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5. Author(s)
1. Gary Jahn
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ENVIRONMENTAL IMPACT ASSESSMENT OF AFRICAN ARMYWORM CONTROL IN ERITREA: AN AMENDMENT TO THE SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT OF LOCUST/GRASSHOPPER CONTROL IN ERITREA

AFRICAN EMERGENCY LOCUST AND GRASSHOPPER ASSISTANCE (AELGA) PROJECT

NOV. 1994

TABLE OF CONTENTS

EXECUTIVE SUMMARY OF THE AFRICAN ARMYWORM AMENDMENT TO THE ERITREAN SEA FOR LOCUST/GRASSHOPPER CONTROL

I. LITERATURE REVIEW OF SPODOPTERA EXEMPTA, THE AFRICAN ARMYWORM
A. Biology and Ecology
B. Distribution
C. Damage
D. Control

II. THE 1994 AFRICAN ARMYWORM OUTBREAK

III. ORGANIZATIONS INVOLVED IN ARMYWORM CONTROL IN ERITREA
A. USAID
B. National Crop Protection Departments
C. Pesticide Regulatory Bodies
D. The Desert Locust Control Organization of East Africa
E. Donor Agencies
F. NGOs
G. United Nations

IV. AFRICAN ARMYWORM CONTROL
A. Control Operations of 1994
B. Future Directions
C. Environmental Impact

V. AREAS OF CONCERN IN THE 1994 AAW CONTROL OPERATION
A. Main Problems
B. National Capacity of Eritrea

VI. CONCLUSIONS

VII. RECOMMENDATIONS
A. Pesticides
B. Research
C. Training
D. Strategic Plans

APPENDIX 1. Amendment of the SEA for locust/grasshopper control to allow African armyworms to be dealt with in East Africa. A memo from John Gaudet, Bureau Environmental Coordinator (AFR/SD/PSGE) to Paul Novick, Director (AA/AFR/DRC). August 9, 1994.

APPENDIX 2. Cable #02173: Armyworm and weather conditions in Eritrea. July 1994

APPENDIX 3. Cable #239673: Armyworm infestation in the Horn of Africa. Sept. 1994.

APPENDIX 4. Ministry of Agriculture Organizational Chart. Oct. 1994.

APPENDIX 5. Armyworm Control Operation in Eritrea 1994. Nov. 1994.

APPENDIX 6. Migrant Pest Situation Report by Amare Beiene. Oct. 31, 1994

EXECUTIVE SUMMARY

AN ENVIRONMENTAL IMPACT ASSESSMENT OF AFRICAN ARMYWORM CONTROL IN ERITREA: AN AMENDMENT TO THE "ERITREAN SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT FOR LOCUST/GRASSHOPPER CONTROL"

The 1994 African Armyworm (AAW) outbreaks in Eritrea originated in Tanzania in January 1994. From March to May 1994, AAW moths migrated from Tanzania to Kenya and Uganda, then on to Ethiopia. In Ethiopia, the first outbreaks were reported from Borena on April 18, 1994. By June the armyworms entered Eritrea. The outbreak ended in August 1994.

The Eritrean Ministry of Agriculture (MOA), requested pesticides and equipment for AAW control, but received no donor support until the outbreak was over. MOA used pesticides remaining from locust campaigns to treat for AAW. MOA maintains that its pesticide stocks are now seriously depleted. Since USAID lacked an environmental impact assessment for armyworm control in Eritrea, regulation 22 CFR 216.3(b)(1) prohibited the Agency from providing pesticides or donating funds that would be used in conjunction with pesticide application activities. However, MOA used pesticides provided in 1993 by USAID for locust control, to control AAW. DLCO/EA provided Eritrea with one aircraft for aerial applications of pesticides.

To allow USAID to deal with AAW in the future, AELGA sent Dr. Gary Jahn, an entomologist, to Eritrea to prepare an amendment to the "Supplemental Environmental Assessment for Locust/Grasshopper Control in Eritrea." During his TDY, he interviewed members of MOA and the Desert Locust Control Organization of East Africa (DLCO/EA). He surveyed fields where insecticides were applied for AAW control. He also inspected the pesticide storage facilities of MOA and DLCO/EA in Eritrea.

The most serious problems in the 1994 Eritrean AAW control campaign were insufficient warning time, inadequate international communication, inadequate communication between provinces, and an absence of pheromone traps in Eritrea for monitoring armyworm moths.

Currently the Government of Eritrea (GOE) has about 30,000 liters of emulsifiable concentrate (EC) pesticides, suitable for ground applications; and 7,600 liters of ultra-low volume (ULV) pesticides, suitable for ground and aerial spraying. GOE also has several hundred kilograms of insecticide-dust and wettable powder.

Approximately 43,700 liters and 42,200 kg. of pesticides were applied in Eritrea to control AAW in 1994. Without importing additional pesticides, MOA brought the 1994 AAW under control. Large amounts of grain were apparently saved from

destruction, though there are no estimates available of the amount of grain saved. The Minister of Agriculture Dr. Tesfai Ghermatsion expressed the need to replenish pesticide stocks. I inspected all of the pesticide storage facilities in Eritrea. All of the facilities were adequately maintained with the exception of the Gonderand facility in Asmara.

The Gonderand facility is a serious public health hazard. As of November 1994 the facility consisted of a single room containing over 30,000 liters of pesticides in leaking containers. Most of the pesticides are expired. It is not known if any are still useable. Pesticides stored there include Ekatin, Malathion, 2,4-D Amine, Sumithion, Diazonon, Dieldrin, and DDT. This store room is constantly emitting pesticide fumes through a broken window. The floor is coated with a thick oily layer of pesticides about 1 cm deep. The apartments above and adjacent to the store room are occupied by families with small children. These families are exposed to potentially deadly vapors continuously. The GOE was informed of this dangerous situation in March and April 1993 by AELGA. Since then approximately 4,000 liters of ULV Fenitrothion and 2,600 liters of Sumithion have been removed from this facility and used for AAW control. Other than that no changes have been made in the Gonderand pesticide facility.

RECOMMENDATIONS

A. Pesticides

1. Relocate the residents of the Gonderand pesticide storage facility as soon as possible. This is a priority item. No other recommendations should be considered until this item is implemented.
2. Remove all pesticides from the Gonderand facility and store them outside Asmara in non-leaking containers. Clean-up all the spilled pesticides and pesticide residues at Gonderand.
3. Do not stockpile pesticides in Eritrea at this time. The dangerous situation at the Gonderand pesticide warehouse indicates that the Government of Eritrea is not prepared to handle a pesticide stockpile at this time.
4. Provide Eritrea with pesticides on an "as-needed" basis for AAW, just as is done for locusts. If USAID provides pesticides to Eritrea for AAW control, a technical expert from USAID should accompany the pesticides to verify proper storage, use, and ground surveys.
5. Support the development of a Pesticide Bank in Europe so that donors and African governments can be prepared for major pest outbreaks.
6. Provide Eritrea with sufficient safety equipment.
7. Provide GOE with guidance on developing pesticide regulations.
8. Test old pesticide stocks to determine which ones are useable.
9. If pesticides must be used, use several different kinds of

suitable insecticides to avoid selecting for resistance.

10. Use a front door for storing and a back door for removing pesticides so that the oldest pesticides will be used first.

B. Research

1. Develop formulations of nuclear polyhedrosis virus (NPV) for control of AAW. NPV is safer to humans than pesticides.
2. Determine if any commercial formulations of Bacillus thuringiensis B.t.), an insecticidal bacteria, control AAW.
3. Develop formulations of B.t. isolates shown to be effective against AAW, e.g., B.t. isolate K-26-21.
4. While ants and other predators are known to reduce the populations of some armyworm species, it is unlikely that parasites or predators could be used to combat an ongoing outbreak of African armyworms. This is because the natural enemies would not be able to control AAW within time to prevent major crop loss during an outbreak. It would be difficult to establish species-specific parasites in Eritrea since AAW do not normally breed in Eritrea, but migrate from breeding sites in Tanzania, Kenya, and possibly southern Ethiopia. Research should be conducted to determine if natural enemies and pathogens can reduce AAW populations at the breeding sites, thus preventing outbreaks.
5. Find out what happens to the AAW that migrate to the north.
6. Devise a means of killing the AAW pupae.
7. Develop transgenic plants that incorporate the gene for B.t. toxin to protect crops from AAWs.
8. Identify egg parasites of AAWs. Such parasites may have the potential to control armyworms before they cause crop damage.

C. Training

1. Support increased pesticide safety training for crop protection workers and farmers.
2. Need for AAW control training similar to the AELGA training for locust control.
3. Teach workers how to maintain pheromone traps and how to report trap data.

D. Strategic plans

1. Prevent outbreaks by controlling AAWs in Tanzania and Kenya before they reach Ethiopia or Eritrea.
2. Eritrea should be continuously informed of the status of AAW in Kenya through DLCO.
3. Place AAW pheromone traps throughout the country, to determine where outbreaks will occur. Concentrate traps near the Eritrean-Ethiopian border, since this is the area where AAW enter Eritrea.
4. Have a planned response to possible monitoring outcomes.
5. All provincial crop protection units should be in radio communication with the MOA in Asmara.

I. LITERATURE REVIEW OF SPODOPTERA EXEMPTA, THE AFRICAN ARMYWORM

A. Biology and Ecology

The African armyworm (AAW), Spodoptera exempta (Walker) (Lepidoptera: Noctuidae), larvae feed on all types of grasses, early stages of cereal crops (e.g., corn, rice, wheat, millet, sorghum), sugar cane, and occasionally on coconut (Odiyo 1984; Yarrow et al. 1981). The armyworm gets it's name from it's habit of "marching" in large numbers from grasslands into crops. AAWs tend to occur at very high densities during the rainy season, especially after periods of prolonged drought (Haggis 1984, 1986). During the long dry season in eastern Africa AAW population densities are very low. Because outbreaks are never observed during the dry season, it is called the "off-season" by those that monitor AAWs (Odiyo 1981).

S. exempta moths live about 10 days. The female can lay a maximum of about 1000 eggs in her lifetime. Eggs hatch in 2-3 days. Six larval instars are completed in 2-3 weeks. Larvae occur in two morphologically distinct forms: a 'gregarious' form, which is black with yellow stripes, and a solitary form, which is green or brown. The morphological form is determined by density -- becoming 'gregarious' at higher densities. However, the AAWs do not exhibit the true gregarious behavior of locusts. It is the gregarious forms of AAW that cause outbreaks. Generally, AAWs are not noticed by farmers until the caterpillars are 10 days old and change from green to black (Brown 1972). In the last instar, larvae burrow 2-3 cm into the ground to pupate. Adults emerge in 7 to 10 days (Dewhurst 1985). The moths, migrate over tens, and probably over hundreds, of kilometers between their emergence sites and their oviposition sites (Riley et al. 1983). The observation that AAW outbreaks can suddenly occur in areas that were free of the pests for several months has lead to the hypothesis that the moths migrate hundreds of kilometers. Evidence for this hypothesis includes:

1) outbreaks in a geographical progression at one generation intervals (Rainey 1979);
2) outbreaks are often preceded by high catches of moths and associated with wind convergence (Blair et al. 1980);
3) results of isozyme analysis imply that AAW populations in Kenya, Tanzania, and Zimbabwe regularly inter-breed (Den Boer 1978);
4) laboratory tests show that the moths can remain in flight for several hours (Gatehouse and Hackett 1980);
5) results of mark and capture studies, and radar tracking indicate long distance, downwind migration of AAW moths (Rose et al. 1985).

There is a trade-off between flight and reproduction, i.e. the longer the moths fly, the lower their fecundity (i.e.,

reproductive potential) (Gunn et al. 1989; Gunn and Gatehouse 1993). The moths tend to fly downwind and infest new areas in regions of wind convergence (Brown et al. 1969; Tucker et al. 1982). There are three distinct periods of flight activity each night for moths: dusk, late evening, and just before dawn (Rose and Dewhurst 1979). Migratory flights begin the night of emergence; or newly emerged moths congregate in trees and mass migration flights begin at dusk the following night (Riley et al. 1983).

During seasons when there are no outbreaks, the AAW persists in it's solitary phase (in which caterpillars remain green, are less active, and therefore less conspicuous). The first outbreaks of the season probably result from concentrations of moths before the synchronized mating and egg laying (Pedgley 1989; Rose 1979). These outbreaks frequently follow periods of prolonged drought. Janssen (1992, 1993) found that plant's have more nutrients than usual, especially nitrogen, following the first rain after a drought. While these nutritional differences may account for increased AAW moth fecundity, this has not been demonstrated. An alternative, and untested, explanation for outbreaks following droughts is that the effectiveness of predators and parasites in regulating population growth may be significantly reduced through droughts (Marcovitch 1957).

It has been suggested that the outbreaks may result from synchronized ending of pupal diapause, as opposed to mass migration. However, no diapausing pupae have ever been found in the field. Diapause in a small proportion of pupae has been observed in the laboratory (Khasimuddin 1977).

B. Distribution

S. exempta is found throughout Africa south of the Sahara, with large infestations concentrated in the eastern half of the continent. The center of AAW breeding is around the Mozambique-Zimbabwe area. Outbreaks progress from this area into 30 African nations, from Mauritania and Senegal in the north-west to Ethiopia and Somalia in the north-east, and to Namibia and South Africa in the south (Odiyo 1984). AAW also occurs in south-western Arabia, and intermittently in the oceanic countries of South East Asia and the Pacific as far east as Hawaii, but not in the Americas (Haggis 1984, 1986). The species is found as far south as Australia and New Zealand (Commonwealth Institute of Entomology 1972).

C. Damage

An infestation of AAW covering 65 square km2 of rangeland with a larval density of 28/m2 consumes about 50 tons (dry weight) of herbage per day during their final instar. This feeding rate is equivalent to that of 8000 head of cattle (Odiyo

1979).

D. Control

1. Forecasting

African armyworm moths are monitored using pheromone traps that attract sexually receptive males. Light traps, Aldis beam observations, radar, and optical infra-red observations are also used to track the movement of the moths and improve forecasting ability (Tucker 1983). Dewhurst (1985) recommends controlling AAWs with insecticides in the first larval instar, thus preventing their northward spread. Control strategies could be improved by determining the conditions that lead to concentrations of moths. If moth concentrations could be located and destroyed, then outbreaks could be prevented (Pedgley et al. 1989).

2. Biological control

There is tremendous potential for biological control of AAWs. According to Dewhurst (1985), viruses can control AAWs under suitable, but restricted, conditions. In an effort to use viral control, farmers around the world have attempted to control caterpillars by collecting dead caterpillars from the field, grinding them up, mixing them with water, and spraying the mixture on threatened crops. The mixture is sometimes referred to as the "green milkshake." The green milkshake is unreliable as a control method. If the farmers are fortunate enough to find caterpillars infected with pathogenic viruses, if the virus are not degraded by enzymes in the grinding process, if the viruses are not rapidly degraded by sunlight, and if the virus can be transmitted orally, the green milkshake can be very effective; but a good deal of luck is needed. Even when the green milkshake works, the potency of the shake tends to decrease with each successive formulation.

The Plant Protection Bureaus of Thailand have modified the green milkshake technique with some success. There, S. exigua are reared in government laboratories. A certain portion of the caterpillars are regularly infected with nuclear polyhedrosis virus (NPV). Infected caterpillars are harvested at the peak of the virus population and ground into the green milkshake. The green milkshake is discributed to farmers. By collecting the dead caterpillars from their fields, farmers are generally able to successfully re-create the green milkshake 2 or 3 times. After that, the potency is too low to be effective and farmers must be re-supplied with laboratory stock. Another drawback is that infectivity rates tend to be low, so large quantities of virus must be used. The rate of infectivity can be greatly enhanced by formulating NPV with adjuvants to provide protection from sunlight. For example, the addition of Tinopal, an optical brightener to NPV adjuvants prevents degradation of NPV by ultra-violet radiation, increasing the virulence of NPV to S.

frugiperda 164,000 to 303,000 times (Hamm and Shapiro 1992).

Bacteria can also be used to control Noctuid caterpillars. Bacillus thuringiensis (B.t.), an insecticidal bacteria, has reduced AAW populations by 95% in field trials. The literature is filled with seemingly contradictory results when it comes to controlling Spodoptera with B.t.. This is because the insecticidal activities of various B.t. strains differ with the target pest species (Belda and Guerreo 1992; Jarret and Burges 1986; Lecadet and Mortouret 1987). Brownbridge (1991) screened 150 B.t. strains for insecticidal activity against AAWs. B.t. strain K-26-21 isolated from soil in Kenya, showed the highest level of toxicity to AAWs in the laboratory. In field trials, isolate K-26-21 provided almost total control of larvae on maize seedlings within 48 hours. In this experiment, ants and spiders played a significant role in suppressing the AAW population, especially early instars. Natural enemy populations were not affected by the B.t..

It is not known to what extent natural enemies keep AAW populations in check. A proposed sampling plan for AAW in maize cannot be used where natural enemies are most efficient and keep the AAWs at very low densities (Schulthess et al. 1991). Ants are known to significantly reduce S. frugiperda populations and associated damage in maize. Reducing applications of broadspectrum insecticides, or replacing them with biological insecticides, such as B.t., allows ants to contribute to Spodoptera control (Perfecto 1990).

3. Antifeedants

The pyrrolidine 2(R), 5(R)-dihydroxymethyl-3(R), 4(R)-dihydroxypyrrolidine (DMDP) deters feeding in S. exempta as well as in the locusts Schistocera gregaria (Forsk.) and Locusta migratoria L. (Blaney et al. 1984; Fellows et al. 1989; and Simmonds et al. 1989 cited in Simmonds et. al. 1990). Due to incomplete coverage, antifeedants alone are rarely sufficient to protect a crop. However, antifeedants can be an important part of an IPM program.

4. Pesticides

Several pesticides are used for AAW control, including malathion, endosulfan, cypermethrin (a pyrethroid), carbaryl, fenitrothion, and chlorpyriphos (Brown et al. 1970; Hewitt and Meganasa 1993; Wheatley and Crowe 1967). Insect growth regulators (IGRs) have only been used experimentally so far. In laboratory studies IGRs have been shown to significantly increase the mortality of another species of armyworm, S. frugiperda. The addition of a feeding stimulant to the IGR increases its effectiveness (Chandler 1993).

When spraying AAWs with cypermethrin the optimal droplet size is 35 microns diameter or more. Field trials in Kenya

indicate that a minimum of nine droplets of 2.4% ULV formulation of cypermethrin per square centimeter is required for 50% AAW kill, whereas 95% mortality requires at least 28 droplets per square centimeter. To achieve 50% AAW mortality requires track spacing of 25 m for back-mounted sprayers and 45 m for vehicle-mounted sprayers. As the track space is decreased, the AAW mortality increases (Hewitt and Meganasa 1993).

II. THE 1994 AFRICAN ARMYWORM OUTBREAK

Eritrea is normally not a breeding area for African armyworms. AAW outbreaks occur in Eritrea when moths migrate there from Ethiopia or further south. The 1994 AAW outbreaks in Eritrea most likely originated in Tanzania in January 1994. Moths may have migrated from Tanzania to Kenya and Uganda in March. From late March through May there were AAW outbreaks in the Coastal, Nyanza and Rift Valley provinces of Kenya. These outbreaks were monitored by the Desert Locust Control Organization (DLCO) and sprayed by the Kenya Plant Protection Department. Moths from Kenya probably migrated to Ethiopia. In Ethiopia, the first outbreaks were reported from Borena Zone, Teltele Wereda on April 18, 1994. Initial infestations in southern Ethiopia were followed by small outbreaks in central Ethiopia. It is possible that the moths detected in Ethiopia resulted from primary outbreaks originating in southern Ethiopia. In 'ay 1994, the northeastern third of Ethiopia, the provinces of Ti ay and Wello, suffered widespread severe outbreaks. Two or three days after the infestations began in Tigray, the AAWs entered Eritrea.

The first reported AAW outbreaks in Eritrea came from Hamassien and Serai provinces in June. Within one week, seven of the nine Eritrean provinces were infested: Serai, Akeleguzay, Hamassien, Senhit, Sahil, Semhar, Gash, and Setit. In the Serai, Hamassien, and Senhit provinces alone, about 220,000 hectares were infested. Armyworms attacked African finger millet, taff, maize, sorghum and various grasses that serve as livestock fodder. Larval densities were 60 to 100 larvae per square meter in the Hazemo plain. The highest density recorded during the outbreak was 500 larvae per square meter. Spraying is recommended when caterpillar densities reach or exceed 15 larvae per square meter (Appendix 6). Depending on the area, 25 to 90% of crops were destroyed; forcing many farmers to resow their crops. The outbreak ended in August 1994.

III. ORGANIZATIONS INVOLVED IN ARMYWORM CONTROL IN ERITREA

A. USAID

The Eritrean Ministry of Agriculture (MOA), requested pesticides and equipment from USAID and other donors to control the AAW outbreaks (Appendix 2). Since USAID lacked an

environmental impact assessment for armyworm control in Eritrea, USAID regulations [22 CFR 216.3(b) (1)] prohibited USAID from providing pesticides or donating funds that would be used in conjunction with pesticide application activities (Appendix 3). According to USAID/Eritrea, the Mission did not participate in AAW control operations, or provide any support. However, according to Mr. Mehari Tesfayohannes (Head of the Agricultural Rural Development Department of MOA), MOA used malathion provided in 1993 by USAID (for locust control), to control AAWs. Interviews with Mr. Kidane Ghebrekidan (a crop protection specialist), and with Mr. Woldu Tekle-Giorgis (Assistant Head of Plant Protection) confirmed that USAID pesticides were used in the armyworm control operations.

To allow USAID to deal with AAWs in the future, AELGA sent Dr. Gary C. Jahn, an entomologist, to Eritrea to prepare this amendment of the "Supplemental Environmental Assessment for Locust/Grasshopper Control in Ethiopia" (Appendix 1).

B. National Crop Protection Departments

The structure of the Eritrean Ministry of Agriculture (MOA) down to the department level is shown in Appendix 4. MOA is divided into 15 departments. The Department of Agricultural Rural Development (ARD), which deals with armyworm outbreaks, works under the authority of the Vice Minister of Operations. ARD is divided into four divisions: Extension, Plant Protection & Quarantine, Crop Production, and Home Economics & Domestic Handicrafts.

The TDYer met with Dr. Tesfai Ghermatsion, Minister of Agriculture; Mr. Mehari Tesfayohannes, Head of ARD; Mr. Kidane Ghebrekidan, Plant Protection Expert; and Mr. Woldu Tekle-Giorgis, Assistant Head of the Plant Protection Section.

C. Pesticide Regulatory Bodies

As of Nov. 1994 Eritrea had no pesticide regulatory body and no pesticide regulations.

D. Desert Locust Control Organization of East Africa (DLCO/EA)

The DLCO/EA has an AAW unit which monitors the movement of armyworms.

A single Beaver spray aircraft was provided to the Government of Eritrea (GOE) by DLCO/EA. All of the DLCO/EA pilots wear protective clothing (i.e. respirators, helmets, and coveralls) during spray operations. Fenitrothion 96% technical and malathion 95% technical were the pesticides applied by air.

E. Donor Agencies

GOE did not receive any donor support for the 1994 AAW control campaign.

F. NGOS

GOE did not receive NGO support for the 1994 AAW control campaign.

G. United Nations

The UN sent Dr. C. F. Dewhurst to Asmara to present a 2 day seminar on AAWs to MOA/ARD. FAO donated 5600 liters of Dursban to Eritrea for armyworm control. Unfortunately, it arrived in Eritrea in October 1994, two months after the outbreak ended. MOA is saving the pesticide to use next year.

IV. AFRICAN ARMYWORM CONTROL

A. Control Operations of 1994

1. Forecasting

Current "forecasting" methods for Eritrea rely on light trap collections made in and around Asmara. Light traps attract all varieties of insects and are poor devices for monitoring AAW moths. It would be better if Eritrea had a network of pheromone traps.

ARD was notified in June by the Ethiopian Ministry of Agriculture that AAWs were infesting Ethiopia. The Ethiopian AAW outbreak began in April. This delay in reporting was quite costly to Eritrea (in terms of crop loss) which only had a week to prepare for the outbreak. DLCO/EA only informed ARD of the outbreak situation in Kenya after ARD had already heard from the Ethiopian Ministry of Agriculture.

Based on the data collected by DLCO, the 1994 AAW outbreak in Ethiopia and Eritrea could have been predicted months in advance. Eritrea would have had time to prepare for the outbreak if the DLCO information had gone to Asmara promptly. Just as DLCO notifies Ethiopia and Kenya of locust breeding in Eritrea, so too should DLCO notify Eritrea and northern Ethiopia of AAW outbreaks in Tanzania, Kenya, and southern Ethiopia.

2. Pesticide applications

ARD was responsible for coordinating AAW control operations throughout Eritrea. A total of 22,970 hectares were treated from the ground with 17,388 liters of liquid pesticide and 42,183 kg of insecticidal dust. A total of 62,246 hectares were treated by air with 26,316 liters of insecticide at an average application rate of 0.42 lt./ha (Appendix 5). This is consistent with the recommended application rate of 0.25 to 0.5 lt./ha for ULV insecticides. Due to the control operations, a second generation

of AAWs was not able to re-infest Eritrea.

Malathion 96% ULV and fenitrothion 96% ULV were applied by airplane and truck-mounted Micronair. Cypermethrin (a pyrethroid), fenitrothion (an organophosphate or OP), diazinon (an OP), Sevin (carbaryl, a carbamate), propoxur (a carbamate), and Dursban (chlorpyriphos, an OP) were applied by backpack sprayer. Though it was probably unintentional on the part of ARD, using a variety of insecticides to control pest outbreaks is a good strategy for avoiding pesticide resistance.

Ground applications were made by extension agents and village brigades. Village brigades consist of farmers that volunteer to apply pesticides with backpack sprayers. There were 15 to 20 teams per province. Each team consisted of 20 to 30 men. ARD does not send women on spray operations out of concern that breast milk may be contaminated by pesticide exposure. Considering that the pesticides are generally applied without protective clothing, this precaution is not unfounded. Certain organophosphates are exceptionally prone to storage in fat tissue, which may be released back into circulation during lactation. No organochlorine pesticides (e.g. aldrin, endosulfan, DDT) were used in the 1994 AAW control operation, but it is worth noting that all organochlorines are highly lipophilic and therefore likely to be excreted in the milk of lactating women (Morgan 1982).

3. Mechanical and cultural control

Mechanical control for AAWs was not used in Eritrea in the 1994 outbreak.

B. Future directions

1. MOA plans to:
   a. Conduct research on the effectiveness of mechanical control for AAW.
   b. Request training on AAW control, similar to the AELGA locust training.
   c. Request more ULV pesticides and more carbamates.

2. DLCO/EA plans to:
   a. Standardize pesticide emission rates.
   b. Increase the use of malathion over fenitrothion for AAW control to decrease the environmental impact.
   c. Conduct quick ground surveys as crops start growing.
   d. Be pre-positioned with pesticide stocks.
   e. Have aircraft on stand-by.

C. Environmental Impact of the 1994 AAW Control Operations

The GOE did not conduct an environmental impact assessment in conjunction with the control operations. No pesticides were

applied to sanctuaries or wilderness areas. There were no reports of human health impacts in treated areas, though there was no GOE program to look for such effects. Likewise, there were no reports of birds, fish, or mammals being killed by the pesticides, but GOE made no effort to look for any dead animals. The only reported environmental impact came from bee keepers, who claimed that the treatments caused the death many honey bees.

V. AREAS OF CONCERN IN THE 1994 AAW CONTROL OPERATION

A. Main Problems

1. Safety equipment shortage

While GOE had enough pesticides to control the AAWs, there was a severe shortage of safety equipment.

2. Inadequate warning system

Outbreaks were not always reported in a timely manner. There was inadequate communication between the Ethiopian Ministry of Agriculture and the Eritrean Ministry of Agriculture; between the Eritrean MOA and the Eritrean provincial offices; between DLCO/EA and MOA; and between DLCO/Kenya and DLCO/Eritrea.

3. Damage to honey bees

According to DLCO, aerial control operations in Eritrea killed many honey bees.

B. National Capacity of Eritrea

1. Pesticides and Safety Equipment

The national pesticide stocks were greatly depleted by the control operation. As of Nov. 1994, MOA had about 30,000 liters of emulsifiable concentrate (EC) pesticides: Dursban and Cypermethrin. The EC pesticide formulations are suitable for ground applications. MOA also has 7,600 liters of ultra-low volume (ULV) pesticide, suitable for ground and aerial spraying. The ULV pesticide stock includes the 5,600 liters of ULV Dursban received from FAO in Oct. 1994. The remaining 2000 liters of ULV pesticides are fenitrothion and malathion. In addition, MOA has several hundred kilograms of insecticidal dust and powder. During the 1994 AAW campaign approximately 43,700 liters of liquid insecticide and 42,200 kg. of solid pesticide were applied in Eritrea. A locust outbreak could require from 10,000 to 50,000 liters of pesticides. MOA staff, including the Minister of Agriculture Dr. Tesfai Ghermatsion, told this TDYer of the need for USAID or other donors to help replenish pesticide stocks. According to Mehari Tesfayohannes, ARD needs more ULV pesticides and more carbamate insecticides, especially Sevin. The GOE has no B.t. stocks at all, and has never had any.

There is a shortage of all types of safety equipment.

2. Facilities

a. Pesticide Storage

(I) The Eritrean Ministry of Agriculture

The majority of useable MOA pesticides are stored at Daro-paulos, former military barracks that have been renovated to store pesticides. The pesticides stored at Daro-paulos are properly labeled and are not leaking. The only problem observed at Daro-paulos was that older pesticides were stored in the back of the building while newer pesticides were piled in front of those. There is only one door on the facility, so workers must take out the new pesticides to get to the old pesticides. A simple solution would be to place a back door on the facility so that pesticides could be loaded in one door and removed from the opposing door. In this way, the oldest pesticide would be used first.

Other pesticides are stored in a government warehouse while awaiting transfer to Daro-paulos. Several hundred kilograms of solid pesticides are stored near the ARD office in steel shipping cars. All of the facilities were adequately maintained with the exception of the single room at the Gonderand facility in Asmara. The Gonderand facility contains pesticides donated to Eritrea by the Government of Ethiopia and the DLCO/EA 25 years ago. Presently, the Gonderand facility belongs to the Eritrean Ministry of Agriculture.

The Gonderand facility is a serious public health hazard. As of Nov. 1994, the facility contained over 30,000 liters of pesticides in leaking containers. Most of the pesticides are expired. It is not known if any are still useable. Pesticides stored there include Ekatin, Malathion, 2,4-D Amine, Sumithion, Diazonon, Dieldrin, and DDT. This chamber is constantly emitting pesticide fumes through a broken window. The chamber floor is coated with a thick oily layer of pesticides about 1 cm deep. The apartments above and adjacent to the store room are occupied by families with small children. These families are exposed to potentially deadly vapors continuously. The GOE was informed of this dangerous situation in March and April 1993 by AELGA. Since then approximately 4000 liters of ULV Fenitrothion and 2,600 liters of Sumithion have been removed from this facility and used for AAW control. Other than that no changes have been made in the Gonderand pesticide facility.

II) DLCO/EA

The DLCO office in Asmara has a small pesticide stock consisting of approximately 1000 liters DDT and 1000 liters of organophosphates. The barrels are stored outside beneath a roof. The containers are not leaking.

VI. CONCLUSIONS

The 1994 AAW outbreak was brought under control and large

amounts of grain were apparently saved from destruction, though no agency has estimates of the amount of grain saved. Any crop loss was the result of delays in the control operation. Several problems hindered the operation:

1) Inadequate communication from Kenya and Ethiopia to Eritrea; and weak internal communication within Eritrea.

Proper communication would have given Eritrea more time to prepare for the outbreak.

2) Improper monitoring.

Eritrea relies on light traps to detect AAW moths; but light traps are not selective for AAW moths so it is difficult to collect data. Eritrea needs a network of pheromone traps for AAW male moths. GOE also needs personnel trained in the operation and maintenance of the traps. Finally, there must be simplified, standardized reporting of moth data so that Tanzania, Uganda, Kenya, Ethiopia, and Eritrea and easily and efficiently share AAW data. AAW outbreaks in any of these five nations should be reported to the other four nations as rapidly as possible. Reliance on regional monitoring, i.e. limited to a single province, makes sense for non-migratory pests, but not for migratory pests such as locusts or AAW.

3) A shortage of trucks, safety equipment, and application equipment.

RECOMMENDATIONS

A. Pesticides

1. Relocate the residents of the Gonderand pesticide storage facility as soon as possible. This is a priority item. No other recommendations should be considered until this item is implemented.
2. Remove all pesticides from the Gonderand facility and store them outside Asmara in non-leaking containers. Clean-up all the spilled pesticides and pesticide residues at Gonderand.
3. Do not stockpile pesticides in Eritrea at this time. The dangerous situation at the Gonderand pesticide warehouse indicates that the Government of Eritrea is not prepared to handle a pesticide stockpile at this time.
4. Provide Eritrea with pesticides on an "as-needed" basis for AAW, just as is done for locusts. If USAID provides pesticides to Eritrea for AAW control, a technical expert from USAID should accompany the pesticides to verify that they are being stored and used in a manner consistent with USAID regulations. The USAID technical expert should also verify that ground surveys for pests are conducted prior to aerial spraying. Donors should only provide pesticides in conjunction with adequate amounts of safety equipment.
5. Support the development of a Pesticide Bank in Europe so

that donor organizations and African governments can be prepared for major pest outbreaks.

6. Provide Eritrea with sufficient safety equipment; so that the Government of Eritrea can provide village brigades of farmers with respirators and other protective gear as easily as they provide farmers with pesticides.
7. Provide the Government of Eritrea with guidance on developing pesticide regulations.
8. Test old pesticide stocks to determine which ones are useable.
9. If pesticides must be used, continue using several different kinds of suitable insecticides to avoid selecting for pesticide resistance in AAWs.
10. Place a front and back door on all pesticide storage buildings. Use one door for storing pesticides and the other for removing pesticides. In this way, the oldest pesticides will be used first without having to constantly re-arrange the inventory.

B. Research

1. Develop formulations of nuclear polyhedrosis virus (NPV) for control of AAW. NPV is much safer than pesticides to humans and the environment.
2. Determine if any commercial formulations of Bacillus thuringiensis (B.t.), an insecticidal bacteria, provide adequate AAW control. B.t. is more host specific than conventional pesticides, is biodegradable, and is non-toxic to humans.
3. Develop formulations of B.t. isolates shown to be effective against AAW, e.g., B.t. isolate K-26-21. To obtain K-26-21 contact Dr. Michael Brownbridge of the International Centre of Insect Physiology and Ecology (ICIPE), P.O. Box 30772, Nairobi, Kenya.
4. Determine if natural enemies can reduce AAW populations at the centers of origin, e.g. Tanzania and Kenya, thus preventing outbreaks in Eritrea
5. Find out what happens to the AAW that migrate to the north.
6. Devise a means of killing the AAW pupae.
7. Develop transgenic plants that incorporate the gene for B.t. toxin to protect crops from AAWs.
8. Identify egg parasites of AAWs. Egg parasites could be used to reduce AAW populations before the caterpillars can damage crops.

C. Training

1. Support increased pesticide safety training for crop protection workers and farmers.
2. Need for AAW control training similar to the AELGA locust control training. Dr. Dewhurst gave a two day seminar on AAW. The seminar was very popular but it wasn't enough.

3. Teach workers how to maintain pheromone traps and how to report trap data.

D. Strategic plans

1. Prevent outbreaks by controlling AAW in Tanzania and Kenya before they reach Ethiopia or Eritrea.
2. Eritrea should be continuously informed of the status of AAW in Kenya through DLCO.
3. Place AAW pheromone traps throughout the country to determine where outbreaks will occur. Concentrate traps near the Eritrean-Ethiopian border, where AAW enter Eritrea.
4. Have a planned response to possible monitoring outcomes.
5. Improve the internal communications of Eritrea. All provincial crop protection units should be in radio communication with the MOA in Asmara.

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APPENDIX 1

Memo from John Gaudet, Bureau Environmental Coordinator (AFR/SD/PSGE), to Paul Novick, Director (AA/AFR/DRC). August 9, 1994.

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
AFRICA BUREAU
Office of Sustainable Development
Division of Productive Sector Growth and the Environment
AFR/SD/PSGE
Washington, D.C. 20523-0089

MEMORANDUM August 9, 1994

TO: Paul Novick, AA/AFR/DRC
Director

FROM: John Gaudet, AFR/SD/PSGE,
Bureau Environmental Coordinator

SUBJ.: Amendment of the Supplemental Environmental Assessments for Locust/Grasshopper Control to allow African armyworms to be dealt with in East Africa

Recent food-security threatening outbreaks have occurred of the African armyworm in the greater Horn of Africa, engendering numerous inquiries concerning USAID options for intervention, including the potential use of pesticides (summarized in State 184163 and Addis 005391). This office has been asked to determine options for USAID intervention in a manner consistent with its Environmental Procedures ("Reg. 16"), specifically the provisions of the pesticide procedures outlined in 22 CFR 216.3(b)(1).

In view of the fact that the 1994 outbreak in the Horn is well along already, thus will soon have run its course for this growing season, and that pesticide-related assistance cannot be rendered before an appropriate environmental assessment has been conducted, it is unlikely that USAID still will be able to respond this year in a manner which invokes pesticide use, directly or indirectly. Nevertheless, it is desirable that expedited measures be taken to provide for this facility as soon as possible for future armyworm outbreaks.

Two key facts are pertinent in this connection:

1. USAID/AFR's regional AELGA project, established to address short-term and medium-term responses to locust and grasshopper outbreaks, already has a mandate to consider responses to "other emergencies" of a pest-related nature.

2. An overarching environmental assessment concerning locust/grasshopper control operations, the "Programmatic Environmental Assessment for Locust and Grasshopper Control

Pesticide

in Africa/Asia" (PEA), already provides the context for rational pesticide use, and lays out measures to mitigate potential negative impacts. Over 20 country-specific Supplemental Environmental Assessments (SEAs) have been prepared, including Ethiopia, Eritrea and for the Desert Locust Control Organization of East Africa (DLCO-EA) operations in Somalia (DCLO has a mandate for armyworm control).

The SEAs contain country-specific environmental information and provide guidance on environmentally sound management procedures for pesticide use in a particular country, guidance which to a large extent is directly pertinent to the considerations which would apply in control decisions for armyworms. Given that African armyworms are mass migrating insects with cyclical population dynamics, and will very likely require intervention over a large geographic area to protect vulnerable crops in drought-prone regions in the future, the interventions required are very analogous to those necessitated by locusts. While a definite differentiation needs to be made between control measures for locust/grasshoppers as opposed to armyworms, clearly, there are also distinct benefits and economies to be gained by minimizing the need to re-visit pesticide management, safe use, environmental health and related issues which apply both to armyworm and locust/grasshopper control.

Environmental assessments may be amended whenever a new need arises and/or valuable information that can be utilized in the process of implementing sound programs becomes available and when such information necessitates an update. Thus, four options for dealing with the requirement to prepare an environmental assessment were considered, from more generic to more limited in scope:

1. Design and carry out a new PEA to address the broader array of pest outbreak emergencies in as preventive a way as possible, but with a more limited geographic scope, including at least an updated treatment of locusts and grasshoppers, ass well as rodents and armyworms in sub-Saharan Africa. This option, while desirable in the long-term, would require considerable time and resources, and would not be consistent with an expedited response. Subsequent SEAs would be needed as well.

2. Conduct an amendment to the existing locust/grasshopper PEA to address the specific situation with armyworms in Africa. Then conduct separate country-specific SEA amendments for each country where needed.

3. Carry out separate amendments to the existing Eritrea and Ethiopia SEAs to address the armyworm situation in those countries only. These Amendments would include enough information (e.g., from the PEA and SEAs) to be complete, self-standing documents.

i.e., self-explanatory

76

4. Delink the armyworm issue from the present PEA and SEAs, and take an independent course following Reg. 16 in connection with a specific planned intervention for armyworms, i.e., do an initial environmental examination, and prepare an independent environmental assessment (which nevertheless will be informed by and based on the PEA and SEAs). This option does not take advantage of economies to be gained by linking the process to the PEA/SEAs.

Determination:

Option 3 is an appropriate and well-circumscribed approach, and consistent with USAID Environmental Procedures and good practice. It will allow immediate steps to be taken to ensure that practical and effective assistance can be rendered if needed, while mitigating and preventing to the fullest extent possible any negative consequences due to pesticide use. The amendments should emphasize, for armyworms even more than for locusts, alternatives to chemical pesticides, as part of an IPM program. All the normal considerations which apply to SEAs per se also pertain to the amendments, for example with respect to scoping and coordination with other donors and the host country government(s), the NGO/PVO community and regional pest management organizations such as the DLCO-EA.

Once intervention is imminent in a given country, the amended SEAs should be linked to a Plan of Action developed by the host country government, FAO and/or NGOs as appropriate, before USG assistance in the matter of armyworm is rendered.

Clearance:

GC, STisa STT Date: 8/5/94
PPC, JHester JH Date: 8/8/94

Distribution:

AA/AFR/DRCO/AELGA, AShowler
FHR/OFDA
AFR/EA, JPryor
USAID/REDSO/ANR, JFlynn
G/EG/AFS, RHedlund
USAID/Addis Ababa,
USAID/Asmara,

Draft: WIKnausenberger, AFR/SD/PSGE, 1-VIII-94

APPENDIX 2

Cable #02173: Armyworm and weather conditions in Eritrea. July 1994.

AGR-4 76:8 4

UNCLAS AIDAC ASMARA 02173

ACTION: AID-1
INFO: DCM-1 AMB-1

DISTRIBUTION: AID
CHARGE: AID

VZCZCDS0351
RR RUEHDS
DE RUEIBS #2173/01 2031342
ZNR UUUUU ZZH
R 221342Z JUL 94
FM AMEMBASSY ASMARA
TO RUEHC/SECSTATE WASHDC 2392
INFO RUEHDS/AMEMBASSY ADDIS ABABA 2078
RUEHBP/AMEMBASSY BAMAKO 0024
RUEHEG/AMEMBASSY CAIRO 0383
RUEHDK/AMEMBASSY DAKAR
RUEHDJ/AMEMBASSY DJIBOUTI 0428
RUEHKH/AMEMBASSY KHARTOUM 0554
RUEHMG/USLO MOGADISHU 0288
RUTAND/AMEMBASSY NDJAMENA 0009
RUEHNM/AMEMBASSY NIAMEY 0024
RUEHNR/AMEMBASSY NAIROBI 0035
RUEHNK/AMEMBASSY NOUAKCHOTT 0024
RUEHOU/AMEMBASSY OUAGADOUGOU 0024
RUEHRB/AMEMBASSY RABAT 0025
RUEHRO/AMEMBASSY ROME 0228
RUEHYN/AMEMBASSY SANAA 0208
RUEHTU/AMEMBASSY TUNIS 0028
RUEHYD/AMEMBASSY YAOUNDE 0025
RUEHAS/AMEMBASSY ALGIERS
RUEHIL/AMEMBASSY ISLAMABAD 0032
RUEHNE/AMEMBASSY NEW DELHI 0027
RUEHJL/AMEMBASSY BANJUL 0020
BT
UNCLAS SECTION 01 OF 02 ASMARA 02173

ANR

INFO: FHA RF+CH

AIDAC

AID/W FOR AFR/AA/DRCO, AFR/ARTS/FARA, AFR/EA AND
FHA/OFDA
DEPARTMENT FOR AF/E
NAIROBI FOR REDSO/ESA
ROME FOR FODAG

E.O. 12356: NA
TAGS:
SUBJECT: ARMYWORM AND WEATHER CONDITIONS IN ERITREA

SUMMARY

UNCLAS AIDAC ASMARA 02173

ARMYWORMS HAVE BEEN CAUSING WIDESPREAD DAMAGE ON THE NEWLY PLANTED CROPS AS WELL AS GRASSES OVER ERITREA; AS A RESULT, FARMERS HAVE BEEN FORCED TO RESOW MORE THAN ONCE. SEVEN PROVINCES ARE AFFECTED TO DATE.
DESPITE THE MINISTRY OF AGRICULTURE EFFORT THUS FAR, THE INFESTATION PROMISES TO BE OUT OF CONTROL UNLESS AERIAL OPERATIONS ARE CONDUCTED IN INFESTED AREAS.

BACKGROUND

A STAFF MEMBER OF USAID ERITREA TRAVELED WITH THE MOA FROM JULY 15-17 OVER LAND FROM ASMARA TO THE SOUTH AND CENTRAL HIGH LANDS PROVINCES OF SERAE, HAMASSIEN AND AKELEGUZAI TO SURVEY THE ARMYWORM SITUATION AND TO OBSERVE THE CONTROL MEASURES BEING UNDERTAKEN IN EACH OF THESE PROVINCES.

ARMYWORM

? economically important

FROM ALL ACCOUNTS, THE AFRICAN ARMYWORM IS ONE OF THE MOST ECONOMICAL SPECIES OF THE GENUS SPODOPTERA. WHEN PRESENT IN LARGE NUMBERS IT CAN CAUSE CONSIDERABLE DAMAGE TO FORAGE CROPS AND TO CULTIVATED PLANTS OF THE GRASS FAMILY (GRAMINAE). EXAMPLES ARE: (EAST AFRICA) MAIZE, DIFFERENT TYPES OF MILLET, RICE WHEAT AND OTHER CEREALS AND OCCASIONALLY SUGAR CANE. THE INSECT IS FOUND THROUGH OUT AFRICA SOUTH OF THE SAHARA AND IN CERTAIN OTHER TROPICAL COUNTRIES.

IN ERITREA, THE ARMYWORM IS LIVING UP TO ITS REPUTATION; IT IS ONE OF THE COUNTRY,S PRINCIPAL PESTS, OCCURRING IN PLAGUE FORM AND CAUSING ENORMOUS DAMAGE TO CEREAL CROPS AND GRASSES. THE ARMY WORMS USUALLY COME FROM ETHIOPIA, CROSSING THE ERITREA/TIGRAY BORDER.

FINDINGS

PEST DAMAGE SEEMS TO HAVE BEGUN IN MID JUNE. FIRST REPORTS WERE RECEIVED FROM FARMERS FROM HAMASSIEN AND SERAE PROVINCES. SUBSEQUENT REPORTS HAVE BEEN RECEIVED FROM NUMEROUS PARTS OF THE COUNTRY INCLUDING SERAE, AKELEGUZAI, HAMASSIEN AND SENHIT. IN THESE FOUR PROVINCES THE INFESTATION IS VERY EXTENSIVE.

AS THE TEAM OBSERVED IN SERAE, HAMASSIEN AND AKELEGUZAI PROVINCES THE CROPS WHICH ARE UNDER HEAVY INFESTATION

INCLUDE AFRICAN FINGER MILLET, TAFF, MAIZE, SORGHUM AND VARIOUS GRASSES THAT SERVE AS LIVESTOCK FODDER. ACCORDING TO THE FARMERS AND DEVELOPMENT AGENTS OF THE MOA, THE TOTAL AREA INFESTED IN THE ABOVE PROVINCES IS ROUGHLY ESTIMATED AT 220, 000 HA. MOREOVER, ACCORDING

TO THE INFORMATION OBTAINED BY THE TEAM, THE RANGE OF DAMAGE TO CROPS IS ESTIMATED FROM 25 TO 90 PERCENT OF TOTAL PLANTING. AS THE RESULT OF INFESTATION SOME FARMERS HAVE BEEN FORCED TO RESOW CROPS MORE THAN ONCE.

Damage

CONTROL OPERATION AND MOA NEEDS

THE MINISTRY OF AGRICULTURE IS WORKING WITH FARMERS TO CONTROL DAMAGE THROUGH AN INTENSIVE GROUND CONTROL OPERATION AND SO FAR 30,643 HA HAVE BEEN TREATED. HOWEVER, CONTROL ACTIVITIES ARE HINDERED BY SHORTAGES OF SPRAYING EQUIPMENT AND TRANSPORTATION FOR MOBILIZING PEOPLE AND TRANSPORTING OF GOODS.

IN ORDER TO IMPLEMENT MORE EFFECTIVE CONTROL OPERATIONS, THE MOA REQUIRES:
- SPRAYING EQUIPMENT SUCH AS MANUAL KNAPSACKS, MOTORIZED KNAPSACKS AND MICRONAIRS.

What happened to the one's they have?

- VEHICLES FOR MOUNTING MICRONAIR AND FOR TRANSPORTATION.

- DUST FORM OF PESTICIDES (THIS IS CRUCIAL SINCE THE AREA UNDER ATTACK IS VERY EXTENSIVE).

What about current stocks?

- SUPERVISION AND ON THE JOB-TRAINING.

WEATHER CONDITIONS

IN MOST PARTS OF SERAE PROVINCE THE RAIN HAS BEEN QUITE GOOD AND AS A RESULT THE SOIL IS THOROUGHLY WET. THOUGH THE RAIN HAS BEEN SPORADIC, IT STARTED EARLY APRIL. THE RAINFALL DATA OF 12 STATIONS ARE SHOWN BELOW IN MM:

STATION	MARCH	APRIL	MAY	JUNE	JULY (10 DAYS)
ADIQUALA		16	37	73.2	54.5
MAIAINI		14.6	28.2	67.50	NOT REC
ENDAGERGIS	7.5	5.1	7.0	81.0	NOT REC
AREZA		32.0	18.0	4.0	41
MAIDIMA		13.0	14.0	32	44
MULKI		3.0	13.0	35	27

DIBARIWA	3.0	48.50	83.50	17.5
ADIFELESTI		45.5	10.0	NOT REC
ADIBEZAHANES	NOT SET UP	NOT SET UP	21.5	20
MENDERERA	25.8	42.1	94.10	54.8
TERAIMNI			67.50	54
KINAFENA		27.00	46.00	38.2

CONCLUSION

THE MOA IS IN THE THROES OF ATTEMPTING TO CONTROL A VAST INFESTATION OF ARMYWORMS. THE IMPACT OF THIS INFESTATION IS POTENTIALLY CATASTROPHIC NOT ONLY FOR HUMAN BEINGS BUT ALSO FOR LIVESTOCK. IF THE SITUATION CONTINUES AS IS OVER THE NEXT MONTH, THE RESULTS COULD BE SERIOUS CROP LOSS YET AGAIN IN 1995, THEREBY PERPETUATING THE FOOD CRISIS IN THE COUNTRY.

damage

HOUDEK
BT
#2173

NNNN

APPENDIX 3

Cable #239673: Armyworm infestation in the Horn of Africa. Sept. 1994.

Ashton - no action unless we want to acknowledge receipt

UNCLAS AIDAC SECSTATE 239673

ACTION: AID-1
INFO: AMB-1 DCM-1

DISTRIBUTION: AID
CHARGE: AID

VZCZCDSO351
RR RUEHDS
DE RUEHC #9673/01 2462339
ZNR UUUUU ZZH
R 032339Z SEP 94
FM SECSTATE WASHDC
TO RUEHNR/AMEMBASSY NAIROBI 2511
RUEHRO/AMEMBASSY ROME 3485
RUEIBS/AMEMBASSY ASMARA 6546
RUEHDS/AMEMBASSY ADDIS ABABA 6454
RUEHMG/USLO MOGADISHU 8279
RUEHKH/AMEMBASSY KHARTOUM 8761
RUEHDR/AMEMBASSY DAR ES SALAAM 0236
RUEHOR/AMEMBASSY GABORONE 4319
RUEHTO/AMEMBASSY MAPUTO 5448
RUEHLS/AMEMBASSY LUSAKA 8365
RUTAND/AMEMBASSY NDJAMENA 1168
RUEHNM/AMEMBASSY NIAMEY 7962
RUEHOU/AMEMBASSY OUAGADOUGOU 6466
RUEHBF/AMEMBASSY BAMAKO 5932
RUEHNK/AMEMBASSY NOUAKCHOTT 0204
RUEHRB/AMEMBASSY RABAT 1978
RUEHTU/AMEMBASSY TUNIS 7509
RUEHAS/AMEMBASSY ALGIERS 4606
RUEHEG/AMEMBASSY CAIRO 4783
RUEHYN/AMEMBASSY SANAA 3719
RUEHYD/AMEMBASSY YAOUNDE 3421
RUEHLG/AMEMBASSY LILONGWE 3888
RUEHDK/AMEMBASSY DAKAR 3312
RUEHJL/AMEMBASSY BANJUL 6306
BT
UNCLAS SECTION 01 OF 02 STATE 239673

AIDAC NAIROBI FOR REDSO/ESA, ROME FOR FODAG

E.O. 12356: N/A
TAGS:
SUBJECT: ARMYWORM INFESTATION IN THE HORN OF AFRICA

REF: ASMARA 02173

1. SUMMARY: A SERIOUS ARMYWORM OUTBREAK OCCURRED IN ERITREA AND ETHIOPIA FROM APRIL TO AUGUST, 1994, AND, AFTER CAUSING SERIOUS, BUT UNQUANTIFIED, CROP LOSSES, THE INFESTATIONS SUBSIDED. CONTROL OPERATIONS WERE MOUNTED IN

UNCLAS AIDAC SECSTATE 239673

07 SEP

no action

FHA

Info: ANR FEWS RF+CH

Damage Assessment
- Control
- pesticides
- Nothing on Environmental Impact

34

BOTH ETHIOPIA AND ERITREA, BUT THESE EFFORTS WERE CRITICALLY HINDERED BY A LACK OF DONOR SUPPORT. NOW THAT FAO HAS AGREED TO PROCURE AND DELIVER EQUIPMENT AND INSECTICIDES FOR USE AGAINST ARMYWORM INFESTATIONS, USAID GRANTS CAN BE USED FOR ARMYWORM CONTROL IN ADDITION TO LOCUST AND GRASSHOPPER CONTROL. USAID ENVIRONMENTAL PROCEDURES REQUIRE THAT EXISTING SUPPLEMENTARY ENVIRONMENTAL ASSESSMENTS (SEAS) FOR LOCUST AND GRASSHOPPER CONTROL FIRST BE AMENDED TO FULLY ADDRESS ARMYWORM CONTROL ISSUES.

What kind of insecticide?

Quote this.

Armyworm Control

2. ARMYWORM SITUATION AND CONTROL: ETHIOPIA. THIS YEAR'S ARMYWORM OUTBREAK BEGAN IN THE BORENA ZONE OF ETHIOPIA ON 18 APRIL, FOLLOWED BY ADDITIONAL UPSURGES IN EASTERN HARARGE AND BALE ZONES IN EARLY MAY. THE INFESTATION

PROGRESSIVELY SPREAD TO COVER MOST OF ETHIOPIA, EXCEPT THE AFAR REGION AND SOME HIGHLAND AREAS. THE OUTBREAK, ACCORDING TO THE FOOD AND AGRICULTURE ORGANIZATION (FAO) WAS THE WORST RECORDED IN MANY YEARS. BY 10 JULY, INFESTED AREAS INVOLVED BOTH PASTURE AND CROPLAND, AND COVERED ABOUT 870,000 HECTARES IN ETHIOPIA. CONTROL MEASURES, WHICH RELIED ON SPRAYING INSECTICIDES, WERE CONDUCTED ON 181,000 HECTARES USING 160,000 LITERS OF LIQUID INSECTICIDES, AND 35,900 KG OF POWDER INSECTICIDES. OF THE TOTAL AREA SPRAYED, ABOUT 4,200 HECTARES IN EASTERN HARARGE AND DIRE DAWA WERE TREATED USING DESERT LOCUST CONTROL ORGANIZATION FOR EAST AFRICA (DLCO-EA) AIRCRAFT, AND 16,600 HECTARES IN THE TIGRAY REGION WERE TREATED AERIALLY BY DLCO-EA AND ADMAS AIR. OTHER CONTROL OPERATIONS WERE CARRIED OUT BY CROP PROTECTION SERVICES AND FARMERS ON THE GROUND. ADDITIONAL SPRAYING WAS CONDUCTED AFTER 10 JULY, BUT BY MID-AUGUST, THE INFESTATION HAD, FOR THE MOST PART, DIMINISHED.

ERITREA. ARMYWORMS CONSUMED MANY NEWLY EMERGING CROP PLANTS SO THAT FIELDS HAD TO BE RESOWED ONCE OR TWICE. SEVEN OF ERITREA'S NINE PROVINCES WERE AFFLICTED BY ARMYWORM INFESTATIONS. ACCORDING TO REFTEL, DAMAGE IN AT LEAST FOUR OF THE PROVINCES WAS DESCRIBED AS BEING 'EXTENSIVE.' IN THE SERAI, HAMASSIEN, AND SENHIT PROVINCES ALONE, ABOUT 220,000 HECTARES WERE INFESTED, AND CROP LOSSES AS A RESULT OF ARMYWORMS RANGED FROM 25 TO 90 PERCENT OF TOTAL PLANTINGS. THE MINISTRY OF AGRICULTURE WORKED WITH FARMERS TO CONTROL DAMAGE THROUGH AN INTENSIVE GROUND CONTROL CAMPAIGN, AND MORE THAN 31,000 HECTARES WERE TREATED. HOWEVER, SHORTAGES OF EQUIPMENT, PESTICIDES, AND VEHICLES HINDERED THE CONTROL EFFORTS. DLCO-EA DID CONDUCT SOME OPERATIONS AGAINST ARMYWORMS IN ERITREA ALSO.

3. DONOR ASSISTANCE: DONORS CONTRIBUTED, THROUGH UNDP, FOR ARMYWORM CONTROL AS FOLLOWS:

- SWITZERLAND: DOLS 38,000
- NETHERLANDS: DOLS 8,230

- UNDP: DOLS 50,000

DONOR FUNDING MADE AVAILABLE THROUGH UNDP WAS USED TO HIRE ADMAS AIR FLYING HOURS; TRANSPORT SERVICES OF PRIVATE TRUCKS TO HAUL INSECTICIDES TO MEKELE; CHARTER THREE ETHIOPIAN AIRLINES FLIGHTS TO DELIVER INSECTICIDE AND EQUIPMENT (13,000 LITERS OF INSECTICIDE, 4,800 LITERS OF AVGAS, 2,600 LITERS OF JETFUEL, AND 532 KNAPSACK SPRAYERS)

FROM ADDIS ABABA TO SHIRE, AXUM, AND MEKELE; AND TO HIRE A SPRAY OPERATIONS CONSULTANT FOR AIR ADMAS.

THE FOLLOWING BILATERAL ASSISTANCE WAS ALSO RENDERED:

- JAPAN: 138,400 LITERS OF PESTICIDES
- KOREA: 38,800 LITERS OF PESTICIDES
- SWEDEN: 32,800 LITERS OF PESTICIDES
- ERRP: 719 KNAPSACK SPRAYERS

what else?

PESTICIDES, FOR THE MOST PART, INCLUDED FENITROTHION, MALATHION, CARBARYL, AND CHLORPYRIFOS - ALL OF WHICH HAVE BEEN APPROVED FOR USAID FOR USE AGAINST LOCUSTS AND GRASSHOPPERS.

Pesticides

THE GOVERNMENT OF ETHIOPIA USED 141,550 LITERS OF INSECTICIDES CARRIED OVER FROM THE 1993 CROP SEASON.

4. FUTURE ARMYWORM CONTROL: BECAUSE ARMYWORM OUTBREAKS IN ETHIOPIA, ERITREA, AND MANY OTHER COUNTRIES IN AFRICA, ARE CHRONIC AND CAN POSE A SERIOUS THREAT TO CROP PRODUCTION AND PASTURELAND, THERE IS A NEED O BE BETTER PREPARED IN ADVANCE OF ARMYWORM OUTBREAKS SUCH THAT CONTROL OPERATIONS CAN BE CONDCTED USING MORE SYSTEMATIC AND PROACTIVE APPROCHES. UNTIL RECENTLY, FAO/ECLO HAD LIMITD ITS MANDATE TO DESERT LOCUSTS. IN PART AS A RESULTOF REQUESTS BY THE AFRICAN EMERGENCY LOUST/GRASSHOPPER ASSISTANCE (AELGA) PROJECT IN AFR/DRC), FAO/ECLO HAS CONSENTED TO ANDLING EQUIPMENT AND PESTICIDE PROCUREMENTS FR ARMYWORM CONTROL USING FUNDS GRANTED BY DONOS.

5. USAID ASSISTANCE: NOW THAT FA/ECLO HAS AGREED TO PROCURE EQUIPMENT AND INECTICIDES FOR CONTROLLING ARMYWORMS IN AFRICA, USAID CAN MAKE GRANTS TO FAO/ECLO FOR ARMYWORM CONTROL. HOWEVER, BEFORE SUCH ASSISTANCE CAN BE RENDERED BY FAO USING USAID GRANT FUNDS, COUNTRY-SPECIFIC SUPPLEMENTARY ENVIRONMENTAL ASSESSMENTS (SEA) FOR LOCUST AND GRASSHOPPER CONTROL MUST BE AMENDED AND APPROVED BY THE AFRICA BUREAU ENVIRONMENTAL OFFICER, OR, IF AN SEA FOR LOCUST/GRASSHOPPER CONTROL DOES NOT EXIST FOR THE COUNTRY REQUESTING ASSISTANCE, THEN A SEPARATE SEA MUST BE CONDUCTED SPECIFIC TO ARMYWORMS (OR IN COMBINATION WITH AN ENVIRONMENTAL ASSESSMENT FOR LOCUST AND GRASSHOPPER CONTROL). SEAS CAN BE CONDUCTED BY AELGA, OR BY THE MISSION. AELGA IS NOW PREPARING TO AMEND EXISTING LOCUST AND GRASSHOPPER CONTROL SEAS TO INCLUDE ARMYWORM CONTROL FOR ERITREA AND ETHIOPIA.

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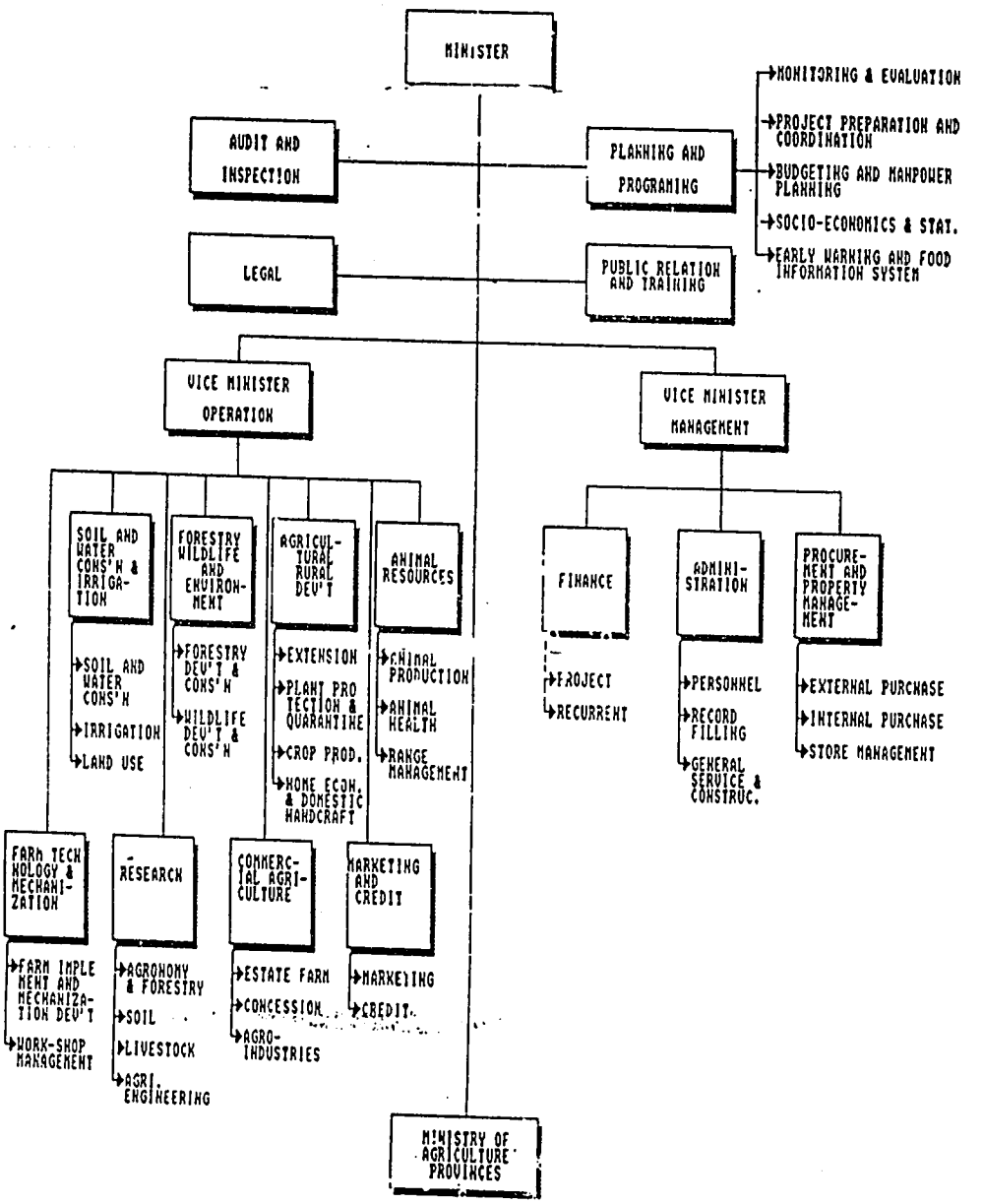
UNCLAS AIDAC SECSTATE 239673

APPENDIX 4

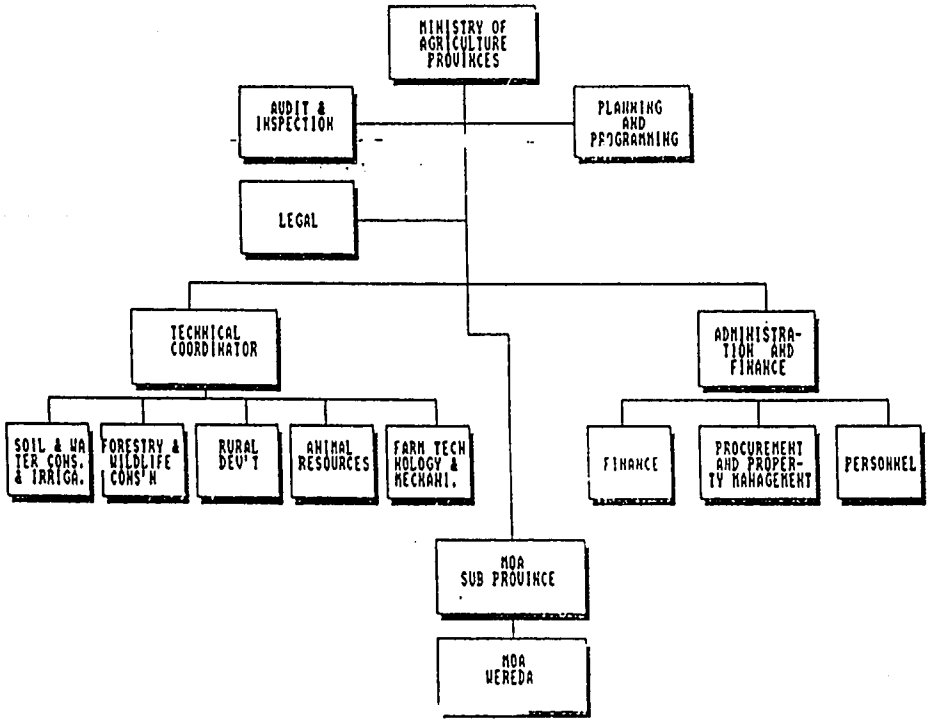
Ministry of Agriculture Organizational Chart. Oct. 1994

MINISTRY OF AGRICULTURE
ORGANIZATIONAL CHART



BEST AVAILABLE DOCUMENT

MINISTRY OF AGRICULTURE
PROVINCES
ORGANIZATIONAL CHART



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APPENDIX 5

Armyworm Control Operation in Eritrea 1994. Nov. 1994

Total

ARMY - WORM CONTROL OPERATION IN ERITREA 1994

PROVINCE	GROUND SPRAY			AREAL-SPRAY	
	Sprayed Area (Ha)	Litre	K.G.	Sprayed Area (Ha)	Litre
HAMASIEN	5048	2839.18	1187.5		
SERAYE	4701.5	4429.82	86	28166	12[illegible]13
AKELEGUZAI	10002.155	6034.3	38704.5	34080	13[illegible]03
BARKA	-	-	-	-	[illegible]
GASHSETIT	34	20	-		
SEMHAR	30	30	-		
SEMHIT	2268.5	3230	2204.75		
SAHEL	886.05	804.5	-		
DEBKEL					
T O T A L	22970.205	17387.8	42182.75	62246	26316

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APPENDIX 6

Migrant Pest Situation Report. Oct. 31, 1994

MIGRANT PEST SITUATION REPORT

By

AMARE BEIENE

DESERT LOCUST SITUATION

The present desert locust (Schistocerca gregaria) situation is calm. During the current Summer, there were heavy abundant rainfalls, green vegetation and good crop. in spite of suitable ecological condition, no desert locust breeding took place in Eritrea, Ethiopia or any other neighbouring coubtries. This was due to the fact that there were no locust populations and no suitable condition during the previous Winter in 1993 along the Red Sea which could have given rise to first generation outbreak. Last year's Winter was characterised by little and erratic rainfall.

Wadis along the Red Sea coast have been receiving floods and the following rainfalls have been recorded:

Karrora recorded 7.7 mm on 19.9.94
Massawa recorded 12.5 mm on 19.9.94
Shieb recorded 8.5 mm on 24.9.94
Ghinda recorded 53.6 mm total rainfall in September
Karrora recorded 5.5mm on 6.10.94
Shieb recorded 1.7 mm on 7.10.94

Recent surveys along the coast North of Massawa revealed some green areas, notably North of Shelshela (Abu Dabas 1610N 3911N) , Wadi Adilo 1550N 3924E and parts of Agbanazuf plain 1559N 3912E.

Reports of early Winter rainfall and vegetation in Ethiopia is awaited.

Aerial surveys are recommended to get first hand view of Red Sea coastal vegetation and the Ogaden zone of Ethiopia. This will be followed by ground surveys on specific green areas located by

by aerial observation.

Locust situation in the Eastern African and other Region is calm but vigilance and constant surveys are necessary. Reasonalble quantities of insecticides and fuels (both for aircraft and vehicles) for surveys should be at hand and for the next four to six months, to cover winter/Spring, jsurveys are recommended at least once every month.

TREE LOCUST

The tree locust (anacridium melanorhodon) situation both in Eritrea and Ethiopia has considerably improved from the previous year. Last year aerial operations successfully controlled over 18,000 ha. of tree locust swarm infestations between December 1992 and April 1993 immature in Eritrea alone and some swarms in Ethiopia were also controlled. It is evident that last year's successful control may have to a greater extent contributed to the suppression and subsequent recession of the insect this year. No fresh generation was observed this season and no tree damage was reported on fruit and accacia trees. This will have a positive impact on domestic animals like camels and goats which mainly feed on annual and pernnial herbs and trees.

THE AFRICAN ARMY WORM

In August 1994, both Eritrea and Ethiopia were affected by outbreaks of African Armyworm (Spodoptera exepta) on teff, barley, wheat and pasture grasses. In Eritrea 60 - 100 larvae per sq. meter were counted (which by far exeeded the recommended rate of 15 per sq. mt. for spraying) in the Hazemo plain. Effective control operations by DLCO aircraft and by ground (see Annex I) were undertaken with good results obtained.

In Ethiopia, in Adwa area one DLCO aircraft controlled 2,15oha

45

of armyworm larvae infestations while by ground knapsack sprayers 230 ha. infestations were controlled. In Rama (alongside Nereb river) 10,000 ha. infestations were controlled by DLCO aircraft and 4,000 ha. by ground using knapsack manual and motorized sprayers. Results were highly satisfactory in both localities.

Though some larvae that escaped control have pupated in early September no further armyworm breeding is likely this year in both countries, where overall good crop yields are expected.

RECOMMENDATION

Currently, the African armyworm is becoming another pest of economic importance affecting both countries. It would be desirable if the Task Force would include the armyworm as an additional pest to the desert locust to be monitored by the Task Force as a matter of an important pest that requires proactive control measures whenever it approaches economic threshold . With this in mind, "the Desert Locust Task Force" can be changed to " the Migrant Pest Task Force" or "The desert locust/African Armyworm Task Force". Whichever is convenient, inclusion of armyworm will be more challenging and the outcome fruitfull. Both pests affect both countries, being endemic and migrant. An ever increasing vigilance will be required in the part pf Plant Protection ground and DLCo aerial support. This may revolutionizeplant protection of both countries , because the successful control of desert locusts, armyworms will also include the suppression of tree locusts, african migratory locusts, grasshoppers, etc. due to the fact that the same materials and methods will be required to control most pests of the same species.

By the same token, the Steering Committee responsible for reports and recommendations will reactivate its responsibilities and presentation of its reports which had recently relaxed due to desert locust recession.

31st October 1994.

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i) Aerial Control: August only, AAW only

Date	Province	Area Covered (Ha)	Chemical Used (Lts)	Hours Flown
1.8.94	Akaleguzai	4,668	Fenitrothion, 1,634	4:20
2.8.94	Akaleguzai	3,394	Fenitrothion, 1,300	3:30
3.8.94	Serae	4,415	Fenitrothion, 1,545	5:10
4.8.94	"	3,514	Malathion, 1,230	3:55
5.8.94	"	1,203	Malathion, 421	1:25
23.8.94	Akaleguzai	2,310	Fenitrothion, 1,155	4:00
24.8.94	"	4,826	Fenitrothion, 2,413	5:00
25.8.94	"	668	Fenitrothion, 334	0:50
	TOTALS	24,998	10,032	28:10

ii) Ground Control:

Province	Area Covered (Ha)	Chemical Used (Lts/Kgs)
Hamasien	2,087	Dursban, 927 ~~kgs~~ lts Fenitrothion, 1,100 lts
Serae	2,380	Dursban, 75 ~~kgs~~ lts Fenitrothion 2,281 lts
Akaleguzai	5,167	Dursban, 4,640 ~~kgs~~ lts Fenitrothion, 1,808 lts
Senhit	285	Fenitrothion, 100 lts
Sahle	[illegible]	Fenitrothion, 430 lts
TOTALS	10,324 Ha	Dursban, 5,642 ~~kgs~~ lts Fenitrothion 5,719 lts

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U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
AFRICA BUREAU
Disaster Response Coordination
AFR/AA/DRC
Washington, D.C. 20523-0089

ENVIRONMENTAL ACTION FORM

Title of Activity: AFRICAN ARMYWORM CONTROL IN ERITREA.

AMENDMENT TO THE SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT (SEA) FOR LOCUST/GRASSHOPPER CONTROL IN ERITREA

Country: Eritrea

Amendment Prepared By: Gary Jahn, Consultant, AFR/AA/DRC

Date: November 1994

Recommended Action:

Approval is recommended. This Amendment to the existing SEA suffices as a self-standing document to address USAID's environmental concerns with regard to mitigation of risks due to pesticide use. Also, it adequately elucidates technical specifics unique to prospective assistance regarding the African armyworm in Eritrea. The present Amendment is consistent with the determination reached by USAID (Appendix 1) that preparing an amendment to the existing SEA for locust and grasshopper control is an appropriate and expedient step to take. It is important to underline that once an actual intervention is contemplated in Eritrea by USAID, the amended SEA must be linked to a specific Plan of Action developed by the appropriate implementing agency(ies).

Action Taken:

Approval: ✓ Date: 1/18/95

Disapproval: _____ Date: _____

John J. Gaudet, Ph.D.
Africa Bureau Environmental Coordinator
AFR/SD/PSGE/ENV

Review and Clearance:

AFR/SD/PSGE, Walter I. Knausenberger: WIK

48