Amendment to a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)

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Contract Number 527-C-00-01-00091-00
Colombia Alternative Development Project

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Colombia Alternative Development (CAD) Project

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Chemonics International

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ACTION FORM
Amendment to a Pesticide Evaluation Report and Safer Use Action Plan
(PERSUAP)
USAID-Colombia

PROGRAMME/ACTIVITY DATA:

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PERSUAP Prepared By: Mario Pareja, Consultant on Environment and Development to Chemonics International, Inc. and Ruth Marcela Avendaño, Fundacad.
Approval Final Action Form Reviewed By: Gabriel Escobar, Mission Environmental Officer (MEO), USAID-Colombia and Victor Bullen, Regional Environmental Officer, USAID-South America.
Submission Date: December …, 2003

INTRODUCTION

This document s a request for an amendment to the PERSUAP submitted and approved by USAID for the CAD project being implemented by Chemonics International. The CAD programme, funded by USAID in the context of the larger Plan Colombia, supports farmers, farmers' families and farmer communities that have been so far involved in the production of illicit crops, such as coca and poppy, to voluntarily switch to licit crop production. Working with communities, community associations, and municipalities in the departments of Bolivar, Cauca, Caqueta, Huila, Nariño, Norte de Santander, Putumayo, and Tolima, the Chemonics' program is creating licit economic opportunities that generate income, improve the quality of life, protect the environment, and support ethnic and cultural values for peaceful coexistence. The programme uses a bidding approach to call for applications from farmers' organisations and supports basic staple crops ('*cultivos de pan cojer*') as well as 'industrial' crops targeted to internal or external markets, many of them with industrial processing and transformation.

As stated in the PERSUAP approved, "for future commodities, pests and pesticide products to be considered under the CAD program implemented by Chemonics, but not covered in the present PERSUAP, ***a further condition is recommended, that an amended PERSUAP shall be submitted***, pursuant 22 CFR 216.3 (b)(1)(i)(a - l). The amended PERSUAP should be submitted to USAID-Colombia MEO and USAID-South America REO within a reasonable amount of time after the bidding process is completed and Chemonics is certain of the crops to be included in the contracts. The amended PERSUAP will be prepared following the instructions that are a component of this PERSUAP (see section 5.5) and it must be cleared by the USAID-Colombia MEO and USAID-South America REO before submission to the Mission Director for signature and before approval by the BEO".

"More specifically, for any pesticide not addressed in the present PERSUAP, a **Negative Determination with Conditions** is recommended pursuant to 22 CFR 216.3 (b)(1)(i)(a - l). The ***condition is that for pesticides NOT listed, in* Section 5.1.1: 'All CAD Pesticides', an amended PERSUAP, specific to the pesticides being proposed, shall be prepared and submitted to USAID.** The amended PERSUAP must be cleared by both the USAID-Colombia MEO and USAID-South America REO and approved by the BEO before the pesticides can be used."

The amended PERSUAP is now being submitted as per the determination of the original PERSUAP and following the procedures included as annex 5.5 of the said document and attached again to this amendment. This face-sheet summarises the findings related to new crops and the new pesticides in use in those crops. All issues related to pesticides, safer use of pesticides, and Integrated Pest Management have been fully and thoroughly discussed in the PERSUAP already submitted and approved. Included in the said document is a full discussion of the 12 key issues related to pesticides mandated by 22 CFR 216.3 (b)(1)(i)(a - l). Only the new pest and pesticide issues, not already addressed in the original PERSUAP, are discussed in this amendment. The new crops included in this amendment are the following:

New crops being supported by CAD: (1) ginger (*Zingiber officinale*) , (2) curcuma (*Curcuma longa*), (3) anamú (*Petiveria alliacea*), (4) ruda (*Ruta graveolens*), (5) limonaria (*Cymbopogon citratos*), (6) estevia (*Stebia rebaudiana*), (7) bell pepper (*Capsicum annum*), (8) tomato (*Lycopersicum esculentum*), (9) onion (*Allium cepa*), (10) watermelon (*Citrullus lanatus*), (11) melon (*Cucumis melo*), (12) papaya (*Carica papaya*), (13) mango (*Mangifera indica*), (14) sweet potato (*Ipomea batata*), (15) platanillo or heliconia (*Heliconia* spp.), (16) ginger shampoo (*Ahuaoei ginger*), (17) iraca palm (*Carludovica palmata*), (18) cordyline (*Cordiline terminalis*), (19) dracaena (*Dracaena massangeana*) and (20) black pepper (*Pipper nigrum*).

RECOMMENDED DETERMINATION

A **Negative Determination with conditions** is recommended on the basis of the completion by CAD for USAID/Colombia of an amendment of the PERSUAP for pesticide use, addressing USAID's Pesticide Procedures, pursuant to 22 CFR 216.3 (b)(1)(i)(a - l). The recommended **conditions** are addressed in the section of 'findings and recommendations' below and add to those already made in the original PERSUAP.

FINDINGS AND RECOMMENDATIONS

A significant number of the new crops to be promoted by CAD in this phase will be produced under eco-friendly agricultural production practices. Two separate groups of crops are to be produced under this approach. The first group is that of the "medicinal and aromatic plants" and includes the following species:

Medicinal and aromatic plants under ecological production: (1) ginger (Zingiber officinale) , (2) curcuma (Curcuma longa), (3) anamú (Petiveria alliacea), (4) ruda (Ruta graveolens), (5) limonaria (Cymbopogon citratos), and (6) estevia (Stebia rebaudiana).

The second group includes "flowers and foliages" of the following species:

Flowers and foliages under ecological production: (7) platanillo or heliconia (Heliconia spp.), (8) ginger shampoo (Ahuaoei ginger), (9) iraca palm (Carludovica palmata), (10) cordyline (Cordiline terminalis), and (11) dracaena (Dracaena massangeana).

The eco-friendly approach to production does not particularly preclude the use of pesticides but emphasises 'clean production' based on improved plant health and proper production management. Priority is given to non-chemical options to fertilisation, such as organic manure, and to pest management, such as biological (management of natural enemies, release of biocontrolers and use of biopesticides), cultural (poly-cropping, cover, repellent and trap crops, and others), and genetic pest control. Producers will resort to chemical controls only when all other measures have failed and, even in these cases, priority choices will be the bio-pesticides, described in further detail in PERSUAP-1. Integrated Pest Management (IPM) will be the approach to pest management.

The second most significant deviation from the conditions previously described in the PERSUAP already submitted to USAID, is the imminent initiation, in the context of the CAD programme, of the Patía Small Scale Irrigation Project. The project will reach small-scale land owners of the alluvial valley of the Patía River, in the municipalities

of Balboa and Patía, Department of Cauca, and will support them in the development of irrigated agricultural parcels of 1-10 ha, in clusters of 30 ha each. The Patía Small Scale Irrigation Project will include the following crops:

Crops to be produced under irrigation in Patía: (12) bell pepper (Capsicum annum), (13) tomato (Lycopersicum esculentum), (14) onion (Allium cepa), (15) watermelon (Citrullus lanatus), (16) melon (Cucumis melo), (17) papaya (Carica papaya), (18) mango (Mangifera indica), and (19) sweet potato (Ipomea batata).

Recommendation No.1: In order to mitigate the potential environmental and human impacts of pest management activities, the Patía project will use only pesticides that (a) have low human toxicity, e.g. are in WHO toxicological classes II, III and U[1]; (b) have low eco-toxicity, e.g. do not have or have a very limited potential impact on aquatic organisms, including fish, crustaceans and phyto- and zooplancton; (c) have low water solubility and so reduced mobility in the aqueous environment; and (d) when pesticides are used, a mitigation plan will be put into effect (see table on Pesticide Risk Analysis) .

Recommendation No.2: In order to prevent the environmental and human impacts of pest control methods, the Patía project will use a preventative approach to the potential development of serious pest problems in crop production, using poly-cropping systems and crop rotations as well as best agricultural practices appropriate to an irrigated area.

Recommendation No.3: The Patía project operator, Fundaset, will fully implement its Best Agricultural Practices (BAP) manual, specifically in relation to those activities that mitigate the potential impact of pest and pesticide management. The drip irrigation system will be, by itself, an important mitigation mechanism for potential environmental impacts.

A total of 102 pesticides that could potentially be used in these crops were screened based on Regulation 216 guidelines and recommendations made as to their appropriate use. For those cleared, specific mitigation recommendations are made. All other general mitigation recommendations formulated in the first PERSUAP regarding Safer Use of Pesticides (SUP), Integrated Pest Management (IPM), organic and eco-agriculture continue to apply to the CAD project and are fully endorsed in this amendment.

APPROVAL OF PERSUAP AMENDMENT RECOMMENDED:

Bureau Environmental Officer: _____ Date:
Paul Des Rosiers Approved: _____.
Disapproved: _____

File No:

Mission Environmental Officer: _____/s/_____ Date:
Gabriel Escobar

Team Leader/ Project Manager: _____/s/_____ Date:
Erhardt O. Rupprechet Jr., Programme Officer, Alternative Programme

Regional Environmental Officer: _____/s/_____ Date:
Victor Bullen

[1] World Health Organisation toxicological classes go from the extremely dangerous (I a) to the slightly dangerous (III) and the 'unlikely' dangerous (U).

Fundación Chemonics
Colombia Alternative Development (CAD) Project

Amendment to a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) USAID-Colombia

1. The Colombia Alternative Development (CAD) Programme

The Colombia Alternative Development (CAD) programme, funded by USAID in the context of the larger Plan Colombia, supports farmers, farmers' families and farming communities that have been so far involved in the production of illicit crops, such as coca and poppy, to voluntarily switch to licit crop production. Working with communities, community associations, and municipalities in the departments of Bolivar, Cauca, Caqueta, Huila, Nariño, Norte de Santander, Putumayo, and Tolima, the program is creating licit economic opportunities that generate income, improve the quality of life, protect the environment, and support ethnic and cultural values for peaceful coexistence. The programme uses a bidding approach to call for applications from farmers' organisations and supporting basic staple crops ('*cultivos de pan cojer*') as well as 'industrial' crops targeted to internal or external markets, many of them with associated industrial processing and transformation.

2. Background to the The Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)

On October 28th, CAD-Chemonics submitted, to USAID-Colombia, the first PERSUAP for the following crops:

Crops included in the first PERSUAP: (1) oil palm (*Elaeis guineensis*), (2) heart of palm (*Bactris* sp.), (3) cocoa *(Theobroma cacao)*, (4) cassava (*Manihot* spp.), (5) rubber *(Hevea brasiliensis)*, (6) dry beans (*Phaseolus vulgaris)*, (7) pastures (*Brachiaria* spp. & others), (8) forest plantations (various species), (9) plantain (*Musa* spp.), (10) maize (*Zea mays*), (11) rice (*Oryza sativa*), (12) potato (*Solanum tuberosum*), (13) sugarcane (*Sacharum officinalis*), (14) nurseries (various species), (15) vanilla (*Vanilla* spp.*)*, and (16) passion fruit (*Passiflora edulis* f. flavicarpa).

This PERSUAP included an in depth and thorough analysis of all issues related to pesticides, safer use of pesticides, and Integrated Pest Management (IPM). Included in the said document is a full discussion of the 12 key issues related to pesticides mandated by 22 CFR 216.3 (b)(1)(i)(a - l) for more than 70 analysed. General (SUP and IPM) and crop specific (IPM and pesticide use) recommendations were made in the first PERSUAP and these continue to apply to the crops being added in this amendment. The first PERSUAP was cleared by USAID-Colombia MEO on …. and by the REA on … and approved by the BEO on …

3. Introduction to the amendment of the PERSUAP

The first CAD PERSUAP clearly established the procedures for adding new crops and new pesticides to CAD.

"For future commodities, pests and pesticide products to be considered under the CAD program implemented by Chemonics, but not covered in the present PERSUAP, ***a further condition is recommended, that an amended PERSUAP shall be submitted***, pursuant 22 CFR 216.3 (b)(1)(i)(a - l). The amended PERSUAP should be submitted to USAID-Colombia MEO and USAID-South America REO within a reasonable amount of time after the bidding process is completed and Chemonics is certain of the crops to be included in the contracts. The amended PERSUAP will be prepared following the instructions that are a component of this PERSUAP (see section 5.5) and it must be cleared by the USAID-Colombia MEO and USAID-South America REO before submission to the Mission Director for signature and before approval by the BEO".

"More specifically, for any pesticide not addressed in the present PERSUAP, a **Negative Determination with Conditions** is recommended pursuant to 22 CFR 216.3 (b)(1)(i)(a - l). The ***condition is that for pesticides NOT listed, in*** **Section 5.1.1: 'All CAD Pesticides', an amended PERSUAP, specific to the pesticides being proposed,**

shall be prepared and submitted to USAID. The amended PERSUAP must be cleared by both the USAID-Colombia MEO and USAID-South America REO and approved by the BEO before the pesticides can be used."

This document is a request for an amendment to the PERSUAP submitted and approved by USAID for the CAD project being implemented by Chemonics International, following the above mentioned guidelines. The amendment includes (1) a discussion of the conditions in CAD that differ from those previously described in the approved PERSUAP; and (2) a discussion of the new pest and pesticide issues (as per the new crops, new pests, and new pesticides), following the 12 pest and pesticide management issues described in 22 CFR 216.3 (b)(1)(i)(a - l)[1]. The new crops included in this amendment are the following:

New crops included in the PERSUAP amendment: (1) ginger (*Zingiber officinale*) , (2) curcuma (*Curcuma longa*), (3) anamú (*Petiveria alliacea*), (4) ruda (*Ruta graveolens*), (5) limonaria (*Cymbopogon citratos*), (6) estevia (*Stebia rebaudiana*), (7) bell pepper (*Capsicum annum*), (8) tomato (*Lycopersicum esculentum*), (9) onion (*Allium cepa*), (10) watermelon (*Citrullus lanatus*), (11) melon (*Cucumis melo*), (12) papaya (*Carica papaya*), (13) mango (*Mangifera indica*), (14) sweet potato (*Ipomea batata*), (15) Platanillo or Heliconia (*Heliconia* spp.), (16) ginger shampoo (*Ahuaoei ginger*), (17) Iraca palm (*Carludovica palmata*), (18) Cordyline (*Cordiline terminalis*), (19) Dracaena (*Dracaena massangeana*), and (20) black pepper (*Pipper nigrum*).

The PERSUAP-amendment considers as valid, and further reinforces and supports, the recommendations made in the first PERSUAP document on issues related to: (a) **sustainable alternative development**; (b) **spread of insect pests and diseases**; (c) **present pesticide use**; (d) **pesticide evaluation**; (e) **pesticide safer use practices**; and (f) general **pest management approaches.** It further includes the Training and Monitoring plans, finalised after the original PERSUAP was submitted, and being now implemented by the project.

This document focuses on main general changes and modifications in project conditions from those described in the first PERSUAP as well as on the analysis of the new pesticides brought about by the new crop-pests associations.

4. Main changes from previous PERSUAP

Two broad scenarios of crop production need to be discussed as somewhat differing from the previous PERSUAP. First, a significant number of new crops to be promoted by CAD will be produced under a special eco-friendly agricultural production approach. Second, a small scale irrigation project will be initiated in the Patía Valley, Cauca.

4.1. Crops with special ecological approach

A significant number of the new crops to be promoted by CAD in this phase will be produced under eco-friendly agricultural production practices divided into two separate groups. The first is that of the "medicinal and aromatic plants" and includes the following species:

Medicinal and aromatic plants under ecological production: (1) ginger (*Zingiber officinale*) , (2) curcuma (*Curcuma longa*), (3) anamú (*Petiveria alliacea*), (4) ruda (*Ruta graveolens*), (5) limonaria (*Cymbopogon citratos*), and (6) estevia (*Stebia rebaudiana*).

The second group includes "flowers and foliages" of the following species:

Flowers and foliages under ecological production*:* (7) platanillo or heliconia (*Heliconia* spp.), (8) ginger shampoo (*Ahuaoei ginger*), (9) iraca palm (*Carludovica palmata*), (10) cordyline (*Cordiline terminalis*), and (11) dracaena (*Dracaena massangeana*).

1 Those sections of 22 CFR 216.3 (b)(1)(i)(a - l) that remain the same as in the previous PERSUAP have been quoted here exactly from the said document.

The eco-friendly approach to production does not particularly preclude the use of pesticides but emphasises 'clean production' based on improved plant health and proper production management. Priority is given to non-chemical options to fertilisation, such as organic manure, and to pest management, such as biological (management of natural enemies, release of biocontrolers and use of biopesticides), cultural (poly-cropping, cover, repellent and trap crops, and others), and genetic pest control. Producers will resort to chemical controls only when all other measures have failed and, even in these cases, priority choices will be the bio-pesticides described in detail in PERSUAP-1. Integrated Pest Management (IPM) will be the approach to pest management.

4.2. The Patía Small Scale Irrigation Project

The second most significant deviation from the conditions previously described in the PERSUAP already submitted to USAID, is the imminent initiation, in the context of the CAD programme, of the Patía Small Scale Irrigation Project. The project will reach small-scale land owners of the alluvial valley of the Patía River, in the municipalities of Balboa and Patía, Department of Cauca, and will support them in the development of irrigated agricultural parcels of 1-10 ha, in clusters of 30 ha each. The Patía Small Scale Irrigation Project will include the following crops:

Crops to be produced under irrigation in Patía: (12) bell pepper (*Capsicum annum*), (13) tomato (*Lycopersicum esculentum*), (14) onion (*Allium cepa*), (15) watermelon (*Citrullus lanatus*), (16) melon (*Cucumis melo*), (17) papaya (*Carica papaya*), (18) mango (*Mangifera indica*), and (19) sweet potato (*Ipomea batata*).

In the Environmental Review (ER) of the Patía irrigation project[2], the "contamination of both soil and water with pesticides was identified as a potential impact of concern since many of the crops proposed (e.g. tomatoes) require intensive pest management". More specifically, the project ER identified the following potential environmental threats from pest management activities: (a) contamination of soil, water and air with pesticides; (b) decrease in biodiversity, possibly in aquatic organisms; and (c) negative impacts on human health.

The study refers to the important caveat that most potential impacts from the use of pesticides will be a function of of a dynamic combination of toxicity and 'best practices'. To this effect the following criteria have been used in the PERSUAP-amendment to analyse the pesticides for approval and to develop recommendations that may prevent and/or mitigate the potential impact of pesticides.

Recommendation No.1: In order to mitigate the potential environmental and human impacts of pest management activities, the Patía project will use only pesticides that (a) have low human toxicity, e.g. are in WHO toxicological classes II, III and U[3]; (b) have low eco-toxicity, e.g. do not have or have a very limited potential impact on aquatic organisms, including fish, crustaceans and phyto- and zooplancton; (c) have low water solubility and so reduced mobility in the aqueous environment; and (d) when pesticides are used, a mitigation plan will be put into effect (see Annex No. 3: Pesticide Risk Analysis) .

The ER of the irrigation project states that the recommendations emanating from the PERSUAP will be "integrated into the Best Agricultural Practices (BAP) for implementation during training and crop production" of the main project operator (Fundaset). Following this guideline, during the preparation of the PERSUAP-amendment, the operator's BAP Manual was thoroughly reviewed, edited and expanded on specific issues regarding pest and pesticide management. Mitigation activities to reduce potential environmental and human health impacts of pest management, as well as a list of prohibited and not-approved pesticides as per the guidance of Regulation 216, were all added to the Manual. An important mitigation intervention for the project is that most, if not all, systems to be installed will be drip irrigation. This irrigation system, by reducing the amount of water and controlling the manner

[2] Greystone Environmental Consultants (GEC). Estudio de Revisión Ambiental, Proyecto de Establecimiento de Cadenas Productivas y Sistemas de Riego para el Valle del Patía, Departamento del Cauca. September 2003.

[3] World Health Organisation toxicological classes go from the extremely dangerous (Ia) to the slightly dangerous (III) and the 'unlikely' dangerous (U).

in which water is delivered to the crop, significantly reduces the potential for environmental, as well human health, impacts of pesticides.

Recommendation No.2: In order to prevent the environmental and human impacts of pest control methods, the Patía project will use a preventative approach to the potential development of serious pest problems in crop production, using poly-cropping systems and crop rotations as well as best agricultural practices appropriate to an irrigated area.

Recommendation No.3: The Patía project operator, Fundaset, will fully implement its BAP manual, specifically in relation to those activities that mitigate the potential impact of pest and pesticide management. The drip irrigation system will be, by itself, an important mitigation mechanism for potential environmental impacts.

As stated in the introduction, all mitigation recommendations formulated in the first PERSUAP regarding Safer Use of Pesticides (SUP), Integrated Pest Management (IPM), organic and eco-agriculture continue to apply to the CAD project and are fully endorsed in this amendment.

5. The Pesticide Evaluation and Safer Use Action Plan Update

The original PERSUAP, already approved for CAD, was done when the projects had already started. As such, the study faced the problem that pesticides were already being used by its operators. After the pesticide analysis was completed, several recommendations were made to modify a situation, to change on going behaviours and to phase out several pesticides. A different scenario was encountered in this PERSUAP amendment since no productive projects have yet been initiated. This has provided the opportunity to influence operators from the onset of the project in order to develop, early on, IPM recommendations and to prevent them to resort to unacceptable pesticides. Recommendations contained in this PERSUAP amendment are to design proper preventive interventions rather than to change ocurringactivities with pesticides.

5.1. Pesticide registration statuses in Colombia and with US-EPA: 22 CFR 216.3 (b)(1)(i)(a)

A total of 102 pesticide active ingredients were screened for this PERSUAP amendment based on the criteria set forth in Regulation 216, starting from their registration status with the Colombian authority, the Instituto Colombiano Agropecuario (ICA)[4], and the US Environmental Protection Agency (USEPA) (see Annex No.2: "All Pesticides in PERSUAP Amendment")[5]. The list of pesticides was compiled from the proposals submitted by CAD operators to Chemonics for the productive projects, as well as pesticides recommendations from the Colombian state and private technical institutions[6]. The analysis is thus preventive and is not based on actual but potential use of the pesticides in the proposed CAD crops for the new phase [See first PERSUAP for an in depth discussion of the methodology used to search for pest control technologies].

Recommendation No.3: The list of all new pesticides, or new pesticide uses, not cleared after this analysis, is presented in Table 1 at the end of this report, including the reasons for each decision. Since this analysis was made on potential, and not actual, use of the pesticides, this list should serve as a reference for CAD project operators' purchases in the future.

5.2. Basis for selecting the pesticides: 22 CFR 216.3 (b)(1)(i)(b)

Of the 102 pesticides screened for this amendment, only 46 have been further analysed as potential candidates to be used in the programme (see Annex No. 3: Risk Analysis). Traditionally, the main criteria for selecting these

[4] For this, an updated "Chemical Pesticide, Bio-inputs and Generics" database was obtained courtesy of ICA authorities.

[5] For this, EPA databases were consulted at its web site. PAN databases provided additional information on human and eco-toxicity of the pesticides.

[6] Sources for technical information were the official ICA or Corpoica, Colombia government recommendations, the growers associations, national and international research centres (see bibliography) and literature references applicable to Colombian conditions, with solid technical and scientific background.

pesticides are: availability, efficacy and cost. We have now changed these and added the risks posed to human health and to the environment. For those pesticides to be used in irrigated crops, in the Patía Project, the potential environmental impacts in the aqueous environment, have been added.

An usually overlooked criterion in the selection of pesticides is their formulation. On the one hand, a simple way to reduce risk from exposure to certain pesticides, such as chlorpyrifos, is to switch to formulations, like granules or pellets, that are not subject to dangerous spills and drifts. The same may be applicable to certain pesticides, such as the herbicide picloram, that by using injections into the bushy weeds, as opposed to sprays, reduces the total volume used and the area impacted. Care must be exercised, however, because a granular or pellet formulation could be more attractive to and/or more toxic to birds. So, the potential health and environmental impact of the various possible formulations from which to choose should always be considered, checked and analysed when selecting a pesticide.

5.3. Pesticides in the context of integrated pest management programmes: 22 CFR 216.3 (b)(1)(i)(c)

"Integrated pest management … is USAID policy because it is the most effective, economical, and safest approach to pest control. IPM attempts to control pests in an economically and environmentally rational manner; it emphasises non-chemical tactics which cause minimal disruption of the ecosystem"[7]. Pesticides should be used as the last resource for pest management after all other options have proven ineffective. Genetic (plants tolerance or resistance), biological (natural enemies), ethological (naturally occurring chemical disrupters), cultural (production practices), and mechanical (physical removal) are all preferred tactics to be used before resorting to chemical control (pesticides).

The matrices in Annex No. 1 ("Pests of [crop] and their Management), present the IPM programme menu options for the various CAD crops analysed in this PERSUAP-amendment. These charts begin with a general introduction on IPM possibilities for each crop; they then list the various possible pest problems for the crop, the management options available, the specific pesticides for each pest and some of the potential problems that may arise from the control options discussed.

5.4. Method of application: 22 CFR 216.3 (b)(1)(i)(d)

Although a few of the farmers may have access to stationary-pump spraying systems, somehow common in illicit crop growing areas, most of the pesticide application will happen through back pack sprayers. A recurret situation with these sprayers is that (a) they are not properly maintained and so they often leak with significant increases in the exposure of the applicator to the pesticide, and/or (b) they are incorrectly adapted for the job with nozzles that are not the most appropriate for the particular type of pesticides (insecticides-fungicides or herbicides) being sprayed. Pesticide mixing is also an issue since often farmers do not follow all the precautionary measures and the concentrated undiluted pesticide, increases the risk of exposure. In some rural areas, women and children may dangerously participate in the mixing, spraying and cleaning of the equipment. Finally, cleaning and disposing of pesticide excesses and of the product container, needs to follow strict norms in order to minimise human and environmental risks.

Although the Patía Project will be using drip irrigation there are no immediate plans to use pesticides mixed in the irrigation water, e.g. pestigation.

5.5. Possible toxicological hazards to humans or to the environment: 22 CFR 216.3 (b)(1)(i)(e)

A pesticide risk analysis was done on the 52 products that passed the first screening test (see Annex No. 3). This analysis included a look at acute and chronic toxicity to humans, eco-toxicity and potential for water contamination. As a result, recommendations were drawn as to the general and specific mitigation activities that need to be implemented in order to prevent and/or reduce the potential health and/or environmental impacts of the various pesticides to be used in the programme. These mitigation activities are all encompassed within the comprehensive

[7] *USAID/AFR Guidance: Preparing PERSUAPs for Pesticide Programmes in Africa.*

risk mitigation-SUP and IPM programmes already described in the original PERSUAP. [See also section 4.2 of this PERSUAP amendment for a discussion on possible specific risks in an irrigation project].

5.6. The effectiveness of the pesticides: 22 CFR 216.3 (b)(1)(i)(f)

Recommendations for pesticide and other pest management tactics to be used in the various crops have been gathered and double-checked with authoritative agricultural R&D institutions of Colombia. Additionally, literary references and relevant web sites (see Section 5.7 of the first PERSUAP) were consulted. CAD has an abundance of Colombian institutions that can provide technical information and support, as well as training in pest and pesticide management.

5.7. Compatibility of pesticides with target and non-target organisms: 22 CFR 216.3 (b)(1)(i)(g)

The pesticide risk analysis mentioned above addressed the main risks posed to non-target organisms in the environment, as well as potential impacts on target organisms, including the likelihood of encouraging the development of pest resistance. Also mentioned in Annex No. 3 are some of the main direct mitigation measures to prevent and reduce the potential impact of the various pesticides upon non-target organisms. The more general approaches to prevent and mitigate the health and environmental impacts from pest management activities, discussed elsewhere in the original PERSUAP and in this amendment are SUP and IPM.[See also section 4.2 of this document for a discussion on possible compatibility of pesticides in an irrigation project setting].

5.8. Conditions under which the pesticide will be used: 22 CFR 216.3 (b)(1)(i)(h)

The majority of the Colombian territory is formed by plains located below 500 meters above sea level (masl). The country could be roughly divided into six great geographical regions. The Andean one, including three Andean mountain ranges and the "inter-Andean" valleys; two coastal regions, the Caribbean and the Pacific; the plains of Antioquia; the Amazon forest; and finally, an insular region.

The CAD project is being implemented in Southern Colombia, in the Departments of Putumayo, Huila, Cauca, Nariño, Caquetá, and in the North Eastern Department of Norte de Santander. The commonality of all these territories is that they are all used for illicit crops, coca and poppy.

Colombia's climate is tropical with patterns strongly influenced by the Andes. They are normally classified as: (a) hot for circa 84% of the territory, reaching the 1000 masl level and with an average temperature of 24 º C; (b) temperate, at altitudes between 1000 and 2000 masl, with an average temperature of 17.5 º C; and (c) cold, with average temperature of 12 º C, and altitudes of 2000-3000 masl.

Ecologically, Putumayo, Caquetá, Norte de Santander, and Huila have a predominant pre-mountainous humid forest (Bh-pm) with close to 1000-2000 mm/yr, 18-24˚C, to low mountainous forest (Bh-mb) at 2000-2500 masl and 12-18˚C. CAD target departments are in the hot climate area. Cauca, Nariño and Tolima have predominance of pre-mountainous to mountainous forests with a much more variable level of humidity and their climate is temperate to cold.

The Patía Irrigation project may offer a good environment for pest development. However, recommendations have already been put forward for the project to follow an environmentally friendly crop production approach that minimises the risks of development of serious pest infestations. To this effect, the Patía project will use its BAP manual emphasising poly-cropping systems over mono-cropping, good crop rotations, preference for bio-inputs, both for fertilisation as well as for pest control, use of trap and border crops, best irrigation practices and only when required, judicious pesticide use.

5.9. Availability and effectiveness of other pesticides and of non-chemical Controls: 22 CFR 216.3 (b)(1)(i)(i)

As discussed in 5.3, the use of pesticides in CAD projects will be inserted into comprehensive IPM programmes. The "Decision Making Tree for IPM & a Guideline for SUP", shown in section 5.4 of the first PERSUAP, and discussed above, should help decision making if and when to resort to pesticides. The tables shown in Annexes No.

1 and No. 4 present other available pesticide options and other pest management tactics for each crop and its associated pests. There are, however, problems with recalcitrant pests, such as ants, that are ubiquitous and pose a serious threat to certain crops. Ants are not easy to control, and hence tend to draw to some of the most toxic chemicals, such as carbofuran and chlorpyrifos. Non chemical options are being suggested and proposed in the pest and pest management matrices for the crops analysed.

An example of a non-chemical approach to a recalcitrant pest: the case of ants

- Attractive baits
- Nest destruction early in their development stages
- Prevention of the emergence of winged ants with covers
- Applying agricultural calcium to change pH and destroy the fungi used as food by ants
- Seeding castor bean (*Ricinus communis*) in rotation or inter-cropped to inhibit ants
- Plough-in green manure (organic matter attracts them away from crops)
- Irrigation
- Mulching with neem or *Melia azedirach* materials (inhibits ants)

5.10. The ability and capacity of Colombia to regulate and control pesticide use: 22 CFR 216.3 (b)(1)(i)(j)

As previously stated, Colombia is one of the most advanced countries in Latin America with respect to pesticide registration, regulation, and control. Colombia has very modern registration procedures, applies international standards and codes for pesticide labelling and has a system to follow up and control pesticide manufacturers and distributors, that is only limited by the insecurity situation that the country has been living for the past 25 years. The Instituto Colombiano Agropecuario, ICA, in charge of pesticide regulations, has taken more than 30 actions, during the past 10 years, to ban hazardous pesticides or groups of pesticides, among which DDT, methyl bromide, canfechlor, captafol, all organochlorides, and toxaphene. Moreover, ICA requires that all Class IA and IB pesticides sold in the country have a back up 'prescription' written by a professional agronomist. Undoubtedly, the widespread insecurity of the rural territory of the country, and more specifically in the areas where CAD is active, limits the enforcement capacity of the CoG institutions. Although the degree and effectiveness of controls in these areas is somehow limited and less than desirable, during the preparation of this PERSUAP we had first hand evidence of on going inspections on pesticide dealers in the Department of Putumayo, one of the most affected by the conflict.

Colombia's pesticide regulations fit within the larger environmental framework, as per law 99 of 1993, "Fundamentals of the Colombian Environmental Policy". This law created the Ministry of Environment and the National Environmental System and established the "Environmental Licences" which were further regulated by decrees 1728 of 2002 and 1180 of 2003.

The modernisation of Colombia legislation regarding pesticides, begins with a major law, No.09, approved by the National Congress in January 1979, regulating "hazardous substances, pesticides, and pyrotechnic articles". This is followed by decree No.1843, of 1991, that further "regulates the use and management of pesticides". This decree defined and clarified terms and elements for the registration of pesticides, such as "efficacy", "contamination",

"fumigation", "residue limits", "risk" and "toxicity", and officially adopted the four-class-WHO hazard classification of pesticides[8]. The same decree further regulated the manufacture and distribution of pesticides in the country.

More recently, Colombia has fully adopted the regional norms of the 'Andean Community"(Comunidad Andina, CAN), to which Colombia is a signatory. CAN results from the integration of Bolivia, Colombia, Ecuador, Peru and Venezuela, in 1997 and in 1998, it passed the 'Andean Norm for the Registration and Control of Chemical Pesticides for Agricultural Use" (Decision 436). In it, the five Andean countries committed themselves to a common system for registration, control and use of pesticides. CAN's decision No.436 established, among other things, (a) requirements for pesticide registration; (b) norms for labelling and packaging; (c) maximum residue tolerances; and (d) norms for product efficacy research. Later, by resolution 532, of August 2001, CAN adopted the 'Technical Manual for the Registration and Control of Chemical Pesticides for Agricultural Use", which was fully developed and published in June 2002, as Resolution 630. This very comprehensive manual, includes detailed instructions to register chemical pesticides, with all the information requirements on the technical as well as the formulated material, as they relate to efficacy, human and eco-toxicology, residues, labelling, packaging, risks and the environmental management plan. Finally, ICA, as the CoG institution for the registration and control of pesticides, fully norms the application of the CAN decrees internally in Colombia, in its resolution No.00770 of March 2003.

Given this comprehensive and detailed pesticide regulatory framework, again, the capacity of Colombia to regulate and control pesticides is restricted by the general situation of the country, along with somewhat weak institutional presence in certain isolated areas. This scenario, however, does not preclude, as we reported above, that ICA authorities are enforcing some pesticide rules and regulations.

5.11. Provisions for Training in SUP and IPM: 22 CFR 216.3 (b)(1)(i)(k)

The CAD supported SUP training programme should focus on risk reduction rather than on safe use of pesticides. In other words, instead of sending the message that pesticides could be used safely, the main goal of the training programme should be to reduce the risk of farmers and their families through careful analysis, management, and understanding of the variables that affect the components of risk, namely:

Risk = toxicity x exposure

This means that "safer use", through risk reduction, begins prior to the "use" of the product, its selection and preparation, and continues well after its use, in the field, where the product is applied[9].

The SUP training could be sub-contracted from Bayer CropScience or from the GoC's Servicio Nacional de Aprendizaje (SENA) in alliance with the Asociación Nacional de Industriales (ANDI). The former, a chemical company, runs a programme called "Agrovida" that focuses on SUP for farmers or farmers' families. Since women and children are in the higher vulnerability group, and women are often involved in the storage of pesticides as well as in cleaning farmer's clothes, they are an audience of extreme importance to be reached with messages of risk reduction. The second is a joint programme between a GoC agency, SENA, in association with the industry and it offers two options, a two-day final user training course and a 5-day training-of-trainers event. CAD should consider training a few 'trainers', from the operators' staff, in each one of the regions where it operates. The contents of the training programme may need to be adjusted as per the various audiences but should include the themes listed in PERSUAP-1, such as risk management, toxicology, labels, transporting, storage, mixing, spraying, cleaning, discarding, container management, applicators protection, etc.

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[8] The WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and 'U' (improbable of presenting an acute risk in normal use). The LD_{50} used for chronic toxicity is either oral (O) o dermal (D). Colombia uses the same classification but classes are numbered I-IV.

[9] For more details see the Power Point presentation "A Practical Guide: Reducing Pesticide Risk", in Spanish, annexed to PERSUAP-1.

As stated previously, in order not to transmit the false idea that pesticides, used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation, but rather in the context of a larger, more comprehensive approach to pest management, that of Integrated Pest Management, or IPM. Moreover, training in ecological and organic agricultural concepts and practices, may always help CAD project operators to better understand, and even search for and experiment with, non-chemical options for pest control. A special training programme, including conferences and short practical courses, for CAD technical staff, field technicians and farmers has been put together and is in the process of implementation by Chemonics (see Table 2 in this report).

5.12. Monitoring effectiveness and use of the pesticides: 22 CFR 216.3 (b)(1)(i)(l)

CAD is working with farmers' associations and enterprises that have a relatively good level of organisation. Most have very well trained field technicians that are regularly monitoring the pest management problems and the effectiveness of pest management methods being used. Open and regular reporting lines exist within CAD project operators and Chemonics to communicate issues such as new pest appearances as well as failures in the standard methods being used. Moreover, the Natural Resources and Environment group of Chemonics has the capacity for, and it is taking a lead role in monitoring the most significant environment related variables of the project, including pesticides. During the preparation of this PERSUAP amendment a Monitoring Plan has been developed for the CAD project taking into account recommendations of the original PERSUAP as well as this amendment (see summary Table No. 3 at the end of this report).

6. Implementing PERSUAP Recommendations

As stated above, Tables No. 2 and No.3 present a summary of the Training and Monitoring Plans recommended for the CAD project, applicable to all crops listed in the first PERSUAP as well as in this amendment, and already being implemented by Chemonics.

Additionally, a very innovative and important element has been developed to support environmental compliance with USAID pesticide procedures. A "CAD Pesticide Policy" document has been finalised and submitted to Chemonics and it is in the process of final approval and initiation of implementation (see Annex No.5). The CAD Pesticide Policy establishes: (a) basic principles for the promotion of sustainable alternative development in Colombia; (b) the means to achieve it, an ecological approach that includes Integrated Pest Management as a cornerstone; (c) a strategy to to reach them, market-led environmental compliance; (d) the instruments CAD has a its disposal to do it, provide technical assistance, training and financial support; (e) the criteria to support the acquisition of pesticides, based on the first PERSUAP and this PERSUAP amendment; and (f) how CAD will operationalise the policy.

Table 1: Pesticides not cleared and reasons for the decision[10]

Pesticide active ingredient	Main Use	Basis for the decision[11]
Acrinatrin	Insecticide	Not registered USEPA
Aldicarb	Insecticide	EPA RUP+toxicity
Aldrin	Insecticide	Not registered USEPA+ICA+PIC
Althrobotrys irregularis	Microbial insecticide	Not registered USEPA+ICA
Arsenic compunds	Molluscicide	Toxicity
Benfuracarb	Insecticide	Not registered USEPA + toxicity
Benomyl	Fungicide	Not registered USEPA + toxicity
Betacyfluthrine	Insecticide	Not registered USEPA + toxicity
Bifenthrin	Insecticide	Not registered ICA
Cadusafos	Nematicide	Not registered USEPA + toxicity
Carbofuran	Insecticide, nematicide	EPA RUP+toxicity
Carbosulfan	Insecticide	Not registered USEPA+ICA
Chlorthal	Herbicide	Not registered ICA
Chlorothalonil	Fungicide	EPA RUP+toxicity
Cyfluthrin	Insecticide	EPA RUP+toxicity
Cypermethrine	Insecticide	EPA RUP+toxicity+eco-toxicity
Chlorpyrifos	Insecticide, nematicide	EPA RUP+toxicity
Diazinon	Insecticide	EPA RUP+toxicity+eco-toxicity
Dichlofluanid	Fungicide	Not registered ICA
Dichloropropeno	Fumigant	EPA RUP+toxicity+eco-toxicity
Dieldrin	Insecticide	Not registered USEPA+ICA+PIC
DDT	Insecticide	Not registered USEPA+ICA+PIC
Endosulfan	Insecticide	Limited registration ICA
Ethoprofos	Insecticide, nematicide	EPA RUP+toxicity
Etridiazol	Fungicide	Not registered ICA
Fenamiphos	Nematicide	EPA RUP+toxicity
Fenthion	Insecticide	EPA RUP+toxicity
Fluvalinate	Insecticide	EPA RUP+toxicity
Heptachlor	Insecticide	Not registered USEPA+ICA+PIC
Hexaconazol	Fungicide	Not registered USEPA
Maneb	Fungicide	Not registered USEPA+ICA+PIC
Metamidophos	Insecticide	EPA RUP+toxicity+PIC
Methyl-parathion	Insecticide	EPA RUP+toxicity+PIC
Methomyl	Insecticide	EPA RUP+toxicity
Monocrotophos	Insecticide	Not registered USEPA + toxicity
Napropamide	Herbicide	Not registered ICA
Naptalam	Herbicide	Not registered ICA
Nicotine	Botanical insecticide	EPA RUP+toxicity

[10] This list is not based on actual use of these pesticides but rather in their potential use based on technical recommendations available in Colombia. Is thus not corrective but preventative. It is to be used as a guideline to know the products that, based on Colombian and USAID regulatory guidelines, have not cleared the first screening. It is not meant to be complete and comprehensive.

[11] Either or more than one: lack of registration with US-EPA, with ICA-Colombia, toxicity, or in Prior Inform Consent (PIC) list, Restricted Use Pesticide with USEPA.

Pesticide active ingredient	Main Use	Basis for the decision
Ofurace	Fungicide	Not registered USEPA
Oxamyl	Insecticide, nematicide	EPA RUP+toxicity
Paraquat	Herbicide	EPA RUP+toxicity
PCNB	Fungicide, nematicide	Not registered ICA
Phosphamidon	Acaricide	Not registered USEPA+ICA+PIC
Propachlor	Herbicide	Not registered ICA
Propanocarb	Fungicide	Not registered ICA
Tatradifon	Acaricide	Not registered USEPA
Zineb	Fungicide	Not registered ICA
Ziram	Fungicide	Not registered ICA

Table 2: Proposed Training for CAD Project Operators and Farmers				
	SUP[1] for Farmers and Project Beneficiaries	***IPM[2] for Farmers***	***General IPM Principles***	***Eco-Agriculture***
Target Participants	Farmers, producers and CAD operators, including personal in charge of acquisitions and warehousing and, possibly, farmer's families.	Farmers, producers and CAD operators, working directly in the field, facing crop pest management day to day in CAD projects.	Field technicians, agricultural engineers or technicians and project operators. Invite UMATA, university and Corpoica technicians.	Farmers, producers and CAD operators, working directly in the field, facing crop pest management day to day in CAD projects.
Objective of Course	Train farmers, buyers, warehouse operators in selecting, stocking and safe management of pesticides in general.	Train farmers in pest and benefic insects and IPM application to their own crops.	Train producer's advisers in basic IPM principles and application techniques.	Train farmers in basic regenerative agriculture and resource protection principles.
Duration	1-2 days	1-2 days	2-3 days	1-2 days
Number of Sessions and Place	3-4 times in 3-4 project sites. Courses could be conducted separately for farmers and operators.	5-6 times in 3-4 project sites. Could be cycles of 3-4 courses each covering selected themes (one for each crop) in about 6 months.	3-4 times in 3-4 project sites. Could be cycles of 2-3 courses each covering selected themes (one for each crop) in about 3 months.	3-4 times in 3-4 project sites.
Possible Topics	Courses should include: pesticide types, toxicity, toxicological class, labels, preparation and application, solid waste disposal, user protection, selection, transportation, warehousing, first aid. A general approach with emphasis on reducing overall pesticide risks, rather than one restricted and concent rated exclusively on safe handling.	The course should be structured around certain fundamental and key IPM elements. However, the course should be flexible enough to attend to particular farmers needs and cover specific crop pest management.	*IPM definitions and concepts, IPM general principles: definitions of 'pests' and 'management', management methods and 'integration'; evolution of pests populations and natural enemies, economic and decision/action thresholds, and other themes of importance in IPM. Concepts should be directly applicable to crops in CAD projects, illustrated with case examples.*	Tropical agriculture: weather, soil, pest concepts needs, health and vegetal nutrients.
Possible Sponsors	Bayer CropScience (Agrovida), SENA-ANDI, ICA	Corpoica, U. Nacional, IICA, Cenipalma, Fedecacao, CIAT, SENA, CONIF	Corpoica, U. Nacional, IICA, Cenipalma, Fedecacao, CIAT, CONIF, CEF	IICA, SENA

[1] Safer Use of Pesticides.
[2] Integrated Pest Management.

Table 3: Monitoring the CAD PERSUAP Recommendations					
Thematic Area	**Specific Theme**	**Indicator**	**Means of Verification**	**Frequency**	**Pre-conditions / Assumptions**
Sustainable Alternative Development	More than crops, CAD promotes agricultural production systems	1. Ha. of crops planted in systems including poly-cropping versus mono-cropping	Technical studies & proposals in CAD	Biannually	Assumes a revision & substitution of the practice of promoting crops for one that promotes systems
			Field verification with project operators	Biannually	
	CAD promotes ecological approaches to crop production	2. No. of conferences in organic, eco-or in sustainable agriculture completed with technicians	CAD central & operators registry about participation.	Quarterly	CAD has signed agreements with the appropriate technical institutions that provide training & technical assistance
		3. No. of training activities completed with farmers			
Prevention of dissemination of plant sanitation problems	CAD has a functional system for certifying plant sanitation	4. Plant sanitation certificates exist for all plant material moved internally within Colombia (Yes/No)	CAD & ICA registry	Biannually	CAD staff, at all levels, is aware of the importance of preventing the dissemination of insect pests, pathogens & weeds internally within the country and their introduction from abroad.
		5. Quarantine periods are respected & there are plant sanitation certificates supporting the introduction of plant materials from abroad (Yes/No)	CAD & ICA registry	Biannually	

Thematic Area	Specific Theme	Indicator	Means of Verification	Frequency	Pre-conditions / Assumptions
Agricultural pest management system that respect the environment & human health.	CAD develops capacities in IPM as the technologically, environmentally, socially & economically most adequate approach to pest management.	6. No. of training activities in IPM completed with technicians (X) & with farmers (Z)	CAD central & operators registries on participation	Quarterly	CAD not only promotes SUP but in the context of IPM, offering non-chemical options to agricultural pest management.
		7. No. of IPM demo-plots installed in X crops & in Z regions	Operators registries & field verification	Biannually	CAD has established agreements with several technical institutions for IPM technical assistance.
		8. % of CAD farmers using a menu of pest management options (+ than 2-3) for each pest	Operators registries & field verifications	Biannually	Farmers know, accept & adopt the IPM approach & use non-chemical options.
		9. % of operators purchasing (X) & of farmers using (Z) biological products for pest management	CAD central & operators purchase registries & field verification	Biannually	CAD has disseminated biological options for pest management.
Reduction of risks from pesticides to human health & the environment	If and when pesticides are used, CAD promotes safer use of pesticides	10. No. of training activities completed with the operators (procurement agents, store keepers, etc.) & No. with farmers & their families	CAD central & operators registries about participation in training	Quarterly	CAD has established agreements with several technical institutions for IPM training & technical assistance.

Thematic Area	Specific Theme	Indicator	Means of Verification	Frequency	Pre-conditions / Assumptions
Reduction of risks from pesticides to human health & the environment (cont'd).	If and when pesticides are used, CAD promotes safer use of pesticides	11. % of farmers using at least the minimum protection equipment when using pesticides	CAD central purchase registry: protection equipment	Biannually	Operators understand the importance of protecting the applicator when using pesticides & know how to do it
			Field verification: deposit stores & farmers	Quarterly	
		12. % of operators that follow technical norms when storing pesticides	Field verification: deposit stores & farmers homes	Quarterly	CAD is aware of the importance of protecting workers & their families from pesticide risks
	In case of using pesticides, CAD promotes their use with lower risk	13. % of operators not using prohibited & not approved pesticides (according to PERSUAP guidelines: list & timing)	CAD central purchase registries & purchase requests from operators	Biannually	CAD staff is aware & accepts USAID environmental guidelines & norms.
			Field verification: deposit stores & farmers	Quarterly	
		14. Ratio of pesticides with red & yellow band (TC I & II) to those with blue & green band (TC III & IV)	CAD central registry of purchase requests by operators	Biannually	Operators & farmers are aware of the importance of considering toxicity when selecting pesticides
			Field verification: deposit stores & farmer homes	Quarterly	

Annex No. 1

Pests of Bell Pepper (*Capsicum annuum)* & their Management

General Comment: Bell pepper offers and excellent opportunity to establish a system for pest management that minimizes the use of external inputs, mainly chemical pesticides & promotes best & clean agricultural practices**.**

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Oidium (*Leveillula taurica*)	Cultural: eliminate weeds & crop rsidues, use healthy plants	Sulfur, fenarimol, triadimefon,	
Grey rot (*Botryotinia fuckeliana*)	Cultural: eliminate weed, crop residues & diseased plants. Care not to damage plants, use only clean & sharp cuts to the stem. Control nitrogen levels, use plastic covers that absorb UV light, planting spacings that allow aeration, proper irrigation management.	Ciprodinil + fludioxonil, tebuconazol, iprodiona, carbendazim	
White rot (*Sclerotinia sclerotiorum)*	Cultural: eliminate weed, crop residues & diseased plants. Care not to damage plants, use only clean & sharp cuts to the stem. Control nitrogen levels, use plastic covers that absorb UV light, planting patterns that allow aeration, proper irrigation management.	Ciprodinil + fludioxonil, tebuconazol	
Wilt (*Phytophthora capsici*)	Cultural: use healthy plants & substrate. Eliminate crop residues, mainly roots & stems. Planting patterns that allow aeration, proper irrigation management. Solarization.	Etridiazol	
Bacterial canquer (*Xanthomonas campestres*)	Cultural: eliminate weeds, crop residues & diseased plants. Avoid high humidity, use healthy or desinfected seeds, proper irrigation management. Do not sprinkle irrigatein case of attack to nurseries. Chemical: use Cu products	Copper sulfate and, since some resistance has been observed, alternate with mancozeb.	

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Diseases (cont.)			
Soft rot (*Erwinia carotovora*)	Cultural: eliminate weeds, crop residues, infected plants. Prevent damaging crop plants, good ventilation & irrigation management, desinfect tools, with a dilution of desinfectant at 20%, avoid excess nitrogen, use planting arrangements that allow good ventilation.		Chemical treatments are not effective after the pathogen enters the plant.
PMMV (virus)	Cultural: use seed free of virus, use resitant varieties, desinfect soils & tools as well as hands.		Chemical treatments are not effective after the pathogen enters the plant.
Nematodos (*Meloidogyne javanica*)	Cultural: use resitant varieties. Desinfect soils, use healthy plants. Phyisical: water vapor esterilization, solarization.	Cadusafos, etoprofos. Biological products prepared with the fungi *Arthrobotrys irregularis.*	
Insect Pests:			
Red mite (*Tetranychus urticae*)	Cultural: desinfect soil & structures, eliminate weeds, crop residues, avoit excess nitrogen, monitor crop during first phases. Biological: enemigos naturales: *Amblyseius, Phytoseiulus persimillis, Feltiella acarisuga*	Acrinatrin, flufenoxuron, piridaben	
White mite (*Polyphagotarsonemus latus)*		Abamectina, summer oil, sulfur, diazinon, endosulfan, potasium permanganate + sulfur, propargita, tetradifon	
White flies (*Trialeurodes vaporariorum*, *Bermisia tabaci)*	Cultural: place nets, eliminate weeds, crop residues, do not asociate crops, do not leave plants at end of cycle, use yellow traps. Biológico: natural enemies: *Encarsia, Cyrtopeltis tenuis, Eretmocerus*	Summer oil, methyl pirimifos , imidacloprid, piridaben, tau-fluvalinato, tiametoxam .	

Pests	Control Methods	Pesticides	Problems
Insect pests (cont.)			
Aphids (*Aphis gossypii*)	Cultural: use nets, eliminate weeds, crop residues, use yellow traps. Biological: natural enemies: *Aphidoletes aphidimyza, Aphidius, Lysiphlebus testaicepes.*	Summer oil, sulfur + cypermetrin, diazinon, endosulfan, imidacloprid, methyl pirimifos, Tau- fluvalinato	
Thrips (*Frankliniella occidentales)*	Cultural: place nets, eliminate weeds, crop residues, do not asociate crops, do not leave plants at end of cycle, use blue traps.	Summer oil, sulfur + cypermetrin, cipermetrin, diazinon, tau-fluvalinato	
Army worm (*Spodoptera exigua*)	Cultural: use nets, eliminate weeds, crop residues. In heavy infestations destroy crop leaves in the lower part of the plant, use feromone & light traps, close monitoring of crops in first stages. Biological: natural enemies: *Apantelles plutellae,* nuclear polyhedrosis virus of *S. exigua*	Sulfur + cypermetrin, betaciflutrin, ciflutrin, clorpirifos, diazinon, endosulfan, esfenvalerato, methyl pirimifos, tau- fluvalinato. Biological Products: *Bacillus thuringiensis*	
Scales (*Pseudococcus affinis)*	Cultural: eliminate weeds, clean fields. Biológico: natural enemies: *Cryptolaemus montrouzieri, Leptomastix dactylopii*	Use highly specific products against scales & add adjuvants to improve penetration.	Chemical treatments are not successful

Annex No. 1
Pests of Black Pepper (*Piper nigrum L*) & their Management

General Comment: Black pepper is a very delicate crop that demands careful and permanent care. It can integrate into poly-cropping or mix-cropping systems in the humid tropics. Accompanying vegetation should have been established before planting pepper. It can be easily grown as an organic crop as long as an Integrated Pest Management program, based mainly in non-chemical controls is developed. Below we suggest a few non-chemical, mainly cultural, options for pest management.

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Wilting (*Phytophthora palmivora*)	Cultural: prevent damage to roots & aerial parts, improve drainage, use organic fertilizers only well decomposed, do not cover stem with mulch, maintain clean field	Etridiazol, metalaxyl, chlorothalonil, mancozeb. In case of severe attack use "Bordeaux mixture".	
	Physical: eradicate & burn diseased plants		
	Chemical:		
	Biological: *Trichoderma*		
	Chemical: sprays to the base of plant. Desinfect tools		
Root rot (*Fusarium solani var. Piperi*)	Cultural: apply agricultural calcium to the neck of the plants, prune & burn infected plant parts, use healthy plants, control nematodes.	Carboxin When heavy infections: Bordeaux mixture	
	Genetic: use resistant varieties		
	Chemical: desinfect tools		
Anthracnosis (*Colletotrichum nicanor*)	Cultural: use agricultural calcium to the neck of plants, prune & burn infected plant parts, use healthy plants, control nematodes	Mancozeb When heavy infections: Bordeaux mixture	
	Genetic: use resistant varieties		
	Químico: desinfect tools		
Soft rot or black foot (*Erwinia carotovora*)	Chemical: before planting submerge plants in a solution of Piton & pH Plus, desinfect tools		
	Cultural: prevent damage to plants		

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Nematodes (*Meloidogyne javonica, Radopholus similes, Heterodera marion, Rotylenchulus reniformes*)	Cultural: use healthy & protected plants, nematode free soil for nurseries, improve soil drainage	Carbofuran	
	Chemical: disinfect soil for seedlings & transplanting		
Insects:			
Stink bugs (*Dasynus piperi)*	Chemical: botanical insecticides	Capsicine Azadiracthina	
	Biological: biological insectices		
Aphids *(Myzus sp, Apis gossypi))*	Biological: Parasitic wasps: *Aphidius spp*, *Aphidimyza* & fungi: *Anisopliae, Metarhizium, Verticillium*	VertiMec	Insecticides are often ineffective
	Chemical: Neem seed oil		
Mites	Cultural: eliminate weeds & crop residues where they bread & feed. Do not over fertilise with nitrogen. Use calcium.	Amitraz, Bifentrin, Abamectina, Propargita, ,Sulfur, mineral oils	Chemical controls are not very efficaceous because mites protect themselves under leaves.
	Biological: biological systemic insecticidas. Use natural predators: *Amblyseius californicus*		
	Chemical: dusting is better that spraying		
White scales	Biological: systemic biological inseticides	Diazinon, malathion	
	Chemical: apply with mineral oils		
Rodents:			
"Taltuzas" (*Orthogeomys cherriei)*	Physical: use traps		One of the main pests of this crop
Weeds:			
Various spp.	Manual: use tools, maintain soil weed free around plants, use cover crops in between rows	Glifosato	
	Químico:		

Annex No. 1
Pests of Cucurbits, Melon (*Cucumis melo*) & Watermelon (*Citrullus lanatus)* & their Management

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Oidium (*Sphaerotheca fuliginea*)	Cultural: eliminate weeds & crop residues; use helthy seedlings, treat nursery structures	Sulfur, cypermethrin, hexaconazol, benomyl, fenarimol, tridemefon, propineb	
	Genetic: varieties with tolerance or partial resistance		
	Chemical:		
Stem canquer of watermelon (*Didymella bryoniae*)	Cultural: use healthy seed, eliminate weeds & crop residues, avoid high humidity, collect damaged fruits	Benomyl, methyl-thiophanate	
	Chemical: desinfect structures & fungicides		
Mildew (*Pseudoperonospora cubensis)*	Cultural: eliminate weeds & crop residues, avoid excess humidity, open planting pattern	Benalaxil, mancozeb, cymoxanil, chlorothalonil, ofurace, copper oxychloride, propineb, triadimefon	
	Physical: eliminate affected plants by end of crop cycle		
	Chemical:		
Wilt, die-back (*Pseudomonas sp., Xanthommonas sp.)*			
Fusarium oxysporum	Cultural: crop rotations, eliminate weeds & crop residues	Etridiazol, proclhloraz	
	Physical: Eliminate diseased plants, solarization		
	Genetic: use resitant varieties, certified seeds		
	Chemical: desinfect structures & tools, fungicides		

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Diseases:			
Melon Necrotic Spot Virus (MNSV)	Genrtic: use resitant varieties		
Zucchini Yellow Mosaic Virus (ZYMV)	Cultural: eliminate weeds & diseased plants Chemical: control aphids		
Cucumber Mosaic Virus (CMV)	Cultural: eliminate weeds & diseased plants Chemical: control aphids		
Watermelon Mosaic Virus - 2 (WMV-2)	Cultural: eliminate weeds & diseased plants		
Squash Mosaic Virus (SqMV)	Cultural: use virus free seeds, avoid mechanical transmission in manual operations, fallow between crops		
Cucumber Vein Yellowing Virus (CVYV)	Gentic: use resistant varieties Cultural: use nets in nurseries, eliminate weeds & crop residues Physical: destroy affected plants Chemical: control vector, white fly, with specific insecticides		
Nematodes (*Meloydogine spp.)*	Gentic: use resistant varieties Chemical: desinfect structures & soil, use nematicies if needed Cultural: use healthy seedlings Biological: fungi *Arthrobotrys irregularis* Physical: vapor esterilization, solarization	Benfuracarb, cadusafos, carbofuran, dichloropropeno, ethoprophos, fenamifos, oxamyl	
Insect Pests			
Red mites (*Tetranychus urticae, T. turkestani, T. ludeni)*	Chemical: desinfect structures, use insecticides Cultural: eliminate weeds & crop residues, avoid excess nitrogen, monitor crops in early stages Biological: natural enemies	Abamectine, summer oil, acrinatrin, amitraz, bifentrin, tetradifon, sulfur, propargita	

Pests	Control Methods	Pesticides	Problems
White flies (*Trialeurodes vaporariorum, Bemisia tabaci*)	Physical: nets, use yellow traps Cultural: eliminate weeds & crop residues Biological: various natural enemies exist Chemical:	Summer oil, amitraz, bifentrin, methyl-pyriphos, thiametoxan	*B. tabaci* transmits viruses
Aphids (*Aphis gossypii, Myzus persicae*)	Physical: nets, yellow traps Cultural: eliminate weeds & crop residues Biological: various natural enemies Chemical:	Summer oil, amitraz, bifentrin, benfuracarb, carbosulfan, endosulfan, methomyl, esfenvalerate, methyl-pyrimifos, thiametoxan	
Thrips (*Frankiniella ocidentalis)*	Physical: nets & blue traps Cultural: eliminate weeds & crop residues Biological: various natural enemies Chemical:	Summer oil, sulfur, cypermetrin	
Leaf miners (*Liriomyza spp.*)	Physical: nets & yellow traps Cultural: eliminate weeds & crop residues, eliminate attaqued lower leaves Biological: various natural enemies Chemical:	Abamectine, summer oil	
Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)*	Physical: nets, light traps Cultural: eliminate weeds & crop residues, destroy lower crop leaves, monitor crop in early stages Ethological: use feromone traps Biological: various natural enemies Chemical:	*Bacillus thuringiensis,* amitraz, bifentrin, sulfur, cypermetrin, esfenvalerate, methyl-pyriphos	

Annex No. 1

Pests of Flowers & Foliage (see species below)[1] & their Management

General Comment: Tropical flowers and foliage will be produced with an ecological, clean, production approach. This approach is based on principles of clean production, such as obtaining and preserving healthy plants, through appropriate fertilisation with organic materials, including manure and green manure, cover crops, poly-crops, agroforestry systems, and microbial enrichment of soils. They will also use IPM approaches, such as bio-controls, crop monitoring and early identification of pest attacks, cultural controls. This eco-friendly approach does not necessarily exclude the use of pesticides but these will be used only after all tactics have failed. Even in these cases, the declared purpose of producers is to resort mainly to non-synthetic pesticides, including insecticidal soaps, vegetable oils (sunflower, soybeans, palm, cotton, etc.), biological and third generation insect growth regulator insecticides. Some of the operators to be involved already have experience with the crops and with IPM in flowers.

Pests	Control Methods	Pesticides[2]	Problems
Diseases:			
Foliar spots (*Fusarium* spp., *Cercospora, Phyllostica)*	Chemical	Maneb, benomyl	
Leaf rot (*Erwinia)*			
Post harvest fungi attacks	Chemical:	Sodium hypochlorite	
Soil born pathogens	Chemical: disinfection	Sodium hypochloride	
Insect Pests:			
Spodoptera sp.	Chemical: Biological: entomopathogen fungi	*Bacillus thuringiensis, Dipterex*	
Cochinilla	Chemical	Lorsban	
Weevil	Chemical: traps with attractants & sprays	Malathion	
Stem borer	Chemical	Malathion	
Trichoplusia nii	Chemical	Malathion, Orthene, Neem extracts	
Heliothis	Chemical Physical: light traps	Malathion	
Red mites			
Post-harvest insects	Chemical:	Malathion	

[1] Species being considered are: platanillo or heliconia (*Heliconia* spp.), ginger shampoo (*Ahuaoei ginger*), iraca palm (*Carludovica palmata*), cordyline (*Cordiline terminalis*), and dracaena (*Dracaena massangeana*).

[2] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Ants	Chemical: dusting	Lorsban, malathion	Toxicity
	Ethological: allelopathy by seeding Canavalia		
	Physical: manual collection of queens		
Weeds			
Various species	Mechanical: hand weed or use appropriate tools	Glyphosate	Does not work at 100%. By denuding soil of vegetation may increase risk of erosion.
	Chemical:		

Annex No. 1
Pests of Medicinal & Aromatic Plants (see list below) & their Management
[Ginger (*Zingiber officinale*) , curcuma (*Curcuma longa*), anamú (*Petiveria alliacea*), ruda (*Ruta graveolens*), limonaria (*Cymbopogon citratos*), y estevia (*Stebia rebaudiana*)]

General Comment: The fllowing table includes pests for curcuma, ruda, limonaria, stevia and anamú. Ginger is treated in more detalail because it presents more and more agresive pests. In general, the management strategies for medicinal and aromatic plants is that of ecological or clean production with crop and pest management approaches that protect the environment and minimize the use of chemical inputs. Among the general practices are: poly-crops, use of trap crops, use of repellent crops (ruda and hot pepper), crop rotations, use of physical and cultural pest control methods, use of natural biological controls and bio-products, and minimization of the use of chemical pesticides. The latter will be used only as a last resources and only when all other methods have failed. Their names are provided in case they are required but they will not be a component of the standard production technology.

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Bacterial wilt (*Pseudomonas solanacerum*)	Cultural: prevent damage to plants when removing soil close to crop	Agri – Mycin	
	Chemical: use antibiotic to the base of plants		
Red rot (*Fusarium zingiberi)*	Cultural: use resistant varieties. Rotate with non-susceptible crops. Do not use drainage water from infested fields.	Benomyl, carbendazin, imazalil	
	Biological: *Trichoderma lingorum, T. koningii, T. harzianum.*		
	Chemical:		
Black dry rot (*Rosellinia zingiberi*)	Cultural: properly select a well drained field. Use crop rotation. Select & use healthy rhyzomes	Tridimephon, carboxin + thiram	
	Biological: *Bacillus subtilis*		
	Chemical:		

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Root rots (*Phytium sp.)*	Cultural: properly select a well drained field. Use crop rotation. Select & use healthy rhyzomes	Furalaxil, propanocarb	
	Biological: *Trichoderma pseudokinigii*		
	Chemical		
Diseases:			
Leaf spot (*Colletotrichum zingeberis*)	Cultural: remove & burn affected plant parts	Difenoconazol, methyl-thiofanate, Bordeaux mix	
	Biological: *Bacillus megaterium, B. mycoides*		
	Chemical: preventative sprays with Bordeaux mixture		
Gull nematode (*Meloidogyne spp*.) – important in ginger -	Cultural: early soil preparation	Carbofuran	Most important pest of ginger
	Chemical: use granular nematicide to the planting spot.		
Raquitism nematode (*Tylencorrynchus sp*.) – important in ginger-	Cultural: disinfect soil before planting.	Dazomet, oxamilo, ethoprofos, aldicarb, carbofuran, fenamifos.	
	Physical: solarization. Remove affected plants.		
	Cultural: Repellent: *Tagetes* & calendula		
	Chemical: use mix of fatty acids.		
Borer nematode (*R.. similis)* – important in Curcuma-	Cultural: Repelent plants: *Ricinos cummunis, Origanum vulgare, Calendula officinalis*	Dibromo-cloropropano, ethoprofos, fenamifos, oxamil.	
	Chemical:		
Various fungi (*Alternaria steviae, Septoria sp, Sclerotium sp, Rhizoctonia solani, Sclerotinium rolfsii, Botrytis cinerea, Cercospora steviae*)	Cultural: *Ricinos cummunis, Nicotina tabacum*	Bordeaux mixture, methyl thiofenate, benomyl.	
	Chemical:		

Pests	Control Methods	Pesticides	Problems
Insects:			
Ants (*Atta sp*.)	Cultural: Change pH of ant hill usign agricultural calcium. Capture queens during nupcial flights. *Mentha spicata, Eucalyptus globulus*	Heptacloro, DDT, aldrín, dieldrín, pyrimiphos – methyl, cypermethrine, phoxim	
	Biológico: oritect natural enemies, such as ant eaters, tatues, birds, etc. Could use fungi: *Metarhizium anisopliae.*		
	Químico: use baits. Apply directly to an hill.		
Aphids	Biological: *Trichoderma, Metrhizium anisopliae*		
	Cultural: *Sambucus nigra,*		
Various other insect pests	Biological: *Trichogramma sp. Beauveria bassiana, Bacillus thuringiensis*	Chlorpyriphos	
	Cultural*: Capsicum sativus, Allium sativus, Curcuma longa,*		
	Chemical:		
Weeds:			
Various	Mechanical: mannual with machete or other tools.	Glifosate, diuron.	
	Physical: plastic mulching		
	Chemical:		

Annex No. 1
Pests of Onion (*Allium cepa)* & their Management

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Mildiew (*Peronospora destructor)*	Cultural: Use light & well drained soils, weed control Chemical: desinfection & sprays	Benalaxil, copper oxichloride, mancozeb, chlorothalonil, maneb, propineb, sulfur, zineb	
Rust (*Puccinia sp.)*	Cultural: avoid high nitrogen & low potassium soils Chemical:	Ziram, maneb, triadimeform, mancozeb, methyl thiofanate	
White rot (*Sclerotium cepivorum)*	Cultural: long rotations, avoid high humidity soils & soils with fresh manure Chemical:	Benomyl, dyclidina, diclofluanida, methyl-thiocianate	
Urocystis cepulae (tizón)	Chemical: desinfect tools Physical: remove & burn affected plants		
Purple root (*Pyrenochaeta terrestris)*	Gentic: use resistant varieties		
White tip (*Phytophthora porri)*	Cultural: long rotations		
Botritis (*Botritis squamosa)*	Cultural: avoid high humidity areas Chemical:	Chlorothalonil, diclofluanida, tebuconazol	
Purple spot (*Alternaria porri)*	Chemical:	Benalaxil, copper oxychloride, chlorothalonil, mancozeb, maneb	
Slugs (*Vaginulus accidentalis)*	Physico-chemical: traps with atractants	Metaldehide, arsenic compounds	

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Insects Pests			
Thrips (*Thrips tabasi)*	Cultural: eliminate crop residues Chemical:	Diazinon, acefate, malathion, formathion, dimethoate	Use humectant to imporve penetration
Aphids (*Mycromyzus formasanus)*	Chemical:	Acefate, methomyl, diazinon, metamidophos, formathion	
Stem cutters & others (*Prodenia, Feltia, Agrotis)*	Chemical: soil applied granular insecticides	Carbofuran, carbaryl, metamidophos	Mainly nursery pests.
Onion worm (*Hylemia antigua)*	Biological: various natural enemies Chemical: soil applied insecticides	Carbofuran, aldicarb	
Weeds			
Various species	Chemical: Mechanical: use weeder or hand weeding mainly around trees & during first 3 years	Pendimethalin, oxifluorfen, propachlor, linuron, trifluralin	

Annex No. 1
Pests of Papaya (*Carica papaya)* & their Management

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Anthracnosis (*Colletotrichum gloesporoides;* may be also others: *C. acutatum, C. demtium* y *Gloesporium* sp.*)*	Cultural: clean plantation, including pick up of dropped fruits, old leaves & stems, etc.	Chlorotalonil, captan, mancozeb, procloraz, tricyclazole	Fungicides must be used carefully because of potential crop injury & cross resistance to benzimidazoles (already observed between benomyl & thiabendazole). Alternate mechanisms of action.
	Chemical:		
	Genetic: plant tolerant varieties		
	Chemical: desinfect tools & sprays		
Stem rot (*Phytophthora palmivora;* may also be others: *P. cinnamomi, P. parasitica)*	Cultural: avoid high soil humidity conditions; do not place fruits on soil; use clean soil for nurseries; do not plant in contaminated soils; plant in light & well drained soils. Do not plant 2X in same terrain.	Metalaxil	There may other pathogens associated: *Phytium sp., Rhizoctonia sp., Fusarium sp.*
	Chemical: may use drenching		
	Physical: solarization of nurseries		
Bunchy top, & other names (mycoplasm associated to fungi)	Physical: remove diseased plants	Abamectine (for vector control)	
	Chemical: vector control		
	Cultural: fertilize with boro & calcium		
PMV (Papaya Mosaic Virus)	Cultural: select seed only from healthy plants; protect seedlings from cuts & from aphids, good fertilization & irrigation		
	Physical: Remove diseased plants		
Rot (*Ascochyta caricae*)	Chemical	Maneb	
Nematodes (*Meloidogyne incognita, Rotylenchulus reniformis)*	Cultural: crop rotation, do not plant 2X in same terrain		
	Sample soils & roots in rainy season		

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Insects Pests			
Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*)	Cultural: weed control	Malathion, acefate, dimetoato, metamidofos, dipterex, lebaycid	Some chemicals injure the crop: chlorpyriphos, forate, diazinon, parathion & methyl parathion.
	Physical: pick up dropped fruits & burry them		
	Genetic: choose varieties with thicker skin & pulp		
	Biological: parasitic wasp *Aceratoneuromiya*		
	Chemical: detect border infestations & apply only to borders		
Aphids (*Aphis spiraecola*)	Physical: eliminate diseased plants		Vector of the PMV
White scale (*Pseudaulacaspis* sp.)	Cultural: Eliminate / destroy old or abandoned plantations	Agricultural oil (does not affect beneficial organisms)	Sugarly secreations allow fungi *Fumagina* sp. to grow
	Chemical:		
Papaya white fly (*Aleurodicus* sp.)	Cultural: proper irrigation with fertilisation	Malathion, acefate, oxydemeton, dimetoato, metamidofos	
	Physical: eliminate old & affected leaves		
	Biological: release of *Encarsia* spp.		
	Chemical		
Empoasca sp.	Cultural: trap & border gramineous crops		Chemical control is normally unnecessary
Red mites (*Tetranichus* spp.)	Physical: remove infested leaves	Fosfamidon (Dimecron), abamectine (Vertimec)	
	Cultural: good fertilization & opportune irrigation		
	Chemical		
	Biological: various natural controlers		
Erinnys spp.	Biological: natural enemies *Trichogramma, Apanteles americanus* normally suffice to control it	Sevin ,carbaril	

Annex No. 1
Pests of Sweet Potato (*Ipomoea batata)* & their Management

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Wilting (*Fusarium oxysporum)*	Cultural: oprn plant spacing Chemical: desinfect soils Physical: remove diseased plansts		
Mumification (*Monilichaetes infuscans)*	Chemical: desinfection & fungicides Genetic: resistant varieties	Benomyl, TBZ	Post harvest disease
Black rot (*Cerastomella fimbriata*)	Genetic: resistant varieties Chemical: desinfect tubers		
Viruses (Sweet Potato Mosaic Virus, Internal Cork Virus, Spotted Mosaic Virus, Sweet Potato Veain Virus)			
Insects Pests			
Wire worm (*Agriotes lineatus)*	Cultural: good soil preparation before planting Chemical: soil applied granular insecticides	Carbofuran, chlorpyriphos, diazinon, phoxim	
Larvae (*Spodoptera litoralis)*	Chemical: baits & sprays	Chlorpyriphos, cypermetrine, deltametrine	
	Chemical		
Weeds			
Various species	Chemical: Mechanical: use weeder or hand weeding	Glyphosate, paraquat, naptalam, chlortal	

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Annex No. 1

Pests of Tomato (*Lycopersicon esculentum)* & their Management

General Comment: Tomato is a pest prone crop. There are many diseases and insect pests that may attack it. So, from very early on, tomatoes demand to establish a system for pest management that minimizes the use of external inputs, mainly chemical pesticides & promotes best & clean agricultural practices. Assuring a reduced use of pesticide during the early stages of crop establishment also assures the protection, maintenance and action of higher populations of natural enemies of the pests that, otherwise, may be wiped off by pesticides. Monitoring and intensive management are a must for tomato production.

Pests	Control Methods	Pesticides[1]	Problems
Diseases:			
Early blight (*Alternaria solani*)	Cultural: use certified seed, treated with disinfectant. Fertilize with K. Use irrigation appropieatly; do not over .	Captan, Clorotalonil, Mancozeb, Propineb	
	Genetic: use tolerant materials		
	Chemical: Seed treatment.		
Mildew (*Cladosporium fulvum*)	Genetic: there are several table varieties with tolerance.	Copper sulfate, copper oxichloride	
	Chemical: copper compounds		
Anthracnosis (*Colletotrichum spp*)	Cultural: crop rotations	Ziram, Zineb, Captan, Mancozeb, Clorotalonil, Maneb + zinc sulphate	
	Chemical: desinfection of seed & nusery. Sprays.		
Soft rot (*Erwinia carovotora*)	Cultural: avoid mechanical damage to fruits plantación		Could be a field as well as post-harvest problem.
	Physical: pick up dropped fruits & bury outside planted field.		
Wilting (*Fusarium oxisporum, Pseudomonas solani*)	Cultural: crop rotations, eliminate diseased plants & crop residues. Use certified seeds & healthy plants.		
	Genetic: use resistant varieties		
	Physical: solarisation		
	Chemical: Desinfect structures & tools. Other chemical treatments are ineffective		

[1] Pesticides mentioned in this table are not necessarily those recommended by CAD.

Pests	Control Methods	Pesticides	Problems
Diseases (cont):			
Late blight (*Phytophthora infestans*)	Cultural: eliminate diseased fruits & plants . Proper management of irrigation. Use healthy plants. Chemical: use adjuvants to imporve product activity	Mancozeb, captan, copper oxichloride, copper sulphate.	Resistance to pesticides has been observed so rotation of active ingredients is a must.
Dampping off (*Phytophthora sp, Phytium sp, Rhizoctonia sp*.)	Cultural: avoid high hunidity. Avoid high seeding density in nurserie. Plant should be properly spaced & in rows. Chemical: disinfect structures & treat seed with protectant		
Root rot (*Sclerotium rolfsii*)	Cultural: use crop totation. Eliminate affected plants & burn roots. Genetic: use resistant varieties Chemical: sprays directed to the plant basi at soil level	Captan, Tebuconazol, Ciprodinil + Fludioxinol.	
Bacterial canquer (*Clavibacter michiganensis*)	Cultural: use certified seed & non infected soils. Chemical: sterilise with hot water or water + chlorine		
Oidium (*Leveillula taurica*)	Cultural: eliminate weeds & crop residues. Use healthy seedlings. Chemical:	Sulfur, Fenarimol, Propineb, Triadimefon	
Grey rot (*Botryotinia fuckeliana*)	Cultural: eliminate weeds & crop residues; eliminate all infected plants. Biological: use a preparation of *Trichoderma harzianum* Chemical:	Benomil, Captan, Carbendazin, Mancozeb	
Soft rot	Cultural: use agricultural calcium to correct soil pH. Fertilise adequately. Maintain good drainage.		

Pests	Control Methods	Pesticides	Problems
Diseases (cont):			
Tomato Spotted Virus (TSWV)	Cultural: do not transplant materiasl presenting symptoms in leaves. Control weeds & completely destroy affected plants. Control thrips.		
	Genetic: use resistant varieties		
	Chemical: control thrips. There is no chemical control for viruses.		
Insect Pests:			
Red mites (*Tetranychus urticae, T. desertorum, T. ludeni)*	Cultural: periodic monitoring, mainly during first crop stages. Weed control. Eliminate weeds & crop residues. Avoid excess nitrogen.	Acrinatrin, Sulfur, Piridaben, Propargite, Avermectina	
	Biological: main species that predate on eggs, larvaes & adults: *Amblyseius californicus, Feltiella acarisuga, Phytoseiulus persimilis.*		
	Chemical: disinfect structures & soil		
	Biological: enemigos naturales: *Amblyseius, Phytoseiulus persimillis,*		
Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	Cultural: use nets in nurseries. Eliminate weeds & crop residues. Use yellow traps.	Dimetoato, Acefato, Sulfur +, Benfuracarb, Carbofuran, Cipermetrin, Chlorpirifós	Transmit viruses.
	Biological: hymenopther: *Aphidius colemani*. Diptera: *Aphidoletes aphidimyza*		
	Chemical:		
Stem borers (*Melanagromyza caucencis, M. tomaterae*)	Cultural: remove & burn affected plants. Eliminate alternate hosts such as *Amarantus sp.*	Trichlorfon	
	Biological: Himenóptero: *Pteromalidae*		
	Chemical: preventative applications with sugarly compounds		

Pests	Control Methods	Pesticides	Problems
Insect Pests (cont):			
White flies (*Trialeurodes vaporariorum, Bermisia tabaci*)	Cultural: avoid succesive planting of susceptible crops. Use crop rotations with corn, onions, peppers, sugarcane, sorghum. Control host weeds. Destroy crop residues. Incorporate organica matter to soils. Monitor populations by checking leaf lower sides. Apply good fertilization & irrigation.	Methyl pirimifos, Imidacloprid, Piridaben, Tau- fluvalinato, Thiametoxam	Transmits viruses.
	Mechanical: Use yellow traps. Use mulch made of rice husks, straw, sugarcane or yellow plastic. Use nets to cover nurseries.		
	Biological: parasites: wasps (*Encarsia formosa, Eretmocerus californicus*). Predators: spiders, *Delphastus* sp., *Chrysopidae* larvae. Enthomopathogens: fungi *Cladosporium herbarum* and *Dialeurodes spp*.		
	Químico:		
Scrobipálpula absoluta	Cultural: avoid succesive plantings. Do not leave contaminated crop residues in field. Do not transplant from infested nurseries.	*Bacillus thuringiensis*	
	Biological: Egg parasite: *Trichogramma* sp. wasps. Larvae control: *Apanteles sp, Bacillus thuringiensis*		
	Chemical: only with crop monitoring. Apply directly to growing point.		

Pests	Control Methods	Pesticides	Problems
Insect Pests (cont):			
Soil pests (*Agrotis ipsilon, Spodoptera frugiperda*)	Cultural: good soil preparation	Trichlorfon	
	Chemical: localiazed applications with baits & in detected foci. Apply in the afternoon.		
Larve (*Trichoplusia ni, Pseudoplusia incluyera*)	Biological: wide array of naturale enemies: *Trichogramma sp. Copidosoma truncatellum, Meteoros leaviventris Euplectrus sp.,* fungi *Nomuraea rileyi*, nuclear polyhedrosis virus (*Trichoplusia*)		

Annex No. 2
All Pesticides in PERSUAP Amendment[1]
Registration, Problem Analysis & Preliminary Decision [Reg 216 point (a)]

Pesticide			Crop & Pest / s	Type of Problem, if any[i]	Recommendation & alternatives
Technical Name[ii]	**Commer-cial Name[iii]**	**Type & Tox Class[iv]**			
Abamectin or aver-mectin	Abamectin a, Agrimec, Verlaq	Insecticide. TC WHO: not available TC Colombia: II	BELL PEPPER: White mites (*Polyphagotar-sonemus latus)* CUCURBITS: Red mites (*Tetranychus urticae, T. turkestani, T. ludeni),* Leaf miners (*Liriomyza spp.*) PAPAYA: to control vector of Bunchy top, Red mites (*Tetranichus* spp.*)* BLACK PEPPER: Aphids *(Myzus sp, Apis gossypi),* Mites TOMATO: Red mites (*Tetranychus* spp.*)*	In PAN Bad Actor List for acute toxicity & reproductive toxin	**Approved**.
Acephate (Acefato)	Orthene, Bambolero, Bambuco	Insecticide. WHO TC III; Colombia TC III	MANGO: Thrips (*Selenothrips rubrocintus*) ONIONS: Thrips (*Thrips tabasi),* Aphids (*Mycromyzus formasanus)* PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*), Papaya white fly (*Aleurodicus* sp.) TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*) FLOWERS: *Trichoplusia nii*	In the 'Bad Actor' list of PAN for: cholinesterase inhibitor. Organophosfate.	**Approved**.
Acrinatrin	Rufast Avance	Insecticide TC WHO: U TC Colombia: IV	BELL PEPPER: Red mites (*Tetranychus urticae*) TOMATO: Red mites (*Tetranychus* spp.*)*	Not registered with USEPA. Suspected endocrine disruptor	**Should not be used**

[1] This list includes all pesticides mentioned in technical recommendations and/or in proposals by the CAD project operators. Only those specifically labelled "approved" could be eventually used in the programme.

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commercial Name**	**Type & Tox Class**			
Agrimycin (streptomycin)		TC WHO n/a	MEDICINALS: Bacterial wilt (*Pseudomonas solanacerum*	Not registered with USEPA nor with ICA	Approved. Could be used based on its biological nature: unlikely to cause adverse effects on human or the environment
Aldicarb	Temik	Insecticide, acari-cide, nematicide TC WHO: Ia; TC Colo. : I	MEDICINALS: Raquitism nematode (*Tylencorrynchus sp*.) ONIONS: Onion worm (*Hylemia antigua)*	RUP with USEPA for high toxicity	**Should not be used.**
Aldrin		Insecticide; TC I	MEDICINALS: Ants (*Atta sp*.)	Not registered in USEPA & Colombia. In PIC list	**Should not be used.**
Amitraz	Amifed	Insecticide; TC WHO: III; TC Col: III	CUCURBITS: Red mites (*Tetranychus urticae, T. turkestani, T. ludeni)* CUCURBITS: White flies (*Trialeurodes vaporariorum, Bemisia tabaci*), Aphids (*Aphis gossypii, Myzus persicae*), Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)* BLACK PEPPER: Mites	In PAN Bad Actor list for moderate toxicity & reproductive toxin	Approved. Reregistered with USEPA November 1996.
Arthro-botrys irregularis	Nem- A-guard	Microbial nematicide TC WHO: not available.	BELL PEPPER: Nematodes (*Meloidogyne javanica*)	Not registered with USEPA. Not registered with ICA	**Should not be used until registered in Colombia.** Microbial product possibly w/o environmental or human health impact
Arsenic com-pounds		Moluscicide	ONIONS: Slugs (*Vaginulus accidentalis)*	Hi toxicity compouns	**Should not be used**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Azaridact hin	Neem extrcats	Insecticide. TCWHO: n/a. TC Col: n/a	BLACK PEPPER: Stink bugs (*Dasynus piperi)* FLOWERS: *Trichoplusia nii*	Registration with ICA	**Approved.** Only if registration with ICA is confirmed
Bacillus thuringien sis	Xentari, Ecotech-Pro, Turilav, Thuricide, Javelín, Batón, Dipel	Micro-biological insecticide: bacteria TC WHO: n/a; TC Col: U.	BELL PEPPER: Larvae (*Spodoptera exigua*) CUCURBITS: Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)* FLOWERS: *Spodoptera* sp. TOMATO: *Scrobipalpula absoluta*		**Approved.**
Benalaxyl	Galben (mix with mancozeb)	Funguicide. TC WHO: U; TC Col III	CUCURBITS:Mildew (*Pseudoperonospora cubensis)* ONIONS: Mildiew (*Peronospora destructor),* Purple spot (*Alternaria porri*	Not registered with US EPA	**Could be used only if no other options is available.**
Benfura-carb	Fulgor	Insecticida-nematicide. TC WHO: II. TC Col III	CUCURBITS:Nematodes (*Meloydogine spp.),* Aphids (*Aphis gossypii, Myzus persicae*) TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	Not registered with US EPA. In PAN Bad Actor list for cholinesterase inhibitor	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Benomyl	Benlate, Benomil, Benoagro	Fungicide. WHO TC: U; Colombia TC III.	CUCURBITS: Oidium (*Sphaerotheca fuliginea*) FLOWERS: Foliar spots (*Fusarium* spp., *Cercospora, Phyllostica)* MEDICINALS: Red rot (*Fusarium zingiberi),* Various fungi (*Alternaria steviae, Septoria sp, Sclerotium sp, Rhizoctonia solani, Sclerotinium rolfsii, Botrytis cinerea, Cercospora steviae*) MANGO: Anthracnosis (*Colletotrichum gloesporoides),* Powdery mildiew (*Oidium mangiferae*) ONIONS: White rot (*Sclerotium cepivorum)* SWEET POTATO: Mumification (*Monilichaetes infuscans)* TOMATO: Grey rot (*Botryotinia fuckeliana*	All uses of benomyl have been voluntarily cancelled as of December 2003. Liver toxicity, developmental toxicity & reproductive effects.	**Should not be used.**
Betacy-flutrin	Baytroide	Insecticide TC WHO: II TC Colombia: III	BELL PEPPER: Larvae (*Spodoptera exigua*)	RUP with USEPA due to acute toxicity to fish. Suspected endocrine disruptor	**Should not be used.** Mainly close to water bodies.
Bifenthrin		Insecticida. WHO TC II.	CUCURBITS: Red mites (*Tetranychus urticae, T. turkestani, T. ludeni),* White flies (*Trialeurodes vaporariorum, Bemisia tabaci*), Aphids (*Aphis gossypii, Myzus persicae*), Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)* BLACK PEPPER: Mites	Not registered in Colombia. In PAN Bad Actor list for repro-ductive toxin, possible endocrine disruptor & carcinogenic.	**Should not be used**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Cadusafos	Apache, Rugby, Cadusafos, Ebufos	Insecticide, nematicide TC WHO: I b TC Colombia: III	BELL PEPPER: Nematodes (*Meloidogyne javanica*) CUCURBITS: Nematodes (*Meloydogine spp.)*	Not registered with USEPA In PAN Bad Actor List: cholineste-rase inhibitor: organophosphat e & acute toxicity	**Should not be used**
Capsaicine (capscici-na)	Hidrolato de ajo-ajó	Botanical repelent. WHO TC: n/a; Col TC IV	BLACK PEPPER: Stink bugs (*Dasynus piperi)*	*Capsicum oleo-resin* registered with USEPA as botanical insecticide.	**Approved.**
Captan	Captan, Merpan, Orthocide	Fungicide. WHO TC: U; Colombia TC: II	MANGO: Anthracnosis (*Colletotrichum gloesporoides)* PAPAYA: Anthracnosis (*Colletotrichum* spp.*)* TOMATO: Early blight (*Alternaria solani),* Anthracnosis (*Colletotrichum spp),* Late blight (*Phytophthora infestans),* Root rot (*Sclerotium rolfsii*), Grey rot (*Botryotinia fuckeliana*	In 'Bad Actor' list of PAN for possible carcinogenic & acute toxicity	**Approved.**
Carbaryl (carbaril)	Sevin, Carbaril, Dhimefo	Insecticide, nematicide. WHO TC II; Colombia TC IV.	ONIONS: Stem cutters & others (*Prodenia, Feltia, Agrotis)* PAPAYA: *Erinnys* spp.	In the 'Bad Actor' list of PAN for cholinesterase inhibitor. Carbamate. In IRED-03 list.	**Approved.** But pending re-registration with USEPA in 2003.
Carben-dazim	Curacarb, Carbendazi m, Derosal, Bavistin, Carbendacr op, Roben-dazim, etc.	Fungicide TC WHO: U TC Colombia: III	BELL PEPPER: Grey rot (*Botryotinia fuckeliana*) MEDICINALS: Red rot (*Fusarium zingiberi)* TOMATO: Grey rot (*Botryotinia fuckeliana)*		**Approved**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Carbo-furan	Furadan, Carbofed, Curater, Furalimor, Fursem, Carbofuran	Insecticide, nematicide. WHO TC IB; Colombia TC I	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Gull nematode (*Meloidogyne spp*.), Raquitism nematode (*Tylencorrynchus sp*.) ONIONS: Stem cutters & others (*Prodenia, Feltia, Agrotis),* Onion worm (*Hylemia antigua)* BLACK PEPPER: Nematodes SWEET POTATOES: Wire worm (*Agriotes lineatus)* TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	RUP with USEPA (Except pellets /tablets). In 'Bad Actor' list of PAN: cholin-esterase inhibitor & acute toxicity. Organophosphat e In IRED-04 list.	**Should not be used.** Except pellets/tablets. Revise registration status in 2004.
Carbo-sulfan	Eltra	Insecticide. TC Col I	CUCURBITS:Aphids (*Aphis gossypii, Myzus persicae*)	Registration in Col cancelled for moth. Registration cancelled in the US	**Should not be used.**
Carboxin	Vitavax	Fungicide. WHO TC U; Colombia TC III	MEDICINALS: Black dry rot (*Rosellinia zingiberi*) BLACK PEPPER: Root rot (*Fusarium solani var. Piperi*)	In 'Bad Actor' list of PAN for possible reproductive toxin. In IRED-04 list.	**Approved.** But pending re-registration with USEPA in 2004.
Chloro-thalonil	Bravo, Bravonil, Centauro, Clorotaloni l, Daconil, , Pugil, etc.	Fungicide. WHO TC U; Colombia TC II	CUCURBITS: Mildew (*Pseudoperonospora cubensis)* ONIONS: Botritis (*Botritis squamosa),* Purple spot (*Alternaria porri)* PAPAYA: Anthracnosis (*Colletotrichum* spp.*)* TOMATO: Early blight (Alternaria solani), Anthracnosis (Colletotrichum spp) MANGO: Powdery mildiew (*Oidium mangiferae*), Anthracnosis (*Colletotrichum gloesporoides)* ONIONS: Mildiew (*Peronospora destructor)* BLACK PEPPER: Wilting (*Phytophthora palmivora*)	RUP with USEPA. In 'Bad Actor' list of PAN for possible carcinogenic & acute toxicity.	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Cyfluthrin	Bulldock	Insecticide TC WHO: II TC Colombia: III	BELL PEPPER: Larvae (*Spodoptera exigua*)	RUP with USEPA due to toxicity to fish. Suspected endocrine disruptor	**Should not be used.** Mainly close to water bodies.
Cyper-methrine	Vexter, Agroper, Cypermon, Insectrica, Latigo, Pyrimetha, Torpedo	Insecticide TC WHO: I b TC Colombia: II	BELL PEPPER: Larvae (*Spodoptera exigua*) CUCURBITS: Thrips (*Frankiniella ocidentalis),* Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)* MEDICINALS: Ants (*Atta sp*.) SWEET POTATOES: Larvae (*Spodoptera litoralis)* TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	RUP with USEPA due to oncogeneicity & risks to non-target organisms In PAN Bad Actor List due to acute toxicity, possible carcinogenic, suspected endocrine disruptor	**Should not be used**
Cymoxanil	Fitiraz (in mixes with propineb)	Fungicide. TC WHO III; Colo. TC: n/a (only in mixes)	CUCURBITS: Mildew (*Pseudoperonospora cubensis)*		**Approved.**
Chlorthal		Herbicide	SWEET POTATOES: weed control	Not registered in Colombia	**Should not be used**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Ciprodinil + fludioxonil	Switch	Fungicide TC WHO: not available. TC Colombia: III	BELL PEPPER: Grey rot (*Botryotinia fuckeliana*), white rot (*Sclerotinia sclerotiorum*) TOMATO: Root rot (*Sclerotium rolfsii*)	Highly toxic to aquatic invertebrates	**Approved** (but with a strict mitigation plan)
Chlor-pyrifos	Lorsban, Clorpirifós, Clorpiricol, Arriero	Insecticide, nematicide. WHO TC II; Colombia TC III	BELL PEPPER: Army worm (*Spodoptera exigua* FLOWERS: Cochinilla, Ants MEDICINALS: Various insect pests MANGO: Scales (*Planococcus citri*) SWEET POTATOES: Wire worm (*Agriotes lineatus),* Larvae (*Spodoptera litoralis)* TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	RUP with USEPA In the 'Bad Actor' list of PAN: cholinesterase inhibitor. Organophosphat e.	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Copper oxychlo-ride	Agrotox, Coper-pro, Coperflow, Cuprene, Oxiclor, Oxicloruro de Cu	Fungicide. WHO TC III; Colombia TC III.	CUCURBITS: Mildew (*Pseudoperonospora cubensis)* MEDICINALS: Leaf spot (*Colletotrichum zingeberis*), Various fungi (*Alternaria steviae, Septoria sp, Sclerotium sp, Rhizoctonia solani, Sclerotinium rolfsii, Botrytis cinerea, Cercospora steviae*) MANGO: Anthracnosis (*Colletotrichum gloesporoides),* "Roña" (*Elsinoe mangifera),* Stem canquer or wilting (*Ceratocystris fimbriata*), Cercospore (*Cercospora* spp.), Bacterial black spot (*Xanthomonas campestris)* ONIONS: Mildiew (*Peronospora destructor),* Purple spot (*Alternaria porri)* BLACK PEPPER: Wilting (*Phytophthora palmivora*), Root rot (*Fusarium solani var. Piperi*), Anthracnosis (*Colletotrichum nicanor*) TOMATO: Mildew (*Cladosporium fulvum),* Late blight (*Phytophthora infestans)*	RUP with USEPA.	**Approved.** Use with a very close monitoring plan. Diseases are a major problem in tropical crop production. There are already many limitations on fungicide availability and it is preferable that operators use copper compounds that other more toxic and environmental damaging products.
Copper sulphate	Verdeagri med	Fungicide, algicide, moluscicid a; TC WHO: II TC Col: n/a	BELL PEPPER: Bacterial canquer (*Xanthomonas campestres*) TOMATO: Mildew (*Cladosporium fulvum),* Late blight (*Phytophthora infestans)*		**Approved.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommenda-tion & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Dazomet	Basamid	Soil disinfectant TC WHO: III; TC Col III	MEDICINALS: Raquitism nematode (*Tylencorrynchus sp*.)		**Approved**
Diazinon	Danol, Diazinon, Diazol, Dicamba	Insecticide TC WHO: II TC Colombia: III	BELL PEPPER: White mites (*Polyphagotar-sonemus latus)* Aphids (*Aphis gossypii),* Larvae (*Spodoptera exigua*) MANGO: Scales (*Planococcus citri*) ONIONS: Thrips (*Thrips tabasi),* Aphids (*Mycromyzus formasanus)* BLACK PEPPER: White scales SWEET POTATOES: Wire worm (*Agriotes lineatus)*	RUP with USEPA due to aquatic & bird toxicity. Registration was temporarily cancelled in 1988. In PAN Bad Actor List: cholinesterase inhibitor: organophosphat e & potential water contaminant.	**Should not be used**
Diclo-fluanid		Fungicide. TC WHO: U	ONIONS: White rot (*Sclerotium cepivorum),* Botritis (*Botritis squamosa)*	Not registered in Colombia.	**Should not be used until registered in Colombia.**
Deltameth rin	Decis	Insecticide. TC WHO: II; TC Col III or IV	SWEET POTATOES: Larvae (*Spodoptera litoralis)*		**Approved.**
Dieldrin		Insecticide	MEDICINALS: Ants (*Atta sp*.)	Nor registered in US nor in Colombia. In PIC list	**Should not be used**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommenda-tion & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Dichloro (dibro-mine) propeno	Telone	Soil fumigant. TC WHO: n/a; TC Col I	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Borer nematode (*R.. similis)*	RUP with USEPA. In PAN BAD Actor list for acute toxicity, carcinogen & ground water contaminant.	**Should not be used.**
Difeno-conazol	Sico	Fungicide. Col TC III	MEDICINALS: Leaf spot (*Colletotrichum zingeberis*)		
Dime-thoate	Sistemín, Sistoato, Agrixon, Agrometox, Di-metox, Perfektion, etc.	Insecticide. WHO TC II; Colombia TC II	MANGO: Scales (*Planococcus citri*) ONIONS: Thrips (*Thrips tabasi)* PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*), Papaya white fly (*Aleurodicus* sp.) TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	In the 'Bad Actor' list of PAN: cholinesterase inhibitor. Organophosphat e In IRED-03 list.	**Approved**. But pending re-registration with USEPA in 2003.
Diuron	Batazo, Direx, Diurex, etc.	Herbicide. TC WHO: U; TC Col III or IV	MEDICINALS: broadleaf weed control	In PAN Bad Actor list for carcinogen, reproductive toxin & ground water contamination.	**Approved.**
DDT		Insecticide	MEDICINALS: Ants (*Atta sp*.)	Registration cancelled in US & Colombia. In PIC list.	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommenda-tion & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Endo-sulfan	Afidan, Thiodan, Beosit, Cyclodan, Devisulfan, Endocel	Insecticide TC WHO: II	BELL PEPPER: White mites (*Polyphagotar-sonemus latus)* Aphids (*Aphis gossypii),* Larvae (*Spodoptera exigua*) CUCURBITS: Aphids (*Aphis gossypii, Myzus persicae*)	Registration cancelled in Colombia	**Not to be used under any circumstance**
Esfen-vaerato	Halmark, Evercide	Insecticide TC WHO: II; TC Col: III	BELL PEPPER: Larvae (*Spodoptera exigua*) CUCURBITS: Aphids (*Aphis gossypii, Myzus persicae*), Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)*	Very high toxicity to amphibians & fish	**Approved.** But with a very strict mitigation plan
Ethopro-fos	Mocap	Insecticide, nematicide TC WHO: I a TC Colombia: II	BELL PEPPER: Nematodes (*Meloidogyne javanica*) CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Raquitism nematode (*Tylencorrynchus sp*.), Borer nematode (*R.. similis)*	RUP with USEPA due to acute toxicity In PAN Bad Actor List: cholinesterase inhibitor, acute toxicity, carcinogenic & potential water contaminant.	**Should not be used**
Etridiazol	Banrot, Koban, Terraclor, Terrazole, Truban	Fungicide WHO TC: III	BELL PEPPER: Wilting (*Phytophthora capsici)* CUCURBITS: Mildew (Pseudoperonospora cubensis) BLACK PEPPER: Wilting (*Phytophthora palmivora*)	Nor registered in Colombia. In RED list: 02/01 In PAN Bad Actor List due to …	**Should not be used**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Fenami-phos	Nemacur	Nematicide . TC WHO: Ib;. TC Col II	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Raquitism nematode (*Tylencorrynchus sp*.), Borer nematode (*R.. similis)*	RUP. In PAN Bad Actors list for acute toxicity, cholinesterase inhibitor & potential for ground water contamination	**Should not be used**
Fenarimol	Rubigan	Fungicide TC WHO: U TC Colombia: IV	BELL PEPPER: Oidium (*Leveillula taurina*) CUCURBITS: Oidium (*Sphaerotheca fuliginea)* TOMATO: Oidium (*Leveillula taurica*)	Potential water contaminant. Suspected endocrine disruptor	**Approved**
Fenthion	Lebaycid	Insecticide. TC WHO II; TC Col III	PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*)	RUP. In PAN Bad Actor List for cholinesterase inhibitor & potential ground water contamination.	**Should not be used.**
Flufenoxu ron	Cascade, Cottonex, Meturon, Uronmate	Insecticide TC WHO: U; TC Col: III	BELL PEPPER: Red mites (*Tetranychus urticae*)	Not registered with USEPA	**Not to be used until registration with USEPA is confirmed**
Fluvali-nate	Mevarick	Insecticide. TC WHO: U; TC Col III	MANGO: Thrips (*Selenothrips rubrocintus*)	RUP. In PAN Bad Actor List for reproductive toxin	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Furalaxil	Fongarid	Fungicide. TC Col IV	MEDICINALS: Root rots (*Phytium sp.)*	Not registered with USEPA	**Could be used if no other alternatives.**
Gyberellic acid	Gibro	Growth regulator. TC WHO: n/a; TC Col IV	MANGO: Fruit flies (*Ceratitis capitata, Anastrepha* spp.*),* Scales (*Planococcus citri*)		**Approved.** Gibberellins registered with EPA.
Glypho-sate	Roundup	Herbicide. WHO TC U; Colombia TC III ó IV	FLOWERS: weed control MEDICINAL: weed control MANGO: weed control BLACK PEPPER: weed control SWEET POTATOES: weed control		**Approved.**
Heptachlo re		Insecticide	MEDICINALS: Ants (*Atta sp*.)	Registrations cancelled in both US & Colombia. In PIC list.	**Should not be used.**
Hexaco-nazol	Anvil	Fungicide. WHO TC U; Colombia TC III ó IV	CUCURBITS: Oidium (*Sphaerotheca fuliginea*)	No registration with USEPA. Registered in Canada, Austra-lasia, Hunger & Portugal.	**Should not be used.**
Imazalil	Magnate sulfato	Fungicide. TC WHO: II; TC Col II	MEDICINALS: Red rot (*Fusarium zingiberi)*	In PAN BAD Actor list for carcinogen & reproductive toxin	**Approved.**
Imidachlo prid	Confidor, Gaucho, Jade, Muralla, etc.	Insecticide. TC Colombia III.	BELL PEPPER: White flies (*Trialeurodes vaporariorum, Bermisia tabci)* TOMATO: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*)		**Approved.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Iprodiona	Brodione, Rhyzolenc, Rovral	Fungicide TC WHO: U TC Colombia: III	BELL PEPPER: Grey rot (*Botryotinia fuckeliana*)	In PAN Bad Actor List due to suspected endocrine disruptor & potential water contaminant	**Approved.** But with a strict mitigation plan
Linuron	Afalon	Herbicide. TC WHO: U; TC Col IV	ONIONS: weed control	In PAN Bad Actor list for reproductive toxin, possible carcinogenic & endocrine disruptor & potential for water contamination	**Approved.** To be used with a close monitoring program to reduce human risks & water contamination.
Mancozeb	Manzate, Curzate, Dithane, Cobrethane Curathane, Acrobat, Aram, Curatox	Fungicide. TC WHO: U; TC Colombia: III	BELL PEPPER: Bacterial canquer (*Xanthomonas campestres*) MANGO: Anthracnosis (*Colletotrichum gloesporoides)* MANGO: "Roña" (*Elsinoe mangifera)* ONIONS: Mildiew (*Peronospora destructor),* Rust (*Puccinia sp.),* Purple spot (*Alternaria porri)* PAPAYA: Anthracnosis (*Colletotrichum* spp.*)* BLACK PEPPER: Wilting (*Phytophthora palmivora*), Anthracnosis (*Colletotrichum nicanor*) TOMATO: Early blight (*Alternaria solani),* Anthracnosis (*Colletotrichum spp),* Grey rot (*Botryotinia fuckeliana)*	In RED-04 list. In PAN Bad Actor List for possible carcinogenic & reproductive toxin.	**Approved.** But pending re-registration with USEPA in 2004.

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommenda-tion & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Malathion	Inition, Cropthion, Fyfanon, Malathion, Algodo-nero	Insecticide. WHO TC III; Colombia TC II-III	FLOWERS: Stem borer, weevil, *Trichoplusia nii, Heliothis,* Post-harvest insect pests, Ants MANGO: Fruit flies (*Ceratitis capitata, Anastrepha* spp*.),* Scales (*Planococcus citri*) ONIONS: Thrips (*Thrips tabasi)* PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*), Papaya white fly (*Aleurodicus* sp.) BLACK PEPPER: White scales	In IRED-03 list. In 'Bad Actor' list of PAN for cholinesteras e inhibitor. Organophos-phate.	**Approved.** But pending of re-registration with USEPA in 2003.
Maneb		Fungicide	FLOWERS: Foliar spots (*Fusarium* spp., *Cercospora, Phyllostica)* ONIONS: Mildiew (*Peronospora destructor),* Rust (*Puccinia sp.),* Purple spot (*Alternaria porri)* PAPAYA: Rot (*Ascochyta caricae)* TOMATO: Anthracnosis (*Colletotrichum spp)*	Registrations cancelled in US & Colombia. In PIC list.	**Should not be used.**
Methala-xyl	Ridomil (only in mixes with mancozeb)	Fungicide. WHO TC III; Colombia TC III	PAPAYA: Stem rot (*Phytophthora* spp*)* BLACK PEPPER: Wilting (*Phytophthora palmivora*)	It was in re-registration with US-EPA.	**Approved.** Re-registration approved by USEPA in Sep 1994.
Metha-midophos	Tamarón	Insecticide, acaricide. WHO TC Ib; Colombia TC I	ONIONS: Aphids (*Mycromyzus formasanus),* Stem cutters & others (*Prodenia, Feltia, Agrotis)* PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*), Papaya white fly (*Aleurodicus* sp.)	RUP with USEPA In PIC list. In 'Bad Actor" list of PAN for choli-nesterase inhibitor & acute toxicity. Organophos.	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Methyl-parathion	Metacap, Metacide, Metil Paration, Penncap	Insecticide. TC Colombia I	MANGO: Scales (*Planococcus citri*)	RUP with USEPA. Limited registration in Colombia. In PIC list.	**Should not be used**
Methyl pyrimifos	Arrierafin	Insecticide TC WHO: III TC Colombia: IV	BELL PEPPER: White flies (*Trialeurodes vaporariorum,Bermisia tabaci*) Aphids (*Aphis gossypii* , Larvae (*Spodoptera exigua*) CUCURBITS: White flies (*Trialeurodes vaporariorum, Bemisia tabaci*), Aphids (*Aphis gossypii, Myzus persicae*), Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)* MEDICINALS: Ants (*Atta sp*.) TOMATO: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*)	In RED-04/99 list. In PAN Bad Actor List: cholinesterase inhibitor: organo-phosphate	**Approved.**
Methyl-thio-phanate	Topsin	Fungicide. TC WHO: U; TC Col III or IV	CUCURBITS: Stem canquer of watermelon (*Didymella bryoniae*) MEDICINALS: Leaf spot (*Colletotrichum zingeberis*), Various fungi (*Alternaria steviae, Septoria sp, Sclerotium sp, Rhizoctonia solani, Sclerotinium rolfsii, Botrytis cinerea, Cercospora steviae*) ONIONS: Rust (*Puccinia sp.),* White rot (*Sclerotium cepivorum*	In PAN Bad Actor list for carcinogen, development of reproductive toxin & potential ground water contaminant.	**Approved**. But not to be used in the irrigation project due to risk of contaminating water.
Methomyl	Lannate, Mercamil, Methavin, Methomex, Metomil, Pilarmate	Insecticide. WHO TC I; Colombia TC I	CUCURBITS: Aphids (*Aphis gossypii, Myzus persicae*) ONIONS: Aphids (*Mycromyzus formasanus)*	RUP with USEPA. In 'Bad Actor" list of PAN for acute toxicity & choli-nesterase inhibitor.	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Monocroto phos	Azodrín, Elan-cron, Fersacrón, Fosacrón, Monocrón, Nuvacrón,, Trifo-tóx, etc.	Insecticide, Acaricide. WHO TC IB; Colombia TC I	MANGO: Scales (*Planococcus citri*)	CANCELLED in US. It was RUP.In PIC list. In 'Bad Actor" list of PAN for choli-nesterase inhibitor. Organophosph.	**Should not be used.**
Napro-pamide		Herbicide. TC WHO: U. TC Col: n/a	MANGO: Fruit flies (*Ceratitis capitata, Anastrepha* spp.*),* Scales (*Planococcus citri*)	Not registered with ICA. Potential ground water contaminant.	**Not to be used unless registered in Colombia**
Naptalam		Herbicide. TC WHO: n/a	SWEET POTATOES: weed control	Not registered in Colombia. Potential ground water contaminant.	**Should not be used unless registered y ICA**
Nicotine (tobacco extracts)	Hidrolato de tabaco Agrisan	Insecticide. TC WHO: Ib; TC Col IV	MEDICINALS: Varios uses FLOWERS: varios uses.	RUP. In PAN Bad Actor List due to acute toxicity & reproductive toxin.	**Should not be used.**
Ofurace	Grolan (Only in mixes with mancozeb)	Fungicide. WHO TC U; Colombia TC not available.	CUCURBITS: Mildew (*Pseudoperonospora cubensis)*	Not registered with USEPA. Registered only in Portugal & UK	**Should not be used.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Oxamyl (oxamil)	Vidate	Insecticide-nematicide. TC WHO: Ib;. TC Col II	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Borer nematode (*R.. similis),* Raquitism nematode (*Tylencorrynchus sp*.)	RUP. In PAN Bad Actor list due to acute toxicity & cholinesterase inhibitor.	**Should not be used.**
Oxy-fluorofen	Reispre (w/ pipero-phos)	Herbicide. TC WHO: U; TC Col III	ONIONS: weed control	Possible carcinogen.	**Approved.**
Paraquat	Gramoxone , Agroquat, Calli-quat, Paraquat	Herbicide. WHO TC II; Colombia TC I	SWEET POTATOES: weed control	RUP with US-EPA.	**Should not be used.** Alternatives: glyphosate;
PCNB		Fungicide, nematicide. TC WHO U; TC Col: n/a	MANGO: Basal rotting (*Rosellinia* sp.)	Not registered in Colombia.	**Should not be used unless registered with ICA**
Pendi-methalin	Pendulum, Pendimetal ina	Herbicide. TC WHO: III;TC Col III	ONIONS: weed control	Posible carcinogen & suspected endocrine disruptor	**Approved.**
Phoxim	Baythion	Insecticide. TC WHO: II; TC Col III	MEDICINALS: Ants (*Atta sp*.) SWEET POTATOES: Wire worm (*Agriotes lineatus)*	In PAN Bad Actor list for cholinesterase inhibitor & moderate toxicity.	**Approved.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Piridaben	Pyramite, Pyridaben, Sanmite	Insecticide, Acaricide TC WHO: III TC Colombia: III	BELL PEPPER: Red mites (*Tetranychus urticae*), White flies (*Trialeurodes vaporariorum,Bermisia tabaci*) TOMATO: Red mites (*Tetranychus* spp.*),* White flies (*Trialeurodes vaporariorum, Bermisia tabaci*)	Very high toxicity to fish & zooplancton	**Approved.** But with a very strict mitigation plan.
Potassium salts (K)	K.S.I.	Acaricide. TC WHO not available; TC Colombia III	BELL PEPPER: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*) MANGO: Powdery mildiew (*Oidium mangiferae*)	K laureate is registered with USEPA.	**Approved.**
Propargita	Omite, Ornamite, Vulcano	Acaricide TC WHO: not available. TC Colombia: III	BELL PEPPER: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*) BLACK PEPPER: Mites TOMATO: Red mites (*Tetranychus* spp.*)*	In PAN Bad Actor List due to acute toxicity, carcinogenic, reproductive toxin & acute aquatic toxicity. Active registration only for Omite 30W	**Approved.** But with a strict mitigation plan. Use only formulation Omite 30W
Propa-chlor		Herbicide.	ONIONS: weed control	Not registered in Colombia	**Should not be used**
Propa-nocarb		Fungicide	MEDICINALS: Root rots (*Phytium sp.)*	Not registered in Colombia	**Should not be used**
Propineb	Format, Punto, Antracol	Fungicide. WHO TC U; Colombia TC II ó III	CUCURBITS: Oidium (*Sphaerotheca fuliginea),* Mildew (*Pseudoperonospora cubensis)* ONIONS: Mildiew (*Peronospora destructor)* TOMATO: Early blight (*Alternaria solani),* Oidium (*Leveillula taurica*)	In 'Bad Actor" list of PAN for reproductive toxin.	**Approved.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Prochloraz	Molto (mix w/propicon azole)	Fungicida. TC WHO: III; TC Col II	CUCURBITS: *Fusarium oxysporum* MANGO: Anthracnosis (*Colletotrichum gloesporoides)* PAPAYA: Anthracnosis (*Colletotrichum* spp.*)*	Not registered with USEPA**.**	**Not to be used unless no alternative is found.**
Phospha-midon		Acaricide	PAPAYA: Red mites (*Tetranichus* spp.*)*	No registration in US nor in Colombia. In PIC list.	**Should not be used.**
Sulfur	Elosal, Pro-hortícola, Suffa, Sulfaplant, Top-Sul, Agrozul, Azuco, Azufral, Azufre, etc.	Fungicide & insecticide. TC WHO U; TC Colombia II	BELL PEPPER: Oidium (*Leveillula taurica*), White mite (*Polyphagotar-sonemus latus)* Aphids (*Aphis gossypii),* Thrips (*Frankliniella occidentales*), larvae (*Spodoptera exigua*) CUCURBITS: Oidium (*Sphaerotheca fuliginea*), Thrips (*Frankiniella ocidentalis),* Red mites (*Tetranychus urticae, T. turkestani, T. ludeni),* Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)* MANGO: Powdery mildiew (*Oidium mangiferae*) ONIONS: Mildiew (*Peronospora destructor)* BLACK PEPPER: Mites TOMATO: Oidium (*Leveillula taurica*), Red mites (*Tetranychus* spp.*),* Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)		**Approved.**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Summer oil	Summer Oil; vegetable oil	Insecticide coadjuvant. TC WHO: not available.	BELL PEPPER: Larvae (*Spodoptera exigua*), White flies (*Trialeurodes vaporariorum, Bermisia tabaci*), Thrips (*Frankliniella occidentales*) CUCURBITS: White flies (*Trialeurodes vaporariorum, Bemisia tabaci*), Red mites (*Tetranychus urticae, T. turkestani, T. ludeni),* Aphids (*Aphis gossypii, Myzus persicae*), Thrips (*Frankiniella ocidentalis),* Leaf miners (*Liriomyza spp.*)	Not registered as such with USEPA but components are.	**Approved**
Tau-fluvalinato	Yardex, Mavrik	Acaricide, insecticide TC WHO: U TC Colombia: III	BELL PEPPER: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*) Larvae (*Spodoptera exigua*) *),* Thrips (*Frankliniella occidentales*), Aphids (*Aphis gossypii)* TOMATO: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*)	Not registered with USEPA In PAN Bad Actor List due to reproductive toxin & suspected endocrine disruptor.	**Should not be used**
Tebuco-nazole	Folicur	Fungicide. TC WHO III; TC Colombia III	BELL PEPPER: Grey rot (*Botryotinia fuckeliana*), White rot (*Sclerotinia sclerotiorum*) ONIONS: Botritis (*Botritis squamosa)* TOMATO: Root rot (*Sclerotium rolfsii*)		**Approved.**
Tetradifon	Tedion	Acaricide; TC WHO: U;TC Colombia: IV	BELL PEPPER: White mite (*Polyphagotar-sonemus latus)* CUCURBITS: Red mites (Tetranychus urticae, T. turkestani, T. ludeni)	Not registered with USEPA	**Should not be used**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
TBZ, thiaben-dazole	Mertect	Fungicide. WHO TC U; Colombia TC III ó IV	SWEET POTATOES: Mumification (*Monilichaetes infuscans*	In 'Bad Actor" list of PAN for carcinogenic effects & repro-ductive toxin. It was in re-registration with USEPA.	**Approved.** Re-registration approved by USEPA in October 2002.
Thiame-toxam	Actara, Adage, Centric, Cruiser, Helix, Platinum, Xamox	Insecticide TC WHO: not available. TC Colombia: II	BELL PEPPER: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*) CUCURBITS: White flies (*Trialeurodes vaporariorum, Bemisia tabaci*), Aphids (*Aphis gossypii, Myzus persicae*) TOMATO: White flies (*Trialeurodes vaporariorum, Bermisia tabaci*)	In PAN Bad Actor List for carcinogenic. OP alternativo Dic./02	**Approved.**
Thiram	(Only in mixes)	Fungicide.	MEDICINALS: Black dry rot (*Rosellinia zingiberi*)	In RED-04 list. In 'Bad Actor" list of PAN for reproductive toxin.	**Approved.** But pending re-registration with USEPA in 2004.
Triadime-fon	Bayleton, Triazofos, Hostathion	Fungicide. TC WHO III; TC Colombia IV	BELL PEPPER: Oidium (*Leveillula taurina*) CUCIRBITS: Oidium (*Sphaerotheca fuliginea),* Mildew (*Pseudoperonospora cubensis)* MEDICINALS: Black dry rot (*Rosellinia zingiberi*) ONIONS: Rust (*Puccinia sp.)* TOMATO: Oidium (*Leveillula taurica*)	In PAN Bad Actor List for reproductive toxin	**Approved.**
Tri-chlorfon	Dipterex, Profitox	Insecticide. TC WHO: n/ a. TC Col: II	TOMATO: Stem borers (*Melanagromyza caucencis, M. tomaterae*), Soil pests (*Agrotis ipsilon, Spodoptera frugiperda* PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata)*	In PAN "Bad actor" list for carcinogenic & moderate acute toxicity	**Approved**

Pesticide			Crop & Pest / s	Type of Problem, if any	Recommendation & alternatives
Technical Name	**Commer-cial Name**	**Type & Tox Class**			
Tricyclazole	Bim	Fungicide. TC WHO: II; TC Col III	PAPAYA: Anthracnosis (*Colletotrichum* spp.*)*		**Approved.**
Trifluralin	Fluran, Rival, Treflan	Herbicide. TC WHO: U; TC Col III	ONIONS: weed control		**Approved**
Zineb		Fungicide. TC WHO: U	MANGO: Anthracnosis (*Colletotrichum gloesporoides)* ONIONS: Mildiew (*Peronospora destructor)* TOMATO: Anthracnosis (*Colletotrichum spp)*	Not registered in the US nor in Colombia	**Should not be used.**
Ziram		Fungicide	ONIONS: Rust (*Puccinia sp.)* TOMATO: Anthracnosis (*Colletotrichum spp)*	Registrations cancelled in both US & Colombia. In PIC list.	**Should not be used.**

[i] Toxicological Class, RUP, registration in USA, registration in Colombia.
[ii] Generic name or active ingredient.
[iii] Name under which is sold in Colombia.
[iv] Type: fungicide, insecticide, herbicide, etc. According to WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), & 'U' (unlikely to present an acute risk in normal use). The LD_{50} used for acute toxicity is oral (O) or dermal (D). Colombia uses the same classification but numbered I-IV & U. The WHO TC is that of the active ingredient. The TC in Colombia is that of the formulated product available in the country.

Annex No. 3
New[1]_All Approved Pesticides – Risk Analysis

Pesticide[2]	Acute Tox Class[3]	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments [4]
Abamec-tina (Avermeci ine)	WHO: n/a.Co-lombia: II	Insecti cide	Acute toxicity & induction of reproductive toxin	Inssuficient data	Inssuficient data	Applications must be carefully supervised to prevent human & environmental exposure
Acephate (Acefato)	WHO TC III; Colombi a TC III	Insecti cide.	Slight acute toxicity. Possibly carcinogenic. It is fetotoxic.	Very low fish toxicity. Moderate toxicity to birds. It is toxic to bees.	Potential	Protect applicators & do not use near bee hives.
Amitraz	TC Col: III	Insecti cide;	Possible carcinogenic & potential promoter of reproductive toxin.	Slightly toxic to birds, moderately toxic to fish & non-toxic to bees.	There is insufficient information.	Protect applicators & consumers. Do not spray near bodies of water.
Azaridach tine	TC WHO: n/a. TC Col: n/a	Insecti cide.	Causes temporal infertility.	May be toxic to fish in large concentrations. No effects on birds.	No information is available.	
Bacillus thurin-giensis	WHO: not availabl e. Colom-bia: U	Mico-bial in-sectici de: bacte-ria	Unlikely to cause any effect. No indication of reproductive, teratogenic, or carcinogenic effects. Possible certain mutagenic effects in plants.	Bio-product with unlikely environmental impacts. Non toxic to fish, birds or other animals.	No evidence of possible contamination of deep water.	Repeated applications over long periods may cause pest resistance. Rotate products.

[1] Includes new pesticides to this amendment and/or new uses for pesticides already reported in CAD PERSUAP-1.
[2] Generic name or active ingredient.
[3] According to WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), & 'U' (unlikely to present an acute risk in normal use). The LD_{50} used for acute toxicity is oral (O) or dermal (D). Colombia uses the same classification but numbered I-IV & U. The WHO TC is that of the active ingredient. The TC in Colombia is that of the formulated product available in the country.
[4] General mitigation tactics to (a) reduce risks to human exposure: protective clothing (mask, hat, glasses, long sleeve shirt, long pants, boots, gloves or plastic bags, wash clothes, no eating, no drinking, no smoking, no re-entry to fields, etc.) y (b) to reduce environmental risks (mix exact quantities, do not apply near water bodies, near bee hives, bird nesting places, avoid windy days, etc.) are components of a SUP programme.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Capsaicine (capsci-cina)	WHO TC: n/a Colom-bia: TC IV	Botani cal insect repe-lent	Unlikely to pose any hazards to humans. Component of human diet for centuries: no adverse effects.	No potential significant risks beyond some possible skin irritation.	No evidence for potential ground water contamination	
Captan	WHO TC: U; Colombi a TC: II	Fungic ide.	Possible carcinogenic , acute toxicity. Unlikely reproductive effects. Non mutagenic, non teratogenic.	Non toxic to birds & bees. Very high toxicity to fish. Moderate toxicity to mollusks, insects & zooplancton.	Low persistence in soils & water bodies. Degrades rapidly in neutral water.	Use with precaution protecting humans.
Carbaryl (carbaril)	WHO TC II; Colombi a TC IV.	Insecti cide, nemati cide.	Possible carcnogenic & potencial endocrine disruptor. Slight mutagenic risk.	Practically non-toxic to birds. Moderately toxic to fish. Lethal to on-tar-get insects, mainly bees.	Maybe a water contaminant.	Care when using should be taken to minimise effects on non-target insects including bees.
Carbenda-zim	WHO: U Colom-bia: III	Fungi-cide	Possible carcinogenic. Suspected endocrine disruptor.	Moderately toxic to birds & highly toxic to fish.	Insufficient data	Applications should be controlles to prevent environmental impacts on non-target organisms.
Carboxin	WHO TC U; Colombi a TC III	Fungic ide.	Possible reproductive toxin promoter. No other effects have been observed.	Non toxic to bees & birds but highly toxic to fish.	No evidence for potential ground water contamination has been found.	In IRED-04. Revise registration status in 2004. Care should be taken not to expose fish
Ciprodinil + fludioxinol	TC WHO: not availabl e. Col.: III	Fungi-cide	Low acute toxicity. causes moderate eye irritation.	Moderately toxic to fish. Highly toxic to aquatic invertebrates. Practically non-toxic to bees & birds.	Potential	Do not apply directly to water or near water bodies. Avoid contact with eyes, skin or clothing. Strict control & follow up pf mitigation measures.
Copper oxy-chloride		Fungic ide	Low acute toxicity. Irritant to skin & eyes & gastric mucosa.	Slight to high toxicity to fish. Highly toxic to annelids. Very high toxicity to zooplankton.	Insufficient information	Carefully monitor use to prevent human exposure as well as minimise contact with water.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Copper sulphate	WHO: II Colom-bia: not availabl e.	Fungi-cide	No evidence of chronic effects on humans	There is no evidence of adverse effects on the environment.	No evidence of potential water contamination.	
Cymoxanil	TC WHO III; Colo. TC: n/a (only in mixes)	Fungic ide.	Unlikely carcinogenic. No data on other potential effects.	No data	No data	
Deltameth rin	TC WHO: II; TC Col III or IV	Insecti cide.	Reported symptoms include: choreoathetosis, hypotension, prenatal damage and shock.	Relatively non-toxic to birds but highly toxic to fish. Toxic to bees.	Unlikely.	Protect users from exposure
Dazomet	TC WHO: III; TC Col III	Soil disinfe ctant.	No data	No date	Potential ground water contaminant.	
Dime-thoate	WHO TC II; Colombi a TC II	Insecti cide.	Organophosphate = cholinesterase inhibitor. Possible carcinogenic & promoter of reproductive toxin.	Moderately to very highly toxic to birds, highly toxic to honeybees & moderately toxic to fish.	Highly soluble in water & poorly adsorbed in soils so it is a potential water contaminant.	In IRED-03. Revise registration status in 2003. Should be used very carefully to prevent water contamination & effects in bees & birds.
Diuron	TC WHO: U; TC Col III or IV	Herbic ide.	Possible a carcinogenic, promoter of developmental & reproductive toxin. Some teratogenic effects.	Slightly toxic to birds. Moderately toxic to fish & highly toxic to aquatic invertebrates. Non toxic to bees..	Ground water contaminant.	Do not use near water bodies. Avoid exposure of aquatic organisms. Protect users.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Esfenvale-rato	WHO: II Colom-bia: III	Insecti cide	Moderate acute toxicity, Not a cholinesterase inhibitor. Suspected endocrine disrupter.	Very high toxicity to amphibians & fish.	Insuficient data.	Applications should be carefully monitored to prevent human & environmental exposure. Should not be used near water bodies to prevent affecting aquatic life.
Fenarimol	WHO: U Colom-bia: IV	Fungi-cide	Light acute toxicity. Not a carcinogenic. Not a cholinesterase inhibitor. Suspected endocrine disruptor.	Moderately toxic to fish. Presents low risk to non target organisms. Low toxicity to bees.	Potential water contaminant. Persists in soils although it is not known that it reaches water through soils.	Applications should be carefully monitored to prevent human & environmental exposure. Should not be used near water bodies to prevent affecting aquatic life.
Glypho-sate	WHO U; Colom-bia: III-IV	Herbic ide	No evidence of any carcinogenic, teratogenic, mutagenic effects.	Slightly toxic to birds, non toxic to fish & bees.	Unlikely due to soil adsorption.	
Imazalil	TC WHO: II; TC Col II	Fungic ide.	Possible a carcinogen & promoter of reproductive toxin. Affects nervous system & liver.	Non toxic to birds & moderately toxic to fish. Non toxic to bees.	Unlikely to risk ground water	Protect users & do not use near water bodies.
Imidaclo-prid	WHO: not availabl e. Colom-bia: III	Insecti cide	Presents moderate acute toxicity. Not a cholinesterase inhibitor. Could be slighlty mutagenic. Minimum carcinogenic risk.	Toxic to birds. Bird repellent in treated seeds. Moderate toxicity to fish. Very toxic to aquatic invertebrates. Highly toxic to bees in foliar applications but not in seed treatment.	Potential. Not a high risk of water contamination of deep waters if used as directed. Moderately soluble in water & moderate affinity to organic materials in soils. However, has high potential to move in porous & sandy soils pending on irrigation system.	Do not apply directly to water or near water bodies. Applications should be carefully monitored to prevent human & environmental exposure.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Iprodiona	WHO: U Colom-bia: III	Fungi-cide	Light acute toxicity. Not a cholinesterase inhibitor. Suspected endocrine disruptor. Slightly toxic by ingestion.	Moderately toxic to fish. Non toxic to bees. Slighlty toxic to birds.	Low potential for water contamination. degrades rapidly by ultraviolet light. Breaks down rapidly in water in aerobic conditions.	Applications should be carefully monitored to prevent human & environmental exposure. Should not be applied directly to water bodies.
Linuron	TC WHO: U; TC Col IV	Herbic ide.	Possible carcinogen & promoter of reproductive toxin. Slightly mutagenic. Suspected endocrine disrupter.	Slightly toxic to birds, fish & other aquatic organisms. Non toxic to bees.	Potential ground water contaminant.	
Malathion	WHO III; Colom-bia: II-III	Insecti cide	Organophosphate = cholinesterase inhibitor. Possible carcinogenic & suspected endocrine disrupter	Highly toxic to honey bees, moderately toxic to birds & variable toxicity to fish	Possible contaminant. It has been detected in well & ground waters.	In IRED-03. Revise registration status in 2003. Malathion should be used with great care in order not to expose workers & prevent water contamination & effects on bees & birds
Mancozeb	WHO: U Colom-bia: III	Fungi-cide	Possible carcinogenic, reproductive toxin promotor & endocrine disruptor.	Moderately to highly toxic to fish & birds. Non toxic to bees.	Not potential.	In IRED-04 list. Revise registration status in 2004. Use carefully to reduce human & environmental risks.
Metalaxyl	WHO: III; Colom-bia: II	Fungi-cide	Carcinogenicity still unknown. No other effects on humans.	Practically not toxic to birds, bees & fish	Potential water contaminant	Re-registration approved by USEPA in Sep. 94
Methyl pirimifos	WHO: III Colom-bia: IV	Insecti cide	Low acute toxicity. Cholinesterase inhibitor.	Moderately toxic to annelids, fish & nematodes. Very high toxicity to insects & zooplankton.	Insuficient data.	In RED-04/99 list. Revise registration status in 2004. Applications should be carefully monitored to prevent human & environmental exposure.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Methyl-thio-phanate	TC WHO: U; TC Col III or IV	Fungic ide.	Carcinogen & promoter of reproductive toxin		Potential ground water contaminant.	Protect users & water bodies.
Oxy-fluorfen	TC WHO: U; TC Col III	Herbic ide.	Possible carcinogen. Long term effects on liver. May be teratogenic.	Practically non toxic to birds. Highly toxic to aquatic invertebrates, freshwater clams, oysters, aquatic plants, and fish. Non toxic to bees.	Unlikely to be a contaminant.	Protect users.
Pendi-methalin	TC WHO: III;TC Col III	Herbic ide.	Possible carcinogen & suspected endocrine disrupter.	Slightly toxic to birds. Highly toxic to fish & aquatic invertebrates. Non toxic to bees.	Unlikely to be a contaminant.	
Phoxim	TC WHO: II; TC Col III	Insecti cide.	Moderate acute toxicity. Organophosphate. Cholinesterase inhibitor.	Moderate toxicity to amphibians. Very high toxicity to crustaceans & insects. Moderate to high toxicity to fish.	Insufficient data	Carefully control use to prevent human & environmental exposure. Prevent exposure to fish & crustaceans.
Piridaben	WHO: III Colom-bia: III	Insecti cide Acarici de	Moderate acute toxicity. Not carcinogenic. Not a cholinesterase inhibitor.	Very high toxicity to fish & zooplankton.	Insufficient data.	Applications should be carefully monitored to prevent human & environmental exposure. Avoid direct contact with water to protect fish.
Potasium salts	WHO: not availabl e. Colo mbia: III	Acarici de	Unlikely carcinogenic. Not a cholinesterase inhibitor.	Insuficient data.	Insuficient data.	Potassium laureate is registered with USEPA.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Propargita	WHO: Not availabl e. Colom-bia: III	Acarici de	Moderate acute toxicity, reproductive toxin promoter.	Toxic to fish. Does not affect bees.	Degrades slowly with heat.	Do not apply directly to or near water bodies. Registration only for Omite30W.
Propineb	WHO TC U; Colombi a TC II ó III	Fungic ide.	Reproductive toxin promoter.	Insufficient data	Insuficient data	Not registered with EPA. In PAN Bad Actor list for reproductive toxin. Use with care. Do not expose applicator.
Sulfur	WHO: U Colom-bia: II	Fungi-cide	Unlikely to cause carcinogenic, teratogenic or reproductive effects. Not mutagenic in micro-organisms. Slight acute toxicity. Very low oral toxicity & no skin irritation	No acute toxicity to amphibians, fish, zooplankton, birds & bees. Does not cause adverse environmental effects when used properly	No evidence of potential deep water contamination.	There is risk to workers when re-entering fields. Requires a minimum 24 hours for re-entry.
Summer Oil	TC WHO: not avai-lable.	Insecti cide coadju vant.	No significant information	Insuficient data	Insuficient data	Not registered with USEPA. However toxicological information does not suggest significant impacts on human health or the environment. Use with precaution..
Tebucona-zole	WHO: III Colom-bia: III	Fungi-cide	Moderate acute toxicity. Possible carcinogenic. Noy a cholinesterase inhibitor.	Insuficient data.	Potential.	Do not apply directly to water or near water bodies. Workers should be protected when spraying to reduce exposure.

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Thiabendazole (TBZ)	WHO TC U; Colombia TC III ó IV	Fungicide.	Possible carcinogenic & promoter of reproductive toxin. Toxic effects in various organs.	Low toxicity to fish. No data on birds. Not toxic to bees. Very toxic to earthworms.	Not likely. Probably bound to sediment & low solubility.	Re-registration approved by USEPA in Oct 02
Tiametoxam	WHO: not available. Colombia: II	Insecticide Fungicide	Carcinogenic. Not a cholinesterase inhibitor.	Insuficient data.	Insuficient data.	Alternative to OP. Dec/2000. Applications should be carefully monitored to prevent human & environmental exposure
Thiram	N/A only in mixes	Fungicide.	Slightly toxic by inhalation & ingestion. Moderately toxic by dermal absorption. Reproductive toxin promoter & suspected endocrine disrupter.	Very highly toxic to amphibians & highly toxic to annelids, zooplankton & nematodes. Non-toxic to moderately toxic to crustaceans. Highly to very highly toxic to fish. Non toxic to birds & bees.	Low to moderate persistence in soils. Slightly soluble in water. Strong tendency to be adsorbed by soil particles. Potencial for deep water contamination.	Applications should be carefully monitored to prevent human & environmental exposure Do not use in irrigation project (not in Patía project).
Triadimefon	WHO: III Colombia: IV	Fungicide	Possible carcinogenic. Possible reproductive toxin promotor. Suspected endocrine disruptor.	Slightly toxic to birds & fish. Non toxic to bees.	Potential for deep water contamination.	Applications should be carefully monitored to prevent human & environmental exposure. Protect workers.
Tricyclazole	TC WHO: II; TC Col III	Fungicide.	Moderate to high acute toxicity.	Slightly toxic to amphibians & zooplankton. Slight toxicity to fish.	Insufficient data	

Pesticide	Acute Tox Class	Type	Chronic Toxicity	Eco-toxicity	Water Contamination Potential	Risk Mitigation / Comments
Tri-chlorform	TC WHO: n/ a. TC Col: II	Insecti cide.	Cholinesterase inhibitor. Carcinogenic & moderate acute toxicity. Unlikely teratogenic & reproductive effects. Moderately toxic by ingestion or dermal absorption	Slightly toxic to amphibious, annelids, fish, zooplankton. Moderately toxic to crustaceans, insects, mollusks. Moderately toxic to birds. Very high toxicity to a great variety of aquatic species. Low toxicity to bees.	Low persistence in soils. Rapidly degraded in alkaline water.	Application with care not to contaminate humans & not to reach water bodies. Damage has been reported to apple leaves & carnations.
Trifluralin	TC WHO: U; TC Col III	Herbic ide.	Slight acute toxicity. Possible carcinogenic. Suspected endocrine disrupter.	Slight aquatic toxicity. Low to high toxicity to amphibians. Highly toxic to annelids. Low to very high toxicity to crustaceans & zooplankton. high to very high toxicity to fish. Sligth to moderate toxicity to insects & molluscs.		Use with care near water bodies. Protect fish.

Annex No. 4
Problem Pesticides
Chemonics - CAD – PERSUAP – Colombia

Pesticide			Target Pest / s	Type of Problem[1]	Alternative to this pesticide
Technical name[2]	**Commer-cial Name[3]**	**Type[4]**			
Acrinatrin	Rufast, Avance	Insecticide	BELL PEPPER: Red mites (*Tetranychus urticae*) TOMATO: Red mites (*Tetranychus* spp.)	No registration with USEPA	Desinfect structures & soil. Eliminate weeds & crop residues. Avoid excess of nitrogen fertilization. Natural enemies: *Amblyseius, Phytoseiulus persimillis, Feltiella acarisuga.* Chemical Use piridaben.
Aldicarb	Temik	In-secticide, acaricide, ne-maticide	MEDICINALS: Raquitism nematode (*Tylencorrynchus sp*.) ONIONS: Onion worm (*Hylemia Antigua)*	RUP with USEPA for high toxicity	For *Tylencorrynchus sp*.: Cultural: disinfected soil before planting. Repellent: Tagetes & calendula. Physical: solarization. Remove affected plants. Chemical: Dazomet For *Hylemia antigua*: Biological: various natural enemies
Aldrin		In-secticide	MEDICINALS: Ants (*Atta sp*.)	Not registered in USEPA & Colombia. In PIC list	Cultural: change pH of ant hill using agricultural calcium. Capture queens during nuptial flights. *Mentha spicata, Eucalyptus globules* Biological: natural enemies, such as ant eaters, tatues, birds, etc. Could use fungi *Metarhizium anisoplae*. Chemical: methyl – pyrimifos, phoxim

[1] Toxicological class I (a o b), RUP, registration with USA-EPA, registration with ICA- Colombia, other.
[2] Technical or generic name, or the active ingredient of the product.
[3] Name under which is being sold in Colombia.
[4] Action against … type of pest: fungicide, insecticide, herbicide, etc.

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Arsenic compunds		Mo-lusci cide	ONIONS: Slugs (*Vaginulus accidentalis)*	Hi toxicity compouns	Physico – chemical: traps with attractants. Use metaldehide
Arthrobotrys irregularis	Nem- A- guard	Mi-cro-bial ne-mati cide	BELL PEPPER: Nematodes (*Meloidogyne javanica*)	Not registered with USEPA. Not registered with ICA	**Should not be used until registered in Colombia.** Microbial product possibly w/o environmental or human health impact
Benalaxyl	Galben (mix with mancozeb)	Fun gici-de	CUCURBITS:Mildew (*Pseudoperonospora cubensis)* ONIONS: Mildiew (*Peronospora destructor),* Purple spot (*Alternaria porri*)	Not registered with US EPA	For *Pseudoperonospora cubensis:* Cultural: eliminate weeds & crop residues, avoid excess humidity, open planting pattern. Physical: eliminate affected plants by end of crop cycle. Chemical: mancozeb, cymoxanil, copper oxychloride, propineb, triadimefon
					For *Peronospora destructor*: Cultural: use light & well drained soils, weed control. Chemical: disinfection & sprays. Copper oxychloride, mancozeb, propineb, sulphur.
					For *Alternaria porri:* Chemical: copper oxychloride, mancozeb

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Benfuracarb	Fulgor	In-secti cida-nem atici de.	CUCURBITS:Nematodes (*Meloydogine spp.),* Aphids (*Aphis gossypii, Myzus persicae*) TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae*)	Not registered with US EPA. In PAN Bad Actor list for cholinesterase inhibitor	For *Meloydogine spp:* Gentic: use resistant varieties Cultural: use healthy seedlings Physical: vapour esterilization, solarization Chemical: disinfected structures & soil . Use nematicies if needed. Carbofuran only in pellet/ tablets
					For Aphids: Physical: nets, yellow traps Cultural: eliminate weeds & crop residues Biological: various natural enemies. Hymenopther: *Aphidius colemani*. Diptera: *Aphidoletes aphidimyza* Chemical: summer oil, amitraz, acefato, dimethoate, esfenvalerate, methyl – pirimifos, thiametoxan

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Benomyl	Benlate, Benomil, Benoagro	Fun gi-cide	CUCURBITS: Oidium (*Sphaerotheca fuliginea*) FLOWERS: Foliar spots (*Fusarium* spp., *Cercospora, Phyllostica)* MEDICINALS: Red rot (*Fusarium zingiberi),* Various fungi (*Alternaria steviae, Septoria sp, Sclerotium sp, Rhizoctonia solani, Sclerotinium rolfsii, Botrytis cinerea, Cercospora steviae*)	All uses of benomyl have been voluntarily cancelled as of December 2003. Liver toxicity, developmental toxicity & reproductive effects.	For Oidium: Cultural: eliminate weeds & crop residues, use healthy seedlings, treat nursery structures. Genetic: varieties with tolerance or partial resistance Chemical: sulfur, fenarimol, triadimefon, propineb
					For Red rot: Cultural: use resistant varieties. Rotate with non – susceptible crops. Do not use drainage water from infested fields. Biological: *Trichoderma lingorum, T. koningii, T. harzianum* Chemical: carbendazin, imazalil
					For various fungi: Cultural: *Ricinus cummunis* Chemical: Bordeaux mixture, methyl thiofenate

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Benomyl	Benlate, Benomil, Benoagro	Fun gi-cide	MANGO: Anthracnosis (*Colletotrichum gloesporoides),* Powdery mildiew (*Oidium mangiferae*) ONIONS: White rot (*Sclerotium cepivorum)* SWEET POTATO: Mumification (*Monilichaetes infuscans)* TOMATO: Grey rot (*Botryotinia fuckeliana*)	All uses of benomyl have been voluntarily cancelled as of December 2003. Liver toxicity, developmental toxicity & reproductive effects.	For *Colletotrichum gloesporoides:* Cultural: good agronomic practices, sanitary pruning, pruning to open c anopy to allow aeration & sun light. Flower induction in dry season. Chemical: protect flowers & fruits, preventative. Captan, mancozeb, copper compounds. Hot water during at 48°C for 49 hours for post – harvest treatment.
					For *Sclerotium cepivorum*: Cultural: long rotations, avoid high humidity soils & soils with fresh manure. Chemical: methyl - thiocianate
					For *Monilichaetes infuscans:* Genetic: resistant varieties Chemical: disinfection & fungicides:TBZ
					For *Botryotinia fuckeliana:* Cultural: eliminate weeds & crop residues, eliminate all infected plants. Biological: use a preparation of *Trichoderma harzianum* Chemical: captan, carbendazin, mancozeb
Betaciflutrin	Baytroide	In-secti cide	Orugas (*Spodoptera exigua*)	RUP due to acute fish toxicity	Use nets, control weeds, remove crop residues, use feromone traps, do not associate crops. Chemical: sulfur, esfenvalerato, methyl pirimifos

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Bifenthrin		In-secti cide	CUCURBITS: Red mites (*Tetranychus urticae, T. turkestani, T. ludeni),* White flies (*Trialeurodes vaporariorum, Bemisia tabaci*), Aphids (*Aphis gossypii, Myzus persicae*), Larvae of Lepidoptera (*Spodoptera, Heliothis, etc.)*	Not registered in Colombia. In PAN Bad Actor list for reproductive toxin, possible endocrine disruptor & carcinogenic.	For Red mites: Cultural: eliminate weeds & crop residues, avoid excess nitrogen, monitor crops in early stages. Biological: natural enemies. Chemical: disinfect structures, use insecticides: abamectine, summer oil, amitraz, sulfur, propargita
					For White flies: Physical: nets, use yellow traps. Cultural: eliminate weeds & crop residues. Biological: various natural enemies exist. Chemical: summer oil, amitraz, methyl-piriphos, thiametoxam
					For Aphis: Physical: nets, yellow traps. Cultural: eliminate weeds & crop residues Biological: various natural enemies. Chemical: summer oil, sulfur
					For Larvae of Lepidoptera: Physical: nets, light traps Cultural: eliminate weeds & crop residues, destroy lower crop leaves, monitor crop in early stages Ethological: use feromone traps Biological: varios natural enemies. *Bacillus thuringiensis* Chemical: amitraz, sulfur, esfenvalerate, methyl -pirifos

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Bifenthrin		In-secti cide	BLACK PEPPER: Mites	Not registered in Colombia. In PAN Bad Actor list for reproductive toxin, possible endocrine disruptor & carcinogenic.	Cultural: eliminate weeds & crop residues where they bread & feed. Do not over fertilise with nitrogen. Use calcium. Biological: use natural predators: Amblyseius californicus Chemical: dusting is better that spraying. Chemical controls are not very efficacious: Amitraz, abamectina, propargita, sulfur, mineral oils
Cadusafos	Apache, Rugby, Cadusafos, Ebufos	In-secti cide, ne-mati cide	Nematodes (*Meloidogyne javanica*)	No registration with USEPA. Toxicological Class: I b	Use resistant varieties. Desinfect soils. Use healthy plants. Sterilize with water vapor. Solarization. Biological: products with *Arthrobotrys irregulari*
Carbofuran	Furadan, Carbofed, Curater, Furalimor, Fursem, Carbofuran	In-secti cide, ne-mati cide	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Gull nematode (*Meloidogyne spp*.), Raquitism nematode (*Tylencorrynchus sp*.) ONIONS: Stem cutters & others (*Prodenia, Feltia, Agrotis),* Onion worm (*Hylemia antigua)*	RUP with USEPA (Except pellets /tablets). In 'Bad Actor' list of PAN: cholin-esterase inhibitor & acute toxicity. Organophosphate In IRED-04 list.	For *Meloydogine spp:* Gentic: use resistant varieties Cultural: use healthy seedlings Physical: vapour esterilization, solarization Chemical: disinfected structures & soil . Use nematicies if needed. Carbofuran only in pellet/ tablets
					For *Tylencorrynchus sp*.: Cultural: disinfected soil before planting. Repellent: Tagetes & calendula. Physical: solarization. Remove affected plants. Chemical: Dazomet
					For Stem cutters & others: Chemical: soil applied granular insecticides: carbaryl, carbofuran only in pellet/ tablets
					For *Hylemia Antigua:* Biological: various natural enemies Chemical: soil applied insecticides. Carbofuran only in pellet/ tablets.

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Carbofuran	Furadan, Carbofed, Curater, Furalimor, Fursem, Carbofuran	In-secti cide, ne-mati cide	BLACK PEPPER: Nematodes SWEET POTATOES: Wire worm (*Agriotes lineatus)* TOMATO: Aphids (*Macrosiphum euphorbiae, Aphis gossypiim, Myzus persicae)*	RUP with USEPA (Except pellets /tablets). In 'Bad Actor' list of PAN: cholin-esterase inhibitor & acute toxicity. Organophosphate In IRED-04 list.	For Nematodes: Cultural: use healthy & protected plants nematode free soil for nurseries, improve soil drainage Chemical: disinfect soil for seedling & transplanting. Carbofuran only in pellet/ tablets
					For *Agriotes lineatus:* Cultural: good soil preparation before planting. Chemical: soil applied granular insecticides: Phoxim
					For Aphids: Physical: nets, yellow traps Cultural: eliminate weeds & crop residues Biological: various natural enemies. Hymenopther: *Aphidius colemani*. Diptera: *Aphidoletes aphidimyza* Chemical: summer oil, amitraz, acefato, dimethoate, esfenvalerate, methyl – pirimifos, thiametoxan
Carbosulfan	Eltra	In-secti cide	CUCURBITS:Aphids (*Aphis gossypii, Myzus persicae*)	Registration in Col cancelled for moth. Registration cancelled in the US	Physical: nets, yellow traps Cultural: eliminate weeds & crop residues Biological: various natural enemies. Hymenopther: *Aphidius colemani*. Diptera: *Aphidoletes aphidimyza* Chemical: summer oil, amitraz, acefato, dimethoate, esfenvalerate, methyl – pirimifos, thiametoxan

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Chloro-thalonil	Bravo, Bravonil, Centauro, Clorotalonil, Daconil, , Pugil, etc.	Fun gi-cide	CUCURBITS: Mildew (*Pseudoperonospora cubensis)* ONIONS: Botritis (*Botritis squamosa),* Purple spot (*Alternaria porri),* Mildiew (*Peronospora destructor)* PAPAYA: Anthracnosis (*Colletotrichum* spp.*)* TOMATO: Early blight (Alternaria solani), Anthracnosis (Colletotrichum spp) MANGO: Powdery mildiew (*Oidium mangiferae*), Anthracnosis (*Colletotrichum gloesporoides)*	RUP with USEPA. In 'Bad Actor' list of PAN for possible carcinogenic & acute toxicity.	For *Pseudoperonospora cubensis:* Cultural: eliminate weeds & crop residues, avoid excess humidity, open planting pattern. Physical: eliminate affected plants by end of crop cycle. Chemical: mancozeb, cymoxanil, copper oxychloride, propineb, triadimefon
					For Botritis: Cultural: avoid high humidity areas Chemical: tebuconazol
					For *Alternaria porri:* Chemical: copper oxychloride, mancozeb
					For *Peronospora destructor*: Cultural: use light & well drained soils, weed control. Chemical: disinfection & sprays. Copper oxychloride, mancozeb, propineb, sulphur.
					For *Colletotrichum* spp.: Cultural: clean plantation, including pick up of dropped fruits, old leaves & stems, etc. Crop rotations Genetic: plant tolerant varieties Chemical: disinfection of seed & nursery sprays: captan, mancozeb, tricyclazole
					For *Oidium mangiferae:* Chemical: before first flowers appears, alternate compounds: sulphur, potassium polysulfur

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Chloro-thalonil	Bravo, Bravonil, Centauro, Clorotalonil, Daconil, , Pugil, etc.	Fun gi-cide	BLACK PEPPER: Wilting (*Phytophthora palmivora*)	RUP with USEPA. In 'Bad Actor' list of PAN for possible carcinogenic & acute toxicity.	For *Phytophthora palmivora:* Cultural: prevent damage to roots & aerial parts, improve drainage, use organic fertilizers only well decomposed, do not cover stem with mulch, maintain clean field. Physical: eradicate & burn diseased plants Biological: *Trichoderma* Chemical: disinfect tools. Spray to the base of plant: metalaxyl, mancozeb. In case of severe attack use: Bordeaux mixture.
Chlortal		Her-bi-cide	SWEET POTATOES: weed control	Not registered in Colombia	Mechanical: use weeder or hand weeding Chemical: glyphosate
Cyflutrin	Bulldock	In-secti cide	Larvae (*Spodoptera exigua*)	RUP due to fish toxicity.	Use nets, weed control, remove crop residues, use feromone traps. Chemical: Sulfur, esfenvalerato, methyl pirimifos
Cypermethrin	Vexter, Agroper, Cypermon, Insectrica, Latigo, Pyrimetha, Torpedo	In-secti cide	Larvae (*Spodoptera exigua*)	RUP. Toxicological Class: I b	Use nets, weed control, remove crop resdiues, use feromone traps. Chemical: Sulfur, esfenvalerato, methyl pirimifos
Chlorpirifos	Lorsban, Clorpirifós, Clorpiricol, Arriero	In-secti cide, ne-mati cide	Larvae (*Spodoptera exigua*)	PUR	Use nets, weed control, remove crop resdiues, use feromone traps. Chemical: Sulfur, esfenvalerato, methyl pirimifos

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Diazinon	Danol, Diazinon, Diazol, Dicamba	In-secti cide	White mite (*Polyphagotarsonemus latus)*, Aphids (*Aphis gossypii*), Larvae (*Spodoptera exigua*)	RUP due to acute aquatic & bird toxicity.	Use nets, weed control, remove crop residues, use feromone & yellow traps, monitor first plant stages. Chemical: For white mite: abamectina, sulfur, potassium permanganate, propargita 30W For aphids: sulfur, imidacloprid, methyl pirimifos. For larvae: sulfur, esfenvalerato, methyl pirimifos
Dichlo-fluanide		Fun gi-cide	ONIONS: White rot (*Sclerotium cepivorum),* Botritis (*Botritis squamosa)*	Not registered in Colombia.	**For *Sclerotium cepivorum*: Cultural: long rotations, avoid high humidity soils & soils with fresh manure. Chemical: methyl - thiocianate** For Botritis: Cultural: avoid high humidity areas **Chemical: tebuconazol**
Dichloro-propeno	Telone	Fu-mi-gant	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Borer nematode (*R.. similis)*	RUP with USEPA. In PAN BAD Actor list for acute toxicity, carcinogen & ground water contaminant**.**	For *Meloydogine spp:* Gentic: use resistant varieties Cultural: use healthy seedlings Physical: vapour esterilization, solarization Chemical: disinfected structures & soil . Use nematicies if needed. Carbofuran only in pellet/ tablets For *R. similis*: Cultural: repellent plants: *Ricinos cummunis, Origanum vulgare, Calendula officinalis*
Dieldrin		In-secti cide	MEDICINALS: Ants (*Atta sp*.)	Nor registered in US nor in Colombia. In PIC list	Cultural: change pH of ant hill using agricultural calcium. Capture queens during nuptial flights. *Mentha spicata, Eucalyptus globules* Biological: natural enemies, such as ant eaters, tatues, birds, etc. Could use fungi *Metarhizium anisoplae*. Chemical: methyl – pyrimifos, phoxim

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
DDT		In-secti cide	MEDICINALS: Ants (*Atta sp*.)	Registration cancelled in US & Colombia. In PIC list.	Cultural: change pH of ant hill using agricultural calcium. Capture queens during nuptial flights. *Mentha spicata, Eucalyptus globules* Biological: natural enemies, such as ant eaters, tatues, birds, etc. Could use fungi *Metarhizium anisoplae*. Chemical: methyl – pyrimifos, phoxim
Endosulfan	Afidan, Thiodan, Beosit, Cyclodam, Devisulfan, Endocel	In-secti cide	White mite (*Polyphagotarsonemus latus)*, Aphids (*Aphis gossypii*), Larvae (*Spodoptera exigua*)	Registration cancelled in Colombia	Use nets, weed control, remove crop residues, use feromone & yellow traps, monitor first plant stages. Chemical: For white mite: abamectina, sulfur, potassium permanganate, propargita 30W For aphids: sulfur, imidacloprid, methyl pirimifos. For larvae: sulfur, esfenvalerato, methyl pirimifos
Ethoprofos	Mocap	In-secti cide, ne-mati cide	Nematodes (*Meloidogyne javanica*)	RUP for acute toxicity. Toxicological Class: I a	Use resistant varieties, desinfect spoils, use healthy plants. Sterilize with water vapor & solarization. Biological: products with *Arthrobotrys irregulari*
Etridiazol	Banrot, Koban, Terraclor, Terrazole, Truban	Fun gi-cide	Wilt (*Phytophtora capsici*)	No registration with ICA-Colombia.	Use healthy plants & substrates. Eliminate crop residues from previous harvests. Use planting patterns that allow aeration, use adequate irrigation methods, solarisation.

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Fenamiphos	Nemacur	Ne-mati cide	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Raquitism nematode (*Tylencorrynchus sp*.), Borer nematode (*R.. similis)*	RUP. In PAN Bad Actors list for acute toxicity, cholinesterase inhibitor & potential for ground water contamination	For *Meloydogine spp:* Gentic: use resistant varieties Cultural: use healthy seedlings Physical: vapour esterilization, solarization Chemical: disinfected structures & soil . Use nematicies if needed. Carbofuran only in pellet/ tablets
					For *Tylencorrynchus sp*.: Cultural: disinfected soil before planting. Repellent: Tagetes & calendula. Physical: solarization. Remove affected plants. Chemical: Dazomet
					For *R. similis*: Cultural: repellent plants: *Ricinos cummunis, Origanum vulgare, Calendula officinalis*
Fenthion	Lebaycid	In-secti cide	PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*)	RUP. In PAN Bad Actor List for cholinesterase inhibitor & potential ground water contamination.	Cultural: weed control Physical: pick up dropped fruits & burry them Genetic: choose varieties with thicker skin & pulp Biological: parasitic wasp : *Acerate neuromiya* Chemical: detect border infestations & apply only to borders: malathion, acephate, dimethoate, trichlorfon
Flufenoxuron	Cascade, Cottonex, Meturon, Uronmate	In-secti cide	Red mite (*Tetranychus urticae*)	No registration with USEPA	Disinfect structures & soils, eliminate weeds & crop residues, avoid excess nitrogen. Natural enemies: *Amblyseius, Phytoseiulus persimillis, Feltiella acarisuga.* Chemical: piridaben.

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Fluvalinate	Mevarick	In-secti cide	MANGO: Thrips (*Selenothrips rubrocintus*)	RUP. In PAN Bad Actor List for reproductive toxin	Cultural: flowering induction to concentrate it in time, eliminate host plants (trees) Biological: release of parasitoides (no yet available) Chemical: acephate
Heptachlor		In-secti cide	MEDICINALS: Ants (*Atta sp*.)	Registrations cancelled in both US & Colombia. In PIC list.	Cultural: change pH of ant hill using agricultural calcium. Capture queens during nuptial flights. *Mentha spicata, Eucalyptus globules* Biological: natural enemies, such as ant eaters, tatues, birds, etc. Could use fungi *Metarhizium anisoplae*. Chemical: methyl – pyrimifos, phoxim
Hexaconazole	Anvil	Fun gi-cide	CUCURBITS: Oidium (*Sphaerotheca fuliginea*)	No registration with USEPA. Registered in Canada, Austra-lasia, Hunger & Portugal.	Cultural: eliminate weeds & crop residues, use healthy seedlings, treat nursery structures. Genetic: varieties with tolerance or partial resistance Chemical: sulfur, fenarimol, triadimefon, propineb
Maneb		Fun gi-cide	FLOWERS: Foliar spots (*Fusarium* spp., *Cercospora, Phyllostica)* ONIONS: Mildiew (*Peronospora destructor),* Rust (*Puccinia sp.),* Purple spot (*Alternaria porri)* PAPAYA: Rot (*Ascochyta caricae)*	Registrations cancelled in US & Colombia. In PIC list.	For *Peronospora destructor*: Cultural: use light & well drained soils, weed control. Chemical: disinfection & sprays. Copper oxychloride, mancozeb, propineb, sulphur. For *Puccinia sp.:* Cultural: avoid high nitrogen & low potassium soils. Chemical: triadimeform, mancozeb, methyl- thiofanate For *Alternaria porri:* Chemical: copper oxychloride, mancozeb

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Maneb		Fun gi-cide	TOMATO: Anthracnosis (*Colletotrichum spp)*	Registrations cancelled in US & Colombia. In PIC list.	Cultural: clean plantation, including pick up of dropped fruits, old leaves & stems, etc. Crop rotations Genetic: plant tolerant varieties Chemical: disinfection of seed & nursery sprays: captan, mancozeb, tricyclazole
Methami-dofos	Tamarón	In-secti cide	ONIONS: Aphids (*Mycromyzus formasanus),* Stem cutters & others (*Prodenia, Feltia, Agrotis)* PAPAYA: Papaya fruit fly (*Toxotrypana curvicauda*) & Nediterranean Fruit Fly (*Ceratitis capitata*), Papaya white fly (*Aleurodicus* sp.)	RUP with USEPA In PIC list. In 'Bad Actor" list of PAN for choli-nesterase inhibitor & acute toxicity. Organophos.	For Aphids: Chemical: acefato
					For Stem cutters & others: Chemical: soil applied granular insecticides: carbaryl, carbofuran only in pellet/ tablets
					For Papaya fruit fly: Cultural: weed control Physical: pick up dropped fruits & burry them Genetic: choose varieties with thicker skin & pulp Biological: parasitic wasp : *Acerate neuromiya* Chemical: detect border infestations & apply only to borders: malathion, acephate, dimethoate, trichlorfon
					For *Aleurodicus* sp.: Cultural: proper irrigation with fertilisation. Physical: eliminate old & affected leaves Biological: release of Encarsia sp. Chemical: malathion, acefate, dimethoate

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Methyl-parathion	Metacap, Metacide, Metil Paration, Penncap	In-secti cide	MANGO: Scales (*Planococcus citri*)	RUP with USEPA. Limited registration in Colombia. In PIC list.	Biological: various natural enemies. Chemical: gyberellic acid, malathion, dimethoate
Methomyl	Lannate, Mercamil, Methavin, Methomex, Metomil, Pilarmate	In-secti cide	CUCURBITS: Aphids (*Aphis gossypii, Myzus persicae*) ONIONS: Aphids (*Mycromyzus formasanus)*	RUP with USEPA. In 'Bad Actor" list of PAN for acute toxicity & choli-nesterase inhibitor.	Physical: nets, yellow traps Cultural: eliminate weeds & crop residues Biological: various natural enemies. Hymenopther: *Aphidius colemani*. Diptera: *Aphidoletes aphidimyza* Chemical: summer oil, amitraz, acefato, dimethoate, esfenvalerate, methyl – pirimifos, thiametoxan
Monocrotofos	Azodrín, Elan-cron, Fersacrón, Fosacrón, Monocrón, Nuvacrón,, Trifo-tóx, etc.	In-secti cide	MANGO: Scales (*Planococcus citri*)	CANCELLED in US. It was RUP.In PIC list. In 'Bad Actor" list of PAN for choli-nesterase inhibitor. Organophosph.	Biological: various natural enemies. Chemical: gyberellic acid, malathion, dimethoate
Naptalam		Her-bi-cide	SWEET POTATOES: weed control	Not registered in Colombia. Potential ground water contaminant.	Mechanical: use weeder or hand weeding Chemical: glyphosate
Nicotine	Hidrolato de tabaco Agrisan	In-secti cide	MEDICINALS: Varios uses FLOWERS: varios uses.	RUP. In PAN Bad Actor List due to acute toxicity & reproductive toxin.	
Ofurace	Grolan (Only in mixes with mancozeb)	Fun gi-cide	CUCURBITS: Mildew (*Pseudoperonospora cubensis)*	Not registered with USEPA. Registered only in Portugal & UK	For *Pseudoperonospora cubensis:* Cultural: eliminate weeds & crop residues, avoid excess humidity, open planting pattern. Physical: eliminate affected plants by end of crop cycle. Chemical: mancozeb, cymoxanil, copper oxychloride, propineb, triadimefon

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Oxamyl (oxamil)	Vidate	In-secti cide, ne-mati cide	CUCURBITS: Nematodes (*Meloydogine spp.)* MEDICINALS: Borer nematode (*R.. similis),* Raquitism nematode (*Tylencorrynchus sp*.)	RUP. In PAN Bad Actor list due to acute toxicity & cholinesterase inhibitor.	For *Meloydogine spp:* Gentic: use resistant varieties Cultural: use healthy seedlings Physical: vapour esterilization, solarization Chemical: disinfected structures & soil . Use nematicies if needed. Carbofuran only in pellet/ tablets
					For *R. similis*: Cultural: repellent plants: *Ricinos cummunis, Origanum vulgare, Calendula officinalis*
					For *Tylencorrynchus sp*.: Cultural: disinfected soil before planting. Repellent: Tagetes & calendula. Physical: solarization. Remove affected plants. Chemical: Dazomet
Paraquat	Gramoxone, Agroquat, Calli-quat, Paraquat	Her-bi-cide	SWEET POTATOES: weed control	RUP with US-EPA.	Mechanical: use weeder or hand weeding Chemical: glyphosate
PCNB		Fun-gi-cide	MANGO: Basal rotting (*Rosellinia* sp.)	Not registered in Colombia.	For *Rosellinia* sp: Cultural: eliminate affected plants Chemical: disinfectation & spray with formalina
Propachlor		Her-bi-cide	**ONIONS: weed control**	Not registered in Colombia	Mechanical: use weeder or hand weeding mainly around trees & during first 3 years. Chemical: pendimethalin, oxyfluorfen, linuron, trifluralin
Propanocarb		Fun-gi-cide	**MEDICINALS: Root rots (*Phytium sp.)***	Not registered in Colombia	Cultural: properly select a well drained field. Use crop rotation. Select & use healthy rhysoms Biological: *Trichoderma pseudokinigii* Chemical: if no other alternatives: furalaxil

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Phospha-midon		Aca-ri-cide	PAPAYA: Red mites (*Tetranichus* spp.*)*	No registration in US nor in Colombia. In PIC list.	Disinfect structures & soils, eliminate weeds & crop residues, avoid excess nitrogen. Natural enemies: *Amblyseius, Phytoseiulus persimillis, Feltiella acarisuga.* Chemical: piridaben.
Tau-fluvalinato	Yardex, Mavrik	Aca-rici-de In-secti cide	White flies (*Trialeurodes vaporariorum, Bermisia tabaci*), Larvae (*Spodoptera exigua*), Thrips (*Frankliniella occidentales*), Aphids (*Aphis gossypii*)	No registration with USEPA	Use nets, weed control, remove crop residues, use feromone & yellow traps, monitor first plant stages. Chemical: For white flies: methyl pirimifos, imidacloprid, piridaben, tiametoxam. For larvae: sulfur, esfenvalerato, methyl pirimifos. For thrips: sulfur. For aphids: sufur, imidacloprid, methyl pirimifos.
Tetradifon	Tedion	Aca-ri-cide	White mite (*Polyphagotarsonemus latus)*	No registration with USEPA	Chemical: abamectina, sulfur, potassium permanganate, propargita 30W
Zineb		Fun gi-cide	MANGO: Anthracnosis (*Colletotrichum gloesporoides)* ONIONS: Mildiew (*Peronospora destructor)*	Not registered in the US nor in Colombia	For *Colletotrichum gloesporoides:* Cultural: good agronomic practices, sanitary pruning, pruning to open c anopy to allow aeration & sun light. Flower induction in dry season. Chemical: protect flowers & fruits, preventative. Captan, mancozeb, copper compounds. Hot water during at 48°C for 49 hours for post – harvest treatment.
					For *Peronospora destructor*: Cultural: use light & well drained soils, weed control. Chemical: disinfection & sprays. Copper oxychloride, mancozeb, propineb, sulphur.

Pesticide			Target Pest / s	Type of Problem	Alternative to this pesticide
Technical name	**Commer-cial Name**	**Ty pe**			
Zineb		Fun gi-cide	TOMATO: Anthracnosis (*Colletotrichum spp)*	Not registered in the US nor in Colombia	Cultural: clean plantation, including pick up of dropped fruits, old leaves & stems, etc. Crop rotations Genetic: plant tolerant varieties Chemical: disinfection of seed & nursery sprays: captan, mancozeb, tricyclazole
Ziram		Fun gi-cide	ONIONS: Rust (*Puccinia sp.)* TOMATO: Anthracnosis (*Colletotrichum spp)*	Registrations cancelled in both US & Colombia. In PIC list.	For *Puccinia sp.:* Cultural: avoid high nitrogen & low potassium soils. Chemical: triadimeform, mancozeb, methyl- thiofanate
					For *Colletotrichum* spp.: Cultural: clean plantation, including pick up of dropped fruits, old leaves & stems, etc. Crop rotations Genetic: plant tolerant varieties Chemical: disinfection of seed & nursery sprays: captan, mancozeb, tricyclazole

Colombia Alternative Development Project (CAD)
Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)
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