INITIAL ENVIRONMENTAL EXAMINATION
SUCCESS Alliance – Vietnam Project

A. Project Data

Strategic Objective:	SO2 Regional Governance and Economic Reform
Project Name:	Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance – Dak Lak
Originating office:	USAID/RDMA Vietnam Office
Country/Region:	Vietnam
Funding Begin:	October 1, 2006
Funding End:	September 30, 2008
LOP Amount:	750,000 USD
Sub-Activity Amount:	Not applicable
IEE Prepared by:	Ross Jaax, Chief of Party, ACDI/VOCA Vietnam
Date:	July 20, 2007
IEE Amendment (Y/N):	N

Environmental Action Recommended:

Categorical Exclusion:	☒	Deferral:	☐
Positive Determination:	☐	Negative Determination:	☐
Exemption:	☐	Neg. Deter. with Conditions:	☒

B. Background and Activity Description

This supplemental project IEE was developed to provide details of activities under the Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance – Dak Lak Project in Vietnam. Specifically, it describes how each project task will be carried out and how it might affect the environment. It provides mitigation measures to ameliorate such negative impacts. In addition, Attachment 2 of this IEE provides descriptions about the Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) as pesticide may be used under Activity Task 3. This project is referenced in the amended SO-level IEE for SO2 Regional Governance and Economic Reform (ANE 07-159, approved on 09/25/07). This IEE is not an amended IEE, therefore, does not supersede the SO IEE as referenced above.

Project goals

To improve the economic well-being of smallholder cocoa farmers in Dak Lak through the growth of a socially, economically, and environmentally sustainable cocoa industry in Vietnam.

Project Objectives

PO1: Ensure cocoa agro forestry cropping systems are successfully adopted by poor and ethnic minority farmers on marginal lands, thereby resulting in reduced poverty and land degradation.

PO2: Ensure cocoa cultivation using sustainable production techniques is acceptable to farmers for intercropping with existing crops.

PO3: Develop a viable cocoa industry in the Central Highlands, based on sustainable production principles.

Project overview

Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance – Dak Lak is a project from the partnership between ACDI/VOCA and the Department of Agricultural and Rural Development of Dak Lak province (DARD/Dak Lak). The project is aiming to improve the livelihoods of the poor and ethnic minority smallholder's farmers in Dak Lak through the sustainable cocoa industry development.

The Dak Lak province is now the fifth province joining SUCCESS Alliance, which is a public-private partnership comprised of ACDI/VOCA, USAID, MARS Inc., USAD, and the World Cocoa Foundation. SUCCESS Alliance has been implementing since 2003 in four provinces, these are Ben Tre, Ba Ria Vung Tau, Tien Giang, and Binh Phuoc. Within three years, the project has successfully promoted 17,000 smallholder farmers planting more than five thousand hectares of cocoa. SUCCESS Dak Lak project will then

continue to introduce cocoa to the Central Highlands using lessons learned, experiences, and successful stories from the four provinces.

The rationale for the project is the potential outlook of global cocoa market as well as the Government support for cocoa development. As the Government focuses in poverty reduction via agricultural production and diversification, sustainable cocoa industry has been introduced to be an industry crop for exporting. The project targets in supporting 1500-1800 farming households with training and extension services in cocoa cultivation; distributing 300,000-360,000 cocoa seedlings; developing post-harvest processing methods and marketing linkage.

Description of activities

The SUCCESS Dak Lak project includes the following specific activities:

- **Task 1:** Training Cocoa Training Facilitators and farmers: selected Cocoa Training Facilitators (TFs) in target communes will receive and graduate from a training-of-trainers (TOTs) course to become the leader of cocoa clubs/cocoa training facilitators. Farmers in cocoa clubs then receive training through farmer field schools conducted by TFs; and the content of farmer field schools cover a number of topics which are designed according to the cocoa annual crop season.

- **Task 2:** Cocoa club formation and extension activities: Approximately 38-45 cocoa clubs will be formed (35-40 farmers/club). These clubs will then receive extension assistance from the TFs, extension staff, and technicians through a number of methods such as demonstration plots, farmer field schools and follow up extension.

- **Task 3:** Providing quality planting material: distribute approximately 300,000-360,000 cocoa seedlings (approx. 200 per farmer trained), and seedlings of other economic and shade perennial crops to be intercropped with cocoa.

- **Task 4:** Developing marketing systems in project areas: Activities related to this section include developing fermentation protocols with high quality cocoa bean production, promoting grading system and quality standard, establishing price information system and supporting market linkage between farmers, traders, and local and international producer and/or exporters.

- **Task 5:** Cocoa industry partners continue to work with relevant research and development institutions in the Central Highlands to improve their technical ability to support cocoa development. This will include industry training and technical assistance to conduct training of extensionists and TFs.

- **Task 6:** Industry partner activities in supporting cocoa development will be inclusive of the marginal, ethnic minority area. Project staff will coordinate with

industry consultants and partners visiting Vietnam periodically for technical assistance.

Environment Situation

SUCCESS Dak Lak will be implemented in two target districts to begin, and these are Lak and Ea' Kar. These are two of the five poorest districts in Dak Lak. In Lak district, 62% of the population is local ethnic people (2.5% Ede and 57.6% M'nong); and Ea' Kar has 10.8% Ede and 15.4% immigrant ethnic minority. The areas that are selected to develop cocoa are selected based on criteria and parameters of agronomic suitability for cocoa, suitable socio-economic conditions, and a conducive operating environment.

Cocoa will be developed in agricultural land within Lak and Ea'Kar district. The average elevation is 450-500m. The main soil type in the target areas is grey soil, or acrisols. Soils in Ea' Kar is generally higher fertility. Therefore, it is needed to improve the soil's composition through mulching and improving its nutrient level. Household farmers have on average approximately 1-1.2 ha of land to grow cocoa. The land is normally on a slight slope (10%), or in the plateau between low hills or valley. Besides growing cocoa as perennial crop, growing other plants for shade and windbreak is necessary. By doing this, the program can protect the land from soil erosion and the soil properties will be improved.

Water supply in Dak Lak is based on surface water, underground water, both of which is relatively abundant. As rainfall distribution is seasonal and not uniform, there is probability of having excessive water in rainy season and limited water in dry season. However, within the target areas, water supply for cocoa development is comparatively available from river, streams, lakes and dams. Therefore, there will not be any alternation or constraint to the water scheme within the target areas as well as Dak Lak environment as a whole.

C. <u>Discussion of Environmental Impacts</u>

a. Categorical Exclusions under 22CFR §216.2 (c)(2).

- ***Task 4: Developing marketing system in project areas*** - These activities are recommended for a categorical exclusion, as they involve meetings, training sections, and information dissemination.

- ***Task 5: Cooperate with relevant research and development institution in the Central Highlands to improve their technical ability to support cocoa development*** **-** This activity is recommended for a categorical exclusion, as it involves cooperative research, seminar, and training sections.

- ***Task 6: Industry partner activities in supporting cocoa development*** **-** These activities are recommended for a categorical exclusion, as they involve field

visits, consultancies, and training sections and they do not directly affect the environment.

b. Negative Determination with Conditions.

Some activities under Task 1, 2, and 3 may fall under the negative determination with conditions as outlined under 22CFR §216.3 (a)(2)(iii). Possible environmental impacts and mitigation and monitoring activities are discussed below.

- ***Task 1: Training Cocoa Training Facilitators and farmers*** - These activities are recommended as Negative Determination with Condition as training activities do not include activities directly affecting the environment.

The training of Cocoa Training Facilitators will be conducted by the Agriculture and Forestry Nong Lam University of Ho Chi Minh City (NLU) under the TOT program. The training of farmers will be conducted in farmer's farm within cocoa clubs in villages and will not require construction of facilities or alteration of the environment. The contents of these training include topics of cocoa cultivation such as planting, pruning, harvesting. These training activities and technical assistance, normally less than 50 participants, will consist of group discussion, activities, observation and practice on demonstration plots which less than 2 hectares and are carefully monitored. The possible environmental impacts from the adoption of agricultural practices from the training program and extension services will be assessed further under Task 2.

- ***Task 2: Cocoa club formation and extension activities*** - These activities are recommended for a negative determination with conditions. The explanations for the recommendation are provided below:

For the sustainable cocoa agro forestry cropping systems, the program will introduce cocoa to the existing intercropping farms that have been carefully surveyed and selected. Farmer households and prospective farms recruited to the program based on their land area that are suitable for cocoa planting and their commitment to follow the program best practices. <u>Therefore, the program will not involve any land clearance, habitat modification, massive irrigation, or any impacts to the forests.</u>

For the extension purpose, the program staff will establish a number of demonstration plots (demplots) and fermentaries, and drying stations that will become training venues. There, farmers can observe and gain hands-on practice. Again, demplots and fermentaries are used to demonstrate the smallholder model in husbandry practices and fermentation processes. <u>Demonstration plots and fermentary construction will not require any clearance of land or cause any potential impacts on the environment</u>.

The demonstration plots are established on existing, successful cocoa farms and are used in farmer field school sections. As the training discourages the use of pesticide, no pesticides will be used in the demplots. It is possible that farmers will be trained to

practice trunk injection of copper sulfate into the cocoa trees. This is fungicide injected directly into the cambrian layer of the tree trunk. Again farmers will be trained on the safe usage, storage and disposal of the fungicide. The farmers' application of best farming practices is spot checked and monitored regularly to make sure no adverse impacts to the environment.

The project will fund the construction of small-scale fermentation and drying stations so that farmers can receive hands-on training in post-harvest practice. For the fermentaries and drying station construction, there will be no heavy equipment, no camps for construction workers and no road expansion. These stations are very simple, household based. The operation site is less than 400 square meters and will basically consist of wooden boxes for fermentation and a drying platform made of wood or poured concrete. As the construction material will consist primarily of local, biodegradable materials, there will not be problems with toxic waste or run-off. The operating process of fermentation and drying stations also does not require water consumption and does not produce significant odors as well as polluted waste to the local water streams.

Extension officers and training facilitators are responsible for providing extension support and assistance to farmers in their clubs. These extension officers and TFs are all qualified under the TOT program. They will be trained in good crop husbandry practices. Along the project timeline, they will also continually receive training in specific cocoa topics such as pruning, disease and pest control, soil health, and harvesting methods. Farmers joining the program are not encouraged to use pesticides, and these extension officers as well as training facilitators are the key persons to monitor and assist / support farmers in combating pests and diseases through an integrated pest management system, biological controls (e.g. weaver ants and black ants), and by protecting the natural environment of their farms. As termites are a major concern for cocoa in the Central Highlands, a number of biological control methods has been investigated, but they are still considered unreliable for general use by farmers.

Farmers will only be eligible to receive cocoa seedlings if they have met the qualifications for farmer field school. Moreover, farmers will also learn environmentally sound and appropriate methods of caring for cocoa. For instance, farmers will learn to plant cocoa in an agro-forestry system, which will help to improve soil fertility and combat soil erosion, and to rationally use water for limited irrigation so as not to harm soil or water quality and availability. Farmers will also learn about fertilizing their crops with organic fertilizer and compost, and sustainably managing their farm against pests and diseases with recommended biological methods, such as Black Cocoa Ants (Dolichoderus thoracicur) and Weaver Ants (Oecephylla smaragdina).

- ***Task 3: Providing quality planting materials* -** This activity is recommended for a negative determination with conditions. The explanations for the recommendation are provided below:

The program will contract nurseries to produce cocoa seedlings, which will then be planted by farmers who have been selected to participate in the farmer field school training. Although the seedlings will be produced by commercial nurseries, rather than the program itself, the program will include environmental guidelines and best practices in the contracts.

The project is promoting farmers to diversify their crop, therefore providing an additional source of income by intercropping cocoa to the existing farm base; the development of cocoa cultivation in the project area will not involve any massive land clearing. Moreover, farmers will be selected based on a number of criteria such as land availability, suitability, and tenure as well. Each farmer will receive approximately 200 seedlings to plant in an area of 0.3-0.4 ha. There will be no intensive impact or alteration to the natural conditions.

Cocoa is an environmental friendly crop. It will not harm the forest base when planted into existing cropping systems, such as is the case in SUCCESS Alliance. Additionally, the Central Highlands conditions are determined to be suitable for cocoa. It is expected that cocoa area expansion there will have a positive impact on the environment. The cocoa plantings will be part of an agro-forestry system, which do not require massive land clearance and irrigation systems. In some target communes where there are a high percentage of ethnic minorities and marginal land, cocoa will be intercropped with other trees, and this is expected to improve the soil fertility and prevent soil erosion.

Before receiving seedlings to plant cocoa in their farms, farmers will attend farmer field schools, which cover sustainable and successful cocoa planting methods including planting trees for shade, windbreak establishment, and planting holes preparation. Besides being taught the sustainable planting methods specifically designed for cocoa, farmers planting cocoa must also follow the environmental guidelines for tree planting (see Attachment 1).

For the termite control, the training program will discourage the use of pesticides. However, as termite is a major threat to newly planted seedlings for farmers in the Central Highlands, both chemical and biological methods are introduced and taught. The training recommends farmers to use pesticide only in the planting hole to control termites for young cocoa. Farmers will receive explicit instructions in safe usage, storage and disposal of pesticide in order to combat termites and grow cocoa in an environmentally sound manner. Again, the type of pesticides permitted to be used in Vietnam and the methods of application which are recommended to farmers must meet the criteria / safety guidelines of the pesticide producer and especially the Vietnamese standards. The recommended pesticide for termite control is Confidor 100SL; see Attachment 2 for the Pesticide Evaluation Report and Safer Use Action Plan outlined under 22CFR §216.3 (b)(1). Its use will ensure there is no impact on soil, vegetation, and water sources.

Table 1: Summary of possible impacts and mitigation measures

Activities	Possible Impacts	Mitigation Measures
1. Training Cocoa Training Facilitators and farmers	Training activities do not cause significant adverse impact to the environment. There might be negative impacts if adoption of farming practices is inappropriate.	Planned mitigation measures include: ▪ Follow the monitoring and evaluation system to make sure all project activities have no environmental impact. ▪ Farmers will only be eligible to receive cocoa seedlings and extension services if they have met the qualifications for farmer field school. ▪ The curriculums for farmer field school include environmentally sound methods of caring for cocoa. ▪ Farming System Appraisal to evaluate the adoption of better crop practices and the impacts of the training programs. Environmental indicators are also included in the survey.
2. Cocoa club formation and extension activities	Cocoa farming can cause environmental impacts if cocoa clubs and farms are selected at inappropriate sites and farming does not adopt good practices. Possible impacts are over water extraction, soil degradation and erosion.	Cocoa will be introduced to existing intercropping farms; those have been surveyed and selected based on land availability, suitability and tenure. Farmers are not encouraged to use pesticide. The extension officers and TFs who are qualified under the TOT program will monitor and support farmer in pest and diseases control.

Activities	Possible Impacts	Mitigation Measures
	The establishment of demonstration plots, fermentation and drying stations will not cause impacts; there will be no heavy equipment, land clearance, or toxic waste /run-off.	Follow the guidelines to make sure all requirements are achieved. Monitor the operating of demonstration plots, ensure all best farming practices are applied and shared with other farms within the program.
3. Providing quality planting material	Nurseries providing seedlings to the program may have some impacts, such as waster run off. Cocoa area expansion will have a positive impact on the environment. Using Confidor 100SL chemical to combat termites may cause impacts to the environment and community if the application is inappropriate.	The program must include and complies with environmental guidelines and best practices in the contracts with commercial nurseries. Farmers will attend farmer field school to gain knowledge and experience and follow advised practices. Farmers will carry out detailed mitigation measures in the Pesticide Evaluation Report and Safer Use Action Plan in Attachment 2
4. Developing marketing systems in project areas	No significant adverse impact	
5. Cooperate with relevant research and development institutions in Central Highlands to improve their technical ability to support cocoa development through training and workshops	No significant adverse impact	
6. Industry partner activities in supporting cocoa development in Vietnam through consultancies and technical assistance	No significant adverse impact	

D. Recommended Environmental Action

The project of Sustainable Cocoa Enterprise Solutions for Smallholders Alliance – Dak Lak is recommended for a **Categories Exclusion** for those activities that are addressed under 22CFR §216.2 (c)(2)(i)(ii)(iii)(v), and (xiv), and for a **Negative Determination with Conditions** for those activities that may have an environmental impact under 22CFR §216.3 (a)(2)(iii) and 22CFR §216.3 (b)(1). The mitigation measures and monitoring are provided as following:

In order to ensure environmental compliance of all project activities as well as to mitigate and manage any potential negative impacts on the environment, the project develops a monitoring and evaluation system (M&E) to monitor all project activities and progress.

The monitoring and evaluation program will cover all steps of project activities; making sure that these activities meet environmental criteria and related government agricultural policy. First of all, farm selection for cocoa planting is carefully monitored from the level of target district and communes selection down to individual farm selection to form cocoa clubs, compiling all requirements based on their conditions (land availability, soil, suitability, tenure).

The M&E program will also regularly monitor the development of cocoa in the project area through the network of extension staff and training facilitators. In this way, environmental compliance is always controlled and reported. Moreover, any possible impacts that may occur will then be identified and timely mitigated. The program will monitor the construction and operation of demonstration plots, model fermentaries and drying stations to make sure that there will be no negative impacts on the environment. Specifically, the program will monitor carefully the pest and diseases management practices within both demonstration plots and smallholder farms. Pesticide is viewed as one of many tools available to farmers within an integrated pest management systems, therefore, farmers will be trained in the safe use of pesticides.

The monitoring and evaluation system involves all levels of stakeholder participation. The contribution of training facilitators in monitoring the impact of farmer field schools and the status/condition of cocoa within the project areas is one of the main parts of the monitoring scheme. Both officers of local partners (DARD/Dak Lak and Extension Central) and ACDI/VOCA staff will take part in monitoring the project activities. Monitoring and evaluation will be supported with a project database that collects information and keeps track of the progress and results of the project. The criteria that are set in SUCCESS Dak Lak will be incorporated into community agreements, and environmental compliance will be monitored by ACDI/VOCA staff and local partner technicians using surveys, spot checks, and other monitoring activities through the Farming system appraisal.

Farming System Appraisal is an integrated survey that will be implemented annually. The survey objectives are to assess the effectiveness of our training program, and to evaluate the level of adoption of better crop practices for sustainable cocoa development and, to better understand the situation of cocoa in the project areas. From the survey, a number of environmental conditions, such as soil properties and water conditions, will also be

investigated in order to determine any possible positive and negative impacts to the environment and the growth of cocoa plants.

E. Attachments

Attachment 1

Environmental Guidelines for Tree Planting in Vietnam

Tree Out-Planting:

- Minimize introduction of exotic species. Clearly recommended species, approved by Ministry of Agriculture and Rural Development under Decision No. 321 QD/BNN-KHCN on January 26th, 2006.
- Minimize transfer of live plants or planting materials from other provinces to avoid spread of pests and diseases. Reduce clearing of sensitive land; instead, try to increase agricultural productivity and sustainability on already-farmed lands. Reduce land clearance for swidden agriculture; reduce fallow periods and promote agro-forestry systems to improve production and decrease land degradation.
- Promote strategies for preventing erosion and run-off. Depending on the slope and land and soil characteristics, these measures could include: contour ridges, terraces, living barriers, etc.
- Improve soil and water conservation by promoting intercropping, improved plant spacing, appropriate crop rotation, low tillage agriculture, and/or agro-forestry practices.
- Promote integrated pest management and use of organic fertilizers; minimize use of pesticides.
- Choose an irrigation system suitable for the type of soil, the crop, and water availability. Promote rain-fed agriculture.
- Promote proper disposal of bags, through re-use, recycling or burial.

Attachment 2

PESTICIDE EVALUATION REPORT AND SAFER USE ACTION PLAN FOR INSECTICIDE TREATMENT IN COCOA

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Plant protection specialist

1. BACKGROUND AND PROJECT DESCRIPTION:

1.1. Cocoa and pests on cocoa

Cocoa was encouraged and the cocoa area was increased recently in Dak Lak of Vietnam under Sustainable Cocoa Enterprise Solutions for Smallholders (SUCCESS) Alliance – Dak Lak, a project from the partnership between ACDI/VOCA and the Department of Agricultural and Rural Development of Dak Lak province (DARD/Dak Lak).

The project aim was improving the livelihoods of the poor and ethnic minority smallholder's farmers in Dak Lak through the sustainable cocoa industry development, reducing the risk due to mono-cropping of coffee, and diversifying the crop system in the region.

As the cocoa area has been increased in the region recently, pests and diseases are very abundant: termites, mosquitoes, mealy bug, thrips, and Phytophthora disease.

1.2. Termites on cocoa and other crops in Dak Lak

Among the pests on cocoa in Dak Lak, termites were the most common and serious. There were at least 4 species of termites: *Odontotermes hainanensis, Macrotermes annandalei, Odontotermes formosanus, Macrotermes barnegi,* among which, *Odontotermes hainanensis* was the most common species (Vo Chap, 2005).

Termites were the polyphagous pests and attacked many crops such as cocoa, coffee, cashew, and tea. If there were no crops on the field, they could feed on plant debris. Termites damaged the roots, root collars, barks, and stems of cocoa. If the root collar is damaged, the plant would be seriously affected, thereby causing it to die.

1.3. Termite control by non-IPM-farmers

To control termites, farmers in the region had used many kinds of pesticides such as Lexus 5SC or Confidor 100SL (imidacloprid 5% or 10%), Sago-Super 3G (Chlorpyrifos Methyl 3%), Mocap 10G (Ethoprophos 10%), Basudin 10G or Basudin 40EC (Diazinon 10% or 50%). Chemical application to control termites was ranged from 4-7 times a year, sometimes it reached 10.

Non-chemical controls was not mentioned by farmers in the region before the project.

1.4. Chemical control guided and trained in the project

In the project, farmers were trained how to control pests effectively by many methods, all of which are safe to the environment and humans. Chemical control was considered only when the invasion of pests was over the economic threshold and other controls were not effective. When the chemical control was decided, the pesticide was selected carefully.

In the project, chemical control against termites was applied to the newly planted cocoa only. Confidor 100SL was chosen for this purpose.

1.5. Purpose of the PERSUAP

Pursuant to 22CFR §216.3 (b)(1), this Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) was completed to evaluate the efficacy of the pesticide application, its effect to the environment and humans. This PERSUAP was also aimed to have a better plan of pesticide application in future.

2. PESTICIDE EVALUATION

a. Pesticide registration status of the requested pesticide

Trade name: Confidor 100SL, with 10% active ingredient (a.i.)

Common name (a.i.): Imidacloprid, it belongs to Neonicotinoid, a new class of synthetic analogs of nicotine (Tomlin, CDS. 2006).

Producer: Bayer CropScience

Pesticide registration status:

- US EPA – This chemical is registered on the US EPA website [www.epa.gov/opprd001/workplan/2006newusecompletions.pdf] for minor use (IR-4) with various fruits, including banana, nuts, pistachio, canberry, coffee, sunflower, and sugar apple. This chemical is proposed for the same use in this project as that stated on the EPA website.
- MARD - Confidor 100SL was registered and allowed to be used in Vietnam under the Decision No. 29/1999/QD-BNN-BVTV on February 4th 1999 by the Ministry of Agriculture and Rural Development (MARD).
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b. Basis for selection of the Pesticide

Reasons of the pesticide selection: Confidor 100SL was selected since the reasons:

- Low toxicity and analogs of nicotine, a natural insecticide
- Effective to the target pest
- Use dosage per hectare was low: 0.4 - 0.6 kg/ha (0.04 - 0.06 kg a.i./ha)
- Easy to be degraded or hydrolyzed in the environment and metabolized in plants
- Low toxic to benefit insects as well as other non-target-living beings

- Recommended to be used in IPM (Integrated Pest Management) when the pest was over the threshold and other pest control methods were not effective

c. Extent to which the proposed pesticide use is part of an integrated pest management program

In the project, IPM (integrated pest management) was the guideline. Non-chemical controls were the priority and chemical control was limited. However, the farmers were also well trained for safer usage to protect themselves, others and the environment. In the project, chemicals are recommended to use only for termite control in the region of Central Highlands, and Confidor 100SL is selected. The application of this recommended pesticide is applied to the newly planted cocoa.

d. Methods of application, including availability of appropriate application and safety equipment

Pesticide usage: the insecticide was used for soil treatment before planting:

Spray 1: 10 ml of Confidor 100SL was diluted into 8 liters of water then sprayed to the sides of 50 planting pits. Then the planting pits were filled with the mixture of soil and decomposed manure.

Spray 2: A hole was made to put the young plant. Before planting, the sides of the hole were sprayed with the insecticide solution with the same dosage of spray 1.

Spray 3: The surface of the soil around the young plant was sprayed with the insecticide solution. The same dosage of spray 1 was used.

Total insecticide used was 0.4 - 0.6 kg/ha

Safety in pesticide application: Although the pesticide use was limited in the project, the farmers were well trained in Safe and Effective Pesticide Handling:

- Keep the tree height under control
- Well knowing the target pests
- What pesticide should be used?
- Wearing personal protective equipments
- Use the properly working sprayer
- Treat properly the target
- Calibration method
- Application technique
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- Containers and hygiene
- Will do better next time?

e. Acute and long-term toxicological hazards, either human or environment

Toxicology: Toxicity class (WHO): class II. Acute oral LD_{50} *per os* for male and female rats was 450 mg/kg, acute percutaneous LD_{50} (24 h) for rats >5,000 mg/kg. Fish LC_{50} (96 h) for golden orfe was 237, for rainbow trout was 211 mg/l (Tomlin, CDS. 2006; EPA website).

Degradation and hydrolysis:

Hydrolysis half-life	>30 days (25^0C at pH 7)
Aqueous photolysis half-life	3.98 x 10-2 days (24^0C at pH 7)
Anaerobic half-life	27.1 days
Aerobic half-life	9.97 x 102 days
Soil photolysis half-life	38.9 days
Field dissipation half-life	26.5 to 229

(Bayer Corp., 1998)

f. Effectiveness of the requested pesticide of the proposed use

Effectiveness of pesticide application: The treatment protected the young cocoa plants from attacking of the termites and other root insect pests. The average efficacy was 80-90%. After one or two months, if plants were re-attacked by termites with high density and severely damaged, one more insecticide treatment was needed. In the project, percentage of the cocoa plants pesticide-treated twice was 15%.

g. Compatibility of the proposed pesticide with target and non target ecosystems

i. Pesticide residue in the soil

Sarkar *et al.*, (1999) reported that the hydrolysis half-life varies from 33 to 44 days at 25^0C and pH 7. In the project, the insecticide was applied once a year. At the moment of the examination, the pesticide was applied more than a year. Therefore, the insecticide should not remain in the soil. However, the insecticide residue in the soil was not tested.

ii. Effect to the water resource:

Contamination to the water resource was considered also.

Rouchaud *et al.* (1994) found that imidacloprid did not leach to the underground water in their field studies, which was covered by loam soil. In another study conducted in 1997 to 1998, Bayer Corporation (Bayer Corp., 1998) found imidacloprid in the ground water, 18 feet below ground surface in the sandy loam soil region. Concentration was < 1 ppb.

In Dak Lak, the region covered by the project, pesticide containers were destroyed after use, therefore they were not found in the field. Insecticide drifting is considered to be limited due to the soil type found in the region (loam soil) and deep water table (24-32 feet below ground). In addition, there are not many rivers, canals or springs nearby that could be affected by the chemical residue, if any.

It must also be stressed that application of the pesticide will strictly follow the manufacturer's instructions for safe usage and further monitoring of water quality in the target area will be performed, when applicable.

iii. Effect to the community:

In using, the drifting, running and other contaminations were considered to be limited. Hence, the effect was expected to be insignificant.

iv. Effect to the consumers

Since the insecticide will be used for soil treatment before the young cocoa seedlings were planted, no residue in the fruits will be expected, thereby causing unlikely effect to the consumers.

h. Conditions under which pesticide is to be used

i. The climate condition:

The climate condition in Pleiku (The Climate Center, 2006)

Temperature (^{0}C)		**Sunny time**	**Humidity (%)**		**Rainfall (*)**
Min	**Max**	**(Hrs / year)**	**Min**	**Max**	**(ml / year)**
19	25	2,606	76	94	1,900

(*) *The rainfall mainly from May to October*

ii. Soil condition:

The average elevation was 450 - 500 m. The main soil type was grey soil, soil pH 4 - 4.5. The land was slightly slope (10%). Before planting, lime and decomposed manure was applied. Water supply for cocoa was mainly from surface water such as from rivers, streams, lakes and dams, some times, from underground water. Around the plants, the soil was mulched by fallen leaves.

iii. Flora:

Beside the planted cocoa, other trees were planted for shading, windbreak and preventing the soil erosion. If the cocoa farm was in multi-cropping, the shading plants were coffee or cashew, if the cocoa farm was in mono-cropping, the shading plant was *Cassia surattensis* (= *C. glauca*).

iv. Fauna:

Earth worm, beetles, nymphs of beetles, ants and some other insects were abundant in the soil. Termites were especially dominant in the region.

There was no evidence indicated that the fauna was effected by the insecticide found. Earth worm and soil insects like ants, and beetles were found abundant in the Confidor -treated soil after 6 months.

However, insecticide residue testing in the insects was not conducted.

i. Availability and effectiveness of other pesticide or non-chemical control

To control termites, many methods were applied:

Cultural control:

- Remove plant debris to limit the food source for termites
- Apply decomposed manure. It was reported that termites hadn't developed in the condition of decomposed manure.
- Collect queen termites to limit the termite population
- Use repellents: use camphor or calcium carbide to repel termites

Biological control:

- Protect and activate natural enemies by limiting pesticide use and creating good condition for them develop.
- Rearing weaver ants, a strong natural enemy
- The biological bait produced by The University of Irrigation was also applied. However, the efficacy was not confirmed yet.

j. Vietnam' ability to regulate or control the distribution, storage, use and disposal of the requested pesticide

The distribution, storage, use and disposal of the pesticide were strongly regulated by the Decision No. 165/199/QD/BNN-BVTV issued on 13-December 1999 by The Ministry of Agriculture and Rural Development of Vietnam.

k. Provisions made for training users and applicators

The safety guide, target pests, and dosage were provided, illustrated, and trained by the manufacturer - Bayer CropScience.

In the project training program, farmers were trained in integrated pest management. The affect of the training was found to be positive as the farmers' perception has changed after the training. Farmers have found chemical control to be inexpensive, effective, and non-toxic. Rearing weaver ants to control

mosquitoes and other insect pests is a good example. The farmers have applied this novel knowledge not only to cocoa but also to other crops as well.

l. Provision made for monitoring the use and effectiveness of the pesticide

The experiment which defines the right effective dosage of Confidor 100SL to control termites should be conducted in the project areas, Dak Lak. The program should continue to monitor and evaluate the efficacy and effectiveness of the pesticide use in coordination with their training and extension activities.

3. SAFER USE ACTION PLAN:

3.1. Research more in the behavior of the termites

The behavior and habitat of the termites should be studied more. This will help manage the termites more effectively. Farmers know which time in a year the termites are the most abundant to avoid planting at that time or farmers can make a condition in which the termites can't develop or reproduce well, or have a better plan for pesticide application.

3.2. Test some more pesticides

Test some more pesticides which have lower toxicity to the environment and more effect to the termites.

Besides, if some pesticides used rotationally, it will prevent pesticide resistance.

3.3. Bio-control and bio-products

The natural enemy population which can limit the development of the termites should be studied more to have a good plan to protect or preserve them.

Rear and make good conditions for weaver ants to develop and reproduce.

Test the efficacies of bio-products sold in the market and then apply on cocoa

3.4. Repellent plants

It was reported that some kinds of weeds had repelled the termites. This matter should be studied more.

3.5. Control termites in the community

Train and encourage all of the farmers in the region to apply IPM or non-chemical control not only on cocoa but also on other crops to enrich the natural enemy population in the region.

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