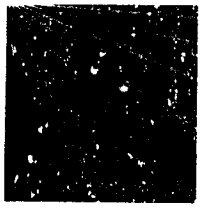

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Pesticide Safety Assessment of the Morocco Locust Control Project

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INTEGRATED PEST MANAGEMENT AND ENVIRONMENTAL PROTECTION PROJECT

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INTRODUCTION

The purpose of my trip was to work as a Pesticide Safety Specialist and to observe the safety in the handling of USAID-supplied insecticides, beginning with their arrival at the port of entry, up to the site where they are utilized. Regulatory aspects ... public health protection from insecticide use, and regulations for pesticide safety and registration were analyzed. The plan of the Moroccan Government for cholinesterase testing, the infrastructure for worker protection, storage facilities, and disposal plans were also reviewed.

This task entailed travelling throughout the locust-infested area, visiting the Command and Sub-command Posts from where the locust control campaign is conducted. Government offices were also visited including: Plant Protection Service, Analytical Laboratory at Casablanca, Port of Casablanca, Ministry of Public Health, and the Central Comm. nd Post in Rabat.

The recommendations made consider the current capabilities of the Moroccan Government and the donor support.

PLACES VISITED

Oct. 27, 1988: Meeting at the Poste de Commande Central (PCC) in Rabat

Met with Mr. Chiki at the Gendarmerie Royale, he participates in the command of the locust control campaign. According to Mr. Chiki, there is a medical doctor and 3 nurses in each regional PC to deal with intoxications of field personnel. The PCs were equipped with kits to monitor levels of cholinesterase activity. Intoxicated workers were sent to hospitals, or separated from work if it was just a case with low cholinesterase activity. There have been some intoxication cases reported. There are 21 health

centers and several clinics ready to handle intoxication cases in this campaign, according to Mr. Chiki.

The Plant Protection Service (SPV) of the Ministry of Agriculture conducts efficacy tests of the products that could be used in the locust control campaign; it also studies their effect on people, plants and animals. The personnel seemed well trained (in France, Belgium, USA), not much information has been published, though. The SPV has been taking residue samples from soil treated with the insecticide DDVP. The samples were sent to Germany for analysis, however the results were not available at the PCC.

Nov. 3, 1988: Visit to the Poste de Commande (PC) at Aït Melloul

At Aït Melloul there is a formulation plant that makes dilutions of DDVP and Karate (lambda cyhalothrin) with highly aromatic naphta (HAN). This was done in cisterns with closed circuit in a relatively safe manner. The pumps, however, did not have an antisplash protection (see appendix). Large amounts of HAN were stored, and the fire protection and firefighting equipment was minimal. A great disadvantage at Aït Melloul was that the pesticide mixing unit and storage areas were surrounded by dwellings. The PC of Aït Melloul supplied all the other PCs with the insecticides that arrived at Agadir. There was, therefore, a large temporary storage of insecticide drums at this PC. Storage was in the open air and on bare ground. Large areas of ground were saturated with spillages, no attempt was made to remove such spillages. Airplane fuel and insecticides were not always clearly separated. According to Mr. Ben Halima, head of the PC, pesticide drums remained in storage for about 1-2 months, this short period has not encouraged the construction of adequate buildings for storage.

Aït Melloul was supposed to centralize the disposal of empty drums, thus receiving drums from all other PCs. Drums were supposed to be

crushed and burried in landfills. Pre-crush rinsing, according to Mr. Ben Halima, consisted of soap and water rinse followed by fuel. There were a lot of drums piled up to be crushed and disposed of, most of them had strong smell of pesticide, most drums had been punctured. The accumulation of disposable drums was due to waiting for the crushing gear to arrive from the U.S. There were no signs or warnings in the entire plant. High pesticide smell was present all over (including offices). Most of the disposable drums that had piled up had contained technical DDVP and, like the rest, were stored in the open air. Access to general public, however, was supposedly not possible.

In general, all drums at Ait Melloul were badly bashed, reflecting very rough and hazardous handling, either at the airport (Agadir) or in the delivery process with transport trucks. Another reason for piling used drums (not punctured) was their reuse with the same product (DDVP) and its dilutions (20% and 4%). Most of these drums were highly corroded however, posing the risk of leakage and corrosion particles plugging spray nozzles. Drums for reuse should undergo a specific process of reconditioning. The labeling of these drums was highly imcomplete. We saw Malathion tanks reused with DDVP, the sole identification was either 20% or 4% painted at the top, many also had DDVP scribbled on the top of the drum. In all cases, however, the Malathion label was still on the drums. Other drums were identified in the same way, but an old label was not present. All this lent itself to confusion and represented a hazard for people not familiar with the contents of the drums. The date of drum arrival to the storage site was not on the drums, a "first in, first out" policy was therefore not possible.

Workers in direct contact with the pesticide wore protective gear consisting of waxed or plastified jackets and pants or cloth coveralls (trousers were worn inside boots instead of outside), long neoprene gloves, cloth caps or helmets, plastic eyeprotectors, rubber boots, and respirator mask to protect against organic vapors. When waxed clothes got very dirty, they were washed in a laundry in town where personnel may not have been fully aware of the type of clothes handled. Some people did not wear hats and others did not wear respirators when close to the insecticides. Some people were smoking, wearing the protective gear (no gloves) sitting on the insecticide drums, some of which had pesticide on their surfaces. Workers spent lunch hours with the protective gear on, they also wore it even while not working with pesticides. Workers should only wear their protective equipment while it is necessary, and never take it home. Everyone complained, especially the crews for terrestrial treatment, that waxed suits were very hot and that working long hours with the respirator mask was unbearable. Several gloves needed to be replaced due to ruptures. There was a separate cabinet for storage of protective gear. The masks were kept in a different cabinet. There were showers for workers, but they were in poor shape and its use may not have been relevant. There was, in general, (authorities and technicians) a relatively sound feeling about pesticide safety, some aspects still needed further work (see Discussion and Recommendations). The working personnel, in general, had very limited education, and this was partly the cause for not wearing the protective gear adequately. The technicians (who had received some training and who lead the working teams) were not always fully capable to deal with the situation. Workers operated the pesticide mixing and diluting plant and the refilling of drums. They were mostly exposed to DDVP (the most used insecticide)

which was diluted in this plant to concentrations for use with aircraft (20%) or with motorized atomizers (4%).

Fire equipment was almost absent, unable to handle a fire of proportions as would be the case if the HAN (flammable DDVP solvent) storage and the insecticide mixtures (containing HAN) had ignited. There was no specific protective gear for workers to combat the fire, nor adequate fire extinguishers. Water is not fully adequate in pesticide fires because it tends to disperse the burning liquids even further. Fire extinguishing equipment and fire walls are particularly important at the mixing unit where the solvent is located. There were no fire barriers separating the most flammable compounds from the pesticides.

The physician posted at the PC explained that the local hospital takes care of intoxicated workers (10 cases in the 87-88 locust control campaign). The hospital kept statistics of such cases and allegedly seemed to have all that is required to treat intoxications. There should have been one trained nurse and one physician at the landing strips of the spray planes. However, I did not find them at 5:30 a.m. when planes were being refilled and departing. When a worker was sent to the hospital, the type of the intoxicating product was communicated to the physician (so far it has always been DDVP). The organization for workers' health care was the same at all the other PCs. Intoxications happened while loading planes and also during terrestrial treatments while operating backpack atomizers, where workers were exposed to the pesticide mist carried in several directions by the air currents.

A technician from Agadir came periodically to conduct cholinesterase test to a sample from the general population of workers.

Visit to the airport of Aït Melloul

The workers' protective gear was the same as at the mixing plant, except that coated cloth coveralls were used. These workers were active from 5:30 a.m. until 10:00 a.m. Therefore, heat should not have been a great deterrent of the use of the safety equipment. Many workers did wear hats. The person who held the hose at the plane's tank did not wear his respirator. Most of the other workers did not wear it either. These masks were uncomfortable and breathing through them was not easy. This became a serious problem where work was fast and intense.

The problem with the plane filling process began when the hose and pipe thatsuctioned pesticide out of the drums had to be changed from an empty drum to a full one (see appendix). Considerable exposure to the insecticide occured in this maneuver. The worker literally had to hug the dripping pipe that was pulled out from the empty drum and inserted into the next drum to be emptied. There were leaks at the hose connections to the pump. Considerable amounts of pesticide was spilled on the ground. Several workers remained soaked with insecticide for the rest of the day. Considering also the volatility of DDVP, this maneuver appeared very hazardous indeed. In fact it seemed responsible for most of the intoxications. The protective clothes were washed at home according to the workers, some had a good idea of the danger of the insecticide spilled over their clothes. In any case, protective equipment should never go home, and it should be removed as soon as it is no longer needed.

There were washing facilities (no showers). An ambulance was available 24 hours. A fire hose was available, no other fire control means was observed.

Drum storage was on the ground and in the open. Drums were very

bashed. The following products were identified:

Malathion (96%), Am. Cyanamid

Malathion (96%), Italian origin (the very poor paper label is missing on most drums

Deltamethrin (Decis)

Lambda cyhalothrin (Karate, which is also mixed with HAN)

The water from rinsing planes was meant to be sprayed over a safe area. However, often this rinsing water was repeatedly dumped on the ground (in the same place) at the airport. Pesticide excess on the planes after spraying was collected and poured into a drum with the same product.

A helicopter that was being refilled had a large pesticide tank immediately behind the pilots. The atmosphere stank of DDVP. This tank was not separated by any barrier from the pilots, thus being a hazard. Later it was known that a hose of the pumping circuit burst and everyone on board was sprayed.

November 5: FC Guelmim

The drum storage was as usual, in the open and on the ground. No preparedness to deal with pesticide spillages was evident. Spillages could be noticed on the ground. Although a rare phenomenon, there have been floodings on this site in 1982, indicating that this storage site may not have been fully adequate. Drums were not dated following their order of arrival. Labels were as usual, in foreign languages. Instruction sheets accompanying safety equipment did not include text in the local language. Workers were seen during their break time sitting on pesticide drums (very strong smell), in their protective clothes and smoking. The risk of fire was thus added to that of intoxication (contaminated cigarette or fingers). The same individuals were seen washing their protective suits (smeared with

insecticide) with their bare hands in a bucket. One worker was wearing sandals instead of boots.

The general public had no means of access to this pesticide storage area.

The process of filling the planes was the same as described for Aït Melloul. It was a hazardous operation (see appendix), where personnel got repeatedly splashed by the product and were forced to breath over the openings of pesticide containers. There were too many workers (8-10) at this operation, too many candidates for intoxication. They almost bothered each other while moving hoses, drums, fiddle with leaky pumps, etc. A modified refilling system should transfer pesticide into the plane in a more closed circuit requiring less workers to operate it. This could be achieved with cisterns and also would allow to put the drums out of circulation.

For the 1987-88 campaign, there were 86 intoxication cases in eight months. At the local hospital, it was stated that intoxications were among refilling personnel and crews of terrestrial treatments. The hospital seemed prepared to handle intoxications from different pesticides. Kits to test for cholinesterase (USAID donation) activity were available for serial monitoring. Individuals with less than 75% cholinesterase activity (with respect to non-intoxicated check) were taken away from their job until a new test indicated recovery to normal levels of activity of cholinesterase. No fatal intoxications occurred, recovery from intoxication usually happened after 24-48 hours, patients were then sent home.

One physician or one nurse were supposed to be at the airport.

There were no warning signs or indications of fire exits in the area.

At the PCs of Aït Melloul and Guelmim, I suggested the possibility of my conducting on-site training to workers who were in contact with

pesticides. The idea was not supported by either PC, Mr. Ben Halima (PC Ait Melloul) stated that his personnel were already trained. The difficulty of withdrawing people from work to undergo training, at this particularly busy time of the year, was emphasized.

November 6: PC Tata

A physician on call at the hospital and a nurse at the airfield dealt with insecticide intoxication cases. Workers in contact with insecticides were tested for cholinesterase activity, using USAID-supplied kits, every 15 days. They had 3 cases of mild intoxications. Workers engaged in terrestrial treatments should have been accompanied by a nurse or paramedic in the field. No showers were available, but there was a water cistern at the airfield.

Supposedly no spraying should have occurred above dwellings, water, or crops such as vegetables, date palms, and olives before harvest. However, on the road to Taroudannt, a dead swarm was found on a road flanked by olive orchards bearing fruits and by dwellings.

At hospital level, the need for materials to treat intoxications was mentioned. The products handled at this PC were DDVP and Malathion.

At the airfield a technician (college BS) was in charge of the working crew and responsible for safety enforcement. The protective suits were the white waxy ones. Workers complained of the heat, especially those operating backpack atomizers. Their rubber gloves were the type for household use, they ruptured easily, and were not appropriate for heavy duty work.

During the pesticide refilling activities at the Tata airfield, several workers wore damaged protective suits. Workers wore their respirators and

also hats (or the hoods of their waxed suits). Even the pilots wore respirators.

Planes were rinsed twice, the first rinse was sprayed over conventional treatment area. Water from a second rinse was dumped on the ground at the airfield.

Three fire extinguishers were at the airfield, in addition to the water cistern used for washing and rinsing.

The area where pesticide drums were stored was not fenced. Fuel was stored far from the pesticide, and malathion drums were also segregated. There were 17 empty drums awaiting transportation to Aït Melloul for disposal or recycling. There were drums refilled with DDVP that bore no label indicative of the type of product contained or toxicity warnings. Drums were stored in the open air and on the ground. Insecticide drums showed signs of very harsh treatment during their unloading from planes or transport trucks. Drums unloaded without using ramps may become leaky and very hazardous.

The sub PCs of Tata were not operational, treatments were made from the airfield of the PC of Tata.

November 8: PC Ouarzazate

Airfield:

The insecticides were stored (open air an on the ground) away from the fuel for the airplanes. Twenty-two 200-liter drums had been refilled with DDVP, only the concentration was painted on. Many of these reused drums were rusting and may become leaky in the future. No signs indicating the toxic nature of the product in the drums. The drums should have been properly labeled at Aït Melloul. Drums were, again, very bashed. By the time I arrived, not all the workers were wearing their protective gear.

some were barefooted and wore various kinds of rubber gloves that were in poor shape. The workers felt very uncomfortable in their protective gear.

While filling a plane with insecticide, the connection between a pesticide pump and a rubber hose broke and insecticide was splashed all over because the pump had no anti-splash protective shield. Workers holding the hose at the plane's tank were too close to the tank opening thus at high risk of being splashed and within an atmosphere of dense pesticide vapors.

There were no showers available.

The plane refilling process (insecticide) was as described for previous PCs, an awkward and hazardous operation.

A fire station was near and seemed to have what is required to deal with pesticide fires.

The spraying planes were operated by Spanish pilots. They were asked not to spray over dwellings, water streams or crops (palms can be sprayed only after harvesting the dates). According to these pilots, the ground crew always wore protective gear.

November 8 (PM): Sub PC Zagora

There had been some intoxications during terrestrial treatments. Intoxicated workers were sent to the hospital in Ouarzazate. The workers had not yet been subjected to the cholinesterase tests. The same plane filling procedure, as in other PCs, was observed.

This was a post of intense activity and the insecticie for the PC at Ouarzazate was stored here in the usual way. This was an important storage site. Lots of malathion drums, part of which were close to fuel tanks. Empty pesticide containers were sent to Aït Melloul. Zagora was an airstrip in the desert, with no fire precautions observed. No indications or

warning signs were displayed. The need for new filter cartridges for the respirators was expressed. Apparently, many filters were consumed by the crew for terrestrial treatments.

November 9: PC Ouarzazate

According to the physician on duty at the PC, last year they had more than 100 workers intoxicated. One case was serious and was sent to Marrakech. They did not have antidotes, or kits to test cholinesterase activity then. By the time of my visit, the government had given them Atropine and cholinesterase tests were made with the USAID kits. Individuals with less than 75% of the normal cholineserase activity were temporarily (2 weeks) withdrawn from work. Before returning to work, the workers were subjected to another cholineserase test. Intoxications resulted from skin penetration and inhalation. Ruptured gloves and neglect to use the respirators weres certainly involved in these intoxications. Four workers that filled planes with insecticide at the airfield laid in bed at the hospital in the same clothes they were working in, which were certainly contaminated with insecticide. The hospital needed pajamas for its patients. The cholinesterase activity of these hospitalized workers was less than 50% normal. Contraction is needed as well as equipment to treat intoxications. The PC and hospital did not have a data sheet of the pesticides used. The field crews, engaged in terrestrial treatment, needed rubber boots, which would also have been useful for protection against snakes and scorpions.

The instructions that came with the respirators were in German.

Pesticide storage in Ouarzazate

Ouarzazate supplied insecticide for the sub PCs. There was a mechanical fork lift to move the pesticide drums. Fire protection equipment

was needed. As previously seen, many reused DDVP drums were stored here. No label, only the pesticide concentration was painted on the drums. No toxicity warnings. No indications or warning signs were posted. Storage was in the open air and on the ground. There were many puddles of DDVP all over, a lot of pesticide went into the ground. There were no washing facilities or showers. Fuel and pesticide drums were close to each other. American carbaryl was stored here since last year. Dwellings were nearby.

Sub PC Boulmane - Dadis

We saw no treatments at this Sub PC because it was raining. The same problems previously discussed, with respect to the operation for refilling airplanes with pesticide, apparently also existed here. There were 17 cases of intoxicated workers, two of which literally fell sick on the ground. Two other strong cases of intoxication were recorded, in which one individual was separaed from work permanently. A team from Ouarzazate conducted cholinesterase tests every 15 days. Most of the intoxications were detected with this test. Deterioration of gloves and lack of enough rubber boots was also a problem at this site. Animals and bees were said to have been affected by the insecticides. The animals belonged to transient nomads, which are usually difficult to locate or reach with instructions. Beekeepers were told to cover their hives while the airplanes sprayed, but nothing was said about a period for reentry to the treated zone.

When planes were rinsed, the rinsing solution was sprayed over the desert. The reused pesticide drums were rusting and scales from the drums' innerwalls needed to be filtered before the product went into the plane's tank. Even after filtering, solid material still plugged the spraying orifices of the Micronair units.

At the hospital, lack of pajamas to change the patient's contaminated clothes was again mentioned as a problem. At the air strip, drums were stored in the open air and on the ground. Fuel drums were separated from pesticide containers. No fire extinguishing equipment was observed. No indications (pesticide storage, name of pesticide in front of corresponding drum clusters, showers, etc.) or warning signs were displayed. Signs would have been very important since personnel were often being renewed and newcomers were not familiar with the premises. There was a small water cistern. The operational units at Skoura and Tinzghir were not visited since no treatments were performed due to the rain.

November 1[illegible]: Errachidia

This was a very well organized command post, where authorities were well aware of pesticide safety issues. According to the head of the PC, and his immediate collaborators, the protective gear worn (including the white rainfast suits) was not adequate for Moroccan conditions. It was difficult to get the workers to wear it, particularly the respirators. And this, in turn, was laregly responsible for the low cholinesterase tests. Terrestrial spraying was considered to be the main source of intoxication. During terrestrial treatments, workers often walked into the spray mist. Lack of protective glasses or neglect in respirator use exposed the worker directly to the pesticide. In general, workers engaged in terrestrial spraying must eat before going to spray; eating, drinking, or smoking should be forbidden during work. Field persnnnel experienced the same deterioration of their gloves as commented before. Gloves were being changed every 15 days. They would have liked to have two protective suits per worker to allow for washing. During my visit, they had no more suits in stock. Protective gear

needs to be renewed as it wears out. It needs to be considered as a consumable item and replacement should be assured.

An interesting feature of this PC was the existence of an academic unit for scientific support. This "cellule" conducted very applied research, establishing optimum dosages, testing for insecticide effectivity, sprayer calibrations and observing effects on the environment. It provided advice on adequate treatment procedures. Studies on pesticide residues in soil had been conducted and the samples had been processed at the Casablanca lab and in Germany. The results were not available.

The PC authorities agreed that a brief training of workers, at the time of my vist, would have been inconvenient since they were very busy. December and January were suggested for better timing, since there is usually a lull in the campaign at that time. They always had the same crew for a given task, thus the individuals became more and more proficient at their job, and imprudences were avoided. Local authorities were supposed to warn the population before treating with insecticide for locust control. Crops were not treated. If locusts were found in the date palms, they were chased away from the crop and were treated far from it.

There was one physician by sub PC and one nurse with each field crew. Each worker had his own health file. Cholinesterase tests were used for diagnosis and indicated where the pesticide management system needed improvement. Even the pilots had been subjected to the cholinesterase test and no problems were detected with them.

Field crews had to light fires very early in the morning to guide the spraying planes. This process went on as the planes sprayed. Safety of these "ballisage" crews is very important, protective gear and good coordination with planes is essential. The new synthetic pyrethroids:

Karate (lambda-cyhalothrin) and Decis (deltamethrin) were reportedly very irritating (eyes, skin) according to the terrestrial treatment crews.

Airfield

There were signs (in French and Arabic) indicating danger areas where protective equipment needed to be worn. Dilutions were made of the pesticide received from Ait Melloul in cistern trucks. Ready to use insecticide was thus supplied to the sub PCs of Errachidia. Drums were identified with the concentration and the name of the product, there was no indication of hazard to health, though. The biological effectivenes of the dilutions was checked in the laboratory, and spraying rates were adjusted accordingly. The pesticide was moved in cisterns to this PC and then drums were filled for the sub PCs. Pesticide storage was in the open air and on the ground. Fuel was stored far from the pesticide. Manual pumps were used to reduce fire risks while filling planes with fuel. Pumps used with insecticides were not used with fuel. Drums were galvanized to avoid corrosion problems. They would have liked to have fiberglass hoses instead of rubber ones, which deteriorate faster.

Physicians visited the airfield three times a week. The workers were examined and periodically tested for cholinesterase activity. There was atropine at each sub PC. An ambulance and a nurse were available. Showers, water faucets, and soap were available. However, at the sub PCs or operational units they used water cisterns.

The workers wore protective gear. They also had army anti-gas masks which they wore while manipulating technical pesticides. There was adequate fire fighting equipment (truck with water and "Carbonic Snow," and manual fire extinguishers) available. Water used to rinse the planes

was sprayed over the airstrip. It would have been better to have done it at different places in a safe area.

Visiting with the physician at the PC who dealt with intoxications in the locust control campaign, we were told that a physician visited the PCs and sub PCs three times per week. The operational units had trained nurses. They needed technical information about treatments of intoxications from products other than organophosphates (lambda - cyhalothrin and deltamethrin).

Workers were tested for cholineserase every 15 days. The AID-supplied cholinesterase kits were used. These tests also helped detect weak points in the handling of insecticides. More kits were needed, however. Their kits had arrived without the rubber gloves that should have been included. During the 1987-88 campaign, 3 workers were hospitalized. No hospitalizations occurred this year, however, some workers with cholinesterase activity lower than 75% of the normal activity were temporarily separated from work. A second test was performed to authorize return to work. Personnel performing cholinesterase tests were trained at the Hygiene Institute of the Ministry of Health. Pajamas were also needed a the Errachidia hospital to replace the contaminated clothes of intoxicated workers.

At Errachidia I saw a video showing pesticide drums being unloaded from a C130. The ramps used were narrow and drums fell off onto the tarmac getting very bashed. Many workers wore no gloves or any special protection against accidental spillage.

November 12: Sub PC Guelmim

Terrestrial treatments were being conducted at this Sub PC when we arrived. Everyone wore protective gear and respirators. The soft rubber

gloves (household use) were easily broken and were a real problem since they retained pesticide inside which remained in contact with the skin. When terrestrial treatments involved large groups of workers, they could easily walk into someone else's spray drift. They had few cases of intoxication, which were detected with the cholinesterase test. Much of the intoxications were by inhalation. This could have resulted from repeated exposure to the insecticide mist, or from respirators not worn or not well adjusted to the face thus leaving channels where pesticide mist or vapors could have penetrated. The respirator's capacity to fully intercept DDVP vapors had not been determined.

Filling the motorized atomizers went without problems and without splashes. No pumps were used, instead a peacock was fitted to the drums which wre then laid horizontally and thus the insecticide was poured directly into the atomizer's tank or a refilling can. The trousers of the protective suit had no means of closing the fly. The scrotum (which is an area of high pesticide absorption) remained vulnerable to pesticide splashes.

There was a technician leading a group of 5 workers in the field.

Sub PC Efroud

The personnel had received training on pesticide handling. As in the other PCs and sub PCs, intoxications resulted from the workers' negligence or from weak enforcement of safety practices. Workers handled a very toxic product (DDVP). Authorities seemed well aware of safety measures, however, this needed to translate into stronger enforcement and education in the field. Training the technicians who were responsible for the field crew seemed relevant. This "training the trainer" concept could have been applied to all PCs and sub PCs.

Intoxications mainly resulted from pesticide inhalation, which was enhanced by the volatility of DDVP, the most commonly used pesticide. All workers wore protective equipment, they wore it even while there was no work. This last observation is a bad habit that has to be avoided.

Insecticides and fuel were stored separately. Records on dates of drum arrivals and departures we kept. Drums, in average, remained less than one month in storage. These were drums refilled with DDVP that were labeled with the name of the insecticide and its concentration. No warnings relative to the product's toxicity were on the drums. No fire protection was observed. Drums, once again, were stored in the open air and on the ground. Insecticide had been spilled on the ground. The storage area was surrounded by dwellings. There were no showers, but water was available. Workers washed their protective suits at home, presumably in the same place where other family clothes were washed. Protetive gear should never leave the working area, nor should it be taken home.

November 13: Bouarfa

This PC had 5 Sub PCs near the Algerian border. Until the time of my visit, 22,000 ha had been treated aerially and 3,000 ha had been ground treated (present campaign). This average was below that of other PCs. They did not have many intoxication cases. The lower work intensity at this PC may have contributed to the low amount of intoxication cases. Teams handling insecticides kept their personnel stable to maintain the expertise and the saftey of the operations. This PC tried to minimize the number of terrestrial treatments which were considered hazardous operations. For terrestrial treatments, the number of workers needs to be low to avoid being contaminated by someone else's spray.

Plastic hoses and tubing of the motorized atomizer, used for terrestrial treatments, deteriorated fast and leakages spilled on the workers. More resistant hoses and tubes were needed. Workers complained about the uncomfortable safety gear. The respirators seemed to be the main problem, and few workers wore them. The same poor quality gloves, as seen in other PCs, were also found here. Holes in the gloves may mean that worker may remain with fingers soaked with insecticide during the entire day.

There were two physicians available for this PC, there was no ambulance, however. At the hospital, there was a nurse who dealt with intoxication cases. Cholinesterase activity was monitored using the USAID-supplied kits. Since water is very scarce in this area, there was no water available for workers to wash themselves.. The stock of pesticide was renewed as the control campaign proceeded. Pesticies arrived in drums or in cistern trucks. The redistribution of pesticide drums to sub PCs was a hazardous operation. It would have been safer to store the insecticide in cisterns and use them to load the planes. There was considerable deterioration of the drums that came from Aït Melloul and continued to Bouarfa's sub PCs and to the operational units. Spare motor pumps should have been available when those in use failed. Filling the planes with insecticide was conducted as already commented for previous treatment centers. This was also a hazardous operation. Rubber hoses transferring insecticide deteriorated fast, more resistant ones (fiberglass) were needed. Spillages remained inbedded in the soil, since the operation was conducted on bare ground. Products used at this center were mainly DDVP and malathion. Residue analysis was made in sprayed areas with samples from vegetation, soil, and water and it was said that no DDVP residues had been found. The water table was very low at this site.

November 14: Terrestrial treatment at sub PC Figuig

Personnel on the truck with the insecticide drums to refill the motorized atomizerswore no respirators. Some workers wore no gloves (which were the usual deteriorable gloves for domestic use). Protective suits (white waxy type) were often ruptured and smeared with pesticide spillages. One worker was spraying without his respirator on. Even the head of the PC had been seen spraying with a backpack atomizer, in front of the field crew, wearing no mask and smoking. Several workers who were spraying wore no rubber boots or protective trousers. There was much splashing and lots of pesticide fell on the ground when insecticide was poured out of the drums to refill the atomizers. Many workers had their faces too close to the pouring pesticide. Workers operating the micronair sprayer (mounted on a truck) wore respirators but no protective suit. The wind-driven "cannon" sprayer received a lot of his own spray, which was brought back by the random air whirls. The driver of the truck carrying the cannon had his window open and wore no protective gear. There was no water for washing. Pesticide storage was in Bouarfa at an abandoned manganese mine. Most of the drums were under cover and on a cement floor. Fuel was stored in a separate room isolated by cement walls. There was no fire protection, or water for washing in the storage areas. At the airport, insecticide drums were stored in the open and on the ground. There was a cistern with water, but no other fire protection. Several insecticide spillages were on the ground.

November 15: PC Oujda

According to the physician, the protective suits were not well adapted to Moroccan conditions. There was a high percentage of workers that did

not wear their respirators. There was no water for washing (Oujda is a desert town). They had the usual problem with the rubber gloves. Intoxications resulted from inhalation and cutaneous absorption. Cholinesterase tests were performed, but their periodicity was unclear. There were good hospital facilities, including an ambulance, but they also relied on other vehicles.

Drums stored at the airport were as usual, unsheltered and on bare ground. Some drums were leaky while others were very rusted. The drums were reused and filled with DDVP (20%). Fuel is stored in a separate shed.

There was a water cistern, other fire protection was received from the airport. In the town storage, fuel was loaded into old DDVP drums, and was stored apart from the pesticide drums. The storage site was unsheltered and on bare ground. Pesticide drums were stored beside a large pile of barley seed. There was a fork lift to move the drums. There was no specialized fire protection, only water cisterns. The drums appeared very bashed and corroded. Much insecticide was spilled on the ground. The field crew was seen lounging in safety suits, instead of taking them off, leaving them in a safe cabinet, and staying away from pesticide contact.

November 24: Plant Protection Service at the Ministry of Agriculture[1]

This organization, among other things, does the registration of pesticides. The rules for registration were being completely renewed by an interministerial committee. The final document, however, was still a draft and had not been published. Part of the contents of that draft were, in fact, already being used for product registration. The requirements for registration seemed quite adequate (see attached Dossier d'Homologation).

1 This section only intends to complement the detailed information presented by Glenn Whaley in his report: Environmental Assessment of the Morocco Locust Control Project. USAID, May 1988.

However, more emphasis on environmental effects is needed. All the toxicological information for registration was supplied by the manufacturer. The products underwent 2 years of local tests for efficacy. Food residue analysis was conducted also. Information on reentry periods and timing of last spray before harvest could be derived from those tests. Soil residues were evaluated only for soil applied pesticides. Pesticide residues in water were not studied, though analysis of residues in water is implied in the 3rd page of the Dossier d'Homologation. Leaching studies were conducted. They had product labels in French and Arabic, with the conventional colors and symbols corresponding to the toxicity category of the product. Information on pesticide safety and on how to handle intoxications was presented in the labels. Information on labels needed to be completed, mainly with information on environmental effects, storage, and disposal. With regards to the existence of guidelines and regulations for safe pesticide use, they had some very old texts that they were supposedly in the process of updating. However, they had nothing in print for me to see. I think that there is a lot to be done in this area. A handbook with information for each product on physical and chemical properties, toxicology and safety, dosages, pests controlled, tolerant crops, residues, etc. should be available for extension personnel. Another very weak area was extension. Extensionists would benefit from training. Extension material needed to be prepared and published; assistance could be provided here, too. Mechanisms for compliance monitoring with respect to the safe (health and environment) use of pesticides needed to be implemented.

The Service de Protection des Végetaux at Rabat would like to have a laboratory that could process residue samples, establish degradation curves, and verify the quality of products received. A well equipped lab

would allow the establishment of broad programs to assess health and environmental impact of pesticides. Such a lab would work with teams collecting human, crop, animal, and environmental samples to determine compliance with pesticide safety rules (which need to be made public). They argued that the laboratory in Casablanca only performs work for each product it receives, and thus would not contemplate a general program for monitoring residues in large areas.

Other manifested needs were a computer to process all the information relative to product registration, efficacy tests, lab work, evolution of residues, and others. The need for updating information on toxicology and registration of pesticides was expressed. It seemed to me that there was still quite a way to go before the regulation of pesticide use could be fully updated, organized, and become of public domain.

November 28: Laboratoire de Casablanca

This laboratory was equipped by the German GTZ. GTZ experts visit periodically for assistance and training. All the technical personnel at this lab had spent some time in Germany for training. This lab was fully equipped and had the adequate training and experience needed to monitor residues of the insecticides used in the locust control campaign. In fact, they had done this on request by the Plant Protection Service, during last year's campaign. Residues on soil and crops were studied.

Pesticide residues on crops and soil were routinely assessed at this lab for the Plant Protection Service. The data were used for pesticide registration.

Quality control of pesticides (verify the percent active ingredient in the formulation) was also done at this laboratory.

Part of the residue analysis work was done for private companies that sought the registration of their products.

This was a service laboratory that did not conduct independent research. Their organophosphate detector was out of order, and could not be fixed in Morocco. In terms of equipment resupply, they considered prioritary to have a gas chromatograph with temperature programing, with two detectors, and selectivity for phosphorus and nitrogen.

A problem at this lab was the disposal of the pesticide samples after they had been processed. They would like to have an incinerator to dispose of old samples. I suggested the use of cement kilns as very adequate and probably the cheapest solution.

Visit to the Port of Casablanca

All USAID-donated insecticide comes through this port. When we visited the port, there were no USAID drums. However, drums of all kinds of pesticides and chemicals (all intermixed) were in very good condition and were stored on pallets. Flammable products were stored together with other chemicals and pesticides,however.

Workers handling chemicals wore no protective gear.

The storage period for USAID drums was short, at the most one week.

There were other products displaying a skimpy label in French and Arabic. The personnel (Plant Protection Service) taking samples from newly arrived products for analysis by the Plant Protection Lab (fraud control), wore no protective equipment to perform their job. Next door to their offices, there were pesticide samples accumulated with no hope of proper disposal. There was a strong smell of pesticide everywhere. The personnel had never been subject to cholinesterase tests.

December 1: Ministry of Public Health, meeting with Mr. Bennouna (Environmental Health Service)

There was no published document ruling public health protection from exposures to pesticides. There was an old Reglamentation for Poisonous Substances (1922). From such text, specific documents were derived. Such was the case of the guidelines for pesticide registration already mentioned. The old Reglamentation, or documents derived from it, we being subjected to modifications. One such modification resulted in the new document for registration, use, handling and disposal of pesticides. An interminsterial Pesticide Commission was elaborating such document, which was still in draft form.

The Ministry is in the process of mastering a working system for implemenation of cholinesterase tests to insecticide-exposed personnel. A second phase of this process will be the implementation of such a system to the general public exposed to insecticides (from the locust control campaign) living near treated areas or near pesticides storages.

The following points were indicated by Mr. Bennouna as relevant for further locust control campaigns:

- Improvement of intoxication-treating facilities at the hospitals.
- More ambulances and vehicles for the transport of intoxicated workers.
- Improvement of the recovery units of the small hospitals.
- Control of pesticide impact on the environment.

Dr. Bennouna insisted on the importance of films, slide shows, cars with loudspeakers (autoparlants) to sensitize workers and the people about the problems of intoxications.

Rendez-vous with Dr. Idrissi Larbi, Chief, Toxicology Department of the National Institute of Hygiene

A publication on pesticide regulations did not exist (it was being developed). The Institute, however, had issued technical guidelines on pesticide toxicology, and safe pesticide use, storage, and disposal. Such guidelines had been circulated to physicians and nurses within the Ministry of Health. A similar effort did not seem to exist within the Ministry of Agriculture. Both ministries should jointly produce guidelines on pesticide toxicology and management, and thus broaden the distribution of such guidelines to include all the technical personnel at the Ministry of Agriculture. Such guidelines would establish provisory rules until the promulgation of the new pesticide law by the interministerial Pesticide Commission.

The need to implement compliance monitoring was expressed. Other needs established were:

- Technical cadres within the locust campaigns needed to become more aware of the problem of intoxication.
- More kits for cholinesterase tests were needed. According to Dr. Idrissi, many kits were being shared among PCs and Sub PCs.
- More nurses and physicians were needed.
- Audio visual means for extension at worker and general public level.
- More protective gear to replace the deteriorating equipment.

Each PC kept a sheet for each worker with the results from cholinesterase tests. Other PCs had access to this information. Therefore, the problem of workers that had been suspended from work due to low cholinesterase activity and attempting to work at another PCs was avoided.

DISCUSSION

In general, the Government of Morocco was well organized and prepared to conduct the locust control campaign. The technical cadres were capable, and most of them had a high level of training. The leading staff was aware of basic safety, health and environmental considerations, and was always receptive to suggestions. This document tries to indicate some spects of the pesticide handling process that could still be further improved.

The pesticide handling situation was very similar at the diverse treatment centers in spite of some local differences. A general discussion is therefore valid.

The storage of pesticide drums on bare ground was inadequate, since leaks could not be detected and the soil could be directly contaminated. Even if the permanence of drums in storage was relatively brief, unsheltered drums under the sun could be exposed to considerably high temperatures. Average temperatures could reach 47C on the metal surface of the containers, and maximal temperatures could exceed that value considerably. With such temperatures, the pesticide can break down and become a hazardous waste. Further storage problems at were the general lack of warning signs, firefighting equipment, fully adequate washing facilities (showers and eye-cleaning devices) and correct labeling of drums. Storage facilities were, in general, inaccessible to outsiders, but often close to dwellings.

Handling of drums was very rough, and some centers began using bulldozers and fork lifts to move them. Progressive drum rusting resulting from their harsh treatment may prevent drum reuse. A drum disposal

method was not operational yet and empty drums (punctured or not) piled up at PCs and Sub PCs, creating a hazard. Reused drums were all insufficiently labeled and represented a harard for those who could not read or were not familiar with the operations. Except for one case where one-year old carbaryl drums were found, I saw no outdated stocks of pesticide. We were told that, on the average, insecticide drums were stored for about 1-2 months or less.

Workers at all PCs, Sub PCs, and Operational Units wore protective suits and respirators. Protective suits were plastified or had a rainfast coat, and most included a hood. Rubber boots were worn mostly with pants covering them. Workers had rubber gloves, unfortunately in most cases their quality was poor (easily broken) and this may have been a source of intoxication for people handling insecticide. The respirators were in good condition, but a good deal of insistence was required for all workers to wear them. Workers complained that the protective gear was uncomfortable and hot, they would have liked to have something more adapted to Moroccan conditions, and something more adequate for the hardships of terrestrial treatments. The respirator was uncomfortable, and respiration through it was hard. Many workers avoided wearing it. The protective gear quickly wore out or got ruptured and continuous replacement was needed. In several cases, boots were in short supply. I think that the protection equipment used offered good protection from pesticide exposures if their comfort could be improved. Proper use could then be easier to enforce. Intoxications resulted from negligence in using protective gear, from wearing equipment that was worn and torn (such as most of the gloves), and from reckless handling of a very toxic product (DDVP).

The use of a respirator should always be enforced and a continuous supply of filtering cartridges should be assured. Since the instructions accompanying the masks were in a foreign language, confusion existed with regards to the frequency of filter changes. In general, filters are to be changed when the mask has a strong pesticide smell, when it is difficult to breath through it, or if headaches and dizziness occur. This is pretty much a decision of the user who needs to be aware of these facts.

It was difficult to identify, in most cases, how and where the protective gear was washed. Many workers washed them at home. It could not be established if workers washed them in the same place other clothes were washed, as was suspected it most cases. One worker was seen washing his protective suit in a bucket to removing the pesticide stains with bare hands. Some PCs sent all the protective suits to a laundry in town. The degree of knowledge at the laundry of the kind of material they were washing was not clear. When washing respirators, filters must be removed, no soap or water must wet the activated charcoal of the filters. The plastic eye protection was randomly worn, visibility soon deteriorated while working with them. However, eyes offer an almost direct route of pesticide penetration and should be protected. The helmet with a plastic face cover appeared more adequate, and would have also solved the problem of many workers not wearing a hat.

Most crews did not have stable personnel, there was a high turnover of workers. In many cases, new and inexperienced workers were incorporated into the crews. These new elements were most vulnerable to the hazards of pesticide handling. Training and safety enforcement at crew

level was needed.

Refilling the planes with pesticides was the most hazardous situation, accounting for at least 50% of the intoxications. It occurred in the early mornings while it was still dark. The crew of about 8 men worked clumsily in the darkness. Pesticide was pumped out of the drums and when one drum had been emptied, the suctioning hose with its terminal pipe was withdrawn and put into the next drum (see appendix). The suctioning pipe came out of the drum soaked in pesticide, which was splashed and fell on the ground. As this hose-pipe assembly was heavy, workers literally hugged it and got thoroughly wet with the insecticide (most often DDVP). The rubber hoses deteriorated and sometimes leaked or broke, splashing pesticide all around. The person holding the filling hose at the tank opening was usually too close, risking inhalation of dense insecticide vapors, or being splashed with product. Not wearing the respirator mask, or wearing perforated gloves resulted in intoxications and hospitalizations. The input of the technicians leading the crews is a key factor for the safety of this operation.

Sophistication and additions to the protective gear are not really going to eliminate intoxications if there is little assurance of it being properly worn. To face this situation, a near closed pesticide refilling circuit for the airplanes is needed, such that it will require the participation of only 2 or 3 workers.

The refilling of the planes resulted in pesticide spillages on the ground day after day. A cement floor (instead of bare ground) to store the drums and contain spillages was needed at each airfield. The refilling areas were, in general, not delimited or isolated and, in most of the cases, no signs were

posted. A nurse was always supposed to be present where pesticide was being handled, but still transport to clinics and hospitals was sometimes a problem. Fire protection and washing facilities were, in many cases, insufficient.

The terrestrial treatment operations were the other important source of contamination with insecticide. Refilling the atomizers with insecticide was often hazardous and another exposure opportunity occurred when a worker walked into somebody else's spray mist, or when changes in wind direction brought back the worker's own spray. Workers going back and forth to refill sprayers usually walked through pesticide mist. Negligence with the protective gear (mainly respirators and eye protection) may lead to intoxications in such situations.

Workers treated large extensions, usually on rough terrain or on sloping landscape. Such work was energy demanding and raised the heat inside the protective suits. Under such circumstances, wearing a respirator became hideous. All these factors made workers prone to partially neglect the use of their protection gear. Seeking lighter, better adapted equipment may help. I think, however, that terrestrial treatments should be minimized, and the involvement of helicopters in such areas should be increased. Smoking, eating, and drinking was forbidden during terrestrial spraying. Often there was a nurse accompanying the field crew to the treatment sites.

There were problems with the motorized atomizers used for terrestrial treatments. Not only were they very often "en panne," but in certain cases there were safety problems such as when rubber and plastic hoses deteriorated leaking pesticide which was spilled onto the worker and the

ground.

Drivers of trucks with pesticides for refilling the atomizers in the field should always wear protective equipment, since operating on irregular terrain is hazardous. Drivers of truck-mounted equipment (micronair and large mistblowers) also need to wear protective gear. While spraying with the mistblower canon, the driver should keep the windows shut to avoid any of the spray mist since a good deal of the spray mist can whirl back towards the spraying unit and be a hazard for the crew.

The medical assistance in this locust control campaign was well organized, and in most cases it worked efficiently, reaching the crews in the field. There was a physician at each local hospital working with the local PC, other physicians and nurses were distributed among the Sub PCs. Cholinesterase tests to workers were done periodically, and more kits and replacement parts began to be needed. Physicians and hospitals were all capable of treating intoxications by organophosphate insecticides, but did not seem very sure about treating intoxications with lambda-cyhalothrin and deltamethrin, new compounds that may be incorporated to the campaign. In most cases, they needed technical information on such new products. In some hospitals, the need existed for basic equipment to treat hospitalized intoxicated patients. Some hospitals were in short supply of atropine and contraction. In some hospitals, the lack of pajamas to replace the pesticide-contaminated clothes of the arriving patient was a problem. Patients lay in bed with the same clothes they arrived in. Hospital staff seemed well aware of the safety problems, and seemed capable to deal with intoxications, and to prevent hospitalizations by using the cholinesterase test as an early diagnostic tool. Many physicians complained that there

would have been less intoxications if the highly toxic DDVP insecticide could have been substituted by a less toxic and equally effective compound. I agree with this idea.

Exposure to insecticides occurred while workers:

a.) refilled the planes at the airfield with insecticide

b.) conducted terrestrial treatments

c.) worked in pesticide storage and mixing operations

The workers were of poor origin, many of them were nomads (depending on the region), most of them only spoke arabic and were not fully literate. In only specific cases the crews were maintained stable for all workers to reach certain level of proficiency. In most cases when individuals lefte, they were replaced by newcomers with no experience. The low education level, and the fluctuating level of expertise in these crews helps understand the difficulty encountered in convincing and enforcing the use of protective equipment. In my opinion, the best alternative for dealing with this problem is to train the technicians that accompany the field crews, and have them train the workers in their own language and thus enforce the proper and daily use of the protective gear. At every PC and Sub PC, I offered the possibility of conducting some training with the workers. However, in all PCs and Sub PCs, training was not considered convenient because workers were, at this time, very busy with the locust control campaign. Informally, however, at each site I spent some time with the workers giving them basic indications. It would be easier to accommodate training during the months of January and February when a lull in the campaign is expected. Moroccan officials were interested in a "train the trainers" approach, and hoped such a training course could be staged in the

future. Agronomists from the Plant Protection Service should also participate as lecturers. There also was interest in using visual aids (films, slides, posters) to increase intoxication awareness among workers.

Regulatory efforts on pesticide use needed to be incentivated and updated. I was shown no regulatory document, except for the guidelines prepared by the Hygiene Institute, but was told that an updating of pesticide safety and management rules was under way. Such was also the case of the new regulations for pesticide registration. It seems to me that the Interministerial Pesticide Commission may benefit from assistance for widespread publication of pesticide management rules. The present registration requirements seem quite adequate (see appendix). Aspects concerning pesticide effects on the environment need more emphasis, however, information on the labels may have to be expanded with considerations about environmental effects, pesticide storage, and disposal.

It seems that there could be a collaborative effort between the Ministry of Agriculture and the Ministry of Health to produce a series of guidelines on toxicology and safe management of pesticides. Such guidelines should be well illustrated and have wide difusion.

The laboratory of the Plant Protection Division at Casablanca appeared as the sole institution, physically and technically, capable of monitoring pesticide residues in the environment. It could also work on defining degradation curves of insecticides in the different components of an environment which is so different from that where pesticides originate. Thus, the laboratory could be used to monitor the environmental impact of the different insecticides used in the locust control campaign.

The handling of USAID pesticide drums at the port of Casablanca should segregate them from other types of chemicals in storage. Definitely,

flammable products need to be isolated from the rest. Fire equipment needs to be more ubiquitous in storage facilities and airfields.

RECOMMENDATIONS

1. The Government of Morocco should:

Place firefighting equipment in mixing plants, storage areas, transport vehicles, and area refueling and refilling planes with pesticides.

Provide sufficient water for firefighting and personal washing.

At airfields, pesticide storage areas, and mixing sites, build cement floor covering the entire working area for better handling of contaminated water and spills and to prevent pesticide infiltration into the soil. The cement floor in storage and mixing areas should be surrounded by a containment wall capable of containing a spillage of at least the total volume of liquid held by the largest drum, as well as the contaminated water from firefighting. Such liquids may flow into drains and waterways posing serious risks.

At the base of the containment wall, there should be a drainage gully sloping to a sump. The sump should be periodically emptied and disposed of in a biodegradation pit (see Appendix). Alternatively, such fluids can be highly diluted (1/10) and then sprayed over a deserted area. This last alternative seems the most practical for use at the airfields.

Asphalt should not be used as flooring material because it softens with heat and with certain solvents.

Seek advice from local firefighting authorities. Identify with clear signs where the firefighting equipment is located. Train a firefighting crew and conduct periodical emergency drills. Maintain records on periodic firefighting equipment maintenance.

Separate pesticides from solvents or fuel by building walls as fire barriers if separation by distance is not practical. Such barriers must be built at the Aït Melloul plant as soon as possible.

USAID should:

Help cover the cost of the construction work (cement floor, etc.) at each spraying and pesticide storage site. A safety expert should advise the Moroccan personnel on the type of construction required.

Provide, where required, firefighting equipment: fire extinguishers, fire blankets, shovels, protective wear, respirators, hose reels, and fire alarms.

Provide cisterns for water supply (for personal washing, clothes washing, and firefighting) where necessary to ensure sufficient water availability in storage areas, airfields, and pesticide mixing areas.

2. The Government of Morocco should:

Post signs with clear symbols indicating smoking or eating restrictions, access restrictions, location of emergency equipment, protective wear required, telephones, and all escape routes. Written indications should be in Arabic. All drums must have symbols indicating the WHO[1] risk classification.

Provide storage sites that are well ventilated and roofed. The roof will prevent eventual deterioration of the insecticide or its formulation with the high desert temperatures.

[1]World Health Organization

Ensure that 200 litre drums are stored on wooden pallets. Thus leaks can be spotted and corrosion at the bottom of the tanks can be prevented. Stacks should be of two layers of drums.

Leave sufficient space (aisles) between stored drums for inspection, firefighting access, and for mechanized handling of drums (use of fork lifts or similar is strongly recommended to substantially reduce drum damage by dropping them). Aisles should be marked on the floor with paint.

Keep careful inventory control of storage and follow the "first in, first out" rule. Identify drums with their arrival date. Regular inspections should be conducted in the storage area to control the stock, age of products, leaks, and product deterioration.

Provide storage facilities with a fence and effective locks. Locate the storage compound in areas not subject to flooding and away from dwellings, offices, water sources, food and animals. In cases such as the Aït Melloul complex, the whole ensemble should be moved out of town and rebuilt following a rational and safe design. Storage areas should always be far from populated areas. If current storage facilities are close to dwellings or offices, cholinesterase tests should be regularly applied to the neighboring individuals.

Ensure that used drums from each spraying site are promptly sent to Aït Melloul for disposal.

Provide storage areas with adequate water supply for emergencies (fire and personal washing in case of direct contact with pesticide)

Provide dry absorbent materials such as absorptive clay, charcoal, sand, sawdust, vermiculite, dry rags or paper for cleaning (mopping up) leaks or spills on cement or plastic floors. After cleaning, these contaminated materials should be disposed of safely as hazardous wastes.

Supply storage facilities with lime or sodium hypochlorite for the decontamination (hydrolysis) of spillages of organophosphates, carbamates, and other products such as lambda-cyhalothrin.

Build biodegradation pits to contain moderate amounts of toxic materials from cleanup of spillages. These pits (see Appendix) should be dug in the ground and lined with 10 cm of clay and 2 cm of lime, cement, or plastic lining. Charcoal layers 3 to 13 cm thick (at the bottom), lime and a source of organic matter (as a source of biodegrading microorganisms) should be added to the base of the pits. These pits must be kept moist, but anaerobiosis should be avoided. The added wastes should be covered with a layer of soil. More layers of charcoal, lime, and organic matter should be added as the pits get filled (see Appendix).

Label all pesticide containers with paint indicating: active ingredient, concentration and formulation, conventional toxicity warnings with a legend in local arabic. Paper labels should not be used. Old labels should be removed or covered with paint.

Train employees in storage areas on how to handle spillages, on emergency treatment of exposures, and to recognize symptoms of over exposure.

Contain spillages on the bare ground (earth, gravel, etc.) by shoveling off the volume of ground affected and putting it into containers for safe disposal.

Be aware that the use of water to clean up spillages on cement floors should be avoided since water disperses the spilled pesticide, enlarging the contaminated area.

Prohibit the storage of food, feed or other articles intended for human or animal consumption in the pesticide storage facilities.

Provide first aid kits to all storage areas, and inform in detail the medical authorities on the pesticides being stored.

USAID Should:

Provide equipment and support for drum disposal.

Provide assistance for the construction and set up of adequate storage and disposal (for moderate amounts of pesticide) sites, and provide the necessary advice on organization of storage, and train personnel on handling spillages and emergencies.

Provide mechanical fork lifts (in proportion to the amount of barrels stored) to handle pesticide drums for all storage centers.

3. The Government of Morocco Should:

Enforce constantly the proper use of protecting equipment, recognizing that the socieconomical and cultural background of the field workers will make the enforcement difficult, mainly when new and inexperienced individuals are added to the crews.

The most relevant progress in safety (reduction of the number of individuals with low cholinesterase activity) should be achieved by simplifying the plane refilling operation (see Appendix), and by using a hermetic refilling procedure that avoids pesticide spillages. At the same

time the number of workers participating in that operation, and in direct contact with the pesticide should be reduced. The following procedure is recommended:

It is a system that avoids the handling of the heavy pipe and hose set (see Appendix) that is presently introduced into the drums to suction the pesticide (which invariably results in pesticide spillages over the workers when they transfer pipe and hose to a new drum). The system proposed uses couplers that are screwed in the large orifices of the pesticide drums; the suction hose connects and clamps to the couplers (see Appendix). Dry break valves (for effective shut off) at the drum and plane ends of the suction hose are open and then a pump circulates the pesticide into the plane. Drums must be tilted for the pesticide to reach the drum outlet. When the drum is empty, the dry break valve is shut to avoid drippings or spillages, the hose is uncoupled and transferred to the next drum (see Appendix). No spillages can occur with this system as opposed to the system presently in use; the difference is on the elimination of the suction pipe presently used. The weight of such pipe plus that of the hose forces the worker to hug the pesticide-dripping pipe thus smearing pesticide over himself. The recommended system requires that planes have a side inlet where the feeding hose (having dry break valve at the end) can be connected. This system can be operated by only 2 to 3 workers (8-10 are currently involved). Maintenance of refilling equipment should be ensured.

If, however, the elimination of drums from airfields and storage areas is desired, other alternatives could be considered:

Cistern trucks with a hermetic pumping system, using dry breaks, can be used. To further reduce risks of spillages and risk of fire, the cistern can be placed on a ramp, thus the pesticide can be fed by gravity eliminating the need for a pump. Cisterns, however, need to be well washed, and washing is another hazardous operation.

USAID Should:

Continue the supply of protective equipment assuring prompt replacement of damaged ones. Ensure supply of good quality rubber gloves. Each center should have a stock of protective equipment to replace damaged ones. Make an effort to find protective outfits that are lighter and more comfortable than those presently used. Protective equipment should be worn only while in active work.

Supply each treatment center with at least 2 hermetic dry break refilling systems with corresponding spare pieces.

Provide each center with a spare pesticide pump, including spare parts.

Explore and promote the use of insecticides with lower DL50 than the currently used DDVP, as another effective way to reduce the number of intoxications.

4. The Government of Morocco Should:

In pumps used with pesticides, install splash guards and receptacles (see Appendix) to contain leakages.

Restrict transit of spark-producing vehicles near solvents and fuel.

Enforce no smoking and no eating in airfield storage areas, and pesticide mixing plants.

USAID Should:

Supply pumps with splash guards.

Implement a "train the trainers" approach for technology transfer. These short courses (1-2 weeks long) on pesticide use and safety for permanent staff and technicians (usually have a BS and work daily with the field crews in charge of spraying) should be implemented. The courses should involve Moroccan scientists as lecturers, and should be staged when work in the locust campaign recedes (supposedly January - February). An outline of such course is in the Appendix. The courses should have a practical approach. My availability to collaborate with this training effort is until the end of February.

Print notes with the lectures of the short courses.

Provide 1 or 2 vans equipped with audio-visual materials, and visual aids for training pesticide workers on site. The material should refer to pesticide toxicity and handling of toxic materials.

Advice on extension techniques to sensitize the general public on the dangers of pesticide use.

5. The Government of Morocco Should:

Contribute with lecturers and participants at the regional training courses, provide the required infrastructure and logistics, and be responsible for all the organizational aspects.

Translate into French any English material to be used as notes for the short courses.

Continue extension campaigns whereby the population is warned about insecticide applications to be conducted in a given area. Provide assistance to ensure temporary relocation of people wherever necessary.

6. Responsibility of the Government of Morocco:

Used drums should be thoroughly drained (30 minutes or more). Pesticide drained should be collected and added to another container with same product. Top and sides should be punctured and a few liters of kerosene or diesel oil added and lit to flame off the residual pesticide. Prevailing winds should not carry contaminated smoke to inhabited places. This operation should be conducted in the open and away from flammable solvents or pesticides. Workers should wear full protective gear and have the wind on their backs. Flamed drums should be crushed and sent to a steel smelting plant to be disposed of as scrap to prevent further reuse. Puncturing and crushing makes drums unusable and easier to transport.

If drum recycling is unavoidable, drums should be refilled with the same product they originally contained. No drum should ever reach the general population.

Given the general scarcity of water and the cost of fuel, the triple rinse procedure (fill 1/4 of the volume of the container with water or other solvent, shake vigorously, drain, and repeat this operation 3 times) was considered not adequate.

The Government of Morocco is responsible for making the necessary arrangements with smelting plants in the country for processing the empty crushed drums. Smelting is viewed as the only safe procedure for large scale disposal of pesticide containers.

Moderate amounts of crushed empty drums could also be buried in landfills. These installations must be on high ground, in little rainfall areas, with a very deep water table (should be deeper in sandy than in heavier soils), and not subject to flooding. Soil should be as impermeable as possible (high clay content). Disposal area should be beyond access by people or animals. Prevailing winds should blow away from sensitive areas. The area should be fenced, and warning signs posted. Ideally the bottom of the landfill should be covered by layers of thick plastic and then by layers (3 feet) of clay, lime, and organic matter (such as manure), and charcoal (activated if available). Clay protects against leaching, lime and organic matter will break down organophosphates and carbamates. Each layer of crushed drums should be covered by a layer of lime and one of soil (absorbent and source of microflora) and should be well compacted by a bulldozer. Wind erosion should not uncover the drums. Periodic soil samples, at different depths, should be taken around the disposal site to check for pesticide leaks. Periodic light irrigation will help maintain the solid microflora active. Flooding history of the site must be known.

The Government of Morocco should provide transportation and manpower for drum disposal.

USAID Should:

Provide equipment to crush drums.

If drums have to be buried AID will provide advice for choosing the disposal site, and in preparing a safe landfill for drum disposal.

7. The Government of Morocco Should:

Provide bed clothes for hospitalized patients wherever needed.

8. The Government of Morocco Should:

Conduct the required experimentation to determine the safe re-entry periods for each of the insecticides used in the locust campaign.

9. The Government of Morocco Should:

Provide the necessary technical personnel to conduct a collaborative research project with USAID to find a less toxic alternative to DDVP, and to establish adequate application techniques for alternative products. This effort will be conducted with the support and assistance of the regional Postes de Commande. When a favorable alternative to DDVP is found, the government will commit itself to its use instead of the highly toxic DDVP.

USAID Should:

Provide advice and financial assistance to the above research project.

10. The Government of Morocco Should:

Enforce adequate practices for unloading pesticide drums, to avoid the current deteriorations. Two men with gloves should ensure slow rolling down of the drums, which should fall gently on a cushioning tire.

11. The Government of Morocco Should:

Rationalize the recycling of drums at Aït Melloul. Only the newest drums should be reused, or those professionally reconditioned.

12. The Government of Morocco Should:

Ensure that all the spraying sites have adequate facilities for washing protective clothing, and are provided with the corresponding storage cabinet.

Provide means for safe disposal of contaminated rinsing water from washing protective wear. Biodegradation pits or large tanks with lime stone pebbles (allow the water to trickle through), could be used.

Washing contaminated protective gear should be conducted far from food, dwellings or water sources. A specific tub should be used for this purpose only. After washing, clothes must be well exposed to sunlight to break down pesticide residues. Long rubber gloves must be worn for washing.

Filtering cartridges should be removed before washing respirator. Activated charcoal must never get wet.

13. The Government of Morocco Should:

Organize 2-3 field teams to monitor compliance with safety rules for pesticide use. The teams should be composed by two plant protection

scientist and one from the Ministry of Health. These compliance monitoring teams should sample soil and water residue around pesticide storage and disposal areas, also in dwellings and crops near recently treated areas. Random samples should also be taken for cholinesterase tests from people living close to pesticide storage areas, disposal sites, or near areas that are being sprayed. Thus deficiencies could be detected and the teams could provide the necessary advice to the population, or to the staff at the Postes de Commande (PC) or Sub Postes de Commande (SPC). Collaboration from local extension agents (who could report on bird or fish kills) and nurses (who can report number of people intoxicated) should be sought. The information collected by these teams will help shape safety policies to protect people and the environment.

The Plant Protection Service and the Ministry of Health should coordinate the work of the monitoring team. Residue analysis from samples collected should be conducted at the Casablanca laboratory of the Plant Protection Service or at any other with similar facilities.

USAID Should:

Provide 2 or 3 vehicles to be used by the compliance monitoring teams.

Provide equipment for soil and water sampling.

Advice on techniques for soil and water sampling for pesticide residue detection.

Provide 3 kits for cholinesterase testing (with readings expressed as % cholinesterase activity).

Organize and train the monitoring teams assisting in the analysis and interpretation of the information collected.

14. The Government of Morocco Should:

Continue the effort of the Interministerial Pesticide Commission to develop a document regulating the rational and safe use of pesticides. Publish all regulations and guidelines for the safe use, transport, storage, and disposal of (at least) the insecticides being used in the locust campaign. This information must be periodically updated to include new products.

The Bureau for Pesticide Registration, from the Plant Protection Service, should use computer facilities to edit a phytosanitary guide with data sheets of all pesticides registered. Wide distribution of this document should be ensured. For each product the following information should be given: Classification, mode and mechanism of action, solubility, toxicological information and WHO classification of risk, uses, dosages.

Prepare extension material on pesticide use and safety, with emphasis on visual and audio-visual means. Ensure the distribution or presentation of such material among populations within locust treatment areas, including personnel in PCs, SPCs and operational units.

USAID Should:

Assist the Government of Morocco in the publication of official rules for safe use of insecticides for locust control.

Provide the Bureau of Pesticides and Registration (Plant Protection Service) with an IBM or IBM compatible (type XT or AT) personal computer with 640K RAM, a hard disk (30 or 40 megabytes) and a dot matrix printer. This equipment should allow for the preparation of a pesticide database and the efficient retrieval of all pesticide records.

Collaborate with the Plant Protection Service in the publication of a phytosanitary guide.

Advise and assist the Plant Protection Service in the preparation of graphic and audio-visual education aids on the precautions and dangers involved in pesticide use. Provision of equipment for the above task should be contemplated.

15. The Government of Morocco Should:

Asses the need to expand the environmental information currently required to pesticide registration.

Consider the addition of the following categories to presently used pesticide labels: description of the formulation and its components; and considerations for the protection of the environment. First aid measures in case of intoxication need to be included; conditions for storage and disposal methods need to appear on the label. Considerations about the environment and guidelines for pesticide storage and disposal should be on the label. Other relevant information is the length of the period between application and safe re-entry to the field, and the minimum period allowed between the last pesticide application to the crop and its harvest.

The Interministerial Pesticide Commission and the Bureau of Pesticides and Registration should consider the following reference material:

Regulating Pesticides. Nat. Academy of Sciences. NAS, 1980

International Code of Conduct on the Distribution and Use of Pesticides. Rome, FAO. 1986

Guidelines on Environmental Criteria for the Registration of Pesticides. Rome, FAO. 1985

Guidelines for the Registration and Control of Pesticides (including a model scheme for the establishment of national organizations). Rome, FAO. 1985

Pesticide Regulation Handbook. McKennay Conner & Cuneo. Executive Enterprises Pub. Co, Inc.

1985 Guidelines on Good Labeling Practices for Pesticides. Rome, FAO.

USAID Should:

Provide the literature suggested above.

Provide short term training in the U.S. for government scientists involved in pesticide registration.

Provide a long term (2 years) consultant to coordinate the implementation of the above recommendations, or of those emerging from a bilateral agreement. This consultant should work in close collaboration with the official authorities of the locust control campaign. The consultant should have experience in toxicology, in pesticides and in pesticide handling, and should arrive with good anticipation to the control campaign, so that the most prioritary changes can be done.

AKNOWLEDGEMENTS

I wish to express my gratitude to the Ministry of Agriculture, the Gendarmerie Royale, and the Ministry of Public Health for their generous collaboration that made my mission possible.

I am very thankful to my colleague Dr. Ahmed Baou, who was my counterpart, for introducing me to the authorities at the regional Command Posts, and for discussing with me several aspects of this report.

I must also thank Captain Abdeslam Bouyhyaoui (Gendarmerie Royale) for having been the key person who arranged all the infrastructural aspects.

Mr. Patrick Hrdlicka, supervisor of USAID air spraying operations in Morocco, was very helpful in discussing with me different aspects of airplane ground support.

I also wish to thank the personnel of the USAID Mission in Rabat, especially Mr. Joseph Kitts, Agricultural Division, for their dedicated support to my mission.

APPENDIX

LIST OF CONTACTS

Government of Morocco

Dr. Lamrissi Abdeljalil
Medecine d'Hommes
Hospital Sidi Hssain
Ouarzazate

Mr. Ahmed Baou
Service de la Protection
des Végétaux, Rabat
(My Counterpart)

Mr. Salah Benani
Chef du Service
de la Protection des Végétaux

Mr. Benazzouz-Tarhy
Service de la Protection
des Végétaux
Laboratoire Officiel d'Analyses
et de Recherches Chimiques
de Casablanca

Mr. Chiki
Poste de Commande Central
Rabat

Dr. André Deom
Laboratoire Central de Chimie
Clinique de l'Hôpital Cantonal
Universitaire, Geneva

Mr. Ahmed Dliou
Chef du PC Guelmim

Mr. Jellouli Driss
Chef du PC Ouarzazate

Mr. Laraisse Esserrhini
Directeur Provincial de
L'Agriculture de Figuig

Mr. Ahmed Hajjaji
Deputy Chef du PC Errachidia

Mr. Ben Halima
Chef du PC Aït Melloul

Mr. Chaouki El Hassan
Chef Adjoutant du PC
Ouarzazate

Mr. Larbi Sabbari Hassan
Chef du PC Errachidia

Mr. Makhati
Service de la Protection des
Végétaux
Bureau d'Homologation des
Pesticides

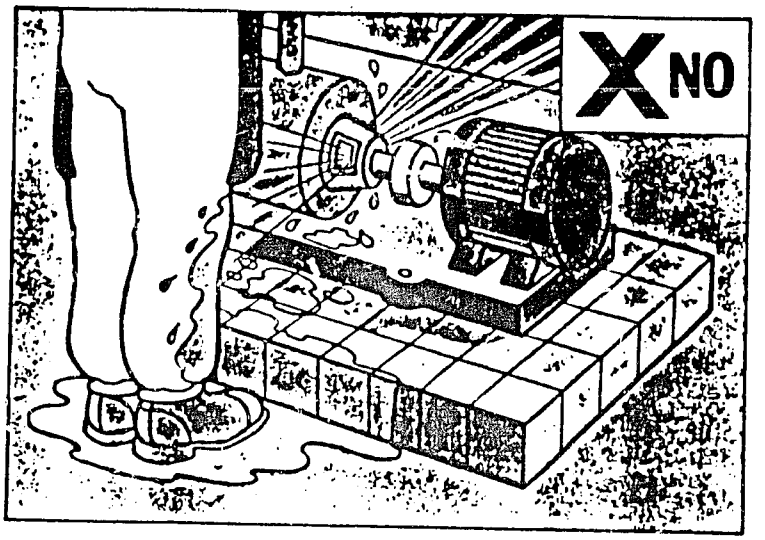
Commandant Maich Mohammed
Mehdi
PC Errachidia

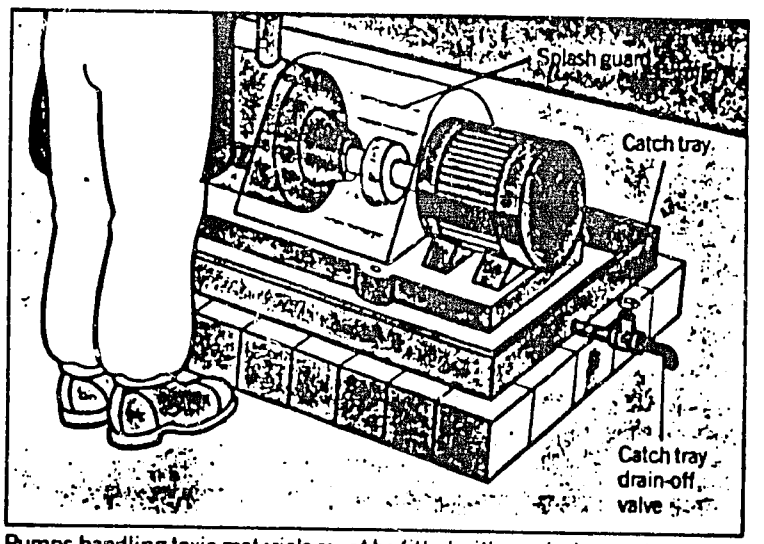
Mr. Abdelmalek Moras
Chef du Sub PC Zagora

Mr. Aazizi El Mostafa
Chef du Sub PC Boulmane-
Dadés, Ouarzazate

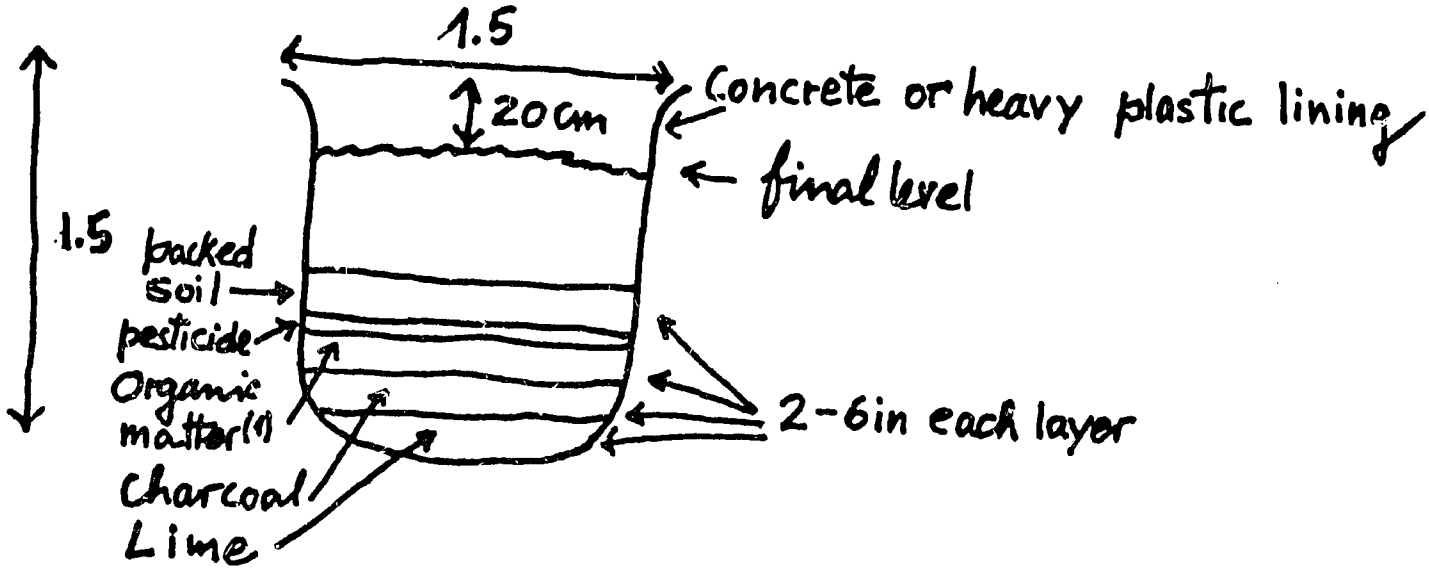
Mr. Ahmed Ouzaouit
Deputy Chef du PC Tata

Mr. Mohamed Sedigui
Inspecteur du Service
de Protection des Végétaux
Casablanca



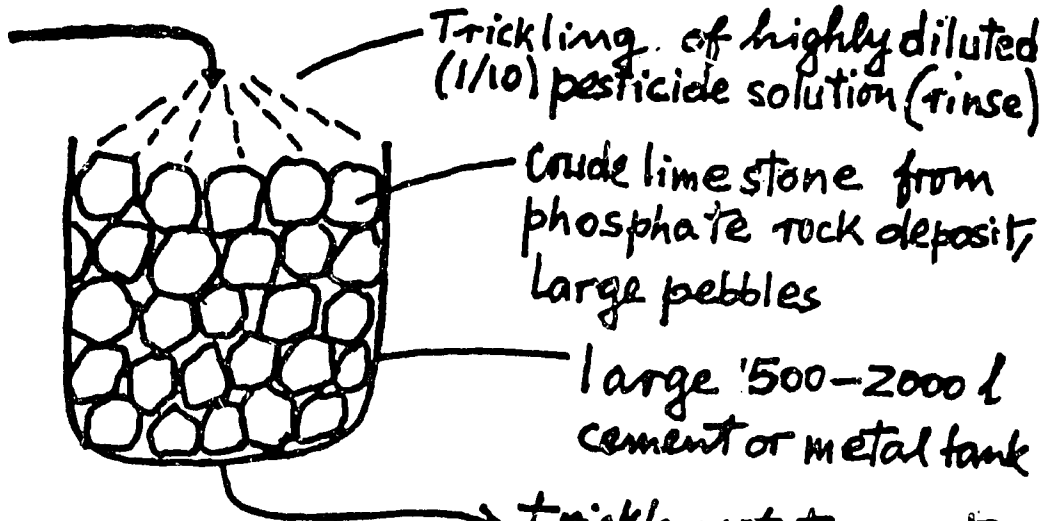


Pumps handling toxic materials *must* be fitted with a splash guard and catch tray.



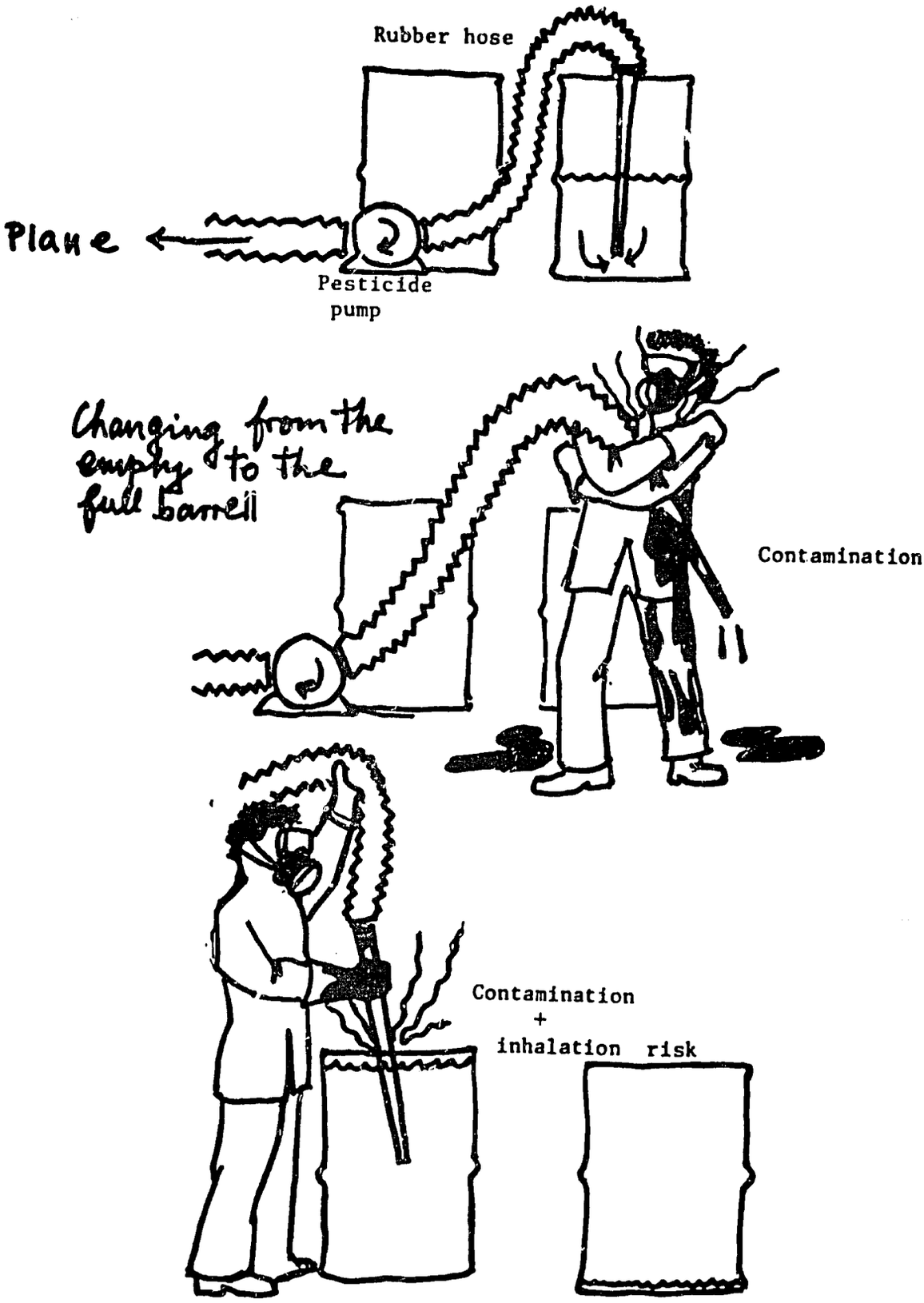
Biodegradation pit for moderate amounts of pesticide solutions

(1) Manure, plant residues, sewage sludge

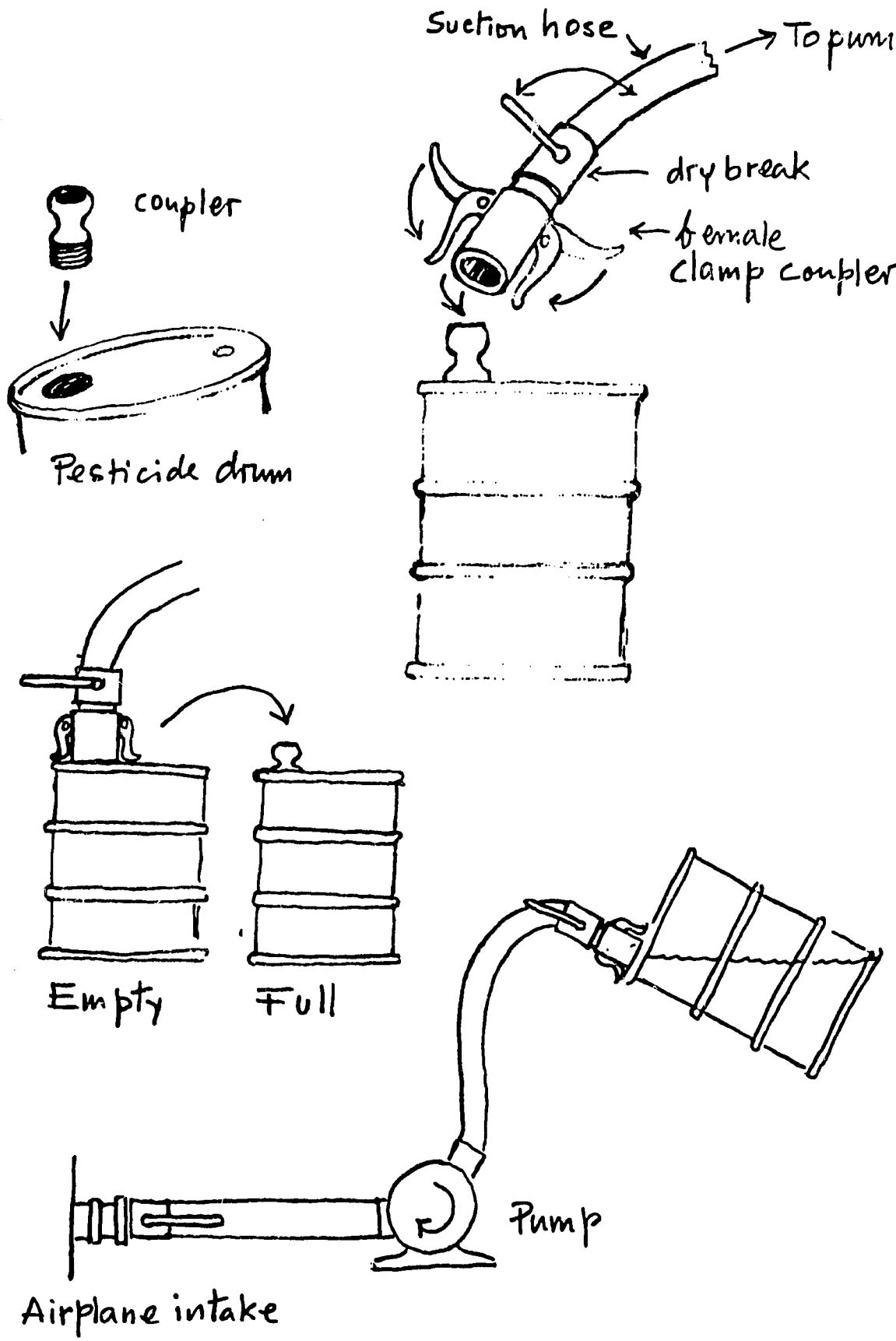


Trickling filter to dispose of rinsing water or spillages. The limestone breaks down organophosphate and carbamate insecticides..

Hazardous step in the refilling process
that takes place at every PC and sub PC



This operation is responsible
for, at least, 50% of the intoxications.



DRY-BREAK SYSTEM FOR REFILLING AIRPLANES USING A HERMETIC CIRCUIT

Pesticide Management Training Technical Topics

1. FAO Code of Conduct

   Introduction to the FAO International Code of Conduct on the Distribution and Use of Pesticides

2. Introduction to Pest and Pesticide Management

   Overview defining the term pest, a general description of pest categories and the types of damage each causes.

   Explanation of "pesticide management" as including all aspects from manufacture/formulation through distribution, retail, application and residue disposal.

3. Pest Control Methods

   Explanation and description of various general control categories (e.g. prevention, cultural, physical/mechanical, biological, chemical).

4. IPM

   Definition of Integrated Pest Management including application accross and within various pest management disciplines. Suggestion of need for economic and environmentally sound approach to pest management.

5. Pesticides

   Focus on types of pesticides, and categorization based on chemistry and target pests. Discussion of characteristics of each group and practical implications for their use. Also discussion of formulation, packaging, label information, etc.

6. Safety

   Focus on precautions to take when handling pesticides in transport, storage, mixing, application, and residue and container disposal. Recognition of poisoning symptoms and first aid procedures.

7. Application Equipment

   Description and demonstration of various pesticide application equipment including proper use and maintenance.

8. Equipment Calibration

   Description and exercises in determining total volume of spray solution applied to any area to be sprayed.

9. Dose Calculation

   Description and exercises in determining the amount of formulated product needed in the spray solution.

10. Extension Resources and Methods

Discussion of regional, national and international public and private organizations that may serve as informational resources. Discussion and demonstration of various methods for communicating pesticide management information to farmers.

11. Pesticide Legislation/Regulation

Discussion of government control schemes for pesticide use at national and regional levels.

Includes suggestion for compliance with FAO guidelines and International Code of Conduct for the Distribution and Use of Pesticides.

topics.doc 08/15/88

ROYAUME DU MAROC

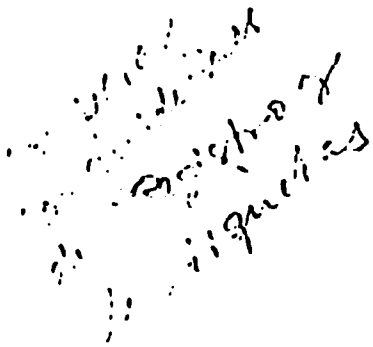
MINISTERE DE L'AGRICULTURE
ET DE LA REFORME AGRAIRE.

DIRECTION DE LA PROTECTION DES
VEGETAUX, DES CONTROLES TECHNIQUE
ET DE LA REPRESSION DES FRAUDES.

المملكة المغربية

وزارة الفلاحة والاصلاح
الزراعي

مديرية وقاية النباتات
والمراقبات التقنية وزجر
الغش.



CONSTITUTION D'UN DOSSIER D'HOMOLOGATION DES PESTICIDES A USAGE AGRICOLE.

Le dossier de demande d'homologation des produits pesticides à usage agricole fourni en 3 exemplaires doit comporter les éléments suivants :

- Indications générales
- Un dossier d'identification du produit
- Un dossier analytique
- Un dossier efficacité
- Un dossier toxicologique détaillé
- Un échantillon du produit fourni dans un emballage résistant et durable.
- Un échantillon du standard analytique de haute pureté avec un certificat d'analyse.
- Projet d'étiquette.

I/ INDICATIONS GENERALES :

1) Nom commercial de la spécialité
2) Nom et adresse du fabricant
3) Nom et adresse du déclarant
4) Aspect physique et coloration
5) Composition chimique
6) Parasites combattus.

II/ DOSSIER D'IDENTIFICATION DU PRODUIT :

1) Nom commercial de la spécialité
2) Dénomination chimique des matières actives selon la nomenclature internationale et le nom commun international (ou proposé à [illegible]isation international pour les matières actives nouvelles).
3) Formule chimique brute et formule chimique développée des matières actives.

4) Composition chimique du produit commercial exprimée en pourcentage de ses constituants : matières actives charges; adjuvants divers, impuretés.

5) Dénomination et nature chimique des charges, adjuvants divers et impuretés.

6) Toutes précisions complémentaires concernant la composition chimique du produit commercial pourront être demandées en cas de besoin.

III/ DOSSIER_ANALYTIQUE :

1) Nom commercial de la spécialité

2) Propriétés physiques.

a) Les constantes physiques :

- qualité physique : finesse de la micronisation, vitesse de sédimentation tenue en émulsion etc...
- Apparence.
- Point d'ébullition
- Point de fusion.
- Poids de moléculaire.
- Densité.
- Tension de vapeur.
- Volatilité.
- et pour les huiles minérales l'indice de sulfonation etc...

b) Solubilité dans l'eau et les différents solvants (en gammes par 100 ml de solvant).

3) Propriétés chimiques :

a) Stabilité du produit formulé : effets de la lumière, de la chaleur, de l'humidité, des acides, des bases de l'emballage etc...

b) Durée limite de conservation de la spécialité : Cette date dépassée, elle ne peut être considérée du point de vue de l'utilisation, comme identique à ce qu'elle était au moment de la fabrication. Prouver s'il y a lieu, apparition de substances toxiques ou phytotoxiques et dans qu'elles proportions une fois cette date limite est dépassée.

c) Toutes ces indications s'entendant pour la spécialité commerciale conservée dans les emballages identiques du point de vue de volume de la nature des parois à ceux dans lesquels elle sera commercialisée et stockée dans les conditions courantes au Maroc.

d) Compatibilité et incompatibilité du produit formulé avec d'autres produits.

4) Propriétés biologiques :

a) Propriétés physiologiques (insecticide ou acaricide, fongicide, herbicide ou autres).

b) Mode d'action du produit vis-à-vis des parasites (ingestion, contact, inhalation et autres).

c) Préciser si le produit est systémique ou non

d) Phytotoxicité.

e) Transmission d'odeur ou de saveur aux récoltes des végétaux traités.

f) Métabolisme du produit (dégradation chez les animaux les plantes et dans le sol).

j) Méthodes d'analyses avec modes opératoires correspondants pour la détermination des matières actives dans:

- Le produit commercial,
- Les végétaux traités,
- L'eau,
- Le sol.

IV/ DOSSIER_EFFICACITE :

1) Désignation des cultures à protéger ainsi que les parasites pour lesquels l'homologation est demandée.

2) Mode d'emploi préconisé ainsi que les doses et périodes d'application pour chacun des ennemis visés au paragraphe précédent.

3) Limite d'utilisation (chaleur, nature du sol, cultures sensibles, stades phénologique, délai de carence).

4) Essais portant sur l'efficacité du produit, effectués de préférence au Maroc ou dans les conditions écologiques semblables et sur les mêmes cultures et parasites pour lesquels la spécialité est destinée. Résultats de trois essais obligatoires pour chacun des ennemis visés.

V/ DOSSIER TOXICOLOGIQUE :

1) Toxicité de la (ou des) matière (s) active (s) constituant la spécialité commerciale.
   a) Toxicité aiguë en faisant état des doses létales 50 pour le plus grand nombre d'animaux pour lesquels elles sont connues, par ingestion, inhalation et par voie cutanée.
   b) Toxicité chronique.
2) Etude semblable à la précédente relative à la toxicité aiguë de la spécialité commerciale.
3) Des effets suivants, la moindre action apparue au cours des observations, doit être signalés.
   - Effet sur le système nerveux (effet neurotoxique)
   - Effet cancérogène
   - Effet mutagène
   - Effet cumulatif.
   - Effet sur la reproduction (sur trois générations)
   - Action tératogène.
   - Autres effets du produit.
4) Conséquences secondaires dues aux traitements du produit.
   • Equilibre biologique des micro-organismes du sol.
   • Action sur les insectes utiles.
   • Effet sur l'ouvrier manipulant ce produit.
   • Effet sur le consommateur résultant de :
     - Contamination indirecte du consommateur (lait, viande etc...).

     Tolérances.
5) Informations médicales.
   • Symptômes spécifiques d'intoxication.
   • Mesures de première urgence et éventuellement l'antidote spécifique.
   • Traitement médical.

VI/ ECHANTILLON :

L'emballage qui contient l'échantillon, d'une contenance de 1 Kg ou 1 l, doit présenter des qualités de conservation d'une durée de 10 ans : rigidité, étanchéité, résistance à la corrosion provoquée par la spécialité elle même ou par les agents atmosphériques (flacons de verre ou autre matière inaltérable)

il doit être scellé à l'aide d'un cachet de cire ou d'un plombage et son étiquetage doit porter référence complète, exacte et précise de la firme qui sollicite l'homologation, de la date de fabrication de la ou des matières actives et de la date de formulation de la spécialité, du nom commercial de la spécialité ainsi que de la composition chimique.

Dans l'éventualité où l'échantillon ne serait pas susceptible de se conserver pendant 10 ans, le demandeur doit en outre indiquer sur l'étiquette la date limite correspondant à la durée de stabilité présumée et prévoir un renouvellement de l'échantillon à la fin de chaque période, jusqu'à concurrence de la durée totale de 10 ans.

VII/ ETIQUETTE :

Les étiquettes doivent porter les indications prévues par les articles 4 et 36 du Dahir du 12 Rabia II 1341 (2 Décembre 1922) ainsi que celles prévues par l'article 2 de l'arrêté viziriel du 29 Hijja 1372 (9 Septembre 1953) réglementant le commerce et la distribution des pesticides à usage agricole.

Outre les dispositions régies par les articles susmentionnés, les indications suivantes doivent également être mentionnées :

Nom de la Spécialité.
Raison Sociale et Adresse de la Firme.
Nature de la Spécialité et sa Composition.
Usages Agricoles et doses d'emploi autorisés.
Mode d'emploi.
Date limite d'emploi avant la récolte.
N° d'homologation : .....
Précautions à prendre :
Par l'applicateur
Pour la protection du bétail, les animaux domestiques et les animaux sauvages.
etc.....

January 30, 1989

TO: Dale Bottrell (CICP); Ron Curtis, Rick Clark (ROCAP)
FROM: Polly Hoppin
RE: Detailed plans for our study of pesticide use practices by growers of non-traditional crops in Guatemala.

M E M O R A N D U M

I. Introduction

ROCAP has agreed to fund a study of the use of pesticides by growers of non-traditional crops in Guatemala. The work will take place through a contract with the Consortium for International Crop Protection (CICP), with assistance from the Johns Hopkins University. The study will be conducted between January 16 and May 31. Field work in Guatemala will comprise five of those weeks. The primary investigator/team leader will incorporate the data gathered in the study in her doctoral dissertation.

The purpose of the study is to collect data about pesticide use among growers exporting non-traditional crops to the U.S. ROCAP will be able to use this data to design programs to address pesticide misuse among these growers. The objectives of the research are:

1) to determine whether or not growers of four non-traditional export crops (broccoli, snow peas, melons and strawberries) are using pesticides in ways could yield residues that would violate U.S. law;

2) to ascertain whether or not there is an association between either selected characteristics of the growers (especially the type of growing and exporting operation they are affiliated with) or the amount and source of technical assistance they receive, and the level of misuse of pesticides;

3) to assess the implications of current legislative and regulatory changes in the U.S., including the Pesticides Monitoring Improvements Act, for growers of these crops in Guatemala.

II. Background

In the last several years, ROCAP has become increasingly involved in the development of the non-traditional export sector in Central America. During that time, a number of shipments of crops -- including snow peas, chayote, strawberries and broccoli -- have been rejected by the U.S. because of pesticide residues found on samples of the shipments have violated the tolerances set by the Environmental Protection Agency (EPA) under the Federal Food, Drug, and Cosmetic Act (FFDCA).

Export diversification is a cornerstone of A.I.D. and ROCAP development strategy in Central America. Both ROCAP and A.I.D.

are concerned about the potential for violative levels of pesticide residues to impede the success of non-traditional exports, and to result in significant economic losses for individual growers and exporters. Congress' recent authorization of a bill (the Pesticides Monitoring Improvement Act) to strengthen the Food and Drug Administration's (FDA) program to monitor pesticide residues on food increases the likelihood that a given violative shipment will be identified and rejected. Congress' action has heightened A.I.D. and ROCAP's interest in helping to ensure that growers of non-traditional export crops use chemicals that are permitted for use on those crops by the U.S. and that they use them in such a way that levels of residues do not violate existing tolerances.

III. Study Design and Methodology

The study will draw upon data gathered in interviews with exporters, a survey of and interviews with growers, visits to pesticide suppliers and EPA and FDA testimony and documents.

A. EXPORTERS

1. Interviews

From the membership of the Gremial de Exportadores de Productos No Tradicionales, the team leader will interview ten to fifteen people that export broccoli, snow peas, strawberries and melons to the U.S. (Some may export more than one of these crops.) The interviews will explore the particular growing/exporting operations of each company; the exporter's perceptions of the pesticide residue issue and of his capacity to influence his growers' use of pesticides; his opinions about the kind of assistance in addressing pesticide residue problems that would be helpful to him. An interview guide will structure the discussions.

The team leader will choose five of these exporters whose exporting and growing structures are distinct, and who agree to participate in the study. At least three structures typical of exporting operations will be included: a large cooperative with over five hundred growers; a company that contracts with under one hundred growers to purchase their produce; a small company whose arrangements with growers are informal and short term. If possible, three companies with different structures that grow one of the four crops will be included, to enable the team to distinguish between differences in pesticide use associated with structure and differences associated with crop.

In order to participate, each exporter must be willing to provide the team leader with a list of growers with whom he works. Exporters that do not maintain such lists will be asked to help identify by other means the growers that produce the crops they export; they may purchase regularly in a particular town, for example, with the assistance of a a local person who

the team could contact.

2. Analysis of interviews

From the information gathered in the interviews, the team will prepare a descriptive profile of each of the exporting operations chosen. Tables will compare the operations with one another, including the crops grown; the volume and destination of the exports; the number of growers; the technical assistance provided; whether or not they test for residues before shipping; pesticide purchasing practices.

B. GROWERS

1. Sampling

A cluster sampling technique will be used to identify the growers that will be surveyed and interviewed. Each list of growers provided by an exporter will be divided into three geographical subgroups. From each subgroup, eight growers will be selected at random. The sampling strategy assumes that the team will be unable to locate about 20% of the growers. Thus, the team will interview 20 growers per exporter, or 100 growers total. If more than 20% of the growers refuse to participate, the team will make an effort to ascertain whether there are reasons why particular people might not have wanted to participate in the study, so as to understand whether or not these non-participants might substantially bias the results of the survey.

2. The Survey Instrument

The survey instrument combines characteristics of a quesitonnaire, interview guide and data recording form. It will be filled out by a team member. The survey form will cover information in seven categories: grower characteristics; availability of pesticides; growers' sources of information about pesticides; technical assistance received; growers' perceptions about pesticides; growers' practices with pesticides (those with implications for residues, and those with implications for applicators' health), and; the impact of a rejected shipment on a grower.

Most of the questions on the survey form were taken from questionnaires used in other surveys of farmers in Guatemala and Costa Rica. However, few published studies have gathered similar data. Consequently, reliability and validity of each question on the questionnaire would be difficult to ensure. The instrument includes several questions that are designed to elicit the same information, as a check on reliability. The team will return to a subsample of the growers to observe how their actual spraying practices correlate with the information gathered in the interview; this information will help validate the important

section of the questionnaire that addresses pesticide practices.

3. Testing the Instrument

During the first several days of field work, the team will test the survey instrument on a random sample of five to ten growers (also drawn from the exporters' lists) and refine it as necessary.

4. Interviews

Where possible, the team will enter a community with someone who is trusted by the local growers. Interviews will be conducted at the grower's house and in his fields. The grower will not fill out the questionnaire. Instead, one team member will lead an informal conversation with the grower, and a second team member will record the data.

5. Data Analysis

Some of the data gathered from the growers will be best analyzed quantitatively, while other data will be best analyzed qualitatively.

a. Association of Independent and Dependent Variables

For the purposes of the quantitative analysis, a grower's characteristics -- including the export operation with which he is affiliated, the crops he grows, the destination of the non-traditional crop, the number of years he has been farming, etc. -- and the amount of technical assistance he receives will be the independent variables.

The pesticide use patterns that could lead to violations of U.S. residue tolerances will be summarized by a "misuse score", that will serve as the dependent variable. The misuse score will be calculated as follows. During each interview, a table will be completed recording those pesticide practices that could result in violative residues. These include: the particular chemicals used; the number of applications of each chemical per crop cycle; the concentration of the solution that is applied; the number of days before harvest that the grower makes the final application. For each table, one point will be assigned per improper practice. The team will use the Farm Chemicals Handbook, and the Code of Federal Regulations (40, parts 150-189), product labels and information from the tolerance setting branch of EPA to determine the number of possible points on a given grower's list of chemicals, and the ratio of the points he receives to possible points. The higher the ratio, the higher

the misuse score.[1]

The misuse scores will enable the team to explore associations between the independent variables -- either various characteristics of the growers or the amount of technical assistance received -- and pesticide practices that could lead to residue violations. SAS regression analysis software will be used to analyse the relationship between the independent variables and the misuse score.

(It is important to recognize that even the highest misuse score will not guarantee that violative residues would be found if a particular grower's crop were sampled, as weather conditions, the length of time between harvest and sampling, the frequency of applications assumed in the tolerance setting process and other factors affect both the legal tolerance and the residue levels on crops. However, the misuse score will enable the team to characterize those growers whose practices are more likely than others to result in residue violations, and who ROCAP might target in a program to educate growers and exporters about steps to take to minimize their economic risk.)

b. Descriptive Data

Quantitative descriptive data will be analysed for various categories of growers (those affiliated with a particular export structure; those growing a certain crop) and presented in tables. If necessary, tests of statistical significance will be conducted to assess differences between categories. Data also will be analysed across categories.

Qualitative descriptive data will be incorporated into the discussion and analysis of the quantitative data, and the discussion about appropriate steps for A.I.D. and ROCAP to take.

C. VISITS TO PESTICIDE SUPPLIERS

The team will also visit fifteen stores, cooperatives or other places (sampled systematically) where the growers

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1 If a U.S. tolerance does not exist for the chemical used on the crop, the farmer will receive one point. If he applies it at a higher concentration than is recommended on the label, he will receive another point. If he applies it closer to harvest than recommended the label (for those chemicals for which pre-harvest intervals have been established), he will receive a third point. For pesticides for which EPA has established a tolerance on the crop, the team will be able to ascertain that more than a certain number of applications per crop cycle could lead to a residue problem. EPA has information for some pesticide and crop combinations about the maximum number of applications that EPA assumes in setting the tolerances. For these chemicals, if the number of applications exceeds the maximum, an additional point will be assigned.

interviewed purchase their pesticides to determine the availability of pesticides with U.S. tolerances for the four non-traditional crops.

D. TESTIMONY AND OTHER DOCUMENTS

To better assess the potential impact of legislative and regulatory changes on growers of non-traditional crops in Guatemala, EPA and FDA testimony and other documents will be reviewed. The review will address three questions: 1) what is the current capacity of the FDA to test for residues of the pesticides used by the growers? 2) which of the chemicals used by the growers are under special review, e.g., their registration status may change; 3) what has FDA's sampling strategy been for Guatemala, and how are legislative and regulatory changes likely to affect it?

Documents to be reviewed will include: 1) the Office of Technology Assessment's October 1988 report Pesticide Residues in Food, Technologies for Detection, and testimony referenced in the report; 2) the EPA's annual "Report on Status of Chemicals in Special Review Program, Registration Standards Program, Data Call-in Program and other Registration Activities (the Rainbow Report)", and; 3) end-of-fiscal-year reports prepared by the FDA summarizing monitoring programs for pesticides and metals in foods. If necessary, interviews with FDA and EPA officials will be conducted.

IV. Methods to Obtain Informed Consent and to Protect the Identities of the Growers and Exporters

The Committee on Human Volunteers at the Johns Hopkins School of Hygiene and Public Health, charged with protecting the rights of the subjects in research projects sponsored by the University, has reviewed and approved the informed consent and disclosure documents that will be used in the study. In addition to getting the exporters' and growers' consent to participate, the team will take the following precautions to protect the identities of the exporters and growers: only the team leader will know which exporters provided lists of growers for the study; the names and addresses of the growers will not be recorded on the survey data forms; the exporters will not know which of their growers were surveyed; no names will be included in the final report to ROCAP, nor in articles or the dissertation that will be published based on these data.

The Committee was concerned that the Government of Guatemala be notified of the study, unless the U.S.' agreements with the government include ROCAP and A.I.D. sponsoring projects and research without such notification. The Committee has asked that ROCAP provide the University with a letter stating that it is not ROCAP/A.I.D. policy to notify the Guatemalan government of each and every research project that it funds.

V. Timeline and Work Products

The team leader will interview the exporters during the week of February 13. The testing of the survey instrument and the survey and interviews of growers will begin during the week of February 26, and continue through the end of March. Data analysis will take place in April and May.

The Pesticide Use Consultant and Team Leader will draft a preliminary report that a ROCAP planning group will be able to draw upon when it meets at the end of March to discuss plans for the next fiscal year. The preliminary report will summarize the researchers' impressions, and will not include formal data analysis.

The team will submit a final report to ROCAP no later than May 31. The final report will include: 1) presentation and discussion of the results of the regression analysis exploring the association between growers' characteristics, technical assistance received and the pesticide practices that could result in violative residues; 2) presentation (in tables, where appropriate) and discussion of descriptive data on the availability of pesticides, growers' sources of information, growers' understanding and perceptions about the residue problem, the economic impact of rejected shipments and pesticide practices that could pose health risks to growers and applicators; 3) discussion of the availability of pesticides for which U.S. tolerances have been established on the four crops; 4) analysis of the implications for the growers surveyed of changes in U.S. law and regulations. If the researchers emerge with strong opinions about various options or approaches to addressing the problems identified in the study, the final report will include a dicuccion of the steps A.I.D. and ROCAP might take.