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ENVIRONMENTAL ASSESSMENT
FOR THE TARGETED WATERSHED MANAGEMENT PROJECT
AND
ASSESSMENT OF THE NEED FOR PESTICIDE USE IN THE
AGROFORESTRY OUTREACH PROJECT

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List of Abbreviations and Acronyms

AOP	: Agroforestry Outreach Project.
APHIS	: Animal and Plant Health Inspection Service.
CICP	: Consortium for International Crop Protection.
COOP	: Cooperative.
DAI	: Development Alternatives Inc.
DARNDR	: Département de l'Agriculture, des Ressources Naturelles et du Développement Rural (GOH).
DCCH	: Développement Communautaire Chrétien d'Haiti.
DRI	: Développement Rural Intégré.
EA	: Environmental Assessment.
GOH	: Government of Haiti.
IEE	: Initial Environmental Examination.
IPM	: Integrated Pest Management.
LAC	: AID Bureau for Latin America and the Caribbean.
LOP	: Life of Project.
NGO	: Non Governmental Organization.
ORE	: Organization for the Rehabilitation of the Environment.
PADF	: Pan-American Development Foundation.
PAP	: Port-au-Prince.
PID	: Project Identification Document.
PMS	: Pest Management Specialist.
PP	: Project Paper.
PVO	: Private Volunteer Organization.
RDO	: Rural Development Officer.
REMS/CAR	: Regional Environmental Management Specialist/Caribbean.
RPAR	: Rebuttable Presumption Against Registration.
SHAG	: Secretariat for Hillside Agriculture (Composed of DARNDR staff)
SNPA	: Service National de la Protection Agricole (GOH).
ST	: AID Bureau of Science & Technology.
TWAMP	: Targeted Watershed Management Project.
UNICORS	: Union des Coopératives de la Région du Sud.
(US)AID	: US Agency for International Development.
(US)EPA	: US Environmental Protection Agency.
WHO/FAO	: World Health Organization/Food and Agriculture Organization.

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1- Introduction

Hillside farming in Haiti is currently faced with severe problems of erosion and low fertility of the soil, a situation which largely results from the ever-increasing population pressure on the land and the associated desire to produce more and more food on constantly shrinking acreages. As a consequence, arable land is not fallowed when it should be and land generally not considered suitable for agricultural production is used for this purpose. In order to reverse this trend, farming practices which have resulted in the erosion and degradation of hillside soils must be replaced with farming practices which regenerate and conserve those soils. This is what USAID/Haiti is proposing to do through the Targeted Watershed Management Project (TWAMP; 521-0191).

The target zone is located in the Southwestern part of Haiti, in the region of Les Cayes, and includes six watersheds flowing south from Pic Macaya. This area represents 4.5% (80,000 ha) of the total land mass of the country and encompasses a population of ca. 400,000 people.

The proposed interventions include: alley cropping, improved food crop varieties, fruit trees, firewood species, forage species, adopted agronomic practices, perennial cropping methods, inorganic fertilizers and pest management. With the alley cropping system, nitrogen-fixing leguminous trees or shrubs, such as Leucaena sp., are planted along the contours of land holdings on steep slopes and act as vegetative barriers to control soil erosion and reduce speed of surface water. In addition, these trees add biologically-fixed nitrogen to the soil and produce green manure and mulch for the companion crops.

However, because the alley cropping system implies that a certain portion of a farmer's land cannot be used for food crop production (that portion is occupied by trees), a peasant may be expected to adopt this system only if crop yields, on the remaining portion of his land, are increased. This can be achieved, in part, through the use of high-yielding varieties, fertilizers and pest management.

The task of implementing those technologies at the farm level will be given to four private volunteer organizations (PYOs) which are already working in the target area (ORE, DRI, DCCH, and UNICORS). An umbrella NGO will supervise this work and provide technical assistance, equipment and funds to the PYOs while coordination with other groups doing similar work in Haiti will be the role of the Secretariat for Hillside Agriculture (SHAG; part of the ministry of Agriculture,

DARNDR). More details regarding the various technical and social aspects of this project can be found in the PP draft as well as in the PID.

The PID includes an Initial Environmental Examination (IEE) conducted by Mr. James J. Talbot REMS/CAR/USAID/Haiti, in which it is made a requirement that a risk/benefit analysis be conducted if pesticides are to be procured or used by the TWAMP. I was contracted to perform this analysis, i.e. Environmental Assessment (EA), which is in the appendix of this document. Also in the appendix is an assessment of the need for pesticide use in the Agroforestry Outreach Project (AOP; 521-0122), a program which has been underway for five years in Haiti and the goal of which is reforestation. It works through PVOs, some of which are also expected to participate in the TWAMP.

The following paragraphs give general observations regarding current pest control practices as well as recommendations for anticipated pesticide use and for the development of pest management programs in the target area.

2- General observations

2.1 Ministry of Agriculture (DARNDR). Because of the unfavorable political and social atmosphere which has prevailed in Haiti for several years, the DARNDR has experienced frequent personnel changes and, as a consequence, its activities have been characterized by a lack of long-term planning, follow-up, organized and integrated research, control policies and data publications. This explains the near absence of reasonably recent and dependable literature on common pests of major crops and trees in Haiti as well as on crop loss assessments.

2.2 Pest identification. Depending on the level of expertise of the various people involved in making decisions or recommendations regarding the selection of "appropriate" pesticides, the pest problems are usually identified in one of the following three ways:

a) In some PVOs, when crude identification of the pest is not possible, any broad-spectrum insecticide such as Carbaryl or Malathion is applied if the pest is an insect and any broad-spectrum fungicide such as Captan is applied if the pest is a fungus.

b) In most PVOs, however, pesticide applicators can perform a crude identification of the pest, i.e. caterpillars, ants, crickets, aphids, scale insects, snails, mites, leaf spots, damping-off, anthracnose, etc..., and usually select a pesticide which is known to be effective against a particular group of pests, e.g. Chlordane for ants or Dicofol for mites. Hill (1975) published tables which indicate the effectiveness of various insecticides against different groups of insects.

c) Agronomists working for the DARNDR or private pesticide suppliers may go a little further and compare a specimen to descriptions given in reference books printed in Mexico (CIMMYT), Puerto Rico (de Mayquez 1974), the Dominican Republic (Rosario 1970), and Haiti (Wolcott 1927). Occasionally, positive identification is possible and more specific recommendations can be given.

2.3 Plant Quarantine. At the present time, Haiti does not have plant quarantine facilities at any of its various points of entry. DARNDR officials distribute forms which should be filled out by anyone who wishes to take plant material in or out of the country. Permits are issued if inspection of the plant material by personnel at the SNPA does not reveal the presence of any pathogen or insect which may be injurious to Haiti's agriculture (imported material) or any other country's agriculture (exported material). A certain number of legislations were passed regarding the introduction of specific plant materials (e.g. coffee because of the threat of the leaf rust, Hemileia vastatrix, a devastating disease which does not presently occur in Haiti) but there are always provisions made for special cases of importation which, with a lack of proper quarantine facilities and a lack of rigor when the inspections are conducted, may lead to the introduction of serious diseases and insect pests in Haiti. Based on discussions that I had with various people who, in recent years, have been involved in the introduction of plant material into Haiti, it appears that inspections are usually very superficial and that the SNPA staffs who conduct those inspections are generally not well qualified for this type of work. The risks of introducing pests of major importance are therefore very high.

The coffee leaf rust, mentioned above, is a particularly critical issue in the context of the TWAMP. This disease could easily wipe out coffee plantations in Haiti which, because of their heavy shade, provide very favorable conditions for

the rust organisms and, because of their physiologically old or weak conditions, are very susceptible to attack by rust which occurs in 24 identified races of varying virulence. At the present time, the DARNDR issues a poster showing what the rust looks like and indicating (in Creole) that any similar symptoms that are observed in Haiti should be reported for immediate destruction of infected material. However, I did not see this poster anywhere but in the DARNDR office in PAP and, in any case, "it is a dangerous illusion to believe that the rust organism can be contained or eradicated once introduced into the country" (see Development Alternatives, Inc. 1977 for more details).

2.4 Use of R- and C-pesticides (see Table 3 in appendix 1). Some EPA Restricted and/or Cancelled pesticides are currently used in all PVOs except DRI and none of the applicators have received proper training. Two technicians (at UNICORS and DCCH) have received some form of training but it cannot be considered adequate.

2.5 Use of protective clothing and safety measures (see Table 3 in appendix 1). Protective clothing is used in only one of the PVOs (DRE). In the others, little attention is paid to the hazards of pesticides; applicators ("aspergeurs") often apply dangerous chemicals bare foot and wearing shorts and no shirt. At one of UNICOR's COOPs, seed treatment with Lindane and Malathion is conducted on a concrete surface where children often play in bare feet not long after the application.

2.6 Use of pesticides by peasants. It is unrealistic to expect the average Haitian peasant to use pesticides properly or, in many cases, to use pesticides at all. First, he often cannot afford a back-pack sprayer (ca. \$75 US) and some of the costly pesticides that would be required for effective pest control. Secondly, if his house is made of bamboo and straw with a thatched roof, we cannot expect him to build a pesticide storage area which would be considered safe by North American standards. Finally, the water necessary to clean up the equipment may not always be readily available around the house. In sum, the peasant's general standard of living will need to be raised before he can use pesticides safely.

2.7 Rodents. People who work and live in the target area claim that rats are the most injurious pests to food crops, more than insects and diseases together. This is a particularly serious problem in rice fields.

3- General recommendations

3.1 Pest management and the TWAMP. The development of sound pest management practices within the TWAMP should mean more than merely establishing a list of pesticides considered safe for use in the project. In view of the problems dealt with in section 2.6, every effort should be made to steer away from the reliance on chemical pesticides to manage pest problems on hillside farms. Pesticide-application-related assistance will likely be provided during the LOP but consideration must be given to the fate of pest management practices after the completion of the project, when such assistance may need to be discontinued. Three pest management approaches are particularly suited to the present agricultural situation in the target zone: 1) use of crop varieties which show acceptable levels of resistance to the local pests, 2) biological control, and 3) cultural control. These methods are environmentally sound and require no capital investment on the part of the farmers.

3.2 Pest catalogue. The development of sound pest management practices usually requires, as a starting point, that the target pest species be properly identified. If reliable information on pest identification became available in Haiti, it would then be possible to conduct a thorough literature search through the various data bases available in the U.S. and through correspondence with pest management specialists working in neighboring countries which may share some of Haiti's pest problems. Such a review of the literature may then reveal that, for some of the pests under consideration, there exist: 1) data on crop loss assessment, 2) effective monitoring techniques, 3) data of efficacy of various chemical and non-chemical pesticides, 4) parasites and predators candidate for introduction as biological control agents, 5) data on plant resistance, 6) data on cultural methods, and 7) data on other pest management components not included in the above list. Although few of the pest insects and pathogens which attack crops and trees in Haiti have been properly identified, some of them have received final or tentative identification. The following is a list of references which may

contain Haiti-related information on 1) insects: Wolcott 1927; Jean Baptiste 1945; Ward 1975; Allen 1979; Becker 1981; Solis & Samedy 1980, and 2) pathogens: Solis & Samedy 1980.

Some insect pest species have been formally or tentatively identified by Mr. Bertrand Derouillères, entomologist at the Faculté d'Agronomie, Damien. They include: Plutella maculipennis, Trichoplusia ni and Myzus persicae on cabbage, Spodoptera fugiperda and Ostrinia nubilalis (??) on maize, Anthonomus grandis and Pectinophora gossypiella on cotton, Leucoptera coffeella on coffee, and Cylas formicarius on sweet potatoes. One corn disease, Phyllachora maydis, has been tentatively identified by Mr. Jean-Yves Banatd, agronomist for the DARNDR in Les Cayes. Further discussions with other professionals working in the field of agriculture in Haiti would very likely yield more of this type of unpublished information.

In order to give Haiti -- and more particularly the target area -- a good base for the elaboration of IPM programs, I recommend that a pest management specialist (PMS) be hired for a period of three years (years 1-3 of the LDP) to develop a Haiti-specific pest catalogue and to initiate and orientate IPM research in the project area. This specialist should have a strong background in entomology and plant pathology, some knowledge of weed and vertebrate pest management, extensive experience in the Caribbean, and good knowledge of tropical crops and their commonly associated pests.

Scope of work

- a) Gather all information already available on the identification of major pests and confirm or correct identification when necessary.
- b) Visit PYOs and farmers and ask about commonly encountered pests. When not previously identified, collect specimens and attempt identification or send to a U.S. laboratory for identification.
- c) Perform a literature search as described above.
- d) Describe all currently available management approaches, based on the literature search and on interviews with DARNDR's agronomists and pesticide suppliers, both of whom may conduct small-scale field trials on pesticide efficacy.

- e) Produce a pest catalogue with recommendations on currently available control measures.
- f) Assist the DARNDR, PVDs, private companies, or other organizations which may be indirectly involved in the project, in conducting crop loss assessment studies and small-scale research aimed at developing alternative pest management strategies.
- g) Prepare a research and extension program for the Ph.D.-level US-trained plant protection specialist (see 3.3) when this one returns from the U.S.
- h) Any other task mentioned in the EA.

3.3 Ph.D. training in plant protection. In the PP draft, provisions are made for the financing of long-term training at the Master's and Ph.D levels in U.S. universities for SHAG personnel (p. III-12). I suggest that the individual who receives Ph.D. training in agronomy do his/her research work in crop protection, possibly entomology (at the "Section de Protection des Végétaux" of the DARNDR there is currently one plant pathologist but no entomologist). The trainee may then be able to take over some of the responsibilities of the PMS when the latter's three-year term is over.

3.4 Training for pesticide applicators. See section 11 of the EA.

3.5 Improved varieties and susceptibility to pests. A number of new, improved varieties are being considered for utilisation in the TWAMP. It is imperative that consideration be given to potential pest outbreaks when selecting among candidate varieties. Some of these improved varieties may be more susceptible to local pests than the local, low-yielding varieties. Such enhanced susceptibility may offset the yield increases expected from the introduction of new varieties. Alternatively, it may accelerate pesticide use. The varieties being considered should be screened by PVDs or other organizations before being released for use on farms. The collaboration of Mr. Amal Chatterjee (Winrock International), who is currently doing such screening, should be sought.

3.6 Plant quarantine. If new coffee varieties are introduced during the LOP to replace the old, low yielding Coffea arabica var. typica, which represents nearly 99% of all coffee trees in Haiti, it is imperative that the selected varieties be resistant to the rust (preferably "horizontal" resistance which is not strain-

specific) and that special precautions be taken when introducing coffee plant material not to introduce infected parts. Special consideration must be given when selecting the donor country with respect to: 1) the occurrence of the disease in that particular country, and 2) the existence of plant quarantine and inspection facilities in that same country.

Mr. Julio Bartholemy, head agronomist at the DARNDR's plant protection section in PAP, has indicated to me that the GOH has plans for the construction of plant quarantine facilities in PAP and Cap Haitien in the coming year. This project appears to be more than a "politician's promise" since Mr. Bartholemy was able to show me detailed documentation relative to this project. Six DARNDR technicians will be assigned to those facilities. However, one can suspect that such technicians will never receive adequate training without assistance from external sources. At least two of these staff members should receive short-term training at the USDA-APHIS station at Hyattsville, Maryland, and the cost of such training should be born by USAID/TWAMP funds.

3.7 Rodent control. The solution to the rat problem in Haiti requires a sustained national effort which should come from the GOH. This is a vast operation which is not feasible within the context of the TWAMP. Punctual, temporary efforts are doomed because of subsequent immigration to areas where control measures have been applied from areas where they have not. Rodenticide tests are currently conducted at the DARNDR but no national organized control plan seems to be underway. TWAMP's director should strongly encourage the GOH to adopt a permanent national rodent control program.

3.8 Storage and disposal of pesticides. Storage of pesticides and disposal of pesticide containers or unused pesticides should be done as described by Parasram et al. (1980).

APPENDIX 1

ENVIRONMENTAL ASSESSMENT

Introduction

Because AID's financing of pesticides for any project must conform to the provisions of AID Regulation 16 (22 CFR Part 216), it is required that an analysis of pesticide use (EA) be conducted as a condition precedent to the disbursement of AID funds into the TWAMP.

In this EA, a list of pesticides, the use of which is anticipated during the LOP, is reviewed to determine their acceptability for use in the project. Factors considered for this evaluation are listed in paragraph 216.3 (b) (1) (i) of Regulation 16 and include, as a highly determinant criterion for selection, the USEPA registration status of each pesticide under consideration. World Bank guidelines for pesticide use are also taken into account in this analysis.

1- Basis for selection of the requested pesticides.

Because of the current lack of : 1) published information on pest identification and, 2) research data on pesticide efficacy in Haiti (see section "General observations" in the attached report), the pesticides which Mr. J. St-André (DAI/TWAMP) has requested for use in the project have not strictly been selected on the basis of accurate knowledge of present or anticipated pest problems, but mainly on their availability at two agrochemical suppliers in the Les Cayes area and on their current use for the control of various, unspecified pest problems in the same area. To this list I have added other pesticides which are currently used by four PYOs that have indicated their willingness to participate in the TWAMP. Most of these pesticides are applied on seedlings of fruit tree and forest tree species which are being considered for adoption in the TWAMP. Some of these pesticides may not be available in the Les Cayes area but they may all be purchased in PAP. Approaches to selection of pesticides vary among the different PYOs but are generally based on crude identification of the pest problems (e.g. aphids, crickets, ants, leaf spots, broad-leaf weeds, etc...) and on information

contained in books and booklets published in other countries and/or obtained from pesticide suppliers (see attached report for more details).

Finally, the fungicide Metalaxil (Ridomil) was added to the list because of its anticipated use for the control of Phyllachora maydis, a corn disease recently identified in Haiti. Field tests conducted by the DARNDR have apparently shown that Metalaxil is very effective in controlling this disease. Consult Table 1 for details on the origin of the requests.

2- The USEPA registration status of the requested pesticides.

Table 2 indicates whether each requested pesticide is registered by USEPA for General Use (G), Restricted Use (R), or whether it has been Cancelled (C) for use in agriculture. Restricted pesticides may be purchased and used only by certified applicators because of their very high toxicity and/or environmental hazard. General-use pesticides may be purchased and used by the general public. Table 2 also gives LD₅₀ values and World Bank acceptability for each of the requested pesticides.

Most of the pesticides that are currently used by the PVDs are not applied on food crops and therefore do not pose residue tolerance problems (DRI and DCCH run forest tree nurseries whereas ORE runs a fruit tree nursery). Only UNICORS currently uses pesticides on some food crops, notably Malathion and Trichlorfon on corn and Trichlorfon on tomatoes, cabbage and carrots. FAO/WHO have not established residue tolerances for Malathion on corn or for Trichlorfon on carrots, but the latter are not presently being considered for use during the LDP. With regard to corn, new varieties will be introduced during the LDP and, if insecticides are necessary, an alternative to Malathion should be sought. Carbaryl is a possible substitute.

It is not known, at the present time, which of the pesticides requested by Mr. J. St-André (DAI/TWAMP) will be used on each of the food crops considered for adoption in the project. It is important that the pesticides authorized for the project be applied only on crops for which 1) they have been registered by EPA and/or 2) FAO/WHO have established residue tolerances, especially in the case of crops which are destined for exportation.

Specific recommendations with reference to Table 2.

The EPA has ruled that some organochlorine insecticides cannot be used for agricultural purposes in the US because of their excessive persistence, propensity to bioaccumulate in human tissues and biomagnification in food chains. Three of the pesticides considered for use in the TWAMP are among those cancelled insecticides: Aldrin, Dieldrin and Chlordane.

In the Targeted Watershed, Chlordane is generally used for the control of ants and potential replacements for it include Carbaryl and Trichlorfon. Dieldrin is currently employed for rat control by at least one of UNICORS'COOPs but should not be used during the LOP. See the attached report (section 3.7) for recommendations regarding rodent control. Aldrin has been requested by Mr. St-André for use in the TWAMP but, since details regarding its anticipated use have not been given, no substitute can be suggested at the present time. The same comment applies to Toxaphene, another organochlorine insecticide, which has been registered for Restricted use only by EPA. Toxaphene should therefore not be used in this project unless no other chemical could be found for the control of a particular insect pest, in which case Toxaphene could be used on demonstration plots only and would need to be applied by a well trained pesticide applicator. Lindane also belongs to the organochlorine family and, although it is registered for use as a seed treatment, it should not be used in this project because of its high acute toxicity and its negative classification based on World Bank standards (it should be pointed out, however, that those standards are based on the toxicity of formulated pesticides while most LD₅₀ values available are determined for technical products). Malagrain, a Malathion-based powder recommended for seed treatment, may be used as a substitute to Lindane (Lindagrain).

Methomyl (Lannate) is a highly toxic insecticide, the use of which has been restricted by EPA. It is currently applied on fruit tree seedlings (ORE) for the control of caterpillars but Malathion is also employed for the same purpose and, if effective, should be considered as a satisfactory alternative.

The use of herbicides on peasants' farms is not anticipated at the present time since weeding is usually done by hand. However, herbicides are currently used for the mass production of fruit tree seedlings at the ORE nursery and their use may be expected to continue during the LOP when such seedlings are produced for the TWAMP. Only two herbicides -- Glyphosate and Picloram -- are presently used and one of them, Picloram, has been classified as Restricted by EPA for

reasons which include hazards to nontarget organisms, specifically nontarget plants, both crops and noncrops. The specific weed problems for which this herbicide is being used have not been clearly exposed to me and I cannot make precise suggestions, at this point, as to which general-use herbicide would be an adequate substitute. If glyphosate alone does not give good control, such a substitute may need to be sought. The herbicide 2,4-D is a candidate.

3- The extent to which the proposed pesticide use is part of an integrated pest management program.

The development of IPM programs requires, as a first step, that the pest species of economic importance be identified. As mentioned in section 1 of this EA, as well as in the attached report, in Haiti this first step has not yet been taken and this is why pesticides are often selected in a more or less haphazard way and alternative control methods almost never considered. Table 3 indicates that two of the PVOs make use of at least one management method which does not require the purchase and application of chemical pesticides. At DCCH, neem seed extract (obtained by soaking seeds in water) is applied to forest tree seedlings to protect them from insect attack (although the technician I interviewed believed it was for disease control). The extract of the neem tree, Azadirachta indica, known as azadirachtin, is an insect antifeedant, i.e. a substance which has been shown to be deterrent to several species of phytophagous insects. It does not kill insects but prevents damage which would normally occur in its absence. Although laboratory tests have clearly shown its antifeedant effects, these same effects have not been well documented by field studies (see Barnays 1983 for a detailed discussion). However, the ease with which it can be obtained and its low cost, warrant some research regarding the potential use of this product. Some PVOs might be interested in conducting field tests.

At one of UNICORS'COOPs, table salt is applied along the margin of crop plots to prevent snails from reaching the plants. Snails lose a large amount of water and die after crawling over salt. Tests should be conducted to determine whether such salt applications have visible detrimental effects on crop health and yields.

These two examples do not require accurate identification of pest species but other management strategies do (e.g. biological control). This is why it is recommended that a pest management specialist (PMS) be hired for a period of

three years to develop a catalogue of the pest species of major economic importance to crops and trees adopted by the TWAMP and to undertake additional steps considered essential to the development of sound pest management practices. This PMS would be part of the umbrella NGO team. (See the Recommendation section 3.2 in the attached report for more details).

5- Acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such hazards.

LD₅₀ values (oral and dermal) for all requested pesticides are given in Table 2. LD₅₀ values give an idea of how acutely toxic pesticides are but, because such values are based on tests conducted with pure or technical products, they may not be very good indicators of how acutely toxic formulated pesticides really are. The LD₅₀ is, by definition, the amount of a chemical necessary to kill 50% of a test animal population (usually laboratory rats). It is a value expressed as the weight of pesticide per unit weight of body (mg/kg), when swallowed (oral LD₅₀), or absorbed through the skin (dermal LD₅₀). A low LD₅₀ indicates high acute toxicity whereas a high LD₅₀ indicates a low acute toxicity.

Although all chemical pesticides are potentially hazardous to humans and the environment, and should be treated with caution, none of the authorized pesticides listed in Table 2 present unusual acute or long-term hazards to the people using them, to the general public, or to the natural environment if applied according to their labels.

With regard to long-term effects, special precautions should be taken when mixing and loading some of the authorized fungicides for which EPA has issued RPARs (temporary status given to some pesticides for which recent data indicate that they may present some hazards to humans or the environment. This status is meant to stimulate research and public debate until a final decision is made regarding the registration status of such pesticides). Those pesticides include Captan, Maneb, Mancozeb and Methyl thiphanate, all of which are suspected of causing tumors and/or genetic changes. Label instructions should be followed particularly closely when using these pesticides.

6- Effectiveness of the selected pesticides for proposed use.

Among the pesticides authorized for use in this project, those selected by Mr. J. St-André were not necessarily selected on the basis of their effectiveness against specific pests in Haiti. However, those pesticides which are authorized and currently in use within the PVQs, are apparently effective at controlling most pest problems encountered in the PVQs' respective environments. As pest identification progresses during the first three years of the LOP, it will become possible to determine the need for specific pesticide efficacy tests which may then be conducted by the DARNDR, pesticide suppliers such as ASSA, or the PVQs. Such tests should be supervised by the PMS from the umbrella NGO.

7- Compatibility of pesticides with target and non-target ecosystems.

Although mammalian toxicity is a very important criterion in selecting a particular pesticide for a given use, effects of pesticides on honeybees, fish, wildlife, and beneficial organisms (i.e. which may help prevent pest outbreaks), should also be considered.

Table 4 gives indications on the periods of the day during which one should apply a particular pesticide in order to protect honeybees when the target crop is in bloom. The same Table also shows that the selected pesticides for which bird toxicity data are available are not very toxic to avian species, with the possible exception of Diazinon which has an LD₅₀ (oral) of 3.5 when tested on Mallard ducks.

With regard to fish toxicity, many of the proposed pesticides are highly toxic to fish, including most fungicides. This aspect should not, however, pose any problem if precautions are taken to avoid drift or accidental spills in rivers and streams.

Finally, in any well designed pest management program, a high priority is given to preserving beneficial organisms such as insect predators and parasites. This requires the use of narrow-spectrum pesticides which are toxic to only particular taxonomic groups of pests (here, again, key target pest species and, if possible, their principle natural enemies must first be properly identified). Unfortunately, most of the insecticides authorized for use in this project are broadly toxic to insects. It is therefore imperative that measures be taken to reduce the number of pesticide applications to a minimum. Such measures include

the use of monitoring techniques, action thresholds, cultural methods, etc..., most of which need yet to be developed. The PMS of the umbrella NGO should seek collaboration of the DARNDR in developing such methods.

8- Conditions under which the pesticides are to be used, including climate, flora, fauna, geography, hydrology and soils.

The TWAMP area lies between latitudes 18.1 and 18.23 N and longitudes 73.32 and 74.13 W in Haiti's Département du Sud. It extends from the eastern edge of the Cavillon catchment area to the western edge of the Les Anglais catchment. The southern slopes of the Massif de la Hotte and of the Monts du Plymouth form the northern boundary of the Targeted Watershed. Pic Macaya, at 2,347 m the highest mountain in the region, is part of the Massif de la Hotte. The Caribbean Sea forms the southern boundary of the Targeted Watershed.

The dominant topography of the region is very steep slopes at elevations less than 1,000 m. However, elevations within the target zone reach to the top of the Pic Macaya (2,347 m). Topography accounts for climatic changes within short distances and for the general inaccessibility of much of the region.

Rainfall in the Targeted Watershed is a function primarily of elevation and ranges from 1,200 mm at the driest sea-level zones in the southwest of the project area to nearly 4,000 mm at the highest elevations of the Massif de la Hotte. High-elevation areas have only a winter dry season and have sufficient rainfall to support vegetative growth for the rest of the year. In low-elevation areas, rainfall follows a bimodal pattern with concentration of precipitation in April-May and September-October.

The soils of the Targeted Watershed are highly weathered tropical soils. However, ca. 35% of the soils are young soils, Mollisols. These are found at lower elevations, in dryer zones and on calcareous parent materials. The highly weathered red tropical soils for which nutrient status is highly organic-matter dependent are those described as having 90% of their nutrients in the upper 10 cm of the top soil. Black Mollisols have a good organic matter level as well as active clay throughout their profile which gives them a superior nutrient status vis-à-vis the red soils.

With regard to flora and fauna, there are about 5000 plant species in Haiti but their endangered/threatened status is uncertain. Of those 5000 plant species, there are 600 species of ferns and 300 species of orchids. Among animals, of

particular importance are the 220 species of birds and the recently discovered species of molluscs in the national parks.

9- The availability and effectiveness of other pesticides or non-chemical control methods.

There are currently several other pesticides available in Haiti, some of which might be more effective at controlling the anticipated pest problems than those which have been authorized for the project. Among such pesticides, however, there are some which are more persistent in the environment and/or more toxic to mammals and to other non-target organisms than the proposed pesticides. Once the major economic pests have been identified, a need for the adoption of some of those other available pesticides may, nevertheless, arise.

Two available non-chemical control methods have already been discussed in section 3 of this EA. Some other non-chemical control approaches which have a high potential for success in this project include: 1) the use of Bacillus thuringiensis, a bacteriological insecticide of very low mammalian toxicity which is effective in the control of various lepidopterous larvae (caterpillars), 2) the introduction of parasites and/or predators for the control of various scale insects which occur in Haiti, 3) the introduction of predatory mites for the control of injurious mites on fruit trees, and 4) the introduction of a coccinellid predator for the control of a psyllid insect which attacks Leucaena leucocephala, a tree that has been recommended for the alley-cropping technique that will be used in the TWAMP. Webb and Webb (1986) recently reported psyllid damage as being very serious in the Northwest of Haiti. Although I did not observe many psyllids in the Southwest, the problem may be expected to reach epidemic proportions in this area at one point.

Leucaena sp. is native to Central America where the psyllid Heteropsylla cubana is kept under check by its natural enemies. In many of the countries where Leucaena has been introduced, this psyllid was (accidentally) introduced as well. In Hawaii, the coccinellid Curinus coeruleus, which was introduced there in 1922 to control the coconut mealybug, has become an efficient predator of the psyllid (McFadden 1987). If the psyllid species found in Haiti turns out to be the same as that found in Hawaii, introduction of C. coeruleus into Haiti should seriously be considered. The PMS of the umbrella NGO is expected to take the necessary steps to determine if the above options are feasible.

10- The requesting country's ability to regulate or control the distribution, storage, use and disposal of the requested pesticides.

The GOH does not have a pesticide control board nor does it have any law or regulation designed to control the use of pesticides in its country. One such law is apparently in preparation but the recent political events in Haiti have, at least temporarily, interrupted further development of this law. In any case, the ability of the GOH to enforce such a law remains questionable.

Therefore, in the context of the TWAMP, it will be the role of the umbrella NGO to verify and control the distribution, storage, use and disposal of the requested pesticides. This should not pose any problem in the early phase of the project when, as recommended in section 11, the handling and application of pesticides is done by trained PVO technicians only. Control may become more difficult, however, if, later in the LDP, peasants begin applying pesticides themselves.

There is one particular control issue over which the umbrella NGO may experience difficulty: The issue of labelling. When a whole bag or container of pesticide is purchased, the product is normally properly labelled but not in a language (usually English) which most Haitians can read. When pesticides are purchased in smaller quantities, they are transferred into paper bags or into containers which do not have any label at all. The salesman may simply write the name of the pesticide on the bag or the container and give verbal instructions relative to the use of the purchased pesticide. Often those bags get ripped or wet and the identification disappears. One solution to this problem lies in the production of stickers printed with Creole translations of the original labels. ASSA, a fertilizer company which will soon begin distributing pesticides in Haiti, may be interested in getting such stickers produced. It will be the role of the umbrella NGO to make arrangements with the pesticide distributors in order to ensure that pesticides purchased by AID/TWAMP are labelled as described above.

11- The provisions made for training of users and applicators.

Since many of the peasants will not be able to afford the purchase of a backpack sprayer, I suggest that, at least initially, pesticide applications for on-farm trials be carried out by trained technicians from the PVOs. UNICORS

currently employs such a system although its applicators are not properly trained. This institution supervises 8 COOPs, each of which is divided into a certain number of sections (e.g. 5). A given COOP has a technician who, in theory, is well trained and qualified to apply pesticides. This technician trains at least one person in each of the sections and this person applies pesticides on private farms when such measures appear necessary.

Adequate training in pesticide application/handling/disposal should be provided for at least two technicians in each of the four PVOs. These technicians should then be able to teach other applicators the safe handling of pesticides. I suggest that advantage be taken of the two 1-day courses which will be offered by a pest management specialist hired by USAID/Haiti Cooperative Agreement for Fruit Tree Production. This course will be offered at ORE which is relatively near DCCH and DRI. Travel would need to be provided for two UNICORS technicians.

If the decision is made, later in the LDP, to transfer the responsibility of applying pesticides to the farmers, trained PVO technicians should organize workshops on proper handling of pesticides for the peasants.

12- The provisions made for monitoring the use and effectiveness of the pesticides.

The umbrella NGO will have the responsibility of monitoring the use of pesticides in the TWAMP and ensure that they are handled correctly and safely. The PMS, and later a US-trained agronomist/entomologist (see the Recommendation section 3.3 in the attached report) of the SHAG, will be responsible for routinely taking crop samples in order to conduct pesticide residue analyses. This will be particularly important in the case of crops exported to foreign countries which may have specific standards regarding pesticide residues. Where such residue analysis will be performed remains to be determined. The University of Miami is one possibility.

Table 1. List of requested pesticides and origin of requests.

PESTICIDE		ORIGIN OF REQUEST					Author
Common name	Commercial name (if different)	DAI	ORE	DRI	DCCH	UNICORS	
Aldrin		X					
Benomyl	Benlate	X	X				
Captan		X		X	X	X	
Carbaryl	Sevin	X	X	X		X	
Chlordane			X		X		
Deltamethrin	Decis		X			X	
Diazinon	Basudin	X					
Dicofol	Kelthane	X	X				
Dieldrin						X	
Glyphosate	Round-up		X				
Lindane	Lindagrain					X	
Malathion		X	X		X	X	
Mancozeb	Dithane M45			X		X	
Maneb	Manzate		X				
" + Metiram	Molosse		X				
" + Methyl- thiophanate	Peltar		X				
Metalaxyl	Ridomil						X
Methomyl	Lannate		X				
Picloram	Tordon		X				
Thiram			X				
Toxaphene		X					
Trichlorfon	Dipterex				X	X	

Table 2. EPA registration status and toxicity of requested pesticides.

PESTICIDE Common name	ACTION ¹	EPA REG. ² STATUS	LD ₅₀ ³ oral/dermal mg/kg	WBA ⁴	SIGNAL ⁵ WORD	PROJECT ⁶ AUTHORIZATION
Aldrin	I	C	40-60/50-100	NO	Warning	-
Benomyl	F	G	>10000/>10000*	OK	Caution	+
Captan	F	G	90000/-	OK	Caution	+
Carbaryl	I	G	500/>2000*	OK	Caution	+
Chlordane	I	C	367-515/>200,<2000*	OK	Warning	-
Deltamethrin	I	G	>5000/>2000*	OK	Caution	+
Diazinon	I	G	300-400/3600*	OK	Caution	+
Dicofol	A	G	684-809/1000-1230	OK	Caution	+
Dieldrin	R ⁷	C	40-60/50-100	NO	Warning	-
Glyphosate	H	G	4900/-	OK	Warning	+
Lindane	I	G	88-125/1000	NO	Warning	-
Malathion	I	G	10090-1375/4100*	OK	Caution	+
Mancozeb	F	G	>8000/-	OK	Caution	+
Maneb	F	G	7990/-	OK	Caution	+
- + Metiram	F	G	7990-10000/-	OK	Caution	+
- + Methyl- thiophanate	F	G	7990-9700/>8000* ⁸	OK	Caution	+
Metalaxyl	F	G	669/>3100	OK	Warning	+
Methomyl	I	R	17-24/5880* ⁹	NO	Danger/Poison	-
Picloram	H	R	8200/-	OK	Caution	-
Thiram	F	G	780/-	OK	Caution	+
Toxaphene	I	R	69/-	NO	Warning	-
Trichlorfon	I	G	150-400/>500	OK	Warning	+

¹ A = Acaricide, F = Fungicide, H = Herbicide, I = Insecticide, R = Rodenticide.

² C = Cancelled, G = General, R = Restricted.

³ Based on technical product unless otherwise indicated. From: Farm Chemical Handbook 1985. Meister Publishing Co., Willoughby, Ohio, USA.

⁴ WBA = World Bank Acceptability: if a pesticide is in category Ia or Ib of the WHO Recommended Classification of Pesticides by Hazard, this pesticide is considered unacceptable. Categories Ia and Ib include all pesticides which fall in the following toxicity categories: LD₅₀ (rat) oral: solid < 50 mg

liquid < 200 mg

dermal: solid < 100 mg

liquid < 400 mg

⁵ See ref. cited in footnote 3 p. C234 for classification criteria.

⁶ -: not authorized, +: authorized.

⁷ Usually classified as an insecticide but used as a rodenticide by UNICORS.

⁸ Datum for Methyl thiophanate only.

⁹ Based on 24% liquid formulation.

* Rabbit instead of rat.

Table 3. Summary of pesticide management in the PVOs

CATEGORY	PVO			
	ORE	DCCH ¹	UNICORS	DRI
Use of C-pesticides	YES	YES	YES	NO
Use of R-pesticides	YES	NO	NO	NO
Basis for selection of pesticides	CIP ²	CIP	±Haphazard and some CIP	CIP
Safety equipment				
mask	YES	NO	NO	Cloth mask
gloves	YES	NO	NO	NO
boots	NO	NO	NO	NO
other	Plastic coat	NO	NO	NO
Storage area	Locked & Safe	Locked & Safe	Locked but also used as a warehouse for grain	Locked & Safe
Identification of pesticides in storage area	GOOD	No pesticide when visited	NOT GOOD	NOT GOOD
Disposal	In an outdoor toilet	Bags are buried	Empty bags are washed and re-used for seed transport	Empty bags are burnt
Use of alternative pest management methods	NO	Use of neem seed extract	Use of table salt to control snails	NO
Particular problems			Seed treatment done on a concrete surface where many children often walk bare foot	Broadcast of pesticides with bare hands
Particularly good feature	Creole guide on CIP, pesticide selection and dosages			

¹ Based on previous use; temporary ban on pesticide use at DCCH.

² CIP = Crude Identification of Pest.

Table 4 Toxicity of pesticides to non-target organisms.

PESTICIDE	BEES ¹	BIRDS ² LD ₅₀ (mg/kg) Mallard; oral	FISH ³
Aldrin	1-A	520	
Benomyl			T
Captan			T
Carbaryl	1-A	2179	T
Chlordane	1-C	1200	
Deltamethrin	1-C		
Diazinon	1-A	3.5	T
Dicofol	1-D		
Dieldrin	1-A		
Glyphosate			
Lindane	1-A	2000	
Malathion	1-B	1485	T
Mancozeb			T
Maneb			T
" " + Metiran			T
" " + Methylthiophanate			T
Metalaxyl			
Methomyl	1-D		T
Picloram		2000	
Thiram			T
Toxaphene	1-C		
Trichlorfon	1-C	700-800*	

¹ 1-A: do not apply on crops in bloom, 1-B: apply only during late evening when crops in bloom, 1-C: apply only during late evening or early morning when crops in bloom, 1-D: can be applied at any time with reasonable safety to bees. From: Handbook for pesticide applicators and pesticide dispensers, 1980. Province of B.C., Ministry of environment, Pesticide Control Branch, Victoria, B.C., Canada.

² Same source as that cited in footnote 1.

³ T: highly toxic.

* Quail instead of mallard duck.

Illustrative budget

Pest Management Specialist hired for three years:	\$ 360,000
Training of two plant quarantine specialists (DARNDR staff) at APHIS:	\$ 12,000
Residue analyses 200 samples at \$15.00/sample:	\$ 3,000
Purchase of protective devices and safety equipment:	\$ 1,000
Purchase of additional back-pack sprayers (<u>ca.</u> 20) at \$75.00/sprayer:	\$ 1,000
Total:	<u>\$ 377,500</u>

(Ph.D. training for a DARNDR staff has already been budgeted).

APPENDIX 2

ASSESSMENT OF THE NEED FOR PESTICIDE USE IN THE AGROFORESTRY OUTREACH
PROJECT

Introduction

Prior to the initiation of the AOP in 1981, an IEE prepared by Mr. William Sugrue, indicated that the use of pesticides in CARE and PADF nurseries would not be necessary. Therefore, AID funding of the AOP was approved with the special condition that pesticides would not be used during the LOP. However, several pest problems have since then emerged which require the use of pesticides in order to avoid substantial losses due to diseases and insect pests.

Technicians in CARE and PVO nurseries of PADF have taken it upon themselves to initiate pesticide treatments in view of the evergrowing pest problems. The purpose of this report is to analyse pesticide use and pest management practices in CARE and PVO nurseries of PADF involved in the AOP.

This report is based on a meeting with Steve Goodwin, project coordinator for PADF in PAP, visits of two of the PVO nurseries of PADF (DCCH and DRI), and a meeting with Rick Scott, project coordinator for CARE in PAP. Because of a lack of time, none of the five CARE nurseries, which are located in the NW of Haiti, were visited.

1- List of pesticides proposed for use in the AOP.

<u>Common name</u>	<u>Commercial name</u>	<u>Users</u>		<u>Authorization</u>
		CARE	PADF	
Benomyl	Benlate		X	YES
Captan		X	X	YES
Carbaryl	Sevin	X	X	YES
Chlordane			X	NO
Malathion		X	X	YES
Mancozeb	Dithane M45		X	YES
Meneb + Methyl- thiophanate	Peltar		X	YES
Trichlorfon	Dipterex		X	YES

The reader should refer to the EA/TWAMP for a detailed analysis of these pesticides. Chlordane, the only pesticide not authorized for use in the AOP because of its Cancelled EPA status, is normally used for ant control in tree nurseries. Carbaryl and Trichlorfon are two adequate substitutes.

2- Use of IPM principles by PADF and CARE.

PADF produces a nursery manual titled: The Small Container Nursery Manual for Roottrainer Fives. This document, printed in both Creole and English, gives control recommendations based on crude classification of pests: damping-off, fungus, crickets, caterpillars, aphids, and ants. Pesticides recommended are all broad-spectrum. The only non-chemical methods recommended are for: 1) crickets: hand weeding around the nursery, and 2) damping-off: reduced watering and increased ventilation. However, at the two PVO nurseries visited, the technicians did not appear to be using the manual and, when asked whether they were using non-chemical methods for pest control, they did not mention the two above methods. At DCCH, however, they do use neem seed extract for the protection of tree seedlings against insect attack (see EA/TWAMP for a complete discussion).

With regard to CARE nurseries, Rick Scott claims that pest problems are not too important at the present time and that all pest problems are controlled with three broad-spectrum pesticides which are relatively safe to use (see table). No non-chemical methods are presently being used. (The reader should consult the EA/TWAMP for more details on potential alternative control methods as some of them also apply to the ADP).

3- Need for training of pesticide applicators

Based on visits at the DCCH and DRI nurseries, the level of training of PADF pesticide applicators appears somewhat low (see section 2.4 in attached report). It has already been recommended that two technicians in each of DCCH and DRI attend one of the two 1-day pesticide application training courses which will be offered shortly by AID/Haiti Cooperative Agreement for Fruit Tree Production in Camp Perrin (see EA/TWAMP section 11). PADF includes several other PVO

nurseries, however, and pesticide application training should be provided for at least one technician in each of those nurseries. The pest management specialist hired for the training course offered by AID/Haiti Cooperative Agreement for Fruit Tree Production, should be rehired for a one-day training session in PAP.

With regard to CARE, Rick Scott informed me that only nursery technicians apply pesticides in the five CARE nurseries and that those technicians are trained by CARE's senior forester. However, since I cannot assess the quality of that training, I suggest that the five CARE nursery technicians attend the one-day course offered in PAP for PADF nursery technicians, as mentioned above.

4- Final recommendation

With the condition that: 1) Chlordane is not used by PADF or CARE during the remaining part of the LDP, and 2) proper pesticide application training is provided for PADF and CARE nursery technicians, the authorized pesticides are recommended for use in the AOP.

Illustrative budget

One-day pesticide training course for PADF and CARE nursery technicians	\$ 2,000
Purchase of protective devices for all PADF and CARE nursery technicians	\$ 2,000
Total:	<u>\$ 4,000</u>

APPENDIX 3

Itinerary in Washington, D.C. and Haiti

Date (July 1986)	Activities
6/Sun.	Air travel between Quebec City, Canada, and Washington, D.C.
7/Mon.	Briefing with Mr. Carroll Collier, crop protection specialist at the AID/ST Office of Agriculture, and with Mrs. Marea E. Hatzios, Deputy Environmental Officer at the AID/LAC Bureau.
8/Tue.	Air travel to PAP, Haiti. Arrival at 15:45. Met with Mr. James J. Talbot REMS/CAR/Haiti and discussed my itinerary in Haiti and details regarding my assignment.
9/Wed.	Spent morning at the AID Mission in PAP to organize my schedule. Visited their library and went through pest management literature which might be related to Haiti. Spent part of the afternoon at the DARNDR office of plant protection, making first contacts and obtaining appointments with Mr. Julio Bartholemy, Mr. Paul Samedy and Mr. Guy Hallman who were impossible to reach by telephone. Went back to the AID Mission and read reports pertinent to my assignment.
10/Thu.	<p>9:00 Met with Mr. Philippe Mathieu of ASSA, a fertilizer/pesticide supplier in Bon Repos near PAP.</p> <p>11:00 Met with Mrs. Anne Hauge of Agri-Supply Co. in PAP.</p> <p>13:00 Spent some time at the library of the Faculté d'Agronomie, going through pest management literature related to Haiti.</p> <p>14:00 Met with Mr. Bertrand Derouillère, entomologist at the Faculté d'Agronomie, Damien.</p> <p>15:00 Met with Mr. Guy Hallman, USDA pest management specialist working on a West Indian Fruit Fly quarantine problem.</p>

16:00 Met with Mr. Julio Bartholemy, agronomist and director of the DARNDR's plant protection section.

- 11/Fri. 9:30 Met with Steve Goodwin, AOP coordinator for PADF in PAP.
11:00 Met with Rick Scott, AOP coordinator for CARE in PAP.
13:00 Returned to the AID Mission and had a discussion with Sean Finnigan of ORE. Spent the rest of the afternoon getting organized for my trip to Les Cayes and Chardonnière.
- 12/Sat. Morning: travelled to Les Cayes (ground transportation).
Afternoon: met with Mr. Gérard Léger, agrochemical supplier for ASSA in Les Cayes.
- 13/Sun. Morning: read TWAMP's PP draft and rested.
Afternoon: read TWAMP's PP draft and met with Mr. Amel Chatterjee of Winrock International (Les Cayes).
- 14/Mon. Morning: visited the ORE fruit tree nursery at Camp Perrin. Met with Sean Finnigan again.
Afternoon: visited the DRI forest tree nursery in Bergaud and met with Mike Bannister of PADF.
- 15/Tue. Morning: travelled to Laborde to visit DCCH forest tree nursery but was unable to meet the nursery technician. Worked on EA instead.
Afternoon: 14:00 Met with Mr. Jean-Yves Banatd, DARNDR agronomist in Les Cayes.
16:00 Left for Chardonnière. Arrived there at 22:00
- 16/Wed. Morning: travelled to Les Anglais and met with Mr. Jean St-Cyr, president of the "Coopérative Agricole Des Anglais", one of 8 COOPs coordinated by UNICDRS. Discussed pesticide use by the COOP.
Afternoon: travelled to Randel to visit another COOP but was unable to meet with the pesticide application technician. Took advantage of being there to visit a couple of peasant farms. Stayed overnight in Chardonnière.

- 17/Thu. Morning: travelled back to Les Cayes.
Afternoon: went back to DCCH nursery and met with Mr. Gilbert Piard, the technician in charge of pesticide application.
16:30 Left Les Cayes for PAP.
- 18/Fri. Morning: went to the AID Mission for short debriefing and went back to the Mission's library to look up new references.
Afternoon: 13:00 Met with Mrs. Fabienne Latortue of Darbouco, an agro-chemical supplier in PAP. Spent the rest of the afternoon working on EA.
- 19/Sat. Worked on EA and CACP report.
- 20/Sun. Worked on EA and CACP report.
- 21/Mon. Morning: made a few telephone calls to some of the people contacted earlier to ask further questions. Called Carroll Collier in Washington, D.C.
Afternoon: had a debriefing session with Mr. Robert Wilson at the AID Mission.
- 22/Tue. Typed the EA at the AID Mission.
- 23/Wed. Submitted a draft of the EA to Messrs John Lewis and Robert Wilson at the AID Mission. Travelled back to Canada.
-

APPENDIX 4

List of major contacts in HaitiUSAID/Haiti (PAP)

Mr. James J. Talbot REMS/CAR
Mr. Robert J. Wilson RDO
Mr. John V.D. Lewis RDO

DARNDR

Mr. Julio Bartholemy, agronomist (PAP)
Mr. Paul Samedy, agronomist (PAP)
Mr. Jean-Yves Banatd, agronomist (Les Cayes)

PADF

Mr. Steve Goodwin, ADP coordinator (PAP)
Mr. Mike Bannister (Les Cayes)

CARE

Mr. Rick Scott, ADP coordinator (PAP)

Winrock International

Mr. Amal Chatterjee (Les Cayes)

ORE

Mr. Sean Finnigan, director (Camp Perrin)

Darbouco, S.A. (Agricultural supply)

Mrs. Fabienne Latortue, agronomist (PAP)

Agri-Supply Co.

Mrs. Ann Hauge, general manager (PAP)

Agricultural Services S.A. (ASSA)

Mr. Philippe Mathieu, agronomist (PAP)

Faculté d'Agronomie, Université d'Haiti, Damien

Mr. Bertrand Derouillères, entomologist.

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