chronic effects include neurobehavioral effects (tremors). The use of PPE will help alleviate risks. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided. |

| F. The effectiveness of the requested pesticide for the proposed use. |
| Deltamethrin is effective against economically important insects including black aphids. Indonesian farmers growing green onion commonly apply Decis 2.5 EC for the control of black aphid (*Neotoxoptera formosana*). |
**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**
While essentially non-toxic to birds (acute oral LD$_{50}$ mallard duck $>4640$ mg/kg, dietary DC$_{50}$ (8d) $>8039$ mg/kg), this product is extremely toxic to aquatic organisms such as *Daphnia* (LC$_{50}$ (48h) = 3.5 µg/L), and fish (LC$_{50}$ (96h) rainbow trout = 0.91µg/L, bluegill sunfish = 1.4 µg/L). It is also extremely toxic to bees (oral LD$_{50}$ bees = 79 ng/bee). Caution must be used to avoid direct or residual exposure to bees and avoid drift or direct application to nearby surface water in order to minimize exposure to aquatic invertebrates.

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**
Deltamethrin is proposed for use against black aphids in green onion farm plots in Indonesia.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**
Other pesticides are available. This research seeks to test those alternate control methods to reduce the amount of deltamethrin used in onion production in Indonesia, particularly in close proximity to aquatic environments.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**
(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**
(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**
Deltamethrin is effective against economically important insects including aphids. Assessing the effectiveness of alternatives to deltamethrin is the object of this research. Monitoring will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to water, or under circumstances which would favor drift, runoff, or through irrigation systems.

**N. Restricted Use Status.**
Deltamethrin is a U.S. EPA Restricted Use Pesticide due to its acute toxicity to fish and aquatic organisms.
emamectin benzoate (Proclaim 5 SG)

A. The registration status of the requested pesticide (USEPA and host country).
There are several formulations of emamectin benzoate registered by the U.S. EPA such as Proclaim 5 SG manufactured by Syngenta (5% emamectin benzoate; Registration No. 100-904). It has been given an insecticide resistance classification IRAC 6 and a Toxicity Class III with the signal word Caution. It is registered in Indonesia for use on vegetable crops such as shallot, chili pepper, cabbage, soybean, and tomatoes (Registration No. RI.1510/3-2000/T). Emamectin benzoate is proposed for use in Indonesia, but not in the Philippines.

B. The basis for selection of the requested pesticide and the proposed methods of application.
Emamectin benzoate is a compound containing emamectin B$_{1a}$ and emamectin B$_{1b}$, as their benzoate salts. It is a stomach poison with some contact toxicity. Emamectin is a synthetically altered avermectin. Avermectins are produced by the bacterium *Streptomyces avermitilis*. They disrupt chloride channels in nerve cells and are effective against arthropods and parasitic worms on vegetables. Emamectin benzoate is a non-synthetic insecticide which penetrates leaf tissues by translaminar movement. It is effective against Lepidoptera larvae such as armyworms, loopers, bollworms, and hornworms. It is also effective against mites. Proclaim 5 SG is currently used in Indonesia to control *Spodoptera exigua* on green onion farmer plots. It is proposed for comparison with the biocontrol agent SeNPV on IPM plots.

C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.
Emamectin benzoate is a product currently used by Indonesian farmers for the protection of vegetables. It is not currently used in the context of an IPM program. The proposed research seeks to find alternatives that are less toxic and more appropriate to IPM objectives such as using seNPV. The biocontrol agent NPV of *Spodoptera exigua* is naturally available among the population of *Spodoptera exigua* and presents a low-cost, environmentally-friendly alternative that farmers can collect for themselves and apply to garden plots.

D. Proposed method or methods of application, including availability of appropriate application and safety equipment.
Proclaim is used as a foliar spray in Indonesia. No more than two applications should be made sequentially. By ensuring that all applicators and handlers are properly trained and adhere to label information, adverse effects to people and the environment can be avoided. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, chemical resistant gloves, socks and chemical resistant shoes. PPE will be provided as necessary by the project for its on-station and on-farm research. Wash thoroughly with soap and water after handling.

E. Acute and long-term toxicological hazards and risk avoidance.
Emamectin benzoate has low acute oral toxicity (rat oral LD$_{50}$ ≈ 1516 mg/kg, rabbit oral LD$_{50}$>2000 mg/kg), and a low acute dermal toxicity (acute dermal LD$_{50}$ rabbits >2000 mg/kg). It also has a low inhalation toxicity (LC$_{50}$ (4h) ≈ 5mg/L). Side effects include severe eye and skin irritation. High dose chronic studies suggest emamectin benzoate causes developmental toxicology, tremors and nerve lesions, and bladder changes. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.
**F. The effectiveness of the requested pesticide for the proposed use.**
Emamectin benzoate is effective against *Spodoptera exigua* and is commonly used by farmers in Indonesia.

**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**
Emamectin benzoate is very toxic to aquatic organisms (LC$_{50}$ *Daphnia* = 0.99 µg/L) and bees. It is moderately toxic to birds (LD$_{50}$ mallard duck ≈ 46 mg/kg) and has slight acute toxicity to fish (LC$_{50}$ (96h) rainbow trout ≈ 174µg/L). Avoiding application near surface water minimizes exposure to aquatic organisms and fish. Emamectin benzoate is highly persistent but immobile in the soil and does not bioaccumulate.

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**
Emamectin benzoate will be used to control *Spodoptera exigua* in tropical small-scale vegetable fields of Indonesia.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**
This research seeks to test NPV as an alternative control method with the intention of reducing the use of emamectin benzoate.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**
(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**
(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**
This research seeks to test NPV as an alternative control method with the intention of reducing the use of emamectin benzoate. Assessing the effectiveness of NPV as an alternative to emamectin benzoate is the object of this research. Monitoring will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to water, or under circumstances which would favor drift, runoff, or through irrigation systems.

**N. Restricted Use Status.**
Proclaim is a U.S EPA Restricted Use Pesticide due to its toxicity to fish, mammals, and aquatic organisms.
**glyphosate (Round Up, Accord)**

<table>
<thead>
<tr>
<th>A. <strong>The registration status of the requested pesticide (USEPA and host country).</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>There are several formulations of glyphosate registered with the U.S. EPA. The formulation which will be used in this project is Round Up (Registration No. 524-445 (glyphosate 41%). It is a Toxicity Class III herbicide with the signal word Caution and has an herbicide resistance classification of HRAC 9. It is registered and proposed for use in the Philippines, but not for use in Indonesia.</td>
</tr>
</tbody>
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<thead>
<tr>
<th>B. <strong>The basis for selection of the requested pesticide and the proposed methods of application.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyphosate is an enolpyruvyltransferase inhibitor in WSSA Resistance Group 9. The enzyme that glyphosate inhibits, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), is unique to plants and microorganisms. Glyphosate kills plants by interfering with this enzyme’s production of amino acids. It has no activity in animals because they lack this enzyme. Therefore, glyphosate has very low toxicity to vertebrates. It is ideal for spot treatments or treating weed-infested fields prior to planting. It is the most widely used household and agricultural herbicide in the United States and one of the most commonly used herbicides in the world.</td>
</tr>
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<thead>
<tr>
<th>C. <strong>Extent to which the proposed pesticide is part of an Integrated Pest Management program.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Because of glyphosate’s low toxicity to nontarget organisms, it is compatible with an IPM program when a chemical herbicide is required. Glyphosate is commonly used in the Philippines to control weeds and is proposed for use as a weed control for vegetable plots before planting.</td>
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<tr>
<th>D. <strong>Proposed method or methods of application, including availability of appropriate application and safety equipment.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyphosate is proposed for use as a spray. It is a post-emergence herbicide effective capable of killing most broad-leaf plants and grasses. It requires deposit on foliage to function and will, therefore, kill neither ungerminated plants nor plants yet to emerge. Because it kills all plants, it cannot be broadcast sprayed when the crop plant has emerged. Whereas some crop plants can tolerate directed application using spray equipment with row hoods, this technique is not recommended for tomatoes. Therefore, spraying is useful only as spot applications or pre-plant/pre-transplant applications. Low-pressure backpack or controlled droplet ULV sprayers are appropriate for broadcast or spot treatments. In addition, contact wand applicators are appropriate for spot treatments. Glyphosate cannot be used with irrigation systems. For purple-leaf nutsedge (<em>Cyperus rotundus</em>), apply when the plant is in flower or when nutlets are beginning to form on the rhizomes. Glyphosate does not control ungerminated nutlets, so repeat spraying will be necessary to kill subsequent emerging plants. Target plants should be sprayed to wetness, not runoff. The REI is 4 hours. The PHI is 14 days. Post-harvest application must be made 30 days prior to replanting with any crop not listed on the label. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, chemical resistant gloves, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.</td>
</tr>
</tbody>
</table>
### E. Acute and long-term toxicological hazards and risk avoidance.
Glyphosate is essentially non-toxic to mammals with an acute oral LD$_{50}$ rats >5000 mg/kg and LD$_{50}$ mice >10,000, and an acute dermal LD$_{50}$rat >5000mg/kg. Four-hour inhalation toxicity LC$_{50}$rat = 5mg/L. It can be a slight eye irritant but not a skin irritant (rabbits). These values indicate that glyphosate is essentially non-toxic regardless of route of entry. Different glyphosate salts have slightly different values. Glyphosate and its formulations can be a slight skin or eye irritant. The Class II designation of some formulations in the United States is due to their ability to cause substantial, but temporary eye injury. Class III formulations are only moderately irritating to eyes. Glyphosate is not teratogenic, mutagenic or carcinogenic. There has been some research in cell culture to suggest that glyphosate might be an endocrine disruptor, but no studies have demonstrated reproductive effects in animals.

PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all advisory information in the label, adverse effects to people and the environment can be avoided. The product must be applied such that it cannot be carried into bodies of water as irrigation runoff. Tank mixes and clean-up rinsate must not enter bodies of water or be disposed of near wells.

### F. The effectiveness for the proposed use.
Glyphosate is a broad-spectrum herbicide that controls both broad-leaf plants and grasses. It is effective against purple and yellow nutsedge as well as other weeds commonly found in vegetable plots.

### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
Glyphosate is toxic to both target and nontarget vegetation. It has very low toxicity to nontarget vertebrates and invertebrates. Round Up formulations have moderate toxicity to fish and aquatic invertebrates (LC$_{50}$fish = 4 to 5.2mg/L, LC$_{50}$Daphnia = 8mg/L). Glyphosate active ingredient is essentially non-toxic to fish (LC$_{50}$fish = 86 to >1000mg/L depending upon species). Dietary tests show that glyphosate is essentially non-toxic to birds (5-days LD$_{50}$mallard, quail >4640mg/kg). Acute oral bird toxicity is also low (LC$_{50}$quail = 3851mg/kg). Formulations are essentially non-toxic to bees (LD$_{50}$ >273µg/bee) as is the active ingredient (LD$_{50}$ >100µg/bee). Glyphosate has variable residence times in soil depending upon soil conditions. Soil half-life varies from 1 to 131 days. It does not bioaccumulate and it binds readily with organic matter and therefore does not leach easily in periods of rain.

### H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
Glyphosate is proposed for use against weeds in vegetable plots in the Philippines.

### I. Availability and effectiveness of other pesticides or nonchemical control methods.
Other herbicides may be as effective as glyphosate for specific weeds. Glyphosate has activity on both broad-leaf plants and grasses while presenting a relatively low hazard compared to other broad-spectrum herbicides such as paraquat, which are too dangerous for handlers. Herbicides of different modes of action need to be rotated to avoid the development of weed resistance. Weeds should be prevented from going to seed. Cultural practices such as cultivation, hand-weeding, plastic sheeting, and drip irrigation can reduce weed competition with crop plants. Proper plant nutrition, plant spacing, and proper crop rotation also can reduce the occurrence and impact of weeds. Conversion to drip irrigation systems will prevent weed populations, reducing the need for herbicides.
| J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.  
(See Section II B, Safe Use Action Plan) |
| K. Provisions made for training of users.  
(See Section II A, Safe Use Action Plan) |
| L. Provisions made for monitoring the use and effectiveness.  
Glyphosate will be used to control weeds in experiments on other pests. In this sense it is being used as a maintenance pesticide and will not be monitored as part of ongoing research. |
| M. Mitigation of possible adverse effects.  
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. The use of PPE will help alleviate any risk to the applicator. |
| N. Restricted Use Status.  
Glyphosate is not a U.S. EPA Restricted Use Pesticide. |
**mancozeb (Dithane)**

<table>
<thead>
<tr>
<th>A. The registration status of the requested pesticide (USEPA and host country).</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are several formulations of mancozeb registered with the U.S. EPA, such as Dithane 75DF. (Registration No. 62719-402) (mancozeb 75%) and Dithane M-45 (Registration No. 62719-396). It is a Toxicity Class III pesticide with the signal word Caution. Mancozeb is registered in both the Philippines (Registration No. 260-063-2031) and Indonesia and is proposed for use in both the Philippines and Indonesia.</td>
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</tbody>
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<tr>
<th>B. The basis for selection of the requested pesticide and the proposed methods of application.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mancozeb is commonly used in the Philippines to protect tomato crops from the fungus <em>Phytophthora infestans</em>. It was selected as a control to be compared to less toxic alternatives. If those alternatives prove to be equally or more effective than mancozeb then they will be recommended for replacement.</td>
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<table>
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<tr>
<th>C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.</th>
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</thead>
<tbody>
<tr>
<td>Mancozeb is not proposed as part of an IPM program for this research. In this project, it will be compared with the use of plant growth promoting rhyzobacteria (<em>Pseudomonas flourescens</em> and <em>Bacillus subtilis</em>) on IPM plots. Mancozeb can be part of an IPM program that manages disease resistance by rotating fungicides of different chemical classes and is often used as a “last resort” chemical pesticide for periods when the pest population escalates beyond that which can be controlled by less toxic alternatives.</td>
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<tr>
<th>D. Proposed method or methods of application, including availability of appropriate application and safety equipment.</th>
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</thead>
<tbody>
<tr>
<td>Mancozeb is commonly used as a spray. By ensuring that all applicators and handlers are properly trained and adhere to all advisory information in the label, adverse effects to people and the environment can be avoided. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, chemical resistant gloves made of waterproof material, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.</td>
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<tr>
<th>E. Acute and long-term toxicological hazards and risk avoidance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mancozeb is essentially non-toxic to mammals (acute oral LD$<em>{50}$ rat &gt; 5000 mg/kg, dermal LD$</em>{50}$ rabbit &gt;5000). The use of PPE will help alleviate the risk to the applicator. Repeated exposure to mancozeb at high doses affects the thyroid, liver, and nervous system in laboratory animals. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.</td>
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<tr>
<th>F. The effectiveness for the proposed use.</th>
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</thead>
<tbody>
<tr>
<td>Mancozeb is effective against pests of tomato crops. Dithane M-45 is used to protect tomato crops from the fungus <em>Phytophthora infestans</em>. It will be compared with the use of plant growth promoting rhyzobacteria (<em>Pseudomonas flourescens</em> and <em>Bacillus subtilis</em>) on IPM plots.</td>
</tr>
</tbody>
</table>
**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**

Mancozeb is of low toxicity to the majority of non-target and beneficial arthropods. The other organisms at high risk are aquatic organisms (LC\textsubscript{50} (96h, flow-through), rainbow trout $\approx 1.0$ mg/L). It is mildly to non-toxic to birds (acute oral LD\textsubscript{50} (10d) mallard ducks $>5500$, English sparrow $>1290$ mg/kg).

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**

Mancozeb is proposed for use against fungal diseases of tomato crops in both the Philippines and Indonesia.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**

There are other pesticides available. This research seeks to test alternative control methods with the intention of supplementing mancozeb with microbial biopesticides as part of an IPM program.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**

(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**

(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**

Monitoring the use and effectiveness of alternatives to mancozeb is an essential part of this research and will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**

By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to surface water or in situations which would favor runoff.

**N. Restricted Use Status.**

Mancozeb is not a U.S. EPA Restricted Use Pesticide.
**nuclear polyhedrosis virus for *Spodoptera exigua* (SeNPV)**

**A. The registration status of the requested pesticide (USEPA and host country).**

Several nuclear polyhedrosis viruses (NPVs) are registered with the U.S. EPA including *Spodoptera exigua* nuclear polyhedrosis virus (SeNPV). SeNPV is registered as Spod-X LC (Registration No. 70051-46) (0.64% polyhedral occlusion bodies). It is a Toxicity Class III bio-pesticide with the signal word Caution. It is accepted for use in organic farming. The local production of NPV by farmers for personal use is unregulated because it is a naturally occurring substance. It is proposed for use in the Philippines and in Indonesia.

**B. The basis for selection of the requested pesticide and the proposed methods of application.**

NPVs are the most species-specific bio-control agents commonly used in IPM. seNPV is an extremely safe product that can be collected in the local environment, formulated in villages, and produced without cash investments. It is therefore an ideal product to attempt to incorporate into traditional vegetable production systems, particularly those grown by women, who often lack capital to invest in crop protection.

**C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.**

SeNPV is proposed for use as the primary element of an IPM program to control *Spodoptera exigua* (beet armyworm) on green onion and shallots. It is a good biopesticide for incorporation into an IPM program due to its narrow target and host range. It is a possible replacement for more harmful chemical pesticides.

**D. Proposed method or methods of application, including availability of appropriate application and safety equipment.**

SeNPV is used as an aqueous spray. In artisanal village-level production, infected larvae are macerated in water to release virus particles. Commercial production is done the same way, but on a larger scale. In villages, the concoction is filtered to remove insect parts that would clog sprayers, and then sprayed onto plants. The water used for maceration and mixing should be clean so as not to encourage adventitious microbial growth. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

**E. Acute and long-term toxicological hazards and risk avoidance.**

SeNPV has not demonstrated evidence of toxicity, infectivity or irritation to mammals. No allergic responses or other adverse health problems have been observed by research workers, manufacturing staff or users. These viruses are in the baculovirus virus group of double-stranded DNA viruses. They kill their target through infection and subsequent overwhelming of the insect’s genetic machinery in making more viral copies. NPVs occur naturally wherever host insects are found. They present no risk to humans, other nontarget organisms, or the environment. The viruses have an extremely narrow host range – usually species specific - with the inability to be activated by any other organism. Therefore, NPVs have no effect on nontarget insects. Because of its narrow host range NPVs pose essentially no risk to applicators and nontarget organisms.

Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.
**F. The effectiveness for the proposed use.**
NPVs are insect biopesticides that attack and kill lepidoptera larvae through ingestion. In the United States, NPVs are used against moths such as the gypsy moth (*L. dispar*), codling moth (*C. pononella*), and Indian meal moth (*P. interpunctella*). SeNPV is effective on its target lepidopteron. SeNPV is an obligate pathology of insects with a narrow host range, *Spodoptera exigua* (beet armyworm). It has been used by local farmers on vegetables. It will be tested on green onion.

**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**
SeNPV occurs in nature and is not expected to show any adverse effects on non-target organisms or on the environment. There is no risk of toxicity to fish and wildlife. The U.S. Forest Service aerially sprays gypsy moth NPV on thousands of hectares of Eastern deciduous forest each year.

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**
SeNPV is proposed for use against *Spodoptera exigua* (beet armyworm) in onion and shallots in Indonesia and the Philippines.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**
NPV is the available nonchemical alternative to the harsher chemical pesticides. It will be used in this project as a possible improvement to those other methods.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**
(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**
(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**
Monitoring the use and effectiveness of SeNPV is an essential part of this research and will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**
No adverse effects of the virus are anticipated.

**N. Restricted Use Status.**
SeNPV is not designated by the U.S. EPA as a Restricted Use Pesticide.
**profenofos (Curacron 500 EC)**

<table>
<thead>
<tr>
<th>A. The registration status of the requested pesticide (USEPA and host country).</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are several formulations of profenofos registered with the U.S. EPA, such as Curacron 8E (Registration No.100-669) (profenofos 73%) and Curacron 500 EC (Registration No. RI.381/6-2002/T). It is a Toxicity Class II insecticide with the signal word Warning and has an insecticide resistance classification of IRAC 1B. It is registered in Indonesia for use on vegetable crops such as chili pepper, mung bean, potatoes, cabbage, and tomatoes. It is proposed for use in Indonesia, but not the Philippines.</td>
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<tr>
<th>B. The basis for selection of the requested pesticide and the proposed methods of application</th>
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<tbody>
<tr>
<td>Profenofos is an organophosphate, a cholinesterase inhibitor. It is a non-systemic insecticide and acaricide with contact and stomach action and is effective against insects and mites. Indonesian farmers apply Curacron 500 EC for the control of flea beetle (<em>Phyllotreta striolata</em>) on pak-choi. In this project, it is proposed for use as a comparison with botanical pesticide (crude leaf extract of <em>Tephrosia vogelii</em> and <em>Toona sureni</em>) on IPM plots.</td>
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<tr>
<th>C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.</th>
</tr>
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<tbody>
<tr>
<td>Profenofos is commonly used in the Indonesia. It is not typically part of an IPM program. This research seeks to find alternatives to profenofos that are less toxic and more appropriate to IPM objectives.</td>
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<tr>
<th>D. Proposed method or methods of application, including availability of appropriate application and safety equipment.</th>
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</thead>
<tbody>
<tr>
<td>Profenofos is commonly used as a spray. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE (long-sleeved shirts and pants, shoes and socks). In addition to the standard PPE, chemical resistant gloves and apron should be worn when mixing profenofos. PPE will be provided as necessary by the project for its on-station and on-farm research.</td>
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<tr>
<th>E. Acute and long-term toxicological hazards and risk avoidance.</th>
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<tbody>
<tr>
<td>Profenofos is toxic to moderately toxic orally (LD$<em>{50}$ rat $\approx$358 mg/kg, LD$</em>{50}$ rabbit $\approx$700 mg/kg). It is moderately toxic dermally (LD$_{50}$ rabbit $&gt;2020$ mg/kg). Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.</td>
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<table>
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<tr>
<th>F. The effectiveness for the proposed use.</th>
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<tbody>
<tr>
<td>Profenofos is an effective insecticide/acaricide. Indonesian farmers apply Curacron 500 EC for the control of flea beetle (<em>Phyllotreta striolata</em>) on pak-choi. In this project it is proposed as a control to test the effectiveness other less-toxic alternatives.</td>
</tr>
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<tr>
<th>G. Compatibility of the proposed pesticide with target and nontarget ecosystems.</th>
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<tbody>
<tr>
<td>Profenofos is highly toxic to bees (LC$<em>{50}$ (contact, 48h) = 0.102 $\mu$g/bee), invertebrates, and fish (LC$</em>{50}$ (96h) rainbow trout = 0.08, crucian carp 0.09, bluegill sunfish = 0.3 mg/L). It is practically non-toxic to birds (LC$_{50}$ (8d) bobwhite quail 70-200, Japanese quail $&gt;1000$ ppm). Locating and avoiding application near surface water minimizes exposure to fish and aquatic organisms. To avoid exposure to bees, do not allow this product to drift to crops or weeds on which bees are foraging. Profenofos has a low bioaccumulation potential and is not persistent in soil or water.</td>
</tr>
</tbody>
</table>
**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**
Profenofos is proposed for application in pak-choi plots in Indonesia for control of the flea beetle *Phyllotreta striolata* in Indonesia.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**
There are other pesticides available. This research seeks to test those alternate control methods with the intention of replacing profenofos and removing it from general use.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**
(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**
(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**
Monitoring the use and effectiveness of profenofos in comparison to possible alternatives is an essential part of this research and will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**
By ensuring that all applicators and handlers are properly trained and through adherence to all label instructions, adverse effects can be avoided. Application and drift near surface water will not be permitted, nor situations that would favor runoff. This product will not be allowed to drift.

**N. Restricted Use Status.**
Profenafos is a U.S. EPA Restricted Use Pesticide due to its high toxicity to nontarget organisms.
### A. The registration status of the requested pesticide (USEPA and host country).
Propineb is not registered by the U.S. EPA. It is a Toxicity Class IV fungicide with the signal word Caution and is classified with a fungicide resistance of FRAC M3. Antracol 70 WP is a propineb formulation registered in Indonesia for use on vegetable and estate crops (Registration No. RI.74/4-2001/T). It is proposed for use in Indonesia, but not in the Philippines.

### B. The basis for selection of the requested pesticide and the proposed methods of application.
Propineb is a dithiocarbamate. It is a non-specific, multi-sight basic fungicide with protective action. This research seeks to find alternatives to propineb. Propineb was selected as a control to be compared with growth promoting rhizobacteria (*Pseudomonas fluorescens* and *Bacillus subtilis*) on IPM plots.

### C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.
Propineb is commonly used in Indonesia and is not proposed for use as part of an IPM program. This research seeks to find alternatives that are less toxic and more appropriate to IPM objectives and then remove it, or greatly reduce its use, from general pest management practices in the region.

### D. Proposed method or methods of application, including availability of appropriate application and safety equipment.
Propineb is applied as a dust or powder. By ensuring that all applicators and handlers are properly trained and follow label instructions, adverse effects to people and the environment can be avoided. PPE will be supplied by project managers as needed.

### E. Acute and long-term toxicological hazards and risk avoidance.
Propineb has practically no acute oral toxicity (LD$_{50}$/rat $> 5000$ mg/kg). It is practically non-toxic dermally (LD$_{50}$/rats $> 5000$ mg/kg) and moderately toxic through inhalation (LC$_{50}$/rat $> 0.7$ mg/L air (aerosol)). It is non-irritating to eyes and skin. However, this chemical causes developmental or reproductive damage. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

### F. The effectiveness for the proposed use.
Antracol 70 WP is effective against *Alternaria porri* and *Colletotrichum spp.* on green onion. It is proposed for use as a control to which possible replacement fungicides will be tested. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.

### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
Propineb is a non-specific, multi-site fungicide. It is known to be effective against the target pests. Effects on nontarget insects are unlikely; only predatory mites are sensitive. It is essentially non-toxic to birds (LD$_{50}$/Japanese quail $> 5000$ mg/kg), fish (LC$_{50}$/ (96h) for rainbow trout = 0.4 mg/L, golden orfe = 133 mg/L) and is not toxic to bees (oral LD$_{50}$/70WP, 70WG $> 70$ µg/bee). Degradation of propineb is very rapid.
H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
Propineb is proposed for use on vegetable and estate crops in Indonesia.

I. Availability and effectiveness of other pesticides or nonchemical control methods.
There are other pesticides available. This research seeks to test those alternate control methods with the intention of replacing propineb and removing it from general use.

J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.
(See Section II B, Safe Use Action Plan)

K. Provisions made for training of users.
(See Section II A, Safe Use Action Plan)

L. Provisions made for monitoring the use and effectiveness.
Monitoring the use and effectiveness of propineb is an essential part of this research and will be conducted routinely by designated personnel.

M. Mitigation of possible adverse effects.
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Treatment areas will be monitored for application according to the local label.

N. Restricted Use Status.
Propineb is not an U.S. EPA Restricted Use Pesticide because it is not registered by the U.S. EPA.
**Pseudomonas fluorescens** (Rhizobacteria)

**A. The registration status of the requested pesticide (USEPA and host country).**

*Pseudomonas fluorescens* is registered through U.S. EPA as Blightban A506 (Registration No. 64004-2-65343) (*Pseudomonas fluorescens* 71%). It is a Toxicity Class III insecticide with the signal word Caution. No registration is required in the host countries because it is produced locally by farmers. It is proposed for use in both Indonesia and the Philippines.

**B. The basis for selection of the requested pesticide and the proposed methods of application.**

*Pseudomonas fluorescens* is a gram-negative rod-shaped bacterium that reduces the growth of disease-inducing bacteria and fungi in and around plants. As a microbial biopesticide it is a desirable part of an IPM package for disease management in vegetables. It was selected because it has a low risk to humans and potential to provide extended control that might otherwise require multiple fungicide applications.

**C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.**

*Pseudomonas fluorescens* is proposed for research as a potential primary pest control agent in an IPM program. It is a possible replacement for more harmful chemical pesticides.

**D. Proposed method or methods of application, including availability of appropriate application and safety equipment.**

*Pseudomonas fluorescens* is proposed for use as a wettable powder seedling treatment. Green onion and tomato seedlings will be dipped into bacterial solution for four hours before planting. PPE will be supplied by the project as needed.

**E. Acute and long-term toxicological hazards and risk avoidance.**

*Pseudomonas fluorescens* is practically non-toxic. There are no records of allergic or other adverse effects following use of this biopesticide. While not expected to cause any environmental or bodily harm, the use of PPE is recommended as standard application equipment.

**F. The effectiveness for the proposed use.**

*Pseudomonas fluorescens* will be tested for efficacy on green onion against *Alternaria porri*, and *Colletotrichum spp.* It will also be tested on tomato against *Phytophthora infestans*.

**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**

*Pseudomonas fluorescens* occurs widely in nature and is not expected to have any adverse effects to nontarget organisms or on the environment. As a precautionary measure it should be kept out of lakes, ponds, and streams.

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**

*Pseudomonas fluorescens* will be tested for efficacy on green onion against *Alternaria porri*, and *Colletotrichum spp.* It will also be tested on tomato against *Phytophthora infestans.*
<p>| | |</p>
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</table>
| **I. Availability and effectiveness of other pesticides or nonchemical control methods.**  
*Pseudomonas fluorescens* is a possible alternative to the available synthetic chemical pesticides. |   |
| **J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**  
(See Section II B, Safe Use Action Plan) |   |
| **K. Provisions made for training of users.**  
(See Section II A, Safe Use Action Plan) |   |
| **L. Provisions made for monitoring the use and effectiveness.**  
Monitoring the use and effectiveness of *Pseudomonas fluorescens* is an essential part of this research and will be conducted routinely by designated personnel. |   |
| **M. Mitigation of possible adverse effects.**  
No adverse effects are expected. |   |
| **N. Restricted Use Status.**  
*Pseudomonas fluorescens* is not a U.S. EPA Restricted Use Pesticide. |   |
### rotenone extract of *Tephrosia vogelii*

#### A. The registration status of the requested pesticide (USEPA and host country).
Rotenone is a commonly used piscicide in the United States (Prentox U.S. EPA Registration No. 655-691). It was registered by the U.S. EPA in 1988 for many uses including the management of fleas on dogs and cats in households and was often used by organic growers, but there are no certified organic uses presently. Due to voluntary requests by producers to cancel registrations of rotenone products, it underwent review in 2007. On March 31, 2007, it was certified for re-registration only as a piscicide. It is a Toxicity Class I and IV insecticide with variable signal words from Danger and Poison to Caution, depending on formulation. It is proposed for use in Indonesia, but not in the Philippines.

#### B. The basis for selection of the requested pesticide and the proposed methods of application.
Rotenone is an extract from the leaves of *Tephrosia vogelii* that can be used as a powerful botanical insecticide. It is a slow acting contact and systemic poison that interferes with the electron transport system in the mitochondria. *Tephrosia* extract is a product of experimental interest by a host country institution. The IPM CRSP is proposing research that will help to formalize the experimental activities in Indonesia. It is proposed to be tested under local conditions against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.

#### C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.
Rotenone is a highly effective plant-based insecticide that works on a wide range of insect pests. It breaks down rapidly in sunlight, water, or soil. It can be an effective pest management tool when less toxic methods aren’t sufficient and re-entry time is only 12 hours, so it is a product that can be used when quick field re-entry is required.

#### D. Proposed method or methods of application, including availability of appropriate application and safety equipment.
Rotenone can be applied as a spray or a powder. Standard PPE must be worn when mixing, loading, applying, or cleaning up. PPE for this product is long-sleeved shirts and pants, chemical resistant gloves, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

#### E. Acute and long-term toxicological hazards and risk avoidance.
Rotenone is slightly toxic to moderately toxic orally, depending on sex (rat acute oral toxicity $LD_{50\ male} \approx 874\, mg/kg$, $LD_{50\ female} \approx 99.2\, mg/kg$). It is highly toxic to moderately toxic through inhalation, depending on sex (acute inhalation toxicity (4 hour) $LC_{50\ female} \approx 0.045\, mg/L$, $LC_{50\ males} \approx 0.087\, mg/L$). It is slightly toxic dermally ($LD_{50\ rabbit} > 2020\, mg/kg$). It is not an eye or skin irritant, but it is a skin sensitizer (pigs). Poisoning effects include conjunctivitis, dermatitis, sore throat, congestion, depression, and convulsions. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.

#### F. The effectiveness of the requested pesticide for the proposed use.
Rotenone is effective against mites, spiders, lice, ticks, and fish. It is proposed to be tested under local conditions against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.
G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
Rotenone is slightly toxic to birds (LD$_{50}$ mallards > 2000 mg/kg) and extremely toxic to fish (LC$_{50}$ (96h) rainbow trout = 1.9 µg/L, LD$_{50}$ bluegill sunfish = 4.9 µg/L). It is nontoxic to bees. Rotenone breaks down quickly in the soil and water and its half-life is 1-3 days. It has not been demonstrated to have carcinogenic effects on laboratory animals. This chemical is a highly active but short-lived photosensitizer. It is a non-residual pesticide. It breaks down quickly in sunlight such that evening application is recommended when possible.

H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
Rotenone will be used to manage pests on vegetable farm plots in Indonesia.

I. Availability and effectiveness of other pesticides or nonchemical control methods.
Rotenone is effective against pests of vegetable crops.

J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.
(See Section II B, Safe Use Action Plan)

K. Provisions made for training of users.
(See Section II A, Safe Use Action Plan)

L. Provisions made for monitoring the use and effectiveness.
Monitoring the use and effectiveness of rotenone is an essential part of this research and will be conducted routinely by designated personnel.

M. Mitigation of possible adverse effects.
By ensuring that all applicators and handlers are properly trained and through adherence to all label instructions, adverse effects can be avoided. Steps will be taken to avoid direct exposure to aquatic organisms by not applying directly to surface water or in situations which would favor runoff.

N. Restricted Use Status.
Rotenone is classified by the U.S. EPA as a Restricted Use Pesticide due to acute inhalation, acute oral, and aquatic toxicity.

http://www.pan-uk.org/pestnews/Actives/rotenone.htm
http://extoxnet.orst.edu/cgi-webglimpse/webglimpse.cgi?ID=1&query=rotenone&case=on
http://www.nysaes.cornell.edu/pp/resourceguide/mfs/11rotenone.php
<table>
<thead>
<tr>
<th><strong>Sex pheromones</strong></th>
<th><strong>for Spodoptera litura, Spodoptera exigua, Spodoptera armigera, and, Leucinodes orbonalis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. The registration status of the requested pesticide (USEPA and host country).</strong></td>
<td>Many sex pheromone products are registered with the U.S. EPA. Pheromones are registered under special U.S. EPA guidelines for biorational plant protection products. The target species for sex pheromones in this project—armyworm moths and leafminer flies—are not found in the United States. Thus, the specific pheromones that are used to lure them are not registered in the United States. These pheromones are not widely available in the Philippines, but are the object of research in many countries where the target species occur. They are proposed for use in the Philippines, but not for use in Indonesia.</td>
</tr>
<tr>
<td><strong>B. The basis for selection of the requested pesticide and the proposed methods of application.</strong></td>
<td>Sex pheromones have been chosen for their specificity to the target organisms, providing a means to manage insect populations without resorting to sprayed insecticides. They are considered safe for human health, the environment, and preserving invertebrate biodiversity in treated areas. Sex pheromones will be used in insect traps and lure products. Once the quantity of trapped insects reaches a predetermined threshold, other management techniques are deployed. Threshold refers to when a pest population has reached a certain level to invoke a response, such as when it might cause unacceptable economic damage to the crop.</td>
</tr>
<tr>
<td><strong>C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.</strong></td>
<td>Sex pheromones are an excellent component of an IPM program. They are attractants, not killing agents. By attracting insects to traps, they provide an effective monitoring tool of target pest populations reducing the frequency and volume of synthetic pesticides that are used.</td>
</tr>
<tr>
<td><strong>D. Proposed method or methods of application, including availability of appropriate application and safety equipment.</strong></td>
<td>Sex pheromones specific to each target insect are proposed to be incorporated into traps for monitoring and possibly for control of those various target insects. PPE will be supplied by project managers as needed.</td>
</tr>
<tr>
<td><strong>E. Acute and long-term toxicological hazards and risk avoidance.</strong></td>
<td>There are no acute and long-term toxicological hazards and risks expected when using these products.</td>
</tr>
<tr>
<td><strong>F. The effectiveness for the proposed use.</strong></td>
<td>Sex pheromones are very effective in attracting males of target species to traps. They are used to monitor pest populations or attract pests to small amounts of synthetic chemicals. In this way, they can be used as an alternate IPM method to foliar spray applications.</td>
</tr>
<tr>
<td><strong>G. Compatibility of the proposed pesticide with target and nontarget ecosystems.</strong></td>
<td>Sex pheromones are target-specific; they have no effect on nontarget organisms.</td>
</tr>
<tr>
<td><strong>H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.</strong></td>
<td>Sex pheromones will be used to attract Spodoptera litura, Spodoptera exigua, Spodoptera armigera, and Leucinodes orbonalis to insect traps in the Philippines.</td>
</tr>
<tr>
<td>I. Availability and effectiveness of other pesticides or nonchemical control methods.</td>
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<tr>
<td>Sex pheromones are not pesticides. They are male attractants that lure target pests to traps where they can be monitored or killed by synthetic pesticides. Sex pheromones are an effective monitoring tool for the target insects. As such, they can reduce the need for synthetic chemicals.</td>
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<thead>
<tr>
<th>J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.</th>
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<tr>
<td>(See Section II B, Safe Use Action Plan)</td>
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<tr>
<th>K. Provisions made for training of users.</th>
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<tr>
<td>(See Section II A, Safe Use Action Plan)</td>
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<tr>
<th>L. Provisions made for monitoring the use and effectiveness.</th>
</tr>
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<tbody>
<tr>
<td>Monitoring the use and effectiveness of sex pheromones is an essential part of this research and will be conducted routinely by designated personnel.</td>
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<tr>
<th>M. Mitigation of possible adverse effects.</th>
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<tbody>
<tr>
<td>No adverse effects are anticipated.</td>
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<thead>
<tr>
<th>N. Restricted Use Status.</th>
</tr>
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<tbody>
<tr>
<td>Sex pheromones are not pesticides and are not covered by the U.S. EPA pesticide regulations.</td>
</tr>
</tbody>
</table>
Toona sureni extract

A. The registration status of the requested pesticide (USEPA and host country).

*Toona sureni* is a tropical tree in the family *Meliaceae* native to Indonesia, tropical Asia, and China. Its local Indonesian name is suren. In the U.S. it is called blume. There are no *Toona*-based products registered by the U.S. EPA. Village-based extraction is a local activity. These extracts have not been commercialized and are thus not registered botanical pesticides in Indonesia. The active ingredient is a limonoid closely related to azadirachtin and neem oil. It is proposed for use in Indonesia, but not in the Philippines.

B. The basis for selection of the requested pesticide and the proposed methods of application.

The *Meliaceae* family is well known for their pest deterrent properties. One example is the Cedar tree. Cedarwood (*Meliaceae*) is often used to build furniture such as hope chests and dressers because its pest deterrent properties protect valuable clothing and other items. Pieces of cedar trees are hung in closets, and placed in flower beds around house foundations to repel insects. The Neem tree is also a natural pest deterrent. Neem tree seeds are placed in grain storage bins, and the leaves placed in between folds of linen for protection from bugs. These trees have natural pesticide properties because they contain limonoids. Limonoids are chemical compounds that repel insects. The limonoid from the Neem tree (*Meliaceae*) is azadirachtin. It is unknown at this time which limonoids are extracted from *Toona sureni*, which has become more popular in the host countries because of its non-toxic mode of action. It is proposed to be tested under local conditions against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.

C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.

Extract of *Toona sureni* is a natural pest deterrent. *Toona sureni* extract is from a local species being used in its native environments. It acts as a deterrent and does not have a toxic mode of action. Therefore it is a possible replacement for synthetic chemical pesticides. It is proposed to be tested against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.

D. Proposed method or methods of application, including availability of appropriate application and safety equipment.

*Toona sureni* extract will be applied either as a foliar spray or as an additive to the soil. PPE for this product is long-sleeved shirts and pants, shoes and socks. PPE will be provided as necessary by the project for its on-station and on-farm research.

E. Acute and long-term toxicological hazards and risk avoidance.

Because *Toona sureni* is not commercialized, a toxicological profile of this botanical extract is not available from labeled products or in the toxicological literature. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.

F. The effectiveness of the requested pesticide for the proposed use.

It is unknown if the extract of *Toona sureni* will be effective against the target pests. It is proposed to be tested under local conditions against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.
**G. Compatibility of the proposed pesticide with target and nontarget ecosystems.**

*Toona sureni* extract is from a local species being used according to traditional knowledge in its native environment.

**H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.**

The extract of *Toona sureni* is proposed for use against the against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.

**I. Availability and effectiveness of other pesticides or nonchemical control methods.**

Other pesticides are available; however, *Toona sureni* extract is a possible alternative method against *Phylotetra striolata* (flea beetles) on pak-choi and *Maruca vitrata* (bean pod borer) on yard-long bean.

**J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.**

(See Section II B, Safe Use Action Plan)

**K. Provisions made for training of users.**

(See Section II A, Safe Use Action Plan)

**L. Provisions made for monitoring the use and effectiveness.**

Monitoring the use and effectiveness of *Toona sureni* is an essential part of this research and will be conducted routinely by designated personnel.

**M. Mitigation of possible adverse effects.**

No adverse effects are expected.

**N. Restricted Use Status.**

Extract of *Toona sureni* is not a pesticide and is not covered by the U.S. EPA pesticide regulations.

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**References:**


http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?411839

http://www.arkat-usa.org/get-file/19735/
**Trichoderma spp.**

**A. The registration status of the requested pesticide (USEPA and host country).**
The U.S. EPA has registered several formulations and three strains of this fungal biopesticide. There are two current registrations in the U.S.: PlantShield (Registration No. 68539-4) and RootShield (Registration No. 68539-3) (Rifai strain KRL-AG2 1.15%). It is a Toxicity Class III insecticide with the signal word Caution. Registration in the host countries is not required because it is produced locally by farmers. It is proposed for use in both Indonesia and the Philippines.

**B. The basis for selection of the requested pesticide and the proposed methods of application.**
*Trichoderma spp.* is a naturally occurring soil fungus inoculated onto plant roots or in the soil to provide protection against root plant pathogens. It actively infects and parasitizes some pathogenic fungi and also excretes substances that can induce a plant’s natural defense mechanisms.

**C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.**
*Trichoderma* is a microbial biopesticide with no known adverse impacts to nontarget organisms. It is a choice of first recourse when control of root pathogenic fungi must be considered. It can be an important part of an IPM program if its mass production is successful and effective at the farm level. It can be used in vegetable crops to control the commonly occurring species of *Fusarium*, *Rhizoctonia*, and *Pythium*, and root-knot nematodes.

**D. Proposed method or methods of application, including availability of appropriate application and safety equipment.**
*Trichoderma* can be applied to soil, seeds, or seedlings as a drench or in-furrow application in the field, greenhouse, or nursery. In this project it is proposed for use as a mixture with compost. The formulation is a granule or powder. The drench is applied dry to soil; but the granular formation is applied as an aqueous suspension that requires tank agitation. *Trichoderma* is compatible with drip irrigation systems. When seed diseases or seedling rot is expected in the field, chemical fungicides are preferred for initial control, with *Trichoderma* used for long-term control after seedling establishment. There is a 0-day REI and 0-day PHI. Because *Trichoderma* is itself, a fungus, fungicides used on the same crop should be selected from those that are designated as compatible on the label. *Trichoderma* poses little risk to applicators. Nevertheless, standard PPE should be worn.

**E. Acute and long-term toxicological hazards and risk avoidance.**
*Trichoderma* is non-infectious and non-pathogenic to mammals. It is moderately toxic orally (acute oral LD$_{50}$ rats $>500$ mg/kg). It is moderately toxic through inhalation (acute inhalation toxicity LC$_{50}$ rats $>0.89$ mg/L). No adverse affects from *Trichoderma* have been reported to the U.S. EPA. Experiments with lab animals did not achieve toxic levels for acute oral and acute inhalation toxicity. Dermal toxicity tests were waived based on reports on worker exposure giving it a default Toxicity Class of III (U.S. EPA, April 2007. *Trichoderma* Species Review Document: Final Review).

The active ingredient is a Toxicity Class IV for acute oral toxicity and acute inhalation toxicity. It is Toxicity Class III for dermal toxicity and skin irritation (U.S. EPA, April 2007. *Trichoderma* Species Review Document: Final Review) Both are labeled with the signal word Caution. PPE should be worn when mixing, loading, and applying any product and will be supplied by the project as needed.
### F. Effectiveness for the proposed use.

*Trichoderma* will be tested against club root disease on broccoli and pak-choi. It is known to be effective against soil pathogens. Strain T-22 is effective against diseases such as *Pythium*, *Rhizoctonia*, *Fusarium*, *Cylindrocladium*, and *Thielaviopsis*. It is also effective against *Botrytis* rots when applied as a foliar spray in greenhouses. *T. harzianum* ATCC2476 is used against fungi that infect tree pruning wounds, *T. harzianum* T-39 against gray mold (*Botrytis cinerea*) on foliage in greenhouses.

### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.

*Trichoderma* has no impact on vertebrates, invertebrates or plants (U.S. EPA, April 2007. *Trichoderma* Species Review Document: Final Review). It is essentially non-toxic to birds (LD$_{50}$ mallard ducks $>2000$ mg/kg). No adverse nontarget effects are anticipated by the use of this biopesticide. The fungus can stimulate root growth in plants and increase their efficiency in nutrient absorption. It is non-toxic to honeybees by oral administration at 1000ppm and is certified for organic farming.

### H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.

*Trichoderma* is proposed for use against fungal diseases of onions in the Philippines and potatoes in Indonesia.

### I. Availability and effectiveness of other pesticides or nonchemical control methods.

Chemical fungicides may be effective against diseases controlled by *Trichoderma*. Being a biopesticide of extremely low risk and being a product that can provide long-term control of soil diseases, *Trichoderma* is a preferred product.

### J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.

(See Section II B, Safe Use Action Plan)

### K. Provisions made for training of users.

(See Section II A, Safe Use Action Plan)

### L. Provisions made for monitoring the use and effectiveness.

Monitoring the use and effectiveness of *Trichoderma* is an essential part of this research and will be conducted routinely by designated personnel.

### M. Mitigation of possible adverse effects.

No adverse effects are expected.

### N. Restricted Use Status.

*Trichoderma* is not a pesticide and is not covered by the U.S. EPA pesticide regulations.

Reference: *EPA biopesticide factsheets via http://www.epa.gov/pesticides/biopesticides/ingredients/index.htm*  
*USEPA label and MSDS via http://www.cdms.net/LabelsMSds/LMDefault.aspx?*
## Vesicular arbuscular mycorrhizae (VAM)

### A. The registration status of the requested pesticide (USEPA and host country).
Several vesicular arbuscular mycorrhizal fungi products are produced in the United States such as Mycormax (U.S. EPA Registration No. 0226-D-A-1). It is considered Toxicity Class IV due to possible skin irritation with the signal word Caution. It is proposed for use in the Philippines, but not for use in Indonesia.

### B. The basis for selection of the requested pesticide and the proposed methods of application.
Vesicular arbusular mycorrhizae (VAM) is a fungus which, when attached to plants, exhibits varied resistance toward soil-borne and foliar pathogens (exclusion of pathogens, lignifications of plant cell walls, change phosphate nutrition resulting in altered root exudation, and the formation of inhibitory low molecular weight compounds). VAM is a non-pathogenic plant mutualist, which is used as a biological inoculate or a soil amendment and does not have a toxic mode of action.

### C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.
VAM is an important part of an IPM program. It strengthens the plants own defenses against pests consequently reducing the need for harsher chemical pesticides. In the Philippines this research will test the feasibility of the local, artisanal commercialization of VAM for growing onions.

### D. Proposed method or methods of application, including availability of appropriate application and safety equipment.
Mycormax is an off-white powder that often comes in easily applicable pouches. Vesicular arbuscular mycorrhizal fungi are non-hazardous and not expected to cause any environmental or bodily harm. However, the use of PPE is recommended as standard application equipment.

### E. Acute and long-term toxicological hazards and risk avoidance.
Vesicular arbuscular mycorrhizal fungi are essentially non-toxic. They may possibly cause skin irritation and should be used according to label instructions. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.

### F. The effectiveness for the proposed use.
VAM is an effective soil inoculate that protects against soil pathogens. It is approved for organic farming and essentially non-toxic.

### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
VAM fungi control soil- and foliar-borne diseases. There is no risk of toxicity to fish and/or wildlife. The formulation may be rendered ineffective with high rates of phosphorous fertilizer, if combined with fungicides, soil fumigants, aqueous ammonia, phosphoric acid, sulfuric acid, or high salt content.

### H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
VAM is proposed for use in onion farm plots of the Philippines.

### I. Availability and effectiveness of other pesticides or nonchemical control methods.
VAM is a non-toxic method of improving the harvest of high value vegetables such as onions and reducing the need for toxic chemical pesticides.
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<thead>
<tr>
<th>J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.</th>
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<tr>
<td>(See Section II B, Safe Use Action Plan)</td>
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<tr>
<td>K. Provisions made for training of users.</td>
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<tr>
<td>(See Section II A, Safe Use Action Plan)</td>
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<tr>
<td>L. Provisions made for monitoring the use and effectiveness.</td>
<td>Monitoring the use and effectiveness of VAM is an essential part of this research and will be conducted routinely by designated personnel.</td>
</tr>
<tr>
<td>M. Mitigation of possible adverse effects.</td>
<td>No adverse effects are expected.</td>
</tr>
<tr>
<td>N. Restricted Use Status.</td>
<td>VAM is not a pesticide and is not covered by U.S. EPA pesticide regulations.</td>
</tr>
</tbody>
</table>

**Sources:**
### λ-cyhalothrin

**A. The registration status of the requested pesticide (USEPA and host country).**

There are several formulations of λ-cyhalothrin registered with the U.S. EPA, such as Matador 120 EC (Registration No. 24984). It is a Toxicity Class II insecticide with the signal word Warning and has an insecticide resistance classification IRAC 3. Many of the formulations that are found in the U.S. are five times more concentrated than the 25g/L formulation sold in Indonesia. Helena λ (22g/L) (Registration No. 100-1097-5905) produced by Helene Chemicals has a concentration closer to Matador 25EC with a concentration of λ-cyhalothrin at 22.8%. Matador 25 EC is registered in Indonesia for use on vegetable and estate crops such as shallot, chili pepper, corn, tomatoes, cabbage, citrus, cocoa, cotton, oil palm, black pepper, and tea (Registration No. RI. 1578/4-2001/T). It is proposed for use in Indonesia, but not for use in the Philippines.

**B. The basis for selection of the requested pesticide and the proposed methods of application.**

λ-cyhalothrin is a pyrethroid that disrupts the function of neurons by interaction with the sodium channel. It is proposed for use against the aphid (*Aphis craccivora*) and the bean pod borer, (*Maruca vitrata*) on yardlong bean. If approved it will be used as an experimental control for comparing possible IPM program alternatives of detergent and botanical pesticide respectively on IPM plots.

**C. Extent to which the proposed pesticide is part of an Integrated Pest Management program.**

λ-cyhalothrin is not currently part of an IPM program among Indonesian farmers. Its frequent use and lack of rotation with other insecticides may encourage resistance of the target pests. Matador 25 EC is currently used in Indonesia and is proposed as a control in this study to which alternatives can be compared.

**D. Proposed method or methods of application, including availability of appropriate application and safety equipment.**

λ-cyhalothrin is commonly applied as an aqueous foliar spray using backpack sprayers. PPE will be supplied by the project as needed. To minimize risk to applicators, standard PPE is required, including long-sleeved shirt and long pants, chemical-resistant gloves, shoes and socks which should be worn when mixing, loading, and applying this product. By ensuring that all applicators and handlers are properly trained and adhere to all advisory information in the label, adverse effects to people and the environment can be avoided.

**E. Acute and long-term toxicological hazards and risk avoidance.**

λ-cyhalothrin is a pyrethroid with a high acute oral toxicity (oral toxicity LD₅₀ rat ≈180 mg/kg) and a high inhalation toxicity (LC₅₀ (4h) rats ≈ 0.06 mg/L air (total particulate)). It has a slight dermal toxicity (LD₅₀ rats ≈ 632-696 mg/kg), but is not a skin sensitizer (guinea pigs). Side effects include mild skin and eye irritation. Effects of poisoning include liver and nervous system damage. Standard PPE should be worn when mixing, loading, and applying any product. By ensuring that all applicators and handlers are properly trained and adhere to all label information, adverse effects to people and the environment can be avoided.
### F. The effectiveness for the proposed use.
λ-cyhalothrin is effective against pests such as rootworms, leafhoppers, beetles and caterpillars. Farmers growing yardlong bean in Indonesia apply Matador 25 EC for the control of *Aphis craccivora* and *Maruca vitrata*.

### G. Compatibility of the proposed pesticide with target and nontarget ecosystems.
λ-cyhalothrin is highly toxic to fish (LC$_{50}$ (96h) bluegill sunfish = 0.21, rainbow trout = 0.36 µg/L) and aquatic organisms (*Daphnia* EC$_{50}$ (48h) = 0.36 µg/L), and should not be applied directly to water or to areas where surface water is present, or in intertidal areas below the mean high water mark. It should not be applied when weather conditions favor drift. It is highly toxic to bees (LD$_{50}$ (oral) = 909 ng/bee) exposed to direct treatment or residues on blooming crops or weeds. Care should be taken to apply it only when conditions are favorable.

### H. Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.
λ-cyhalothrin is proposed for use against aphids (*Aphis craccivora*) and bean pod borer (*Maruca vitrata*) on yardlong bean farmer plots in Indonesia.

### I. Availability and effectiveness of other pesticides or nonchemical control methods.
λ-cyhalothrin is a control in this study. It will be compared to other nonchemical control methods with the intentions of replacing it with the less toxic alternatives, such as detergent and botanical pesticides. For this research it is important to include λ-cyhalothrin to make this comparison.

### J. Requesting country’s ability to regulate or control the distribution, storage, use, and disposal.
(See Section II B, Safe Use Action Plan)

### K. Provisions made for training of users.
(See Section II A, Safe Use Action Plan)

### L. Provisions made for monitoring the use and effectiveness.
λ-cyhalothrin is a control in this study. It will be compared to other nonchemical control methods with the intentions of replacing it with the less toxic alternatives, such as detergent and botanical pesticides. Monitoring the use and effectiveness of λ-cyhalothrin is an essential part of this research.

### M. Mitigation of possible adverse effects.
By ensuring that all applicators and handlers are properly trained and through adherence to label instructions, adverse effects can be avoided. Applicators will avoid exposure to aquatic organisms by not applying directly to surface water or in situations which would favor runoff.

### N. Restricted Use Status.
λ-cyhalothrin is a U.S. EPA Restricted Use Pesticide due to its toxicity to fish and aquatic organisms.

Reference: USEPA label and MSDS via http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=
II. Safe Use Action Plan

A. Ensuring Safe Use

Synthetic chemical pesticides are commonly applied by vegetable farmers as often as twice a week. Pesticide safety within the Southeast Asia region is not a primary concern for most, and appropriate pesticide safety procedures are rarely followed. Safe use of pesticides is a priority in all IPM CRSP activities where they are used. In virtually all cases, the Southeast Asia program’s field activities compare and improve IPM practice to current farmer practice. An important objective of the IPM CRSP Southeast Asia program is to decrease risk to applicators, bystanders, and the environment by decreasing the quantity of chemical pesticides used or replacing chemical pesticides with biopesticides and less toxic alternatives.

To improve safety to pesticide applicators, the national IPM CRSP coordinator is developing collaboration with CropLife to plan additional training on safe use of pesticides for farmer cooperators. Until better pesticide safety education programs are established, research applications of pesticides used in IPM CRSP projects will be carried out under the supervision of trained IPM CRSP personnel.

Farmers in both the Philippines and Indonesia are the primary pesticide applicators in the on-farm research programs. They manage the demonstration fields according to guidance given by the researchers. Therefore, it is important for IPM CRSP to ensure that farmers are given proper pesticide safety training and that they have access to the appropriate safety information and Personal Protective Equipment.

The following steps will be taken to ensure Safe Use in all IPM CRSP project activities involving the use of pesticides:

1. Designated applicators and handlers will be properly trained by qualified resident scientists and are expected to follow all label instructions.

2. Restricted entry intervals and pre-harvest intervals will be respected according to label instructions.

3. Standard Personal Protective Equipment (PPE), long-sleeved shirts and pants, gloves, shoes and socks, will be required for all chemical pesticide applications in the course of IPM CRSP activities.

4. Additional PPE, such as protective eyewear and/or a respirator, will be required according to label instructions and as indicated in section D of the templates in Table 3.

5. Necessary PPE will be provided by the project as needed to ensure that applicators are properly protected.
6. Mitigation:

- To mitigate possible adverse effects to humans, all pesticide applicators will take precautionary steps such as washing hands with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet and all contaminated clothing will be removed and washed before reuse. Standard PPE (long-sleeved shirts and pants, chemical resistant gloves, shoes and socks) will be worn when mixing, loading, applying, or cleaning up.

- To mitigate possible adverse effects to the environment, all pesticide applicators will be trained in the proper use and disposal of pesticides that have the potential to adversely affect bees, aquatic organisms, birds and other wildlife, so as to minimize any danger to aquatic, terrestrial, non-target species, surface and ground water.

Neither the Philippines, nor Indonesia have strong national pesticide Safe Use programs. However, pesticide safety has been addressed in both countries.

In the Philippines, applicators intending to use Class I or II pesticides (in a classification system homologous to that of the U.S. EPA) are required to be certified by a government approved training program.

In Indonesia, IPM is an important part of government policy, which states that pesticides are only to be used as a last resort (Rianto, J. H., 2005). However, there is no national pesticide applicator certification program. Farmer Field Schools (FFS) were established specifically to implement this IPM policy and are reported by the FAO to have been successful with “hundreds of thousands of farmers trained on the IPM concept and farmer's understanding on such a concept was quite high” (Rianto, J. H., 2005). (Joeli Hartono Rianto, FAO country report Indonesia 2005, http://www.fao.org/docrep/008/af340e/af340e0b.htm#bm11).

While FFS originated in Indonesia in 1989, they are also administered in the Philippines. They were first implemented by the UN Food and Agricultural Organization to promote IPM and technology transfer to local rice farmers (Luther et al., in Norton et al. 2005, Globalizing Integrated Pest management, Blackwell Publishing, Ames, Iowa, p. 159). They have since been adapted to other crops such as fruits and vegetables (Luther et al., in Norton et al. 2005) and the program has been adopted in other countries. IPM is a primary focus for many FFS and pesticide safety an important part of the curriculum. Pesticide safety courses in FFS teach pesticide applicators how and when to use appropriate protective equipment, how to interpret label instructions (including application requirements and precautions), proper storage, containers, disposal, and regulations.

While FFS are available to smallholders, many still carry out most of their own pesticide applications with very little training. Local pesticide dealers are very aggressive in their marketing; frequently offering free samples, t-shirts, hats, and other enticements to farmers to boost sales. In the context of such an environment, the IPM CRSP promotes individual
Responsibility for proper pesticide application, personal protection, and respect for the instructions on the label, minimizing pesticide use, and using less toxic materials.

B. National Pesticide Regulation

Both the Philippines and Indonesia have national pesticide registration systems which regulate importation and use of products.

**Indonesia:** Pesticide use and regulation in Indonesia falls under the Minister of Agriculture according to Government Stipulation No. 7 of 1973 (FAO, 2005). The most recent legislation enacted by the Indonesia government concerning the regulation of pesticides was the Decree on Pesticide Registration, or Ministry of Agriculture Decree No. 434.1 of 2001 (FAO, 2005). This decree includes 50 regulatory statements intended to provide basic regulations that “protect the community and environment from adverse effects due to pesticide application, promote the efficiency and effectiveness of pesticides use, and to promote the IPM concept” (FAO, 2005). Compliance with FAO/WHO standards, are required. Pesticides undergo a strict registration process and once registered are accepted as international standard.


Indonesia had relatively tight control on pesticide importation during the Suharto years, and is famous in IPM lore for a presidential ban of many rice pesticides in 1986 that resulted in a recovery of beneficial insect populations in rice fields, and ultimately, the restoration of natural control over the brown planthopper. The brown planthopper is an insect that had not been a pest until over-spraying of synthetic pesticides allowed resistant populations to escape natural predation. Shortly after the ban, the brown planthopper ceased to be a major pest. The impact on natural enemies from overusing insecticides is widely understood among rice farmers in Indonesia. Even though IPM is not widely practiced, Indonesia is a country where farmers and the government are especially accepting of an IPM message. With the current liberalized government, pesticide importation and regulation is regulated but regionally more varied in enforcement.

**Philippines:** Pesticide registration and importation in the Philippines is regulated by the Philippine Pesticide and Fertilizer Authority (PFA), established in 1977 under the Department of Agriculture (CIPRC, 2008). The commitment to the regulation of pesticides is clear with strict pesticide registration and transportation regulations stated in the Mandate (CIPRC, 2008). Practical goals of the PFA are strong, including regulation, outreach services, monitoring, a public information campaign, and crop pest infestation monitoring programs (CIPRC, 2008). While the Philippine pesticide regulation program is strong institutionally, enforcement is still lacking (Austria, 2005)

(Central Insecticides Board and Registration Committee (CIPRC), Philippine Department of Agriculture and Cooperation, 2008, http://cibrc.nic.in/cibrc_header1.htm)

The Philippine government was previously responsible for heavy pesticide subsidies that encouraged unnecessary pesticide use. Identifying and measuring the negative impact of these subsidies on farmer income and the environment was an important activity in the first two phases of the IPM CRSP.

Once pesticides have entered either country, their use is not carefully regulated. Purchase of certain particularly toxic registered products is not restricted to certified applicators in Indonesia because there is no national certification system. Professional applicators are rare.

Japan is the export destination of produce, especially fruit, from the Philippines. Regulation of pesticides and pesticide residues on fresh export produce is a responsibility actively undertaken by the national government. However, pesticide use on vegetables and fruit for local consumption or regional trade (i.e. within islands of the Philippines) is not carefully regulated. It is in this sub-sector that the IPM CRSP has worked for many years among smallholders.