EVALUATION OF THE 1987 GRASSHOPPER CAMPAIGN IN THE SAHEL

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JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

REPORTS OF THE VARIOUS COUNTRY MISSIONS

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JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

BURKINA FASO

Mission: (2-7 October 1987)

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JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

BURKINA FASO

1. INTRODUCTION

1. Burkina Faso, a largely agricultural country, suffered from large-scale grasshopper infestations (mainly Oedaleus senegalensis) in 1986; a total of 232,900 hectares were treated with pesticides, of which 20,900 hectares by ground treatment and 212,000 hectares by aerial spraying.

2. During these operations, a total of 314 tons of pesticide powder and 61,000 litres of ULV liquid pesticides were used. This large-scale campaign was made possible through the support of the international community and by the decentralized organization of the National Plant Protection Service.

3. As the risk of new infestations during the 1987 agricultural season were very large, the international community again furnished large-scale assistance to Burkina Faso's National Plant Protection Service.

4. The mission, which visited Burkina Faso from 1 to 7 October 1987, was charged with examining the development of the grasshopper populations, the functioning of the monitoring and rapid alarm systems, training, control operations, crop losses, the organization and coordination structures involved and any long-term considerations.

5. The mission would like to thank all those who worked with it and provided the information that is reflected in the present report.

2. THE DEVELOPMENT OF THE GRASSHOPPER SITUATION IN 1987

2.1 The Weather

6. In northern Burkina, the area in which grasshopper infestations most frequently occur, the rainy season began late, except at Ouahigouya, where 70.3 mm of rain were registered in the first decade of June. In the areas of Dori and Djibo, some rain fell in June, but it was not regular. Rainfall was below normal in the month of August in all regions of northern Burkina; it only approached the norm in the month of September.

2.2 The Grasshopper Situation

7. The first hatching took place in the Yatenga (Ouahigouya) where the rains were not late. At Ramsa (36 km south of Ouahigouya) hatchings of Oedaleus senegalensis were noticed on 12 and 13 June. At Bembella (south-west of Ouahigouya) 4th and 5th instar hoppers were noticed: hatching must have taken place in this area at the end of May. Because

of low, badly-distributed rainfall, grasshopper densities per square metre were very low, including in the 8,030 hectares attacked in the region of Ouahigouya; during the first phase, only 2,342 hectares were treated. Grasshopper densities were often 1 or less than $1/m^2$, and did not therefore need treatment. During Phase II, in the same region, some 450 hectares were attacked; grasshopper densities reached 3 to 4 adults/m^2 and hoppers of various instars were frequently found together with the adults. The most commonly found species were Oedaleus senegalensis and Kraussaria anguilera. By 3 October, 290 hectars had been treated.

8. In other regions of the north (Dori, Djibo) the first hatchings were late, following the late onset of the rains; the irregularity of these rains did not favour the development of the grasshoppers. Violent sand storms in the region at the beginning of the campaign seem to have resulted in a mechanical destruction of a large number of the first hatchings.

9. During Phase I, 5,054 hectares were attacked in the region of Dori, most frequently at very low densities (less than $1/m^2$); 3,168 hectares were treated. At Djibo, in the same phase, 107,639 hectares were infested with grasshoppers, of which 576 were treated; densities were generally very low. The most common species at Djibo were Acrotylus sp. and Pyrgomorpha sp. During the second phase, rainfall was higher, and 1,200 hectares were infested with Oedaleus senegalensis at Tin Akoff at densities from 4 to 5 adults/m^2; aerial treatment was carried out.

10. At Bogandé at the beginning of the second phase, in a strip of low-lying ground, 700 m by 20 km long, attacks by Hieroglyphus daganensis and by Cataloipus fuscocerulipes, at densities of 9 to $10/m^2$, took place.

11. At Dedougou, Kaya and Arbinda, both the areas attacked and densities were very low. At Dedougou, Pyrgomorpha sp. was noted as well as Oedaleus senegalensis.

12. In general, the grasshopper situation was very calm. Some treatment took place in areas of high density, above all to prevent breeding and laying. Although the grasshopper populations were not very large, attacks by armyworms (Spodoptera exempta) were, on the other hand, very extensive in a number of regions, and 10,410 hectares were affected. All areas infected by armyworms were treated.

2.3 Egg-pod surveys

13. No egg-pod surveys took place at the end of the 1986 Campaign, nor at the beginning of the 1987 Campaign, because the National Plant Protection Service did not have adequately qualified personnel. At the end of the 1986 Campaign, the areas in which laying had been noticed were considered to be the zones at risk, requiring more careful monitoring during the 1987 Campaign.

2.4 The Effects of Control Operations on the Populations

14. An evaluation of the efficacity of treatment was undertaken three days after each spraying. Mortalities of between 80 and 90% were observed.

2.5 Residual Populations at the End of the Season

15. There were no large-scale infestations this year, and control operations were undertaken in all regions where the grasshopper density per square metre was high. Therefore, as the mortality rate was between 80 and 90%, the residual populations at the end of the season should not be very large. Nonetheless, partly because the control campaign was not yet over when the mission visited, it has not been possible to make any firm estimate of residual populations.

3. SYSTEMS OF MONITORING AND RAPID ALERT

3.1 The Performance of the National Monitoring System

16. The mission which evaluated the 1986 grasshopper campaign recommended the following:

- The improvement of training and education at all levels
- The development of a radio network to allow the rapid transmission of data
- The strengthening of monitoring through the use of a helicopter so as to better evaluate and follow the development of pest populations.
- The more rapid transmission of meteorological data which would assist in predicting the risks of grasshopper upsurges.

These recommendations were all implemented.

17. In the northern provinces the most menaced by grasshopper infestations, the plant protection system was reinforced. Eight ground, and three aerial units were set up, all with fixed or mobile radios. The aerial teams were based at Ouahigouya, Dori and Djibo. The Chief of the aerial unit is responsible for all operations in the area. Attached to each aerial unit are two or three prospectors. Each day, they transmit by radio information on pests in their zone to the Directorate of the National Plant Protection Service. These data form the daily prospection record. This year, monitoring of the grasshopper situation was largely carried out by the rural population itself. In each village of the zones at risk, a Phytosanitary Intervention Cell (CIP), made up of five farmers, was set up. Data flowed from the person responsible for the CIP to the officers in charge of the agricultural sectors, who transmitted them to the national aerial or ground control units. The system, as set up, allowed the National Plant Protection Service to rapidly identify the zones where hatching was taking place and to follow the development of the grasshopper situation in all areas at risk.

3.2 The Use of Information in the Management of Control Operations

18. Data forwarded by the CIPs was the basis on which a decision was taken as to whether populations were large enough to justify chemical control. If densities appeared high, control was carried out by the farmers themselves, under the supervision of the Sector Chief. Where the areas attacked appeared to be large, and where the crops were relatively advanced, ground teams of the National Plant Protection Service undertook control operations.

19. Helicopter prospections over large areas allowed the identification of the zones infested and, after a check by ground teams, aerial control was undertaken when the grasshopper densities warranted it.

3.3 Recommendations

20. This system was set up only for the 1987 grasshopper campaign. In the medium term, it will be necessary to establish a monitoring network for all food crop pests. The network could build on the work of the CILSS Integrated Pest Management project (observation posts have been built, personnel trained to take the necessary observations, and equipment installed for meteorological purposes and for biological observations, motorcycles for transport have been provided, etc.).

4. TRAINING

4.1 Training Activities in 1987

21. A very large-scale training programme has been carried out. Not only farmers, but all professional categories of the National Plant Protection Service, and the agents of what used to be the ORD (Regional Development Organism) have benefitted.

4.1.1 Farmer Training

22. Between 15 February and 15 April, and between 30 April and 15 May, 1987, farmers, organized into phytosanitary intervention cells, were trained by the chiefs of the Phytosanitary Bases. 14,140 farmers were trained in this way, of whom 468 where women. Training covered, above all, the use of application equipment (powdering bags and sprayers), precautions that should be taken when using pesticides, and the identification of grasshoppers, but elementary monitoring and reporting procedures were also taught. In the two years, 1986 and 1987, a total of some 25,000 farmers have been trained.

4.1.2 The Training of Technicians

23. So as to train both technicians from the National Plant Protection Services and technicians from the ORD (Regional Development Organism), training courses were organized in Burkina by FAO and GTZ consultants and outside the country, in Niamey, by the CILSS Department

of Training and Plant Protection, and in Dakar by FAO. All technicians in the National Plant Protection Service received some training in plant protection, particularly in grasshopper control.

4.1.3 Training of Higher Level Personnel

24. i) Four officers of the National Plant Protection Service took part in a training course in Montpellier on the rational use of pesticides and on grasshopper control methodology (8 January to 13 February 1987).

ii) Between 4 and 15 May 1987, two officers of the National Plant Protection Service participated in the training course on "expertises acridiennes" at Montpellier.

4.2 Public Information

25. Posters giving information on precautions to be taken when using pesticides were widely diffused. Public meetings at village level were also organized to provide farmers with information on grasshopper control.

4.3 Further Needs for Medium and Long-term Training

26. The training carried out by the FAO consultant, especially on prospection methods, was extremely useful to the national technicians. Training of such sort should continue and should include field visits. So that Burkina Faso does not have always to fall back on foreign assistance, it is indispensable to immediately train two National Plant Protection Service officers in acridology. This training should be in two parts:

- theoretical studies in a university able to provide a higher study certificate or the equivalent;

- practical field work, which could form the basis of a Doctoral thesis.

4.4 Evaluation

27. The training given meant that the personnel involved were much more able to undertake grasshopper control campaign. The training by the FAO consultant was particularly appreciated: the fact that he was both an African and a grasshopper expert, who therefore understood the local problems of the African countries, was largely responsible for the quality of the training program.

4.5 Recommendations

28. Burkina Faso should receive two bursaries for studies in grasshopper entomology as soon possible. Burkina should at the same time agree that the two specialists should return, after their studies, to research work, monitoring, or control activities related to grasshoppers. Until enough high-level national manpower has been trained, consultants should be used for the local training of technicians in the Plant Protection Services and of the farmers.

5. CONTROL OPERATIONS

5.1 The Preparation of the Campaign

29. The planning of the 1987 Campaign began on 13 November 1986. In the light of the large-scale infestations in 1986, and the operations against them, it was assumed that infestations would be similar in 1987.

30. The plan therefore assumed that, in Phase I, immediately followed the onset of the rains, ground control of some 50,000 hectares, and possibly aerial control of some 100,000 more hectares, would be necessary. In Phase II (control operations against adult grasshoppers in the ripening crops), aerial control of some 275,000 hectares was provided for, as well as ground control of some 25,000 hectares.

31. In December, requests were made to donors for insecticides and other inputs for the campaign. As a result, the necessary inputs were delivered during the first six months of 1987, which allowed the National Plant Protection Services to organize three aerial intervention units and eight ground teams in May 1987.

32. The plan included, in Phase I, extensive control operations with dusting bags by farmer brigades. For this reason, more than 14,000 farmers, from 362 villages, were given one day training courses. This training was vital element in the campaign, because the early destruction of a large number of grasshoppers would greatly facilitate the rest of the campaign. Large quantities of insecticides were transported from Ouagadougou to the three aerial bases at Ouahigouya, Djibo and Dori.

33. Some 77,000 litres of pesticides, the equivalent of 365 drums, had to be transported to the bases. Four vehicles were borrowed from the Ministry of Family Welfare, and two lorries from UNICEF, which also provided drivers and covered the incidental costs of the operation.

34. Apart from insecticides for aerial operations, 583 tons of Propoxur dust were distributed to the eight ground control teams, which further distributed it locally amongst the villages for use against the first hatchings.

35. On the basis of the distribution of populations at the end of the 1986 season, the three aerial units were stationed to the north-west, north, and the north-east of Ouagadougou.

36. Almost all of the equipment and supplies necessary were in place by the end of May. A lack of vehicles and mobile radios meant that a number of teams had, at the beginning of the campaign, only two vehicles with radios, instead of the three that had been planned.

37. The vehicles provided by Italy arrived later and ground control units are now up to strength. Some supplies came late, because of transport problems between the port of Abidjan and Ouagadougou. This problem arose from the fact that a number of donors do not agree to pay transit costs, even though these are different from import charges. In fact, all donations to the campaign were free of tax.

38. So as to increase operational efficiency, all control units were made directly responsible for their own petrol supply.

39. Detailed instructions were also given on the data to be daily transmitted to the central Plant Protection Service in Ouagadougou, which included:

- prospection and reporting;
- control activities;
- proposed activities;
- other information.

5.2 Funds and Supplies Available

40. The Ministry of Agriculture covered the salaries of the regular Plant Protection Service personnel (eight high-level officers and twenty medium-level officers (technicians)) and of drivers. Two drivers were also temporarily seconded to the campaign by the Ministry of Agriculture. Temporary additional staff, drivers and labourers, were employed with funds made available by donors for general operating expenses.

41. Tents for the ground teams were made available by both donors and the Ministry of Popular Defense. The number supplied is not cited anywhere, but there were 18 at least in the province of Yatenga alone. Assistance given by the donors reached over US$ 3 million. The largest element was pesticides, but some US$ 578,000 were made available for operating expenses (See Annex II). Application equipment, vehicles, and flying hours were provided, and costs of training and technical advice were also covered.

5.3 Control Operations Undertaken and the Areas Treated

42. During the brief period the mission passed in the country, it was not possible to obtain complete information on the size and precise location of all infestations treated. Nonetheless, a number of general remarks can be made: the first and most important is that control operations were on a much smaller scale than had been expected.

43. Large-scale hatching occurred in the north-west and in the north-east of Burkina Faso, which confirmed that the aerial units at Ouahigouya, Djibo and Dori had been correctly placed. Hatching was observed in the middle of the month of June, following the first rains. These early rains were nonetheless followed by a period of dryness, with high temperatures and sand storms. The sandy winds and dehydration destroyed a large proportion of the young hoppers.

44. Phase I of the campaign, against the first hatchings, was largely carried out by the farmers. A helicopter was used for 49 hours of

prospection and reporting. According to National Plant Protection Service, a total of 9,062 hectares were treated. Most of this area was treated by the farmers themselves, but the Plant Protection Service intervened in a number of places where the grasshopper populations were heavy enough to make this necessary. Large areas were treated by the teams of Ouahigouya (2,342 hectares), Dori (3,168 hectares) and Bogandé (1,543).

45. All control operations in Phase I used Propoxur dust. The equipment available included a large number of battery powered ULV sprayers and motorized knapsack sprayers and dusters. Though it was originally intended that they should be used by the farmers, the National Plant Protection Service did not believe that they were sufficiently trained to use them well. Further training is envisaged.

46. At the time this report is being written, Phase II, including aerial control in the region of Tin Akoff, is still been carried out. The National Plant Protection Service does not believe that the level of infestations surpasses their intervention capabilities, and remains confident that the grasshopper populations will be reduced to acceptable levels. At the time of control activities being launched, grasshopper densities were four adults/m^2.

5.4 Evaluation of the Efficiency of Control Activities

47. Control activities were very limited, because of the low grasshopper densities. No treatment occurred without prospectors first checking the reports and confirming that the densities observed were sufficient to need treatment. The intervention thresholds fixed by National Plant Protection Service were 9 hoppers/m^2 and 4 adults/m^2.

48. The efficiency of the treatments undertaken is systematically evaluated by comparing the grasshopper densities before, and three days after treatment. The efficacy of treatment in Phase I is estimated between 80 and 90%. In no cases was treatment judged inefficient.

5.5 Evaluation of the Pesticides, Equipment and Aircraft Used in Spraying

49. No pesticide tests were carried out in Burkina Faso during this campaign. In general, the dosage rates indicated on the labels of the products used were followed. The farmers used Propoxur 1 or 2% dust at 120-200 gr. of a.i./ha. For ground treatment, powder formulations were preferred to more concentrated formulations, because farmers, and the staff of the National Plant Protection did not have the training or the necessary experience to use ULV formulations, or simply more concentrated formulations.

50. Small-scale operations were carried out by the farmers with dusting bags; motorized knapsack sprayers were used by the staff of the Plant Protection Service. For large-scale ground treatments, there had been training in the use of Micronair AV 7000 ULV sprayers mounted on trucks. All the necessary preparations had been made for aerial control, but, this year, very few aircraft were used. The use of helicopters for survey in distant and difficult regions is necessary and should be recommended.

5.6 Impact on the Environment

51. The very limited scale of control operations meant that the impact on the environment was limited. The precautions that were observed during control operations will certainly limit secondary effects. In all operations, care was taken to avoid water courses and inhabited areas. Posters detailing security measures to be observed during and after pesticide application were widely distributed. The evaluation mission noted, at Ouahigouya, that safety and health measures (the cleaning of protective clothing, boots, gloves, etc.) were respected.

6. CROP LOSSES

6.1 Report on Crop losses

52. At the time of the evaluation mission, no significant crop losses have been noted. It will therefore be necessary to wait until the end of the agricultural season before attempting to evaluate them. That there is no serious crop damage can be imputed both to the low population levels and to the efficient control campaign carried out in the few zones where population densities were high.

6.2 Cost/benefit Analysis of Control Operations

6.2.1 Costs

53. Costs include:

a) Government contributions, that is the salaries of the permanent Plant Protection personnel, the cost of 194 tonnes of Propoxur and of some of the necessary equipment. The analysis does not include this contribution, which was not costed.

b) Donor contributions amounting to more than US$ 3 million (source FAO: situation at 10 August 1987).

6.2.2 Benefits

54. Donor contributions can be considered as a form of "insurance" with the aim of sparing the people of the Sahel serious food shortages which might have been caused by grasshopper damage. The agricultural area which might have been attacked by grasshoppers in Burkina Faso has a total potential cereal production 831,530 tons (source FAO: 1986 evaluation report). At the market price of FCFA 90/kg, the value of this potential cereal production may be estimated at US$ 250 million. The donor contribution of US$ 3 million, seen as a form of "insurance", therefore cost about 1.2% of the potential production, which appears very reasonable when taking into account the real threat that the heavy grasshopper infestations at the end of last year posed. Moreover, it should be noted that a large part of these contributions will remain of use for a number of years, thereby contributing to the reinforcement of the National Plant Protection Service.

7. ORGANIZATION AND STRUCTURES

7.1 The Role of the National Coordinating Committee

55. This Committee, which included the Ministry of Agriculture, Plant Protection, the Donors, and Regional and International Organizations, has a very important role to play in:

- evaluing the needs of the campaign;
- finding finance and supplies rapidly as the needs are identified;
- reallocating, when necessary, some of the assistance pledged;
- monitoring the grasshopper situation and operations.

56. Within the larger Committee, a technical Committee was formed, and included experts from the National Plant Protection Service, the Canadian expert with Plant Protection, and the consultants supplied by FAO, USAID and Italy. This committee made following the grasshopper situation at the end of the first phase much easier. The National Coordinating Committee maintained permanent and useful liaison between the National Plant Protection structures and the donors.

7.2 Improvements to the National Plant Protection Service

57. Apart from protecting food crops, the two years of campaign against grasshoppers have:

- begun training the necessary national personnel in all aspects of grasshopper survey and reporting.
- provided a stock of pesticides and equipment (Unimogs, 4x4 vehicles, radios, sprayers, protective material);
- made the national authorities and public opinion, as well as the donors, aware of the importance of plant protection in a strategy of food self-sufficiency.

7.3 The Role of the Regional Organizations

7.3.1 CILSS

58. CILSS has worked for very close collaboration between the various countries of the Sahelian sub-region. Nonetheless, there are many difficulties in the rapid transmission of information. A number of solutions for coming years are under consideration, in particular the establishment of common radio frequencies. The Plant Protection Department (DPV-CILSS) organized a workshop on the judicious use of pesticides, and the regular programme trained the technicians in acridology.

7.3.2 OCLALAV

59. As Burkina Faso did not suffer from Desert Locust infestations, it was impossible to judge the role of OCLALAV.

7.3.3 PRIFAS

60 The SAS Operation organized in 1986 by PRIFAS continued in 1987. Its objective is to better follow the development of grasshopper populations in the Sahel. The information generated is transmitted in a series of letters. This information did not allow good prediction. It was more useful as an overview of the grasshopper situation and its more or less short-term consequences. Collaboration with the National Plant Protection Service will allow, in future, better collection of information on grasshoppers. PRIFAS also organized a course entitled "expertise acridienne", and a course on the rational utilization of pesticides in grasshopper control, at Montpellier.

7.4 The Role of FAO

61. The FAO training consultant organized excellent theoretical and practical training courses, which were much appreciated by the participants.

62. In the 1986 Campaign, the FAO Representative was Secretary of the National Coordinating Committee and at the same time played an important role in setting up the structures for ground and, above all, aerial control. This year, the Secretariat to the Committee was assumed by the National Plant Protection Service which also managed the control campaign and all operations involved, so that FAO's role became that of an advisor. This is a positive development.

8. FOLLOW-UP AND LONG TERM CONSIDERATIONS

8.1 Stocks at the end of the 1987 Campaign

63. The mission noted that chemical control in the first phase was much less than had been expected. The development of the second phase, at the time of its visit, suggested that there would be large stocks of pesticides remaining over at the end of the campaign. It will nonetheless be necessary to await the end of the second phase for a definitive evaluation of the stocks.

64. The equipment that was supplied (vehicles, radios, unimogs and spraying equipment) will be available for future campaigns.

8.2 The Use of Empty Pesticide Containers

65. Some of the drums in which liquid pesticide was supplied have been used to mix powders intended for seed protection.

66. Other drums will be buried by the Army, which has been requested to dig suitably large and deep holes.

8.3 Preparations for Future Years

67. Following the infestations of this year, it will be necessary to define the zones at risk next year, and to increase monitoring activities in them.

68. Building on the experience of the CILSS Integrated Pest Management Project, a monitoring network for crop pest should be installed.

8.4 The Long-term Improvement of Crop Protection Structures

69. The equipment that was supplied greatly strengthened control teams, and allowed rapid liaison between the phytosanitary bases and the central Plant Protection Service at Ouagadougou. The training given to Plant Protection staff improved their knowledge on the various grasshoppers, and of control operations, particularly aerial, as well as of environmental protection.

9. RECOMMENDATIONS

70. The Government of Burkina Faso, the Donors, and all who took part in the control campaign against grasshoppers should be congratulated for its effective preparation and implementation.

71. Nonetheless, following two years of emergency campaigns, there is a risk that a large number of the farmers and the staff of the Plant Protection Service have become too used to chemical control and believe it the only possible method. They must be taught that the large-scale use of pesticides should only be resorted to when absolutely necessary, and that it can have potentially dangerous effects on people, animals, and the environment.

72. It is therefore necessary:

a) to establish a minimum intervention threshold to and apply this;

b) to systematically evaluate control operations for secondary effects on humanity, animals and on useful insects, and phytotoxicity;

c) to include information on the secondary effects of pesticides in training programs for farmers and for the staff of the Plant Protection Services;

d) to give greater priority to those measures which can help limit the large-scale use of pesticides (that is, monitoring, rapid alert and spot treatments).

73. There is a risk that the pesticides which were not used (above all Propoxur powder) will deteriorate before they can be used. To avoid this, the National Plant Protection Department needs assistance in:

- developing and implementing a modern system of pesticide storage, which will allow for pesticide deterioration;

- monitoring the potency of pesticides in stock, by chemical, biological and laboratory methods.

74. The training of farmers and the staff of the Plant Protection Services should continue: qualified consultants should be charged with this. Two higher-level staff members should be trained in acridology, with their practical work taking place in Burkina Faso.

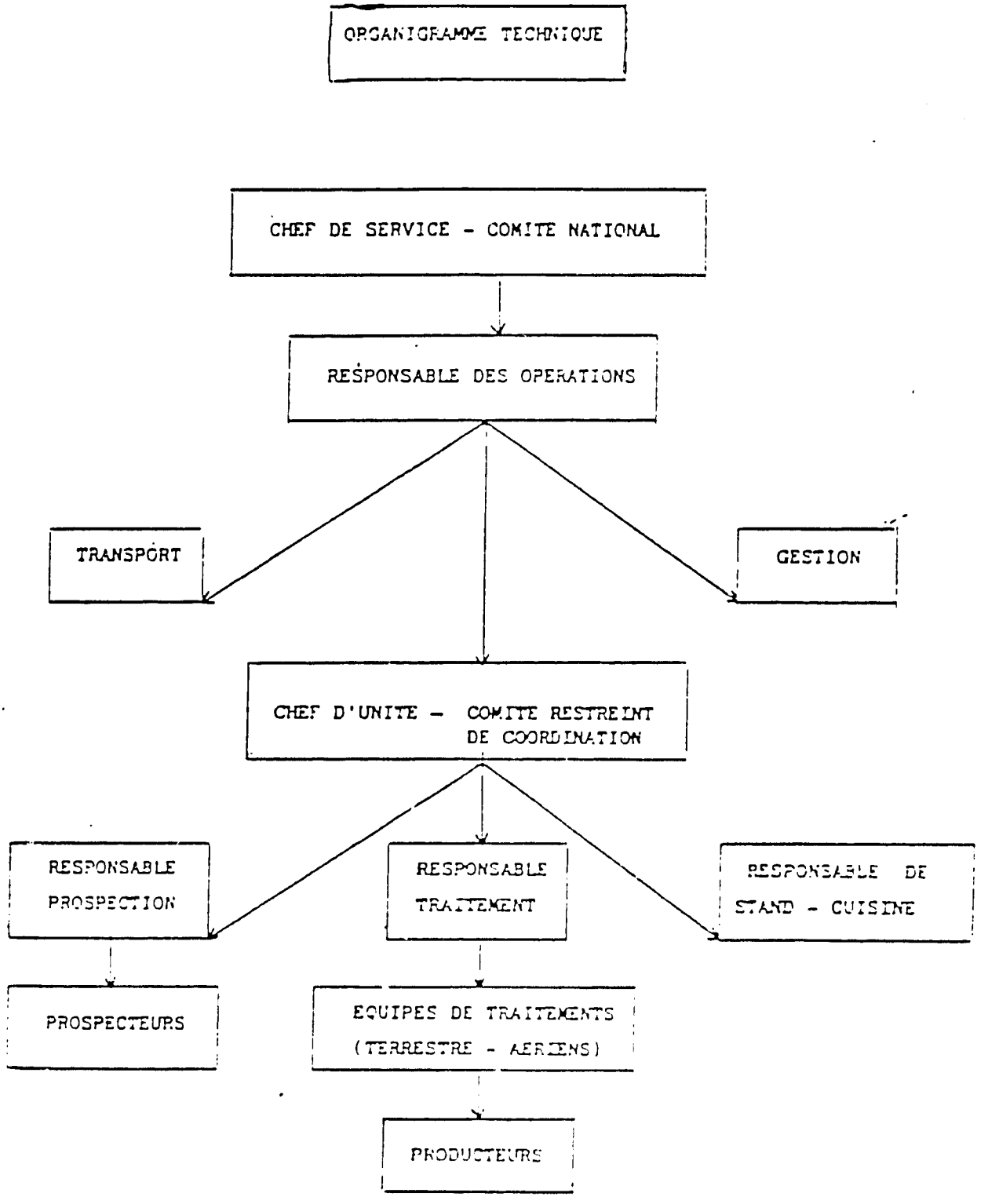
75. A permanent network to survey food crop pests should be set up, so as to allow rapid warnings and localize control operations, thereby avoiding emergency programs with large-scale spraying.

76. The organization of the rural population into phytosanitary intervention committees should continue, so that they may progressively take over ground control of their crops. The National Plant Protection Service would then intervene only against large-scale infestations.

77. It would be adviceable for the donors to agree to cover pesticide transit costs. The Government of Burkina Faso should take all necessary measures so that any gifts which arrive at the airport, or at the station, are immediately collected, thereby avoiding storage charges.

78. For 10 years now, Canada has assisted the National Plant Protection Service, and should be both congratulated and urged to continue this support in the same fields as before. For the proper reinforcement of Plant Protection, other assistance, both medium and long-term, to cover sectors which the Canadian funds do not provide for, should be considered. Emergency campaigns are not a long-term solution for the production of food crops; the only real solution lies in adequately reinforcing the National Plant Protection Service and in the effective participation of farmers in the protection of their own crops. The mission noted that the Netherlands has already shown an interest in contributing to this work.

ANNEXE I


ORGANIGRAMME TECHNIQUE
CHEF DE SERVICE - COMITE NATIONAL
RESPONSABLE DES OPERATIONS
TRANSPORT
GESTION
CHEF D'UNITE - COMITE RESTREINT DE COORDINATION
RESPONSABLE PROSPECTION
RESPONSABLE TRAITEMENT
RESPONSABLE DE STAND - CUISINE
PROSPECTEURS
EQUIPES DE TRAITEMENTS (TERRESTRE - AERIENS)
PRODUCTEURS

A N N E X E II

S I T U A T I O N D E S R E A L I S A T I O N S D E S E N G A G E M E N T S *

	FAO/PNUD	FAO/CEE	FAO/USAID	CANADA	FRANCE	HOLLANDE	ITALIE	URSS	USAID	RFA	SUISSE	CHINE POI
EMETTEURS-RECEPTEURS		-	12+8 antennes fouets	-	6+5 ant. fouets	-	-	-	-	-	-	-
PESTICIDE												
- Propoxur 5%, 2%	-	-	-	310 T	-	100 T	-	-	-	173,3T	-	
- Fenitrothion 20%, 50%	-	-	-	-	5.000 L	-	-	-	-	20.000L	-	
- Fenitrothion 100G, 96%	-	15.320 L	-	3.650 L	3.000 L	20.000 L	-	-	20.000L	-	15.000	
- Bursban 12%	-	-	-	-	-	-	1.000 L	-	-	-	-	
- Malathion 50%	-	-	-	-	-	-	7.520 L	-	-	-	-	20 T
- Callixur 75%	-	-	-	400Kg	-	-	-	-	-	-	-	
APPAREILS DE TRAITEMENT												
- Atomiseurs	-	-	-	-	100	300	194	-	-	-	-	
- Pulverisateurs/Poudreu-ses a gros debit	50	-	-	-	-	-	56	-	-	3	-	
- Micron ULVA	-	-	-	-	500	-	-	-	-	512 +4100piles	-	12
MATERIEL DE PROTECTION												
- Atrophe (doses)										400		
- Combinaisons	-	-	-	-	-	-	249	397	-	500	-	
- Bottes (Paires)	-	500	-	-	-	-	249	251	-	505	-	
- Gants (Paires	-	500	-	-	-	-	248	201	-	1000	-	
- Lunettes (Paires)	-	500	-	-	-	-	240	302	-	1000		
- Masques (échanges)	-	700 (R)	-	-	-	-	510	1000	-	1000	-	
MATERIEL DE CAMPEMENT												
- Tentes	10	-	-	-	-	-	25	-	-	-	-	
FRAIS FONCTIONNEMENT												
- Milliers de F CFA	-	-	-	116.000	15.000	15.000	-	-	-	9.250	20.000	

* Dans ce tableau ne sont pas pris en compte les heures de vol, les véhicules, la formation et l'expertise fournis pour la campagne 1987.

ANNEX III

PERSONS MET

MINISTRY OF AGRICULTURE

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- Mr. S. Traore	Chief of the National Plant Protection Service (SNPV)
- Mr. R. Ouedraogo	Officer in charge of operations in the SNPV
- Mr. M. Coulibaly	National Plant Protection Service
- Mr. S. Sangare	Chief of the aerial unit at Ouahigouya
- Mr. A. Traore	Chief of the phytosanitary base at Ouahigouya
- Mr. P. Yameogo	Chief of prospections in the aerial unit at Ouahigouya, National Meteorological Unit

DONORS

Canada

- Mr. M. Leblanc	Chief of the Canadian Cooperation Centre (CCC)
- Ms. A. Gaudet	Assistant Director of the CCC

EEC

- Mr. S. Illing	Economic Counseller

Netherlands

- Mr. R. Muyzert	Coordinator of the Sahel Programme
- Mr. R. Guarda	Resident Representative
- Mr. F. Lyons	Assistant Resident Representative

FR Germany

- Mr. P. Dettmar	First Secretary

USA

- Mr. B. De Marken	Liaison Officer for CILSS and Emergency Programmes
- Mr. Seatle	Consultant

CILSS

- Mr. M. Brah	Executive Secretary

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- Mr. G. Diagen	Representative
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- Mr. Ben Halima	Consultant

FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

CAMEROON

Mission: (22-26 October 1987)

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Mr. Carl Castleton (USA)
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JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

CAMEROON

1. ACKNOWLEDGEMENTS

1. The evaluation team wishes to thank the persons encountered during its mission for their open and fruitful discussions and their willingness to spare their time, even during the weekend.

2. EVOLUTION OF THE GRASSHOPPER AND LOCUST POPULATIONS IN 1987

2.1 Organization of the Plant Protection Service

2. The structure of the Plant Protection Service of Cameroon generally, and in the Far Northern province in particular, are depicted in Annexes II and IV. The central organization for plant protection at provincial level in the Far Northern Province is the Phytosanitary Base at Maroua, where planning and decision making are carried out. A stock of control equipment and pesticides is maintained, under supervision, at the Maroua base. The province is divided into several departments (Far North: 6; North : 4) each of which houses a Phytosanitary Brigade. This brigade coordinates crop protection at departmental level and carries out surveys and control operations. A brigade normally consists of 5-10 people who have been trained in surveying and primary pesticide applications (survey scouts/sparymen). The monitoring of grasshopper populations was carried out largely, however, by the extension agents in the villages.

3. They report to the brigades, where pest outbreaks are concerned, but, for administrative purposes, are part of the Departmental Agricultural Committees. The FAO consultants are based at the Far Northern Phytosanitary Base in Maroua. Central coordination of grasshopper control was carried out at the Plant Protection Sub-Direction (Opérations Department) in Yaoundé.

2.2 The weather

4. The first rains in the north of Cameroon fell around 25 May and lasted for a week (>100 mm). After these rains, a dry spell was recorded until the end of June. The months of May, June and July were much drier than in 1986 but in August and September normal amounts of precipitation were recorded. October has been dry to date. Data on the movement of the Intertropical Convergence Zone were not available.

2.3 The grasshopper and locust situation

5. The first hatchings of Oedaleus senegalensis took place in mid-June. Infestations were very localized and generally comprised relatively small areas of wild vegetation. Grasshoppers were seldom found in sorghum or millet fields in the early months of the wet season. Until the end of August, the major species encountered was O. senegalensis and, to a lesser extent Aiopolus simulator (Annex 5). The highest densities were found in the Far Northern province. The drought during June and July is thought to have caused a considerable reduction in the populations of O. senegalensis, and the species did not reach the expected high densities over large areas. Heavy rains in August flooded great parts of the flood plains in the north of the country and probably caused another reduction in grasshopper populations. In September and October, other species became more prominent, such as Acrida bicolor, Pyrgomorpha cognata, Ornithacris turbida, Cataloipus cymbiferus and Aiolopus simulator. The latter species was found locally at high density on the dry flood plains in October, when off-season sorghum (Moussakwa) is planted.

2.4 Egg-pod surveys

6. No egg-pod surveys were carried out last year, nor are any planned for the forthcoming dry season. Because of the very patchy distribution of infestations and the large amount of manpower that would be needed, egg-pod surveys are not considered very efficient. Monitoring concentrated, rather, on establishing the distribution of hoppers after the first rains.

2.5 Effect of control operations

7. The first treatments against O. senegalensis were carried out in mid-June by the staff of the Plant Protection Service, and by farmers using dust formulations. These dust treatments were not very effective, and therefore, further treatments were carried out by the PPS brigades using liquid formulations, which were more efficient. Treatments during the rainy season, mostly carried out in wild vegetation, caused local and often temporary reductions in grasshopper populations. Infestations of A. simulator in off-season sorghum were being treated with liquid formulations in October. The efficiency of these treatments is doubted by the evaluation mission. By 31 September a total of 13.069 ha had been treated (phase I + phase II) but spraying continued.

2.6 Residual Populations

8. Because of the relatively low populations of O. senegalensis in 1987, high initial infestations of the species are not expected at the beginning of the 1988 rainy season. A return to normal, natural population levels can be expected in the region. Local plant protection experts expect that an increase in population levels of the minor species (observed in 1987) will continue in 1988. However, massive outbreaks are not, of these species expected. Aiolopus simulator may possibly cause damage in rainfed cultures neighbouring flood plains, at the start of the rainy season of 1988, but this is by no means certain.

3. MONITORING AND EARLY WARNING SYSTEMS

3.1 Performance of the national monitoring system

9. Monitoring was carried out by agricultural extension workers who had received some training in acridology, and by field scouts specifically trained for the job. Extension workers are based in the agricultural stations in the villages themselves. Fifty mobilettes were distributed among these agents to improve their mobility. All grasshopper data were compiled on standard forms (Annex 8) by the agents and handed in to the Phytosanitary Brigade of the department at least once a week (petrol for the mobilettes was distributed to these brigades and was used as an incentive for the correct and speedy completion of the forms). Further monitoring was carried out by brigade personnel. In the Far North, 56 survey scouts/spraymen had been trained for this work. All brigades were equipped with a radio and were in daily contact with the Phytosanitary Base in Maroua. This network allowed the fast and detailed exchange of information. Control equipment was kept with the Brigades and was therefore ready for rapid treatment. The Phytosanitary Base in Maroua housed the two FAO Consultants charged with the overall technical coordination (an acridologist and a logistician).

3.2 The use of information for control operations

10. The reports handed in by the extension agents and scouts served as the basis for decisions on the need for control operations. The quality of this information could not be assessed by the evaluation team. However, given the scouts and control teams relatively short experience with grasshopper surveys, these data were probably not always sufficient to make correct decisions on control operations.

11. However, the evaluation team would emphasize the great importance of the existing monitoring system: in a very short time, the provincial Plant Protection Service, together with the FAO consultants, has succeeded in establishing an effective network in which rapid exchange of information is possible. This structure should therefore be maintained and strengthened. Funds must be, in the future, be made available to include the monitoring of other pests and food crops diseases.

12. According to PRIFAS, 111 copies of the SAS Bulletin were distributed in Cameroon. However, these do not appear to have reached many decision-makers in the northern provinces. The bi-weekly grasshopper prediction maps produced by AGRHYMET in Niger were not available to decision-makers in the Far North.

3.3 Recommendations

13. 1) Egg-pod surveys should be carried out at least in those areas which are known to be potential sites of high infestation. These surveys enable realistic estimates of likely grasshopper

hatchings, and of the financial or material requirements, and need to be carried out early in the year.

2) The grasshopper monitoring network in North Cameroon is of high value, and should be maintained and strengthened. The assessment of other important pests and diseases has to be included in future.

3) In order to implement recommendation 2, training activities must be increased at all levels: at the level of scouts and extension workers for the improvement of pest surveys in the field, and at higher levels for the improvement of the technical decision-making capabilities for pest assessment and control.

4) Efforts to make farmers more aware of the importance of monitoring potential pests in and around their own fields should be continued and increased. This is a key both to an effective early warning system and to the increased integration of farmers in early season control.

5) Contacts should be established between the provincial plant protection services and PRIFAS/AGHRYMET for the exchange of information. SAS bulletins and forecast maps should go directly to the provincial PPS-base, so as to prevent delays. The data-forms presently used by the field scouts should be replaced by the standard PRIFAS/SAS forms (which are used in most of West Africa). These grasshopper infestation data should be sent regularly and directly from the provincial PPS to AGHRYMET. Only in this way can the biomodel in use at AGHRYMET hope to make accurate predictions of grasshopper outbreaks in the north of Cameroon.

4. TRAINING

4.1 Training activities in 1987

14. Training played a key role in the 1987 campaign. The FAO consultant developed two short practical courses. The first concerned control strategies and the safe utilization of application equipment, and was given between April 21 and 30 by the consultants Soumare and Praker to 199 agents from the northern provinces. The last three days of the course were also attended by spraymen, scouts and agricultural monitors. The second course, from 11-14 May, was developed for the 27 newly-recruited scouts who needed training in survey and application techniques (Annex VI).

15. In addition, two senior staff members from national headquarters attended intensive short courses abroad, one in "expertises acridiennes" at PRIFAS, and the other in aerial application at Cranfield, in the UK.

16. The FAO consultant worked conscientiously to upgrade each brigade's knowledge of practical acridology, and encouraged agents to put together their own reference collection (at Maroua, even the secretary has her own).

17. Villagers were mobilized through direct contacts, i.e. through village meetings, called by the extension agents who lived within the district. No posters, pamphlets, or radio programmes were used. Although villagers willingly cooperated in dust applications in their fields, difficulties were frequently encountered in persuading them to treat infestations outside their own fields, as was the case with most 1987 infestations.

18. The 1987 training programme was more far reaching than the programme of 1986 which was given to only 23 agents. The courses were too short, however, to provide adequate training for so disparate an audience (which included Brigade Chiefs, District Officers, Outpost Chiefs, etc.). The daily technical advice of the FAO Consultant was undoubtedly of greater value than short courses would have been in creating a small nucleus of qualified staff. In future, the diversification of training should be emphasized. It should also include at least three days of training techniques, so that each agent is better equipped to train others. It is estimated that 2,000 farmers were trained in dust application in 1987.

4.2 Recommendations

19. 1) Further short-term training courses should be planned in collaboration with CREPHY (le Centre régional de formation phytosanitaire de Yaoundé), with the aim of developing the participants' ability to set measurable objectives for survey and control, and to facilitate the preparation of training aids.

2) The local extension services' training officers, such as those of DODECOM, should be invited to participate, so that their agents can also be trained in grasshopper control.

3) Flip charts, pamphlets and posters should be prepared as an aid agricultural monitors to transmit the message to villagers. Radio spots should be used by local authorities to encourage village participation, and should include interviews with the local farmers.

4) More funds should be provided for short-term training at PRIFAS and to ensure Cameroon's participation in regional workshops. The nominees, however, should come from the best workers of the northern provinces, not from national headquarters. Attendance at short courses should be used as an incentive for good work.

5) A pesticide application/certification course should be developed and implemented. This will be especially important if it is decided that farmers should use ULV rather than dust formulations.

6) Curriculum items on grasshopper control should be developed for use in technical agricultural schools in the northern provinces.

5. CONTROL OPERATIONS

5.1 The organization of the campaigns

20. A National Coordinating Committee was formed on 12 March, 1987, and includes representatives of the Crop Protection Services, of relevant Ministries, of FAO and donors such as the USA, the EEC, the United Kingdom, Canada, the Federal Republic of Germany, Israel, Belgium, France and the African Development Bank. A two-phase control plan was presented to the donors by the Crop Protection Service on 17 March and approved on the same date.

21. Phase I was to concentrate on the early season control of early instars nymphs in 15,000 ha of cropland and 75,000 ha of adjacent fallow, forest or pastureland. The cropland was to be treated by the farmers themselves, using dusts. The other target areas were to be treated by six mobile CPS teams equipped with motorized equipment, such as the Micronair AU 7000. Limited aerial intervention by fixed-wing aircraft was envisaged, if infestations built up beyond the capability of the ground teams.

22. Phase II was to concentrate on aerial application of ULV formulations over 10,000 ha of cropland and 70,000 ha of forest, pastureland and fallow.

23. The budget for the two-phase plan was estimated at US$ 2 million. The Government contribute supplies worth US$ 350,000 and requested an emergency allocation of US$ 175,000 from the national Treasury for early season training and the purchase of mobilettes. Donor contributions totalled US$ 1,153,120. The combined resources of the donors and the host Government amounted to 84% of the original budget estimate. The projected costs of each hectare treated was US$ 9.80 (comparable to the costs of the campaigns in other Sahelian countries).

24. The weakest point of the control plan was a tendancy to exeggerate the threat posed by the grasshopper and locust comple. It presented crisis situations, in which "nearly 400,000 ha of food crops in the outbreak zone of the Far North province risk complete destruction before maturity if the first generation of grasshoppers and locusts is not controlled". In fact, such crop loss would only have been possible if massive outbreaks of Oedaleus senegalensis had councided with gregarious locusts upsurges. Data from late season survey in 1986 did not support this hypothesis.

25. By insisting too much on the "emergency" aspect of the grasshopper problem, the National Crop Protection Service lost an opportunity to use the FAO expertise and donor support made available to develop a strategy to address the regular annual problem of modest grasshopper losses in the north, and to establish grasshopper population thresholds which would trigger more extensive campaigns when these were, in fact, necessary.

26. Since the actual grasshopper problems varied greatly from those predicted, the control activities which were carried out also differed from those planned.

5.2 Funds and inputs

27. The resources made available for the 1987 Campaign by the Government and donors are presented in Annex VII. It is important to note that, in the Far Northern province the Government of Cameroon provided an additional 27 temporary staff for pest scouts, bringing the total staff to over 92. They used thirteen vehicles, nine of which are practically new. Their work was supplemented by 50 agricultural monitors, who were based in key villages, and used mobilettes for transport.

28. Unfortunately, the arrival of the donated commodities was often delayed by sea transport time, and by difficulties in extracting the goods from the Customs at Douala. To date, several important items such as the six Land Rovers from the UK, and the remaining 100 tonnes of Propoxur dust, have still not been received.

29. The execution of the field campaign was complicated by the lack of an operating budget provided by the Cameroon Government. The Crop Protection base in Maroua at present owes US$ 6,000 in unpaid vehicle repair bills. Fuel coupons are traded for spare parts and repair services.

30. The 27 temporary employees have not yet received their salary, after three months of service, and their future conversion to permanent status is still uncertain.

31. On the whole, however, the resources received exceeded the minimum needed to ensure protection of the crops against the principal grasshopper and locust species.

5.3 Control activities

32. Annex V presents the Phase I control operations effected in 1987, up to the end of August. At that time, 10,042 ha had been treated, out of 33,852 hectares infested at densities which varied from two to 50 grasshoppers/m². Almost all treatments were effected in uncultivated areas. According to the FAO consultant, only 800 hectares were treated by villagers using dust formulations, almost all the rest being treated by the phytosanitary brigades.

33. In Phase II, the grasshopper infestations were much less than anticipated, except for Aiolopus sp. This species is currently found in abundance in many areas of dry-season sorghum. However, since the sorghum plants become resistant to grasshopper attack if they survive for a week after transplantation, it is doubtful whether losses will be serious, except for limited areas. The areas controlled in the last weeks, with Micronair AU 7000 and motorized backpack mistblowers, have not exceeded 4,000 ha.

34. The control operations carried differ sharply from what was planned, as the following table shows:

Planned	Executed	Degree of Completion
Phase I		
15,000 ha of cropland by farmers using dust	800 ha by farmers	5%
	1,190 ha (max) by the brigades	8%
75,000 ha of fallow by brigades	8,052 by brigades	14%
Phase II		
10,000 ha of crops by air	4,000 ha of crops by ground	40%
75,000 ha of fallow by air	2,500 ha by ground	3%

35. The discrepancy between the surface areas actually treated and treatments planned is probably due to three factors:

i) an under-estimation of the difficulty of pesticide application;

ii) unfavourable meteorological conditions for the large-scale development of O. senegalensis populations; and

iii) an over-estimation of the seriousness of the grasshopper threat.

36. There were several problems with the application of pesticides. Farmers were reluctant to apply dusts outside of their own plots. They were also dissatisfied with the slow knockdown and poor mortality rates of the three dust formulations used. If we assume that 2,000 farmers were trained in the use of dust formulations, and were given supplies, then the total area treated suggests that each used less than 7 kg (sufficient for less than a hectare): either the training was insufficient to motivate the farmers, or the agents who were supposed to train the farmers did not do so properly.

37. Much of the area treated by the phytosanitary brigades was fallow, woodland, or pasturelands, with grasshopper densities far below the treatment threshold of 25/m² established by meeting of December 1986 in Rome.

5.4 Pesticides, spraying equipment and application techniques

38. The most common type of application equipment was the motorized backpack mistblower, using emulsifiable concentrate (EC) formulations which have to be mixed with clean water. Usually the brigade had to haul sufficient water from the larger towns to the fields, in order to effect treatment. The evaluation mission does not consider such application methods practical for the Sahel.

39. There was a confusion over the correct use of the Micronair AU 7000 sprayers: for example, it was reported that three of the six sprayers lacked the support arm for vehicle mounting when, in fact, only three vehicle-mountable sprayers had been provided: the other three blowers/reservoirs are intended to be used on tripods for bird control. The swath width in use (25-30 m) seems much too narrow for drift spraying. No oil-sensitive paper was used to monitor droplet size or effective drift.

40. During the evaluation mission's visit, a Micronair AU 7000 mounted on a Land Rover, was being used to control Aiolopus sp. in newly transplanted dry-season sorghum. The team feels that baits would be more effective than ULV formulations for this species, because of its habit of hiding deep within cracks in the soil. Aircraft would be even less appropriate than the vehicle-mounted ULV sprayers, unless repeated applications were to be made at the peak of the creature's day-time activity (10-12 a.m.), using a pesticide of low volatility.

41. All the planes of UTAVA, the semi-autonomous air-arm of the CPS, are still grounded. France donated funds for a pilot and mechanic services, but the unit was completely non operational in 1987.

42. Pesticide trials are being carried out at the moment. They involve the products Ficam (Bendiocarb) 1% dust and 25% ULV, and Fastac (Fenvalerate) 100 EC and 40 ULV. Results of the trials have not yet been reported (Annex III).

5.5 Technical assistance

43. To a large extent, the CPS is still highly dependent upon the two FAO consultants for the coordination of its daily control operations. The chief of the provincial base is gaining considerable competence in grasshopper control, and should be able to handle daily operations in future years.

5.6 Late season control

44. The present late-season control activities are probably not necessary, as it is doubtful whether the three locust species being controlled in Mokelo are causing significant damage to food crops. The threat to dry season sorghum by the present complex of sedentary grasshoppers will soon be over, and it is time to bring the 1987 campaign to a close and start planning for 1988.

5.7 Environmental and health impact

45. During of the mission's visit, eight of 10 pesticide applicators were absent, due to illness. It was not possible to determine if they were suffering from chronic intoxication, or merely exhausted from long days without adequate rest. Other cases of possible intoxication were reported in connection with poor quality, absorbent "protective" clothing. The mission also learned that the entire stock of atropine sulphate tablets had already been consumed during the course of the campaign. Greater care should be taken in the case of human intoxication: each suspected case of intoxication should be recorded, the symptoms noted, and conditions of work that may have contributed to it identified. Any case warranting the administation of antidotes should be referred to a doctor (atropine sulfate should not be used as if it were asprin) and the operator should be given adequate time off. The inhibition of acetylcholinesterase should be periodically checked in spraymen who regularly use carbamates or organophosphates.

46. Bird deaths (probably Ardeola ibis) were reported after application of Fenitrothion 1000 ULV at 500 gr. a.i./ha. These appear to have resulted from the consumption of contaminated grasshoppers, rather than from direct contact during spraying. Some birds were reported to have recovered. No other adverse effects were reported.

47. No assessment of the environmental impact of control activities has been carried out.

6. CROP LOSSES

6.1 Report on crop losses

48. No information was available on actual losses in 1987. Since the ITCZ stayed in the north for a long time, it is probable that most of the millet was harvested before any serious loss to third generation CSE occurred. The evaluation team estimates that no more than 0.5% of the millet crop was lost in the Far Northern province (<300 tons). Rainfed sorghum is largely resistant to Cedaleus senegalensis, and only very minor damage was seen in any of the fields visited. A loss of 0.25% would signify a loss of 700 tons. Dry-season sorghum (Moussakwa) is the most susceptible, but usually only for the first 10 days after transplanting, during which period grasshopper attacks usually cause total destruction of the seedlings, and hence the complete loss of the crop, since replacement is seldom possible. If we estimate that 2% of the dry-season sorghum was lost to grasshoppers, this represents a loss of another 1,600 tons. Thus, a possible total of 2,600 tons of cereal was lost to the various grasshopper species in the Far Northern province this year.

6.2 The cost-effectiveness of operations

49. In 1986, only 2,650 ha were sprayed against grasshoppers, out of a 32,400 ha known to be infested (8%). The donor input, however, was only US$ 77,000, or about $29/ha. In 1987, the donor input per hectare treated was over $88. The areas treated were too small to allow the determination of the cost effectiveness of the different types of equipment.

7. ORGANIZATION AND STRUCTURES

7.1 The national steering committee

50. A National Steering Committee was established and met on a bi-weekly basis; it included donors, FAO, and representatives of the Ministry of Agriculture. The Committee dealt mainly with donor inputs and administration. Technical metters were not usually considered, as donors were not actively involved in control operations (as they were in Chad, for instance).

7.2 Improvements in the National Plant Protection Service

51. In the northern provinces, the establishment of a network of agents able, to a certain extent, to survey grasshopper infestations, is a marked improvement. New personnel has been taken on. Extension agents and scouts have been trained in basic acridology and in pesticide application. The flow of data has been improved by the aquisition of mobilettes and the installation of several radios.

7.3 The role of international and regional structures

52. Except for the regular meetings with donors and FAO, and irregular contacts with the Crop Protection Services of Chad and Nigeria, no use was made of international or regional structures.

7.4 The role of FAO

53. The consultants working under the umbrella of FAO were financed by donors. FAO, in Cameroon, has been the regular intermediary for external funding and the acquisition of materials.

7.5 Recommendations

54. The evaluation team strongly recommends the establishment of contacts with PRIFAS/AGRHYMET for the exchange of information.

55. The LCBC (Lake Chad Basin Commission) may in future become an important structure for the coordination of control operations in its member countries (Cameroon, Nigeria, Niger and Chad) and for the rapid exchange of data on outbreaks.

8. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

8.1 Stocks at the end of the 1987 campaign

56. A large amount of application equipment is available in the northern provinces, as well as a number of vehicles, though spare parts for some of these are lacking. Some protective clothing is not available in sufficient quantities. Information on pesticides in stock was not available, but the mission was assured that, given the large areas of cash-crops treated in southern Cameroon, appreciable amounts of pesticide are in stock at the Crop Protection Service.

8.2 Preparation for future years

57. No detailed plan for future years has been drawn up by the Crop Protection Service. At the end of October, however, the Crop Protection Service published a "strategy for the anti-grasshopper campaign, phase II", which is basically a request for application equipment (3 Micronairs), vehicles (6 tankwagons, 6 Unimogs, 30 mobilettes) and pesticides (40,000 l ULV), as well as for the repair of five airstrips. The mission does not feel that these requests are justified given the low and localized, near normal, grasshoppers infestations. Even if they were, the plan was presented far too late to be of any value to the second phase of the grasshopper campaign in 1987, which will be over during the month of November. The strategy for future campaigns should be based primarily on early season treatment by farmers, which requires simple application equipment and the training and mobilization of the farmers involved.

8.3 Long-term considerations

58. Despite the relative absence of grasshopper problems in 1987, crops in Cameroon's northern provinces can suffer significant losses, primarily to the African Migratory Locust. The last outbreaks occurred in 1981 in northern Cameroon, Nigeria and Chad. Now that OICMA is defunct, the national Crop Protection Service is the most appropriate agency to monitor the African Migratory Locust's breeding grounds, and to intervene with ground applications when necessary. The scale of the problem is such, however, that can it be resolved using national resources, and a minimum of donor input.

8.4 Recommendations

59. In general, most of the assistance and inputs needed to improve Cameroon's grasshopper survey and control capabilities in the long-term can be provided within existing projects. The mission recommends:

- Two m/m of consultancy to continue the training programmes, if this from FAO can be done in conjunction with CREPHY is aimed at training officers based in the North, and includes the preparation of posters, flip charts, etc., about grasshoppers.

- Research on crop losses is necessary, especially for dry-season sorghum, including the verification of the pest status of several species of grasshopper (especially Aiolopus and Anacridium): on the basis of real loss figures, thresholds for the initiation of control measure should be established, so as to avoid the unnecessary use of pesticides.

- Applied research on pesticide applications is needed, including equipment efficacy trials on actual infestations, and initial trials of bait formulations against Aiolopus.

- Pesticide recommendations should emphasize ULV formulations, rather than dusts or EC, and cover products routinely available in the stores of the Plant Protection Service.

- The linkage between the Crop Protection Service and international or regional organizations should be strengthened, as this would facilitate the flow of technical information, and thus assist in accurate pest forecasting. These organizations include PRIFAS and CBLT.

- The campaign coordinator should attend any suitable technical workshops, organised in Sahelian countries.

- A control plan for a possible African Migratory Locust upsurge should be drafted. It should include action thresholds which, when reached, would trigger additional funds for the reallocation of manpower to the Crop Protection Service; this plans should be implemented if an upsurge occurs.

- This capability to respond to an African Migratory Locust upsurge should be field-tested twice a year, either by a simulation exercise or by using an indigenous sedentary species as a surrogate.

- Farmers should be mobilized and trained in pest monitoring in their own fields and in early-season localized control. As early season control is essential for effective grasshopper control, the involvement of farmers should play a primary role in the future strategy of the Crop Protection Service. The existing agricultural extension network offers an excellent means for such work.

ANNEX I

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Mr. Marire	Head of the French Cooperation Mission
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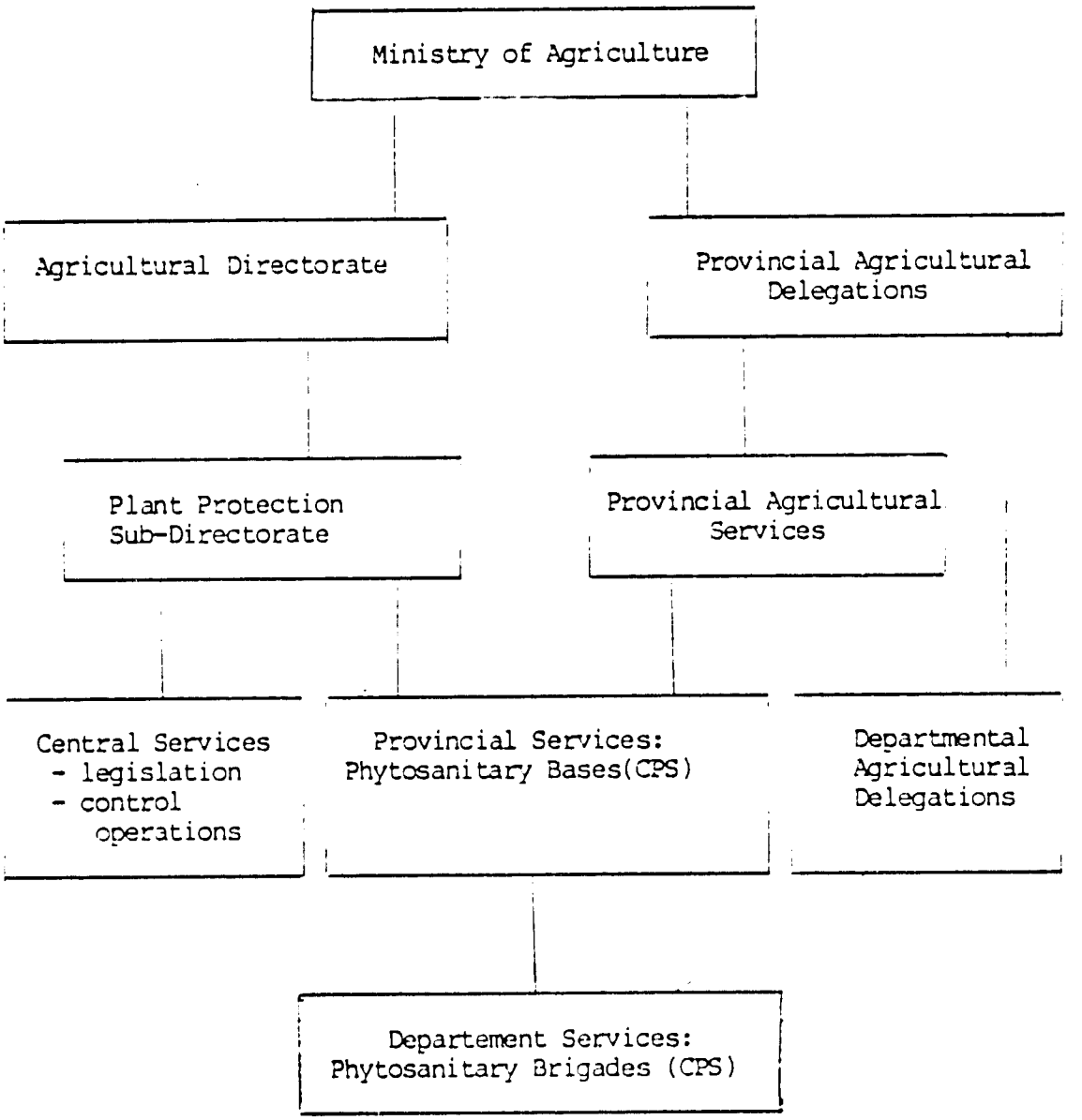
Mr. F. Marx	GTZ, Federal Republic of Germany

ANNEX II

ORGANIGRAM OF THE PLANT PROTECTION SUB-DIRECTORATE



W.I.E/

MINISTERE DE L'AGRICULTURE

DIRECTION DE L'AGRICULTURE

SOUS-DIRECTION DE LA PROTECTION DES VEGETAUX

BASE PHYTOSANITAIRE PROVINCIALE DE L'EXTREME-NORD

République du Cameroun
Paix - Travail -Patrie

ESSAI PESTICIDE MINAGRI F.A.O.

PROTOCOLE D'IMPLANTATION DES ESSAIS PESTICIDES

FICAM ET FASTAC (ACRIDICIDES)

I. PRODUITS ET DOSES A TESTER:

1.1. FICAM POUDRE 1% (soit 10 g.m. a/kg)

- 50 gm. a/ha = FMP 1
- 100 gm. a/ha = FMP 2
- 150 gm. a/ha = FMP 3
- 200 gm. a/ha = FMP 4
- temoin = Proporur 2% : 200 gm a/ha

1.2. FICAM ULV 25% (soit 250 gm.a/litre)

- 25 gm. a/ha = FMC 1
- 50 gm. a/ha = FMC 2
- 75 gm. a/ha = FMC 3
- 100 gm. a/ha = FMC 4
- témoin = Fénitrothion ULV : 500 gm. a/ha

1.3. FASTAC 100 CE (soit 100 gm a/litre)

- 15 gm. a/ha = FTS 1
- 20 gm. a/ha = FTS 2
- 25 gm. a/ha = FTS 3
- Témoin = Malathion CE : 1000 gm. a/ha

1.4. FASTAC 40 ULV (soit 40 gm. a/litre)

- 10 gm. a/ha = FTC 1
- 20 gm. a/ha = FTC 2
- 25 gm. a/ha = FTC 3
- Témoin = Fenitrothion ULV : 500 gm. a/ha

.../...

II. LOCALITES RETENUES POUR LES ESSAIS :

- Mayo-Sava (Mora)
- Mayo-Tsanaga (Mokolo)
- Diamaré (Maroua)
- Logone et Chari (Kousseri)

III. PARCELLES ELEMENTAIRES :

- 1 - 2 ha pour les pesticides poudres et concentrés émulsifiables (CE)
-10 - 15 ha pour les pesticides Ultra Low Volume (ULV)

IV. MATERIEL DE TRAITEMENT A UTILISER :

- Atomiseurs MICRONAIR ou Poudreuses manuelles pour épandre les pesticides poudres
- Atomiseurs MICRONAIR ou pulverisateurs manuels pour les pesticides en concentrés émulsifiables (CE)miscibles à l'eau
- Micronair AU 7000 ou atomiseurs ULV pour les pestidides ULV.

V. RENSEIGNEMENTS A FOURNIR SUR LES ACRIDIENS.

- Densité
- Stade de développement
- Principales espèces.

VI. RENSEIGNEMENTS METEOROLOGIQUES A FOURNIR :

- Temps couvert ou ensoleillé
- Humidité relative
- Température au moment du traitement ou température moyenne de la journée.
- Humidité du sol
- Direction du vent
- Force du vent (faible, très faible, moyen, fort, très fort).
- Pluviometrie annuelle moyenne du lieu d'implantation de l'essai.

VII. AUTRES RENSEIGNEMENTS A MENTIONNER :

- Jour et heure de traitement
- Durée du traitement
- Largeur de passe
- Vitesse de traitement
- Quantité de produit épandu
- Nature de produit épandu
- Surface traitée
- Nature de la végétation (jachère ou culture)
- Appareil utilisé
- Débit.

VIII. METHODOLOGIE D'IMPLANTATION DES ESSAIS :

- Si possible choisir une zone à forte ou moyenne infestation de sauteriaux (10 - 50 insectes/m2 ou plus).
- Délimiter les parcelles d'essai à traiter sans oublier la parcelle temoin.
- Calculer les doses de pesticide à appliquer.
- Prélever les doses de pesticide à appliquer.
- Faire les dilutions si cela est nécéssaire
- Règler l'appareil de traitement de telle sorte que le produit à épandre soit suffisant pour couvrir d'une manière homogène la parcelle à traiter.
- Faire d'abord un ou plusieurs tests en dehors de la parcelle d'essai en utilisant l'eau afin de pouvoir bien régler l'appareil de traitement (débit convenable).

.../...

- Déterminer la densité des insectes des parcelles d'essai, parcelle témoin comprise.
- Procéder ensuite au traitement des parcelles d'essai avec le pesticide approprié entre 07h et 09h.
- Déterminer les densités 2h, 4h, 24h et 48h après le traitement (voir fiche d'observations jointe).
- 2h et 4h après le traitement, compter le nombre de cadavres sur 4 fois 1 metre carré pris au hasard.
- Remplir les fiches d'observations jointes au protocole.

IX. REPARTITION DES ESSAIS ENTRE BRIGADES :

- MORA : FTC 2 - FTS3 - FMP 2 - FMC 4
- MOKOLO : FTC 1 - FTS 1 - FMP 4 - FMC 3
- MAROUA : FTC 3 - FMP 4 - FMC 1 - FMC 2
- KOUSSERI: FTS 2 - FMP 1 - FMP 3 - FMC 4

MAROUA, 31 AOUT 1987

LE SOUS-DIRECTEUR DE L'AGRICULTURE.

- S. NJIKAM -

LE CONSULTANT F.A.O.

- L. SOUMARE -

N.B. : Le FICAM ULV ne doit être dilué qu'avec du SOLVESSO, produit qui l'accompagne.
- Le FASTAC ULV peut être dilué avec du gas-oil.
- Le FASTAC CE ne doit être dilué qu'avec l'eau.

MINISTERE DE L'AGRICULTURE
:-=-=-:
DIRECTION DE L'AGRICULTURE
:-=-=-:
SOUS-DIRECTION DE LA PROTECTION DES VEGETAUX
:-=-=-:
BASE PHYTOSANITAIRE PROVINCIALE DE L'EXTREME-NORD
:-=-=-:

République du Cameroun
Paix - Travail -Patrie
-=-=-

ANNEXE I.

ESSAI PESTICIDE MINAGRI - F.A.O.

FICHE D'OBSERVATIONS

NOM EXPERIMENTATEUR :

GRADE :

Date :

Localité :

Brigade :

Site	Surf.Parc.	Espèces stade dév.	Nature de Produit	Quantité Produit	heure Observat°	densité av.trait.	densité après trait	Moy.cada livre au m2	% mortalité	Commentaires - Observat

MAROUA le 31 Août 1

MINISTERE DE L'AGRICULTURE

DIRECTION DE L'AGRICULTURE

SOUS-DIRECTION DE LA PROTECTION DES VEGETAUX

BASE PHYTOSANITAIRE PROVINCIALE DE L'EXTREME-NORD

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ANNEXE II.

ESSAI PESTICIDE MINAGRI - F.A.O.

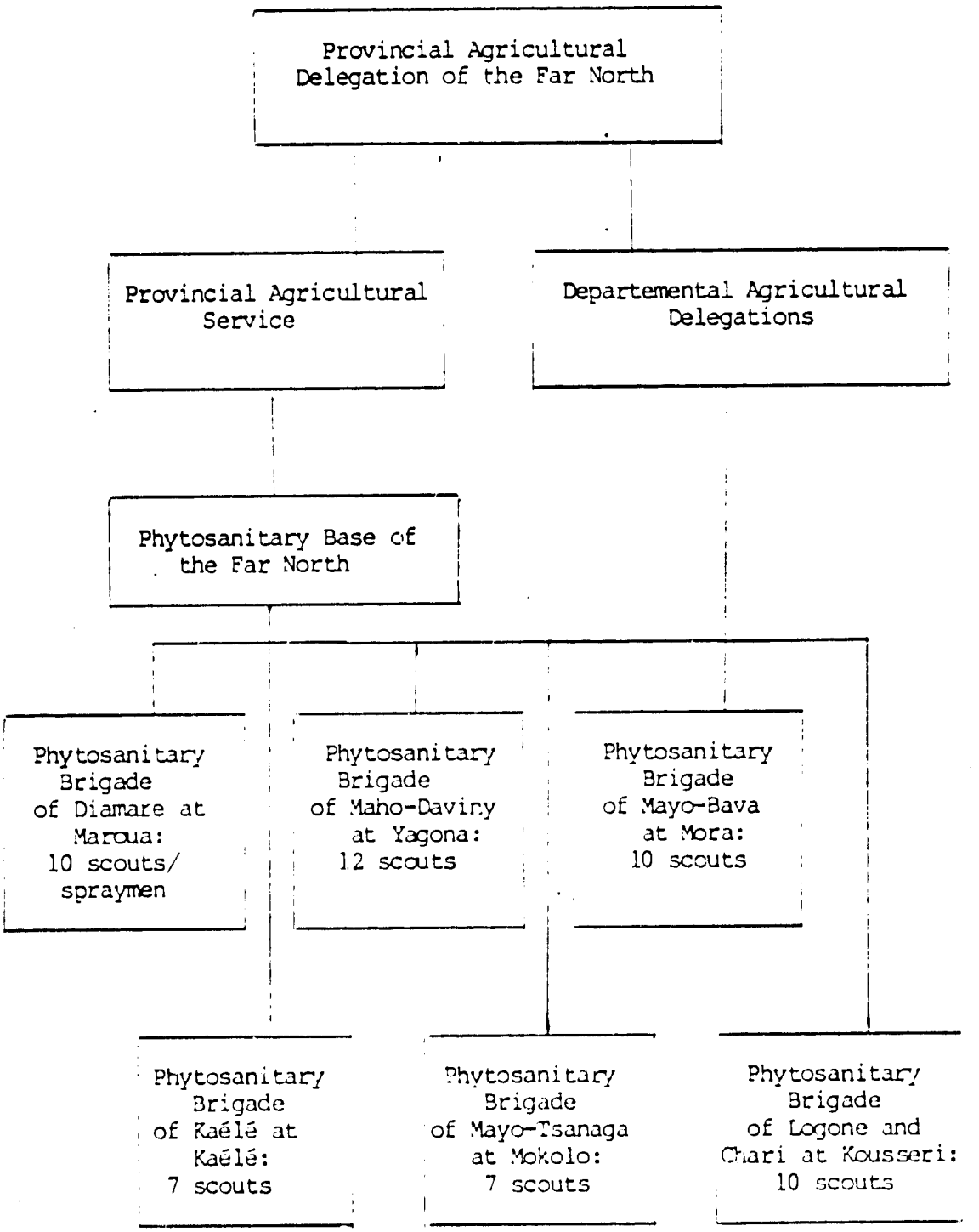
RENSEIGNEMENTS COMPLEMENTAIRES A FOURNIR :

I. SUR ACRIDIENS :	II. METEOROLOGIQUES	III. AUTRES RENSEIGNEMENTS
- Densité avant traitement :	- Temps :	- Date traitement :
- Stades développement :	- Humidité relative :	- Heure traitement :
- Principales Espèces :	- Température :	- Durée traitement :
	- Humidité du sol :	- Vitesse de traitement :
	- Force du vent :	- Largeur de passe :
	- Pluviometrie :	- Surface traitée :
		- Nature Produit :
		- Quantité Produit :
		- Nature végétation :
		- Appareil utilisé :
		- Débit :

MAROUA, le 31 Août 1987

ANNEX IV

ORGANIGRAM OF THE PHYTOSANITARY BASE IN THE FAR NORTHERN PROVINCE



SITUATION ACRIDIENNE CAMPAGNE 1967

EXTREME-NORD CAMEROUN

ARRETEE AU 31 AOUT

DEPARTEMENTS	MOIS	SUPERFIC. INFESTEES (ha)	SUPERFICI. TRAITEES (ha)	DENSITE au m2	NATURE VEGETAT°.	MORTALI-TE. (%)	FENIT. ULV 50% (litres)	SUMIT. CE 50 (litres)	MALAT. CE 50 (litres)	PROPOXUR 2% (kg)
MAYO-SAVA (MORA)	MAI	300	300	2	Forêt art.	95	300	–	–	–
	JUIN	4 900	1 250	20	Jachères	90	350	35	75	1 800
	JUILLET	1 500	1 100	18	Jac + Cul.	92	–	181	60	6 725
	AOUT	465	390	25	Jac.+ Cul.	95	–	153	271	150
	Total	7 165	3 040	–	–	–	650	369	406	8 675
MAYO-TSANAGA (KOKOLO)	MAI	–	–	–	–	–	–	–	–	–
	JUIN	6 500	2 300	50	Jachères	85	–	625	260	4 725
	JUILLET	1 450	540	13	Jachères	80	40	60	289	–
	AOUT	880	580	25	Jachères	90	–	220	135	413
	Total	8 830	3 420	–	–	–	40	905	684	5 138
DIAMARE (MAROUA)	MAI	–	–	–	–	–	–	–	–	–
	JUIN	1 500	75	15	Jachères	80	–	–	110	200
	JUILLET	6 300	1 240	12	Jachères	92	375	120	385	–
	AOUT	1 840	355	15	Jachères	97	75	180	100	–
	Total	9 640	1 670	–	–	–	450	300	595	200
LOGONE ET CHARI (KOUSSERI)	MAI	–	–	–	–	–	–	–	–	–
	JUIN	–	–	–	–	–	–	–	–	–
	JUILLET	980	750	30	Jachères	65	400	198	–	–
	AOUT	437	337	8	Jachères	87	–	230	–	200
	Total	1 417	1 087	–	–	–	400	428	–	200

.../...

MAYO-DANAY (YAGOUA)	MAI	-	-	-	-	-	-	-	-	-	-	-	
	JUIN	-	---	-	-	-	-	-	-	-	-	-	
	JUILLET	3 000	270	9	Jachères	85	-	260	-	190			
	AOUT	800	370	20	Jachères	92	200	-	-	1 670			
	Total	3 800	640	-	-	-	200	260	-	1 860			
KABIE (KABIE)	MAI	-	-	-	-	-	-	-	-	-	-	-	
	JUIN	-	-	-	-	-	-	-	-	-	-	-	
	JUILLET	2 500	120	8	Jachères	78	-	-	90	-			
	AOUT	500	65	7	Jachères	80	-	-	50	-			
	Total	3 000	185	-	-	-	-	-	140	-			

PRINCIPALES ESPECES

Oedaleus senegalensis : 80 %
Aiolopus sp -: 15 %
Zonocerus Variegatus : 2 %
Acrotylus sp : 1 %
Pyrgomorpha sp : 1 %
Autres : 1 %

MAROUA, 13 02/09/1987

- L. SOUMARE--
CONSULTANT F.A.O.

MISSION DE CONSULTATION AU CAMEROUN

15/04/87 - 15/08/87

PAR LASSANA SOUMARE INGENIEUR AGRONOME ACRIDOLOGUE
BP. 1 066 DAKAR

PROGRAMME DE FORMATION DES AGENTS DE LA PROTECTION DES VEGETAUX NORD - CAMEROUN

04/05/87

I. SYSTEMATIQUE ET TAXONOMIE : (Théorique)

1.1. Définition
1.2. Classification des Acridiens
1.3. Loi binomiale
1.4. Loi de priorité

II. BIOLOGIE DES ACRIDIENS : (Théorique)

2.1. Définition
2.2. Etats biologiques
2.3. Arrêts de developpement (quiescence - diapause)
2.4. Cycle biologique
2.5. Voltinisme
2.6. Critères de datation
2.7. Relations lutte - stade de developpement

III. DYNAMIQUE DES POPULATIONS (Démécologie)Théorique.

3.1. Définition
3.2. Populations autochtones et allochtones
3.3. Natalité,
3.4. Mortalité
3.5. Dispersion
3.6. Pullulations

05/05/87

IV. PREPARATION D'UNE CAMPAGNE DE LUTTE ANTIACRIDIENNE:(Théorique)

4.1. Personnel
4.2. Matériels
4.3. Produits
4.4. Plan de campagne
4.5. Choix méthode de Lutte
4.6. Evaluations résultats

V. PROSPECTION (Théorique et pratique

5.1. Définition

5.2. Buts

5.3. Préparation

5.4. Déroulement (espèces, surfaces, densité, dégats)

5.5. Présentation des résultats

5.6. Exploitation des résultats.

06/05/87

VI. ESPECES DANGEREUSES (Théorique)

6.1. Locustes

6.2. Sauteriaux.

VII. LUTTE ANTIACRIDIENNE (Théorique)

7.1. Formes de Lutte

7.2. Techniques de Lutte

7.3. Produits de Lutte

7.4. Stratégie de Lutte

07/05/87

VIII. PRATIQUE SUR LE TERRAIN :

8.1. Capture

8.2. Détermination surfaces et densités.

08/05/87

IX. UTILISATION DU MANUEL D'IDENTIFICATION DES ACRIDIENS (Pratique)

9.1. Manuel pratique d'Identification des principaux acridiens du Sahel GERDAT/PRIFAS M.LAUNOIS

X. CONSTITUTION DES COLLECTIONS DE REFERENCE : (Théorique et pratique)

10.1. Capture

10.2. Préparation des échantillons

10.3. Mise en collection des échantillons

09/05/87

XI. CONTROLE DES CONNAISSANCES :

YAOUNDE, LE 18 AVRIL 1987

- L. SOUMARE -

ANNEX VII
Page 1

RESOURCES AVAILABLE IN THE FAR NORTHERN PROVINCE

	SOURCE	COMMENTS
I MANPOWER		
FAO GRASSHOPPER EXPERT	USAID/EEC	
FAO LOGISTICAL EXPERT	USAID	
APPLICATION EXPERT	UK	1 MONTH
RADIO COMMUNICATION EXPERT	USAID	1 MONTH
CHIEF OF BASE	GOC	1
SECRETARY	GOC	1
CHIEF OF BRIGADE	GOC	6
SURVEY SCOUTS/SPRAYMEN	GOC	56
DRIVERS	GOC	13
MAINTENANCE/WAREHOUSE	GOC	5
PILOT AND MECHANIC FOR UTAVA	FRANCE	50
II TRANSPORT		
PICKUPS	GOC	08
LORRIES	GOC	05
MOBYLETTES	GOC	50
III APPLICATION EQUIPMENT		
MICRONAIR AU 7000	FAO	03 SETS
EXHAUST NOZZLE SPRAYERS		02
BACKPACK MISTBLOWERS	CANADA/EEC	160
BACKPACK ULV	USAID	10
LOK SPRAYERS		30
DUSTERS (MOTORIZED)		144
DUSTERS (MANUAL)	CANADA	110
CDA		05
SHAKE BAGS	CANADA	50,500
IV PESTICIDES		
FENITROTHION 1000 ULV	GOC (EXISTING STOCKS)	2,600 L
FENITROTHION 50 EC	GOC (EXISTING STOCKS)	2,940 L
MALATHION 96 ULV	CHINA	20,000 L
MALATHION 50 EC	BELGIUM	17,785 L
PROPOXUR 2% D	FRD	42 TON (100 TON STILL TO BE RECEIVED)
FENITROTHION 3% D	EEC	63 TON

V	PROTECTIVE CLOTHING		
	JUMP SUITS (DISPOSABLE)	UK	381
	GLOVES	UK	197
	GOGGLES	UK/USA	200
	RESPIRATORS	UK/USA	199
	REPLACEMENT CANISTERS	UK/USA	200
	BOOTS	CANADA	397
VI	RADIO EQUIPMENT		
	SSB RADIOS		06
	WALKY-TALKIES		02
	BATTERY CHARGERS		03
VII	OPERATING COSTS	BELGIUM/USA	242,735

ANNEXE VIII
Page 1

N.O/
MINISTERE DE L'AGRICULTURE

DELEGATION PROVINCIALE DE
L'AGRICULTURE DE L'EXTREME-NORD

SERVICE PROVINCIAL DE L'AGRICULTURE

BASE PHYTOSANITAIRE

BRIGADE PHYTOSANITAIRE DE .....
POSTE AGRICOLE DE .....

REPUBLIQUE DU CAMEROUN
Paix - Travail - Patrie

FICHE DE PROSPECTION ACRIDIENNE

DATE:

LIEU (ARRONDISSEMENT)

NOM ET GRADE DU PROSPECTEUR:

1	2	3	4	5	6	7	8
VILLAGES	ESPECES	ADULTES	LARVES	SURFACES INFESTEES	DENSITES	CULTURES	VACHERE

REMARQUES: Les Colonnes sont à remplir de la façon suivante:

Colonne 1 - Mettre le nom du village où a lieu la prospection.

Colonne 2 - Mettre le nom des Espèces si possible.

Colonne 3 et 4 - Mettre les signes + ou (-): Le signe (+) s'il y a des infestations, le signe (-) s'il y a pas d'infestation, deux (++) en cas d'infestation forte

Colonne 5 - Faire une estimation grossière des cultures infestées.

Colonne 6 - Faire une estimation du nombre de criquets (larves et adultes) par mètre carré.

Colonne 7 et 8 - Mettre le signe + quand l'infestation a lieu dans les cultures et les jachères (friches).

ANNEXE IX
Page 1

OBSERVATIONS SUR LE PROJET DE RAPPORT
FAITES PAR LA PV/REPRESENTATION DE LA FAO

13/11/87

RE PRINCIPALES CONCLUSIONS MISSION EVALUATION ET SUR BASE BROUILLON RAPPORT LAISSE PAR LA MISSION PRIERE NOTER COMMENTAIRES ET/OU OBJECTIONS SUIVANTES:

AAA VISITE TERRAIN:

PRIMO: SIGNALONS MISSION ARRIVEE MAROUA 21/10 14H30 ANNONCANT DEPART JEUDI 22/10 10H CE QUI DONC ANNULAIT TOUTE POSSIBILITE VISITE TERRAIN ET APPRECIATION STRUCTURES MISES EN PLACE METHODES ET RESULTATS BASES SUR OBSERVATIONS REELLES MISSION. SEULE INSISTANCE 2 CONSULTANTS FAO PERMIT REPOUSSER DEPART AU VENDERDI 23/10 APRESMIDI ET REALISATION VISITE TERRAIN CONSIDEREE COMME UN MINIMUM IMPERATIF POUR UNE APPRECIATION OBJECTIVE.

SECUNDO: VISITE TERRAIN ETANT LIMITEE POUR IMPERATIF TEMPS ZONE DE VISITE CHOISIE PROCHE MAROUA NE PERMETTAIT QU'APPRECIATION PARTIELLE ET PEU REPRESENTATIVE DE SITUATION GENERALE D'INFESTATION.

BBB PLAN ACTION PHASE I ET II:

MISSION AFFIRME, PLAN ACTION MANQUAIT CLARETE QUANT A LA MENACE REELLE POSEE, QUI PRESENTAIT LE PIRE DES SCENARIOS POSSIBLE ALORS QUE OBSERVATIONS FIN SAISON 86 NE PERMETTAIENT PAS SOUTENIR HYPOTHESE DE BASE SUR LES POSSIBILITES D'INFESTATION PRESENTEES PAR PLAN ACTION. MISSION CONCLU FALLAIT DONC PLANIFIER EN VUE INVASIONS MODESTES ET ETABLIR SEUILS D'ALARME. CEPENDANT

PRIMO: RAPPELONS QUE C'EST SUR BASE ACTION ETE ELABORE AINSI QUE SUR BASE DES CONCLUSIONS ET RECOMMANDATIONS CONSULTANT SOUMARE. EN EFFET EN 86: 26,000 HA INFESTES CMR PAR POPULATION ALLOCHTONE O.S.E. ET NON TRAITES. DE PLUS OBSERVATION ESSAIMS PRIMAIRES CRIQUETS PELERINS AU TCHAD PERMETTAIENT CRAINDRE INVASION IMPORTANTE SUR CAMEROUN EN 87.

SECUNDO: DU REACTION EXTREMEMENT TARDIVE GVT CMR EN 86 AUCUNE STRUCTURE LUTTE N'ETAIT EN PLACE POUR PREPARER/ORGANISER CAMPAGNE LUTTE ANTI ACRIDIENNE.

TERTIO: SOULIGNONS PRATIQUEMENT AUCUN DES PRODUITS, MATERIELS ET EQUIPEMENTS NECESSAIRES A LUTTE DISPONIBLES LOCALEMENT EN CONSEQUENCE PLUSIEURS MOIS DELAIS EXISTANT ENTRE COMMANDE ET DISPONIBILITE NON A YAOUNDE MAIS SUR LIEUX DE LUTTE.

QUARTO: DONC, SUR BASE 3 POINTS PRECENDENTS JUGEONS AURAIT ETE EXTREMEMENT RISQUE DE SUIVRE APPROCHE PROPOSEE PAR MISSION EVALUATION C.A.D. PREVOIR INVASIONS MINIMALES AVEC AJUSTEMENT EN FONCTION SITUATION TERRAIN.

CCC MISSION EVALUATION AFFIRME

"RESSOURCES RECUES EXCEDAIENT LE MINIMUM NECESSAIRE POUR ASSURER LA PROTECTION DES RECOLTES CONTRE LES ESPESCES PRINCIPALES DE LOCUSTE ET SAUTERIAUX" HORS SOULIGNONS:

PRIMO: SEULE UNE PARTIE DES RESSOURCES PREVUES POUR PREMIERE PHASE ONT ETE RECUES MAIS RIEN POUR DEUXIEME PHASE.

SECUNDO: RE PRODUITS RECUS AU 31/10/87 RAPPELONS RESTAIT 38.000 HA NON TRAITES ET STOCK PESTICIDES DISPONIBLE INSUFFISANT POUR TRAITEMENT CETTE SURFACE ET PAS MEME SUFFISANT SI TRAITEMENT LIMITES AUX SEULES CULTURES. RE AUTRES RESSOURCES RECUES. JUGEONS QUE MATERIEL DE TRAITEMENT ET VEHICULES RECUS ONT ETE EN DESSOUS MINIMUM NECESSAIRE CE QUI EXPLIQUE QUE LES 38.000 HA N'ONT PU ETRE TRAITES AU 31/10.

DDD CONCERNANT LA POSITION DE LA MISSION QUI JUGE QUE LES TRAITEMENTS ULV CONTRE AIOLOPUS SIMULATOR DANS SORGHO DE CONTRE SAISON N'ETAIENT PAS APPROPRIES ET RECOMMANDE L'EMPLOI D'APPATS EMPOISONNES. INFORMONS

PRIMO: OBSERVATIONS APRES TRAITEMENT MICRONAIR AU 7000 SUR PARCELLES SORGHO CONTRE SAISON ONT REVELE TAUX MORTALITE SUPERIEUR A 90%.

SECUNDO: UTILISATION APPATS EMPOISONNES DEMANDE IMPORTANTE QUANTITE DE SUPPORT (SON) DONT DISPONIBILITE INCERTAINE NORD CAMEROUN.

TERTIO: REACTION SAUTERIAUX QUI DELAISSERAIENT POUSSES SORGHO VERT POUR APPAT NON DEMONTREE.

EEE CONCERNANT TABLEAU RECAPITULATIF ETABLI PAR MISSION SUR SURFACES ET CALCUL POURCENTAGE REALISATION TROUVONS REGRETTABLE QUE CALCUL TAUX REALISATION FAIT SUR RATIO SURFACES CITEES PLAN ACTION/SURFACE TRAITEES ET NON RATIO SURFACES INFESTEES/SURFACES TRAITEES.

FFF CONCERNANT COUT PAR HA DE CAMPAGNE DE LUTTE 87 ETABLI PAR MISSION REGRETTONS QUE CALCUL NE SOIT PAS BASE SUR TOTAL SUPERFICIES TRAITEES EN FIN DE CAMPAGNE.

GGG FINALEMENT TROUVONS QUE RAISONNEMENT SOUS ENTENDAIT PARTIE DE L'EVALUATION EST ERRONE. EN EFFET L'APPROCHE EST BASEE LARGEMENT SUR LES RAPPORTS ENTRE MOYENS DE LUTTE MIS EN OEUVRE ET DOMMAGE CAUSES PAR SAUTERIAUX ET LOCUSTES SUR CULTURES, CEREALIERES EN PARTICULIER EN 1987. POURTANT RAPPELONS QU'IL S'AGISSAIT

PRIMO: PREMIERE VRAIE CAMPAGNE DE LUTTE ANTIACRIDIENNE AU NORD CMR NECESSITAIT DONC D'IMPORTANTS INVESTISSEMENTS.

SECUNDO: OBJECTIF FONDAMENTAL LUTTE 87 ETAIT REDUIRE POPULATIONS ACRIDIENNES AU PLUS BAS NIVEAU POUR TENTER EVITER FLEAU ACRIDIEN NE DEVIENNE ENDEMIQUE CET OBJECTIF DEPASSAIT DONC DE LOIN UNE SIMPLE PROTECTION DES RECOLTES.

(MUKENDI FAOR YAOUNDE)

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

CHAD

Mission: (10-15 October 1987)

Mr. Maurice Balmat (FAO)
Mr. Carl Castleton (USA)
Mr. H. van der Valk (Netherlands)

Contents: **Paragraphs**

5. CROP LOSSES

6. ORGANIZATION AND STRUCTURES

7. THE 1987 CAMPAIGN AGAINST THE DESERT LOCUST IN CHAD

8. CONCLUSIONS AND RECOMMENDATIONS

9. ACKNOWLEDGEMENTS

Annexes:

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

CHAD

1. THE EVOLUTION OF GRASSHOPPER POPULATIONS IN 1987

1.1 The Weather

1. The rainy season of 1987 was early; the first rains fell at the end of the month of May. In the first decade of June, cumulative rainfall had reached 222.2 mm at Sahir, 122 mm at N'Djaména, and 75 mm at Amtiman. This rainy period was followed by very irregular rains, very unevenly distributed, and a long dry period in June, July and August.

1.2 The Grasshopper Situation

2. Oedaleus senegalensis populations consequently suffered heavy losses, after a good development first generation. The decline in population was greatest in August, due to drought.

3. Declining populations were reported all over the country, and there was some movement into areas in which some moisture remained, southwards, into the Oueds around the mountainous areas in Ouaddai and Biltine, and into the areas near the lakes (Lac Fitri).

4. The heaviest populations, which required treatment in Phase II in September, occurred in the eastern part of the country in the case of Oedaleus senegalensis (Batha-Ouaddai-Biltine-Guéra), and in the west in the case of Cataloipus, Hieroglyphus, and Locusta (Moyen Chari-Lac-Chari Baguirmi).

5. The unusual development of the 1987 rainy season meant that the operations planned at the beginning of the campaign (the spraying of some 280,000 ha) could be reduced, even though the spectacular development of the first generation (with very dense populations of heavily-pigmented nymphs seen in June in the region of Mao) had seemed to suggest a particularly severe season.

1.3 Egg-pod Surveys

6. Egg-pod surveys were carried out during the dry season, between the end of February and April 1987, in each of the nine prefectures where grasshoppers pose a problem, by mobile teams of nine scouts. France paid for this work. USAID also contributed, in the region of Biltine, after some of the Plant Protection Service's staff had died in a road accident with the loss of the data they had collected.

7. The method followed was similar to that described by G. Popov (in the FAO document on egg-pod surveys); villagers were first questioned so as to identify the places where heavy laying has taken place. The topsoil is removed over a number of square metres, exposing the

egg-pods, which are then counted. Each egg-pod is removed and examined to establish the number of live and of parasitized eggs.

8. The data are elaborated by computer and presented by prefecture in terms of the density of egg-pods per hectare, the number of eggs per egg-pod, and the number of eggs that had been parasitized. A general overview is given in Annex I and a synoptic map in Annex II.

9. These data allowed the Plant Protection Service to set up its provisional plan of operations (Annex III) and to distribute the pesticides for Phase I, that is for control activities by village teams.

10. The results were interesting in that they showed that egg-pod parasitism was greater than in 1986.

11. It must, however, be noted that the reliability of the data varies with the technical skill of the various teams, and the FAO consultant entomologist was, of course, not able to be everywhere at once in all the prefectures.

1.4 Recommendations

12. A general egg-pod survey at the end of this season would be useful, but only by the small number of mobile teams really qualified for this work, adequately supervised in the field by the entomologist in charge of the whole operation, so as to ensure a minimum level of reliability in the data collected.

13. The best period for such a survey is between November and January, preferably as early as possible, so as to make it easy to pin-point the concentration of adults at the end of the season and, therefore, the areas in which the heaviest numbers of egg-pods are laid.

14. The easiest solution would be to keep the FAO consultant entomologist in Chad to undertake this work immediately following the campaigns against grasshoppers and the Desert Locust, at the end of November.

1.5 The Effects of Control Operations

15. The reports of the various experts who have followed the campaign show clear progress in the effective mobilization of farmers for ground treatment in Phase I, when 1987 is compared with 1986.

16. Even though control activities may have been imperfect in some regions, it appears certain that they adequately protected crops at the beginning of the season.

17. These operations were able to limit losses but not to completely prevent some local destruction of the first plantings.

18. The biggest difference from 1986 is that, in certain regions, farmers showed great interest in acquiring insecticide, even when they had to pay for it.

19. Certain prudent farmers preferred to wait a few weeks, because of the unusual earliness of the rains, before sowing. This was a risky decision, but would have profitted the farmer very well if the older Oedaleus senegalensis nymph populations remained in the natural vegetation.

20. In reality, the heaviest crop damage noted was in the Sahelian zone where the incidence of stem borers (Raghuva) was heavier than in 1986 and where, as well, the July drought put the harvest at great risk and reduced yields.

21. The ground and air treatments on OSE populations in more than 186,000 ha, carried out by 14 October, will play an important role in reducing their reproductive potential in the next campaign. The control operations in Phase II, mainly aerial, took place in the valleys and cultivated oueds where grasshopper populations tend to gather at the end of the rainy season, making control operations more efficient.

22. The return south of the Oedaleus senegalensis population at the end of the season, on a line passing through N'Djaména, was slower and later by about two weeks than in 1986.

23. This makes possible that eggs have been deposited further north than last year.

24. At the time of writing, there is no way of providing more precise information than the few comments made here, because of the lack of numerical data.

25. Nonetheless, the egg-pod surveys which should be carried out between December and February will provide more precise data.

2. MONITORING AND RAPID WARNING SYSTEMS

2.1 The National Monitoring System

26. The staff of the Plant Protection Service has grown from ten in 1986 to about thirty in 1987.

27. Nine motorized teams were set up at the beginning of the rainy season; each was responsible for surveying a sector and checking reports from farmers, soldiers and the local authorities, either brought in physically, or sent by radio to the Plant Protection Administration in the ONDR (Office National de Développement Rural).

28. There is no doubt that actual monitoring has improved greatly since 1986, but there are still huge weaknesses in communications, and in the quality and trustworthiness of data.

29. Between the first rains and the harvest, fields are routinely monitored for grasshopper infestations by PPS agents, extension staff (ONDR, SODELAC) and the staff of various NGOs. Written reports (on PRIFAS' forms) are forwarded (when roads permit) to PPS headquarters.

In emergencies, these reports are more speedily transmitted through the network of NGO and governmental SSB radios. To date, the PPS headquarters received over 600 PRIFAS forms and over 250 radio field reports of grasshopper or locust infestations. The Government plans to improve this system, through increased training of extension workers in pest identification, by adding mobile radios to the radio network, and by establishing pest survey posts in each prefecture.

2.2 Egg-pod Surveys

30. The egg-pod surveys were very useful in predicting the first hatchings and in planning both the phase I ground control programme and the phase II aerial programme. On the results of the survey, a ratio was established for each prefecture between the amount of land to be treated and the total cultivated area (see Annex III): this ranged from 5 to 50%. The survey cost less than US$ 35,000, which is much less than the emergency transport of pesticides by air would cost, once rains had made the roads impassable.

31. The figures extrapolated from these egg-pod surveys (see Annex II) were used by the Plant Protection Service to establish the likely need for control operations and to define a general campaign strategy. In Phase II, USAID was responsible for the eastern prefectures (Guéra-Ouaddai-Biltine-Salamat-Batha) and FAC for the western prefectures (Lac-Chari Baguirmi-Moyen Chari). At the same time, USAID was able, using the computerized analysis of the egg-pod surveys, prefecture by prefecture, to establish its overall aerial logistic needs in the eastern region.

2.3 The Use of Information in Control Operations

32. The field survey system described above is still inadequate, by itself, for campaign decision-taking. PRIFAS' predictions, on the basis of its OSE biomodel, were sent as the SAS Newsletter to 64 correspondents in Chad, but arrived after the event. Unfortunately, the maps of OSE distribution in Chad were received only in September, and most of the campaign decisions had already been taken: it was therefore frequently necessary to obtain supplementary data directly, through field visits by the FAO, PRIFAS, GTZ and USAID experts.

33. In future, PRIFAS should provide its predictive maps for each country every ten days, from the time the campaign begins. This information could become a very important element for decisions in the control campaign.

2.4 Other Sources of Information

34. Once the threat from the Desert Locust became obvious, USAID provided the PPS with two sets of Greenness Maps, which are extrapolated from NOAA satellite imagery. Such maps are potentially useful, in that they identify areas as small as 1 km² in which green vegetation has recently developed. They may prove a useful tool for directing ground survey crews to potential locust breeding areas in remote parts. Overall, the major contraints to effective monitoring continue to be the lack of trained manpower, and the lack of a rapid communications system.

2.5 Recommendations

35. The Plant Protection Department's scout teams should be more mobile, so as to be able to supply better information during the next campaign.

36. Because of the very great difficulties of movement in the Chadian rainy season, the 4-wheel drive scout cars should be equipped with the radios, so that sightings from the air can be immediately and precisely reported to the control centre.

37. The mission also encourages the use of every possible form of information, such as the computerized prediction maps, by ten-day periods, which PRIFAS establishes on the bases of its OSE biomodel, and vegetation mapping extrapolated from satellite imagery, which could be supplied at the beginning of the rainy season to the Plant Protection Service.

3. TRAINING

3.1 Training Activities in 1987

38. Trainer-training courses for 613 agents of the PPS, and for extension agents from the four zones, were organized between 12 January and 10 March 1987, using Swiss Aid funds, and the resources of FAO. In April, 105 more agents were trained by GTZ in the use of ground application equipment. These trainers then trained an estimated 13,400 farmers. It should however be noted that this training was very scanty and dealt largely with the use of dusting bags; it did not adequately cover the use of pesticide application equipment, nor safety measures to be observed.

39. During the Desert Locust upsurge, OCLALAV teams from Cameroon and Niger were brought into Chad to help in survey and ground control operations. Members of the OCLALAV teams were paired with DPV field staff and a considerable amount of knowledge was thus transferred to the PPS field staff involved.

40. At a higher level, three Chadians attended the course on grasshoppers organized by PRIFAS in Montpellier between 4 and 15 May 1987 (one from the PPS, one from a parastatal, and a project officer from USAID). The Director of Agriculture and a senior staff member of the PPS attended the short course on aerial applications organized by USAID in Niamey between 18 and 22 May 1987.

41. The only attempt at popular education was through the numerous radio announcements warning rural populations of precautions to be observed during aerial control operations, and attempting to ensure the safety of low-flying aircraft. But the most effective way to convince the nomadic peoples of the area that pesticides will not harm their livestock would be to conduct visably successful small-scale applications.

3.2 Assessment

42. Training played a vital role in the success of the 1987 campaign, not only because of the information and skills it imparted, but also because it helped motivate the many unpaid volunteer workers, and because it encouraged collaboration between the various official and non-governmental assistance organizations involved.

3.3 Recommendations

43. This training programme should continue; simple, accurate training materials in the local languages, for use of semi-skilled extension agents, are needed. A training module should be developed for schools and for the Swiss-funded Rural Professional Development Centres. The PPS should establish a programme of in-service training for its staff and should collaborate in training programmes organized for the staff of other government and NGO agencies. The need for short-term technical training far outweighs the need for academic training.

44. The mission recommends a continuing and increased priority for the mobilization of farmers for monitoring and early control activities in Phase I. A number of years will be necessary, and all available media should be used, the press, posters, and the national radio. The final aim is to improve the technical level of village teams, so that they may use hand-held battery-powered ULV equipment instead of reling on dusts.

45. A second important aspect is to select for further technical training some staff of the Plant Protection Service, both for control measures and as trainers. This should be done within the framework of a general strengthening of the service by the FAO/UNDP, and other projects.

46. Control plans should be prepared as early as possible, so as to allow funds to be found, and all the work possible to be carried out before the actual campaign.

4. CONTROL OPERATIONS

4.1 The Organization of the Campaign and the Supplies and Equipment Available

47. In all the Sahel region, Chad is undoubtedly the country with the greatest material, geographic, and financial difficulties in carrying out a large-scale control campaign.

48. With the experience gained in 1986, and the information from the egg-pod surveys, the Plant Protection Service Directorate prepared a good 1987 campaign plan.

49. Requests for insecticide were put to donors on the basis of a total of 280,000 ha to be treated by ground and air, account taken of existing stocks.

50. In the month of June, all the pesticides available in Chad (162 tonnes of powder and 190,000 litres of ULV liquids) were distributed to the prefectures and to the various sectors of the ONDR, according to infestations predicted, taking into account, as far as possible, the need for a priority distribution to areas that are most inaccessible in the rainy season.

51. The Federal Republic of Germany's assistance (1,000 ULV hand-held battery sprayers, 50 tonnes of Propoxur dust and 10,000 l of Fenitrothion 20%) was air-freighted to Chad. Allowance was also made for local operating expenses for the transport and the local distribution of these pesticides, which was completed in June.

52. Other donor's insecticides were expected to arrive at the end of May, or at the beginning of June (53 tonnes of Fenitrothion supplied by the EEC through FAO, and 40 tonnes of Propoxur and Lindane supplied by FAC). The European shippers kept to these dates, but transit through the port of Douala caused considerable delays. In fact, apart from the time lost in discharging and for customs clearance in the port of Douala, goods for Chad were required to go by train as far as Ngaoudnere, which means two further unloadings, and an additional delay of between one or two months.

53. Because of these problems, the insecticides needed by farmers for Phase I control operations only arrived in Chad in August or September; such delays did not occur with air freight, and 14,600 l of Fenitrothion 50% from the EEC through FAO arrived on 4 June.

54. It should, in future, be clearly understood that only if insecticide dusts are available in Chad at the beginning of the month of May will they be of any use. Such dusts are the most cost-effective, as they are used by farmers at the beginning of the season: each dead insect in June means that generations of its offspring die with it, equal to some 200 insects in September.

55. Because of this, if orders cannot be placed by February, then dust should not be shipped by sea. It would be better to send less, but to send it by air, and have it in time for the campaign. The Chadian Government, and the local representatives of FAO, the EEC, and FAC unanimously prefer this solution; they argued it from the month of March on.

56. It must be noted that the Chadian Government has made a real effort to facilitate customs clearance and remove tax from all products and equipment for the campaign against grasshoppers. Air freight, in particular, carries no tax, but the obligatory transit costs and airport costs (ASECNA) come to 13 FCFA per kilo.

4.2 Funds Available

57. It is very important to point out how little money the Plant Protection Service has for operating costs. Its budget really covers only the salaries of its staff and the running of the Directorate.

58. For every control operation which takes place, funds for transport, scouting, spraying, and the general operating costs must either come from foreign assistance or through the effective participation of the ONDR services.

59. But the ONDR do not usually have funds to cover the operating costs, including the purchase of batteries and fuel, the repair and maintenance of spraying equipment and the use of the various means of transport necessary, and there are many of these, including motorbikes, bicycles, horses and camels.

60. This lack of funds is partially compensated by the understanding of the local authorities and of the international assistance organizations, and by the the excellent spirit of cooperation which exists in the National Coordinating Committee between those in charge of the Plant Protection Service and the development bodies (ONDR-SUDELAC, etc.), international assistance bodies, and the NGOs, and by good will at all levels.

61. It is clear that things will continue in this way in Chad until the country has left its present military and international problems behind.

62. All foreign assistance must therefore include some part of the operating costs, so that maximum efficiency is reached.

63. In 1987, assistance supplied by the international community was essential in carrying out the campaign, and most needs were met.

64. A table of inputs in 1987 is given in Annex V; it dates from 10 August 1987, but has not changed greatly, except in the case of additional means put at the disposal of Chad by FAO from international moneys at its disposal for survey work and implementation of control operations against the Desert Locust from August and September on.

65. This included the assistance of an OCLALAV control team during three months, for scouting and spraying operations in the region of Kalait (Oum Chalouba), a number of consultant missions, and the hire of a helicopter for 150 flying hours in October.

4.3 Control Activities

4.3.1 In Phase I

66. The very early rainy season, a tardy start to the campaign, the lack of a solution to the problem of radios, travel problems, and late and inaccurate information of the grasshopper situation, frequently made it difficult to take the necessary decisions.

67. Nonetheless, the helicopter provided by FAC, and used for scouting in June at the beginning of the campaign, was extremely useful, particularly in the Lake region.

68. The work that was put into informing farmers during the dry season, which involved more that 13,000 people, led to an undoubted success in the Phase I control operations. In a number of regions, the farmers themselves bought pesticides, and everywhere they worked actively, sometimes alone, but more frequently in groups, volountarily transporting pesticides and dusting their fields.

69. The motorized scout teams set up with the personnel of the Plant Protection Service and the ONDRA were turned into spray teams in July and September, and also undertook the training of village brigades.

4.3.2 In Phase II

70. The Plant Protection Service's mobile teams, now equipped with motorized spraying equipment supplied by FAI (Italy) and FAC (France) carried out operations over more than 80,000 ha in the Lake and south-west regions and in the Sahelian zone in September.

71. The spray plane supplied by FAC for one month was put on alert earlier than planned, at the end of August, for emergency spraying of Desert Locusts, particularly second generation hopper bands, but, in spite of the importance of this work, was not able to carry it out as the herdsmen of the region were violently opposed to the use of insecticides. It took a certain amount of time, and demonstrations by the ground teams of the Plant Protection Service and of OCLALAV, to convince them that operations against locusts would not harm their herds, after which they no longer posed a problem. But, in the meantime, the control strategy adopted by the technical committee and by the consultants in the country turned rather to ground control.

72. At the same time, reports of large-scale infestations of grasshoppers in the prefectures of Moyen Chari (in the valley of the Mandoul, in the region of Koumra) and Chari-Baguirmi. The species most characteristic of humid regions were involved, especially Catalolpus fuscocoerulipes, Hieroglyphus daganensis and africanus, Kraussaria angulifera and Locusta migratoria, this latter in proportions that varied from place to place.

73. The FAO plane (a Cessna 188 Agtruck equipped with Micronairs AV 5000), logistic support of the Plant Protection Service and FAC, undertook operations in these two prefectures and then in the Lake region, until the end of September. Fenitrothion ULV at a dose of 250 gr. a.i./ha was used.

74. USAID had signed a contract with MAF (Mission Aviation Fellowship), an American christian mission supplying planes and pilots in Chad; MAF worked in September in the prefectures of the eastern region, especially Ouaddaï, Batha, and Guéra, which were, at that time, the most heavily infected by Oedaleus senegalensis. The populations were concentrated by irregular rainfall in low-laying areas, and valleys which had retained a certain amount of moisture, that is, the areas where crops were found.

75. In mid-October, at the time of the mission's visit to Chad, control operations were being rounded up in Guéra, but were to continue in Ouaddai. Possible aerial operations against the last Desert Locust breeding in November was also under consideration.

76. In spite of security great difficulties in these operations, the American team managed to find solutions and gave full logistic support to the operation. The work undertaken during the months of September and October was excellent. Three planes (a Cessna 185 Agwagon and two Cessna 188 Agtrucks, carrying Micronair AU 5000) were all spraying at the same time and, by 14 October, had managed to treat more than 71,000 ha of crops, using Malathion 98% at a dose of 0.6 l/ha.

77. The table in Annex VI gives the results by prefecture, as of 14 October, of all ground and air treatments carried out during the 1987 Campaign.

78. A more complete and accurate picture will be provided by the technical committee of the Plant Protection Service at the end of the campaign, when all the operations have finished. An inventory will be made at the same time of unused pesticide stocks.

4.4 Assessment of the Control Campaign

4.4.1 The Use of Information in Decision-taking

79. One of the greatest problems faced in Chad is the difficulty in obtaining reliable data on the basis of which correct decisions can be made.

80. The data that reach the Plant Protection Directorate are often incomplete and imprecise. Because of the great difficulty in traveling about, and because of the lack of radios aboard the scout cars, reports arrive late, and the radio operators, in spite of their good will, have frequently not been sufficiently trained to perform well in such circumstances. This means that some of the data received are useless.

81. There is, therefore, a real need for training of radio staff.

82. OCLALAV has a chief radio operator and radio repairers who could undertake such training for the mobile vehicles used in scouting in Chad.

83. All operational decisions are taken by the officer in charge of the campaign against locusts and grasshoppers. But during the campaign he has so many different tasks, and cannot be everywhere at once, both in the field, and at a central decision point. Beside which, during this campaign, his Government required him to undertake a number of missions abroad.

84. A number of coordination problems therefore arose between the Plant Protection Services and the ONDR during the campaign, and the authorities should define more clearly the respective roles of these two bodies, and of the Plant Protection Service and international assistance in as far as concerns field operations.

85. Inevitably, in a campaign as complex and over as large an area as in Chad there will be differencies of opinion in the heat of events. But in Chad, the personal relationships between the actors, the mutual confidence and the good will that was evident, always allowed such difficulties to be overcome. All the participants involved in administration, both from international assistance and from foreign organizations, coordinated their work in the interest of the country and always sought and found a practical solution to problems as they arose.

86. The entomologist who coordinated the campaign for FAO, because of his experience in 1986, his full understanding of the problems, both technical and those specific to Chad, as well as his close relations with the nationals responsible for the campaign, was, on a number of occasions, able to take operational decisions directly.

4.4.2 Organization

87. The diverse sources for operational funds, and the fact that they were not always immediately available, or enough to cover the needs, complicated the organizational problems that arose during the campaign. Occasionally, control operations were held up while awaiting supplies, such as batteries, fuel, etc.

88. Another undeniable difficulty is the rarity of competent technicians in Chad. However, the situation is much better than in 1986. Training courses, in Chad and abroad, have brought to thirty the number of technicians in the Plant Protection Service who have taken part in control operations.

89. The organization of ground control must take into account the structures that exist in the field, including the ONDR (Organismes de Développement Rural) in each sector, and try to resolve the technical difficulties that exist during the campaign itlelf.

90. Air control began at the best moment, according to the information available to the FAO entomologist and coordinator. This coordinator played an essential role in the 1987 Campaign; he took part in all important decisions and therefore played a real operational role.

91. The logistician put at Chad's disposal by FAO also actively particiated in the campaign and organized the necessary transport; he also worked at resolving logistic problems for both ground, and aerial control operations, with the FAC plane, in the south and western regions.

4.4.3 Efficiency

92. In spite of all these difficulties, the campaign treated nearly 190,000 ha. All specialists agree that these treatments were efficient.

93. Whenever farmers had enough time, they efficiently protected their crops.

94. The comparative efficiency of liquid pesticides has been shown, both when applied by hand-held battery-powered sprayers and by motorized sprayers. The local control teams and their chief officers wish to see more hand-held ULV battery-operated sprayers available in the field, so that they can increase, when necessary, the number of village spray teams.

95. The excellent quality of aerial control was born out in the field. Micronair AU 5000 adapt themselves perfectly to grasshopper and locust control.

96. This campaign will certainly have a great effect in reducing grasshopper populations, because it must be added to the more natural factors which did not favour the grasshopper populations in 1987, that is, poor rainfall and parasitism.

4.5 Environmental Impact

97. No side effects of the pesticide applications was reported, but neither was there any investigation of the environmental impact.

98. Taking into account the low toxicity of the products used, and the low application rates, there are unlikely to be major side effects on birds and mammals, but the possibility of high mortalities in fish and aquatic invertebrates cannot be excluded.

99. Because of the importance of parasites and predators as factors naturally limiting grasshopper populations, the impact of such treatments on these benefical organisms should urgently be assessed, as well as their normal role in limiting grasshopper populations.

100. It should be noted that the areas treated against grasshoppers in the Sahelian zone of Chad represent only a very small proportion of the total area of the country, and the environmental side-effects of such treatments are therefore likely to be limited.

4.6 Recommendations

101. For the improvement of control operations in Chad, the mission recommends the following:

- Medium-term support to strengthening the Plant Protection Service from 1988 onwards, by increasing the number of its staff, and by selecting good technicians for further technical training, and by providing the service with a budget sufficient to allow it to undertake a campaign of normal size.

- Practical training for its staff in the upkeep and repair of the radio equipment used in contol work.

- To provide the service with further spraying equipment (hand-held battery-powered ULV sprayers, as a reserve for large-scale operations) and vehicle-mounted radios for scouting and reporting.

- To keep the FAO coordinator, and entomologist, in his post for at least the next campaign, as he has already taken part in two, and is perfectly integrated into the Service's decision-making structures.

5. CROP LOSSES

5.1 Report on Crop Losses

102. No systematic attempt was made to measure the damage grasshoppers caused to crops. There were undoubtedly some losses in millet in the Sahelian zone due to the general irregularity of the rains, and, locally, to grasshoppers and stem borers, but they are very difficult to quantify.

103. In Chad, experts estimate that losses due to grasshoppers were relatively limited this year, because of the very energetic control campaign, and because climatic conditions worked against the insects, particularly the second generation. On the other hand, there was a great increase in the incidence of stem-borers (Raghuva), which are becoming generalized throughout the whole Sahelian zone. It was not rare to see 10 or 20% of the ears attacked, sometimes by up to eight insects at a time. No losses to the Desert Locust were recorded. A number of swarmlets of Anacridium melanorhodon (tree locust) were sometimes confused with Schistocerca, but had no effect on crops.

104. During November, a USAID team carried out a study comparing crop losses to the various millet pests.

5.2 Cost/benefit Analysis

105. The figures available do not allow a cost/benefit analysis to be made.

5.3 Recommendations

106. There is no national system assessing crop losses. The mission recommends that such studies be regularly undertaken at the end of the agricultural season, and that they be as exhaustive as possible.

6. ORGANIZATION AND STRUCTURES

6.1 National Committees Involved

6.1.1 The National Coordinating Committee

107. The National Coordinating Committee, which was set up in 1986 to deal with the urgent problem posed by grasshoppers in the Sahel, functioned very well in 1987.

108. Its members included the Chadian authorities (the Plant Protection Service, ONDR, SODELAC, etc.), international organizations

(FAO, UNDP, the EEC, etc.), and the representatives of donors and the NGOs. It met when needed at the request of the Ministry of Agriculture during the period when the campaign was being prepared, before the season began, and regularly two or three times a month during the campaign proper.

109. The Committee was able to take up all the problems that arose during the campaign and to find the best possible solutions, especially in as far as regards operating costs.

6.1.2 The Technical Committee

110. The Technical Committee backed up the work of the Coordinating Committee in operational matters. Its members included the officers of the Plant Protection Service in charge of the campaign, the technicians supplied to Chad by FAO (an entomologist as coordinator and a logistician), consultants visiting the country, and the more important donors directly involved in operations and in logistic problems (USAID and FAC). It met at the request of the officer-in-charge of the campaign to look at strategic and operational needs, took decisions, and, when necessary, referred the matter to the National Coordinating Committee.

6.1.3 Evaluation

111. The system worked well in 1987 under actual campaign conditions, because of the large amount of assistance which Chad had received, and because of the general good will, availability and efficiency of the chief actors in this work, whose sole aim was the good of the country.

6.2 Improvement of the Plant Protection Services

112. The Service's staff was increased from seven members in 1986, to ten, and then to a total of thirty in 1987.

113. A large number of its staff members were selected to undergo training at different levels, including in the courses organized by PRIFAS at Montpellier and the course organized on USAID funds in Niamey with the cooperation of FAO.

114. The equipment left over from the 1986 Campaign (vehicles, radios and sprayers) as well as the pesticides in stock, were carefully stored and used in 1987, not only in the control campaign proper, but also during the period of preparation, for egg-pod surveys, and for training courses and the mobilization of farmers.

115. The supplies and equipment acquired in 1987 will further increase the Service's capacity. A complete inventory will be drawn up in November at the end of the Campaign.

116. But these supplies will not be sufficient if the Service is called upon to mount sizeable campaigns against grasshoppers, even when populations have returned to a normal level; such campaigns will have to monilize the entire resources of the Plant Protection Service and of the country's development institutions.

117. Because of the gregarious breeding in 1987, it appears obvious that the Service will have to deal with the great, and even more pressing problem of the Desert Locust next year.

118. It is therefore necessary to strengthen the Service, both in terms of personnel and of equipment, over a number of years. The UNDP/FAO Project presented to the Government in June may need light modification, but it is a first attempt to solve the problem. Parallel and coordinated bilateral assistance will improve the efficiency of this project. It is the Government's intention to greatly beef up the Service and, in the long-term, to give it all it needs to carry out its task. The Chadian authorities perfectly understand the great importance of pest control in Africa, and its role in improving the production of food crops.

6.3 International and Regional Structures

119. CILSS worked with FAO and FAC to coordinate the campaigns against grasshoppers in the various Sahelian countries. Its role in promoting such coordination is positive. In spite of the tendency so frequently seen to retain for the good of one country the inputs given to it, a number of positive examples of cooperation between states and between services occurred during this year, including the campaign carried out in Mauritania from bases in Mali; control activities in Mali using supplies from Senegal; and the desire unanimously expressed at the meeting in Maiduguri in June for better coordination of control activities and information between the countries of the LCBC (Lake Chad Basin Commission).

120. In future the control of grasshoppers and all other migrant pests must be based on a better understanding and cooperation between the countries of the region. The outlook seems favourable, but all attempts in this direction must be encouraged, and CILSS has its role to play in this.

121. OCLALAV, with FAO funding, sent a team of fourteen, then thirteen more, of its staff and five vehicles from Niger and north Cameroon to undertake control activities in Chad between August and the end of October. The team functioned very well and sprayed some 28,000 ha in which Desert Locust hopper bands and some young adults were found.

122. The present organizational problems are raised elsewhere, as urgent decisions need to be taken within the framework of general strategy in the Sahelian sub-region to control the Desert Locust in this pre-plague period.

123. PRIFAS in Montpellier carried out a new training programme in 1987, financed by various donors and by FAO, with a theoretical part in Montpellier and practical work in Niamey. This training was intended for those responsible for actual operations in the Sahelian countries, but was also followed by the technical officers of USAID.

124. PRIFAS' information letter, SAS (Sauteriaux au Sahel), which functioned in 1986, was expanded in 1987 with FAC funds, and a

biomodeling section, under Dr. Annie Monard, was set up in Niamey, so as to be able to immediately use ten-daily AGRHYMET data on rainfall.

125. These data, translated into predictions on the basis of PRIFAS' Oedaleus senegalensis (OSE) biomodel, were transmitted every ten days to all the Plant Protection Services in the Sahel and to all the correspondents of Operation SAS.

126. From September on, colour computer map for each country allowed these predictions to be more easily used in deciding where to undertake surveys and control operations.

127. These maps would be most useful to the Directors of the Plant Protection Services as one of the elements on which operation decisions can be taken during the campaign. It is to be hoped that this programme will continue and grow.

5.4 The role of the FAO

128. The roles of the entomologists and logisticians who were provided by FAO for the campaign in Chad are discussed in section 4.3. Of particular value was the fact that the entomologist was in Chad from February on, in time for the egg-pod surveys, training and the preparation of the campaign. This made his work even more useful.

129. At their level, these experts contributed to an efficient coordination of the campaign, and participated in the taking of strategic and operational decisions throughout the campaign.

130. Their work was efficient and fulfilled the mandate that they had been given.

131. Apart from organizational coordination, and logistic and operational coordination, FAO also undertook regional coordination of the campaign.

132. FAO also participated in organizing the campaign against the Desert Locust.

133. All these activities appeared to have been most favourably received by the Chadian Government.

5.5 Recommendations

134. The National Coordinating Committee should hold most of its meetings in the period when the campaign is still under preparation. Once a plan of operations has been established, it need meet only infrequently during the campaign itself.

135. The Technical Committee should continue to play an active role throughout the whole course of the campaign.

136. The process of reinforcing the National Plant Protection Service should continue through the UNDP/FAO Project from next year on, over a number of years, with parallel support from bilateral assistance.

137. CILSS should continue to work for the cooperation of all the Sahelian states and for the coordination of the campaign.

138. PRIFAS should again be requested to undertake specialized training in grasshopper and locust control. Its monitoring programme, Sauteriaux au Sahel (SAS), should continue and include the provision of predictive maps in colour to the Plant Protection Directorates of each country every ten days.

139. FAO should continue to act as coordinator, as was the case this year.

7. THE 1987 CAMPAIGN AGAINST THE DESERT LOCUST IN CHAD

140. In May and June 1987, reports from north-west Sudan that the Desert Locust was benefitting from the excellent conditions for reproduction in the region, suggested that there was a real risk of Chad being invaded in the rainy season.

141. As early as June/July, and in August, the FAO entomologist noted hopper bands and gregarious swarms in the region of Kalaït (Oum Chalouba, 1550 N, 2055 E).

142. Following these reports, FAO recommended to the Chadian authorities that rapid control measures be undertaken by an OCLALAV team called from Niger, using barrier spraying with a very rapidly working pesticide (Fenitrothion ULV) mixed with a very small amount of a more permanent pesticide. This strategy aimed at destroying the hopper bands before they could reproduce and at sterilizing any laying that nonetheless occurred. But the permanent pesticide was not sent to Chad, as the Government would not accept its use, believing that herdsmen in the region opposed such treatments from the fear that it would harm their cattle.

143. Soon afterwards, at a meeting of donors held in Rome, a number of strategic decisions were agreed upon by FAO, FAC and USAID. These included a joint mission by expert consultants from FAO, FAC and USAID; the hiring of a Britten Norman BN2 from a private company, Transniger, (a dual-purpose, scout and spray plane, well adapted to work in the Sahara); and the dispatch by air of large quantities of the rapidly-action pesticide necessary for a campaign against gregarious hopper bands; and the mobilization of a strengthened OCLALAV team drawing on its staff in both Nigeria and northern Cameroon.

144. These decisions, in the light of the emergency situation, were not all carried out. The consultant mission visited the country between the middle of August and the end of September; the OCLALAV team was in Kalaït by the beginning of the month of August; but the aircraft was not immediately hired because of some hesitancy on the part of the Niger Government, overcome by the end of the month.

145. These developments, and the result of an aerial survey by the consultants, led the Technical Committee to decide to strengthen the

ground scouting and control teams, increasing to a total of fourteen the Plant Protection and OCLALAV vehicles working in the area of Kalaït-Biltine-Iriba. The area that needed scouting (where there seemed to be sufficient vegetation for the insects) formed a rectangle running east to west, largely on the 16th parallel north, of about 150 by 300 km.

146. At the beginning of September, FAO agreed to finance the mission of the OCLALAV team, which remained in the country till the end of October; control of the hopper bands in the region of Kalaït began at the end of August.

147. The area west of a line from Kalaït to Biltine, that is, the western half of the area at risk, was not surveyed.

148. Most of the control activities took place in the month of September in infested oueds in the region of Kalaït and in an area of about 50 km around this.

149. Control continued from the end of September into October in the area to the east of Iriba and Guereda.

150. At the beginning of October, most of the Desert Locust populations had fledged. It proved difficult to follow the movements of swarms, as some moved west and others east. A number of reports also appear to have been of swarmlets of tree locusts (Anacridium melanorhodon), which posed no danger to crops.

151. The helicopter financed by FAO (an Alouette II hired from Gyrafrance) arrived at Abeche on 28 September. The FAO coordinator and logistician in Chad and the FAO regional coordinator, in the country on a mission, used it for scouting from Abeche. After this, it sprayed a number of young adults swarms, mixed with late-instar hoppers, in the eastern region. On 14 October it carried out control activities over 13,900 ha.

152. For work against the Desert Locust, the Alouette helicopter suffered from two handicaps:

- Its effective radius of action (some 2½ flying hours) was not sufficient, because of the enormous area that had to be covered.

- For security reasons, it was obliged to return to its base at Abeche each day, further limiting the distances it could travel while scouting.

153. By 14 October, control activities between the end of August and the beginning of October had been carried out over 41,950 ha by ground and aerial spraying, the 13,900 ha treated by helicopter included.

154. At the present moment, the entire population is adult, and nearing sexual maturity and new infestations will soon appear if egg-laying occurs in the region itself. But the swarms may also migrate

away, and for long distances. It is probable that control activities will have to be mounted in the Biltine-Kakaït-Iriba-Guereda area. Ground treatment should continue, supplemented, if necessary, by extra aircraft.

155. Nonetheless, if very large hopper infestations occurr (of, say, 100-200,000 ha, or even more), it is very unlikely that they can be destroyed using only pesticides with a low degree of permanence.

156. Finally, it should also be noted that populations, which may be very large, were reported by the army in August and in September in the regions of Zouar and of Faya Largeau. These unconfirmed reports leave very unclear the real size of the problem and what may happen to these insects. The FAO entomologist will continue to follow the situation at least to the end of November.

157. Intense activity by Schistocerca gregaria in Chad must be expected next year, of the level greater than in all the campaigns undertaken in the Sahel in more than 25 years. It is therefore most important to give Chad the equipment, means and specialist scouts necessary to face up to this new problems.

8. CONCLUSIONS AND GENERAL RECOMMENDATIONS

8.1 Grasshoppers

158. After two difficult years, the grasshopper situation appears to be returning to normal in the Sahel, with populations falling, parasitism growing, and because of the efficiency of the control campaign.

159. International assistance will no longer be on an emergency basis, but must continue, in the more normal way, to support activities underway, and to build on the recent technical and strategic gains of the Plant Protection Service (including the mobilization of farmers in Phase I).

160. A number of matters which must be considered follow:

12 Maintain and strengthen a strategy based on ground control

Phase I

- Make farmers, that is the village brigades, directly responsible for monitoring and control operations.

Phase II

- Move to survey and control by the mobile teams of the Plant Protection Service, with their motorized spraying equipment, and by the largest possible number of village teams.

2º Strengthen the Plant Protection Service

- Support the UNDP/FAO Project to assist the Plant Protection Service in Chad.

- Give favourable consideration to bilateral projects in the fields of technical training, the supply of material, the construction of buildings, etc.

- Attempt to resolve the various logistic, maintenance and storage problems for supplies and equipment between campaigns, and during actual control operations. Give the Plant Protection Service sufficient fixed and mobile radios, so that the field and the Directorate, where decisions are taken, are effectively linked.

- Provide a national operating budget for the Plant Protection Service, as, by its work, it efficiently prevents crop losses. Continue technical training for the staff of the PPS and standardize its equipment and control methods.

3º Training

- Continue and extend farmer training, so that they may take over the monitoring and destruction of infestations at the beginning of the rainy season; this means local training and the use of such media as the national radio, the press, posters, etc.

- The progressive improvement of their control capabilities will involve a change from the dusting bag to the hand-held ULV battery-operated sprayer, and this will require a number of years.

- Organize long-term training for the PPS' operational staff in the fields of spraying, maintenance, and transport and storage. Set up a system to recruit and promote competent staff members.

- Prepare trainer-trainers in a whole set of fields, including scouting activities, control decisions, logistics, campaign preparation and management, and the standardization and upkeep of equipment. Such training could be within the framework of the UNDP/FAO Project to reinforce the PPS, or through bilateral assistance.

4º Supplies and equipment

- The equipment most suited to the needs of mobile control teams is:

  - exhaust nozzle sprayers, mounted on six-cylinder diesel engines;

  - hand-held ULV sprayers.

- Regional stores of hand-held ULV battery-operated sprayers, which can be used by the village brigades, should be set up.

- Equipment should be chosen for its roboustness, the quality of its spray, the simplicity with which it can be used and with which it works, the ease of maintenance, and of transport and storage. Too fragile or too sophisticate equipment should not be considered. In general, it would be better to follow a policy of developing the largest possible number of small control teams, with the support the the technical officers of the PPS. This would mean adopting a strategy, in the future, of many small ground control operations based on a large numbe. of strategic stores of small-scale spraying equipmenr, rather than on the systematic use of aerial spraying.

5Ω The early purchase and delivery of pesticide reserves

- Following an inventory of the pesticide stocks left over at the end of this campaign, it will be necessary to supply, by May 1988 at the latest, sufficient powder and ULV (20 or 50%) pesticides for control activities in Phase I; regional stocks for contol activities in Phase II will also be needed, as will general strategic reserves.

- In 1988, such pesticides will again have to be provided by international assistance, but the long-term expressed objective of Chad is to ask farmers to make a financial contribution to country's cost in supplying pesticides and control equipment. In the medium-term, these inputs must all be financed from agricultural production.

6Ω The possible use of supplementary aerial campaigns in the event of exceptionally heavy infestations in Phase II

- There always remains the possibility that aerial operations are necessary, because no long-term meteorological prediction, and hence biological prediction, can be made.

- Bilateral assistance might consider paying industrial insecticide producing companies and aerial service hire companies to keep reserves from which they can supply what is needed when the events justify it. This may be the best solution when locust and grasshopper activity has returned to more normal level, and the emergency situation is over.

8.2 The Desert Locust

8.2.1 At the Regional Level

161. Gregarious Desert Locust breeding has increased this year in eastern Africa, on the shores of the Red Sea, in Ethiopia and in Sudan, and in west Africa, in Chad and Niger.

162. The situation did not, however, prove to be as catastrophic as one might have imagined in June at the beginning of the rainy season.

But experts agree that next year's campaign will be very difficult, and that there is a very real risk of a plague in Africa.

163. At the same time, the region has never been so badly prepared. OCLALAV both saw its mandate reduced only to the Desert Locust, and suffered from its Member States no longer even providing the necessary minimum so that it might regularly pay the normal salaries of its staff. In spite of the skills of its field staff, it can therefore not carry out its work of surveying the Desert Locust and undertaking preventive control when necessary.

164. Its member states' lack of support for the organization has led to the unwillingness of most of the potential donors to assist it, and a general preference for bilateral support.

165. This is regrettable, considering the technical efficiency of this organization when it still had the equipment and financial means necessary for field activities, such as in 1974 and 1975, during the first grasshopper emergency in the Sahel. The success of that campaign, and the prevention of Desert Locust plagues during the last fifteen years, has undoubtedly contributed to the organization's problems.

166. It is no longer possible to deny reality. The organization appears to be condemned to disappear, probably rapidly, perhaps over a longer period, but it is necessary that a number of decisions concerning it be taken as soon possible.

167. OCLALAV's Administrative Counsel, with the support of CILSS, should ensure that the acquired rights of all its staff members be satisfied as soon as possible after its accounts have been closed and its goods re-distributed or sold off.

168. No other structure for rational and coherent monitoring, and for implementing a control strategy in the Sahelian countries, can at present be conceived of.

169. The solution adopted by the Niger Government, which is to itself assume the responsibility for the preventive control of the Desert Locust in its own territory, through its Plant Protection Department, could be generalized throughout West Africa.

170. Survey and preventive control in the gregarization zones of West Africa from 1988 on would then rely upon the Plant Protection Services of Chad, Niger, Mali and Mauritania.

171. If this solution receives international agreement, every effort must be made to have it working by the next campaign, so as to be able to face the very real threat of a plague.

172. Without considering how this should be done, the following five points appear important.

- A complete transfer to these four national Plant Protection Services, now responsible for Desert Locust preventive control, of OCLALAV's supplies, buildings, and experienced field staff (monitors, scouts, drivers).

- Funds and possible operational support must be provided by bilateral assistance to each country.

- Desert Locust experts must continue to work only on the problem of survey even when the Desert Locust is in a recession, and when there is a temptation to forget it.

- Regular ratio contacts between the four Sahelian Plant Protection Services involved should be maintained on OCLALAV's regional frequencies.

- Regional technical coordination, by a small expert team, and the regional and international centralization of data on locusts, and for the development of common control strategies, particularly in periods of danger, will be necessary.

173. Such coordination, financed by international assistance, could also use improved but expensive methods of data gathering such as the regular photogrammetry of satellite imagery, and computerized statistical biomodeling of populations.

8.2.2 The Case of Chad in Particular

174. After a very long period without control activities against the Desert Locust, Chad has been invaded by gregarious Desert Locust populations from Sudan, or which developed locally. The final breeding of 1987 is now underway.

175. The movements of the swarms that result from this breeding must be monitored immediately after the end of control activities against hoppers.

176. The Chadian Plant Protection Service will need help throughout the period between campaigns to maintain scouting and survey, and to train a number of expert mobile scout teams.

177. At the beginning of the spring of 1988, the possibility of using an aircraft of the Britten Norman BN2 type for regular aerial survey should be considered. This aircraft might also perform similar survey work in the neighbouring Sahelian countries, Niger, Mali and Mauritania, if needed because of the development of the locust situation at the end of 1987.

9. ACKNOWLEDGEMENTS

178. The evaluation mission would like to greatly thank all those who gave it their assistance and contributed to its work, in particular the FAO and its Representative in N'Djaména, for having coordinated the campaign, and for his efficient support during the mission's visit to Nigeria, and USAID, which organized a quick field trip to the aerial campaign, to FAC and its representatives for their full support, and to the national officer in charge of the campaign, for his full and invaluable cooperation.

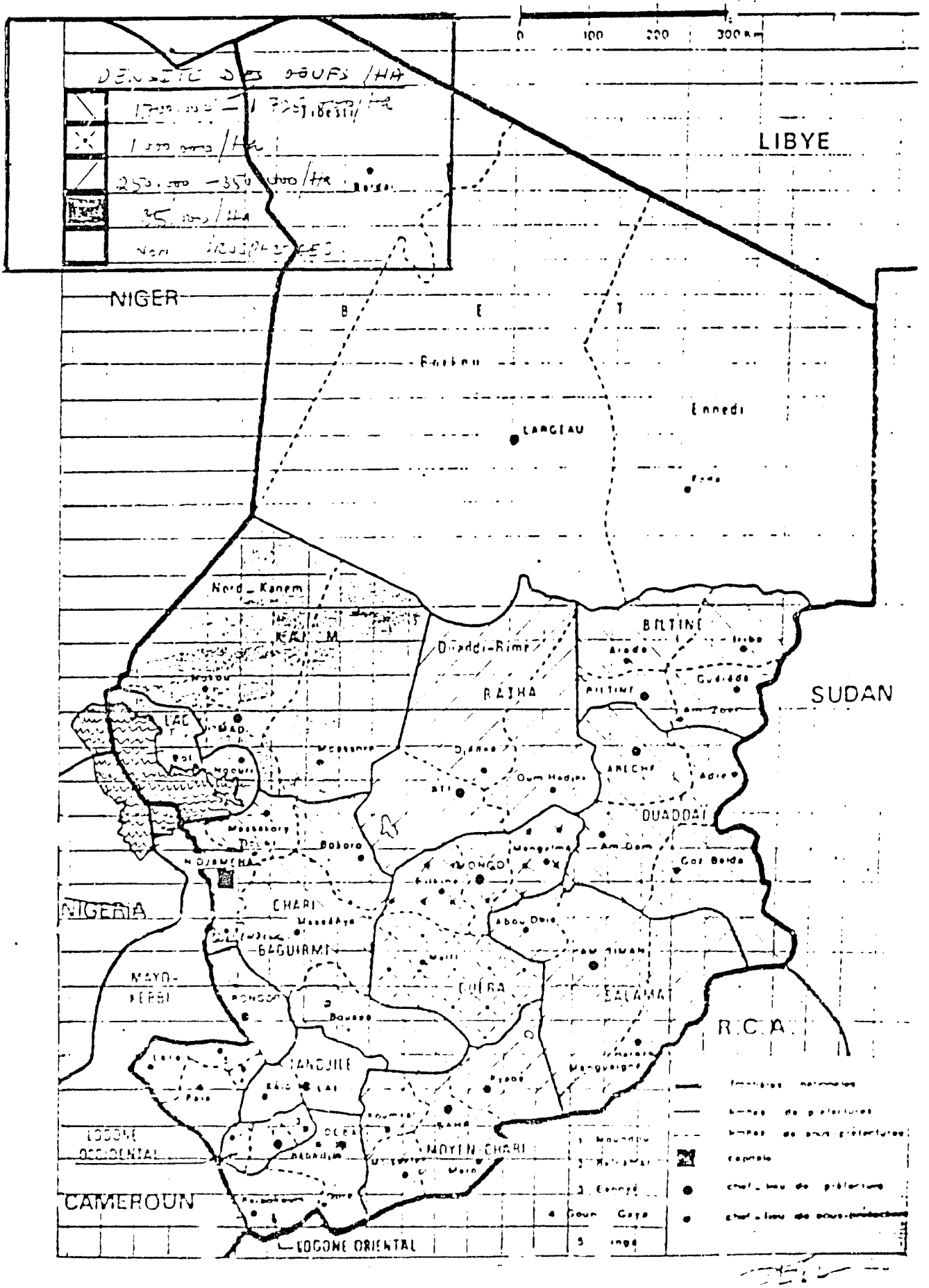
PROSPECTION D'OOTHEQUES

RECAPITULATION PAR PREFECTURE

PREFECTURE	OOTHEQUES/ M2		OEUFS/M2	OOTHEQUES	OEUFS PARASITISME/M2	OEUFS/ OOTHEQUES	% OOTHEQUES	OOTHEQUES PAR HA	OEUFS PAR HA
OUADDAI	6.39	172.59	0.04	19.70	25.96	0.0	10.69	63,902.12	1,725,899.47
CHARI-BAGIRMI	3.42	170.71	0.00	58.43	46.43	0.0	30.57	34,175.82	1,707,142.86
GUERA	4.16	68.54	0.00	5.89	16.60	0.0	6.83	41,648.35	685,439.56
MOYEN-CHARI	2.11	34.76	0.63	0.20	12.59	32.24	0.69	21,053.57	347,589.29
SALAMAT	1.17	26.73	0.00	0.29	21.05	0.00	1.54	11,693.12	267,328.04
BATHA	2.49	25.34	0.00	1.17	10.02	0.00	5.08	24,891.77	253,441.56
KANEM	0.58	8.47	0.01	0.03	17.86	0.01	0.01	5,808.27	84,689.85
LAC	0.20	0.73	0.00	0.15	5.27	0.00	0.46	2,040.82	7,295.92
BILTINE									

ANNEX II

RESULTATS
DES PROSPECTIONS D'OOTHEQUES
(1937)



ANNEX III

PROVISIONAL CONTROL PROGRAMME

Prefectures	Areas Involved/ha	% to treat
Ouaddai	67.017	60%
Biltine	56.230	40%
Batha	62.202	25%
Kanem	36.256	15%
Chari-Baguirmi	109.678	45%
Lac	109.000	15%
Guéra	147.063	40%
Salamat	21.625	25%
Mayo-Kebbi	233.370	7%
Moyen-Chari	170.000	20%
Tandjilé	128.669	5%
Logone Occidental	110.380	5%
Logone Oriental	151.532	5%
	1.403.022 Ha	283.415 Ha

REPARTITION DES PRODUITS LIQUIDES ET SUPERFICIES A TRAITER PAR PREFECTURE

PREFECTURE	SUPERFICIE TOTALE (HA)	MALATHION		FENITROTHION	
		SUPERFICIE (HA)	QUANTITE (LIT)	SUPERFICIE (HA)	QUANTITE (LIT)
* OUADDAI (ABECHE)	40,200	26,700	16,020	13,500	3,649
* CHARI-BAGUIRMI (NDJAMENA)	49,350	32,700	19,628	16,650	4,500
* GUERA (MOUNDOU)	58,820	39,000	23,400	19,820	5,355
* BILTINE (BILTINE)	22,490	15,000	9,000	7,490	2,024
* SALAMAT (AM-TIMAN)	5,400	3,600	2,160	1,800	487
* MOYEN-CHARI (KOUMRA)	34,000	22,500	13,500	11,500	3,108
* BATHA (ATI)	15,500	10,500	6,300	5,000	1,350
* KANEM (MAO)	5,400	-	-	5,440	1,470
* LAC (BOL)	16,350	-	-	16,350	4,420
* MAYO-KEBBI (BONGOR)	16,335	-	-	16,335	4,412
* TANDJILE (LAI)	6,430	-	-	6,430	1,738
* LOGONE-OCCID. (MOUNDOU)	5,520	-	-	5,520	1,490
* LOGONE-ORIENTAL (DOBA)	7,576	-	-	7,576	2,047
T O T A L	283,411	150,000	90,000	133,411	36,050

ANNEX V

LIST OF DONOR ASSISTANCE

b+	**Canada** TOTAL: (++)		
	4,600 l Fastac	(+)	
	* * *		
m+	EEC TOTAL: ECU 150,000		169,500
	technical assistance	ECU 18,700	
	200 pairs plastic goggles	USD 4,500	
	expert costs	ECU 12,000	
	53,075 kg Fenitrothion 3 percent dust	59,974	
	14,600 l Fenitrothion 50 percent ULV	70,165	
	Through FAO		
	* * *		
b+	EEC TOTAL: 27,000		27,000
	internal transport of pesticides, supplies and equipment (local currency)	27,000	
	* * *		
b+	FR Germany TOTAL: 450,000		252,809
	1 month training for two experts	(++)	
	technical assistance	(++)	
	general operating expenses and in-country transport	150,000	
	1,000 ULV hand sprayers	(+)	
	10,000 batteries	(+)	
	500 protective overalls	(+)	
	50 MT Propoxur	(+)	
	10,000 l Fenitrothion 20 percent	(+)	
	7 MT Propoxur (additional pledge)	(+)	
	* * *		
b+	France TOTAL: FF 3,250,000		490,000
	80 helicopter flying hours for 1 month of prospection	(++)	
	1 or 2 aircraft month for phase II		
	150 hrs, best of	(+)	
	helicopter for locust survey in August	(+)	
	additional plane for locust control	(+)	
	1 4x4 lorry with sprayer	(+)	
	1 4x4 liaison vehicle	(+)	
	1 fellowship to PRIFAS	(+)	
	1 PRIFAS mission	(+)	
	1 logistician mission	(+)	

	operating expenses	FF 200,000	
	500 ULVA sprayers + batteries	(—)	
	100 Knapsack sprayers	(—)	
	ground surveillance	(—)	
	egg-pod survey	(—)	
	40 MT Propoxur and Lindane	(—)	
	10,000 l Fenitrothion 1000	(—)	

This assistance is part of the FF 20 million made available on a regional basis

* * *

b+	Indonesia TOTAL: 10,000			10,000
	operating expenses		10,000	

* * *

b+	Italy TOTAL: lit. 308,000,000			244,444
	4 1.5 MT lorry FIAT 40 WM	lit. 148,000,000		
	4 sprayers	lit. 32,000,000		
	200 knapsack dusters	lit. 8,000,000		
	50 motorized knapsack sprayers	lit. 25,000,000		
	20 tractor-mounted sprayers	lit. 16,000,000		
	790 masks	lit. 8,500,000		
	350 goggles	lit. 1,750,000		
	350 protective overalls	lit. 3,500,000		
	350 gloves	lit. 700,000		
	550 boots	lit. 9,500,000		
	1 MT Acephate/Ortene	lit. 10,000,000		
	1,000 kg Carbaryl (=Sevin)	lit. 10,000,000		
	3,000 kg Chloropyrifos/ Dursban 12 percent a.i.	lit. 30,000,000		

* * *

b-	NGO/World Vision TOTAL: (++)			
	50 hand-held sprayers		(++)	

* * *

b+	Switzerland TOTAL: 27,000			27,000
	training on pest control for 254 agri-extension agents		27,000	

* * *

a-	UNDP TOTAL: 34,000			34,000
	secretariat for emergency operations		34,000	

* * *

b-	United Kingdom TOTAL: UKL 9,000			13,867
	assistance for Mission Aviation Fellowship (MAF) aircraft		UKL 9,000	

* * *

b.	USA TOTAL: 1,254,261		1,254,261
	250 hours fixed-wing operations and ground support	398,708	
	airgas, fuel	74,023	
	ground support for aerial operations	80,000	
	13 4-wheel drive vehicles (5 due in May 87)	(—)	
	training at PRIFAS	8,100	
	senior entomologist 7 m/m and field entomologist 4 m/m	191,000	
	in-country transport of pesticides	16,500	
	90,000 l Malathion	485,930	
	in-country transport of Malathion	16,500	

* * *

TOTAL COSTED AID US$ 2,522,881

ANNEX VI

PROVISIONAL ANALYSIS OF CONTROL ACTIVITIES AGAINST GRASSHOPPERS IN 1987

as of 14 October 1987

PREFECTURES	GROUND TREATMENT	AERIAL TREATMENT	TOTAL TREATMENT HA
KANEM	1.036		1.036
LAC	2.632	3.000	5.632
CHARI-BAGUIRMI	8.272	6.600	14.872
MOYEN-CHARI	21.307	17.300	38.607
		Sub-total 26.900	
BATHA	19.234	24.770	44.004
OUADDAI	16.876	11.763	28.639
BILTINE	5.387	14.250	19.637
GOERA	12.223	21.000	33.223
SALAMAT	1.411	-	1.411
		Sub-total 71.783	
GRAND TOTAL	88.378	98.683	187.061

ANNEX VII

PERSONS CONSULTED

Mr. CHERIF AB EL WHAB	Director-General of Agriculture
Mr. Michel NGAROMILLET	Director of Agriculture, Officer in Charge of the 1987 Campaign
Mr. Philippe MENGIN	FAO Representative in N'Djaména
Dr. John EGELE OHABUIKE	Coordinator, Entomologist, FAO
Mr. GAYARD	Logistician, FAO
Mr. Jacques COMPAGNON	Head of the French Cooperation Mission
Mr. François ENGLEHARDT	Counsellor of the French Cooperation Mission
Mr. Loc PARENT	UNDP
Mr. CHAMBERAN	EEC
Mr. Bernard WILDER	Director, USAID
Mr. Kurt FULLER	Officer-in-Charge of Agricultural Management, USAID
Mr. Habib KHOURI	Logistician, USAID

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

THE GAMBIA

Mission: (13-17 October 1987)

Mr. Channing J. Fredrickson (FAO)
Mr. André Duhart (France)
Ms. June Andreasen (USA)

Contents:

7. CROP LOSS ANALYSIS

8. ORGANIZATION AND STRUCTURE

9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

Annexes:

JOINT FAO/DONOR REVIEW OF THE THE 1987 GRASSHOPPER CAMPAIGN

THE GAMBIA

1. ACKNOWLEDGEMENTS

1. The team wishes to thank the FAO Country Representative for expeditiously arranging a meeting with the donor community. Thanks are also due to the FAO staff for logistic support.

2. The active cooperation of USAID was much appreciated, especially the provision of vehicles and other logistic help.

3. The Crop Protection Service provided documents, and gave the mission assistance in gathering information for this report. The mission greatly appreciated this cooperation.

4. Special thanks is due to Ms. Alida Laurense, FAO Entomologist, who unselfishly gave so much of her time, even in the evenings, to assist the mission.

5. The National Coordinator of the Grasshopper Campaign, during a busy day, gave the team a comprehensive account of the Command Centre's activities, which was most useful.

2. INTRODUCTION

6. As late spraying in 1986 in extensive crop areas took place after oviposition occurred, it was fully anticipated that a serious grasshopper infestation would continue in the 1987 crop year. The FAO/Donor Evaluation Team noted this in November 1986, and made certain recommendations which were followed by the Crop Protection Service.

7. A meeting in Rome in December 1986 of donors and representatives of the national plant protection services developed a list of requirements for the 1987 campaign including for the Gambia; virtually all the items Gambia requested were supplied.

8. In 1987, grasshopper populations did not reach the expected levels, and more timely, selective spraying was possible. In addition to the Steering Committee, a technical task force was organized, which greatly facilitated control operations.

9. This report reviews grasshoper control operations in Gambia in 1987, and makes certain recommendations for the consideration of donors, FAO, and the National Crop Protection Service.

3. EVOLUTION OF GRASSHOPPER POPULATIONS IN 1987

3.1 The Weather

10. Rainfall only reached significant volumes in May. Rains in June were very heavy, apart from one month from 15 June, in the extreme west of the country. In August and September, rainfall was excellent and continued into the first 15 days of October, when the mission visited the country.

11. Because, largely, of these excellent rains, cereal harvest either are, or will be, very good. Short-cycle millet had already been harvested by 15 September. Long-cycle millet, sorghum, and maize appear to be heading for a good harvest, which will begin at the end of the month of October. The ground-nut, sesame, and root crops would be equally successful. It should be noted that the 1987 rainy season in Gambia was not marked by hot and drying north-easterly winds, which caused damage to all crops in the 1986 season.

12. From May to October, Gambia remained in the Intertropical Convergence Zone.

3.2 The Grasshopper Situation

13. In as far as regards the size of the various grasshopper populations, the situation in 1987 in Gambia was very similar to the situation in I986. A number of factors, however, meant that a spectecular late-season aerial campaign like that of last year, when some 250,000 ha were treated was not necessary: these included a generally better level of organization; the establishment, before the campaign began, of a network for monitoring and reporting; the training of village intervention teams; the setting-up, by the Crop Protection Service, of ground control teams; and a more accurate estimation of the areas infested.

14. As ever, the most important species were Kraussaria angulifera, Kraussella amabile, Cataloipus fuscocoerulipes, Zacompsa festa, and Hieroglyphus, above all daganensis. This complex of species, which is typical of Sudanic savannahs, and of the biotopes of the south Sahel, is described by George Popov as the "Savannah complex".

3.3 Egg-pod surveys

15. A number of scattered egg-pod surveys were undertaken in January by the technicians of the Plant Protection Service. But, as the FAO entomologist was not present during these prospections, they were not carried out with the necessary rigour. The results obtained varied widely and were not expressed numerically, nor were the grasshopper species involved identified. It would be very valuable if the FAO consultant, George Popov, could undertake a training mission to Gambia at the beginning of 1988, to train the staff of the Plant Protection Service in egg-pod survey methodology, including the identification of the species involved.

3.4 The Effects of Control Operations on Populations

16. The 1987 Campaign was much better organized than was the 1986. Work started at the beginning of the year. Nine phytosanitary bases were set up in various parts of the territory, and under them 21 stations. The total staff of the Plant Protection Service was increased to 61 people, of whom a number had been trained, or had acquired experience, in integrated pest management (IPM). Ten thousand villagers, students included, were given a course on grasshopper problems in May, and farmer brigades were set up for early control operations using the equipment and pesticides that were available. The entire Crop Protection Service was either trained or re-trained between March and June, with the help of the FAO expert, in grasshopper biology, species identification, density estimation methods, the various pesticide formulations, the various application techniques with different equipment, the use of radios (a network of 31 sets) and map reading. Ground control equipment and insecticides were delivered in time and distributed, in spite of some difficulties with the Treasury, to the secondary centres where they would be used. For large-scale aerial operations, the Plant Protection Service had at its disposal two Commodore aircraft supplied by Canadian assistance and a Cessna 188 supplied by Luxembourg.

17. The first hatchings of the five principal species mentioned above were observed from 20 July on.

18. The following densities were recorded:

Lower River Division	2 - 27/m^2
MacCarthy Island Division South	2 - 32/m^2
Upper River Division	4 - 18/m^2

19. The control threshold had been fixed at 15 hoppers per square metre. Village intervention teams immediately began to dust, particularly in the rice fields.

20. In the month of August, grasshopper densities went above 15 only in bush areas of the Lower River Division (26/m^2), in MIDS (20/m^2), and in URD (26/m^2), in rice and sorghum in URD (17 and 16/m^2), as well as in millet fields in the same region (17/m^2).

21. Ground teams from the phytosanitory stations carried out control activities over 630 ha in August; on the 20th and 21st of the month, at Kambo, near Jambarijally, the Cessna treated 8,400 ha.

22. The adults of the principal species mentioned appeared in September, but neither their densities, nor the areas invaded, were sufficient to justify aerial treatment. Ground control teams still continued working and treated about a further thousand hectares.

23. At the beginning of October, some damage to newly planted-out rice fields was noted. The two Canadian planes then treated an area of 12,104 ha under this crop on the 8 October. The same planes returned from Dakar on 13 and 14 October to spray a strip of land under rice between the tree limit and some 200 metres from the river Gambia: the total area was about 10,000 ha.

24. Dr. Alida Laurense, the FAO entomologist in Gambia, estimates that operations against these five principal species should have been considered finished by 15 October, because large-scale laying had already taken place by this date. Nonetheless, the Plant Protection Service Directorate wished to continue operations over some thousands of hectares by ground control and using the Cessna aircraft.

3.5 Residual Populations at the end of the Season

25. At the end of the season, the residual adult population of the five principal grasshopper species remained large. Densities of between 10 and 15 winged individuals per square metre occurred in the bush and in the crops. The area infested is estimated at 4,000 to 5,000 hectares. These populations have only one generation a year and do not much move around their biotopes.

26. Although this was recommended by the November 1986 Evaluation Mission, the FAO entomologist did not have the time to study the effect of last year's large-scale spraying on the hymenoptera parasite of the cassava mealy-bug, Phenococcus manihoti, which had been introduced by the Integrated Pest Management (IPM) Project. On the other hand, it is clear that a number of Tse-tse flies, of interest in the work of a British medical research team, were killed; the larvae in the soil, however, had not been affected.

4. MONITORING AND RAPID WARNING SYSTEMS

4.1 The Performance of the National Monitoring System in 1987

27. The Directorate of the Plant Protection Service is at Yundum, near the capital's airport, quite distant from the city itself. There are nine bases and twenty-nine stations spread throughout the territory. These bases and stations all have receiver-transmitter radios, powered by small generators. Considering the relatively small area involved, the plant health communications network, for the rapid warning system, is extremely dense; a much thinner network was set up in the much larger neighbour, Senegal.

28. Daily reports are transmitted by radio, first from the stations to their bases, then from the bases to the Plant Protection Service Directorate at Yundum.

29. The data is recorded on a three-page form: the first page is modelled on PRIFAS grasshopper form; the second deals with other insect pests of crops; and the third with plant diseases.

4.2 The Use of Information in Control Operations

30. The analysis of the data received at the Plant Protection Service Directorate is not always very logical. The FAO expert in Gambia had frequently to intervene at the stage when conclusions were being drawn and when decisions, sometimes urgent, were being taken.

4.3 Evaluation and Recommendations

31. A Division for Agricultural Warning and Rapid Alert should be created within the Crop Protection Service Directorate.

5. TRAINING

5.1 Training Activities in 1987

32. Between 30 March and 17 June, five crop protection training programmes were held, four financed by USAID, two of which were organized jointly with FAO. The fifth was financed by an NGO, Action Aid, and executed by CPS staff. Training materials were prepared by the FAO assistant expert, and the courses were as follows:

30 March - 10 April	Trainer training; 30 agents of the CPS or from NGOs were trained in grasshopper biology, in pesticide use and safety, and in radio communications.
1 - 31 May	Farmer training: CPS agents spent 2 hours each in a large number of villages, demonstrating pesticide use and safety; 10,000 farmers were thereby trained.
3 - 5 June	Nine pest surveyors were trained by the Command Center staff in data collection, grasshopper identification and in survey methodology.
6 - 12 June	These nine pest surveyors then trained 25 pest scouts under the supervision of Command Center staff, in the same subjects.
16 - 17 June	18 Action Aid agricultural agents were trained by two pest surveyors and one Command Center staff member.

33. The 31 radios and generators provided by USAID were installed by a Gambian electrical engineer on contract to USAID, who trained each operator in radio use.

5.2 Further Training Needs

34. The 31 new radios provided to the CPS will require systematic maintenance and repair, as will the generators. Vehicle maintenance continues to be a major problem. Agents will need repeated training in the calibration and use of the various spray equipment provided by donors, in the safe and correct use of pesticides, and in the disposal of containers.

35. If the CPS is absorbed in the extension service, in the restructuring of the Department of Agriculture, the training needs will be even more extensive because, as farmers take more responsibility in pest control, the risk of pesticide misuse will be greater; private pesticide firms will not take responsibility for such training, nor for monitoring treatment, and the correct storage and disposal of pesticide containers.

36. The insect collection, the library with its publications, etc., are tools of training and should be maintained and improved. A budget for training supplies is needed.

37. Those Gambians who have returned, or will soon return, with degrees in such fields as IPM, Entomology and Plant Pathology may need short-term training in management or in training techniques to enable them to be effective. CPS agents and team leaders would also benefit from additional training, although some were well-trained by the IPM Project. Ideally, one or more agents should be trained in radio and generator repair. In the long run, replacement of the generators with solar panels would be cost-effetive.

5.3 Evaluation and Recommendations

38. The excellent training materials prepared by the FAO expert helped the 1987 training program, which was funded by USAID, to be very successful. The farmer-training programme was probably effective in the case of a good number of the farmers involved, especially in some aspects of pesticide use, though, in general, the sessions were too short (2 hours), and the groups too large.

Recommendations

39. - Whether or not the CPS remains in existence, the CPS Centre in Yundum should be the focal point for crop protection training, and should have a training budget.

- The CPS still needs technical assistance in organizing programmes, and to procure and produce training materials. An officer to liaise with the Dakar Training Centre should be appointed.

- CPS agents should be given short-term training in survey techniques, grasshopper identification, and in the correct and safe use of pesticides. Selected staff should receive courses in radio, generator, vehicle and spraying equipment repair.

- Calibration equipment must be purchased, so that agents can be trained to use spray equipment properly and to avoid wasting pesticides.

- Light-weight protective clothing suitable for tropical, humid countries such as the Gambia should be purchased, so that safety training has better chance of success.

6. CONTROL OPERATIONS

6.1 Organization of the Campaign

40. The National Steering Committee was chaired by the Permanent Secretary of the Ministry of Agriculture; it included representatives of the donors and FAO, and through this mechanism, donors were able to rapidly identify the inputs needed.

41. This year, a County Task Force was also established. The Under-Secretary of the Ministry of Agriculture was Chairman, and it included technical personnel from such government departments such as Crop Protection, Health, the Environmental Unit, the Medical Services, etc. The USAID, FAO and ODA technical advisors were also members. The CPS in Yundum organized a Headquarters Command Centre with a National Coordinator, an assistant and technical advisors from the donors. This coordinating unit maintained daily contact with 31 up-river stations through the radios which had been supplied by donors. See annex VI.

42. The Command Centre supported the 61 field staff and evaluated their effectiveness. It served to link the field, the Task Force and the Steering Committee. It recommended control procedures and intervention thresholds, based on data received daily by radio. It also followed health, and administrative matters.

43. Between 12 and 18 March, USAID fielded a consultant team, consisting of an entomologist, a logistician, a member of the Foreign Disaster Assistance Unit, and an aerial application expert. The latter stayed until March 28. This team produced a report on the needs for the 1987 Campaign and on the feasibility of aerial applications.

44. The USAID Entomologist provided for the period of the campaign, and the USAID Assistant Coordinator (a former Peace Corps volunteer) were fluent in French and in the local language.

45. The FAO Associate Expert assisted field staff in pest monitoring, in the assessment of control activities, the collection of grasshopper species, and the training of field staff and farmers between April 1 to December 31.

46. Italy supplied a plant pathologist to work directly with the Command Center and to assist in training in the utilization of the sprayers and equipment supplied by Italy.

6.2 Funds and Inputs made available

47. The donors supplied virtually all the pesticides and equipment which had been requested by the Gambia. See annex III.

6.3 Control Activities and Areas Treated

48. Extensive blanket spraying by aircraft during the 1986 campaign had undoubted adverse effects on the environment. The technical experts from the donor countries, in conjunction with CPS staff, therefore improved monitoring and reporting procedures, and established grasshopper population threshold levels for treatment. This allowed a greater selectivity of target and avoided widespread indiscriminate application. Apart from the ecological benefits, there were also savings on pesticides and from the lesser wear and tear on spraying and dusting equipment.

49. As of 8 October, ground treatment had covered 12,104 hectares. On 15 October, the mission made a field trip up river from Mansakonka to Jenoi station. The grasshoppers observed were principally in the

natural vegetation bordering fields of millet and ground nuts. The species were Hieroglyphus africanus, Cataloipus cymbiferus, Kraussaria angulifera, and Oedaleus nigeriensis.

50. Several localities had a high incidence of blister beetles, particularly Psalydolytta fusca, which seem to follow grasshopper upsurges. Early planted millet escaped serious damage, due to the hardness of the grains at the time of grasshopper attack, but those fields planted later suffered damage in the milky head stage. At the time of the mission, approximately 1,000 hectares have been treated for Blister Beetle.

51. From 20 August to 15 October, 20,504 hectares were treated by air, partly by a Cessna 188 supplied by Luxembourg and partly by two Canadian aircraft. The Cessna treated high density hoppers in the Western Division, and the Canadian planes treated 10,000 hectares of rice along the Gambia River in the McCarthy Island Division above Mansakonka.

6.4 Evaluation of the Efficiency of Control Operations

52. The CPS continues to suffer from a lack of fuel, both for vehicles and for radio generators. The Government allocates fuel to the different divisions of the Ministry of Agriculture on a quota basis, and, during the growing season (which corresponds with the period of maximum activity for the CPS) fuel shortages occur.

53. As a result of a considerable training effort, monitoring and reporting was much better than in 1986, and the radio network allowed the instant reporting of high pest infestations.

54. The CPS is also hampered by poor roads. The main highway itself is in a bad state and urgently needs repair. Rough roads also result in shorter vehicle life, and the lack of spare parts is a constant problem.

55. Technical advisors provided by the donors should have taken part in all Task Force meetings.

6.5 Evaluation of Pesticides Spraying Equipment and Aircraft

56. The pesticides used in the campaign were exclusively those provided by the donors, Malathion and Fenitrothion, and there is no private production or sale of pesticides in the Gambia. The equipment provided by donors was varied, resulting in a need for extensive training and in a lack of spare parts.

57. The aircraft used were two Canadian Turbo Thrushes and one Cessna 188 provided by the Luxembourg. Due to the low density of grasshoppers in the 1987 season, widespread blanket spraying was not attempted.

6.6 Environmental Impact

58. No assessment of the environmental impact of spraying was carried out in the Gambia.

59. As in many countries, various pressures influence the decision to carry out, or not carry out, aerial spraying. Firstly, there is a pressure to use the means available, simply because they are there. But there was also pressure not to spray in certain areas which suffered adverse effects from last year's blanket spraying. For example, a highly estseemed British medical team working extensively on malaria, requested that blanket spraying be avoided; the International Trypanosomiasis Centre is developing a breed of cattle resistant to sleeping sickness, and made the same request, as its work depends on the presence of tsetse flies. There have also been protests from farmers that spraying kills all the bees. The FAO entomologist with the CPS noted a resurgence of manioc pests and blister beetles, which may be attributable to the destruction of their pests and predators last year. She also expressed concern at the end of the 1986 season as to the fate of cassava mealybug predators introduced by the IPM project, though there was not time to investigate the siutation scientifically.

60. The blood cholinesterase levels of pesticide workers was tested. The tests showed many people with dangerously low cholinesterase levels working with pesticides: they will probably continue in this work because they need the salary. The tests were carried out at the beginning, middle and end of the campaign, and were financed by USAID.

61. Such testing of CPS personnel is a sure way of monitoring the safe use of pesticides, but farmers, especially those most active in the campaign, should also be tested.

62. An inventory of pesticide drums is being taken by the ODA logistician. It may be possible to use a nearby industrial crusher to flatten them, and then bury them, but a seed specialist working in Banjul is hoping to put the drums to more constructive use as hermetically-sealed seed storage containers.

6.7 Recommendations

63.
- The Campaign Coordinator should be adequately advised by expatriate technical experts, so as to be able to avoid the pressure for unnecessary spraying.
- Environmental assessments, both of air and ground treatments, should be carried out.
- Blood cholinesterase tests should continue, including of farmers, particularly those most active in the campaign. CPS staff with low levels of cholinesterase should be forbidden to work with pesticides and, for this purpose, a budget to pay off those workers and hire others should be provided. All test records should be carefully kept so as to control pesticide abuse and to spot workers with a continual low blood cholinesterase level resulting from not properly using protective clothing.
- The CPS budget should include an increased allottment for fuel at the time of pest emergencies, when the mobility of CPS staff is highest.

- The mission was informed that an unidentified donor had constructed 50 wharves along the Gambia River, which is deep and navigable by large boats as far as Georgetown; smaller craft can travel the whole length of the river in the Gambia. Roads being so poor, donors might consider providing boats for the CPS to transport pesticides, personnel and supplies from headquarters to the Brigade Centres up river.

- The CPS, and the National Coordinator for the grasshopper campaign, have no budget for small purchases of supplies, and for repairs. USAID has been generous with the use of vehicles and in supplying miscellaneous items, but a petty cash fund is needed.

7. CROP LOSS ANALYSIS

7.1 Crop Losses in 1987

64. Crop losses in the Gambia appear negligible this year, due to timely intervention by the CPS. The most notable losses occurred in transplanted rice fields, which are particularly vulnerable to grasshoppers, and which were sprayed aerially in October (10,000 hectares). No crop loss assessment was carried out in 1987.

7.2 Cost/Benefit Analysis of Control Activities

65. A cost/benefit analysis cannot now be made, as data on the amount of pesticide used, hectarage treated and harvests are not yet available. However, the FAO Entomologist is collecting data on four different crops, and will prepare a report after the harvest is over.

7.3 Recommendations

66. Accurate crop loss assessments are needed. A training programme should be undertaken, perhaps by FAO, to import a tested methodology. The Dakar Training Centre could be a site for training participants from neighboring countries.

8. ORGANIZATION AND STRUCTURE

8.1 The National Steering Committee

67. The National Steering Committee is a means of liaison between the donors and the host government and helps coordinate the efforts of the various parties. The committee meets regularly to follow the pest situation, make recommendations, analyse needs, and coordinate donor inputs.

8.2 Improvements in the CPS since 1986

68. The recommendations made by the evaluation team in November 1986 have, to a certain extent, been implemented:

- Nine team bases have been established, each with vehicles, a radio, motorbikes, and pesticide application equipment.

- A radio network to maintain contact with survey and control teams has been set up.

- The pesticides, equipment and personnel needed for the 1987 campaign were in place before the season began.

- Two more airstrips were prepared.

- The Permanent Secretary of the Ministry of Agriculture chaired the steering committee in 1987.

69. Considerable training to upgrade CPS staff was conducted in 1987, both in the Gambia and abroad.

8.3 The Role of FAO

70. The role of FAO has been of paramount importance in the grasshopper campaign in the Sahel. FAO has successfully coordinated the work of donors, the Sahelian countries and other international organizations, particularly on a regional basis where more than one country was involved.

8.4 Recommendations

71. Due to a restructuring of the Ministry of Agriculture promoted by the World Bank, consideration is being given to dissolving the CPS and absorbing its functions and personnel into the Extension Service. The mission does not support the proposal for the following reasons:

- The decision-making process would be more complicated and slower; prompt action is required for pest emergencies.

- The vehicles needed for CPS activities would tend to be used by the extension service for other purposes.

- In budgeting, the extension component will be favoured.

- Technical research activities, which are the responsibility and mandate of the CPS, could not be adequately managed by the extension service.

- The CPS is more able to administer its technical subdivisions, such as the phytosanitary section (quarantine) and the section for product storage, and to assure adequate expert monitoring and control of crop pests.

- A fine reference collection of insects, and the library, need to be maintained and upgraded, for the use of fieldworkers.

- To preserve its integrity and esprit de corps, the CPS should remain a separate entity; to dissolve it would leave the Gambia as the only county in the region without a distinct CPS.

- The restructuring of the Ministry of Agriculture will involve increased privatization and greater responsibility for the farmers, and the increasing misuse of pesticides is inevitable:

the CPS is equipped and trained to monitor and train farmers in pesticide use and pest management.

- Rather than dissolve an existing infrastructure, the Government should trim and strengthen it. The CPS personnel could be reduced to a core of well-trained agents in the nine substations, capable of effectively dealing with pest infestations, able to train farmers in safe pesticide use, to oversee pesticide and spraying equipment and to ensure the safe disposal of containers. The radio network now in place has revolutionized pest control in the Gambia, and has the added advantage of allowing emergency communications for other purposes as well. A distinct CPS is necessary to coordinate all these aspects of crop protection, and to maintain vigilance for inevitable pest resurgences. See Annex VII.

- The work of the CPS agents is a full-time occupation; it is unrealistic to expect village extension workers to assume the role of a CPS agent, in addition to their own duties.

9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

9.1 Stocks at the end of the 1987 Campaign

72. Carry over pesticide stocks in the Gambia will be ample for next year, even if heavy pest infestations occur. During the USAID Regional Food Crop Protection Project (1976 to 1986), a large warehouse at Jenoi, and 3 others at strategic locations, were constructed. Storage facilities are adequate in the interior, but there is no adequate storage facility at CPS headquarters in Yundum. The mission wishes to emphasize the importance of maintaining good inventory records and utilizing the older insecticides first. When the mission left the Gambia, an inventory of peticides on hand had not yet been made. There is good storage space for spraying and dusting equipment; all but the nine substation radios will be stored with their generators during the dry season; and most of the motorbikes will also go into storage.

9.2 Preparation for Future Years

73. The evaluation mission strongly recommends the appointment of a long-term (minimum 2 years) entomologist to work with the CPS. Other expertise, in biological control and in other specialized fields, can be provided through consultancies when needed.

9.3 Long-term Improvements of Plant Protection Structures

74. Further training is needed at all levels. A service is only as good as its trainers, and this needs to be kept in mind and emphasized in coming years.

75. An adequate budget must be established each year. Monitoring on foot is inadequate: vehicles and motor bikes must therefore be operable and have fuel; a petty cash provision would be most useful for small purchases of a miscellaneous nature.

ANNEX I

ACRONYMS USED

FAO	Food and Agriculture Organization of the United Nations
CPS	Crop Protection Service
IPM	Integrated Pest Management
EEC	European Economic Community
USAID	United States Agency for International Development
ODA	Overseas Development Administration (U.K.)
U.K.	United Kingdom
UNDP	United Nations Development Programme

ANNEX II

PERSONS CONTACTED

Dr. F.M. Reda	FAO Representative
Mr. Mario Izzo	Agronomist, Italian Cooperation
Mr. Ramesh K. Singh	Seed Technologist, Action Aid
Mr. Thomas Hobgood	Agricultural Development Officer, USAID
Mr. Ralph Conley	Agricultural Development Officer, USAID
Mr. J.M. Stone	Director, USAID
Mr. Saihou Jolu	Agricultural Programme Assistant, USAID
Ms. Alida Laurense	Entomologist, FAO
Mr. Alistair McKenzie	Deputy British High Commissioner
Ms. Fatouniata Tambgeng	Assistant Programme Officer, UNDP
Mr. Y. Jallo	Permanent Under-Secretary, Ministry of Agriculture
Mr. Douda Jagne	Director, Crop Protection Service
Mr. B. Trawally	National Coordinator, Crop Protection Service
Mr. Sidi Njie	Assistant National Coordinator, Crop Protection Service
Mr. T. Harrison	Technical Advisor to the CPS, ODA/USAID
Mr. L. Baldeh	Crop Protection Service, Jenoi Research Station

ANNEX III

DONOR ASSISTANCE

			US Dollars equivalent
m+	EEC TOTAL: ECU 170,000		195,897
	150 knapsack sprayers	ECU 60,000	
	3 Micronair 7000	ECU 10,000	
	150 pairs boots, 200 protective masks, 200 pairs gloves	USD 8,800	
	14,600 l Fenitrothion 96 percent ULV	USD 104,286	
	Through FAO		
	* * *		
b+	FR Germany TOTAL: DM 240,000		134,831
	Provision for 1987 campaign, covering both Senegal and Gambia		
	* * *		
b+	Italy TOTAL: lit. 253,000,000		200,793
	1 Fiat Panda 4x4	(++)	
	4 vehicle-mounted sprayers	lit. 36,800,000	
	400 knapsack sprayers	lit. 26,000,000	
	20 motorized knapsack dusters	lit. 10,000,000	
	90 motorized knapsack sprayers	lit. 45,000,000	
	10 wheel-barrow sprayers	lit. 8,000,000	
	2,000 masks	lit. 10,000,000	
	500 goggles	lit. 2,500,000	
	500 gloves	lit. 1,000,000	
	300 boots	lit. 3,000,000	
	2,000 antidotes	lit. 1,700,000	
	2,000 kg Chloropyrifos/ Dursban 12 percent a.i.	lit. 20,000,000	
	5,000 l Malathion 40 percent EC	lit. 50,000,000	
	1,000 l Fenvalerate-Sumicidin	lit. 20,000,000	
	* * *		
b-	Japan TOTAL: (--)		
	20 MT Fenitrothion 3 percent dust	(--)	
	* * *		
b+	Japan TOTAL: (++)		
	3 Nissan pick-up trucks	(++)	
	4 Nissan patrols	(++)	
	spare parts	(++)	
	182 motorized knapsack sprayers	(++)	

To upgrade DPS generally.

b+	Luxembourg TOTAL: 140,000		140,000
	200 hours CESSNA Agtruck between 19 July and 30 October	140,000	

* * *

b+	NGO/Action Aid TOTAL: 133,000		133,000
	local costs in Phase I for farmer brigades in Lower River Division	(+-)	
	52 motorized backpack sprayers	15,000	
	3 vehicle mounted Micronair sprayers	36,000	
	protective outfits, 200 of each (jackets, aprons, masks, boots)	13,000	
	1,200 filters for masks	(+-)	

* * *

m+	OAU TOTAL: 21,430		21,430
	logistic support	21,430	

* * *

b+	UK/ODA TOTAL: UKL 173,000		266,563
	two expert consultants (logistics expert and spray application expert)	(++)	
	510 hand dusters	5,100	
	140 MT Propoxur 2 percent dust and transport	105,000	

* * *

m+	UNDP TOTAL: 20,000		20,000
	entomologist	(+-)	
	camping gear	(++)	

Left-over of 1986 funds

* * *

b+	USA TOTAL: 631,932		631,932
	aviation fuel for Luxembourg planes	23,926	
	PRIFAS training	9,000	
	training for CPS + farmers	30,385	
	2 entomologists	136,000	
	1 local coordinator	included above	
	1 crop loss assesment	included above	
	medical monitoring	included above	
	3 mobile and 11 base radios	30,137	
	29 motorbikes	22,589	
	100 sprayers	5,259	
	10 dusters	1,000	
	50 tally counters	215	
	73,750 l Malathion 91 percent ULV and transport	266,238	
	1,850 l Carbaryl Sevin-4-oil	6,790	
	TOTAL COSTED AID US$		1,744,446

Figure 2 · Location of Bases and Fieldstations.

• GAMBIA PROTECTION SERVICE BASES AND Stations

(GCH) = Grasshopper Control Headquarters

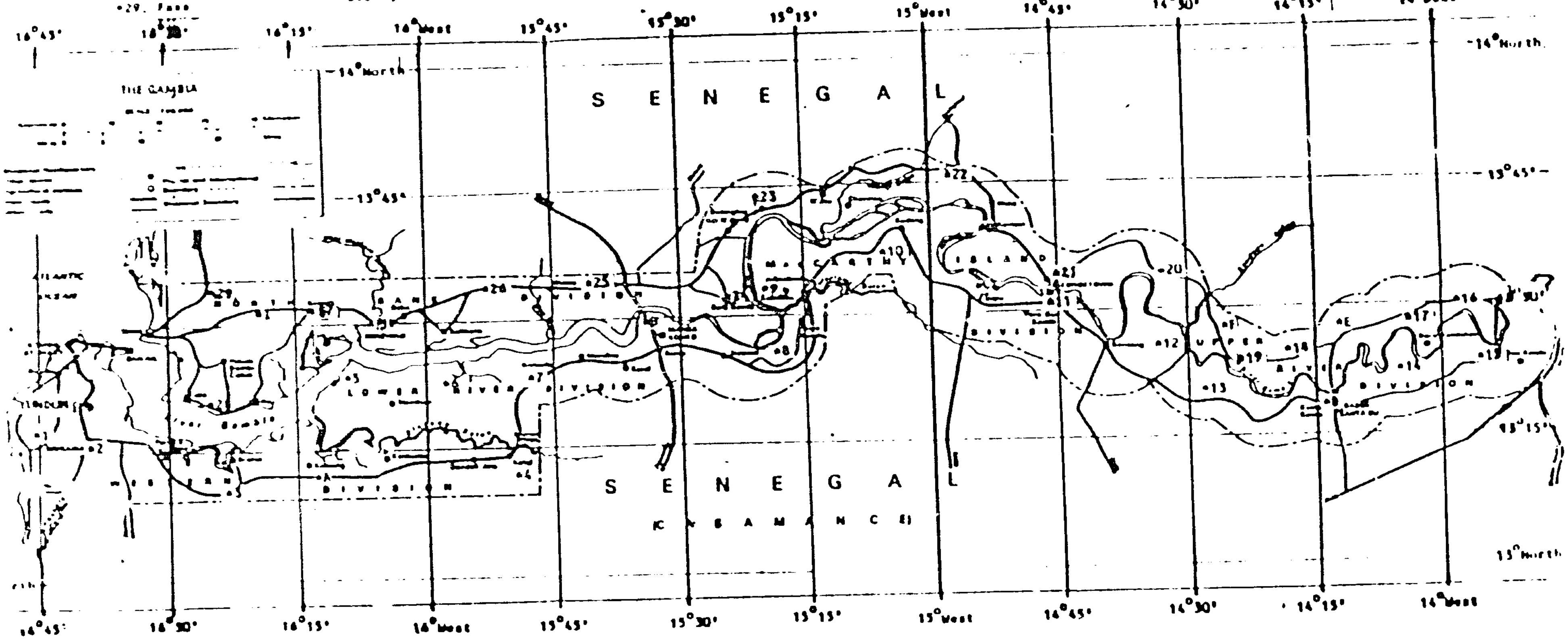
•I. ... BASE
•27. Kuntair
•28. Lamin
•29. Fass

•H. KEREWAN BASE
•24. SaraKunda
•25. Tallal
•26. NjabaKunda

•G. KUNTAUR BASE
•20. SamiKarantaba
•21. LamiliKoto
•22. NyangaBantang
•23. Kaur

•F. NAUDE BASE
•18. Baralli...
•19. Diabu...

•E. JARKUNDA BASE
•16. Brifu
•17. BadjaKunda



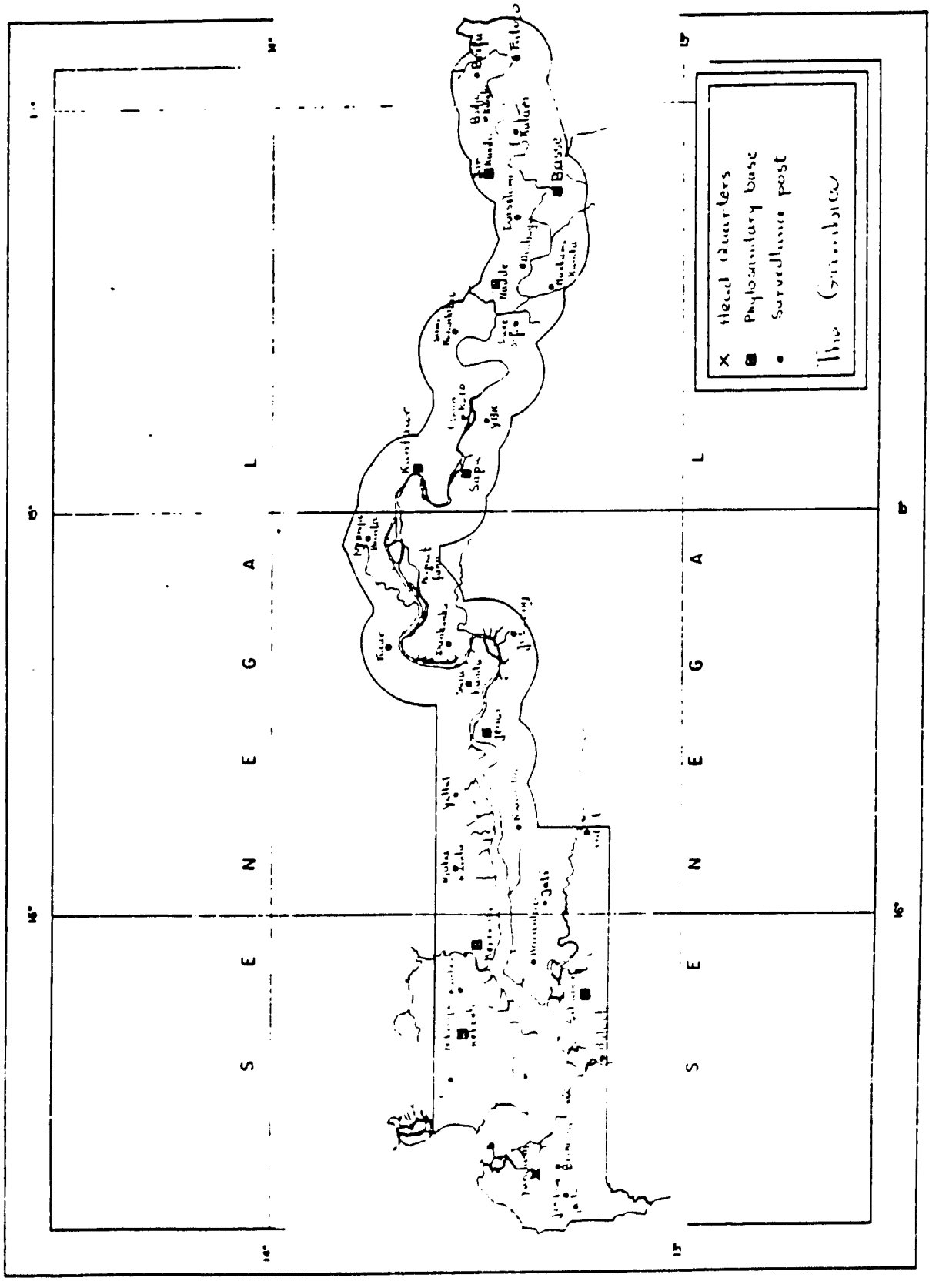
•A. SIBANOR BASE
•1. Jambanjelli
•2. Brikama
•3. Bulok
•4. Sintet

•B. JENOI BASE
•5. Karantaba
•6. Jali
•7. Kuinella
•8. Jassong

•C. SAPU BASE
•9. Dankunku
•10. Mamut Fana
•11. ToruBeriKunda
•12. Sare Sofi

•D. BASSE BASE
•13. Mankamakunda
•14. Kulari
•15. Fatoto

ANNEX IV,


SENEGAL
SENEGAL
Basse
Dakar
Kaolack
Tambacounda
Ziguinchor
Kolda
Fatick
Kaffrine
Kédougou
Sédhiou
Kaffrine
Matam
Louga
Thiès
Diourbel
Saint-Louis
Kaolack
Fatick
Ziguinchor
Kolda
Sédhiou
Kédougou
Tambacounda
Matam
Louga
Thiès
Diourbel
Saint-Louis
Dakar
Head Quarters
Phytosanitary base
Surveillance post
The Gambia

ANNEX V

THE ROLE OF INTERNATIONAL AND REGIONAL STRUCTURES

(Note: this section is common to the reports on Guinea-Bissau, the Gambia, Mauritania and Senegal)

The evaluation mission of 1986 determined that there were two areas in which the Sahel contries could benefit from regional crop protection organizations:

- in survey and preventive control operations against the Desert Locust and the African Migratory Locust;

- for assistance in aerial control operations, when pest infestations surpassed the national crop protection capabilities.

The question of OCLALAV, the regional organization for Desert Locust Control, remains unsolved, and a number of major decisions need to be taken: should it be revitalized; should a new organization be created; or should the strategy of reinforcing national CPS services be adopted, so they can ensure preventive control of the Desert Locust in their own countries and, working together, preventive control on a regional basis?

This evaluation team therefore recommends a detailed study by the donor community of the issues involved, so as to identify a long-term solution to the problem. Some considerations are:

- At present, OCLALAV depends for funding on its member countries, but this has not in the past been sufficient to assure operations. Moreover, its member countries have an inordinate influence on personnel management within OCLALAV, and it is difficult to dismiss inefficient personnel. To succeed in its task, the institution must have administrative and finanacial autonomy.

- A number of new techniques and products are available which could improve survey and control strategies. These include the increased use of computers for the mathematical modeling of population dynamics, remote sensing, new methods of biological control, and new insecticides and the use of juvenile normones for control purposes.

- An adequate ground survey capacity is essential in the preventive control of the Desert Locust and other migratory pests.

- Any aerial intervention capability, to be cost effective, would have to be utilized in both agricultural and public health work.

Figure 1 : 1987 GRASSHOPPER CONTROL CAMPAIGN - ADMINISTRATIVE STRUCTURE

STEERING COMMITTEE

COUNTRY TASK FORCE

CAMPAIGN COORDINATOR

DIRECTOR OF CPS YUNDUM

COMMAND CENTRE CPS YUNDUM

- CAMPAIGN COORDINATOR (CPS)
- ESTAME COORDINATOR (CPS)
- TECHNICAL EXPERTS (DONORS)
- LABORATORY ASSITANTS (CPS)
- RADIO OPERATOR (CPS)
- DACTYLOGRAPHERS (CPS & DIVS.)
- STOREKEEPERS (CPS & DIVS.)
- TRANSPORT FOREMAN (CPS)
- LOADERS (CPS)

PHYTOSANITARY BASE

CAMPAIGN TEAMS (9 IN NUMBER)
1,2,3,4,5,6,7,8,9

CAMPAIGN TEAM

1. TEAM LEADER
2. ASST. TEAM LEADER
3. PEST SURVEYOR
4. OPERATOR
5. EXTENSION AGENT
6. NGOs
7. DRIVERS

SURVEILLIANCE POST MIXED FARMING CENTRE

1. CROP PROTECTION STAFF (EQUIPMENTS & PESTICIDES)
2. CROP PROTECTION STAFF (PEST MONITORING - MOBILE)

ANNEX VI

ANNEX VII

ORGANIGRAM RECOMMENDED BY THE EVALUATION TEAM

FOR THE PRESERVATION OF THE GAMBIA CPS

Ministry of Agriculture

Permanent Secretary

Direction, Crop Protection Service

Monitoring and Control	Phytosanitary (Quarantine)	Financial Control	Stored Products	Research and Training

ANNEX VIII

REFERENCE MATERIALS

- Monthly Reports on the Grasshopper Campaign
  by A. Laurense, FAO Entomologist

- 1987 Grasshopper Control Campaign
  by B. Trawally, Coordinator

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

GUINEA-BISSAU

Mission: (19-22 October 1987)

Mr. Channing J. Fredrickson (FAO)
Mr. André Duhart (France)
Ms. Jude Andreasen (USA)

Contents:

7. CROP LOSSES

8. ORGANIZATION AND STRUCTURES

9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

Annexes:

JOINT FAO/DONOR REVEIW OF THE THE 1987 GRSSHOPPER CAMPAIGN

GUINEA-BISSAU

1. ACKNOWLEDGEMENTS

1. The team is grateful for logistic support from FAO, including transport, entry and departure formalities at the airport, and the preparation of an agenda which made optimal use of the mission's time. The FAO Consultant Entomologist, Mamadou Diallo, provided valuable data and reports.

2. Thanks are due to USAID for transport on several occasions and for office space loaned to facilitate preparation of this report. Mr. Bruce Thomley, USDA Acridologist, was especially helpful, and accompanied the mission and Crop Protection Service staff to the field.

3. The active cooperation of the Crop Protection Service was very much appreciated. The Director of the CPS was particularly attentive to the requests of the team, providing documents and giving valuable information, personally and through his staff, which greatly facilitated the evaluation.

2. INTRODUCTION

4. The northern half of Guinea-Bissau contains rich agricultural land, enjoys abundant rainfall (averaging 1,000 mm per year), and has the potential to become entirely self-sufficient and an exporter of many agricultural products.

5. A vigilant Crop Protection Service (CPS) is essential if this potential is to be realized. Every year, there are losses due to various pests. Significant losses due to grasshoppers occurred in 1986 and the CPS was unable to cope with an outbreak which covered some 87,000 hectares.

6. The Government of Guinea-Bissau therefore requested donor aid for the funds and the inputs necessary to mount an effective control campaign against grasshoppers in 1987. Donor support was forthcoming from the FAO, the USA, the EEC and Italy.

7. This report reviews the crop protection capacity in Guinea-Bissau and makes recommendations for the years ahead.

3. THE EVOLUTION OF GRASSHOPPER POPULATIONS IN 1987

3.1 The Weather

8. The first rains fell at the beginning of the month of June. Though satifactory in volume, they were badly distributed, both in time

and in space. Normal rains fell in the month of June. In the northern province, rainfall in July was slightly higher than average, but, in the southern province, it was 100 mm less than average. During August, rains in the eastern province were higher than the norm; in the northern and, above all, in the southern province they were less than the norm, but the number of rainy days was average. In September, rainfall in the three provinces was excellent and much better than last year, and rainfall continued to be normal in October. In general, rainfall in the 1987 rainy season can be considered as excellent.

9. Climatic conditions therefore favoured the crops during their growing season. Production of the crops already harvested was very good, including maize (60% of the area cultivated), millet and early sorghum, upland rice, ground nuts and cassava. There are good prospects for planted-out and irrigated rice, "souna" millet (the Wolof name), and for late sorghum.

10. Little crop damage has been noticed, apart from some attacks in July by Zonocerus variegatus in the centre of the country on both sugar cane (25% damage) and cassava; and, between 15 April and 15 May in the region of Bafata on 15 hectares of vegetables, by 2nd and 4th generation hoppers at a density of 50 to 60/m^2 (and 30% damage), and on 3 hectares of ocra, by hoppers of the 2nd and 3rd stage at a density of 15/m^2. Village teams which had had basic training and were equipped with dusting bags, as well as the mobile units of the Plant Protection Service, were able to protect, with a few exceptions, all other crops. Heaviest losses were to cantharides in cereals and to the cassava mealy-bug.

3.2 The Grasshopper Situation

11. The grasshopper situation and the problems of plant protection in general fall under the Plant Protection Service in Bissau (which has the following divisions: entomology, phytopathology, control operations, training, and administration, to which it is planned to add legislation and quarantine, and biological control). Its field personnel is distributed over four zones: zone 1 in the northern province, with 10 officers, zone 2 in the eastern province, with 9 officers, and zones 3 and 4 in the southern province, with 8 and 3 officers respectively. Grasshoppers are a problem only in the north and eastern provinces, that is, in zones 1 and 2.

12. As noted in paragraph 10 above, Zonocerus variegatus hoppers of the 2nd and 3rd instars, at heavy density, caused damage to vegetable crops between 15 April and 15 May in the region of Bafata. The earliest hatching of other species was observed in mid-July at Bissora, to the north of Bissau. Further hatchings occurred in many biotopes of the north and eastern provinces. The most numerous and widely represented species were Kraussaria angulifera, Gastrimargus africanus, Cataloipus fuscocoerulipes, Kraussella amabile, Catantops sp. and Hieroglyphus sp. Hatchings occurred over a number of weeks. Hopper densities in the bush and in millet and sorghum cultivations were of between 10 and 60 individuals/m^2. As the Plant Protection Department was not yet ready to conduct control operations, crops were protected only by dusting by village teams.

13. In August, 87,000 hectares, mainly bush, were invaded in the north-west: Cacheu 10,000 ha, Oyo 40,000 ha, Bafata 35,000 ha and Gaba 2,000 ha. Average densities were generally between 15 and 50/m² and reached 90/m² near the village of Cadjambo to the east of Farim. The most commonly represented species were Cataloipus, the two Hieroglyphus, Kraussaria and Homoxyrrhepes punctipennis. Hoppers had reached the 4th and 5th instars. The farmers continued to protect their crops with dusting bags and the Plant Protection Teams carried out control operations over large areas with motorized knapsack dusters and sprayers, mostly of Italian make. No application equipment for large-scale work, such as exhaust nozzle sprayers, was available, and the two Micronairs that had recently arrived could not be used because there were no vehicles on which to mount them.

14. In September and October, most of the harvests had been gathered. There remained only the late millets and sorghums, as well as ground-nuts and irrigated rice. Many of the grasshoppers had now reached the adult stage. On the recommendation of the Plant Protection Service, the farmers attempted to protect their crops by surrounding them with a belt of dusting. The Plant Protection Teams continued their control operations, sometimes treating again the areas they had already treated.

15. The Plant Protection Teams had treated 6,000 ha by 20 October 1987; in the entire 1986 season, they treated only 3,000 ha. Precise figures as to the areas treated by the farmers were not kept, but these amount to total some 3,000 hectares.

3.3 Egg-pod Surveys

16. The FAO consultant, Mamadou Oury Diallo, first gave the staff of the Plant Protection Department an introductory theoretical course, and then accompanied them on an egg-pod survey between 17 April and 15 May. A number of biotopes in 52,000 ha in the northern and eastern regions were sampled: 157 egg-pods were collected, and the average density ranged between 0.5 and 2.5/m² in the zones of Bafata, Oyo, Cacheu and Gaba. Thirty-four of these egg-pods had been parasited. Caged egg-pods proved, on hatching, to be of Cataloipus fuscocoerulipes. Further egg-pod surveys would be carried out in December this year for the next campaign.

3.4 Effects of Control Operations on Populations

17. Control operations aimed only in protecting crops. They were largely successful, and much appreciated by farmers. Without powerful spraying equipment, there was no way of attacking either the hoppers or the adult grasshoppers, which sometimes reached densities of a number of dozen individuals per square metre in the huge uncultivated areas. These populations will therefore carry over almost intact into the next year. The main species involved, which mostly have but one generation a year, are largely sedentary, and do not move much above their biotopes. Nonetheless, some movements by these populations under the the forest cover towards cultivated areas have been observed, which means that new control operations will be necessary in fields already treated towards the end of the season, and these will continue until laying has taken place.

3.5 Residual Populations at the End of the Season

18. As indicated above, the residual populations are very large in the northern and eastern regions of the country. The very small area actually treated in relation to the total areas invaded by grasshoppers makes it difficult, in fact, to use the term, "residual". On 20 October, to the east of Farim, the mission noted very dense concentrations of very young-winged Cataloipus. An area of 22,000 ha, in three zones, at Cacheu, Oyo and Bafata, showed densities ranging between 10 and 20 per square metre.

4. MONITORING AND RAPID WARNING SYSTEMS

4.1 The Performance of the National Monitoring System in 1987

19. Egg-pod surveys before the 1987 campaign were carried out too late (17 April - 15 May). This should not be the case for the next campaign.

20. The monitoring system is concentrated upon control operations in cultivated areas, and is not able to monitor the enormous bush areas, because of the lack of both equipment and staff.

21. The lack of radio communications within the country made it impossible to set up a rapid warning system. For the grasshoppers in Guinea-Bissau, the long period of immaturity of most of the species in question usually allowed control operations be mounted in time, but a number of crops, nonetheless, suffered damage.

22. The presence of crop pests is reported on a monthly form, of which there are three copies, the first to be kept by the observer, the second for the Plant Protection Supervisor in the zone, and the third for the Plant Protection Directorate in Bissau. One form covers both grasshoppers and other insects. Another is used for plant diseases. The form for grasshoppers is very incomplete as it does not request information on the instar, densities or areas invaded, or on sexual maturity.

4.2 The Use of Information for Control Operations

23. As the system for transmitting information is not very effective, control operations are mounted in a disorderly, blow by blow way: an infestation monitored by one plant protection team may in fact be treated by another team.

4.3 Evaluation and Recommendations

24. 1) The absulute priority is to provide a radio receiver-transmitter in each of the four zones for communications with the Plant Protection Directorate at Bissau. A total of six radios should be installed before the beginning of the 1988 Campaign.

2) A helicopter should be used for about 15 days at the beginning of the month of August 1988 (some 50 flying hours) to monitor the very large areas of uncropped bush.

3) A new reporting form for grasshoppers should be developed, and should be based upon the form recommended by PRIFAS.

5. TRAINING

5.1 Training in 1987

25. The following training was organized in Bissau:

1-2 April — Training by an ORSTOM scientist from Dakar of CPS senior staff in nematode control.

April — A two-week annual training course for 30 CPS agents, in subjects including preparations for the agricultural campaign, and insect and plant disease identification; instruction in egg-pod survey techniques was also given by the FAO expert. The egg-pod surveys were then carried out between 9 May to 21 July.

May — A team of American and Senegalese scientists from Senegal's Agricultural Research Institute (ISRA), in collaboration with senior CPS staff, conducted a two-week training course on storage techniques and pest control in numerous villages.

20-24 July — 25 CPS agents were trained by the FAO expert and by CPS staff in grasshopper identification and control, in the safe and efficient use of pesticides, in the estimation of infestation densities and areas, etc.

26. Individual CPS agents throughout the country conducted farmer training on the safe and efficient use of pesticide. During the dry season, the agent at Bafata conducted farmer training on garden pest control.

27. The training officer prepared an information bulletin for distribution to all CPS agents, and is preparing a booklet on insects.

5.2 Training Needs

28. Guinea-Bissau currently has six people under long-term training in entomology and plant pathology in the United States, two of whom will return by January, 1988.

29. The present senior staff are in need of short-term training, and a few should be sent to study for advanced degrees. Short term training is needed in grasshopper biology and identication, management, extension and training techniques, the production of audio-visual materials, vertebrate pest control, rapid alert systems and radio use. At least

one person should be selected for training in radio repair, in anticipation of the setting up of a future radio network. The CPS director is also hoping to upgrade the technical level of the regional CPS supervisors by both short and long-term training.

30. The training officer should be further instructed in training methods, and could profit from a visit to the Dakar Training Centre and the Cambarene Horticultural Centre. The instructors there should provide her with examples of their training calendars, budgets and fact sheets. Ideally, technical assistance should be provided to train her in the coordination and planning of the course curriculum, and in their implementation, etc.

31. The Bissau CPS has the potential to greatly extend its training activities. The laboratories are well-equipped and maintained, and there is a large conference room available. Pesticide and equipment storage is exemplary. Whilst the Dakar Training Centre is a regional resource, the special needs of Guinea-Bissau (language, ecology, epidemology) require an adequate local training facility. The existing facility, financed by USAID, is adequate, but technical assistance is needed to organize training programmes, and to procure and produce materials. Given the abundance and diversity of the grasshopper species in Guinea-Bissau, the Bissau CPS could be used for regional grasshopper training seminars, if lodging for participants could be provided.

32. When a radio network is installed, to allow rapid communications, CPS agents will need training in radio operation. They at the moment need further training in the correct use and calibration of the pesticides and spraying equipment donated for the campaign, and in species identification. When vehicles are obtained, on which to mount the Micronair sprayers, training in their use and maintenance will be required.

5.3 Recommendations

33. 1) A training budget to permit the production and procurement of training supplies and materials.

2) Technical assistance to plan and coordinate the training programme.

3) Long-term technical assistance, in the form of an entomologist, by preference a grasshopper expert, to work with CPS staff in population monitoring and control. If the entomologist has training experience, he or she could also fulfil recommendation two above.

4) Short-term training for senior staff as described above, and advanced degree programmes for selected senior staff. Short-term training for field staff in Niger, or in Montpellier, France.

5) Funds should be allocated for follow-up activities by senior staff who would supervise CPS agents in conducting farmer training in the villages.

6) Continued training of farmer brigades.

6. CONTROL OPERATIONS

6.1 Organization of the Campaign

34. Following heavy grasshopper densities during the 1986 crop year, in January 1987 the CPS analysed the requirements for grasshopper control in the 1987 season and prepared a programme. A National Campaign Coordinator was appointed.

35. In April, a seminar was held at the CPS for the scouts who would monitor the incidence of grasshoppers. In May, village brigades were formed in those areas where infestations were expected, and equipment and insecticides were transported to strategic locations.

36. The plan for this year included the organization of farmer brigades working with the CPS teams and trained in the use of pesticides and application techniques. With the appearance of the first nymphs, Propoxur 2% dust was applied with bags and dusting equipment. Follow-up treatments were to be made, as necessary, using wettable powders and ULV concentrates of Malathion and Fenitrothion.

37. A US Department of Agriculture acridologist was seconded to work with the CPS for four months from July to the end of October.

38. Requests for assistance were made in January, and the donors, (Italy, the USA and the EEC) responded generously. FAO played a major role in coordination and in the provision of technical assistance.

6.2 Funds and Inputs made available

39. The funds and inputs made available are shown in Annex II.

6.3 Control Activities Undertaken and Areas Treated

40. The areas of infestation can be seen in Annex III. A total of 6,000 hectares was treated by CPS teams, as follows:

Bafatà	1,795 hectares
Gabú	986 hectares
Oio	3,000 hectares
Cachen	219 hectares
Total:	6,000 hectares

41. The insecticides used were Fenitrothion 96% ULV, Propoxur 75% wettable powder and Fenitrothion 3% dust.

42. The farmers, using dust bags and 3% Fenitrothion, treated 3,000 hectares as follows:

Bafatà	843 hectares
Gabú	250 hectares
Oio	1,650 hectares
Cachen	257 hectares
Total:	3,000 hectares

43. On 20 October, the mission, accompanied by the Director of the CPS, several members of his staff, and the USAID acridologist, visited the area around Farim (Oyo Region). Grasshoppers were abundant and were migrating into grain crops such as rice, sorghum and millet. In several villages, farmers were undertaking follow-up applications, and the CPS brigades repeat applications in high density areas.

6.4 Evaluation of the Efficiency of Control Activities

44. Communication between the CPS headquarters and the field posts proved inadequate. The request to donors for a radio network in 1987 was not met. The telephone system is unreliable and much time is lost in trying to communicate with Bissau.

45. Another serious handicap was the lack of 4x4 pick-up trucks to transport equipment and materials. The CPS had requested eight Toyota Land-Cruiser pick-ups and two seven-tonne trucks.

46. The willingness and morale of the CPS staff were noteworthy and much was accomplished in spite of difficult field conditions.

47. The insecticides used were most effective, resulting in very high grasshopper mortalities, but farmers may be applying excessive amounts of dust, particularly on young 1st to 3rd instar hoppers.

6.5 Evaluation of the Pesticides, Spraying Equipment and Aircraft Used

48. The most widely used pesticides, which were all chosen by donors, were Fenitrothion, Malathion and Propoxur.

49. A consistent problem has been the incorrect or insufficient labelling of pesticides received through FAO from other countries. The drums often bear neither certificate of origin nor date of manufacture. Moreover, the team noted drums labelled "Fenitrothion", sent from Senegal, which, from their smell, were definitely not Fenitrothion.

50. The spraying equipment donated by Italy and the US proved efficient and appropriate, but two Micronairs could not be used, due to lack of vehicles on which to mount them.

51. No aircraft were used in Guinea-Bissau, as the farming areas are interspersed with a thick "park savannah", where even blanket spraying would not be effective.

6.6 Environmental Impact

52. Given the tree density and the irregular distribution of crop land and waterways, aerial spraying was not considered practical and therefore not requested by the Ministry of Rural Development. Large-scale ground operations were not possible, because no vehicles appropriate for mounting Micronairs were available. Hence, the treatment of ca. 9,000 ha by the CPS and farmers was carried out with hand-held and knapsack sprayers or dusting bags only. No cases of

sickness or pesticide poisoning were reported, and use of protective clothing was strictly enforced by CPS agents. The Bissau CPS staff is acutely aware of pesticide toxicity, and conscientiously ensures that farmers keep children and animals away from treated fields.

53. All pesticides brought into the country must be approved by the Department of Agriculture, and there is no commercial supply, therefore, as in the case of the Gambia, only donor-approved pesticides of moderate toxicity were available. The CPS Director is currently reviewing pesticide and quarantine legislation in other countries, in order to formulate a policy for Guinea-Bissau.

54. Pesticides are removed from barrels by manual pumps, both at CPS headquarters and in the interior; mouth-siphoning is never practiced.

55. The disposal of pesticide containers is undertaken by CPS agents. Bags are burned, bottles and plastic containers broken and buried, and drums are washed and recycled as fuel containers.

6.7 Recommendations

56. 1) All pesticides should be correctly and completely labeled and be accompanied by a dated certificate of origin.

2) Spraying equipment should be accompanied by sufficient spare parts and calibration equipment.

3) Unimogs or a similar type of truck should be provided on which to mount the two Micronair units.

4) 4-wheel drive pick-up trucks are needed for secondary CPS stations.

5) Storage facilities are needed in the interior of the country.

6) The creation of a radio network is essential. The team recommends eight radios for seven field posts, one for headquarters and one in reserve.

7) Continuous follow-up training is necessary at all levels. Repetitive training for farmers is of paramount importance and, during times of treatment, operations should be monitored by a CPS staff member whenever possible, so as to prevent excessive dosages.

7. CROP LOSSES

7.1 Report on Crop Losses

57. Despite heavy grasshopper counts of up to 90/m^2, the 1987 harvest was good because of favourable weather, good rainfall, and the fact that grasshoppers fed predominantly on natural vegetation, principally grasses. By the time migration into cropping areas took place, the corn

had been harvested and the millet was mature. At the end of the mission, sorghum damage by cantharids was occurring and spraying was continuing in the Oio region to protect groundnuts. The most frequent estimate of losses proposed by CPS staff was of roughly 5%.

7.2 Cost/Benefit Analysis of Control Activities

58. A cost/benefit analysis of 1987 only is not possible as the value of the pesticides, equipment and vehicles provided will be amortized over a number of years, and as it is difficult to put a value on the degree to which the CPS has been strengthened.

7.3 Recommendations

59. As in the other countries visited by the mission, a definitive methodology is needed to determine crop losses and assess the cost/benefit ratio for different crops with precision.

8. ORGANIZATION AND STRUCTURES

8.1 Role of National Steering Committees

60. In Guinea-Bissau, only three donors (USAID, EEC and Italy), were involved in this campaign. USAID and FAO were in continuous contact with the CPS, though no formal NSC meetings were held. The Italian representative is based in Conakry, Guinea, and has not been in contact with the CPS. Consequently, at the time of the mission, no information was available on those items promised by Italy which had not yet arrived. An unfortunate consequence of the lack of formal meetings with other donors is that 110,000 ECU earmarked by the EEC for Guinea-Bissau were unused, and so were reabsorbed into the regional budget.

61. The CPS includes a senior staff of scientists (entomologist, plant pathologist, IPM expert, quarantine expert, and nematologist) and a staff of technicians in the interior. The country is divided into four agricultural zones, each with a CPS Supervisor. Within each zone, there are several regions, each with a CPS Section Chief. The entire CPS staff totals 66. Some staff are located on the coastal islands, and a CPS motor boat is used to transport pesticides, equipment and personnel.

8.2 Improvements in the CPS since 1986

62. The Bissau CPS Headquarters is now located in a former school building renovated by USAID, which was inaugurated in April 1987. The building houses administrative offices, a library, an entomology and a plant pathology laboratory, a furnished conference room used for training, and a kitchen able to feed large groups of trainees. A 50 Kwh generator has been installed, and electrical work is still in progress on the building. USAID also provided a minibus for personnel transport, which has greatly improved attendance and morale. There is a repair area next to the generator housing, which is used for the repair of motorcycles and spraying equipment. The pesticide warehouse is a model

of organization and good storage practices. Pesticides are stored on pallets, and a manual fork lift is in use. The building is properly ventilated and secure, and there is evidence of good inventory control. The Bissau CPS was the most impressive seen by the mission visiting Gambia, Guinea-Bissau, Mauritania and Senegal, and a tribute both to the USAID entomologist who spent several years coordinating the Crop Protection Project, and to the CPS Director, who is both competent and dedicated.

63. Efforts are being made to secure and refurbish abandoned buildings in the interior of the country to ensure proper regional pesticide storage. One such building is already functional.

8.3 Role of International and Regional Structures

64. As aerial spraying was not considered appropriate for Guinea-Bissau, many of the logistical considerations needed for other countries were not necessary. However, the donor community could have vastly improved Guinea-Bissau's monitoring and control capacity by providing a radio network and vehicles for transport in the interior.

8.4 The Role of FAO

65. Guinea-Bissau is a reservoir for numerous grasshopper species, in numbers that surpass anything members of the mission had ever seen. Whilst locust outbreaks are unlikely, the grasshoppers species can and do cause considerable crop damage. Given that there is a basic CPS infrastructure, which has been strengthened by USAID, and a professional CPS staff, FAO could take advantage of the research potential in Guinea-Bissau while providing technical assistance to lift the CPS' intervention capabilities to a degree of efficiency rare in developing nations.

8.5 Recommendations

66. 1) The Steering Committee, however small, should have regular, formal meetings so that all parties are kept up to date on the situation.

2) Radios and trucks should be provided so that donor-supplied equipment and pesticides can be better used, and a rapid-alert monitoring system installed.

3) The FAO grasshopper specialist provided for the 1987 campaign is scheduled to leave in December. He should be quickly replaced so that the surveillance work continues, especially in view of the high-density populations observed this year, and the need for training in determining egg-pod incidence and monitoring techniques.

9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

9.1 Stocks at the end of 1987 Campaign

67. Substantial quantities of insecticide are in place for next year's campaign. The CPS estimates it will not require additional quantities. As of October 22, an inventory has yet to be taken and spraying was continuing in heavily-infested areas.

9.2 Preparation for Future Years

68. A clear need, already stated, is to establish a CPS radio network in order to communicate pest incidence more effectively and to improve the logistics of pest control.

69. Further training at all levels should be continued.

70. Due to the difficult terrain and virtually inaccessible croplands, helicopter surveillance should be undertaken in August 1988 to determine the levels of grasshopper infestation which, from all indications, will be high in the 1988 crop season.

9.3 The long-term Improvement of Plant Protection Structures

71. The CPS would welcome short-term acridologists and training expertise to assist in future campaigns., but the ideal solution is to use the long-term services of an entomologist, as was the case with the USAID entomologist, Carl Castleton, who was in Guinea-Bissau for several years and greatly assisted in creating the infrastructure of the CPS.

ANNEX I

PERSONS CONTACTED

Mr. Mame N'Diack Seck	FAO Representative
Mr. Rafael	Programme Officer, FAO
Mr. Pedro Nicacio	Administrator, FAO
Mr. Alioune N'Diaye	Regional Coordinator, FAO
Mr. Mamadou Oury Diallo	Consultant, FAO
Mr. Bruce Thornley	Entomologist, USAID
Mr. Cameron Pippit	USAID Representative
Mr. Joseph Beausoliel	Agriculture Development Officer, USAID
Mr. Halvdan Jakobsen	Agronomist, Project for Integrated Rural Development, Swedish Embassy
Mr. Derek Enright	EEC Delegate
Mr. Gunnar Ring	Consultant, EEC
Mr. Moustapha Cassama	Director, Crop Protection
Mr. Marcelino Vaz	Deputy Director, Crop Protection
Mr. Lourenço Abreu	Entomologist, Crop Protection
Ms. Ana Baldé	Training Officer, Crop Protection
Mr. Bailleul	Head of Mission, Mission Française de Coopération
Ms Cia N'Queba	Phytopathologist, Crop Protection
Mr. Pedro Correia Sandim	Entomologist, Crop Protection
Mr. Carlos Correia	Minister, Ministry of Rural Development

ANNEX II

LIST OF DONOR ASSISTANCE

			US Dollars equivalent
m+	EEC TOTAL: ECU 155,000		178,612
	technical assistance	ECU 3,000	
	50 Holder 45 HP sprayers	USD 19,000	
	5,000 dusting bags	ECU 3,000	
	36 MT Fenitrothion 3 percent dust arriving 1/7	USD 28,500	
	60 MT Propoxur 2 percent dust	ECU 80,000	
	2,000 l Fenitrothion ULV (supplementary)	ECU 13,000	
	1,000 l Sumicidin	ECU 14,000	

Through FAO

* * *

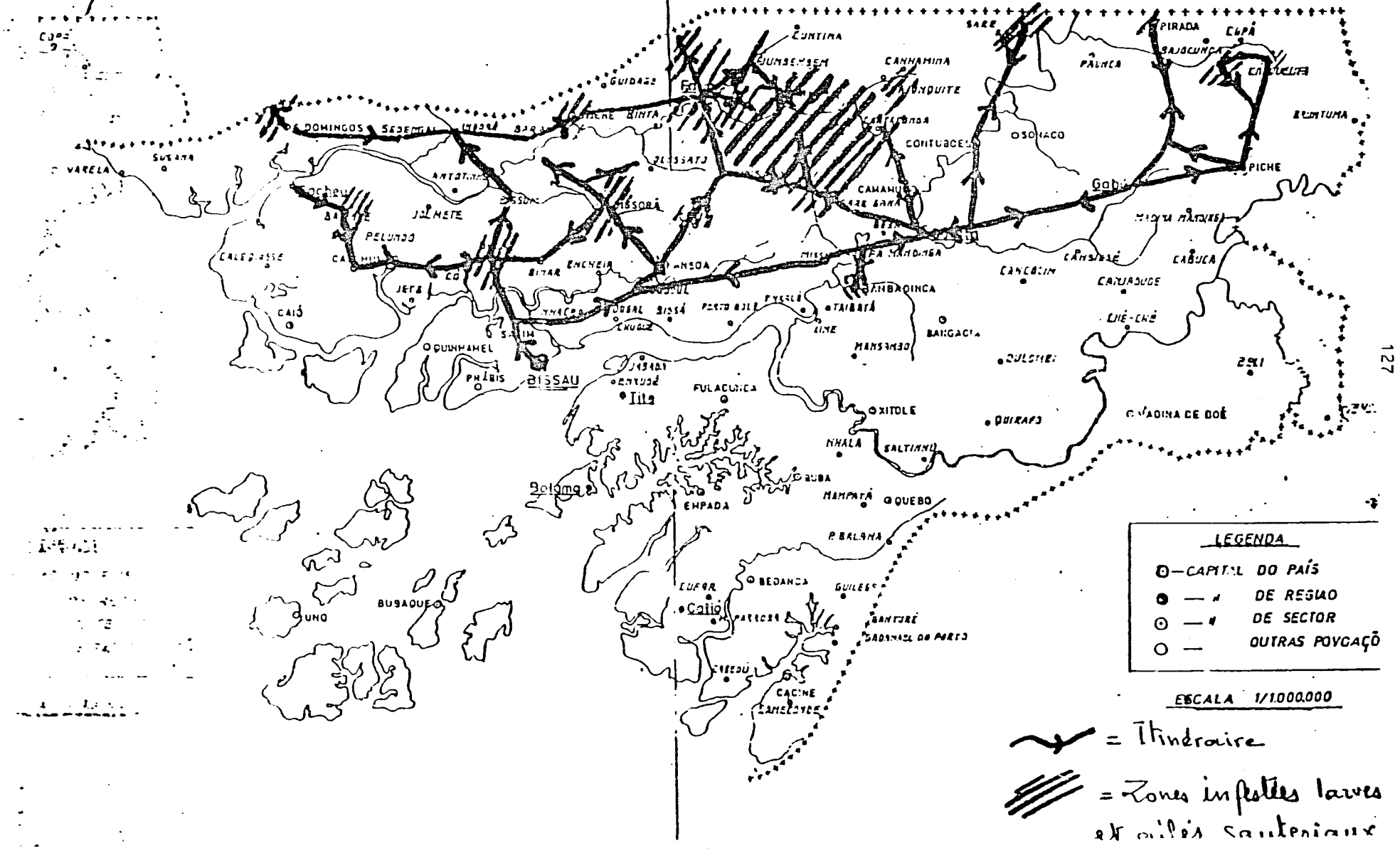
b+	Italy TOTAL: lit. 195,500,000		155,158
	2 Toyota 4x4 pick-up	lit. 60,000,000	
	200 knapsack dusters	lit. 8,000,000	
	500 knapsack sprayers	lit. 30,000,000	
	10 motorized knapsack dusters	lit. 5,000,000	
	90 motorized knapsack sprayers	lit. 45,000,000	
	100 masks	lit. 500,000	
	100 goggles	lit. 500,000	
	100 protective overalls	lit. 3,000,000	
	700 boots	lit. 7,000,000	
	100 barrier cream	lit. 500,000	
	2,000 kg Propoxur 2 percent	lit. 8,000,000	
	100 kg Carbaryl (=Sevin)	lit. 1,000,000	
	100 l Malathion 40 percent E.C.	lit. 1,000,000	
	1,000 l Fenvalerate-Sumicidin	lit. 20,000,000	

* * *

b+	USA TOTAL: 283,287		283,287
	bicycles	25,000	
	vehicle spare parts	50,000	
	fuel	12 000	
	training	2,000	
	management support	39,000	
	operational expenses	20,000	
	camping equipment	35,000	
	sprayers	40,000	
	8,000 l Carbaryl and transport	24,250	
	7,500 l Malathion and transport	32,037	
		TOTAL COSTED AID US$	617,057

* * *

Appendix VII PROSPECTION Mois d'Août 1987



ANNEX IV

RESOURCE MATERIALS

- 1987 Work Plan for the Crop Protection Department
  by Moustapha Cassama, Director

- Monthly Reports on the Grasshopper Campaign
  by Mamadou Diallo, FAO Consultant

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

MALI

Mission: (15-22 October 1987)

Ms. Daoulé Diallo Ba (FAO/CILSS)
Mr. Christopher Hemming (EEC)

Contents:

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

MALI

INTRODUCTION

1. Because of the very heavy grasshopper infestations in Mali in 1986, 484,000 ha were sprayed from the air. Aerial control did not, of course, cover all areas attacked, so the risk of infestation in 1987 remained large. As in 1986, Mali requested assistance from the international community to mount the 1987 Campaign against grasshoppers.

2. The mission would like to thank all those who received it and who provided it with information on the 1987 Campaign.

2. EVOLUTION OF THE GRASSHOPPER AND LOCUST POPULATIONS

2.1 Rainfall

3. The areas that are most at risk to grasshopper infestation are the zone of Kayes-Yélimané (the north-west), the northern area (Nara, Mourdiah, Dilly, Ballé), and the region of Mopti. In all these areas, the rain that fell in May was insufficient. During June, rainfall was low and irregular, except in Mourdiah, San and Koro. Nonetheless, the rains that had fallen produced favourable conditions for the hatching of egg-pods. During the first decade of July, rains remained poor and irregular, with pockets of dryness in the areas most at risk to grasshoppers. Then, during the second decade of July, rainfall improved at Kayes, Yélimané and Nara, while at Mopti, and in the lake region, dry conditions continued, and, on 17 July, rains fell throughout the north-west of Mali. This improvement in the rains did not carry on into the third decade of July, and the amounts received during this period were relatively low. During the month of August, in all regions except at Gao, rainfall improved, even though it remained less than normal, and this situation continued into the month of September.

2.2 The Grasshopper and Locust Situation

2.2.1 Grasshoppers

4. At the beginning of July, very local and low density hatchings were observed in the north-west (Kayes-Yélimané), north (Mourdiah, Nara and Dilly), and in some parts of the region of Mopti, where a few adult Oedaleus senegalensis were noted, which shows that some rains must have fallen in this area at the beginning of May, even though they had not been registered by the National Meteorological Service. Towards the end of the month of June, nymph densities of between 2-5/m^2 (2nd and 3rd instars) were noted in the north-west in natural vegetation. At the same time, in the northern area, Oedaleus senegalensis nymph densities (1st to 4th instars) were of about 1-2/m^2; in the Dilly-Alasso-Djadjébougou Bola triangle, densities reached 20-30/m^2.

5. In the month of July, large stretches of natural vegetation in the north-west area were infested with nymphs at relatively low densities (1-5/m²); by the end of the month these densities had risen to 15-20/m² in certain sectors, and a number of adults had been noted in the south of the area. The following species were involved:

- Kayes sector: Oedaleus senegalensis; Aiolopus simulator
- North Yélimané sector: Oedaleus senegalensis; Acrida sp; Catantops sp.

Control operations in these sectors were carried out by the village brigades which had been trained and organized by the Stromme Foundation of Norway; 40,000 ha were covered by 49 village brigades. During the same month, in the northern area, some hatching of Kraussaria angulifera was noted to the south-west of Mourdiah, in the sectors of Dilly-Alasso, at densities of 4-6/m². In this area, young adult Oedaleus senegalensis at densities of between 1 and 20/m² were also observed; in certain sectors, the density reached 30/m². Aerial control was carried out over 53,430 ha.

6. In the Mopti region, following the low rainfall of the month of July, the grasshopper situation had remained calm, with only very localized low density infestations (1st instar nymphs at densities of 2-3/m², and young adults at densities of less than 1/m²). In the Markala-Niafunké area, in July, Oedaleus senegalensis nymphs of the 1st to 3rd instars were noted in 24 ha (in the sector of Diafarabé, Saye, Baro) at densities of 1-3/m². Throughout the month of July, the situation remained calm in the area of San.

7. In the month of August, following the rains that had fallen at the end of July and the beginning of August in the area of Kayes-Yélimané, heavier grasshopper activity was observed in the sections of Ségala and to the east of Yélimané, where 1st to 3rd instar nymph densities varied between 10 and 25/m². The species in question were Kraussaria angulifera, Hieroglyphus daganensis and Kraussella amabile. At Kirané and Krémis, bands of Oedaleus senegalensis nymphs were noted in some 10-15,000 ha. Towards the end of the month, the grasshoppers that had been in the natural vegetation began to migrate into the crops. Aerial control operations were carried out by the Stromme Foundation. At the same time, in the northern area, bands of nymphs at a density of 35/m² were noted in the sectors of Dilly and Ballé in some 20,000 ha; ground and aerial control was carried out. In the area of Mopti, limited areas (20-30 ha) were infested with Oedaleus senegalensis and Aiolopus simulator in the lake sector; densities ranged between 5-20/m². In the sector of Douentza, hatching took place on the north side of the Bandiagara cliffs, in some 1,500 ha, and ground control was undertaken, followed by a relatively long dry spell, which considerably slowed down grasshopper activity. In the sector of Senemango (Mopti area), the situation was calm, following a dry spell, but from 15 August on, copious rains fell. In total, 25,707 ha were treated during the month of August, of which 23,996 ha at Mourdiah-Ballé, 715 at Yélimané and 496 ha at Mopti.

8. During the month of September, there was a shortfall in rains at a number of places in the north and the east, while in the sectors of Nara, Dilly, Ballé, Kayes, Yélimané and Douentza, conditions remained favourable to grasshoppers, particularly Hieroglyphus daganensis, Kraussaria angulifera, Cataloipus sp., Kraussella amabile, Diabolocantops and Cryptocatantops haemorroidalis. On the other hand, the ecological conditions did not favour Oedaleus senegalensis which had difficulties in producing a third generation. During this month, in the zone of Kayes-Yélimané, some 200,000 ha were infested with Hieroglyphus daganensis, Oedaleus senegalensis and Cataloipus sp. (varying from nymph to adult stages), at densities between 5-20/m². Aerial operations over some 66,179 ha were carried out by the Stromme Foundation. In the area of Mourdiah-Ballé, surveys carried out on both sides of the Mauritanian frontier identified some 50,000 ha of infestation on the Mauritanian side (Tendi and Djigueni) at densities varying from 25 to 100/m². The species noted were Oedaleus senegalensis and Kraussaria angulifera. Aerial control had been undertaken in this area at the beginning of the month of August. In the sectors of Dilly and Ballé, adult Oedaleus senegalensis populations and Kraussaria angulifera (both nymphs and adults) were noted, at densities between 5 and 30/m², and aerial control was undertaken over 47,225 ha. In the sector of Douentza, in the north and east, edges of the Senemango, 22,200 ha were heavily infested (30 insects/m²) and were treated from the air.

9. Because of the late onset of the rainy season and the often poorly-spaced rains, the infestations were not of the gravity predicted. At the end of the campaign, there is some worry as to the situation on the frontier with Mali and in the north-west, where a long-cycle variety of sorghum is cultivated on the residual moisture flood plains. In these crops, aerial treatment (by helicopter) will be undertaken.

2.2.2 The Desert Locust

10. Surveys were carried out in the Adrar des Iforas and in the Tamesna; the situation was calm.

2.3 Egg-pod Surveys

11. An egg-pod survey was undertaken between 19 November and 8 December 1986. Six teams of prospectors carried out this work in the north and north-west areas; in the eastern area (Mopti region) it was four teams worked. The survey covered 12,511 m², chosen at random from a total area of 3,313 ha thought to be heavily infested. As expected, egg-pods were found over this entire area, and a total of 8,50-, at densities of 0.6-92/m² were recorded; 31.4% had been parasited. In the sector of Yélimané, the egg-pods found were of Oedaleus senegalensis, Kraussaria angulifera, and Catantops axillaris. In the Nara sector, the dominant species was Kraussaria angulifera, and at Ballé, the egg-pods found were of Catantops axillaris and Kraussaria angulifera. In the Dilly sector, egg-pods of Oedaleus senegalensis, Kraussaria angulifera, and Catantops axillaris were discovered. In the sectors of Koro, Bankasa et Douentza, Oedaleus senegalensis egg-pods were found. The overall distribution of egg-pods was as follows:

- Yélimané sector: 1.300 egg-pods (of which 16,7% parasited) over 1.093 m^2
- Nioro sector: 603 egg-pods over 1.195 m^2
- Ballé sector: 1.134 egg-pods (of which 61,38% parasited) over 1.587 m^2
- Nara sector: 1.258 egg-pods (of which 63,4% parasited) over 2.073 m^2
- Dilly sector: 1.489 egg-pods (of which 52,18% parasited) over 795 m^2
- Mourdiah-Fallou sector: 621 egg-pods (of which 69,2% parasited) over 1.741 m^2
- Bandiagara Bamba-Korientzé sector: 384 egg-pods (of which 27,8% parasited) over 653 m^2
- Koro-Bankass sector: 868 egg-pods (of which 74,5% parasited) over 1.479 m^2
- Douentza sector: 603 egg-pods (of which 66% parasited) over 1.158 m^2
- Gao sector: 44 egg-pods (of which 47% parasited) over 737 m^2

These surveys allowed the preparation of a map showing probable areas of high infestation during the 1987 crop season, and made it possible to take special measures to prepare for the campaign in these areas. The map showed that the heaviest hatching was likely to take place along the 16th parallel, and, in fact, the 1987 infestations occurred largely as predicted.

2.4 The Effects of Control Operations on Populations

12. Two days after control operations, mortality rates of between 75 and 90% were recorded.

2.5 Residual Populations at the end of the Season

13. Control operations continue on the Mauritanian frontier, above all on the Mauritanian side. Because they were not yet finished at the time of the mission, it is difficult to evaluate residual populations. As most of the areas infested this year were of natural vegetation, and not covered by control operations, there will undoubtedly be some residual populations. Another egg-pod survey is planned for the end of the campaign, which will make it possible to identify the areas of likely infestation in 1988.

3. MONITORING AND EARLY WARNING SYSTEMS

3.1 The Performance of the National Monitoring System in 1987

14. Six phytosanitary bases (Kayes, Yélimané, Mourdian, Mopti, Markala and San) were set up for the campaign, as well as sixteen phytosanitary sectors. Thirteen prospection teams were formed and distributed amongst the zones at risk, four to Mopti, four to Mourdian, two to Kayes, two to Markala and one to Yélimané. The two teams of Markala were mainly involved in bird control. All scout vehicles had radios. The scouts who used to be with OICMA were members of these teams. Monitoring relied on farmers providing data to the rural mobilization officers, who then transmitted them to the phytosanitary sectors; these then contacted the phytosanitary bases, but it should be noted that most of the sectors did not have access to radios.

15. In the Kaarta (Nioro area), monitoring is carried out by the Integrated Development Operation of the Kaarta (ODIK); in the Kayes-Yélimané area, by the Stromme Foundation. Common radio frequencies have not been established for Plant Protection, ODIK and the Stromme Foundation. ODIK does not have enough staff to monitor activities and has only one vehicle, and that in very poor condition. The absence of radio communications between the sectors and the bases is a real handicap to the rapid transmission of data.

3.2 The Use of Information in the Management of Control Operations

16. In general, the monitoring carried out by the teams made it possible to identify areas of high density populations and to direct control operations towards them.

3.3 Recommendations

17. Common radio frequencies should be agreed for all areas where this would facilitate pest monitoring.

18. So as to allow the correct functioning of a rapid warning system, and, thereby, localized control operations, a permanent network of observation posts with radios should be established, monitoring all food crop pests, and transmitting the data to the sectors and phytosanitary bases charged with control operations.

4. TRAINING

4.1 Training Activities in 1987

19. The training activities listed below took place.

4.1.1 Farmer Training

20. Farmers were trained in the areas of Mopti, San, Niafunké, Mourdiah and Kayes. The national language was used by the officers of

the Plant Protection Service and, when a foreign trainer was involved, an interpreter was provided. A total of 585 villagers and 9,464 farmers took part in this training programme.

21. The Stromme Foundation undertook farmer training in the Kayes-Yélimané area and then helped set up village brigades.

22. The following subjects were taught: the different developmental stages of the grasshoppers, the use of collecting boxes, an introduction to the detection of laying areas, various forms of damage, pesticides and spraying equipment, precautions to be observed in the use of pesticides (both when in stock, and at the actual time of spraying), the advantages of preventive control and the disadvantages of curative control. Training took place between 23 April and 31 May 1987.

4.1.2 Training for the Staff of the ODR (Opération de développement rural)

23. Staff of the Plant Protection Service and two staff members of GTZ (FRG) undertook this training, with the financial support of the FRG. The operations covered were ODIK, OMM (Opérations Mils-Mopti), ORM (Opération Riz Mopti), ARS (Action Riz Sorgho, Gao) and OVSTM (Opération Vallée Sigui Térékolé Magui).

24. Ninety staff members were trained in this way. The programme included monitoring methodology (prospection, reporting, transmission of information), control strategies (both preventive and curative), various control methods, pesticides and equipment, and precautions to be observed during spraying; also covered were the grasshopper anatomy, physiology, biology and population dynamics. During their training, the participants learnt to distinguish the growth stages of the grasshoppers, and to differentiate between grasshoppers and locusts (the african migratory locust, and the desert locust) and between the various species of grasshopper of economic importance.

4.1.3 Training for the Staff of the Plant Protection Service

Middle-level Staff

25. Three technicians took part in the course on Micronairs organized by FAO, Dakar, and two more took part in the workshop organized by the CILSS Plant Protection Training Department (DFPV-CILSS), on the proper use of pesticides.

High-level Staff

26. One high-level staff member took part in the course entitled "expertise acridienne", and two others took part in the course on the rational use of pesticides in grasshopper control, both organized by PRIFAS at Montpellier; two other officers took part in the seminar organized by USAID on the calibration of aircraft spraying in locust control work.

4.2 Further Training Needs

27. Italy supplied the National Plant Protection Service with 4x4 vehicles, sprayers and dusters. Proper training in the use of this equipment is indispensable and should be given before the beginning of the next campaign.

28. The National Plant Protection Service has at its disposal two aircraft (a Britten Norman and a Cessna 185). It is necessary to train two pilots as soon as possible.

29. High-level training in acridology for the senior staff of the National Plant Protection Service should be considered immediately, so as to be able to assure continuity of the work already launched by the various consultants. This training might be broken into a theoretical part at a university, and a practical part in Mali,- this latter forming the basis of a doctorate thesis.

4.3 Evaluation and Recommendations

30. This year, the farmers, now better trained, have played a much more important role in monitoring and control activities than in other years. Such training should continue, with the aim of creating further village brigades.

5. CONTROL OPERATIONS

5.1 The Preparation of the Campaign

31. About one month after the end of the 1986 campaign, an egg-pod survey was undertaken by ten teams, each composed of about four officers, and the work took about one month. It was clearly shown that dense hatching might occur at the beginning of the 1987 campaign along latitude 16°N. Six phytosanitary bases were therefore set up, at Kayes, at Yélimané, at Mourdian, at Mopti, at Markala and at San, and sixteen phytosanitary sectors (secondary bases) were set up under the authority of the various phytosanitary bases, except at San (Annex I).

32. The Plant Protection Service also realized the importance of setting up a base in Nioro du Sahel, but this proved impossible, as the area falls under the responsibility of ODIK (Opération de développement intégré du Kaarta), which was to undertake crop protection in its area of responsibility.

33. The needs of the 1987 campaign had already been established by November 1986, and submitted to donors: they included insecticides, vehicles, spraying equipment, radios, flying hours and general operating expenses.

34. A campaign plan was prepared and presented to a meeting of the Donor Committee in February and accepted. The plan foresaw the control of nymphs in Phase I by the farmers themselves, using dusts. The concentrated Propuxur (left over from 1986) was therefore formulated at

2% and 447 tons were distributed to the bases, the sectors, and to villages, before the beginning of the wet season.

35. Ninety rural trainers and 9,464 farmers in 585 villages were trained before the campaign began. In the north-eastern area (Kayes-Yélimané), farmer training was carried out by the Stromme Foundation of Norway, which also assisted in the establishement of village brigades, partly as a form of experiment. Excellent results were achieved this year, as most of the ground treatment in this area was in fact carried out by the farmers themselves and by the village brigades.

36. It was agreed that, when infestations went beyond the control capacity of the farmers, the phytosanitary bases should intervene with sprayers and dusters mounted on 4x4 vehicles. Unfortunately, the five equipped vehicles promised by Italy (4) and France (1) arrived late. Nonetheless, they will be of great use in 1988, and fill the gap that at present exists between ground control by the farmers and aerial control.

37. Most donors' pledges were fulfilled, but delivery to Bamako was often in July; pesticides needed for aerial control were then rapidly distributed to the air strips, as follows:

Kayes	82,000 litres
Nara	64,000 litres
Mopti	64,000 litres
Gao	14,000 litres

38. The United Kingdom supplied ten Land Rovers; these were landed at the port of Dakar in May but only arrived in Bamako in July. Once received, these vehicles were immediately put to work in monitoing operations.

39. The pesticides for Phase II were delivered late, but, as the rains themselves were late, they were in fact available at the time aerial control was necessary.

5.2 The Funds and Supplies Provided

40. The National Plant Protection Service was created in April 1987, but the passage of its functions between the Director of the OPSR (Opération de Protection des Semences et des Récoltes) and the Director of the National Plant Protection Service only took place in October 1987. Nonetheless, this service functioned organically from the beginning of the rainy season on. The fact that the National Service is attached to the Minister of Agriculture's Cabinet, and not to a National Directorate, allowed it to set up its decentralized structures referring to the areas threatened by pests, and not according to the pre-existing administrative system (Regions, Circles, Districts). The Service now has eleven agronomists, seventeen agricultural engineers, and seven agricultural monitors and thirteen well-trained scouts, of whom eleven have already worked for OICMA (Organisation inter-états de lutte contre le criquet migrateur africain), which has been dissolved.

41. The international aid supplied included vehicles, pesticides, fuel, protective clothing, flying hours, and technical advice.

- The UNDP transferred a 12-tonne lorry to the Plant Protection Service from another project. It needed repairs and spare parts and was only finally transferred in October 1987.

- The United Kingdom supplied ten Land-Rovers; even though these arrived in Bamako in July, this allowed the rapid fielding of mobile survey units. The Stromme Foundation bought five Toyota Land-Cruisers, three of which to be used in its area, and two as supply vehicles for the Plant Protection Service.

- The GTZ financed special training in ground control: 9,464 farmers were trained and 90 officers of the agricultural service.

- The Plant Protection Service supplied the pesticides for Phase I from stocks left over from the 1986 campaign. On top of this, the United Kingdom supplied 150 tons of Propoxur 2% dust and France 30 tons. Fenitrothion, of a variety of concentrations and formulations, was provided by a number of donors: the EEC, 118 MT of 3% powder and 15.6 MT of ULV 50%; the Stromme Foundation, 24,000 l of ULV 1000; and France, 5,000 l of ULV 1000. USAID also supplied 32,000 l of Malathion ULV.

- Italy supplied four vehicles equipped with sprayers, and France one. These arrived late and were not usable in this year's campaign.

- USA supplied 350 fixed-wing flying hours, and 100 helicopter flying hours, and the Stromme Foundation, 300 helicopter hours. France covered 80 helicopter flying hours and supplied a pilot for the Plant Protection Service's Cessna aircraft.

- In the final stage of the campaign, the USA supplied two spray 'planes for control operations south of the Mali-Mauritania frontier and in the zone of Ballé-Nioro, as well as an additional quantity of 40,000 l of Malathion from Dakar. Two 'planes were also supplied by Canada.

- Not taking into account the assistance from USAID and Canada last mentioned, total donor assistance is estimated at US$ 5.05 million.

3.3 Control operations and Areas Treated

42. The first survey, carried out between 11 and 17 June in the region of Mopti, found adult grasshoppers. From this it is clear that the first hatchings must have taken place in May. The sparse early rains had, in fact, given rise to very unevenly distributed hatching. Phase I of the campaign, by farmers against early instar nymphs, began in June.

43. Between 2 and 16 July, a helicopter survey was undertaken in the Mourdiah-Dilly-Ballé area. Nymphs and young adults were found, at very varied densities of up to 30/m². The densest young adult populations in the areas of Ballé and Dilly were sprayed by the same helicopter on 9 and 13 July. Fourteen areas, totalling 5,340 ha, were sprayed, and 2,670 l of Fenitrothion 50% were used. A number of these areas were again sprayed in August.

44. Ground surveys on 6 and 7 July in the northern part of Yélimané found 5-10,000 ha infested at densities of up to 5/m² (a number of different species were noted).

45. A helicopter survey on 15 and 17 July found nymphs of all instars at the following densities: Kremis, 10,000 ha at 4-8/m²; and Kirané, between 6-10,000 hectares at 3-5/m² and between 2-10,000 ha at 1-3/m² in the Térékollé valley. At the end of the month of July, these densities at times reached 15-20/m². In a number of places, dusting with dusting bags had to be reduced because not enough dust was available locally. Helicopter spraying was resorted to once in the month of August in this area. A survey by helicopter in the Mopti area between 20 and 29 July found only a few immature and adult grasshoppers. There was little green vegetation except in low-lying areas. Between 10 and 15 July, 300 areas were dusted with Propoxur 2%. The grasshopper situation remained generally calm until the end of the month of July, except in the triangle of Dilly-Nara-Ballé, where good rains had fallen between 20 June and 10 August. At the end of the month of July, 2,329 ha were treated by ground teams with 9.2 MT of insecticide dust and 1,312 l of Fenitrothion 50% ULV. During Phase I, a total of 5,340 ha were sprayed from the air, using a total of 2,670 l of Fenitrothion 50% ULV. The Plant Protection Service's Bulletin no. 4 lists clearly the preparations that had been made for aerial treatment in Phase II. 125,000 of ULV pesticides were distributed to the field and action had been taken to increase this quantity by a further 49,800 litres, which would have allowed the treatment of some 392,340 ha.

46. In August, major infestations in the areas of Kayes-Yélimané, Ballé, Nara, Dilly and Douentza were noted. The Britten Norman Islander belonging to the Plant Protection Service began spraying on 20 August in the Dilly-Ballé area, where, by 31 August, 23,936 ha had been treated; 715 more were treated in the Yélimané area, and 496 ha in the Mopti area.

47. As good rains had fallen in the areas bordering Mauritania, there appeared to be a danger that the grasshopper populations to the north of the frontier might re-infest the places already treated in the areas of Nara, Ballé, Mopti in Sahel and Yélimané. This part of Mauritania is easily reached from Mali, and it was in Mali's interest that spraying should be carried out. An agreement was made with Mauritania that a helicopter might survey both sides of the frontier in mid-September. This survey showed that it would be necessary to mount extensive aerial control operations.

48. Because of logistic and administrative problems, these operations did not take place until 2 October. It proved necessary to use six

planes and to send an extra quantity of 40,000 l of Malathion ULV from Dakar by rail. Before these operations began, the area needing treatment was estimated at 160,000 ha: while this report is being written, these operations are still in progress but, by 18 October, the area sprayed is already greater than this estimation.

49. In the area where the Stromme Foundation was working, spraying began on 17 September and continued until 18 October. Two helicopters were used. The targets included immature and adult grasshoppers breeding in Mali, as well as adults which had come from Senegal and Mauritania. At least 150,000 ha were sprayed and high mortalities were achieved.

5.4 Evaluation of the Efficiency of Control Activities

50. The mortality rates measured varied from 75 to 80%, which is normal when Fenitrothion is used at 250 gr. a.i./ha.

51. Inefficiencies in control operations occurred with late spraying, that is, when spraying was too late to prevent laying: in such case, a second treatment was necessary.

5.5 The Evaluation of the Pesticides, Spraying Material and Aircraft Used

52. It appears that the planes and spraying equipment used worked well and no failures were noted.

53. The very limited range of insecticides used proved adequate. Nonetheless, two pesticide trials were carried out during the campaign, and the reports will soon be published. The aim was to reduce dosage rates and toxicity to non-target organisms.

54. Helicopters proved to be very useful in survey work and in undertaking rapid spot treatment when necessary.

5.6 The Environmental Impact

55. A large quantity of protective clothing had been supplied so as to minimize possible danger to spraymen.

56. So as to protect the villagers, they were requested to leave the areas about to be treated from the air, and to not use water sources within them.

57. Both the donors and the countries suffering from grasshopper attacks believe that pesticides should not be abused. One of the reasons for this is that if pesticides are overused, it is difficult for the natural ennemies of the grasshoppers to multiply. No detailed studies of these natural ennemies were attempted, but a number of observations of parasitism of egg-pods were made. To improve the situation, it would be necessary to undertake much detailed research on the natural enemies of grasshoppers, to use less dangerous pesticides, and to organize control operations more efficiently: in the meantime, every attempt should be made to not twice treat the same area.

58. So as to protect cattle against the ingestion of pesticides, no pastures were sprayed. This is not necessarily a good thing for the success of control operations, and a pesticide with low mammalian toxicity should be urgently sought.

59. In the context of the pesticide trials carried out by USAID, some samples of sprayed vegetation were gathered, but the results of the residue analysis carried out on this material have ot yet been made public.

60. The Stromme Foundation also fielded its specialists in the environmental impact of spraying, but the results of their work are not yet available.

6. ECONOMIC ANALYSIS

6.1 Crop Losses

61. There were very few crop losses during 1987. Nonetheless, there were some cases of the complete destruction of seedlings and re-seeding. High levels of loss were only noted in one field: in the Diorolé area on 25 August, over an area of about 5 ha, the millet crop had been eaten back to the stems.

62. The campaign against grasshoppers must be considered a success, in that the damage they caused to crops is estimated at less than 1%.

63. The forms of damage that grasshopper cause are very varied, and sometimes difficult to establish, but it is clear that, this year, millet stem borers (Raghuva) caused much greater losses. It is clear, too, that the general fall in agricultural production this year (the details of which are not yet available) should rather be laid to the account of the three or four weeks of drought which occured during the period when plants were growing rapidly.

6.2 Cost/Benefit Analysis of Control Operations

64. The statistics gathered by USAID for 1985/86 (a good year) show that the zone in which grasshopper infestations occurres produced a total of 375,532 tons of millet, 186,206 tons of sorghum and 26,680 tons of maize.

65. These figures are the result of adding the regional production of Kayes, Mopti, Timbuctou, and Gao, and 50% of the production of the Koulikoro region, as well as 33% of the production of the Ségou region. The figures for the Sikasso region, the most productive, are not included. They represent, nonetheless, 44% of total millet production, 33% of sorghum, and 15% of maize.

66. All the above crops included, the total area covered is estimated at 4,783,346 ha, which is 41% of the total cultivated area.

67. The average price of a kilo of millet, sorghum or maize, is 55 FCFA, or US$ 0.1815. The total production of these three cereals is 588,418 tons, with a value of US$ 106.8 million.

68. It is difficult to estimate the total cost of the campaign, but, by 10 August, total foreign aid was estimated at US$ 5.054 million. This figure is 4.7% of the total value of one year's crops in the areas threatened by grasshoppers when rains have been good, which appears to be very high.

69. This analysis, however, does not take into account the crops in the Sikasso region, which is the most productive agricultural zone.

7. ORGANIZATION AND STRUCTURES

7.1 The Role of the National Coordinating Committee

70. In Mali, the name "Donor Committee", is used; it met regularly for six months (February to June inclusive). The plan for the year's campaign, which had been drawn up by the National Plant Protection Service, was discussed and adopted by the Committee in February 1987.

7.2 Improvements in the National Plant Protection Services since 1986

71. The authorities are now very aware of the importance of protecting field crops and, in April 1987, a National Plant Protection Service was created; its Director was named in August 1987.

72. The equipment received (lorries, 4x4 vehicles, spraying equipment, etc.) will greatly increase the intervention capacity of the Plant Protection Service.

73. The training which the farmers have received will ensure their active participation in the protection of their own food crops.

7.3 The Role of International and Regional Structures

74. CILSS promoted close collaboration with neighbouring countries, particularly with Burkina Faso and Mauritania. Radio communication with Burkina was not possible, because different frequencies are used, but communications with Mauritania were much easier, as the same frequency is in use.

75. The CILSS Department for Training in Plant Protection (DFPV) organized a workshop on the judicious use of pesticides, and its regular training programme for technicians includes a section on acridology.

76. AGRIFAS diffused its information bulletin on grasshoppers in the Sahel (SAS) widely. It also organized a seminar entitled "expertises acridiennes" at Montpellier, and a course on the judicious use of pesticides in operations against grasshoppers. Close collaboration with the National Plant Protection Service in data collecting would be very valuable.

77. OCLALAV, with the assistance of an FAO consultant, undertook surveys in the Adrar des Iforas.

7.4 The Role of the FAO

78. The presence of an FAO consultant in the two campaigns of 1986 and 1987 means that the National Plant Protection Service now knows how to conduct egg-pod surveys.

79. During the course of this campaign, the FAO Representation in Mali played only a limited technical advisory role.

8. LONG-TERM AND OTHER CONSIDERATIONS

8.1 Stocks at the End of the 1987 Campaign

80. As operations were not yet completed, it was difficult for the mission to estimate the stocks that would be left over at the end of the season, but it appeared certain that some of the stocks intended for ground control will remain over for the next campaign.

8.2 The Use of Empty Pesticide Drums

81. As urged by the USAID mission in Mali, these drums were collected, washed by bicarbonate, holed, burned and buried.

8.3 Recommendations

82. The campaign against grasshoppers in Mali this year was much better prepared. In less than a year, Mali has replaced the old OPSR (Opération Protection des Semences et Récoltes) with the National Plant Protection Service and the Malian Pesticide Company, and has named the Director of the Plant Protection Service and transferred its responsibilities from the OPSR to him. It is recommended that the international community give its technical and financial assistance to the National Plant Protection Service, so as to allow it to operate in all the areas threatened by pests.

83. Throughout the whole 1987 campaign, USAID gave its constant support to the National Plant Protection Service; such support should continue within the framework of a medium-term programme to reinforce the National Plant Protection Service.

84. Training at all levels should be increased, particularly for the farmers, so that they can progressively take over responsibility for the first ground operations. Some of the senior staff of the National Plant Protection Service should be trained in acridology.

85. A number of applied research studies are necessary (intervention thresholds, pesticides better adapted to grasshopper control and their secondary effects, and the natural enemies of grasshoppers which might be used in control operations).

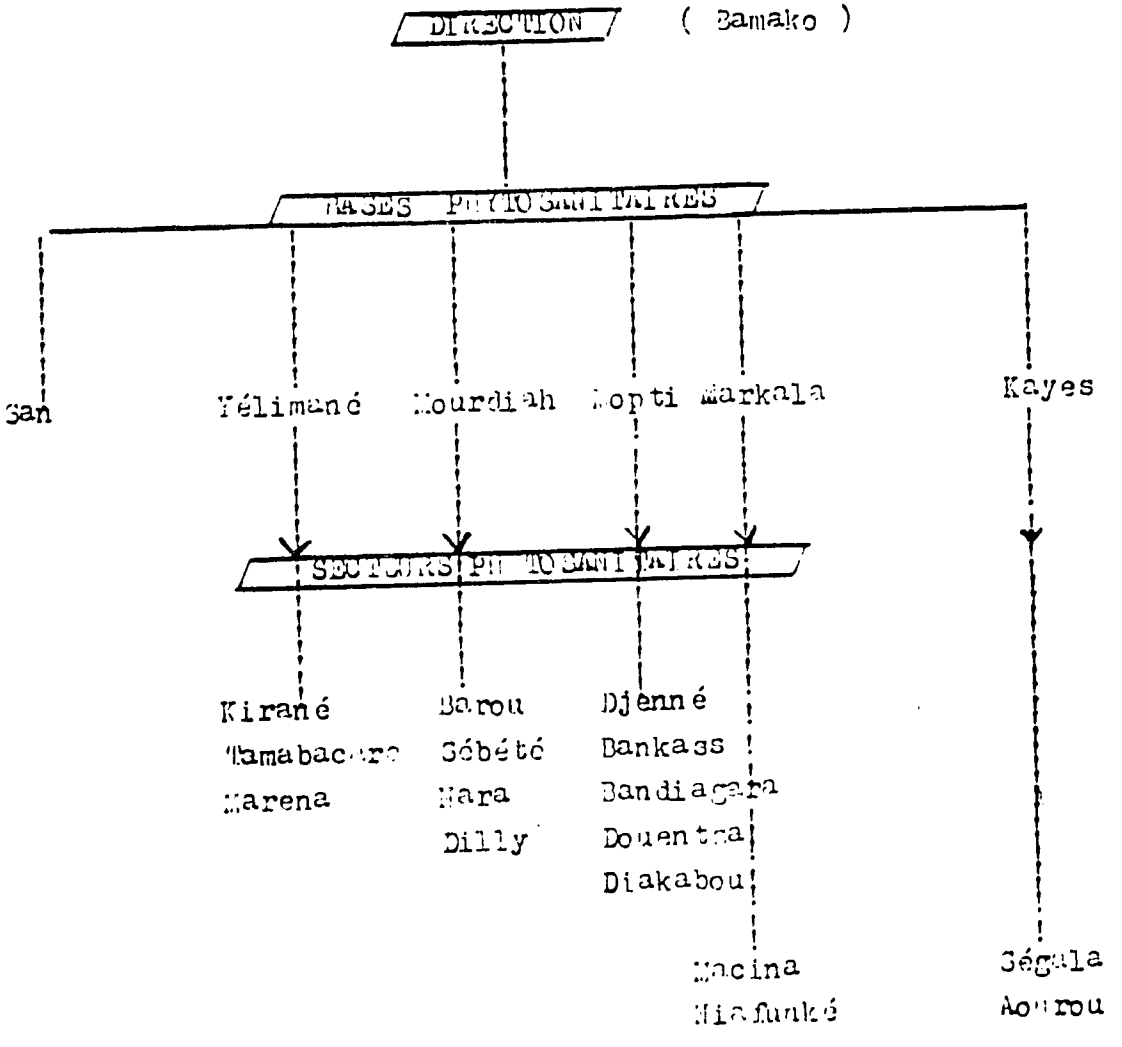
86. A survey network in the areas threatened by pests is most necessary; this would allow rapid warning and local treatment, and so avoid the use of huge quantities of pesticide.

87. The National Plant Protection Service should be charged with the organization of Plant Protection in the zones looked after by ODIK and the Stromme Foundation, while continuing to benefit from the support of these structures.

88. Phase I had at its disposal only the pesticide stocks remaining from 1986, because of the slow delivery of insecticides by the donors. That most of the equipment arrived in Bamako only in July, although delivered to the port of Dakar in May, shows that it is difficult, perhaps impossible, to ensure the arrival of pesticides before the beginning of the campaign.

89. It is therefore recommended that sufficient stocks of insecticides be made available to Mali at the beginning of 1988, so as to ensure that there is enough on hand for control operations in Phase I of the 1989 campaign. The question of late delivery raises the problem of transit costs: it would be advisable for donors to cover transit costs, and bring their weight to bear on forwarding agents in Dakar, so that equipment and pesticides are sent on to Bamako as fast as possible.

ORGANISATION MISE EN PLACE POUR LA CAMPAGNE 1987 DE LUTTE CONTRE LES SAUTERIAUX



PRODUITS ET MATERIELS

DONATEURS	Total aide en Dollars, Ecus, FF, Lires ou IS	Produits de lutte	Matériels: Traitements	Matériels: Protection	Matériels: Véhicu.	Date arrivée Bamako	Frais opérationnels	Heures de vol	Assist. technique	Location	Sensibilisatio
C E E	210.000 Ecus	18,4T féni.3 %poudre 15.600 l féni. 50%ULV	- -	- -	- -	2.07.87 17.07.87			18.000Ecus		
			18.000Ecus pour 100combi 150 masques 150lunettes			- - - -					
GRANDE BRETAGNE	285.000 LS	150T propoxur 2%	-	-	- 10 LR	17.07.87 4.07.87	- -	- -	- -	- -	-
USAID		42 000l malathion 90 ULV =289.989 $	-	-	-	27.07.87 12.06.87	70.000$	350h avion 100h héli pc 1.8.87	18.000$ dont 20.000 (évalua- tion)	10.000$	25.000
			10.000sacs poudreurs =2.750.000CFA 100balances = 945 $	10.000masques		1.6.87 1.6.87					
STROMME	1,5millions $	24.000l féni 100%/l =8.079.845 CFA 32.000l huile colza/de =10.976.112 CFA pièces rechange =4.262.104CFA 40.000l Essence = 6.917.200	-	-	-	27.07.87 -"- -"- -"- -"- -"- -"-	25.000$	300h héli	140.000 dont 100.000 évalua- tion		
			100 pulvéri- sateurs	100 combi- naisons 100 masques 100lunettes 100 gants 100 bottes	5 LR	Juin 87 -"- -"- -"- -"- -"-	-	-	-	-	-

ANNEX ...

Produits et matériels

Donateurs	Total aide en Dollars, Ecus FF, ou LS	Produits de lutte	Matériels			Date arrivée Bamako	Frais opérationnels	Heures de vol	Assistance technique	Location	Sensibilisation
			Traitement	Protection	Véhicules						
CANADA	500.000 $	-	-	-	-	-	-	-	-	-	-
FRANCE	2.075.000 FF	5.000 l Péni 1000g 30T poppo. 2%	-	-	-	27.7.87	200.000 CFF	80h héli	-	-	-
			-	-	-	7.87	-	-		-	
			500 micron ULVA 3888 ailes 100 atomiseurs			15.8.87 -"-	-	-	-	-	-
					1 camion équipé (1) 4 x 4	29.7.87		1 à 2 avions à ailes fixes	2.000.000 cfa		
ITALIE	100.000.000 CFA (423.000.000 lires	3000 l Durshan 12% CE	100 ato.à dos 200 poudreurs 2 camions traitement liquides 2 camions -"- poudre 20 ato. à brouettes			17.08.87 -"- -"- -"- -"-					
				100 masques 200 lunet. masques 100 lunet.protection 1000 combi. 500 gants 1000 bottes PVo 1000 tubes pommades		-"- -"- -"- -"- -"- -"- -"-					
					4 TT 4 x 4	*	-	-	1 expert 6 mois		
					2 Pu 4x4	*	-	-			
FNUD					1 camion 12T 4x4	21/10/87					

ANNEX III

PERSONS MET

MALI	
I. Ongoiba	Ministry of Agriculture
B. Bathily	Directeur de Cabinet, Ministry of Agriculture
S. Sountera	Director of the National Plant Protection Service
M. Keita	National Plant Protection Service
Y. Kone	National Plant Protection Service
DONORS	
CANADA	
R. Benjamin	Ministry of Agriculture on mission in Mali
EEC	
G. Fontaine	Economic Counsellor and Delegate, a.i.
STROMME FONDATION	
B. Hellum	Liaison Officer
FRANCE	
R. Trebuchet	Counsellor
UNITED KINGDOM	
J. Rowley	Entomologist, Assistant Director, British Projet for Plant Protection
UNDP	
M. Gautier	Assistant Resident Representative
F.R. GERMANY	
D. Lingeman	First Secretary
USAID	
W. Thomas	Assistant Director
F. Michaud	Logistician, Grassnopper Control
FAO	
M.S. Bouleçane	FAO Representative
G. Popov	Consultant, FAO
A. Ouattara	National Consultant, FAO

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

MAURITANIA

Mission: (24-27 October 1987)

Mr. Channing J. Fredrickson (FAO)
Mr. André Duhart (France)
Ms. Jude Andreasen (USA)

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9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

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JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

MAURITANIA

1. ACKNOWLEDGEMENTS

1. The team is grateful to the FAO Representative in Mauritania and to his staff for their assistance in arranging interviews and meetings and for the logistic support they provided. Special thanks are due to Dr. Magema for the valuable reports and detailed information on the 1987 Grassnopper Campaign which he provided.

2. The Ministry of Rural Development was most cooperative, and briefed the mission and provided documents needed.

3. The views of members of the Donor Community on the 1987 campaign proved valuable in the preparation of this report.

2. INTRODUCTION

4. In Mauritania, losses due to insects, particularly grasshoppers, are, in certain years, a grave problem for the farmer and for the country.

5. When severe losses occur they aggravate food shortages and the necessity to make up the cereal deficits.

6. Grasshopper populations in the 1987 season were again heavy, and the situation has been complicated by a potentially dangerous desert locust build up in northern Mauritania.

7. In 1986, considerable losses were averted through the close cooperation of the Ministry of Rural Development, FAO and the donor community in the Campaign against grasshoppers. The continuation of this collaboration into 1987 will certainly prevent excessive losses.

8. This report deals with the 1987 campaign, and recommends future actions.

3. EVOLUTION OF GRASSHOPPER AND LOCUST POPULATIONS IN 1987

3.1 Egg-pod Surveys

9. Between [illegible] February 1987, a team of Mauritanian and Malian technicians carried out an egg-pod survey in the southern regions of Touil and Kaboni, where the residual population of Aedaleus senevalensis at the end of the 1986 campaign had been very dense. This team scraped the surface off some [illegible] m². 209 egg-pods were found, and 113 of these had been parasited. The average density per square metre was of 0.2% to [illegible] egg-pods. The prospectors and inspectors of the

Mauritanian team, were trained by participating in these experiments, then each carried out further egg-pod surveys in other biotopes, but the results of this work were not considered significant and were not taken into consideration.

3.2 The Weather

10. By mid-June, important rains had fallen on the border zone with Senegal, in the regions of Kaedi and Maghama, and in the region of Hodh Gharbi, on the Malian frontier. These rains allowed farmers to sow millet and sorghum; they continued sowing even after the the rains stopped. Their work went unrewarded, as the young plants dried out, with the failure of the rains over a large part of the country for some weeks. Nonetheless, between the beginning of July and 10 August, decent rains fell in some areas, sometimes more than once, which allowed the development of cereal crops to continue in the lucky zones. Only from 10 August on did the ITCZ stabilize at the height of Nouakchott, bringing regular rain to the south and south-east of the country. Farmers immediately re-planted rapid millet and sorghum in the areas that had suffered from dryness after the first early rains. In the days that followed, a strange mixture of crop development stages might be noted: in some places re-seeded cereals were just putting out leaves; in others, where the drought had been less severe, the harvest was going on. At the same time (from 10 August onwards), a regular rainfall was reported in the centre and north-west of the country, in zones favourable to the Desert Locust. These rains continued throughout the month of September and into the second decade of October, and their volume reached the annual average for the period under consideration. The agro-pastoral areas were also well watered. In the second decade of October, a 41 mm of rainfall were registered on the Malian frontier in the Djiguenni; other rains were recorded in the region of Oualata. These rains may continue at the end of October and in November in the eastern and northern zones, which are the areas most favourable to _Schistocerca gregaria_.

3.3 The Grasshopper and Locust Situation

11. The Grasshopper situation was very adequately handled by the Plant Protection Services in 1987 which set up nine principal bases throughout the territory: at Rosso, Aleg, Skaedi, Sélibaby, Kiffa, Aioun, Néma, Atar and Tidjikja. To each principal base were attached a number of secondary bases. Because of the efficiency of the work of the National Coordinating Committee, which met from the month of January onwards, and included FAO, Plant Protection, and the donors, both equipment and insecticides were delivered in time and distributed to the principal and secondary Plant Protection bases. The 14 Plant Protection technicians [illegible] trained in [illegible] Niamey and Dakar. [illegible] followed a [illegible] and practical course on eggpod surveys in Mauritania in February. Moreover, 33 technicians of the Agricultural Inspectorate attended a re-training seminar organized by the Ministry of Rural Development and FAO, which lasted all the month of May. More that 7,000 farmers were involved in crop pest monitoing and in early control operations in the crops, and village committees for control operations were set up in the

agro-pastoral zones. Finally, thanks to the help of the French cooperation mission, a helicopter undertook monitoring of the distant regions.

12. Monitoring of the Desert Locust situation was undertaken, from the month of June onwards, by two OCLALAV teams in the Tagant, and continued, with the help of Plant Protection, in September and October in the Hodhs, the south of the Adrar, the Inchiri and in the north of the Tagant.

13. The first hatchings of Oedaleus senegalensis were noticed at the beginning of July in the regions of Boustella and Adel-Bagrou. Those hatchings were only partial, particularly in the biotopes which had had very early rains, at densities of 9 - 15/m² in pasturages, and of 6 - 12/m² in millet fields, and only covered areas of some tens of hectares. These patchy infestations were easily treated by the farmers, and crops suffered no losses. Apart from Oedaleus senegalensis, by far the most common grasshopper, the principal species were Hieroglyphus daganensis and Aiolopus simulator on clay soils along the river. With the rains of August, a new series of hatchings of Oedaleus senegalensis began, which resulted in the simultaneous presence of G1 and G2 generations. At the beginning of October, following the rains of September, the situation was worrying, with an area of 130,000 hectares infested in the Hodh Charghi (in Timbédha and Djigueni departments) and 130,000 in the Hodh El Gharbi (in the departments of Tintane and Roboni) as well as 50,000 hectares in Assaba, especially in the south of Kankossa. Grasshopper densities frequently varied between 50 - 100/m². Other less important concentrations occurred locally in dunes and in Cenchrus biflorus pasture.

14. There was no national aerial intervention capacity, because of a lack of funds and of usable air fields, and the plan of the FAO logistician could not therefore be put into practice. Mauritania had to call on Mali; from airstrips close to the Mauritanian border, two planes supplied by Canadian Assistance and two others from USAID (Thrush and Turbo Thrush respectively) treated an area of 56,200 ha in the Hodh Charghi and 50,000 in the Hodh El Gharbi on 19 October. Fenitrothion ULV 50 and Malathion 96 were used. On 22 October, 17,200 more hectares were treated in the Hodh El Gharbi. At the same time, the Plant Protection Service undertook ground control over 2,365 ha in the region of Sorgol, Assaba, and in the two Hodhs, from its principal and secondary bases. The pesticides used were Fenitrothion 3% dust and Fenitrothion ULV 50. Farmer teams also took part in these operations, which, at the time of the mission, continued by ground and by air.

3.- Effects of Control Operations on Populations

15. The efficiency of these treatments was high: mortalities between 80 and 90% were measured in the various areas treated. These control operations efficiently protected those crops which had not yet been harvested, except in the region of Boustella and Djibueni, where very local losses of 20 - 30% were registered. Millet losses in the region of Touil are estimated at between 1 and 2%.

3.5 Residual Populations at the End of the Season

16. In the second decade of October, the return south of the ITCZ results in the drying out of vegetation at the same time as the grasshopper populations reach maturity. They migrate from the northern regions towards the south and into the cropping areas. In spite of large-scale treatments, Oedaleus populations are still heavy and it is intended to immediately carry out a number of surveys to asses and locate the populations. Late millet in the Hodh Charghi, as well as late sorghum, which will not be harvested till mid-November, may be threatened and it may be necessary to intervene to protect them, before the last generation disappears after laying.

17. The Plant Protection Service is also worried about the possibility of threats to residual moisture flood plain crops from Hieroglyphus daganensis and Aiolopus simulator. Poisoned bait could be used against grasshoppers which hide in cracks in the earth.

18. In as far as concerns the Desert Locust, mature autochtonous insects have been collected in the northern and north-eastern depressions. Very recent information (25 October) has been received of the presence of swarms of Schistocerca gregaria in the Tindouf region of Algeria, and the Moroccan authorities, in collaboration with FAO and other experts, have decided to carry out aerial surveys of the zones at risk with a hired aircraft capable of long distance survey.

4. MONITORING AND EARLY WARNING SYSTEMS

4.1 Performance of the National Monitoring System in 1987 and Recommendations

19. The Crop Protection Service has 25 radios of various types, and uses the single wave band. As communications are often unclear, because of interference, the FAO logistician has carried out a study in which he proposes a supplementary frequence in the 5,000 MHZ band for contacts between the Plant Protection Directorate and its principal bases, a reserved wave band and four frequencies for communications between the principal and secondary bases. Although the present alert and early warning system has functioned relatively well until now, the evaluation mission agrees with the logistician's proposals, which would greatly improve the reliability of such communications. The mission also proposes that batteries be charged by solar panels, instead of by generators, which often break down.

20. The locust and grasshopper reporting forms are very well established, and inspired by those of PRIFAS: one copy remains in the secondary base, the two others go to the principal base and to the Plant Protection Directorate.

4.2 The Use of Information in the Management of Control Operations

21. Data received is not analysed by a special division of the Plant Protection Service, but by the Directorate itself, with the cooperation

of the FAO expert. It is intended to soon install a mini-computer soon for the management of a data-base.

4.3 Other Matters

22. Mauritania does not yet have a phytosanitary law, as is required by the Rome Convention.

23. The 15 radio antenna donated by USAID should be replaced by a bi-polar model.

5. TRAINING

5.1 Training in 1987

24. In preparation for the 1987 campaign, agents of the Mauritanian CPS participated in the following short-term training courses in grasshopper biology, identification and control:

Month	No. of Participants	Place	Sponsor
January	1	Montpellier	FAO
February	3	Niamey	CILSS
March-June	3	Niamey	CILSS
April	5 (1PCV)	Dakar	USAID
April	3	Dakar	FAO
May	3	Montpellier	USAID/FAO

25. The Ministry of Rural Development has benefited from a project (TCP/MAU/6651), financed by FAO, to better prepare CPS technicians to train farmers and to continue and expand the annual farmer training programme. Five regional "trainer-training" sessions on the following subjects were held:

- the biology and ecology of DSE
- surveillance techniques
- the organization of Grasshopper Campaigns
- the use of pesticides and spray equipment
- the principal bird pests in Mauritania
- bird control techniques
- the use of poisoned baits against rats
- traditional crop protection methods.

26. These training courses were held not in Nouakchott, but in the interior, to permit the practical study of the existing resources, storage areas, nesting areas, etc. An added advantage was the participation of representatives of other organizations, such as SONADER, the Peace Corps, OPAM, etc. A total of 5 agents were trained in the cities of Kaedi, Konkossa, Aioun, Tidjikja and Aleg. Training sessions lasted from two to five days and were conducted by Dr. Magema, the FAO expert, by Tanara Galledou, the Chief of the CPS, and by Taleb Ould Jeddou, a CPS technician. These agents then trained farmers, supervised by the Agricultural Inspectors and by Dr. Magema.

This training took place between June and August, and a total of 7,385 farmers were involved, coming from the regions of Hodh Charghi, Hodh Gharbi, Assaba, Guidimaka, Gorgol, Brakna, Tagont, Adrar and Trarza. Village committees, or farmer brigades, were given the responsibility of managing village pesticide stocks, of organizing collective treatment activities, and of implementing all extension directives from the Department of Agriculture/CPS. Included in all farmer training were traditional crop protection methods, such as the destruction of bird nests, the use of fires at night for attracting and killing grasshoppers, the burning of millet stalks against stem borers, and seed selection and treatment, etc. Thirty GERDAT grasshopper identification manuals were distributed, but the dissection kits and magnifying glasses requested from FAO were not received in time.

27. The Ministry and USAID co-sponsored the training of nine agents in egg-pod survey techniques.

5.2 Training Needs

28. Several Mauritanians will soon return with advanced degrees in entomology, plant patnology, etc., six from the US, three from France, and one from Morocco. Both long and short-term training is still needed to supply the technical expertise Mauritania needs. The strengthening of surveillance by egg-pod counts, and of ground operations, will require continued short-term training in the interior. The farmer training conducted this year by the CPS and by FAO should continue, as should the radio broadcasts sponsored by USAID. Rural radio programmes have been broadcast on a daily basis in all the important local languages, and covered such topics as grasshoper control and, in particular, pesticide safety. As experts to produce these programmes had to be recruited from Senegal, it would be useful to send one or more Mauritanians for long-term training in rural radio use techniques.

29. An urgent need to train two people in radio repair has been expressed to USAID. Only one technician currently repairs the radios, and he is nearing retirement.

5.3 Recommendations

30.
- the training of at least two Mauritanians in radio repair;
- continuation of the training of CPS and agricultural agents in egg-pod survey and ground operations;
- continuation of the rural radio programmes;
- continued short-term training in Montpellier and Niger;
- more long-term training for Mauritanians in entomology and acridology;
- an emphasis on extensive, repetitive farmer training in basic pesticide safety and in the use of protective clothing;
- technical assistance, such as the current FAO entomologist, to conduct and supervise training sessions.

6. CONTROL OPERATIONS

6.1 Organization of the Campaign

31. The rains came earlier than usual in Mauritania, beginning in the first 10 days of June with the arrival of the Inter-Tropical Convergence Zone. There were significant populations in the Gorgol region and in other regions along the Senegal River. As a result of last year's grasshopper campaign, the Crop Protection Service had carried out considerable training at all levels, and the Director of Crop Protection himself coordinated the campaign.

32. Although some 300,000 hectares were treated in 1986, mainly in cultivated areas, a large residual population remained in the natural vegetation. An effort to preposition insecticides and equipment was handicapped by the early rains and the lack of storage facilities; the road network leaves much to be desired, and vehicles break down frequently.

6.2 Funds and Inputs made available

33. The following campaign supplies were available at the beginning of the 1987 crop season:

- 960 tons of Propoxur 2% dust
- 84,000 litres of liquid pesticides
- 8,800 sprayers
- 18 vehicles
- 17 motorcycles
- 8,229 units of protective equipment (masks, gloves, goggles, boots, etc).
- 43,000 litres of diesel fuel.

34. Pesticides and sprayers were distributed as in the following table.

Table I - Distribution of Pesticides and Sprayers

REGIONS	Matériel Traitement		Produit Phytosanitaire		Raticides	Avicides Finthion	Explosif
	Poudreuse	Pulvérisateur	Insecticide poudre.	Insecticide liquide			
Nouadhibou	990	150	130 T	13.000 l		240 l	1.200kg
Gorgol	1.090	200	135 T	14.400 l			1.140kg
Brakna	730	150	125 T	3.000 l	100 l	240 l	410kg
H. El Chargui	1.000	150	164 T	14.000 l		240 l	-
H. El Gharbi	850	150	135 T	14.000 l	[illegible]	240 l	1.650kg
Assaba	880	150	145 T	14.000 l	[illegible]	240 l	-
Trarza	800	150	60 T	3.000 l	300 l	240 l	-
Adrar	330	100	15 T	4.000 l			-
Inchiri	230	100	10 T	400 l			-
Tagant	500	100	40 T	4.000 l	50		-
TOTAL REGIONS	7.400	1.400	950 T	85.000	500	1.440 l	4.400kg
Stock Nouakchott	2.500	500	-	10.350	2.400	600 l	450kg
TOTAL GENERAL	7.650	1.900	950 T	94.350	2.900	2.040 l	4.850kg

35. The distribution of fuel and financial resources is given in table II.

Table II - Distribution of fuel and financial resources

REGIONS	CARBURANT	CREDITS DELEGUES
NEMA	225.000	997.860
AIOUN	135.000	677.860
KIFFA	90.000	487.860
SELIBABY	135.000	931.460
KAEDI	180.000	991.460
ALEG	135.000	826.860
ROSSO	153.000	755.860
TIDJIKJA	135.000	404.460
ATAR	112.000	343.000
AKJOUJT	60.000	344.460
COORDINATION	135.000	308.000
	1.495.000	6.981.140

36. In 1987, the donor community again responded generously and gave the CPS the means to carry out a successful campaign. The list of donors and their contributions is in Annex IV.

6.3 Control Activities Undertaken and Areas Treated

37. Ground applications were made in the following regions:

	Area (hectares)	Product used
Gorgol	2,526	Fenitrothion 3% dust
Assaba	6,780	Fenitrothion 3% dust
Hodh El Gharbi	5,993	Fenitrothion 3% dust + Fenitrothion 50% ULV
Hodh Charghi	7,066	Fenitrothion 3% dust

38. Treatments were generally carried out by farmers with CPS assistance. Mortalities varied from 80 to 95% (the figures are of October 25.)

39. Aerial applications by the American and Canadian Turbo Thrush planes, and by the Mali PV on USAID funds had covered 225,200 hectares in Hodh Charghi and Hodh El Gharbi as of October 25.

6.4 Evaluation of the Efficiency of Control Activities

40. Despite the donor input to the CPS in past several years, particularly in the last two years, its ability to respond to pest emergencies is still poor. Under the Regional Food Crop Protection Project, USAID constructed four storage warehouses for pesticides and supplies; more are, however, needed as prepositioning of the insecticides and equipment could not be properly effected. The road network is inadequate and moving supplies is difficult and costly. There are hundreds of broken-down vehicles in the country, many requiring only a spare part to be serviceable.

41. The CPS needs six large trucks to transport insecticides. Time did not allow the mission to thoroughly investigate the transport situation.

42. There were some savings in transport costs this year because of importing Propoxur concentrate and formulating it locally with a local inert carrier which tests have shown to be suitable. The local plant's capacity is adequate for future emergency needs for dusts of low conentration.

43. As a result of the late arrival of aircraft, after their use in Senegal and Mali, and of technical difficulties, the region of Bousteilla and Djiguenl suffered losses of 20 to 30 percent. On a visit to the area, a USAID entomologist found some late-maturing millet fields with losses of up to 100%. In general, however, losses were minor in heavily-infested areas, due to timely treatment.

6.5 Evaluation of the Pesticides, spraying equipment and aircraft used

44. The pesticides now commonly used in the Sahel lack permanence, which means that repeated applications are sometimes necessary, but they are, nevertheless, relatively safe to use, particularly the dusts.

Target mortalities run from 70 to 100% twenty-four hours after treatment. There is no doubt that some overdosing by farmers occurs but the low mammalian toxicity of Malathion, Fenitrothion and Propoxur makes them especially appropriate for use as the careless handling of more toxic substances could result in serious accidents. The gradual transition, for ground applications, from dusts of low concentration to liquids, is not feasible at present which is unfortunate, as it is costly and slow to move high volumes of dust to the interior over poor roads and tracks. The CPS is very cautious about pesticide use, and repetitive training over the years may allow farmers to make this transition.

45. There is a great variety of ground spraying equipment given by various donors, each wishing to supply its national products. This creates problems with spare parts and repairs. Ample spare parts should be provided with dusters and sprayers.

46. The aircraft used in 1987 were adequate. The Turbo Thrush is especially efficient, as it has a much longer sortie time, which greatly cuts down ferrying time. Air spraying was more selective than in 1986 and large areas have not been blanket sprayed, as was the case last year.

6.6 Environmental Impact

47. Mauritania's vast area, harsh climate and scattered population make pest control logistically difficult. Prior to aerial spraying, the population is informed by rural radio, but unforeseen delays make it difficult to be precise as to their exact timing. An average of twenty sets of protective clothing were distributed per region, and no cases of pesticide poisoning were reported.

48. Pesticides are frequently stored in the open air due to a severe shortage of buildings. Those purchased from a local pesticide formulation plant are unlabelled. While there are liquid pesticides which need to be transferred to new drums, there is only one pumping stand for aerial treatments, and there are no manual pumps for removing pesticides from drums.

49. Given the scarcity of water in much of the country, and the level of technical expertise and supervision, dusts are at present the most environmentally sound formulation for village use.

50. No environmental assessments were conducted.

6.7 Recommendations

51. - Facilities for the storage of at least 30 tons of pesticide dusts in the interior are essential. However, the shelf-life of dusts is short and proper storage conditions are crucial.

- Bad roads mean that, at present, 4x4 vehicles are the only practical way of moving pesticides: large 7-10 tonne trucks 4x4 are needed and would give the CPS the ability to ensure supplies.

- Dusts should be formulated locally; the formulator must, however, properly label the bags, giving the name of the product, its concentration, the date of manufacture, etc., as, in 1987, some bags were delivered to the field completely unlabelled.

- Ample spare parts should be provided with spraying and dusting equipment, as well as instructions for its repair.

- For liquid pesticides, hand pumps and pump stands are needed.

- Technical assistance should be provided for the correct storage and transport, disposal of pesticide containers, and of protective clothing and gear.

- An environmental assessment of the effects of air and ground applications would be desirable.

7. CROP LOSSES

7.1 Report on Crop Losses

52. As indicated in para 43 above, crop losses varied from negligible to severe, although severe damage was only observed in one locality. During the campaign, the grasshopper population was moderate and remained largely in the natural vegetation; this, and good rains, favoured the phenological development of the crops. Some pockets of heavy infestations were treated, and rains continued until October, by which time most of the millet and sorghum was being harvested. The Hodh regions, however, required aerial spraying to prevent widespread losses.

7.2 Cost/Benefit Analysis of Control Activities

53. A cost/benefit analysis of activities in the 1987 crop year was not possible at the time of the mission, as spraying was in progress and the harvest not yet in. The CPS would attempt to make a cost/benefit assessment at the end of the season.

7.3 Recommendations

54. Crop loss assessments would be a valuable tool, and should be made. A training programme should be established, perhaps by FAO, to import a tested methodology. The Dakar Training Centre could be a venue for training participants from neighbouring countries.

8. ORGANIZATION AND STRUCTURES

8.1 The Role of the National Steering Committee

55. The National Steering Committee in Mauritania has played a vital role in the coordination of donor support. The lead is taken by FAO, through diligence of the FAO representative and entomologist, who make

virtually daily contacts with the donor community, and with all levels of the Ministry of Rural Development. Formal NCC meetings have been held regularly and reports have been circulated to all parties keeping them informed of current activities.

56. Some donors, particularly the smaller Embassies, felt that their involvement in the NCC was very time-consuming, but worth-while.

8.2 Improvement in the National Plant Protection Services since 1986

57. The intensive activity of the 1986 grasshopper campaign gave an impetus to accelerate training programmes and improve coordination of logistical and planning efforts; egg-pod surveys, surveillance and reporting were all improved. With many people now undergoing academic training abroad (see section 5) the CPS will be further strengthened.

8.3 The Role of International and Regional structures

58. See Annex V.

8.4 The Role of FAO

59. FAO has played a dynamic role in coordinating the grasshopper campaign and has provided liaison between donors and the Government of Mauritania in a most commendable manner. FAO is expected to continue this role in the future.

8.5 Recommendations

60.
- The National Steering Committee should continue, although, when there are no major pest problems, meetings could be held less frequently.
- Training at all levels should continue, so as to strengthen the CPS.
- The options for regional organizations should be studied.
- FAO should continue in its exemplary role as coordinator of the effort against locusts and grasshoppers and as the channel for the exchange of information between the parties concerned.

9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

9.1 Stocks at the end of the 1987 Campaign

61. If a total of approximately 250,000 hectares are treated, good stocks of pesticides will be carried over and it is unlikely that additional quantities will be needed in 1988.

9.2 Preparation for Future Years

62. - Continue training at all levels.

- Continue monitoring and reporting pest infestations.

- Improve pesticide handling and storage.

9.3 Long-term Improvement of Plant Protection Structures

63. - Continue to develop an autonomous unit for decision-making, as pest management requires prompt, decisive action.

- Continue an integrated pest management approach to pest problems, with the aim of minimizing the use of pesticides whenever possible. Develop clear threshold levels for intervention against the various pests.

- Continue training farmers, CPS field workers and team leaders, and mechanics in repair of vehicles and equipment.

9.4 Recommendations

64. The CPS should check on actual conditions in all storage facilities in the interior, and endeavour to provide adequate storage wherever needed.

65. The other recommendations under Section 9 are given above.

ANNEX I

ACRONYMS

FAO	Food and Agriculture Organization of the United Nations
MRD	Ministry of Rural Development
EEC	European Economic Community
FRG	Federal Republic of Germany
FAC	French Assistance Corporation
MCPS	Mauritanian Crop Protection Service
OCLALAV	Organisation Commune de Lutte Antiacridienne et de Lutte Antiaviaire
IPM	Integrated Pest Management
CILSS	Comité Inter-Etats de Lutte Contre la Sécheresse dans le Sahel
USAID	United States Agency for International Development

ANNEX II

PERSONS CONTACTED

Mr. Khalil Choueiri	FAO Representative
Mr. Abdallah El Fekih	FAO Deputy Representative
Mr. Dieudonné Kognuiyagda	FAO Programme Officer
Dr. Magema Nsombe	FAO Consultant
Mr. Sy Adama	MDR (Agriculture) Director
Mr. M.L.D. Abdi	MDR Secretary-General
Mr. Tahara Galledou	MDR/CPS Director
Mr. Habert/Riddel	FAC (France)
Mr. M.K. Schregle	RFA (West Germany)
Mr. Erich Lewandrowski	RFA Agricultural Attaché
Dr. Son Nguyen	USAID Development Officer
Mr. J.J. Zuidberg	European Economic Community
Mr. P. Blanchet	FAO Logistician
Mr. Bastiaan De Regt	EEC Agricultural Advisor
Mr. Ahriz Abdel Moun'aan	Algerian Embassy
Mr. Adderrahmane El Kohen	Ambassador of Morocco
Mr. William Thomas	USAID Deputy ADO

ANNEX III

RESOURCE DOCUMENTS

- Rapport du seminaire national sur la programmation de la campagne agricole 1987/88
  4-13 avril 1987
  by Adoma Sy

- Assorted Documents by the Crop Protection Service, and by the FAO Entomologist, Dr. Magema

- Situation acridienne en Mauritanie - Hivernage 1987
  by the Plant Protection Service of Mauritania.

ANNEX IV

LIST OF DONOR CONTRIBUTIONS

MAURITANIA

				US Dollar equivalent
b+	Canada	TOTAL: (++)		
	4 aircraft to be transferred from Senegal in mid-October		(++)	

* * *

m+	China	TOTAL: (++)		
	20 MT Malathion ULV		(++)	

Arrangements made through FAO

* * *

m+	EEC	TOTAL: ECU 105,000		120,996
	technical assistance		ECU 17,000	
	100 pairs goggles, 100 pairs gloves, 200 pairs boots		USD 5,700	
	110 MT Fenitrothion 3 percent dust, arriving 7/6		USD 91,300	

* * *

b+	EEC	TOTAL: ECU 100,000		115,234
	internal transport of pesticides		ECU 100,000	

* * *

b+	EEC: Plan de relance et de réhabilitation			
		TOTAL: ECU 90,000		104,000
	repair of 5 Unimogs		(++)	
	internal transport of pesticides (598 MT, Japanese donation)		(++)	

* * *

m+	FAO/TCP	TOTAL: 20,000		20,000
	training of plant protection officers then farmers		20,000	

In framework TCP project approved in 1986

* * *

b+	FR Germany	TOTAL: DM 200,000		112,359
	ground treatment		DM 200,000	

Possible support in 1987

* * *

b+	France	TOTAL: FF 1,200,000		197,694
	80 hours helicopter for prospecting, Phase I		(++)	
	1 aircraft for Phase II		(++)	
	1 vehicle equipped for spraying		(++)	
	1 fellowship for PRIFAS' May course		(++)	
	2 10-day Technical Assistance mission by PRIFAS		(++)	
	operational costs, Phase II		FF 300,000	
	500 manual sprayers		(++)	
	100 knapsack sprayers		(++)	
	5,000 l Fenitrothion 1000 ULV		(++)	
	5,000 l Fenitrothion 500 ULV		(++)	
	50 MT Propoxur 2 percent dust		(++)	
	3,000 l Chlorphacenon		(++)	

From global allocation for region of FF 20 million.

* * *

b+	Italy	TOTAL: lit. 556,900,000		441,984
	6 Bremach 4x4 vehicle		lit. 210,000,000	
	20 tents		lit. 3,000,000	
	4 sprayers		lit. 28,000,000	
	500 knapsack dusters		lit. 20,000,000	
	2,000 bellows dusters		lit. 20,000,000	
	500 knapsack sprayers		lit. 32,500,000	
	95 motorized knapsack dusters		lit. 47,500,000	
	25 motorized knapsack sprayers		lit. 12,500,000	
	10 tractor-mounted sprayers		lit. 8,000,000	
	520 masks		lit. 4,960,000	
	500 goggles		lit. 2,500,000	
	500 protective overalls		lit. 15,000,000	
	500 gloves		lit. 1,000,000	
	500 boots		lit. 5,000,000	
	60 MT Sumicombi		lit. 130,000,000	
	500 l Fenvalerate-Sumicidin		lit. 10,000,000	

* * *

b+	Japan	TOTAL: (++)		
	insecticide powder		(++)	

Bilateral aid under '86 budget, delivered late '87

* * *

b+	Japan TOTAL: (++)		
	13 4 wheel-drive vehicles	(++)	
	20 tents, 100 cots and mosquito nets	(++)	
	300 units protective clothing	(++)	
	800 MT pesticide powder/Fenvalerate 1,8 percent	(++)	
	30,000 l Fenitrothion 50 percent ULV arriving May 87	(++)	

* * *

b+	NGO/World Lutheran Federation TOTAL: (++)		
	costs of internal transport of material and pesticide to Assaba	(++)	

* * *

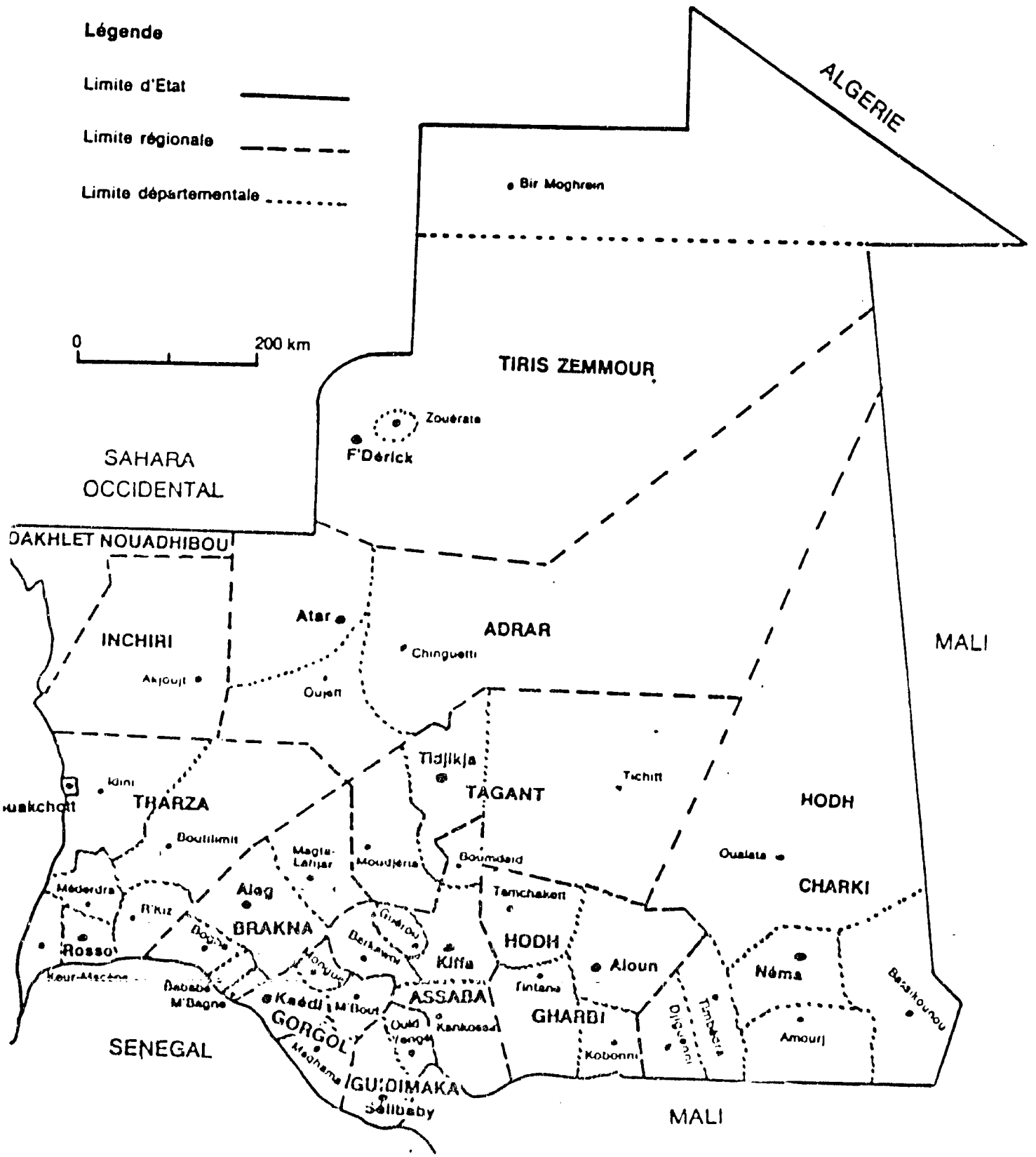
b+	USA TOTAL: 209,900		209,900
	training by PRIFAS	5,000	
	entomologist	100,000	
	phase I egg-pod survey	10,000	
	vehicle fuel	45,000	
	15 radios	23,300	
	Ambassador's authority grant	25,000	
	face masks	1,600	

* * *

b+	USA TOTAL: (++)		
	2 aircraft transferred in October from Senegal, with 40,000 l pesticide to treat the Mali/Mauritania border zone from Nara in Mali	(++)	

* * *

TOTAL - AID FOR WHICH SUMS HAVE BEEN ANNOUNCED: US$ 1,374,167


Légende
Limite d'Etat
Limite régionale
Limite départementale
0
200 km
ALGERIE
Bir Moghrein
TIRIS ZEMMOUR
Zouérate
F'Dérick
SAHARA
OCCIDENTAL
DAKHLET NOUADHIBOU
INCHIRI
Atar
ADRAR
Chinguetti
Akjoujt
Ouadane
MALI
Tidjikja
Tichit
TAGANT
HODH
TRARZA
Boutilimit
Magta-Lahjar
Moudjéria
Boumdeid
Oualata
CHARKI
Méderdra
Aleg
Tamchakett
BRAKNA
Rosso
Kiffa
HODH
Aioun
Néma
Kaédi
ASSABA
Tintane
GHARDI
Kankossa
Kobonni
Amourj
SENEGAL
GORGOL
GUIDIMAKA
Sélibaby
MALI

JOINT/FAO DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

NIGER

Mission: (8-14 October 1987)

Ms. Ba Daoulé Diallo (FAO/CILSS)
Mr. Christopher Hemming (EEC)
Mr. Pieter Oomen (Netherlands)
Mr. Jean Têtefort (France)

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6. CROP LOSSES

7. ORGANIZATIONS AND STRUCTURES

8. OTHER MATTERS AND LONG-TERM CONSIDERATIONS

Annexes:

JOINT/FAO DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

NIGER

1. INTRODUCTION

1. Niger, where about 90% of the population is made up of farmers and herdsmen, last year suffered large-scale grasshopper and desert locust infestations requiring the spraying, in the case of grasshoppers, of 390,000 ha, and, in the case of the Desert Locust, of 3,917 ha. Niger has a well-organized national Plant Protection Service which was able to carry out effective control operations in the country's various departments, with financial support from the international community. Nonetheless, these operations did not prevent breeding and laying, and there was therefore the risk of heavy hatchings from the first rains on. Niger again requested assistance for 1987 from the international community. An FAO/CILSS/Donor evaluation mission visited Niger between 8 and 14 October 1987 and would like to sincerely thank all who worked with it.

2. EVOLUTION OF THE GRASSHOPPER AND LOCUST POPULATIONS

2.1 The Weather

2. This year's rainy season was two or three weeks later than last year's, except in the department of Diffa and in the east of the department of Zinder. The rains in the second and third decades of June were poor, above all, in the departments of Dosso and of Niamey. During the first 15 days of July, rainfall did not much increase, and cumulative rainfall was 30-50% lower than the year before. More regular rains fell during the second 15 days of July in the departments of Maradi (centre and south), of Zinder (south), of Niamey, Dosso, and Tahoua (centre and south), and, on 24 and 25 July, rains fell throughout the whole country. However, during the first two decades of August, rainfall was sub-normal in the southern part of the country, although satisfactory in the central and northern regions. Rainfall on the third decade of the month of August was good everywhere, except in the region of Diffa; the northern and eastern slopes of the Aïr and the Tamesna received abundant rain during this period. During the month of September, rainfall was good and regular in almost all agricultural regions, except in the east of the country and in the northern crop zone. Rainfall was infrequent in the first decade of October but, following heavy rainfall in the month of September, crops developed well in the regions commonly known as Niger's bread basket (Dakoro, Tanout).

2.2 The Locust and Grasshopper Situation

Grasshoppers

3. After the first sufficient rains in the department of Maradi (24 May 1987), the first hatchings were noted at Dan-Issa on 3 June, at densities of between 15-20/m^2 over 400 ha of natural vegetation; by 6 June, densities had reached 50 hoppers/m^2.

4. In the department of Zinder, an invasion of adult grasshoppers from Nigeria was noted from 27 June on (in the division of Matameye).

5. During the month of June, in all the southern area (except the division of Gaya), immature populations were reported, but the dry spell in the second 15 days of June did not favour neither the immature grasshoppers nor the winged adults which had come from Nigeria. Village brigades carried out treatments; at Maradi, the Plant Protection Service used the Unimog with a sprayer mounted on it, but 13 villages entirely lost their first plantings, and had to replant in July.

6. Following the low rainfall of the first 15 days of July, the situation remained relatively calm throughout the month, where infestations occurred, they were treated by the village brigades. By 31 July, 40,925 ha had been sprayed against grasshoppers (Niamey, 4,689; Dosso, 4,398; Tahoua, 297 ha; Maradi, 16,669 ha; Zinder, 2,677 ha; and Agadez, 12,194 ha).

7. During the month of August the situation remained calm: where infestations were noticed, they were treated by the brigades but, on 9 August, in the central region of the department of Maradi, the presence of adults from Nigeria was observed in 15,000 ha. The density in this region reached 25 adults/m^2 while the crops were in rapid growth and developing leaves. Aerial operations with Fenitrothion 1000 were carried out over 9,600 ha.

8. During the first decade of September, in spite of abundant rainfall, the second generation of Oedaleus senegalensis developed very poorly, and migration northwards slowed down. But, from the second decade of September on, large-scale hatchings were observed at Dakoro (in the department of Maradi) in 10,000 ha of natural vegetation, with densities of 32 nymphs/m^2. From 18 September on, when it became clear that the control activities carried out by the village brigades were not sufficient, aerial operations were undertaken at Dakoro (26,960 ha) and at Kornaka (22,800 ha). On 25 September, infestations were noted in the south of the region of Tahoua and to the east of Tanout: these were insects of the second and third generation, at densities of between 15 and 32 per square metre, and must have come from natural vegetation in the northern parts of the region, where there were no village brigades. Aerial treatments were carried out between 1 and 8 October: such treatments should continue. Niger has requested assistance for this emergency operation and estimates the cost at 20,925,000 FCFA, of which 20 million FCFA will be supplied by the Niger Government to hire a Britten Norman aircraft.

9. During the campaign, 90% of the grasshoppers noted were Oedaleus senegalensis, though in the department of Dosso, Kraussaria angulifera was also present.

The Desert Locust

10. Surveys carried out in the second decade of July found bands of all instars in the Zagado valley, light green to whitish for instars 2 and 3, and yellow with black spots for instars 4 and 5. Some isolated parents were also noted, the males lemon-yellow and the females light grey. About 450 ha had been invaded, of which about 6% were infected at

densities of 2-3 hoppers/m^2. In the same period, 4th and 5th instar hopper bands were reported in the Farés valley, with adults included in some bands. The hoppers ranged from light green to yellow, and were lightly pigmented: about 100 ha were infested with hopper densities of 1/m^2. On 5 August, in the Aïr (Oued Zalilet, 1835 N, 0855 E), an immature swarm was seen; in the 120 ha infested at 2-5/m^2, copulation and laying was reported. A pink fledgling swarmlet noted in 5 ha (at 1-2/m^2) in the Oued of Tchighazerine. 25 km away, another fledgling swarmlet was reported in 1 ha in the Oued Baouet. During the first decade of August, at 100 km from Agadez, on the route to Tahoua, solitarious insects were seen in the pasturages (20 ha), and isolated insects were recorded in the Oued Ekedi Mellen (1951 N, 0555 E). During the third decade of August, three gregarious, copulating and laying swarms were seen in the sector of Tchintolous, and, in the north of this sector, hoppers, greenish or yellow lightly spotted with black, were reported in 1,000 ha as well as fledglings at densities of 1-5/m^2. In the first decade of September, four small swarms were noted on the north-east slopes of the Aïr; they were composed of very large grey females and of small males of a very strong yellow colour. During this decade, isolated insect populations were noted almost throughout the Aïr: their density remained low (10-100/ha) but, in the Oued Iférouane, the density reached 1,000/ha over 5,000 ha, and, at Zagado (1829 N, 0991 E), in the Adrar Chiriet area (1915 N, 0905 E) 4th and 5th instar hoppers were reported over 1,000 ha, at densities of one solitarious G2 hopper/m^2. During the third decade of September, about 50 3rd, 4th and 5th instar hopper bands and adults were observed in the south of the Aïr (Iférouane). During the first decade of the month of October, in the Tamesna, over some tens of thousands of hectares, isolated insects and copulation were reported, and a single swarm heading for Tegguidam Tessem (1757 N, 0612 E) was observed during the night. On 7 October, locust populations coming from the north were reported at Bilma, as they travelled west: these populations certainly came from Chad (Tibesti-Zouar).

2.3 Egg-pod Surveys

11. Egg-pod surveys were carried out in May 1987 (in places in the areas infested during the 1986 campaign) and mortality was estimated at 70%.

12. A number of problems in carrying out this sort of survey were noted:

- The staff is not well enough trained.
- Egg-pod surveys require large-scale inputs.
- Sampling methods are not very well defined. For the next campaign, the Plant Protection Directorate (DPV) prefers to base itself on maps of the infestations as they were at the end of the 1987 campaign.

2.4 The effect of Control Activities on the Populations

13. The control operations against the first infestations were carried out by the village brigades with ULV sprayers, or with motorized

knapsack sprayers. These treatments gave excellent results, and considerably reduced the grasshopper populations. In the department of Maradi, where, in June, the level of infestation, and the areas infested, surpassed the intervention capacity of the village brigades, a sprayer mounted on an Unimog was used by the departmental Plant Protection Service. These two interventions gave excellent results, as well as the aerial operations carried out with Fenitrothion 1000. Nonetheless, in certain regions, new infestations were observed after five days, requiring further treatment.

2.5 Residual Populations at the End of the Rainy Season

14. Large-scale infestations were observed during the first 15 days of October in the regions of Maradi, Zinder, Tanout and Tahoua. Aerial spraying was in progress when the mission visited Niger. It is too early to say what the residual populations will be: such an estimation can only be attempted at the end of the campaign.

3. SYSTEMS OF MONITORING AND EARLY WARNING

3.1 The Performance of the National Monitoring System in 1987

15. The monitoring of grasshoppers was carried out by the farmers themselves and the decision to intervene was taken by the farmers brigades.

16. Data on the infestations was transmitted by the head of the agricultural district to the officer responsible at divisional level, who, in his turn, transmitted them to the departmental chief of Plant Protection. The departmental Plant Protection team undertook follow-up monitoring missions and, if the infestations were indeed beyond the control capacity of the village brigades, the departmental Plant Protection Service intervened with ground control equipment (a sprayer mounted on Unimog). Data where then transmitted to the Directorate of Plant Protection (DPV) at Niamey, which is the sole body able to take the decision to launch aerial operations.

17. The divisions are not linked to the departments by radio. The DPV is able to make radio contact with only two departments, Zinder and Diffa, where there are four vehicles with mobile radios; this system does not facilitate the rapid transmission of data. It is absolutely necessary to set up a proper network to collect data on pests and to transmit them by radio to the departmental Plant Protection Services (for large-scale ground treatment) and to the DPV (for aerial operations). A monitoring project, funded by UNDP, Canada, Switzerland and FAO, has just began, and will certainly be operational during the 1988 crop season. USAID has just supplied the DPV with six radios, which will allow links with a number of regions to be established.

3.2 The Use of Information in the Management of Control Operations

18. The data gathered by the farmers allow the village brigades to decide if it is necessary to carry out control operations. This decision, whether at the level of the department, or of the DPV itself,

is not always taken in time, because, due to a lack of radios, data is not rapidly transmitted to the departments, and not enough information is collected. The central DPV service has four survey vehicles with radios but the Departmental DPV has but one vehicle per team; this does not always have a radio, which limits the amount of data collected and makes its transmission difficult. The establishment of the rapid pest warning project will improve the situation.

3.3 Recommendations

19. Everything should be done as soon as possible to make the crop pest rapid warning project operational. The whole observation network must have radio transmitters to speed up the data flow and facilitate rapid warning. This is initially an eighteen-month project, but it would be advisable to continue it until the end of phase IV of Canadian support to the DPV (1990).

20. Monitoring and field surveys must be intensified at the end of the season so as to identify the heavy residual populations and draw up a map showing their geographical location. Such a map would pin-point the regions where survey and monitoring should be concentrated at the beginning of the 1988 cropping season.

4. TRAINING

4.1 Training Activities in 1987

4.1.1 Farmer Training

21. By mid-June, 11,869 farmers had been trained and organized into 2,274 brigades. This training concentrated on the use of ULVA sprayers (Micron ULVA or Gyro 1) and on backpack sprayers (Tomtan and Arimitsu), as well as on survey and reporting. Courses for the heads of the Agricultural Districts were organized and supervised by the departmental Plant Protection teams. The farmers who had been trained were given a sprayer. Visits by the departmental Plant Protection teams to the various brigades afterwards showed that this training had been valuable, and that control operations were being carried out efficiently.

22. Apart from training in plant protection itself, 3,316 farmer-mechanics were trained by the mobile mechanical teams of the Plant Protection Department, so that they might look after the maintenance and repair of the brigades' spraying equipment.

4.1.2 Training of Agricultural Technical Officers

23. For the 1987 agricultural season, agricultural technical officers were trained in plant protection as follows:

159 agricultural conductors
52 officers of the divisional agricultural services
225 technical assistants
437 trainers.

24. This training was carried out by the Canadian experts of the Niger-Canadian Project. A Canadian consultant for adult training took part in the training of the trainers.

4.1.3 The Training of Plant Protection Officers

25. Two officers took part in the seminar on the use of Micronair sprayers in Dakar. Three others took part in the seminar in Niamey on the use of aircraft in grasshopper control. The Training and Plant Protection Department of CILSS organized a seminar in Niamey in January on the prudent use of pesticides, and four Plant Protection officers took part in this.

4.1.4 The Training of High-level Officers

26. A number of high-level officers took part in the courses organized by PRIFAS at Montpellier (three participated in the course on the rational use of pesticides, and five in the course entitled "Expertise acridiennes").

4.2 Further training needs in the medium and long-term

27. The training of farmers and of technicians will continue within the framework of the Niger-Canadian Project.

28. At the moment, the Plant Protection Directorate has no specialist in acridology; it will be necessary to fill this hole by training two of the DPV's agronomists in specialized acridology. Such training should be at doctoral level; the theoretical section should take place in a foreign university, and the practical field work in Niger itself.

4.3 Information

29. Posters illustrating traditional control methods and safety measures to be observed when using pesticides were widely distributed to the village brigades.

30. Tapes with information on plant protection were prepared and circulated to the farmers: tapes have the advantage that farmers may play them on their tape recorders as frequently as they wish. Television was also used to provide information in the national languages to farmers on a number of aspects of plant protection and of crop practices. In a number of villages, a television with a solar aerial is installed in the village chief's home, but is used by the whole village.

4.4 Evaluation and Recommendations

31. Very considerable efforts have been made to involve the farmers, so that they can themselves undertake the protection of their crops during the first stages of their development.

32. In the course of farmer training, a particular emphasis should be put on the secondary effects of the use of pesticides, and they should be made aware that chemical control should not automatically be seen as the only solution for reducing pest populations.

33. Specialist training in acridology for two high-level officers of the DPV should be made available as soon as possible. Niger should agree to use the persons trained should work in grasshopper control once their training has finished.

5. CONTROL OPERATIONS

5.1 Preparation of the Campaign

34. There were two basic aspects to the preparation of the campaign:

- The first aspect was farmer training, the establishment of the village brigades and the re-training of 470 monitors at division and agricultural district level. Decentralized plant protection activities were the rule, and 2,270 brigades (each of five farmers) were set up and given ULV sprayers. The advantage of such decentralization is that local treatment against the first hatchings at densities needing treatment can be carried out, thereby reducing the work of the DPV, which need only intervene once the task is too great for the farmers. The DPV intends establishing a control brigade in every village; the immediate problem is to supply them with pesticides and control equipment. Consideration is being given to making the agricultural cooperatives responsible for selling pesticides and equipment.

- The second aspect of the preparation of the campaign was the mobilization of international assistance, and the preparation, at department, division, and agricultural district, and village brigade levels, of the necessary equipment and pesticides. A large quantity of Fenitrothion 1000 was sent to the airstrips, so as to prepare for aerial activities. Large stocks of aircraft fuel were also sent.

5.2 Funds and Equipment Available

35. In October 1986, the needs for the 1987 Campaign were estimated and found to be few, and requests for assistance were then put to donors. A large stock of pesticides was available at the end of the 1986 Campaign. The new needs were estimated for a period of two years, as a way of strengthening the national control capacity. Dusts in hand (Propoxur and Lindane) were enough to cover some 20,000 ha and the enough ULV pesticides available for 42,000 ha by ground control and 343,700 ha by aerial control. Moreover, the DPV had at its disposal 81,000 l of aircraft fuel and 28,000 l of vehicle fuel. The extra pesticides received for the 1987 Campaign brought the control potential to 45,000 ha by dusting, 130,000 ha by ground control by ULV spraying, and 495,680 ha by aerial control.

36. The central DPV has at its disposal four vehicles equipped with motorized sprayers/dusters, and each department has a Unimog equipped with a sprayer/duster. The DPV at Niamey has four vehicles equipped with a radio for survey work, and each departmental service has one 4-wheel drive vehicle without a radio. The DPV also has three aircraft (two Cessna 188 and one Cessna 185) equipped with spinning cage

Micronair sprayers. The total aid provided by the international community amounted to US$ 4.3 million, of which US$ 40,000 made available by the FRG for operational expenses. All this assistance was received in time, except for the four 4-wheel drive vehicles equipped with motorized sprayers/dusters, which were to be supplied by Italy. They were finally delivered on 21 July, but without spraying/dusting equipment.

5.3 Control Operations and Areas Treated

37. The first control operations took place in the department of Maradi at the beginning of June against young nymphs. The first hatchings were reported in 400 ha in the south of the department, at densities varying between 15-19 nymphs per square metre. Almost all of the first control operations were carried out successfully by the village brigades in every region.

38. In the department of Maradi, following an invasion of grasshoppers from Nigeria, at densities of 15-20/m^2, the departmental Plant Protection Service carried out control operations with the Unimog equipped with the duster. Crop damage to young millet sprouts nonetheless occurred and thirteen villages (about 600 ha) lost the first planting. In the same department, a movement of adults from Nigeria was reported on 9 August, with an average density of 25 adults/m^2. The millet crop was at the rapid growth and leaf-production stage, and aerial control operations were mounted.

39. By the end of August, ground operations had treated 75,420 ha, and aerial operations, 88,980 ha.

40. From mid-September on, large-scale infestations were noted in the departments of Maradi and Zinder (Dakoro, Tanout), at densities of 32/m^2: 200,000 ha had been infested at Dakoro and 400,000 at Tanout. Control activities over 99,880 ha were carried out on 18 September and 8 October. At the time the mission visited the north of Maradi, spraying operations were still being conducted, and were to continue. So as to be able to conduct operations in the departments of Maradi and Zinder, Niger had requested donors for emergency assistance worth FCFA 20,925,000. It was intended to treat 150,000 of the 600,000 ha infested. It is obvious that a large grasshopper population will escape treatment this year, and will lay, from which arises the risk of a potentially dangerous situation in the next year.

5.4 The Evaluation of the Efficiency of Control Operations

41. Ground control operations were carried out by the farmers: almost all the ground treatment undertaken was by farmers with ULV sprayers at the rate of 2.5 litres/ha of Fenitrothion 20%. These operations were not followed systematically this year but, according to DPV, treatments were efficient. The use, by farmers, of baits poisoned with Lindane 5%, gave good results.

42. Control operations carried out by the DPV (on the ground with sprayers mounted on Unimogs, and aerial control with Mirconairs mounted on Cessna 185 and 188 aircraft) were systematically assessed. Efficiencies were measured by calculating densities before and after

spraying. These density figures are not yet available, but it appears that the control operations carried out considerably reduced grasshopper populations in the area sprayed.

5.5 The Assessment of Pesticides, Equipment and Aircraft Used in Spraying

43. Some tests were carried out by the technicians of the Niger-Canadian Project, but the results are not yet available. After spraying with Deltamethrine, some recovery in the populations sprayed was noted, indicating that the dosage was inadequate; a rapid re-infestation of areas treated was also noticed, which bears out the fact that this pesticide has very little permanence. The Plant Protection Department was very satisfied with the performance of the spraying equipment used (Micron ULVA 16, Giro 1). It has proved difficult to properly maintain the knapsack motor sprayers used by the village brigades. Farmers were not very pleased with spraying from Unimogs in fields where the millet was already at an advance state, because of the damage caused by the movement of the vehicle itself. There were no problems with the Cessna 185 and 188 used. The Bell Ranger helicopter, put at the disposal of the Plant Protection Department by USAID for survey work, was very much appreciated.

5.6 The Impact on Human Populations and the Environment

44. Farmers were well informed on the precautions they needed to take during spraying operations (by radio, advertisments in the market, cassette-tapes, and television publicity). They were counselled to keep away from their villages, pastures and watering spots (wells and open water) during treatment. Villages are always asked to cover their wells before spraying begins. Nevertheless, no studies of possible intoxication, phytotoxicity, and effects on non-target organisms were undertaken. The Plant Protection Department believes that only very low dosages were used, that the insecticides in question are little toxic and very effemeral, that farmers received adequate information beforehand on the precautions they should take, and that most pesticide spraying is over very limited areas. Nonetheless, the mission believes that studies on the secondary effects of spraying should be undertaken, even if it is only to verify the arguments of the Department of Plant Protection.

6. CROP LOSSES

6.1 Reports on Crop Losses

45. As the agricultural year was not yet over, the mission was unable to obtain precise data on crop losses. It limited itself to the following observations:

- At the beginning of the rainy season, early plantings were completely destroyed in places where there were heavy grasshopper densities (as in the case of thirteen villages in Maradi department, over some 600 ha of cropland).

- The mission was able to confirm, during its field trip to Konarka, in Maradi department, that there were areas of heavy infestation where crop losses could be estimated at between 30-40%.

6.2 Cost/benefit analysis of Control Activities

46. The costs of control activities include:

- The contribution and support of the Niger Government (but these costs are not taken into consideration in the following analysis).

- Donor contributions to the 1987 Campaign.

47. The benefits of control activities were:

- The invaluable experience of having prepared and implemented a large-scale control campaign.

- The protection of cereal crops against grasshoppers.

48. The greater part of 4.5 million hectares in Niger are under cereal crops vulnerable to grasshopper attack. Annual cereal production is of around 1,500,000 to 1,800,000 tonnes of millet and sorghum. Attributing a value of FCFA 50 to a kilo of cereal, the total value of the annual production can be estimated at US$ 250 to 300 million. Donor contributions amounted to US$ 4.5 million, which represents 1.5% of the value of total annual production, which appears reasonable in comparison to the damage which might otherwise have been caused, had control measures not been undertaken, by grasshoppers.

6.3 Recommendations

49. A systematic evaluation of damage to food crops caused by pests should be included in the project to strengthen the national Plant Protection Service by the establishment of a food crop pest rapid warning network.

7. ORGANIZATIONS AND STRUCTURES

7.1 The Role of the National Coordinating Committee

50. The National Coordinating Committee met every 15 days under the chairmanship of an officer of the Ministry of Foreign Affairs. The committee ensured very close cooperation between Niger and the donors for the funding of control activities and in following the development of the grasshopper situation. After large-scale infestations in the departments of Maradi, Zinder and Tahoua, an expert Technical Committee was set up at the end of September. The Department of Plant Protection, and the experts of the Niger-Canadian and Niger-German Projects, and of the FAO, took part in the Technical Committee, which followed the grasshopper situation and proposed to the National Coordinating Committee ways of rapidly and efficiently combating grasshoppers when large-scale infestations occurred.

7.2 Improvements in the National Plant Protection Service

51. The extra equipment received (vehicles and sprayers) has improved the Plant Protection Department's ability to undertake operations.

52. The crop pest monitoring project will allow the installation of a monitoring and early-warning network.

7.3 The Role of International and Regional Structures

53. CILSS plays two roles:

- It promotes close cooperation between Sahelian countries, particularly those which have a common border, and common activities in the border areas; this is not always easy, and radio communications must be improved, both regionally and between neighbouring countries.

- It also promotes the training of middle-level staff, through courses and workshops organized by the Department for Plant Protection Training.

54. AGLALAV took part in surveys and control operations against the Desert Locust in the Air and in the Tamesna.

55. PRIFAS set up a biomodeling station at Niamey. The SAS information bulletin on the grasshopper situation was very widely diffused. PRIFAS also organized, at Montpellier, a course on the rational use of pesticides in grasshopper control and another on "Expertises acridiennes".

7.4 The Role of FAO

56. The FAO representation and the FAO consultant played an important role in giving technical advice to the National Coordinating Committee and the Department of Plant Protection.

8. OTHER MATTERS AND LONG-TERM CONSIDERATIONS

8.1 Stocks at the End of the 1987 Campaign

57. The campaign is not yet over, and stocks cannot be assessed with any degree of accuracy, but the grasshopper situation remained calm until mid-September, which means that large pesticide stocks will certainly be left at the end of the campaign.

8.2 The Use of Pesticide Containers

58. The Niger-Canadian Project intends carrying out studies on the decontamination of pesticide barrels.

8.3 Recommendations

59. Niger has set up an excellent system for control activities against crop pests by the way in which it involves the farmers: village

brigades take charge of pest monitoring and of control operations. The Plant Protection Department works as a "fire brigade", when the village brigades can no longer cope with the situation. Nonetheless, the mission noted a number of weaknesses:

- There is no network of observation posts.

- Nor are there radio communications between the zones at risk to grasshoppers and the central services (except for Zinder and Diffa).

- Not enough surveys are undertaken by the departmental services of the Plant Protection Department.

60. On the basis of these remarks, the mission recommends:

- That the project entitled "Strengthening of the Department of Plant Protection by the Establishment of a Rapid Warning Network against Pests", which was initiated at the beginning of September, should be operational by the 1988 Campaign. The mission recognizes the great importance of this project, and agrees with the priority placed on a system of monitoring and reporting which will allow rational decisions to be taken as to when and where to intervene, and the areas to be treated. The mission recommends including studies on crop damages, on the efficiency of spraying, and on the secondary effects of pesticides on the environment (on the human population, on cattle, vegetation and non-target organisms) in the work of the project.

- The mission recommends establishing an intervention threshold before the beginning of the 1988 crop season, and that this threshold be perfected with the data gathered by the rapid warning project. The use of an intervention threshold is a rational way of approaching the problem as to when to initiate control activities.

- The mission recommends close collaboration between the rapid warning project and the biomodeling station which PRIFAS has established in Niamey.

- The long-term support of Canada and the Federal Republic of Germany to the Plant Protection Department has laid the necessary bases for adequate plant protection. This support should continue, so that the Plant Protection Department can become even more effective.

ANNEX I

PERSONS CONTACTED

Ministry of Agriculture

Mr. Allele	Minister of Agriculture
Mr. I. Mouddoun	Director, Plant Protection Department
Mr. Bonzi	FAO Expert, Rapid Warning Project
Mr. Moumouni	Chief of the Departmental Plant Protection Service

DONORS

Canada

Mr. A.L. Potevin	Counselor, Consul and Head of Office, Canadian Embassy
Mr. F. Baillargeon	Counselor, Niger-Canadian Project

EEC

Mr. F. Rohde	Economic Counselor
Mr. D. Simigallia	Expert

France

Mr. G. Bossy	Counselor, French Embassy

UNDP

Mr. J. Cavalli	Resident Representative
Mr. J.F. Cuenod	Expert

FRG

Mr. M.E. Zweigert	Director, Niger-German Crop Protection Project

USAID

Mr. K.J. Mullaly	Deputy of Agriculture
Mr. J. Reid	Project Assistant for the Grasshopper and Locust Programme
Mr. F. Fuller	Project Assistant for the Grasshopper and Locust Programme
Mr. S. Kondo	Project Assistant for the Grasshopper and Locust Programme

PRIFAS

Ms. A. Monard	Head of the Biomodeling Station at Niamey

CILSS

Mr. M.H. Ould Kary	Administrative and Financial Director of the AGRHYMET Centre
Mr. Sanou	Director of the Crop Protection Training Department (DFPV), AGRHYMET Centre
Mr. G. van Klashort	Chief Technical Advisor to the DFPV

FAO

Mr. S. Niare	FAO Representative
Mr. M. Germaux	Consultant Acridologist, FAO

Liste à la date du 22/09/87	Pays/Organisation : F A O Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	Fourniture de 40 tonnes de raticide (warfarin)	réceptionné par P.V. le 20 Mai	
	Consultant pour la coordination de la lutte anti-acridienne 87		
	Consultant pendant 6 mois projet PNUD/FAO	Juillet	
	Equipement et consultants projet PNUD/FAO	Août	

Liste à la date du 22/09/87	Pays/Organisation : P.N.U.D Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
1.	Financement d'un projet d'alerte rapide exécuté par la FAO.	31/08/87	

Liste à la date du 22/05/87	Pays/Organisation : GTZ. R.F. Allemagne Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
1.	10.000 Appareils ULV à piles Micron ULV	début juin	
2.	270.000 Litres de pesticides pour lesdits appareils, dont 220.000 Litres de fénitrothion 20% et 50.000 litres de karate, couvrant respectivement 100.000 et 20.000 ha.	livraison 30-4 11.5 ; livré juin	
3.	15.000.000 FCFA pour achat local de piles	à partir de mi-mai	
4.	14.000.000 FCFA pour frais de fonctionnement	à partir de fin Avril	
5.	Fourniture de 10.000 paires de gants et 10.000 lunettes de protection pour brigadiers. (ordinateur, 4 radios sol, communication telex)	reçu 17 juin	
6.	Appui en équipement au projet PNUD/FAO d'alerte rapide	envisagé pour 1/8/87	
	Sous le programme d'aide d'urgence 87,95 millions FCFA restent toujours disponible et destinés aux brigades villageoises. L'utilisation est discutée actuellement avec la PV.		

Liste à la date du 22/09/87	Pays/Organisation : ACDI/CANADA Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers.
1.	Formation de 2 - 3000 brigades villageoises, soit 10.000 à 15.000 paysans.	Activité en cours	
2.	Fourniture d'environ 5.000 habits de protection (achat local)	Livraison encours	
3.	7.000.000 FCFA pour récupération/création de pistes d'atterissage (environ 20 pistes).	mis a dispostion en Avri	
4.	Appui technique au projet PNUD/FAO d'alerte rapide	dès 1/8/87	
5.	Bourse pour stage PNIFAS, Montpellier	4 - 15/5	
6.	Fonds "Urgence Sautériaux 1987" de 490.000 $ canadiens, dont 350.000 $ seront affectés ainsi : - Carburant avions et véhicules 80.000 - Pesticides 65.000 - Emissions de T.V 16.000 - Equipement de propection 60.000 - Trouses d'outils pour brigades 52.000 - Outillage et pièces d'avion 10.000 - Equipement de pompage 7.000 - Fabrication locale d'appareil de traitement 40.000 -Prospection et signalisation 20.000 -Prospection OCLALAV 58.000 - Salaires de 2 pilotes nigériens pendant 4 mois 65.000 $ est le reliquat. ACDI demande à DPV proposition de leur utilisation.	- Essence terrestre achetée de 12 millions CFA Reste 8 Mil.CFA pour essence avion Réalisé	en supplément au point 2.

Liste à la date du 22/09/87	Pays/Organisation : Communauté Européenne/FED Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	L'enveloppe accordée pour la première phase de la campagne est de 295.000 ECU (soit environ 340.000 $ E.U. ou 100.000.000 FCFA). Les activités prévues seront exécutées par la FAO :		
1.	17.700 ECU pour assistance technique (expert en logistique, coordonnateur de la campagne)		
2.	178.000 ECU pour fourniture de pesticides : - Fénitrothion poudre 3 %, 90 tonnes - Fénitrothion ULV, 50 %, 24.000 litres	mi-Juin 15/7	
3.	96.000 $ pour achat sur place de 15000 vêtements de protection, en continuation du programme du projet ACDI (achat de tissu et participation aux coûts de fabrication).	en fabrication sur place	194
4.	12.000 ECU pour frais d'expertise (renforcement du personnel de l'ECLO, Rome)		
	20.000 L CYPERMETRINE 20.000 L CHLOMPERMETHRINE 30.000 L FENITHROTION, 3 %, POUDRE 10 T RATICIDE, CHLORAPHACINON 4 .000 l dimethoate 40 % 32.000 l " 40 %	ARRIVE PV JUIN - LIVRE - DPV en route Cotonou-Niamey	

à la date du 22/09/87	Pays/Organisation : USAID/ETATS-UNIS Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
-.	Enveloppe totale de 501.000 $, répartie comme suit :		
1.	Formation de 2 pilotes locaux (stage de 6 à 8 semaines aux Etats-Unis)	mi-Mai - Juillet	arrivés 10 Juillet 87
2.	Location d'un hélicoptère pour propections, avec pilote, mécanicien, support terrestre ; 150-200 heures de vol (240.000 $ E.U)	29 Juillet	Prospection commencée 10-Août
3.	Essence d'Avion	20.000 $EU	
4.	Location de mécaniciens du Transniger	à partir de mi-juin	Contrat signé
5.	Entretien d'avions	26.500$EU	Contrat avec Transniger
6.	Pièces d'échange pour avions P.V.		
7.	Equipement radio avion-avion et avion-sol	livré début mai	
8.	Logisticien mis à la disposition de la PV.	Arrivée fin mai pour 8 mois	Base PV
9.	Assistance d'urgence à l'OCLALAV, permettant le fonctionnement des équipes de propection à Agadez (15.000 $ E.U.)	?	signature de la convention attendue
10.	Bourses pour 2 participants au stage du PRIFAS, Montpellier	4 - 15 Mai	Octroyé
11.	Appui en équipement au projet PNUD/FAO d'alerte rapide	1/8/87	
12.	10.000 $ pour achats d'urgence	débloqués mi-Avril	
13.	Organisation et financement d'un séminaire régional à Niamey	18 - 23 Mai 29 Juillet	tenu

Liste à la date du 22/05/87	Pays/Organisation : Coopération Française Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	L'Assistance total sera d'envison 100.000.000 FCFA, qui seraient distribué parmi les volets suivants :		
1.	Perfectionnement sur place des 2 pilotes formés par USAID	envisagé pour fin juillet	?
2.	Mise à disposition d'un pilote pendant 2 mois (en complément à celui qui est déjà sur place) disponible en cas d'urgence		
3.	Petit équipement d'appui terrestre aux avions	à partir de Juin	achat local
4.	Récupération/création de pistes d'arrerissage.	fonds disponibles début Juin	?
5.	Fourniture de 500 appareils pulvérisateurs à dos ULV		
6.	Fourniture de 50 tonnes de Lindane, 50 %	Livré	
7.	Fourniture de 5000 litres de fénitrothion ULV	Livré	
8.	Fourniture de 15 tonnes de Comafène (raticide) sous forme d'appâts.	Livré	
9.	Bourses de stage et missions d'expers	sur demande du GVT	
10.	Financement d'un projet régional du PRIFAS basé à Niamey, dans le domaine du suivi et de la prévision des populations de sautériaux. Collaboration avec projet PNUD/FAO d'alerte rapide prévu pour composante Niger.	durée 12 Mois à partir de Juin.	

Liste à la date du 22/09/87	Pays/Organisation : COOPERATION ITALIENNE Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	L'Assistance totale 4527790000 Lit ;		
	4 camionnettes (Brenach GR 35 V 4X4)	31.7.87	
	1 voiture (Fiat Panda)	31.7.87	
	20 Moto cyclettes (Guzzi 125)		
	5 masque nez-bouche B (Moneti MB 1216)	31.7.87	
	500 " " " A (Moneti MB 1214)		
	300 lunettes à masques (Moneti)	31.7.87	
	200 lunettes protectives (Moneti)		
	300 bottes PVC (Moneti AMO 5503)	31.7.87	
	1000 Unitéspommades protectives (Agriprotection)	31.7.87	
	10.000 kg chloropyrifos/Dursban 12 %	31.7.87	
	20.000 l Malathion 40 %	31.7.87	
	2.000 l Fervalerate - Sumicidin	31.7.87	
	L'Assistance d'un agro-économiste pendant 6 mois		

Liste à la date du 22/09/87	Pays/Organisation : ALGERIE Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	30.000L carburant	15.09.87	
	1 technicien		
	1 mécanicien		
	2 Land-Rover		

Liste à la date du	Pays/Organisation : Coopération Suisse		
22/09/87	Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	Enveloppe total de 12.600.000 FCFA. La Coopération Suisse envisage de destiner ce montant à un appui au projet FAO/PNUD d'alerte rapide (volet formation). 1° - Financement 3 mois consultant de formation observateurs aide-encadreurs 2° - Equipement	A partir du 1/8/87	

Liste à la date du	Pays/Organisation : Coopération Belge		
22/09/87	Nature de l'Assistance	Date d'arrivée/mise à disposition	Divers
	11.000 litres de Fénitrothion ULV 100% (= 40 millions CFA)	Arrivés juin	

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

NIGERIA

Mission: (17-20 October 1987)

Mr. Maurice Balmat (FAO)
Mr. Carl Castleton (USA)
Mr. H. van der Walk (Netherlands)

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JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

NIGERIA

1. EVOLUTION OF THE GRASSHOPPER POPULATIONS IN 1987

1.1 Organization of the Plant Production Services in Nigeria

1. As a result of its federal structure, the organization of crop protection in Nigeria is complex. It involves independent bodies at different levels of government, with a lack of coordination between the different organisations, which weakens the efficiency and efficacy of crop protection itself (Annex 1).

2. At federal level, a Federal Department of Pest Control Services (FDPCS) is responsible for crop protection. It comes under the Federal Ministry of Agriculture and Natural Resources and has its headquarters in Kaduna. There is an FDPCS office in every state, but actual crop protection is hardly carried out by FDPCS owing to lack of personnel and funds. It does, however, distribute equipment and pesticides for pest control. It is also involved in legislation and phytosanitary services. In all but one of the northern States (Borno), Agricultural Development Projects (ADP) have been established, which form the Central State Agricultural Organizations. The ADPs fall under the State Ministries of Agriculture and Natural Resources. Those Ministries have only a coordinating role. Each ADP has a Plant Protection Service. In Borno State, no full ADP has yet been established and the Ministry of Agriculture and Natural Resources acts as the operating body, with a plant protection officer taking care of crop protection. In 1988, Borno State hopes to develop a full ADP.

3. During the first half of 1987, a Pest Control Task Force was established in every state to coordinate and stimulate crop protection. They meet regularly (weekly or monthly) and consist of representatives of federal and state agricultural/crop protection organizations. Furthermore, Task Force Committees were established at local government level, with the participation of ADP extension staff, zonal coordinators, village heads and representatives from other units with agricultural responsibility. Grasshopper monitoring and control is basically carried out and coordinated by the states (ADP or equivalent). National coordination is performed by the FAO Consultant with the National Coordinator in the FDPCS.

1.2 The Weather

4. The first important rainfall in Maiduguri (Borno State) was recorded in the last days of May (29 mm) (Annex 2), followed by a drought of 16 days. Another fairly dry period was recorded in the last week of June and the first week of July. September was very dry compared to 1986. Comprehensive data for the whole northern Nigeria Sahel area were not available. According to the FAO Consultant, it was

impossible to obtain these data from the national meteorological service, and so, instead, he had had to visit the state airports regularly.

1.3 Grasshopper Situation

5. The first hatchings were observed near Maiduguri on 8 June. By 12 June, records of hoppers of Oedaleus senegalensis were reported from many localities in Nigeria north of the 11th parallel. Densities in Borno State usually varied from 1,000 to 6,000 per ha. A northward migration was observed. Losses of millet seedlings were low. In July, the population decreased due to the drought, and the density of O. senegalensis hoppers remained low during August (100 to 5,000 per ha, sometimes 10,000 per ha). Generally speaking, the population levels of O. senegalensis have been low in most of northern Nigeria in 1987.

6. By the end of the wet season (September/October) other species increased in density: Aiolopus simulator on off-season sorghum; Ornithacris turbida, Catantops sp. and Hieroglyphus sp. on rice; and Kraussaria angulifera, which caused considerable local damage to crops.

1.4 Egg-pod Surveys

7. Detailed egg-pod surveys were carried out in the northern Nigerian Sahel during December 1986 and January 1987. One team (the FAO Consultant, a driver and three scouts) carried out the survey in Borno State, and trained similar teams in other States. Sites which were cropped with millet in 1986, and other known infested areas, were chosen as sample sites. Two plots (4 m^2 each) were exposed by blowing off the topsoil of the plot, using pressurised air from a motorized sprayer. This method was very fast and effective. Egg-pod densities in Borno State varied from nil to 42 per m^2 (Annex 3), the majority being O. senegalensis. The mortality of eggs due to predation by ants, dipterans and other natural factors ranged between 15 and 90%, and was generally 50% or more. Infestations in Kano, Sokoto and part of Bauchi and Kaduna States were reported to be similar. The costs of organising an egg-pod survey of two months, as conducted in Borno State, was estimated to be US$ 3,000. For the period December 1987 January 1988 a new egg-pod survey is proposed.

1.5 The Effect of Operations on the Populations

8. It was hard to evalue the actual effect of control operations. Phase I control was not very effective, as no pesticides were available to distribute to farmers. Traditional control methods were not much help in reducing populations, although farmers were effectively mobilised for these actions. State control teams treated some local outbreaks. Phase II control is being carried out by the State control teams, always on a local scale, with unknown effect on the grasshopper populations. Between 60,000 and 70,000 ha are estimated to have been treated in Phases I and II (see 4.3 for details).

1.6 Residual Population at the End of the Season

9. Data were not yet available. An egg-pod survey will be carried out.

2. MONITORING AND EARLY WARNING

2.1 The Performance of National Monitoring Systems

10. In Nigeria, the results of the 1986 grasshopper campaign had exposed inadequacies in the plant protective services at both Federal and State levels. The egg-pod survey provided basic data for the prediction of the first hatchings, their densities and distribution. At State level, the surveys provided information which assisted in the planning of the control campaign.

11. In 1987, improvements have been made. In most states, links were established between the farmers and the plant protection services through the extension workers of the ADPs. Farmers' extension agents formed the first line of monitoring. Some States succeeded in reducing significantly the time lapse between notification of a pest by the farmer and the publishing a warning by the State plant protection service. However, in other States, the lack of an effective transport and communication networks resulted in reports being received late or not at all.

12. A major problem with the existing early warning system is that data received from farmers on grasshopper densities were not very reliable (and often highly biased, due to the personal interest of the farmer). Therefore, before control operations could be carried out, survey/control teams (of which very few could be manned) had to be sent out to verify pest densities and the potential damage posed to crops. The FAO Consultant spent much of his time travelling all over northern Nigeria to assist in surveying and to verify reports.

2.2 Use of Information

13. The basic information used by decision makers was what was reported by farmers/extension agents and by control teams. The PRIFAS/AGRYMET predictive maps of grasshopper infestations and the SAS Bulletin were not known in Nigeria.

2.3 Recommendations

14. Monitoring remains a weak point in grasshopper control campaign in Nigeria. The vast area under cultivation means that the survey/control teams operating in each state are never able to cover everything. It is therefore of prime importance to continue the training of extension agents and farmers. The ADPs provide an excellent means to do so. Some basic operational funds must be made available for the establishment of survey/control teams at state level. For the existing teams, transport and communication facilities are often insufficient, and impede efficient work.

3. TRAINING

3.1 Assessment

15. There was no national plan for training in grasshopper control at the extension agent or farmer level, partly due to the lack of a comprehensive control strategy delegating responsibility to federal, state or local authorities. Despite these uncertainities, some State task forces organized practical training on pesticide application and safety. In Borno State, the FAO consultant trained three pest control supervisors, who in turn trained 30 agents. In Kano and Kroma States the programme were executed by the ADPs and reached several hundred agents. The number of farmers trained subsequently by these agents is not known.

16. Radio and television were frequently used to report on Task force activities. Newspapers are commonly read, and carried two articles on pest problems during the short stay of the Review Mission. However, the most effective means of mobilizing villagers seems to be establishment of farmers' councils at the village level and using local authorities to pass information.

3.2 Recommendations

17. Further training is an essential element in strengthening the plant protection services of both the State and the Federal Governement. It should proceed at different levels:

- Farmer level: Because of the very large areas of the northern Nigeria Sahel under cultivation, the mobilisation and training of farmers is the major task of the State plant protection services. Farmers should be trained to monitor to their own fields and be able, with the help of local extension agents, to treat grasshoppers nymphs early in the season. The best way to reach the farmers is through the extension agents of the ADPs. In the 1987 campaign the ADPs have shown willingness to provide funds for training materials. In future, funds should be made available for ADPs to intensify their training activities. Effective training materials on grasshopper control could be obtained from PRIFAS or USAID.

- Technician level: Survey and control teams, and training officers of the ADPs should be trained in both pesticide application (possibly through the introduction of pesticide application certification) and survey techniques.

- Higher levels: There is certainly a necessity for professional training in grasshopper control for decision makers at the State level and within the FDPCS (for instance, the FDPCS branch for Kano State, consisting of a dozen people, had only one person trained in crop protection). However, to prevent the waste of knowledge, personnel at this level, trained in a specific job, such as grasshopper control, should afterwards be actively involved in control and survey operations, and not transferred to other jobs.

4. CONTROL OPERATIONS

4.1 Organization of the Campaigns

18. Grasshopper control was carried out by individual States, coordinated by the Pest Control Task Forces (Annex 1), with the FAO Consultant providing technical advice. For Phase I it had been envisaged that an important element would be control by farmers using dust formulations. Although the farmers were succesfully mobilized on a large scale, this type of control could not be effectively carried out (see 4.3). The result of the egg-pod surveys were used to plan the distribution of equipment to the appropriate places at the beginning of the season.

19. Afterwards the rest of Phase I and into Phase II control depended on reports of grasshopper observations. In cases of reported high infestations, a control team would go to the area in question, verify the report and decide whether or not to treat. The control teams were normally based at the State operational centres. Borno had 5 teams available, Kano had 10, Kaduna had 3, Sokoto had 8 and the number at Bauchi was not known. The review mission notes that a real strategy for grasshopper control existed, although many decisions had to be made on an ad hoc basis. Furthermore, coordination and the exchange of information between the different bodies concerned was often inadequate. Thus it was possible for aerial treatments to be carried out in Borno and Kano States without the FAO consultant being informed. Also, collection and analysis of operational data at a central point (e.g. the national coordinator) is insufficient. It was very hard for the evaluation team to get an overview of what had actually been done and was being done in the different states. However, the team noted a willingness at State level to consider the grasshopper problem seriously and find reasonable and practical solutions.

4.2 Funds and Inputs Made Available

20. According to a recent decree of the federal government, states are responsible for pest control. However, no federal funds have been made available to the states to enable them to take this responsibility seriously. Even the FDPCS received only half of its planned budget. Local governments were therefore expected to allocate a part of their budget to pest control. Although in this way the involvement of local government in crop protection can be increased, it seems highly recommendable that the state Plant Protection Services have their own, more secure, budget.

21. The EEC, through FAO, funded pesticides and experts costs (Annex 4). A list of equipment and pesticides available in the different states has been compiled and is given in Annex 5. A donation of 22.000 l. of fenitrothion has been blocked in Lagos harbour, for rather vague reasons, which appear to be due mainly to bureaucratic problems at the federal level.

4.3 Control Activities and their Efficiency

Phase I

22. Farmers were mobilized to treat grasshopper nymphs around their villages with dust bags. However, the pesticides reached the villages too late or in too small quantities. Traditional control was also carried out, involving groups of farmers sweeping the hoppers into concentrations, where they were physically destroyed or burnt. These methods were not considered very successful. Ground teams treated areas of heavy concentration. The area treated in Phase I amounted to approx. 13,000 ha (Annex 6). Phase I was considered, by all parties involved, to be insufficient, basically because of the lack of dust formulations for the farmers.

Phase II

23. When the evaluation team visited Nigeria, Phase II operations were still taking place. An estimation of areas treated by ground teams is given in Annex 6. In Kano and Borno States some aerial treatment was carried out, but just how much the mission could not discover, beyond the Kano work involving 23 flight hours? The evaluation mission is of the opinion that the aerial treatment of grasshoppers in northern Nigeria is absolutely not justified. Densities are too low, the areas infested too localised and transport by road relatively easy. Therefore, expensive large scale aerial applications are expensive and not cost effective. Spraying were probably being carried out because provided for by contracts with aviation companies. It was also felt that control of O. senegalensis was often carried out at too low an infestation level. While FAO recommends 25 grasshoppers/m^2 as the action threshold, treatments were carried out at less than 1 hopper/m^2. This may be justified for large species, such as Kraussaria, but it hardly ever is for Oedaleus.

4.4 Pesticides, Spraying Equipment and Aircraft Used (see also Annex 5)

24. The most commonly used pesticides were fenitrothion (EC, ULV, dust) and cypermethrin (EC). Small quantities of dimethoate and deltamethrin have also been applied. Emulsifiable concentrate formulations always need a considerable amount of clean water. This is not very practical in the Sahel. Therefore a further move to ULV formulations and application equipment is advisable. In future, when sufficient training at farmer level can be provided, hand-held battery-powered ULV sprayers may replace dusting in first-phase control operations. The efficacy of ULV formulations is higher than of dusts, but their use requires a certain level of training, and the equipment requires a supply of batteries and regular maintenance.

25. Two private companies in northern Nigeria rent sprayplanes (Mazda in Kano and Capital Aviation in Kaduna). FDPCS also has two 'planes of its own (a "turbo-thrush" and an "ag-cat") but these are grounded. The FDPCS pilots have no licences for agricultural spraying and lack recent flight experience. The future of the FDPCS aviation unit is uncertain.

26. The evaluation mission considers that aerial applications cannot be justified under the present circumstances. Possible future grasshopper control is not sufficient to make the FDPCS unit functional again. In the rare cases that justify aerial treatment, planes can be rented.

4.5 Environmental and Health Impacts

27. No side effects of the pesticide applications were reported. However, no assessment of the environmental impact of the treatments has been made either. The pesticides used against grasshoppers are not very likely to cause large-scale damage to bird or mammal populations when applied at the recommended dose-rate.

28. It is important to assess the potential side effects on the natural enemies of pests. They often constitute a very considerable natural mortality factor among pest organisms (e.g. the 50% egg mortality of O. senegalensis reported in 1.4). For this reason, treatment of populations of grasshoppers at densities far below the intervention threshold should be avoided, as it may do more harm than good by destroying potential predators.

29. One case of human poisoning was reported. A driver of a vehicle with an exhaust nozzle sprayer became unwell after not paying sufficient attention to the direction of the wind, and driving in the pesticide mist for a time. No standard health tests were carried out on the spray teams (eg. AGHE - inhibition). The teams were given a few days rest after two weeks of spraying.

4.6 Recommendations

30. Effective control of grasshopper infestations at the moment is best carried out at State level, as the States are relatively independent. The ADP is a good mechanism for implementing pest control, as the extension service provides a direct link between farmers and decision makers. Special emphasis will have to be placed on ensuring quick, effective coordination between the States.

31. The Federal Government should allocate a budget to the State PPS for crop protection. The evaluation mission is of opinion that a large part of the budget for strengthening the State PPS should be supplied by the Federal Government. The importance of the enormous area under grain in northern Nigeria certainly justifies federal responsibility for effective plant protection.

32. Early season treatment of nymphs by farmers is the preferred method of grasshopper control in Nigeria. The 1987 campaign has shown that farmers can effectively take part in these activities. However, emergency stocks of pesticides have to become established at state/local government level.

33. The change from EC to ULV formulations should be encouraged.

34. It is very important that intervention thresholds for grasshopper control are established and respected. This will prevent the unnecessary application of pesticides.

35. Spray teams should receive regular health check-ups.

5. CROP LOSSES

36. No systematic assessment of crop losses due to pests has been made in northern Nigeria. Several estimates, however, are given by different authorities. All refer to millet, as sorghum is hardly attacked by grasshoppers. Seedling loss in Phase I was estimated to be at most 20% in some areas, but generally less. When reseeding occurred, it was as often the result of drought as of grasshopper attack.

37. Late season crop losses varied greatly. In Kano State, reported losses ranged from 5% in the south-west to 80% in the north-east, but it should be noted that this also includes the effect of drought. In Borno State, 80-100% local destruction by Kraussaria was reported.

38. On the whole, the FAO Consultant estimates that losses attributable to grasshoppers this year are less than 10%.

39. Recommendation: it is very important that crop loss assessments be carried out for grain in Nigeria, covering grasshopper damage but also losses to other pests and diseases. The methodology of the assessment presently taking place in Chad (USAID) might be used by the PPSs, as it was developed specifically for millet and sorghum in the Sahel.

6. ORGANIZATION AND STRUCTURES

6.1 National Steering Committee

40. A National Steering Committee (NSC) was only very recently established. The evaluation mission expects that this committee will not become operational in the short-term. Its task is rather vague, as the donor input is very limited, and as control primarily takes place at State level.

6.2 Improvement of Plant Protection Services

41. The establishment of the Task Forces for Pest Control was an important step to better coordination of state crop protection activities. However, crop protection in Nigeria still clearly shows a lack of coherence. Further strengthening of the PPSs is therefore still necessary.

6.3 The Role of International and Regional Structures

42. In the 1987 campaign, international and regional structures played no role. Regular information exchange on migratory pests should

be established between Nigeria and Niger/Chad/Cameroun on migratory pest subjects.

43. At State level, interest was expressed in improving contacts with these countries which share a long border with northern Nigeria. The Lake Chad Basin Commission (LCBC) may be a logical channel for such communication. It was proposed by Borno State officials that the LCBC establish small offices (2-3 persons) in each country of the lake Chad Basin. This could improve information exchange and diminish the "distance" between local and state organizations and the regional LCBC headquarters in N'Djamena (Chad). As recommended above, contacts should be established between State PPSs and PRIFAS/AGRHYMET for the exchange of information and for the improvement of early warning.

6.4 Role of FAO

44. One FAO consultant worked in northern Nigeria. Furthermore, FAO acted as intermediary between Nigeria and a donor (EEC). The work of the consultant and the donor coordination carried out by FAO were highly appreciated by officials of the States visited by the evaluation mission. In future, some technical assistance may still be necessary.

7. GENERAL CONCLUSIONS AND RECOMMENDATIONS

45. As everywhere in the Sahel, the most practical solution to the grasshopper problem lies in the mobilization of farmers and in their being given the responsibility for efficient control operations.

46. Only a very small part of the many millions of hectares of cereals are at risk to grasshopper attack at the beginning of the rains.

47. These attacks can be very serious, especially when heavy populations of Oedaleus nymphs occur close to the crops at the beginning of the rainy season. Only the farmers themselves are able to find such populations before damage occurs and, if insecticides and simple application equipment are available, and understood by the farmers, operations aimed at destroying these populations before they become too numerous and occupy too large an area will be efficient. Unless all these conditions are fulfilled, the operations will fail.

48. Bearing this in mind, the evaluation mission recommends the following:

a) in the dry period between campaigns, every attempt should be made to encourage the participation of the northern farmers and to educate them systematically bu the repeated use of every possible media: the national development organisms, ADI, posters, the press, radio, television, and this both at the federal level and at the level of each state involved.

   Such mobilization activities should be simple, but carried out over a long period of time and improved each year, over at least five years. They could, and in fact should, not only

deal with grasshopper problems, but should progressively include all other problems of crop defense and agricultural development.

b) The work of the Plant Protection Services, of the intervention brigades, and of development organisations should be coordinated by a task force in each of the states, under the sole authority of the state Government. It would be wise to limit the number of decision making bodies, so as to avoid overlapping and a waste of effort. The Federal Government could financially assist the most vulnerable northern states, particularly Borno, Kano and Sokoto.

c) Each of these State Governments should be able to directly negociate for supplies and assistance through the World Bank or other financing agencies, as well as for its own budgets and those of the Districts.

Efficient control operations in phase I, at the beginning of the rainy season, of the next campaign, should not require more that 50-100 tons of insecticide dust per State, as well as simple application equipment, particularly dusting bags. But it is most important that these should be distributed and available in the ADP centres of the principal agricultural areas by the end of April, or the beginning of May, at the very latest.

If the interest of farmers is awakened, and they are convinced of their responsibility for the defence of their own crops, then they must accept, except in situations of real emergency, to at least participate by purchasing pesticides.

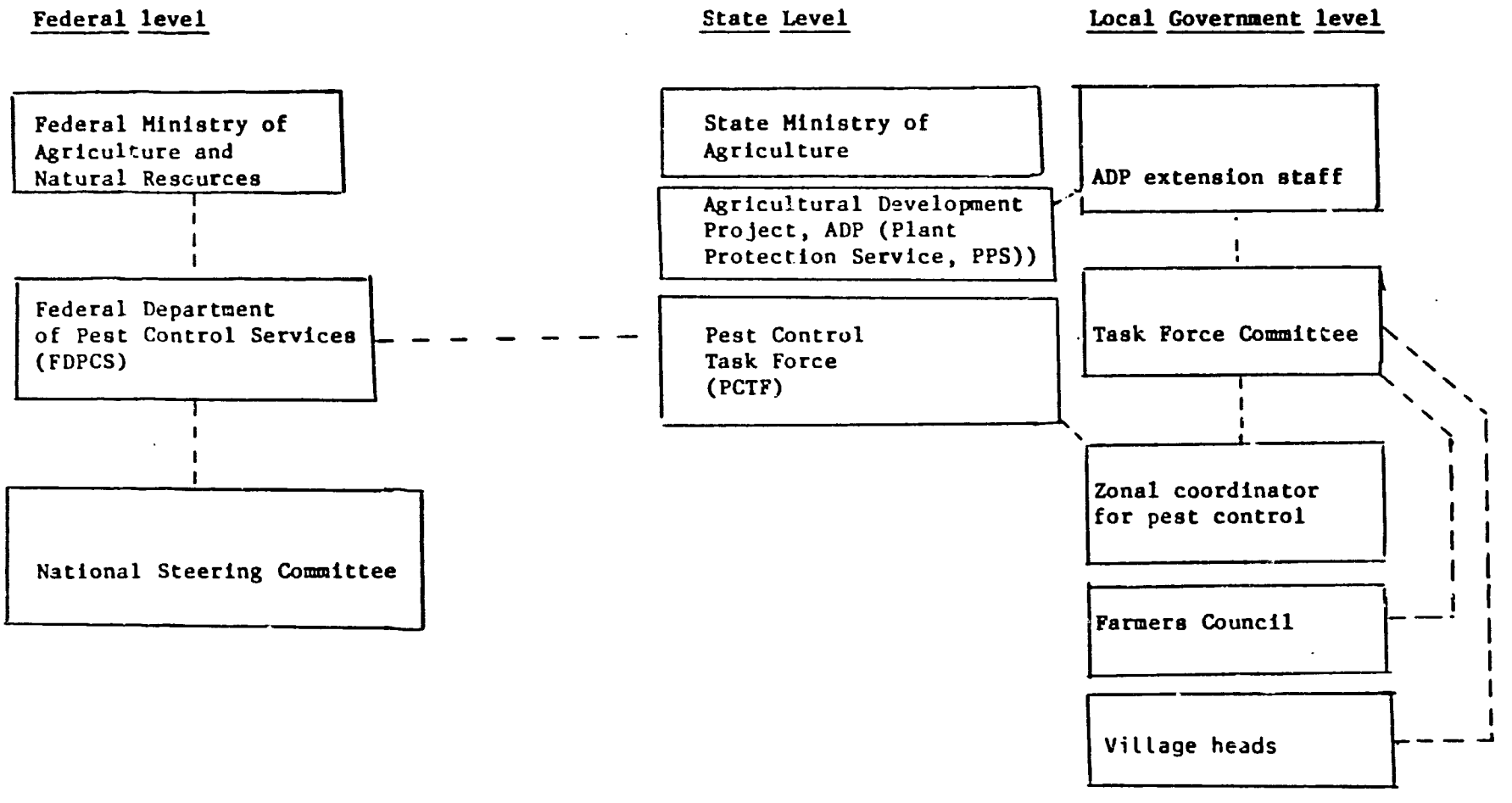
d) Egg-pod surveys might usefully be undertaken during the dry season, at the very earliest, so as to localize where important concentrations of adults occured at the end of the 1987 season. These egg-pod surveys might take place between November and January, under the control of an entomologist, preferably the 1987 FAO coordinator.

e) In 1987, the Oedaleus senegalensis populations returned to normal, because of the late rainy season, which was very unfavourable to the insect, and because of an increase in parasitism, as well as because of the control operations undertaken in Niger and Nigeria. If phase I control activities are well carried out in 1988 on the populations arising after the first rains of 20 mm or more, then control operations in a second phase, in September, will not be needed or will, at least, be very limited. Intervention should only be attempted in the case of important densities of grasshoppers in crops, at numbers of over 30-50 insects per square metre, and if damage is occurring in grain crops before they mature, at the milky stage, or the dough stage.

f) It would be necessary to give specialist training to Plant Protection officers responsible for grasshopper control in each of the States. Local training should also be organized at State level for the large number of technical officers who must train and lead the farmers and take charge of ground control teams with modern spray equipment, such as motorized ULV sprayers or hand-held ULV battery operated sprayers.

g) In the normal conditions like those of the 1988 campaign in Nigeria, it should not be necessary to use aircraft, unless heavy concentrations of adults occur in millet crops before the ripening of the grains. This should not happen unless the natural vegetation has entirely dried up at the end of August or at the beginning of September, which would be extremely unusual in Nigeria; in fact, this year, in spite of very good rains in September at Maiduguri, it did not occur. Nonetheless, it should be noted that private and federal aircraft are available in Nigeria, and could be easily mobilized by a State if necessary.

ORGANIZATION OF PLANT PROTECTION IN NIGERIA



ANNEX II

RAINFALL IN WET SEASON OF 1987 AT MAIDUGURI (BORNO STATE)

MONTH	DECADE	RAINFALL (mm)
May	13	0.0
	14	0.0
	15	29.1
June	16	less than 0.1
mm		
	17	17.7
	18	14.5
July	19	1.5
	20	70.4
	21	34.8
August	22	24.1
	23	100.1
	24	40.1
September	25	0.0
	26	4.4
	27	9.4
October	28	4.2

DENSITY OF EGGPODS OF OEDALEUS IN BORNO STATE, NIGERIA

PLACE	AREA(HA)	EGGPOD/M^2	% MORTALITY
Maiduguri	16	6.5*	50%
Lake Alau	300	8.5*	15%
Shettimari(Km 52-53)	15	4.2	50%
Bama	40	4.0	50%
Bama Pulka Rd(Km 21-171)	25	2.0	50%
Mafa	25	2	75%
Dikwa	50	2.5	75%
- Kosasi	10	15*	80%
Gubio	4	3	50%
- Layi	10	3	90%
- Minati	10	10*	60%
Kukawa	5	2	90%
Gudumari	16	10*	60%
Damaturu	10	13*	80%
Damagum	30	12*	25%
Waringabo(Potiskum)	50	42*	60%
*Bambangida	15	11*	70%
*Bambongida(North)	30	24*	60%
Dapchi	20	8*	30%
Geidam	30	Nil	-
Kelluri	20	Nil	-

*Red zones surveillance will be maintained.

ANNEX IV

DONOR INPUTS FOR THE 1987 SEASON

EEC (through FAO)

Technical Assistance	:	20,300 ECU
Protective clothing	:	37,200 ECU (arrived?)
Expert costs	:	12,000 ECU
54 MT fenitrothion 3% dust	:	42,660 ECU (arrived)
21,800 l. fenitrotion 50 ULV	:	93,338 ECU (blocked in harbour)
	total	207,421 ECU

ANNEX V

MATERIAL USED BY THE NORTHERN STATES

BAUCHI STATE (30/987)

* SPRAY EQUIPMENT:

Knapsack sprayers	:	205
Motorized sprayers (Harch)	:	20
Motorized sprayers (Kinhelder)	:	53 (urgent 10)
ULV sprayers (Electredyn)	:	408
ULV sprayers (Hardy)	:	408
Atomiser (?)	:	2

* PESTICIDES (most of which has now been used)

Fenitrothion 50 EC	:	9,400 l.
Fenitrothion ULV	:	950 l.
Fenitrothion 3% dust	:	360 bags

* VEHICLES

Landcruiser	:	1
Landrover	:	1
Lorry	:	1

KANO STATE (5/10/87)

* SPRAY EQUIPMENT

Knapsack sprayer (hand operated)	:	3,270
Knapsack (motorized)	:	450
Exhaust nozzle sprayers, Landrover mounted	:	10
Wheel barrow sprayer	:	1

* PESTICIDES (just arrived)

Queletox (fenthion)	:	5,000 l.
Cymbush (Cypermethrin)	:	50,000 l.
Fenitrothion 96% ULV	:	15,000 l.

* VEHICLES

Service van for spray equipment: 1

SOKOTO STATE

Situation unknown

KADUNA STATE

Situation unknown

BORNO STATE

Situation unknown

ANNEX VI

ESTIMATION OF AREAS TREATED IN THE GRASSHOPPER CAMPAIGN OF 1987 (IN HA)

	Phase I (till 21st July)	Phase I + II (to date)
Borno State	6 000	11 700 (end July)
Kano State	3 000	35 000 (10 October)
Bauchi State	?	9 600 (30 September)
Kaduna State	1 200	?
Sokoto State	3 000	?
	13 200	56 300

TOTAL .....59 500 ha

ANNEX VII

PERSONS WITH WHOM DISCUSSIONS WERE HELD

Mr. Buahin, G.K.A.	(FAO Consultant, Univerisity of Maiduguri)
Mr. Ozdua, Koo	(Principal Agricultural Officer, FDPCS, Sokoto)
Mr. Omeni, AA	(Principal agricultural Officer, FDPCS, Kaduna)
Mr. A. Kinnigbagbe J.A.	(Assistant Chief Agricultural Officer, FDPCS, Kaduna)
Mr. Umar Abba Gana	(Commissioner of Agriculture for Borno State)
Mr. Innocent C. Iyioke	(Head, Division of Agroaviation, FDPCS, Kaduna)
Mr. Ayedele Sadia	(Assistant Chief Agricultural Officer, FDPCS, Kano)
Mr. Abd. Al Azeez Abba	(Programme Manager, Kano State Agricultural and Rural Development Authority)
Mr. Mohammed	(Chief Pest Officer, KNARDA, Kano)
Mr. Havilla Shara	(Chief Officer for Agricultural Product Inspection, Borno)

JOINT FAO/DONOR REVIEW OF THE 1937 GRASSHOPPER CAMPAIGN

SENEGAL

Mission: (8-12- October 1987)

Mr. Channing J. Fredrickson (FAO)
Mr. André Duhart (France)
Ms. Jude Andreasen (USAID)

Contents:

JOINT FAO/DONOR REVIEW OF THE 1987 GRASSHOPPER CAMPAIGN

SENEGAL

1. INTRODUCTION

1. There were widespread grasshopper and locust outbreaks in West Africa in 1986 and a major emergency campaign was mounted. At the end of the season, Joint FAO/Donor evaluation missions visited each of the Sahelian countries.

2. Their reports were presented to a meeting of donors and countries in Rome in December 1986. The needs for 1987 were projected on the basis of information available and donors agreed to provide aid within the framework of these projections. Steering Committees, composed of donors, FAO and the relevant technical ministries, were set up in most countries, including Senegal: they met at regular intervals to prepare the 1987 campaign. The mission heard only praise of these committees and of their contribution to the success of the campaign against grasshoppers.

3. In 1987, similar FAO/donor missions visited all Sahelian countries in which campaigns against grasshoppers had taken place. This is the report on Senegal of the mission that visited the Gambia, Guinea Bissau, Mauritania and Senegal.

2. ACKNOWLEDGEMENTS

4. The mission is grateful to the FAO Representative in Dakar and to his staff, who gave logistic support and made arrangements for it to meet the donors and officers of the Crop Protection Service.

5. The Crop Protection Service was most cooperative and briefed the mission throughly. It also provided the mission with a vehicle when needed, which was much appreciated.

6. The mission must also thank USAID for its useful briefing and for making available an office from October 16 to 18 for preparation of this report.

7. Particular thanks are due to the FAO Regional Coordinator, who gave generously of his time and accompanied the team to many meetings.

3. EVOLUTION OF THE GRASSHOPPER AND LOCUST POPULATIONS IN 1987

3.1 The Weather

8. The first significant rains fell in June, largely in the south-east, in the region of Tambacounda and of Kolda, and in the south, in the region of Ziguinchor. The central regions then received rain, as did the department of Matour, in the north of the country. The rest of the north received very little rain.

9. The north continued to suffer from a drought in July, except during the first ten days of the month. Good rains were registered throughout the month in the south, and in the south-east of the country, but the centre received only irregular rain, in some places sufficient, in others insufficient. These rains allowed some cereals (millet and sorghum) to be planted in July.

10. Unfortunately, these crops then suffered from the long interruption in the rains (of between 10 and 15 days) in August, and certain fields had to be re-planted. Fortunately, the rains were regular in September, and continued into the first ten days of October, when the evaluation mission visited Senegal. During this period, the northern regions continued to suffer from drought. In the rest of the country, the millet and sorghum harvest appeared to be satisfactory. In the south, crops had already been harvested; in the centre, they were being gathered in.

11. Generally speaking, the Intertropical Convergence Zone (ICTZ) remained for a long time in the south and south-eastern regions, and arrived very late in the central regions.

3.2 The Grasshopper Situation

12. One important fact must be noted, and that is the near absence of Oedaleus senegalensis in the grasshopper infestations in Senegal in the rainy season of 1987. The fact that aerial control operations had been carried out in September and October 1986, late in the season, over more than a million hectares, almost certainly contributed to this unusual situation, even though a large-scale re-infestation by this species had been reported in the zones treated by air.

13. Apart from a few concentrations of adult Oedaleus, which never reached more than 8 or 10/m^2, and that very locally and over small areas, the commonest species of grasshoppers in this year's infestations, and hence those which were the targets of ground and air control, were: Cataloipus fuscocoerulipes, Kraussaria angulifera, Kraussella amabile, Acrida sp., Acorypha glaucopsis, Hieroglyphus africanus and daganensis, and Catantops sp.

14. The first sizeable hatchings were seen at the beginning of July just north of the Gambia (Zonocerus variegatus); further hatchings, this time of Oedaleus senegalensis, took place in the same region, during the second half of July. These nymphs, all species considered together, reached densities of between 15-30/m^2 over large areas in the region of Kaolack (adults infested one patch of 4,500 ha and another of 21,000 ha in the same region between 10 and 15 August). Hatching progressed from south to north. The adult populations that resulted were never quite as large as in 1986. By 30 September, 134,872 ha had been treated from the air and 36,556 by ground teams of the Plant Protection Division, without taking into account the areas sprayed by the village intervention committees, which had been well trained this year before the campaign began.

15. At the end of the evaluation mission's visit to Senegal, on 12 October, rain continued, and control operations, on the ground and by air, were being mounted against concentrations of adults which had not

yet laid their last eggs, even though the cereal harvests had already been saved. As in 1986, it is probable that control operations will be launched against grasshoppers in November (mainly against Aiolopus simulator) in the residual moisture flood plain crops close to the river Senegal and in Casamance.

16. In 1987, perhaps because of the low densities of the Oedaleus senegalensis populations, and perhaps because the ICTZ remained so long in the southern zones, large-scale migration was not recorded. The infestations which occurred were largely local in their origin, which was not the case in 1986.

3.3 Egg-pod Surveys

17. Grasshopper egg-pod surveys were carried out by Plant Protection, a little late perhaps, between 16 February and 2 March 1987. The five teams found the laying areas and attempted to estimate egg-pod densities in the regions of Thies, Diorbal, Fatick, Kaolack, Kolda, Ziguinchor, Louga, Saint Louis and Tambacounda. Each team had at its disposal a vehicle and was composed of two scouts and a driver. Considerable concentrations of egg-pods were found to the north of the road running Mbour-Kaolack-Kaffrine-Tambacounda-Kidira and to the south of the road running Louga-Linguère-Matam. Egg-pod densities per square metre ranged between four at Ndiébel (in the district of Gandiaye-Kaolack) and 150 at Ribot (in the district of Koughaul-Kaolack): some 9% were parasited.

3.4 The Effects of Control Activities on Populations

18. Mortalities of about 80 to 90/m^2, all species lumped together, were recorded in the 170,000 ha which were treated by air and on the ground.

3.5 Residual Populations at the End of the Season

19. On 11 October, just before the evaluation mission left Senegal, the campaign against grasshoppers could be considered over. Although Oedaleus senegalensis is still rather uncommon, the other species listed in paragraph 13 abounded over large areas in the south and centre of country. Although these species have but one generation a year, and although the harvests are already underway, or about to begin, a number of concentrations, in areas where hatching has not yet finished, will be treated. The residual moisture flood plain crops will also be protected in November against Aiolopus.

20. It should be noted that thousands of hectares have also been invaded by Spodoptera, Amsacta moloneyi and Cantharids (without taking into account grain-eating birds and various plant lice), and that the Plant Protection Services are more and more worried by the various pest attacks.

4. MONITORING AND RAPID WARNING SYSTEMS

4.1 Performance of the National Monitoring Systems in 1987

21. The pilot reporting and early warning system, set up in cooperation with the Integrated Pest Management section established by

CILSS at Nioro du Rip did not work, in spite of the advice given by the FAO consultant, Jean Tétefort, in the seminar organized in Dakar in June 1986.

22. On the other hand, the Plant Protection Division had began to set up a monitoring and rapid warning system before the end of the 1986 campaign. This network, which, when completed, will include ten secondary Plant Protection Centres, began working in 1987, with four secondary Plant Protection Centres based in the south, at Kolda and Missira (Tambacounda), at Nganda (in the Kaolack region) and at Richard-Toll, with CCLALAV's anti-grasshopper team. The infrastructure for a fifth centre is being prepared at Ogo (close to Matam). Qualified staff have been appointed to all these secondary centres which are in charge of scouting in the zones under their control, have a four-wheel drive vehicle, and are in contact with the rural people, who are aware of the dangers posed by the various pests. They also undertake the training of the village intervention committees. Each secondary Plant Protection Centre collects and transmits the data needed for the rapid alarm system through a radio installed at its base, to the Agricultural Reporting Division of the Plant Protection Division. The radios of this division are also permanently tuned in to receive information.

4.2 The Use of Information in the Management of Control Operations

23. The Agricultural Reporting Division of the Plant Protection Division refers important or urgent data to the Operations Centre, a section of the Plant Protection Division with the special responsibility of taking decisions, on the basis of the data received, as to what control measures to adopt.

4.3 Evaluation and Recommendations

24. A number of the scouts lack experience. Their training should in future be improved, to increase their knowledge both of grasshoppers and other pests, and of scouting methods, the estimation of population densities, and the correct transmission of data by radio and on reporting forms. Their training in the use and calibration of the sprayers which have been given to them, as well as for their role of advisors to the village intervention committees, must also be improved.

25. The four secondary Plant Protection Centres have proved their value in 1987, although their activities could be improved in future.

26. The evaluation mission recommends that the monitoring and rapid warning network be brought up to the full ten secondary Plant Protection Stations originally planned.

5. TRAINING

5.1 Training Activities in 1987

5.1.1 Training at the Dakar Training Centre

27. The centre is a focus for both national and international training. In 1987, seven training sessions were held between March and the start of the rainy season.

9 - 14 March	Training in the use of radios and pumps in aerial control for twenty-one Senegalese CPS agents; funded by FAO.
17-21 March	A similar course for 23 more CPS agents, funded by USAID.
23-28 March	Training in the use of Micronair equipment for 20 participants from five countries; funded by FAO.
1-13 April	A weed management course for 17 participations from three countries; funded by the OAU and FAO.
15-30 April	A course for grasshopper control trainers (30 CPS agents from three countries); funded by USAID.

28. Two one-day courses for CPS personnel, on rats and on the use of satellite maps, were held on 7 and 14 July.

29. Some 40 newly-appointed CPS agents throughout Senegal (30 for "crop defense" and 15 for "agricultural warning") have but limited knowledge of pest identification and control, and would profit from further training at the Dakar Training Centre, as would the workers hired during the campaign for pesticide application. There are three experienced, dynamic instructors at the Centre, but the Director estimates that five instructors are needed immediately, and eight in the long run, if the training needs of the CPS are to be met.

5.1.2 Farmer training

30. The Centre's instructors conducted seven courses for nearly 900 farmers in various parts of Senegal. Topics included the identification and control of grasshoppers and other pests, the safe use of pesticides, the correct use of locally-available pesticide equipment (calibration and the influence of wind speed), and first aid in the case of pesticide poisoning (using a slide show and a pamphlet produced by the Centre in 1984). These courses, each in a new village, lasted one to two days, with sessions in the morning and in the afternoon.

31. The training of farmers is hindered by a lack of operating funds. The CPS provides a vehicle and fuel if available, and the per diem of instructors and the driver, but instructors are expected to travel at their own cost and claim for expenses, which they may not receive for six months or more.

32. In 1987, a training course financed by an NGO in Dahra was very successful, partly because meals for the participating farmers (who would otherwise have been unable to spend two days away from their own homes) were provided. Nine agents from other development groups in the area also benefited from this training.

33. As the Centre's instructors train further agents of the CPS, CER, SODEVA, Peace Corps, etc., it will be important to monitor the way in which they, in their turn, train farmers, as until now, they have not always been very effective in disseminating the knowledge they were taught.

34. The cost of the Centre's training in 1987 was 8,000 FCFA ($ 25) per person per day, including room and board. The cost of farmer training was 2,500 FCFA ($ 8.50) per farmer/per day, plus fuel cost, plus the instructor's per diem.

5.1.3 Radio messages

35. Crop protection messages on the radio are broadcast in local languages every Friday evening, covering a number of diverse topics, including grasshoppers. Interviews by the CPS confirm that these broadcasts are heard and discussed by farmers; the radio station also receives a number of letters from farmers requesting information on specific topics.

5.2 Training Needs

5.2.1 The Dakar Training Centre

36. The Centre has no training budget, and will need donor support to maintain and improve its curriculum. Repairs to buildings and some equipment are sorely needed, including a new septic system, fans for the dormitory and fresh paint generally. Some laboratory equipment must be repaired or replaced, and supplies are needed for preserving and dissecting insects. The present reference collection of grasshoppers and other insects should be expanded, and reference collections should be provided for each of the departments (30) and inspectorates (10). The projection equipment needs repair and a supply of spare parts, particularly bulbs, which cannot be obtained locally. No new audiovisual aids (films, slides, posters) have been acquired in several years.

5.2.2 CPS personnel

37. The priority of the CPS is to train its newly-appointed agents. The longer, six-month programmes in Niger and Montpellier would be appropriate for agents in charge of CPS secondary stations.

38. The Centre's instructors themselves are in need of more extensive training, but cannot easily be released from their duties. The USAID consultant, E. Huddleston, recommends they study for advanced degrees in such a way as to permit them to return to Senegal when critically needed.

39. The director of the CPS will need at least one specialist officer for each major pest group. The long-term training of selected CPS staff members in both technical and managerial skills would allow them to also assist the agricultural schools in improving crop protection training.

40. At least one instructor should study training techniques and the production of audio-visual materials.

5.2.3 Farmer training

41. Unless NGOs regularly fund farmer training, the DTC will need outside support for this work. Funds for training will be needed in 1988 to insure the proper use and storage of pesticides and equipment provided in 1987.

42. A vehicle, specially equipped for training, is needed so that the Centre's instructors may conduct or monitor farmer training. They may in this way support the agents who have been trained at the Centre with their experience and audio-visual resources.

5.3 Recommendations

43. A training budget for the Dakar Training Centre is necessary. Allowance should also be made for refurbishing the Centre and for the production and procurement of training materials. The Centre would be of much greater value if such funds were available.

44. Short and long-term training should be given selected CPS personnel, as outlined in section 5.2.

45. The Centre will need foreign help and advice in the production and procurement of training materials until a qualified Senegalese national is available.

46. The Centre will need technical assistance to organize and upgrade its library and files on the various pest groups.

47. Funds should be provided so that the Centre may function as a regional resource, either by the sending of its instructors to other countries to train there, or by bringing batches of about twenty agents at a time from another country to the Centre.

48. Funds are required to specially equip a vehicle for training.

49. The training budget should include provision for the advance payment to instructors of their per diem.

50. Technical assistance is required for the storage of pesticides and for the disposal of surplus or outdated pesticides and empty containers.

51. Technical assistance should also be provided so that environmental impact sudies may be carried out.

6. CONTROL OPERATIONS

6.1 Organization of the campaign

52. Of great importance this year was the establishment, at CPS headquarters, of an Operations Centre for pest surveys and control, including two experts in acridology and aerial control provided by a donor country. In addition, the CPS Director appointed his Assistant Director and the Director of the Dakar Training Centre to the operations team. This Centre daily considered reports from field survey teams, in person or by radio, analysed the material and logistic needs, and recommended the appropriate action. Weather reports were also received daily from AGRHYMET. The Centre reported weekly on developments to the donros, FAO, and governmet agencies.

6.2 Funds and Inputs Made Available

53. Donor contributions are shown in Annex IV. The Senegalese government provided adequate funds for staff salaries, the costs of operating vehicles and for the transport of pesticides and equipment. The Government is also constructing a large storage building close to the CPS headquarters, at km 15 on the route de Roufisque (Thies), but this will not be ready for storing pesticides in the next dry season; alternative storage facilities must be found, as numerous drums of pesticides will otherwise be left in the open.

54. Pesticides and application equipment were positioned in the region and village level farmer brigades were organized before the rains began. Jacto sprayers were mounted on 13 Unimogs, which were also equipped with power dusters.

6.3 Control Activities Undertaken and Areas Treated

55. Grasshopper populations in Senegal were of such low density that a mere 2,280 hectares were treated by ground application between June and September.

56. The first aerial application was made by two US Turbo Thrushes between 23 and 25 June. 4,500 hectares in the Bao Bolam and Nganda areas were treated with Malathion ULV. Between 10 and 16 August, a further 23,000 hectares in the Mbegue Forest area were treated with Malathion ULV.

57. Four Canadian Turbo Thrushes treated 73,000 hectares near Thies and Bour using Fenitrothion 500 ULV. As of October 7, a total of 100,195 hectares had been treated.

6.4 Evaluation of the Efficiency of the Control Activities

58. Aerial operations were evaluated by Abdoulaye Niassy of the CPS (who has an M. Sc. in Entomology) using the vesical square metre and the 0.1 m^2 ring methods. Mortality rates varied between 77% to 92% at sites near Nganda; in aerial treatment at nine sites in Mbegue Forest, between 94% to 95%. Mortality rates of between 70.4% and 96.8% were measured at seven sites near Thies and Bour, where Fenitrothion was used.

59. Mr. Niassey estimated the mortality rate in various ground control operations he observed at between 60 and 80%.

60. Problems with swath spacing occurred in areas where trees were numerous: electronic guiding systems might facilitate future aerial operations.

6.5 The Evaluation of Pesticides, Equipment and Aircraft Used

61. Both the pesticides used, Malathion and Fenitrothion, are suitable for aerial application, and are economical and relatively safe to humans and to the environment.

62. The value of dusts for ground application is questionable. The cost per pound of the active ingredient is high, as are transport costs, and inhalation by the user is a distinct risk.

63. The warehouse being presently constructed should be supplied with a forklift and pallets. Technical assistance in the handling and storage of pesticides will be necessary.

6.6 Environmental Impact

64. An EPA representative, Kyle Barbehenn, spent three weeks in Senegal, but as there were no aerial treatments during his stay, he had little to evaluate. Despite several requests by the CPS Director to USAID for an extensive environmental evaluation of the 1987 campaign, funds were not provided. The technician promised by Italy to evaluate ground control never arrived.

65. On field trips in early October 1987, the mission noted the presence of parasites on various species of grasshoppers. Aerial treatments endanger the grasshopper parasite and predator complex, as well as those of other species, such as the cassava mealybug, whose natural predators and parasites were introduced by the International Institute for Tropical Agriculture in 1984.

66. CPS personnel have neither the expertise, nor the time during the campaign, to conduct in-depth environmental monitoring and the assessment of pesticide spraying. In 1987, the CPS entomologist, Abdoulaye Niassy, worked with the EPA representative and reported on treated areas he was able to visit (Kaffrine, Gossos, Nganda and Nioro). He observed no mortality of lizards, birds or other vertebrates, but high mortality amongst non-target insects, such as scarabids, tenebrionids, sphecids, carabids, cincindeltids, meloids, lampyrids, etc.

67. In the light of diverging opinions as to whether large or small aircraft should be used in control operations, environmental studies should be given greater priority. The cost/benefit analysis of any control operation must include an ecological component, since the elimination of beneficial species, or of parasite/predator complexes, either of harmful or of non-target species, may result in long-term damage, which neither the host-country nor the donors can afford to repair.

6.7 Recommendations

68. An environmental impact expert should work closely with the CPS entomologist before, during, and after the 1988 campaign.

69. Donors should provide a crop loss assessment expert in 1988 to work closely with CPS agents, and possibly with Peace Corps volunteers, to collect and evaluate data on the incidence of pests and data on yields and losses.

70. At least eight more solar-powered radios are needed to speed up communication with the CPS secondary stations.

71. A blood testing programme, to reinforce the awareness of pesticide toxicity, should be considered.

72. ULV pesticides, rather than dusts, are recommended, because of the lesser expense of the active ingredient and of lower transport and storage costs. However, training in ULV applications is required before the formulation can be used by farmers. The CPS now has new ULV equipment, and training in its calibration and maintenance is essential.

73. A stricter accounting for vehicles, equipment and fuel is needed.

74. Further studies on grasshopper population treatment thresholds are essential.

75. Mortality estimates and environmental studies for ground applications should be carried out using the same methodology as for aerial applications.

7. CROP LOSSES

7.1 Report on Crop Losses

76. The daily surveillance reports mentioned any losses which occurred: apparently, losses to grasshoppers were negligible in 1987.

7.2 Cost/Benefit Analysis

77. Any analysis of the value of pesticides and equipment supplied in 1987 must take into account its use over the next few years, and this is not yet possible.

78. Malathion, Carbaryl and Fenitrothion can all be utilized against other pests as well, and this must also be considered.

79. It will be necessary to use the stocks judiciously, as a "full cupboard" may result in the temptation to use more pesticide than necessary. Donors can help by providing technical expertise to establish threshold-levels for major pests.

80. The relative cost of dusting bags and spraying with Carbaryl was studied by Dr. Ellis Huddleston of USAID/Dakar. The results of this analysis are given in table 1.

81. Should severe grasshopper outbreaks occur in the Sahelian countries, the value of different types of aircraft for different types of work should be born in mind: helicopters, small and larger planes all have differing roles to play.

7.3 Recommendations

82. A cost/benefit comparison of dust and ULV applications should be made.

TABLE 1.

Theoretical Comparison of Dust Bags and ULV Application of Carbaryl

Dust Bags	ULV Carbaryl
A. Walking Speed 60m/min.	A. Walking speed 60m/min.
B. Swath width 2 meters.	B. Swath width 30 meters.
C. Work Rate 60m/min.X 2m swath = $120m^2$/min. $120m^2$/min.X 60mins = .72 ha/hr.	C. Work Rate 60m/min.X 30m swath = $1800m^2$/min. $1800m^2$/min.X 60 = 10.8 ha/hr.
D. Cost of Chemical 1% Propoxur @ $1200/metric ton 10Kg/ha.=$12.00/ha.	D. Cost of Chemical Sevin 4-Oil @ 3.50/Liter 1.18 liters/ha.=4.13/ha. + (.3 liters of Diesel =.21) = 4.33/ha.
E. Cost of Transport (Based on estimate of $40/metric ton) $40 - 100 ha. = $.40/ha.	E. Cost of Transport (Based on estimate of $40/metric ton) $40 - 743 ha/ton = .05/ha.
F. Labor Cost/Ha. .72 ha./hr. X 1.00/hr. = $1.40/ha.	F. Labor Cost/Ha. 10.8 ha./hr. X 1.00/hr. = $.09/ha.
G. Efficiency rate (est.) 50% - 1.40/ha. = $2.80/ha	G. Efficiency rate (est.) 90% - $.09/ha. = $0.10/ha.
H. Total Cost/ha. Insecticide 12.00/ha Transport .40 Labor 2.80 15.20/ha.	H. Total Cost/ha. Insecticide 4.33/ha. Transport .05 Labor .10 4.48/ha.
I. Cost Per Unit of Efficacy 70% - 15.20/ha. = $21.71/ha.	I. Cost Per Unit of Efficacy 85% - 4.48/ha = $5.27/ha.

83. Donors should assist the CPS in the prudent use of present stocks.

84. Any cost/benefit analysis of the 1987 campaign should include the wider factors, such as risk avoidance and response preparedness, and, under benefits, should include losses avoided in all crops.

85. A comparative study of various types of aircraft under Sahelian conditions should be made.

8. ORGANIZATION AND STRUCTURES

8.1 The role of National Steering Committees

86. The general consensus is that the Steering Committees played a vital role in the organization and coordination of the campaign. The fact that meetings with several donors present were held every two weeks shows that FAO succeeded in its role of coordinator, and in following up the recommendations of the meeting of December 1986 in Rome.

8.2 Improvements in the National Plant Protection Services since 1986

87. The Crop Protection Directorate has been substantially restructured and a new Director appointed. He delegated direct control of operations to an operational team. The Directorate has been given more autonomy for action and decision making. This greatly facilitated control operations. There are three divisions: Survey and Warning; Control; and Legislation, including quarantine and the registration of pesticides.

88. The CPS developed a national action plan for 1987, with the technical assistance of USAID. This plan was approved by the Government, which lent authority to the work of the Steering and Techaical Committees.

89. The mission coordinator (who was also on last year's evaluation mission) found a remarkable improvement in the capability of the CPS. The revitalization of the service should be encouraged, the donors should strengthen the CPS in a coordinated programme.

8.3 The Role of Regional and International organizations

90. FAO provided an acridologist, who had spent many years in West Africa, and a logistician, who worked with the Canadian aerial operations, assisted in the US aerial operations, and worked with survey teams when time allowed.

91. OCLALAV organized and trained the field support team for the Canadian aircraft, and provided a scout and vehicle for a month towards the end of the campaign. OCLALAV is discussed in the mission report on Gambia.

92. Canada, in addition to aircraft, supplied a coordinator for its assistance activities.

93. USAID acted as the donor coordinator, and provided staff support and technical assistance to develop the 1987 Action Plan. The US supplied the following temporary experts:

1) For the development of the Action Plan, an entomologist, an acridologist, a logistician and a specialist in aerial application.

2) In the early stages of the campaign, two acridologists, and one entomologist for the later phase. A computer specialist and an aerial operation specialist were also provided. The donors also provided logistical support (vehicles, drivers, fuel, etc. provided for the experts)

8.4 The role of FAO

94. FAO played the role of Regional Coordinator and served as a funnel for disbursements from the EEC.

9. FOLLOW-UP AND LONG-TERM CONSIDERATIONS

9.1 Stocks at end of 1987 campaign

95. At the time of the mission, it is not yet possible to draw up an inventory of pesticides on hand, but it is clear that, barring major upsurges, stocks are adequate for the 1988 season and beyond. The mission stresses the importance of proper storage and inventory control and the need to use the older pesticides first during the 1988 season.

9.2 Preparation for future years

96. The mission recommends a heavy emphasis on training. See Section 5 of this report. The development of many categories of expert specialization would considerably improve the CPS.

9.3 The long-term improvement of the Plant Protection Structures

97. Senegal could take the lead in a number of fields:

1) The evaluation of the efficacy, and environmental impact, of pesticides on different crops of economic importance and on the major pests.

2) The development of grasshoppers population thresholds (that is the numbers of insects which should be reached before chemical control is resorted to), both for ground and for aerial application. This would mean integrating grasshopper population dynamics, the crop's phenological stage, and a technical evaluation of the risk of crop damage.

3) More and more complex training will be necessary to benefit from new technologies in integrated pest management. Senegal is fortunate in having a fine Training Centre, and should capitalize on it in the years ahead.

ANNEX I

ACRONYMS USED

FAO	Food and Agriculture Organization of the United Nations
CPS	Senegal Crop Protection Service
USAID	United States Agency for International Development
UNDP	United Nations Development Program
OCLALAV	Organisation commune de lutte antiacridienne et de lutte antiaviaire
FAC	French Cooperation Assistance
ICTZ/FIT	Front Inter Tropicale/Intertropical Convergence Zone
AGRHYMET	Centre régional de formation et d'application en agrométéorologie et hydrologie operationnelle
ULV	Ultra low volume
EPA	Environmental Protection Agency
EEC	European Economic Commission

ANNEX II

PERSONS CONTACTED

Mr. Mohamed Ly	Director, Crop Protection Service
Mr. Aly Nbaw	Chief of the Intervention Division, CPS
Mr. Firmin Jouki	Chief of the Monitoring and Warning Section (Satellite Maps) CPS
Mr. Eloi Diémé	Assistant Director, CPS
Mr. Christophe Gueye	Chief of the Crop Defense Division, CPS
Mr. Lamine Ba	Director, Dakar Training Centre
Mr. Abdoulaye Niassy	Entomologist, CPS
Mr. Oumar Barry	Instructor, Dakar TC, CPS
Mr. Aziz Thiam	Instructor, Dakar TC, CPS
Mr. M.M. Ben Kheder	FAO Representative in Senegal
Mr. Alioune Ndiaye	Regional Locust Coordinator, FAO/ECLO
Mme Tabet-Nême	Operations Officer, FAO
Mr. Billard	Logistician, FAO
Mr. Ousmane Yonli	Entomologist, FAO
Mr. Frederic Jenny	Crop Loss Assessment Consultant, FAO
Mr. Wayne Nilesestuen	Agriculture Development Officer, USAID
Dr. Ellis W. Huddleston	Consultant, USAID
Mr. Ron Harvey	Deputy Agricultural Officer, USAID
Mr. Frances Can	Project Officer, USAID
Mr. Didier Affoyon	Technical Director, OCLALAV
Mr. Carol Voyer	First Secretary, Canadian Embassy
Mr. Emmanuel Mersh	Consultant, EEC
Mr. Guideau	Director, French Cooperation Assistance (FAC)
Mr. Akira Kono	Third Secretary, Japanese Embassy
Mr. Thomas Lipp	Commercial Attaché, Federal Republic of Germany
Mr. Pierre Rouleau	Director, AgricAir, West Africa

ANNEX III

REFERENCE MATERIALS USED

Evaluation de la situation acridienne au Sénégal au début du mois de septembre 1987, par Stanislaw Manikowski.

Report on the Evaluation of Grasshopper Control with ULV Malathion in Mbegue Forest, August 11-17, 1987 by A. Niassy, F. Diatta.

Report on the Evaluation of Aerial Treatment for Grasshopper Control in the Region of Kaolack, by A. Niassy & O. Boye.

Draft Report on the 1987 Grasshopper Campaign, by E. Huddleston, USAID/PSC

Plan d'Action de la Campagne de lutte anti-acridienne 1987/88, par le Service de la protection des végétaux.

Situation phytosanitarie au mois de septembre 87, par T.O. Yonli, Consultant- acridologue pour la FAO.

Prospections et critères d'intervention en lutte antiacridienne, par S. Manikowski et T. Yonli.

ANNEX IV

LIST OF DONOR CONTRIBUTIONS

				US Dollars equivalent
b+	**Canada**	TOTAL: 750,000		750,000
	about 400 hrs aerial operations		(++)	
	services of 4 small planes still in Dakar, for region		(++)	
	training		(++)	
	technical assistance		(++)	
	3 months support for OCLALAV operational costs		(++)	
	pesticides		(++)	

* * *

m+	China	TOTAL: (++)		
	20 MT Malathion ULV		(++)	

Arrangements made through FAO

* * *

m+	EEC	TOTAL: ECU 230,000		265,038
	technical assistance		ECU 56,000	
	Fenitrothion 3 percent dust		ECU 174,000	

Through FAO

* * *

b+	FR Germany	TOTAL: DM 240,000		134,831

Provision for 1987 campaign, covering both Senegal and Gambia

* * *

b+	France	TOTAL: FF 1,070,000		176,277
	1 helicopter for 1 month from 15.6		(++)	
	1 aircraft in Phase II		(++)	
	1 fellowship in PRIFAS May course		(++)	
	2-10 day technical assistance mission by PRIFAS		(++)	
	operating expenses		FF 300,000	
	500 Knapsack sprayers		(++)	
	30 MT Propoxur 2 percent dust		(++)	

From regional allocation

* * *

b+	Italy TOTAL: lit. 401,300,000			318,492
	3 1.5 MT lorry FIAT 40 WM	lit	111,000,000	
	2 MT lorry	lit	150,000,000	
	2 sprayers	lit	18,400,000	
	200 knapsack dusters	lit	8,000,000	
	500 knapsack sprayers	lit	30,000,000	
	2 motorized knapsack dusters	lit	50,000,000	
	100 motorized knapsack sprayers	lit	50,000,000	
	8 tractor-mounted sprayers	lit	6,400,000	
	1,000 masks	lit	5,000,000	
	500 goggles	lit	2,500,000	
	700 protective overalls	lit	7,000,000	
	700 boots	lit	7,000,000	
	1,000 barrier cream	lit	5,000,000	

* * *

b+	Japan TOTAL: (++)		
	50,000 l. Fenitrothion, from local counterpart funds		(++)

* * *

b+	United Kingdom TOTAL: (++)		
	15 Land Rovers (delivered)		(++)

* * *

b+	USA TOTAL: 1,941,092			1,941,092
	480 aircraft hrs (2 planes to spray 240,000 ha in Bake, and Central and Southern peanut basin)		740,000	
	60 hrs helicopter		139,309	
	fuel and lubrificants		50,000	
	training in egg-pod survey and logistical support		55,000	
	control centre, including equipment and support costs:			
	entomologist/TL 6 m/m			
	entomologist/field scout 4 m/m			
	computer specialist/logistician 3 m/m			
	aerial application specialist 4 m/m		280,000	
	entomologist for survey, 1 m/m		3,475	
	13,250 l Carbaryl for Phase I baiting		228,505	
	75,600 l Carbaryl for aerial application		405,803	
	113,400 l Malathion for aerial applications		405,000	

* * *

TOTAL OF COSTED AID: 3,585,730