



LAC-IEE-04-56

## ENVIRONMENTAL THRESHOLD DECISION

<b>Activity Location:</b>	Ecuador
<b>Activity Title:</b>	Pesticide use under the Income and Employment Increase Project in the Northern Border – PRONORTE/Broccoli cluster
<b>Activity Number:</b>	518-013
<b>Funding:</b>	\$1,410,000
<b>Life of Activity:</b>	FY 2003 – FY 2006
<b>IEE Prepared by:</b>	Jill Kelley, Mission Environment Officer Victor Bullen, Regional Environmental Officer
<b>Recommended Threshold Decision :</b>	Negative Determination with Conditions
<b>Bureau Threshold Decision:</b>	Concur with Recommendation

### Comments:

The Threshold Decision is based on the completion by USAID/Ecuador of the attached IEE - PERSUAP, addressing USAID's Pesticide Procedures, pursuant to 22 CFR 216.3 (b)(1)(i)(a - 1). **An overall condition is that the USAID Regional Environmental Advisor for South America will review the compliance to these conditions at least once each year of implementation.**

For future commodities, pests and pesticide products to be considered under this program implemented, but not covered in the present PERSUAP as amended, **a second condition is stipulated: An additional amendment to the PERSUAP shall be submitted,** pursuant 22 CFR 216.3 (b)(1)(i)(a - 1). Any additional amendment to the PERSUAP must be cleared by the USAID-Ecuador MEO and USAID-South America REA before submission to the Mission Director for signature and before review by the BEO. Finally, **the third condition is that all recommendations in the attached PERSUAP**

**will be adhered to and all mitigating actions shall be part of the implementing agents' contracts or grants. In particular, if the three very environmentally-friendly pesticides are not effective, and additional pesticides are contemplated, the second condition above applies.**

Based on these conditions a **Negative Determination is issued.**

CTOs are responsible for making sure environmental requirements are met. It is the responsibility of the SO Team to ensure that the SOAG and MAARDs or contracts and grants contain specific instructions to this effect.

\_\_\_\_\_  
Date \_\_\_\_\_  
George R. Thompson, P.E.  
Bureau Environmental Officer  
Bureau for Latin America & the Caribbean

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**Attachment: IEE – PERSUAP**

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**INITIAL ENVIRONMENTAL EXAMINATION  
(Including Pesticide Evaluation)**

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<u>Date Prepared:</u>	August 18, 2004

**I. Background Information**

Associates in Rural Development, ARD, the institutional contractor for the Income and Employment Increase Project, Pronorte, selected the vegetables subsector as one of the clusters to be developed in the Northern Border provinces, more specifically in the provinces of Carchi and Imbabura. Within this subsector, broccoli has been identified as the first value chain to be supported by Pronorte mainly due to the existence of a secure and stable market, with a long term operational horizon, the experience of some farmers –mainly large ones- in broccoli cultivation, and the willingness of small farmers to diversify their cropping pattern away from traditional products and towards non-traditional agricultural export products.

The production component of the proposed Imbabura broccoli cluster value chain will be in the municipality of Cotocachi on the eastern slopes of the western Cordillera and the western side of the Inter-Andean Valley. These sites lie at elevations from between 2,200 and 2,800 meters above sea level. Production sites are gently sloped or flat. Soils are “Black Andean” that have developed from volcanic ash. They are generally deep, fertile, and high in organic material but are underlain by a hardpan layer of compacted volcanic ash.

Temperatures vary little through the year but, at lower elevations temperatures can be as high as 27 C during mid-day and, at higher elevations and on flat ground, can drop to below freezing at night. Average annual rainfall is between 900 and 950 mm with more rainfall between October and May and a drier, windy season between June and September.

In the Inter-Andean Valley, the original, natural vegetation was dry, highland tropical forest. Between about 2,800 masl and 3,200 masl the natural vegetation was montane rainforest. Above 3,200 m the natural vegetation is *paramo* (high-altitude grasslands and tundra vegetation). At present large areas of natural *paramo* still exist but there are no significant extensions of natural forest left in or close to the proposed broccoli production areas. The municipality of Cotocachi lies on the eastern border of the Cotocachi-Cayapas Ecological Reserve.

Most of the rural population is indigenous peoples, known generally as Otavalans, although there are many different subgroups of this indigenous group. Agriculture, dairy farming, tourism and handicrafts underlie the region's economy. Agriculture includes both traditional crops, especially corn and beans, and intensive flower production for export. Land tenure is divided into a relatively few, large farms (*haciendas*) that may have from 60 to several hundred hectares, and many smaller farms that have from less than 1 to more than 30 hectares. There is presently no production of broccoli on small farms, although there are some large farms that produce broccoli.

Soil erosion is one of Ecuador's most serious environmental problems, especially on the inner and outer slopes of the Andean highlands (Winters et al, no date). Most, although not all, of the proposed broccoli production sites are on the inner slopes of the Western Cordillera, sites that frequently are susceptible to soil erosion. Broccoli production could cause soil erosion mostly as a result of turning over and working the soil by plowing and harrowing in preparation for planting, during weeding and harvesting operations, and as a result of the application of irrigation water to sloped land.

## **II. Description of activities**

PRONORTE's targets for the production component of the broccoli value chain are to help farmers establish 240 hectares (ha) of broccoli production with an average yield of 12,000 kg/ha and involving 150 families.

PRONORTE will provide technical assistance and training to small-scale farmers in the cultivation of broccoli. As a result the farmers will be able to grow broccoli that meets the standards required for export to international markets. An agronomist will transfer knowledge of broccoli production practices to farmers through the establishment of on-farm demonstration plots and training sessions.

PRONORTE will also help to fulfill agreements between commercial broccoli operations and broccoli growers and will assist small-scale farmers to organize themselves into broccoli growers' cooperatives. The buyers of PRONORTE's beneficiaries target exclusively the EU and the U.S. markets. Both markets have stringent requirements regarding the use of pesticides; thus, appropriate pesticide usage is one of PRONORTE's broccoli value chain main activities. Since this is a market-driven activity, the entire value chain will fail if it does not meet these stringent requirements.

## **III. Use, Toxicity and Environmental Impacts**

The following sections respond to the twelve factors that USAID Pesticide Procedures require be analyzed with respect to the economic, social and environmental risks and benefits of planned pesticide use. The following information should be reviewed and modified, if necessary, once PRONORTE's technical recommendations for broccoli production have been fully formulated.

The extent of the risk to human health and ecosystems caused by PRONORTE's broccoli cluster will depend on the effectiveness of its training and technical assistance program in pesticide use to broccoli farmers. Within the overall framework of integrated pest management, PRONORTE intends to take several measures to avoid, reduce, and mitigate the risk to human health and environment from pesticides used on broccoli. First, it will incorporate training in safe pesticide application methods into its training program for broccoli cultivation. Second, it will recommend the use of pesticides that attack specific broccoli pests, rather than the use of broad-spectrum pesticides. Third, it will recommend non-persistent pesticides that are likely to decompose before they reach and contaminate water bodies. Fourth, it will advocate the protection and establishment of vegetation along the edges of water bodies, which will act to filter out pesticide

residues before they reach water bodies. The degree and consistency with which broccoli farmers actually use these safer methods of pesticide application will determine the risk to human health and ecosystem which the pesticides represent. However, PRONORTE's beneficiaries are producing broccoli solely for export; approximately 50% for the EU and 50% the U.S. market. The buyer of this broccoli requires that only European Union (EU) and US Environmental Protection Agency (EPA) approved chemicals are used, and has a monitoring system in place that will trace pesticide use to each producer. Further, under the newly implemented system of European Retail Produce Good Agricultural Practices Act (EUREGAP), worker safety, in this case safe application of pesticides is a condition of accepting product. These are not just theories, but compliance with EUREGAP requirements are verified by periodic field audits.

Small farmer community organizations signed a delivery contract with one broccoli export firm, International Quick Freezing Agroindustry (IQF), by which farmers will supply at least 18,000 kg of broccoli heads per week. The fulfillment of this contract requires a staggered planting of 1.5 ha per week, demanding both farmers' organization and good planning.

Predicted environmental consequences:

No data are available on the rate of soil erosion on the farms of the participants in the broccoli cluster. It is not, therefore, possible to establish a baseline rate of soil erosion against which to compare the rate of soil erosion on the same or similar sites under broccoli production. Nevertheless, as part of its on-farm demonstration and training activities PRONORTE will train farmers in broccoli production techniques that include soil conservation measures. For example, PRONORTE will assist farmers to install and operate drip irrigation systems. Drip irrigation applies water slowly to soil surface and directly above the plant roots. Such irrigation techniques will almost certainly reduce the rate of soil erosion as compared to the current surface irrigation practices. Likewise, PRONORTE will train farmers in soil conservation practices such as incorporation of organic material into the soil, contour plowing, and establishment of vegetative barriers and wind breaks. Broccoli, moreover, produces a large proportion of organic material that can be reincorporated into the soil, either directly or as humus and compost. The organic material improves the structure of the soil and makes it more resistant to soil erosion. In sum, PRONORTE's proposed actions in the production component of the broccoli cluster value chain are likely to reduce rather than increase the rate of soil erosion.

**USAID Pesticide Procedures Evaluation**

**(a) The USEPA registration status of the requested pesticide;**

Table 1 indicates the USEPA registration status of the pesticides that broccoli farmers in Ecuador are currently applying. The lightly shaded pesticides (yellow) are those that are registered with EPA, general use pesticides, and registered by EPA for use with broccoli. The darkly shaded pesticides (green) meet these criteria and are recommended for use on broccoli in Ecuador by this IEE.

**Table 1: Pesticides Currently Used for Broccoli Production in Ecuador (1)**

<b>R E F#</b>	<b>Active Ingredient</b>	<b>EPA No. (2)</b>	<b>EPA RS (3)</b>	<b>EPA TS (4)</b>	<b>SRS (5)</b>	<b>Crop Protection Reference (6)</b>	<b>Use on Broccoli (7)</b>	<b>Commercial Product Name in Ecuador (8)</b>	
	<b><i>FUNGICIDES</i></b>								
1	Acido citrico	n.d. (9)	n.d.	n.d.		None	n.d.	Lonlife 40	
2	Azufre colloidal	n.d.	n.d.	n.d.		None	n.d.	Azucos, Cosaqn, Kumulus, Thiobit	
3	Azufre humectante	n.d.	n.d.	n.d.		None	n.d.	Cosaqn, Kumulus, Thiobit	
4	Benomyl (carbamatos)	n.d.		n.d.		None	n.d.	Benex 50, Benochem, Benocor, Benodel, Pilarben	
5	Bicarbonate of Soda <b>(10)</b>	0107772-03*	G.			<a href="http://www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl">www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl</a>	Yes		
6	Captan	51036-166				Captan 50, p.1563	No	Captan 50	
7	Carbendazim (Under [Ecuador] authorization)	Not registered				n.d.	No		Bavistin, Cekuda Goldazim, Korso
8	Clorthalonil	n.d.	n.d.	n.d.		None	No	Bravo 500, Balear 500, Daconil 500, Fungil 500, Thalonex 500	
9	Fosetyl aluminium (Registered by Bayer Cropscience in EPA)	264-516	G	60		Aliette WDG, p. 221	No	Aliette, Fosetic, Fostonic	
10	Copper Hydroxide	55146-57	G	n.		Champ DP Dry Prill, Champ Formula 2 Flowable	No	Cudox 720 F	
11	Cuprous Hydroxide (Hidróxido cúprico)	n.d.	n.d.			None		Champion, Kocide 101	
12	Copper sulphate	n.d.	n.d.	n.d.				Phyton	

<b>R E F#</b>	<b>Active Ingredient</b>	<b>EPA No. (2)</b>	<b>EPA RS (3)</b>	<b>EPA TS (4)</b>	<b>SRS (5)</b>	<b>Crop Protection Reference (6)</b>	<b>Use on Broccoli (7)</b>	<b>Commercial Product Name in Ecuador (8)</b>
13	Iprodione	264-453	G	25		Iprodione 4L, p.1570 Rovral, p.473 Rovaryl WDG, p478;	Yes Yes Yes	Rovral 50 PM, Rovral 500 CE
14	Maneb	554-141- 5905	G	10			n.r.	Trimangol 80 PM
15	Metalaxil	100-798	G	2		RIDOMIL Gold GR p 2248	Yes	Lachero (+ Oxiclururo de cobre)
16	Oxicloruro de cobre	n.d.	n.d.					Lanchero (+Oxicluro de cobre)
17	PCNB/Quintozene	400-3999	G	0.1		Terraclor 75% p 687	Yes	Terraclor 75% PM
	<b><i>INSECTICIDES</i></b>							
18	Acephate, acefato (Under Ecuador authorization, organophosphate)	51036-238 59639-26 59639-33 59639-91	G G G G			Acephate 90SP, p. 1525 Orthene 75 S, p. 2386 Orthene 90S, p.2393 Orthene 97, p. 2396	No No No No	Orthene
19	<b><i>Bacillus thuringiensis (Bt) (10)</i></b>	000004- 00226*	G			<a href="http://www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl">http://www.cdpr.ca.gov/cgi- bin/epa/mkrep3.pl</a> **	Yes	
20	Carbaryl	264-316	G	10		Sevin brand 80S Carbaryl p.524	Yes	Sevin 80 S
21	Chlorpyrifos	n.d.	R	1		Lorsban 4E	Yes	Lorsban 4F (Pyrinex, Pyrinox, Bólido, Dursban, Kanon)
22	Chlorphrifos+Cipermetr ina	n.d.	n.d.			n.d.		Látigo, Kanon plus, Pyrinox plus
23	Cypermethrin,	n.d.	n.d.			n.d.		Arrivo, Cipermetrina,

<b>R E F#</b>	<b>Active Ingredient</b>	<b>EPA No. (2)</b>	<b>EPA RS (3)</b>	<b>EPA TS (4)</b>	<b>SRS (5)</b>	<b>Crop Protection Reference (6)</b>	<b>Use on Broccoli (7)</b>	<b>Commercial Product Name in Ecuador (8)</b>
	cipermetrina (Under Ecuador authorization, pyrethroid)							Cipertox, Cipercor, Kung fu, Surgían, Cipertox 25%, Master 25, Pirmetha 25
24	Diazinon (Under Ecuador authorization, organophosphate)	7501-112-5905	G	0.7		KickStart, p.1420	No	Basudin, Campodin
25	Dimethoate	n.d.	n.d.			n.d.		Dimepac, Diabolo, Perfekthion
26	Endosulfan	264-638	264-658	G	2	Phaser 3E (C), p.432 Phaser 3E (Cal), p.438	Yes Yes	Palmarol, Thiodan, Thionate, Thionex
27	Endosulfan+Methomyl	n.d.	n.d.					Methofan
28	Imidacloprid (Registered by Bayer in EPA)	264-758 264-763	G G	3.5		Admire 2 Flowable p 213 Provado 1.6 Flowable p 449	Yes Yes	Confidor
29	Lambda-cyhalothrin (Under Ecuador authorization, pyrethroid)	100-1097 100-1112	R R	n.d.	n.d.	Karate. p. 2175 Warrior. p. 2311	No No	Karate
30	Methamidophos	264-729	R	1		Monitor 4, p. 415	No	Attack, Crysmaron, Magnum, Matador, Mefisto, Monitor, Rector, Tamaron
31	Methomyl	353-384 352-342	R R			Lanate LV p 1173 Lante SP p.1182	Yes Yes	Methomex 90 PS
32	Oxydimethon-Methyl	n.d.				n.d.		Metasistox R
33	Permethrin,	279-3059	R	1		Pounce25 WP, p.1372	No	Permasect

<b>R E F#</b>	<b>Active Ingredient</b>	<b>EPA No. (2)</b>	<b>EPA RS (3)</b>	<b>EPA TS (4)</b>	<b>SRS (5)</b>	<b>Crop Protection Reference (6)</b>	<b>Use on Broccoli (7)</b>	<b>Commercial Product Name in Ecuador (8)</b>
	Permethrina	279-3051 279-3014 279-2083	R R R			Pounce 1.5G, p. 1373 Pounce 3.2EC, p.1379 Pounce WSB, p 1385	Yes Yes Yes	
34	Potassium Salts of Fatty Acids (insecticidal soap) (10)	53219-6 051036-221* 070191-01* 070191-01*	G	n.d.		M-Pede <a href="http://www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl">http://www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl</a>	Yes	Biosec. Impide
35	Thiodicarb	264-379	R	7		Larvin Brand 3.2 Thiodicarb, p.388	Yes	Futuro, Larvin
36	Trichlorfon (Registered by Bayer in EPA)	032802-00029	G	0.1			No	Dipterex, Cekufon

(1) This list of pesticides currently being used in Ecuador on broccoli was provided to PRONORTE by IQF Agroindustrial del Ecuador, one of three companies in Ecuador that buy broccoli for export. Recommended pesticides reference # 5 and 19 (bicarbonate of soda, BT, and) and were given by another broccoli exporter, recommended pesticide ref. # 34 (potassium salts of fatty acids) was given by both exporters.

(2) United States Environmental Protection Agency Registration Number taken from the Crop Protection Reference. \*Registration numbers were also used from EPA web site for the recommended pesticides.

(3) United States Environmental Protection Agency Registration Status (G = General Use; R = Restricted Use)

(4) USEPA Tolerance Status. This information was provided to PRONORTE by IQF Agroindustrial del Ecuador.

(5) USEPA Special Review Status. So far as could be determined, none of the pesticides are in this status.

(6) Crop Protection Reference, 2004 Edition, published by the C&P Press, was consulted to determine the information in this table. EPA websites also used for recommended pesticides.

This column provides the brand names for the pesticides that are listed in this reference and the page number in the Crop Protection Reference where the label of the pesticide is presented.

(7) This column states whether the USEPA has authorized the use of the pesticide for broccoli.

(8) This column provides the brand names under which, according to the information provided by IQF Agroindustrial del Ecuador, these pesticides are sold in Ecuador.

(9) No data – there were no data on this pesticide in the Crop Protection Reference, presumably because the EPA does not permit their use in the United States.

(10) Recommended by this IEE for use with broccoli in Ecuador as part of the PRONORTE activity

**(b) The basis for selection of the requested pesticide**

Table 1 provides a preliminary analysis of the pesticides that *Agroindustrial del Ecuador* and International Quick Freezing Company (IQF) have advised PRONORTE that broccoli farmers presently use in Ecuador. Only the darkly shaded (or green) pesticides are recommended for use: they are registered by EPA, they are general use pesticides, they are recommended by EPA for broccoli, they have low human toxicity or health risks, they have low environmental risks, and they treat most of the broccoli pests or diseases in the project area. PRONORTE also notes that IQF must comply with the requirements of their import markets, which are exclusively the United States and the European Union.

This pesticide IEE recommends the use of the following three products; all approved by the EPA for use with broccoli:

- Bicarbonate of soda
- *Bacillus thuriengisis* (Bt)
- Potassium salts of fatty acids (insecticidal soap)

IQF, the broccoli buyer/exporter, also recommends that these three pesticides be used for broccoli grown by small farmers. Aside from the selection criteria mentioned above, these three pesticides are also very inexpensive, are approved for organic production in most countries, can be used up to or close to the day of harvest, leave only permissible or no residues on the crop, break down quickly in the field, and are relatively easy and safe to use.

As PRONORTE’s agronomist professionals observe the use and effectiveness of these pesticides in the field, they may formulate additional recommendations for pesticides. If additional pesticides are needed then a supplemental pesticide IEE will be prepared and submitted to the USAID LAC Bureau Environmental Officer.

**Table 2. Products that may be used to combat common pests and diseases of Broccoli in Ecuador**

REF No.	Pesticida	Pest or Disease
18	Acephate/Acefato	Falso medidor ( <i>Trichoplusia ni</i> ) - Falsa oruga - Gusano del repollo ( <i>Pieris rapae</i> ) - Gusano ejército ( <i>Spodoptera Exigua</i> ) – Pulgón ( <i>Brevicoryne brassicae</i> ).
19*	<i>Bacillus thurigiensis</i>	<b>Cabbage looper</b> , Falso medidor ( <i>Trichoplusia ni</i> ) <b>Imported cabbageworm</b> , Gusano de la col ( <i>Pieris rapae</i> ) <b>Leafminer</b> , Minador ( <i>Scrobipalpa sp</i> ) <b>Cutworm</b> Trozadores ( <i>Agrotis sp.</i> ) <b>Diamondback moth</b> , Palomilla dorso de diamante ( <i>Plutella sp</i> )
5*	Bicarbonate of Soda	<b>Powdery Mildew</b> , Mildiu lanoso ( <i>Peronospora parasítica</i> )
20	Carbaryl	Trozadores ( <i>Agrotis sp.</i> )
21	Chlorpyrifos	Trozadores ( <i>Agrotis sp.</i> )
23	Cypermethrin, cipermetrina	Trozadores ( <i>Agrotis sp.</i> ) – Gusano del repollo ( <i>Pieris rapae</i> ) – Falso medidor ( <i>Trichoplusia ni</i> ).

REF No.	Pesticida	Pest or Disease
24	Diazinón	Palomilla dorso de diamante ( <i>Plutella</i> sp) - Pulgón ( <i>Brevicoryne brassicae</i> ), Trozadores ( <i>Agrotis</i> sp.) - Gusano de la hoja ( <i>Plutella</i> sp).
25	Dimethoate, dimetoato	Pulgón ( <i>Brevicoryne brassicae</i> ).
26**	Endosulfan	Pulgón ( <i>Brevicoryne brassicae</i> ) – Trozadores ( <i>Agrotis</i> sp.)
9	Fossetil aluminio	Pulgón ( <i>Brevicoryne brassicae</i> )
28**	Imidacloprid	Pulgón ( <i>Brevicoryne brassicae</i> )
29	Lambda cialotrina	Palomilla dorso de diamante ( <i>Plutella</i> sp)
30	Metamidofos	Pulgón ( <i>Brevicoryne brassicae</i> ) - Gusano del repollo ( <i>Pieris rapae</i> ) - Gusano medidor de la col.
31	Methomyl	Falso medidor ( <i>Trichoplusia ni</i> ) - Gusano cortador ( <i>Agrotis</i> sp.) – Palomilla dorso de diamante ( <i>Plutella</i> sp) - Gusano ejército – Pulgón ( <i>Brevicoryne brassicae</i> )
32	Oxidimeton methyl	Pulgón ( <i>Brevicoryne brassicae</i> ).
33	Permethrin, permotrina	Trozador ( <i>Agrotis</i> sp.) – Palomilla dorso de diamante ( <i>Plutella</i> sp).
34*	Potassium Salts of Fatty Acids (Insecticidal Soap, Sales potásicas de ácidos grasos)	<b>Cabbage Aphid</b> Pulgón ( <i>Brevicoryne brassicae</i> ).
36	Trichlorfon, Dipterex 80	Cortadores o tierreros ( <i>Agrotis</i> sp.)

\* Recommended pesticide by this IEE

\*\* General pesticide registered with EPA for the use with broccoli

Appendix 2 is the guide for pesticides that Ecuador's largest distributor of pesticides, Ecuaquimica, provides to broccoli growers. It contains 24 fungicides and insecticides. Ecuaquimica's recommendations do not correspond to that of IQF Agroindustrial del Ecuador. It also includes some pesticides, such as Malathion 57 EC, that are not listed in the *Crop Protection Reference*.

(c) The extent to which the proposed pesticide use is part of an integrated pest management program

At present in Ecuador broccoli farmers do not use pesticides as part of an integrated pest management program. PRONORTE, however, does intend to promote the use of integrated pest management with the participating broccoli farmers in accordance with internationally accepted guidelines. Besides this, PRONORTE is promoting the use of safe handling of all agricultural inputs, which was hitherto unknown in the growing area.

PRONORTE's training and technical assistance to broccoli farmers will include integrated pest management practices that will make the use of pesticides safer and less likely to cause negative effects on natural ecosystems.

PRONORTE will not promote or work with farmers who use any pesticide other than those registered for the same or similar uses by the USEPA.

PRONORTE has several sources of internationally accepted IPM guidelines for cole crops:

- IPM/CIIFAD (Cornell University Global Crop Pest and treatment database);
- IPM CRSP (Integrated Pest Management Collaborative Research Support Program) – have accomplished field trials in Guatemala, which results may be applicable to Ecuador;
- UC IMP Online – plus their publication: *IPM for Cole Crops and Lettuce*
- Broccoli Integrated Crop management (BICM) Program
- University of Maine – which is just developing an IPM program for broccoli
- FAO – we monitor their IPM publications and programs although that which they have currently on cole crops is minimal
- CABI's bioscience program which has many publications on IPM.

PRONORTE considers the IPM CRSP UC Davis program materials from Guatemala as quite relevant to our work since much of the environment in which they work is similar to that in which we hope to work, plus, they have similar pests and diseases as does our region. However, any of these IPM guidelines must be adapted to local conditions.

At the onset, farmers in the area selected have very few resources, thus they are not the type of developing country farmers encountered in other countries who buy agricultural chemicals and use willy-nilly, hoping to kill all potentially damaging pests and diseases using a shotgun approach. Having signed a delivery contract with IQF-Agribusiness firm that is exporting broccoli to EU and USA, farmers are even more aware of the impediments they will find to sell their product if they use not approved chemicals.

Nonetheless, PRONORTE is aware that farmers must use any inputs judiciously, and as a matter of course stress natural methods due to cost considerations, environmental concerns and business contract specifications.

Regarding IPM in general, there are so many recommendations, treatments and results that each one has to be tried to see if it works under a particular set of environmental conditions. For example, farmers have already found cut worms that have started chewing on the seedlings. Since these worms were not abundant, PRONORTE recommended to farmers to monitor fields early in the morning, and if they find damaged plants, to dig around these, find the culprit and smash it. If they find more than four chewed plants along a row on more than two rows then they will be instructed by the field technician to spray Bt (*Bacillus thuringiensis*).

Finally, PRONORTE stresses to farmers that if they practice good irrigation and good field design so as to avoid low-lying water that promote growth of disease like powdery mildew (especially during the final stages of plant growth) they will not have to resort to the use of agrochemicals.

Besides this, PRONORTE is promoting the use of safe handling of all agricultural inputs, which was hitherto unknown in the growing area.

(d) The proposed method or methods of application, including availability of appropriate application and safety equipment

The participating potential broccoli farmers presently apply pesticides with low-pressure, motorized backpack sprayers. They rarely use appropriate safety equipment or use appropriate application methods. PRONORTE intends to train broccoli farmers to apply pesticides appropriately using safety equipment. Indeed, appropriate application methods are a strict requirement of the EU buyers under EUREGAP and are verified by field audits.

Appendix 3 of this IEE includes application guidelines for the three recommended pesticides:

- Bicarbonate of soda
- *Bacillus thuringiensis* (Bt)
- Potassium salts of fatty acids (insecticidal soap)

(e) Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such hazards

Table 3 indicates the hazards associated with bicarbonate of soda, *Bacillus thuringiensis* (Bt), and potassium salts of fatty acids (insecticidal soap), as well as the other pesticides that are presently being used in broccoli production in Ecuador.

**Table 3: User and Environmental Hazards Associated with Pesticides Currently Used for Broccoli Production in Ecuador**

Ref. No.	Active Ingredient	Crop Protection Reference	Hazards	
			Human	Environmental
	<b><i>FUNGICIDES</i></b>			
1	Acido citrico	n.d.	n.d.	n.d.
2	Azufre colloidal	n.d.	n.d.	n.d.
3	Azufre humectante	n.d.	n.d.	n.d.
4	Benomyl (carbamatos)	n.d.	n.d.	n.d.
5	Bicarbonato de Soda		Non-toxic.	Non-toxic to terrestrial wildlife, fish and aquatic invertebrates. Can build up in soils in droughty areas and when used in conjunction with drip-type irrigation. This will eventually lead to the unavailability of calcium and magnesium ions in soils, and subsequent chlorosis in leaves.
6	Captan	Captan 50, p. 1563	Causes irreversible eye damage.	Toxic to fish.
7	Carbendazim (Under Ecuador authorization)		Low acute toxicity, but suspected hormone disruption	Low toxicity to terrestrial wildlife, but highly toxic to earthworms, fish and aquatic organisms.
8	Clorthalonil	n.d.	n.d.	n.d.
9	Fosetyl aluminium fometil aluminio (Registered by Bayer Cropscience in EPA)	Aliette WDG, p. 221	Harmful if swallowed or absorbed through skin.	Toxic to aquatic and estuarine invertebrates.
10	Copper hydroxide	Champ DP Dry Prill, Champ Formula 2 Flowable, p. 2263	Harmful to eyes and body in general if ingested	Toxic to aquatic organisms

Ref. No.	Active Ingredient	Crop Protection Reference	Hazards	
			Human	Environmental
11	Cuprous Hydroxide (Hidróxido cúprico)			
12	Copper sulphate			
13	Iprodione	EPA R.E.D Facts (EPA 738-F-98-017)	Low acute toxicity.	Practically non-toxic to slightly toxic to birds; practically non-toxic to small mammals, relatively non-toxic to bees, moderately toxic to freshwater fish, moderately toxic to aquatic invertebrates.
14	Maneb			
15	Metalaxil	RIDOMIL Gold GR p 2248	Causes eye irritation. Harmful if inhaled or absorbed through the skin.	For terrestrial uses, do not apply directly to water or otherwise contaminate water.
16	Oxicloruro de cobre			
17	PCNB/Quintozene	Terraclor 75%	p687	Harmful if swallowed.
	<b><i>INSECTICIDES</i></b>			
18	Acephate, acefato (Under Ecuador authorization)	Acephate 90SP, p. 1525, Orthene 75 S, p. 2386, Orthene 90S, p.2393, Orthene 97, p. 2396	Harmful if swallowed. Causes eye irritation.	Toxic to birds and highly toxic to bees.
19	<i>Bacillus thuringiensis</i> (Bt)	EPA R.E.D. Facts (EPA 738-F-98-001)	Non-toxic.	Non-toxic to birds, freshwater fish, aquatic invertebrates arthropod predators/parasites, honey bees, mammals and other non target organisms.
20	Carbaryl	Sevin brand 80S Carbaryl p.524	Overexposure causes toxic signs and symptoms due to stimulation of the cholinergic nervous systems. Carbaryl	Extremely toxic to aquatic and estuarine invertebrates. May kill honeybees in substantial numbers.

Ref. No.	Active Ingredient	Crop Protection Reference	Hazards	
			Human	Environmental
			poisoning may occur rapidly and prompt removal of stomach contents is indicated.	
21	Chlorpyrifos	Lorsban 4E, p. p.857	Harmful if swallowed, causes moderate eye irritation.	Toxic to birds and wildlife and extremely toxic to fish and aquatic organisms.
22	Chlorpyrifos+Cipermetrina	n.d.	n.d.	n.d.
23	Cipermetrina (Under Ecuador authorization, pyrethroid)		Similar to Permethrin	Similar to Permethrin
24	Diazinon (Under Ecuador authorization, organophosphate)	KickStart, p.1420	Harmful if swallowed, inhaled or absorbed through the skin	Highly toxic to birds, fish and other wildlife. Runoff may be hazardous to aquatic organisms. Exposed treated seed may be hazardous to birds and other wildlife.
25	Dimethoate	n.d..	n.d.	n.d.
26	Endosulfan	Phaser 3EC, p 432, Phaser 3E(Cal), p.438	Central nervous system stimulant absorbable by mouth, inhalation or through contact with skin. It may cause convulsions. There is no specific antidote. Fatal if swallowed. Causes irreversible eye damage. May be fatal if inhaled or absorbed through the skin.	Toxic to fish, birds, and other wildlife. Birds feeding on treated areas may be killed.
27	Endosulfan+Methomyl	n.d.	n.d.	n.d.
28	Imidacloprid	Admire 2 Flowable p 213, Provado 1.6 Flowable p 449	Harmful if swallowed or absorbed through skin.	Highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Highly toxic to aquatic

Ref. No.	Active Ingredient	Crop Protection Reference	Hazards	
			Human	Environmental
				invertebrates. Toxic to wildlife. Use in permeable, shallow soils may contaminate water.
29	Lambda-cyhalothrin (Under Ecuador authorization)	Karate, p. 2175, Warrior, p. 2311	May be fatal if swallowed or inhaled.	Highly toxic to fish and aquatic organisms and to other wildlife. Highly toxic to bees.
30	Methamidophos	Monitor 4, p. 415	Organophosphahate. Fatal is swallowed, inhaled or absorbed through skin.	Acute dermal toxicity and residue effects on avian species. Extremely toxic to birds and other wildlife.
31	Methomyl	Lanate LV p 1173, Lante SP p.1182	Fatal if swallowed. May cause blindness if swallowed, inhaled or absorbed through eyes. Causes irreversible eye damage.	Toxic to fish and aquatic invertebrates and mammals. Known to leach through soil into ground water where soils are permeable.
32	Oxydimethon-Methyl	n.d.	n.d.	n.d.
33	Permethrin, Permethrina (pyrethroid insecticide)	Pounce25 WP, p.1372, Pounce1.5G, p. 1373, Pounce 3.2EC, p.1379, Pounce WSB, p 1385	Low acute toxicity. Harmful if swallowed or absorbed through skin. Cause moderate eye irritation.	Extremely toxic to fish and aquatic organisms.
34	Potassium Salts of Fatty Acids (Insecticidal Soap)	M-Pede, See also HYPERLINK <a href="http://www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl">http://www.cdpr.ca.gov/cgi-bin/epa/mkrep3.pl</a>	Low toxicity to humans,	Practically non-toxic to birds, and slightly toxic to fish. Highly toxic to aquatic invertebrates, however, since soap salts are not applied directly to water, their current uses should not seriously impact aquatic invertebrates.
35	Thiodicarb	Larvin Brand 3.2 Thiodicarb, p.388	Overexposure may cause toxic signs and symptoms due to stimulation of the cholinergic nervous systems.	Avian, aquatic and small mammal toxicity.
36	Triclorfon (Registered	<a href="http://www.epa.gov/oppsr">http://www.epa.gov/oppsr</a>	Trichlorfon can cause cholinesterase	Chronic risk levels of concern are

Ref. No.	Active Ingredient	Crop Protection Reference	Hazards	
			Human	Environmental
	by Bayer in EPA)	rd1/REDS/factsheets/trichlorfon_fs.htm	inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills), respiratory paralysis and death.	exceeded for freshwater invertebrates and birds. Concern for pond application.

**(f) The effectiveness of the requested pesticide for the proposed use**

The pesticides which are listed in Table 1 are those that the agronomist for IQF *Agroindustrial del Ecuador* presently believes to be effective. However, IQF believes that bicarbonate of soda, *Bacillus thuriensis* (Bt), and potassium salts of fatty acids (insecticidal soap), are the most effective for small farmers in the Otavalo region. These pesticides are generally effective for broccoli pests and diseases in other regions. Quantitative data are not available, however, on the effectiveness of these pesticides in Ecuador. So far, the professional staff of PRONORTE has not formed an independent opinion of the effectiveness of these pesticides. They intend to use the three recommended pesticides unless experience demonstrates that they are ineffective in controlling the mentioned broccoli pests in Ecuador, or new pests for which they are not incorporating into this decision internationally accepted best practices.

**(g) Compatibility of the proposed pesticide with target and non-target ecosystems**

Bicarbonate of soda, *Bacillus thuriensis* (Bt), and potassium salts of fatty acids (insecticidal soap), are generally compatible with non-target ecosystems, and practically non-toxic to non-target organisms (except for the case insecticidal soap, which is highly toxic to aquatic invertebrates) However, since soap salts are not applied directly to water, their current uses should not seriously impact aquatic invertebrates. In any case, pesticide application will be closely monitored so as to prevent misuse or drift from the application site.

Table 3 indicates that most of the pesticides currently being used for broccoli production are not compatible with target and non-target ecosystems. Rather they are all toxic to a greater or lesser extent to aquatic organisms. A number of them are extremely toxic to birds, wildlife, and honey bees.

(h) The conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils

The pesticides are to be used in the northern Andean highlands of Ecuador. This is a region where temperatures vary little through the year, averaging around 18° C, but vary widely during the day. Most of the natural vegetation has disappeared, so the landscape is dominated by agricultural crops, especially corn and beans. Slopes are moderate to steep, except in the Inter-Andean Valley where there are some flat areas. Rainfall averages about 900 mm per year concentrated between the months of October and May. There is a marked drier and windier season during the months of June, July, August and September. The soils are derived from volcanic ash and are generally black, deep and fertile, although underlain by a hardpan layer of compacted volcanic ash.

PRONORTE should, however, be aware of more specific environmental conditions once it has selected the sites of broccoli production where it will work. Such specific environmental conditions could include special soil types, occurrence of patches of natural vegetation, existence of nearby honeybee production, and proximity of water bodies.

(i) The availability and effectiveness of other pesticides or non-chemical control methods

The extent to which other pesticides or non-chemical control methods can be effective is at present unknown. PRONORTE intends to investigate and introduce integrated pest management methods for the cultivation of broccoli. Such methods would first use non-chemical control methods before

resorting to the use of pesticides. The three recommended pesticides would be used only when the economic threshold of pest infestation had been reached.

(j) The requesting country's ability to regulate or control the distribution, storage, use and disposal of the requested pesticide

Responsibility in Ecuador for regulating or controlling the distribution, storage, use and disposal of pesticides lies in the Ecuadorian Service for Agricultural Health (SESA), part of the Ministry of Agriculture and Livestock. Importers and distributors must receive permission from SESA to import and distribute pesticides. SESA makes its decisions regarding these permissions on data from the governments of the United States and European countries. It carries out no independent research. SESA is able to regulate and control legal imports of pesticides. Some pesticides, however, appear to be imported without permission from Colombia and to a lesser extent, Peru.

SESA appears to have very little capability to regulate or control the distribution, use, or disposal of pesticides. It does not have sufficient staff to permit more than occasional inspections of distribution points, such as farm supply stores. It completely lacks sufficient staff to make field inspections of pesticide use or disposal of pesticides. This is one of the reasons why only “alternative” or “organic” (bicarbonate of soda, Bt, and insecticidal soap) were recommended by this IEE. PRONORTE will ensure that all pesticides associated with its broccoli activity will be distributed, stored and disposed of according to manufactures directions.

**(k) The provisions made for training of users and applicators**

Currently there are no programs for the training of users and applicators of the pesticides used on broccoli. PRONORTE will provide training for users and applicators as part of its field school training and technical assistance activities.

(l) The provisions made for monitoring the use and effectiveness of the pesticide

PRONORTE’s technical advisors will closely monitor the use and effectiveness of the three recommended pesticides. They will do so by measuring pest populations before and after pesticide applications, within the context of an integrated pest management program. This is supplemented by the buyers’ traceability audit system, which will detail exact use of pesticide and method of application not only per producer, but per section of each producer’s land under cultivation. PRONORTE will prepare an annual monitoring report, to be approved by USAID/Ecuador’s Mission Environmental Officer, on the use of the three recommended pesticides and IPM activities associated with broccoli production under this activity.

**IV. Mitigation Measures**

Pesticides

PRONORTE’s training and technical assistance to broccoli farmers will follow the above guidelines and include integrated pest management practices that will make the use of the recommended pesticides, which safer and less likely to cause negative effects on natural ecosystems.

PRONORTE will not promote or work with farmers who use any pesticide other than those recommended by this IEE.

PRONORTE is stressing to farmers that if they practice good irrigation and good field design so as to avoid low-lying water that promote growth of disease (especially during the final stages of plant growth) they will not have to resort to the use of agrochemicals. Besides this, PRONORTE is promoting the use of safe handling of all agricultural inputs, which was hitherto unknown in the growing area.

Pesticide use can best be monitored as part of PRONORTE's extension activities with broccoli farmers. Extension agents can establish the baseline data regarding pesticide use on each farm that they visit. In the case of broccoli, since these are new productive activities there will be no pesticide baseline use. However, in subsequent visits, they will note any variation from the specified types of pesticides that the farmers are using and their methods of application. In this way, the extension agents will accumulate data on each of the participating farms on pesticides use practices.

Towards the end of PRONORTE, these data can be analyzed in order to determine the effect of PRONORTE's actions in the broccoli cluster on the use of pesticides, especially focusing on the extent to which integrated pest management practices have been understood and adopted.

#### Soil erosion

The environmental issue of soil erosion can be monitored and evaluated using the same evaluation and monitoring system that PRONORTE will use to track changes in productivity. PRONORTE's extension agents will be visiting each farm periodically. During their first visit to a farm they can establish baseline data regarding the farm's situation with regard to soil erosion. In subsequent visits they will observe and note changes in this situation. They will note, for example, if the area suffering from soil erosion is expanding or contracting and if the farmer is adopting soil conservation practices or not. In this way, over the course of PRONORTE's activities, a base of data about each participating farm will be accumulated.

The data will be based on actual field observations taken in close collaboration with the participating farmers periodically over the period that PRONORTE operates. On an annual basis PRONORTE will analyze these data in order to determine the trend that PRONORTE's activities have established on the participating farms with regard to the issue of soil erosion.

#### General

PRONORTE will translate this IEE into Spanish, make it available to all its extension agents, and train them in its use.

### **V. Recommended Threshold Decision**

Based upon the above discussion, it is recommended that the LAC Bureau Environmental Officer issue a Negative Determination with conditions for the use of pesticides and erosion control measures in the broccoli production cluster of the PRONORTE program under the supervision of the activity manager and implementing partners.

Approval:

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George Thompson  
LAC/BEO

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Date

Concurrence:

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Lars Klassen  
Mission Director USAID/Ecuador

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Date