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PROJECT

JOINT FAO/DONOR REVIEW

OF THE 1986

GRASSHOPPER CAMPAIGN IN THE SAHEL

Team Report
for
SENEGAL

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TABLE OF CONTENTS

I. ACKNOWLEDGEMENTS

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II INTRODUCTION

With the advent of abundant rains in the 1985 cropping season, the ecological conditions were conducive to a rapid increase in grasshopper populations in many areas of the Sahel. With heavy egg-laying towards the end of the season, there was a substantial residual population of grasshoppers, principally Oedaleus senegalensis

Forecasts were made as early as October of 1985 by the Locust Commission of FAO and others that a serious outbreak could occur in 1986 with favorable ecological conditions In April of this year the Director General of FAO, Edouard Saouma, asked President Abdou Diouf, President of CILSS, to spread the message requesting assistance for a vast international effort to control grasshoppers and locusts

Due to a complacent wait and see' attitude by the Crop Protection Service and the donor community, the mobilization of monitoring activity and logistical requirements were delayed This made necessary a monumental effort at the end of the cropping season to save the harvest from serious devastation

Once the gravity of the situation became evident, the international community responded generously and the 1986 control campaign came to an end In order to profit from lessons learned during the campaign, the donors and FAO jointly formed a team to evaluate the campaign in Senegal, The Gambia and Mauritania A second team is reporting on Mali and Burkina Faso and a third on Chad and Niger

This report reviews the successes and failures of the campaign in Senegal and provides recommendations for the 1987 cropping season and the years to follow

ACRONYMS

FAO	Food and Agriculture Organization
PRIFAS	Program de Recherches Interdisciplinaires Français sur les Acridiens du Sahel
CILSS	Comité Inter-Etats de Lutte Contre la Sécheresse dans le Sahel
USAID	United States Agency for International Devlopment
OCLALAV	Organisation Commune de Lutte Antiacridienne et de Lutte Antiaviaire
SCPS	Senegal Crop Protection Service
CPS	Crop Protection Service
NGO	Non-governmental Organizations

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DONOR SUPPORT
SUMMARY FOR SENEGAL
IN U.S DOLLARS

FAO	3 Experts, sprayers and radios	$ 156,000
Canada	4 Small planes, fuel, 1 expert, support for large aircraft	1,700,000
ADB	Cash support	165,000
U S	4 Large aircraft DC-7, experts, ground support, radios, training, pesticides	2,447,000
G O S	Pesticides	1,280,000
EEC	Pesticides	650,000
FRG	Pesticides (fenitrothion, propoxur), support for large aircraft	300,000
UNDP	Pesticide (fenitrothion)	200,000
Japan	Pesticides	800,000
France	Pesticide and support costs	100,000
Denmark	OCLALAV operations	110,000
Italy	Pesticides and support costs	800,000
U K	Pesticide, fuel and dust bags	70,000
Sweden	OCLALAV (support)	50,000
	TOTAL	$8,838,000

III THE CAMPAIGN

Survey and Reporting

Generalist type agricultural extension agents along with a small number of SCPS agents are responsible for pest survey and reporting in Senegal. Agricultural extension agents are located in each of the 30 administrative departments Their efforts were complemented in 1986 by 3 SCPS agents permanently based in the interior of the country

There appears to have been little effort to train the personnel involved in monitoring pest populations in the use of standardized, systematic survey methods Transmission of information relied on the local telephone system, but there was no organized schedule for reporting

In reality, much of the pest reporting occurred via an informal network from farmers to administrators and even to high level politicians (governors, ministers, and the president) This type of information transfer adds confusion, and at times a sense of panic, to agricultural pest conditions

At the end of the 1985 cropping season a survey of residual grasshopper populations, along with estimates of egg densities, was conducted by G Popov under the auspices of the FAO This survey indicated the potential for serious grasshopper populations in 1986 In June, FAO sponsored a training program of SCPS personnel. At this time a plan to train farmers in simple crop protection control techniques was elaborated Unfortunately, implementation of the plan did not take place until after the first rains in 1986

Much of the survey work conducted during the 1986 cropping season was accomplished by joint missions of SCPS, donors, and the FAO These include

- FAO/SCPS Several survey trips conducted by an FAO entomologist assigned to work with the SCPS were carried out during the course of the growing season (July to October)

- USAID/SCPS Two USAID short-term entomologists accompanied by SCPS personnel made several trips in the interior from August to October

- France/OCLALAV Conducted survey in September using a helicopter

- France/SCPS Conducted helicopter surveys in October

Later 5 teams were organized to conduct survey trips These include

- SCPS/OCLALAV
- SCPS/FAO
- SCPS/OCLALAV
- SCPS/USAID
- France/OCLALAV

Appraisal of the Survey System

All crop protection operations must be based on sound field data reported on a regular basis. Only this will permit judicious decisions on if, when, and where to apply pesticides. This appears to have been totally lacking in Senegal

In spite of early warnings of potential grasshopper problems in 1986, there was little action on the part of the SCPS to organize a systematic, standardized, survey effort in 1986 The SCPS appears to have a large resource base of equipment and personnel. These were not mobilized until after the grasshopper problem became apparent Actions were curative rather than preventive in nature

Differences in interpretation of the gravity of the grasshopper situation were registered during the season This was due, in a large part, to different methodologies used in monitoring grasshopper populations Also, entomologists involved in survey efforts came to the field with a wide range of experience with sahelian grasshopper problems Because of the lack of a well-organized concerted effort in survey, it is extremely difficult to define at any given point during the campaign, the grasshopper situation in Senegal

Ground Control Operations

The SCPS distributed insecticide dust in May to the interior regions of the country Also, an effort was made to repair equipment and vehicles just prior to the growing season

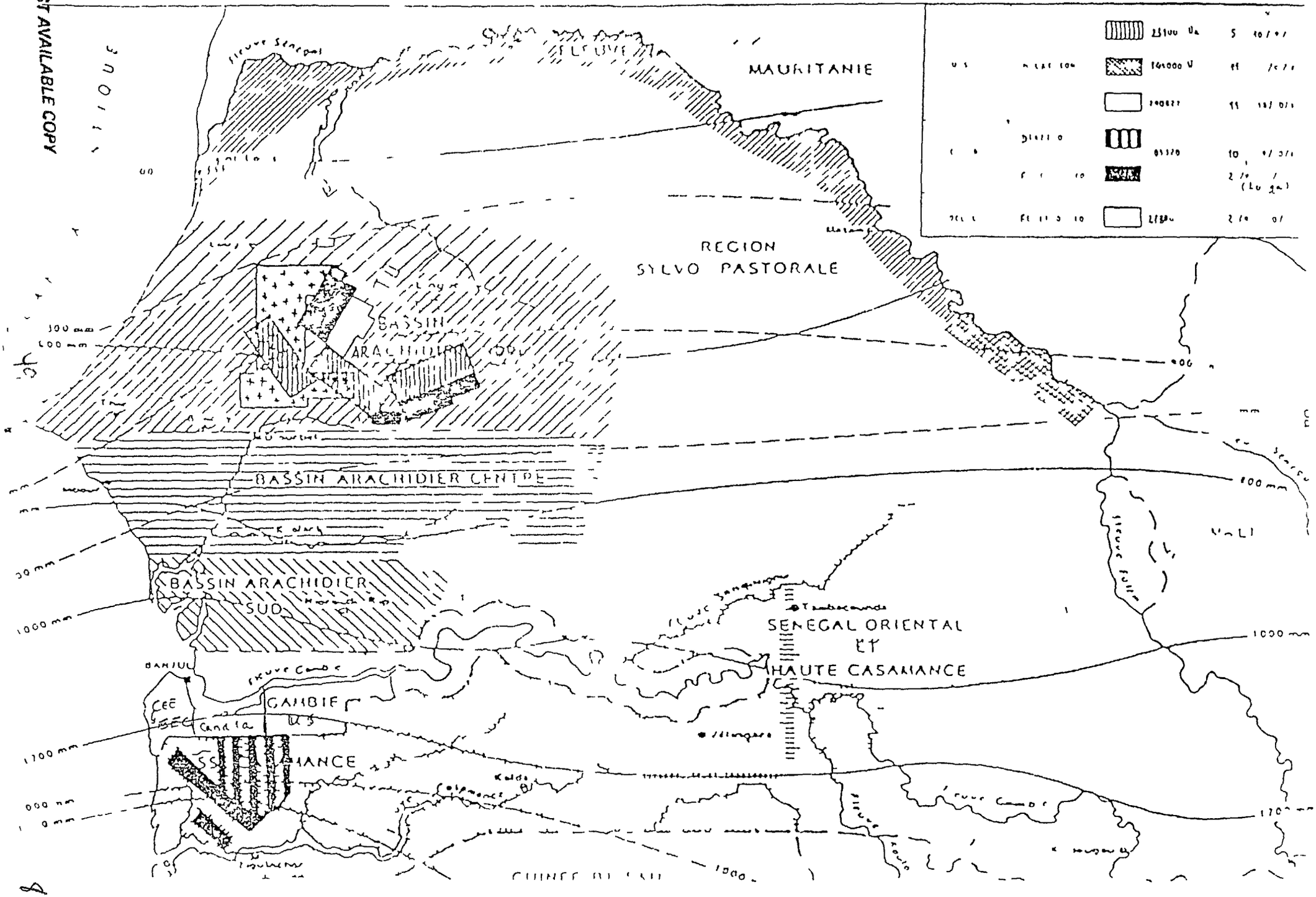
A group of non-governmental organizations was instrumental in the implementation of farmer training programs concerning grasshopper survey and the use of pesticides This training, however, did not take place until the last three weeks in August The NGOs also assisted in the purchase and distribution of insecticides and dusting sacks to farmers

It is difficult to provide specific details on the ground treatments effected in Senegal as these were not available from the Ministry of Rural Development However, they estimate that approximately 300,000 ha were treated using ground application equipment It has not been possible to ascertain what part of this area was treated by farmers and what part by crop protection teams

Aerial Control Operations

The international community of donors responded rapidly in August to the grasshopper situation with the mobilization of an enormous assistance

GRASSHOPPER TREATMENT ZONES (SEPTEMBER-OCTOBER, 1986)



program For the most part this was aimed at aerial treatment of large areas of grasshopper infestation. A strategy for control operations was elaborated by an inter-ministerial crisis committee under the direction of the Ministry of Rural Development. Coordination of activities was the responsibility of the FAO Three weekly meetings were held including the Inter-Ministerial Steering Committee, the Inter-Donor Committee, and an Ad hoc Committee. These meetings were aimed at coordinating and adjusting control operations to an evolving situation.

The donors involved, date of treatments, and areas treated are presented below

Zone	Aircraft Type	Donor	Dates	Area Treated
Northern Peanut Basin	4 DC-7	USAID	5-10/9	231,000 ha
	4 Ayers Commando	Canada	20/9-7/10	146,000 ha
	3 DC-7	USAID	12-18/10	314,300 ha
	2 Cessna(185,188)	OCLALAV	20/9-10/10	27,800 ha
Bakel/Matam	4 DC-7	USAID	11-14/9	145,000 ha
Casamance	4 Ayers Commando	Canada	10-19/10	158,700 ha
			TOTAL	1 022 800 ha

* Note below.

Conclusions

In spite of early warnings of the potential for serious grasshopper problems in 1986, mobilization and organization of ground control efforts did not take place in a timely manner Actions were taken in response to a serious situation rather than in anticipation of it Training of farmers, distribution of pesticides and equipment, and intervention was too late and was not sufficient to control early localized grasshopper populations The evaluation team strongly believes that, if early populations are detected and treated by farmers with assistance from the CPS, the situation can be contained early in the season This is where the emphasis on future control operations must be placed

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* November 29, 1986 There were additional aerial pesticide applications in November in the Senegal River Basin Region (November 19-24) and Casamance Region of Senegal (November 2-8) We were informed by the SCPS and FAO that approximately 65,000 additional hectares were treated in the Senegal River Basin for control of the grasshopper, Aiolopus simulator Approximately 72,000 hectares have been treated in the Casamance for control of unspecified species Applications were made by an OCLALAV airplane and financed by FAO

Once the international donor community made the decision to respond to the serious grasshopper problem, the response was rapid and generous. The majority of donor efforts were correctly aimed at aerial spraying since by that time ground operations were rightly deemed insufficient

Considering the urgency and lack of sufficient time for proper coordination, the aerial spraying operations were very effective. Because of the lack of time for adequate field survey, extremely large block areas were sprayed Even the smaller agricultural aircraft, which have the capability of 'spot treating, were used to blanket cover large areas with pesticides There was not sufficient time to target treatments at well-defined areas of high grasshopper density. At times, treatments were possibly made too late in the season to either protect the 1986 crop or reduce the grasshopper population for 1987 Politics, at times, appeared to have become involved in what should have been purely technical decisions

The evaluation team feels that in the future it is essential to aim control operations at ground intervention means thereby minimizing the necessity for large scale crisis type aerial operations with the consequent proliferation of pesticides

Recommendations

1 Next year's grasshopper campaign should be planned in detail as soon as possible A calendar of activities from now until next growing season must be elaborated The strategy (see also General Recommendations) should include

- inventory of pesticides and equipment
- determination of needs for next season
- training of CPS personnel in standardized survey methods
- training of farmers in detection and use of pesticides for grasshopper control Assistance in farmer training by the group of NGO's should be stimulated
- ordering application equipment and pesticides
- repair and maintenance of vehicles and equipment
- distribution of pesticide to strategic locations in the interior

2 The Crop Protection Service must organize a survey/intervention network permanently based in the interior of the country

3 Intervention thresholds for grasshoppers (and eventually other pests) must be developed The thresholds must be as simple as possible, and yet dynamic to allow for different periods of plant susceptibility Even if the grasshopper threshold for next year is only a rough estimate and not based on a detailed scientific study, it must be set in order to give CPS agents a rationale for intervention decisions The thresholds should, of course, be refined in future years.

4 Coordination of CPS activities, including survey and intervention, should not be overly complicated The Director of the Service in consultation with technical experts must be willing to make rapid decisions in response to sound field data

IV. INSECTICIDES USED, EFFICACY AND SIDE EFFECTS

Ground Operations

Details on insecticides used in the Senegalese ground treatments are either not available or unreliable Farmers applied propoxur dust with "sacs poudreurs'. At least 5-7 CPS teams have treated large areas with propoxur dust 1%, fenitrothion dust 3%, deltamethrin, Sumicombi, and probably other insecticides The treated surface has been estimated to be more than 300,000 hectares Dosage rates and quantities of insecticides used have not been reported Before the campaign, 1290 tons of dust, 1825 kg propoxur 75 WP, and 67,500 liters of EC and ULV insecticides had been prepositioned in the different regions for ground treatments Evaluations of the efficacy and of side effects on man, crops, or non-target organisms have not been made

Aerial Operations

The American DC7's treated the largest surface (690,300 ha) of the about 1,000,000 ha sprayed in aerial operations in Senegal They sprayed 386,500 liters of malathion 96% ULV at a dosage rate of 0 58 l/ha The 4 Canadian planes and 2 OCLALAV planes sprayed 375,000 ha mainly with fenitrothion ULV of different concentrations, and 33000 liters of diazinon 95% ULV Dosage rates of fenitrothion and diazinon were about 240 g of active ingredient per ha

These dosage rates of malathion, diazinon and fenitrothion are low compared to the dosage rates used in temperate countries Of different insecticide candidates, malathion was selected - among other reasons - for its efficacy, low mammalian toxicity, and low price

Evaluation of the efficacy and environmental effects of the aerial treatments in October 1986 were made by the American entomologists C R Edwards and E W Huddleston They found the malathion ULV at 0 58 l/ha highly efficacious (more than 98%) against Oedaleus senegalensis in North Central Senegal However, FAO entomologist A Ouattara reported a considerable reinfestation of the treated areas by young grasshoppers hatching from eggs in the sprayed area Efficacy of grasshopper control by 0 25 l/ha of diazinon 95% and fenitrothion 96% in the South of Senegal ranged on an average between 73% and 91%

In a simple, small scale experiment the entomologists did not find indications that birds or mammals had been affected by malathion applications in North Central Senegal, nor by applications of diazinon or fenitrothion in South Senegal Of the non-target insects they found that parasitic Hymenoptera, ground beetles, Odonata (dragon flies) and especially honey bees were severely affected by diazinon and fenitrothion in the South Also crabs were reported to be killed in large numbers by fenitrothion

A SCPS/USAID team reported malathion not only to be highly effective against grasshoppers (95-100%) but also against harmful non-target insects as aphids and Coleoptera. Farmer reactions about control efficacy of the malathion sprays against house flies, mosquitoes, and black and woolly aphid were enthusiastic. Symptoms of intoxication of man or cattle were not observed

Storage of Insecticides

Large quantities of insecticides have been imported, stored, transported and applied during the campaign Malathion is reported to have been properly handled and stored Little information is available about whether the other insecticides elsewhere were handled and stored properly The evaluation team visited the storage facility at the headquarters of the SCPS in Dakar and found large numbers of bags with propoxur dust as well as liquid insecticide containers stored on the ground in open air in full exposure to the weather There were no pallets or fork lifts. Workers are likely to be seriously exposed Suitable covered storage place however, was available nearby

V. CROP LOSS AND COST/BENEFIT ANALYSIS

Very little data on crop loss due to grasshoppers are available. Estimates of crop loss incidentally made during grasshopper surveys in Casamance in October were around 5-10% on rice and 5% in millet Damage by grasshoppers was often mixed with serious damage by Cantharidae, which made the evaluation even less reliable Edwards and Huddleston estimated crop loss in this same region at about 5% in rice, no appreciable losses in millet and sorghum, and a damage of 20% in corn due to grasshoppers and birds together

As little data on benefit to crops as a consequence of the spray operations are available, a very rough calculation is made of the cost of the aerial spraying operations per surface area of cultivated land benefitting from grasshopper control

The surface area of Senegal is 19,600,000 ha Surface of cultivated land is about 2,300,000 ha (1985) This means that about 12% of Senegal is cultivated Surface of aerially sprayed area is 1,000,000 ha Treated cultivated area is at least 12% of 1,000,000 ha = 120,000 ha and at most (100% of) 1,000,000 ha Total donor contributions (roughly cost of aerial spray operations) $8,838,000 Cost of aerial spray operations per hectare of cultivated land benefitting from grasshopper control ranges from $9 up to $74 (The high figure is a result of blanket spraying)

Discussion and Recommendations

As far as data on insecticides used in Senegal are available, selection of the insecticides and the dosage rates were adequate Especially the widest used insecticide, malathion, had been adequately selected Evaluation of efficacy and side-effects were scarce and insufficient in relation to the very large area treated A good effort was made to evaluate the effects of the malathion treatments Insight into optimal timing of the treatments was possibly lacking Technical assistance for defining intervention thresholds therefore is recommended

Acute side effects on people, cattle and other non-target organisms except insects appears to have been either absent or acceptable However, available data on side effects on honey bee, aphids, flies, and mosquitoes indicated that these large scale treatments have a tremendous acute impact on the environment, while long term effects are completely unknown yet Any large scale treatment against grasshoppers in future years should be monitored for side effects on man, cattle, and other non-target organisms until it is clear that short and long term side effects are acceptable Absence of intoxication of man and cattle is probably due to effective education of the population and SCPS teams, and to the low mammalian toxicity of the insecticides used Storage and handling of insecticides was not always properly done This aspect needs more consistent attention

As far as is known, crop losses appear to have been generally low Cost of crop protection against grasshoppers seems to have been relatively high per area of benefitting crop This again indicates that large scale operations are not the most appropriate as long as small scale operations are still feasible Small scale operations, however, need reliable survey data on grasshopper infestations As these were not sufficiently available in the 1986 season, large scale operations were a logical option.

There appears to be an acute need for additional pesticide storage facilities. This should be a high priority item as it is highly likely that large quantities of pesticides will be arriving in the country before the next rainy season As an interim measure, the Crop Protection Service with possible donor assistance, should explore the possibility of renting sufficient storage space for next year's campaign

VI GENERAL RECOMMENDATIONS FOR GRASSHOPPER CONTROL STRATEGY FOR NATIONAL CROP PROTECTION SERVICES

Grasshoppers are an endemic problem common to all Sahelian countries In order for grasshopper populations to be controlled, a well organized strategy must be developed Following is a brief outline of the steps which the evaluation team feels must be included in a general strategy for combatting grasshopper populations

1. Farmer Intervention Soon after the first rains grasshoppers begin to hatch from eggs laid at the end of the previous season These early populations are a threat to newly planted crops During this period, emphasis should be placed on treatment of localized populations by farmers Only farmers are able to detect these localized populations Treatments should be made with simple equipment such as dusting sacks In order for this initial control operation to work, the farming community must be sensitized to the potential threat of grasshoppers, and trained in the management of grasshopper populations The Crop Protection Service, along with the extension services, must be responsible for the early distribution of pesticides to farmers, and the training of farmers in the use of these chemicals

2. Ground Treatment by CPS Teams During the entire cropping season the Crop Protection Service must have a sufficient number of teams in the field for grassnopper survey and eventual intervention if necessary These teams should be led by agents adequately trained in pest detection and management Survey must necessarily be conducted in a systematic and standardized manner with results reported on a regular basis The team must also have sufficient autonomy and decision making responsibility to allow for intervention without waiting for a decision from headquarters Intervention decisions must absolutely be based on thresholds elaborated by experts prior to the season

Team operations must be coordinated on a national basis by the director of the service along with his technical advisors Decision on movement of pesticides, teams, and other resources must be swift and based on up-to-date reliable field data

A strategy with a well defined calendar of activities must be elaborated at the end of each season to ensure that preparations are made for the upcoming year Pesticides must be ordered on time and distributed in the country Vehicles and other equipment must be repaired and/or replaced Training of crop protection agents and farmers must be scheduled and conducted All of these activities necessitate a well organized management system that depends to a very large extent on the competency of national crop protection service directors

3 Aerial Pesticide Application The use of airplanes to rapidly treat heavily infested areas should not be excluded from the arsenal of crop protection tools This type of intervention should be kept to an absolute minimum and initiated only in response to sound field data This will allow for 'spot' treatments in areas of heavy grasshopper densities.

Preparations for the possible use of aircraft in grasshopper control operations should be made during the period between cropping seasons Landing strips should be built or repaired to allow for multiple centers of operation Arrangements should be made in advance to allow for rapid arrival of aircraft if aerial treatment are deemed necessary The Sahelian states must attempt to arrive at agreements to facilitate the movement of aircraft and pesticides from one country to another

As was the case in 1986, aerial application of pesticides in the forseeable future, will depend on donor financing Donors should remain as flexible as possible to provide rapid assistance if needed in the context of a well planned strategy for control of grasshoppers. Contacts and mutual preparations should be initiated as soon as possible to facilitate mobilization of resources if grasshopper populations in 1987, once again, reach levels that cannot be properly managed by ground application methods

4. Evaluation of the efficacy and environmental impact of pesticide applications, whether by ground or air, should be conducted until it is clear that efficacy is optional and that negative effects are acceptable This is especially important with large scale aerial treatments which could have a widespread negative environmental impact Recently developed pesticides, especially synthetic pyrethroids, should be routinely tested for possible incorporation into Sahelian grasshopper control operations

5 Intervention thresholds both for aerial and ground application must be set taking into account grasshopper population dynamics, phenological stage of crop development and a technically based evaluation of risk for crop damage Definitions of such thresholds could be worked out with assistance by PRIFAS

VII. CONSIDERATIONS FOR REGIONAL ORGANIZATIONS

There are two areas in which Sahelian countries could benefit from a regional crop protection organization

a. Survey and preventive control operations against the Desert Locust and African Migratory Locust (Schistocerca gregaria, Locusta migratoria)

b Assistance in aerial control operations against agricultural (and possibly public health) pests when infestations surpass national crop protection service capabilities

The evaluation team believes it is important to deal with these two pest situations on the regional level Up to the present, OCLALAV has been responsible for preventive operations against the Desert Locust OCLALAV has also assisted Sahelian countries in grasshopper control operations to a limited extent (1974-75 in Senegal, Mali, Mauritania, and Niger)

OCLALAV has many well-trained and experienced agents, but no longer has the financial means necessary to respond to locust or grasshopper problems They currently have only one usable aircraft in the western sahelian zone (which was repaired with donor assistance for the 1986 grasshopper control efforts) Salaries of OCLALAV personnel cannot even be assured at this time

There appear to be several possibilities for dealing with regional pest control problems These include 1) revitalization of OCLALAV, 2) creation of a new organization(s) or 3) reinforce national crop protection services to such an extent that they are able to deal with these types of problems

Due to the complexity of this problem, the evaluation team recommends a separate study to consider the cost/benefits of these alternative possibilities

Some of the issues which should be considered in this type of study are

- As presently structured, OCLALAV depends on its member countries for funding This funding has not been sufficient in the past to assure operations. Member countries also have an influence on personnel management within OCLALAV This has created situations in which ineffective personnel could not be eliminated from the organization In order for a regional crop protection organization to be effective, it must have financial and administrative autonomy

- A revision of the current survey/control strategies must be made This should take into account modern advances in technical tools which could be adopted to pest problems (computers, remote sensing, mathematical models of population dynamics, biological control, modern insecticides)

- It is essential to continue "OCLALAV TYPE' ground survey operations, in particular for Desert Locust and other migratory acridiens

- It would be beneficial to have aerial control capabilities based in the Sahel for locust and other pest situations In order for this to be more cost effective, operations could be envisioned in both the agriculture and public health sectors

Any eventual projects developed by a study team should be with the agreement of all concerned parties (Sahelian and Northern African countries, donors, international organizations) A guaranteed source of long-term funding is essential to assure smooth operations

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