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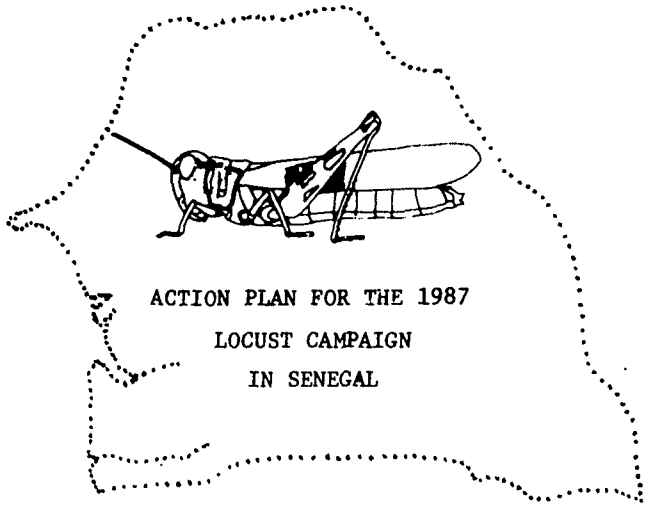

ACTION PLAN FOR THE 1987 LOCUST CAMPAIGN IN SENEGAL

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INTRODUCTION

During the 1986/87 season, the Senegalese farmers have gone through great hardships in their agricultural production due to late rains followed by rather long rain stoppages in July and August and also to the locust infestations which had ravaged most rainfed food crops (millet, sorghum, corn...). Despite the numerous land and air interventions by the GOS Crop Protection Service (DPV) to limit the damages to an economic level, surviving grasshopper populations and third generation pullulations towards the end of the rainy season have thus become a major threat to the next season's crops.

Information sources from PRIFAS (November 1986) and from FAO (December 1986) indicate that the quantity of eggs ready to be hatched following the 1987 early rains in Senegal, Mauritania, Mali and Burkina Faso will be almost equal to last year's.

Therefore, in view of the seriousness of the locust situation, the Ministry of Rural Development has called upon the international community to provide both technical and financial assistance to the GOS Crop Protection Service (DPV) so that a locust campaign can be properly developed under the following action plan:

1. Setting up an Operations Action Committee.
2. Training program.
3. Survey and establishment of signals networks.
4. Grasshopper Control Intervention Plan.
5. Logistic preparation.
6. Assessment of the impact of pesticides on pests and the environment.
7. Evaluation of the campaign results and prospects for the 1988/89 campaign.
8. Annual report.

I. SETTING UP OF AN OPERATION STRUCTURE

1. The locust campaign being multidisciplinary, it is recommended that the Senegal grasshopper control effort should be organized in the following fashion:

a. Coordinating Committee

The Coordinating Committee would be made up of the representative donors and a GOS representative. Their function would be to review the country plan, determine needs, set broad policy guidelines and solicit funds and assistance from their respective capitals.

b. National Coordinator

The GOS should appoint a National Coordinator who will have responsibility over the entire Senegal Grasshopper Control Program. This individual will report directly to the Minister of Rural Development and be chairman of the Technical Committee.

c. Technical Committee

The Technical Committee may be composed of the following:

- .Director of CPS
- .Technical Advisor of the Minister of Rural Development
- .FAO Representative
- .Donor Technical Assistants (US, France, Italy, FAO..)
- .CPS Chiefs of Divisions: surveys, pest control, logistics.

The National Coordinator will be the chairman of this committee and appoint new members as needed.

The Technical Committee will implement the plan of action as approved by the Coordinating Committee. It will handle the day to day operation of the grasshopper survey and control effort but will seek guidance from the Coordinating Committee on matters of policy.

d. Command Center

A Grasshopper Control Command Center should be established in Dakar. The Center would be the focal point of all grasshopper survey and control operations. All information regarding the control effort would come to the Command Center for distribution and immediate action.

e. Operational Structure

The Ministry of Rural Development best meets the needs to act as the grasshopper survey and control effort operational structure. All directorates in the Ministry of Rural Development should play a role in this effort especially the Crop Protection Service.

2. It is suggested that the Senegalese Technical Committee prepare a concise listing of all objectives for the grasshopper campaign: the goals and the steps they feel are necessary to achieve them. Members of the Committee would be assigned the tasks of assuring their implementation; they will be mandated responsibility for every aspect of the project and its timely implementation.

3. The CPS should have a sophisticated communication network sufficient to maintain constant 24 hour communication with all out bases and all mobile units, together with adequate maintenance and backup transceiver units. Aircraft operation companies should be required by contract to equip their aircraft with radio equipment which is compatible with that used by the CPS communication network.

II. TRAINING PROGRAM

1. Training Sessions

Through FAO and USAID funding, training programs for technicians, pesticide applicators and farmer groups, will be organized at the Training Center and in the different regions.

- 60 DPV technicians at the Training Center (in March).
- 60 Pesticide Applicators at the Training Center (in April-May).
- 16 Farmer groups in Kolda, Kaffrine, Linguère, Matam (UFG/region), (in June-August).

2. Short term training

Under the retraining of the National Crop Protection Service agents, the Director of the Crop Protection Training Center is seeking funding sources for the short-term training of some staff in grasshopper control at GERDAT (Montpellier, France). Thus, upon their return these staff will be able to make a clear diagnostic of a given grasshopper infestation and take appropriate control measures.

3. Collaboration with the Regional Development Agencies

Considering the very limited number of trainers, the Pest Control Training Center can collaborate with the Crop Protection and Training sections of the Regional Development Agencies (SAED, SODEVA, SODAGRI, SOMIVAC, SODEFITEX) to retrain their extension agents in locust control with the assistance of the regional and departmental pest control inspectors. These extension agents will subsequently organize training sessions for farmers in inaccessible or hard access villages of their intervention zones.

4. Collaboration with the Specialist of the CILSS/USAID Integrated Pest Management Project

The development and translation of data sheets for identifying the major food crop pests should be conducted in close collaboration with the integrated management specialists and with the literacy sections of the Regional Development Agencies.

For the next season, the CILSS Project will lay the emphasis on the implementation of on-farm pilote projects and wishes to obtain the collaboration of the DPV, the Agricultural Inspection Service and Regional Development Agencies. During our recent field trip for monitoring the DPV

survey program in the regions (from 2/17 to 3/2, 1987) all agriculture and pest control inspectors, managing directors of the Regional Development Agencies and integrated management specialists have been sensitized and expressed their willingness to collaborate favorably with the DPV to carry out such integrated management pilot programs at every department.

5. Rural Education Radio Program

In Dakar, the Training Center and the Agricultural Warning Division will be able to collaborate with the national information services (Radio, TV..) to broadcast on-farm crop protection messages (warnings on pests and control methods). At the regional level, the weekly broadcasts of the Rural Education Radio Program for Regional Development Agencies (St. Louis, Ziguinchor....) could be made use of and the chiefs of regional crop protection services could also join the Training and Crop Protection section chiefs to broadcast the extension package of the locust campaign.

6. The school agricultural program

In rural areas, children are used to helping their parents with field work (sowing, weeding, guarding) during the rainy season. In this way, they become rather skilled in the survey and reporting of locust/grasshopper hatched eggs or infestations. Therefore, the DPV should sensitize and encourage all regional and departmental primary school inspectors, and headmasters to urge the students to participate in such important acitivities of the locust campaign. The information provided to them will subsequently be checked by the pest control agents of the CERP's.

III. SURVEYS & REPORTING

1. Cooperation with Regional and Departmental Services

Due to limited staffing, it is necessary for the warning division to maintain close cooperation with agriculture and crop protection inspectors at regional and departmental levels to develop a strategy for searching of eggs or the reporting of grasshopper infestations. In this case, all agriculture

and crop protection technical agents (crop defence division) can be used both to survey and protect crops. Likewise, a warning network could be more effective if regional development agencies extension workers, PVO's ,Peace Corps Volunteers (Americans, Italians, French and Japanese..), students and youth groups are involved. These are the people who help develop awareness and motivation among the farmers in the searching and monitoring of the crops during the agricultural season.

2. Training Program

The purpose of the survey is to locate adequately grasshopper egg laying zones and to evaluate egg or nymph densities in order to assess the potential infestation sizes and define an intervention strategy. It is therefore necessary to develop a joint training program (survey, reporting, pest identification, pesticide treatment) with the Crop Protection Training Center (Dakar) where participants can learn concurrently all the basics on grasshopper control.

3. Survey Periods

a. Nymph survey

It should start with the early rains and continue until the end of the rainy season, which will not only permit to make preventive control more effective against larva as soon as they are hatched, but also to save the insecticides which will be used for the control of other pests. (millipedes, termites, hairy caterpillars, coleopteres, aphids..) which emerged during the rainy season.

b. Survey of eggs

It involves a proper estimation of egg densities at the end of the season (Nov-Dec). It will enable a better assessment of the potential of infestation size and a definition of an adequate intervention strategy for the next campaign.

4. Establishment of a consistent signalling network

a. Grassroot informants

- Shepherds report on the situation in the ranges, fallows and forests. Farmers, students and Peace Corps Volunteers report on the grasshopper situation in the fields.
- Presidents of producer groups or (trained) pilot farmers gather these data to forward them to the head of the CERP (agricultural technical agent, crop protection agent) who go to the field to check and assess the magnitude of infestation in order to make appropriate intervention recommendations.

b. Warning bases and observation posts

As transmitter/receiver sets have already been ordered and delivered to the Crop Protection Service, it is necessary to install them at fixed locations at all warning bases and observation posts, and to strengthen the staff there in order to make Crop Protection Service reporting and intervention networks more responsive.

c. Regional monitoring committee

In order to alleviate farmer's concern for grasshopper (or other pests) attacks, it is necessary for all the data to be officially conveyed at the CERP level where agricultural or (Crop Protection) agents discuss and take appropriate intervention measures.

i. In the case of specific attacks on their crops, farmers will be advised to perform preventive treatment as soon as the first signs appear.

ii. In the case of overall infestation in large acreage or in the ranges or fallows, both crop protection supervisors (departmental and arrondissement levels) should be warned so that a field verification can be jointly organized with the rural community or the regional development representatives(s); this will not only facilitate the assessment of the magnitude of the attack in order

to intervene but also the evaluation of disaster cases for farmers involved in the agricultural program. In such a situation, the intervention will be performed by Crop Protection Service and phytosanitary teams established at rural community and village levels.

Except for emergency cases (severe attacks, breakdown of telephone network) when information cannot be sent directly to the Crop Protection headquarters (Dakar), agricultural or phytosanitary supervisors of the CERP should report to their superiors (departmental, regional) in order to maintain an adequate coordination of reporting and intervention methods.

Once CERP or agricultural area heads (agriculture or Crop Protection Agents) have been given classroom and practical training on grasshopper control, they should be given the opportunity to hold training sessions for PVO's, regional development agencies, or pilot farmers selected by village groups. In this case, during the campaign, the task of the Warning Division is to help regional or departmental crop protection heads to determine, evaluate the magnitude of problems and to send the data to the Operational Action Committee (National Crop Protection Service/Dakar) through warning centers, observation locations, government telephone network. Likewise, through a close collaboration with agriculture and Aghrymet agents, all climatic, phenologic and phytosanitary information on crops could be concurrently transmitted to the Dakar National Crop Protection Service/Warning Division.

As three grasshopper intervention phases have been planned during the campaign, 1(2) mobile survey team should intervene periodically in the various zones of overall infestation involving aerial or ground treatment with high performance means (UNIMOGS, EXHAUST...)

d. Agricultural warning division in the National Crop Protection Service

It centralizes and utilizes data sent by regional and departmental crop protection agents. However, it is also necessary for this division to work closely with FAO, OCLALAV and the National Geographic Center to communicate the data gathered and to obtain the agro-climatic information and the grasshopper infestation status in other Sahelian countries. This would allow the division to better review and disseminate information on appropriate forecasting and control methods.

IV. GRASSHOPPER CONTROL INTERVENTION PLAN

Due to concern for a large-scale grasshopper infestation during this campaign, the National Crop Protection Service together with donors' experts, plan various appropriate intervention methods (ground and aerial treatment) based on rainfall and intertropical shift related grasshopper population dynamics. (Table III)

1. Ground intervention

a. Nymph Control

With regard to ground intervention, the strategy considered aims à priori at a preventive control early in the season against nymph concentrations as they are hatched as a result of a threshold of 25 mm of rain approximately. These hatchings will take place 12 to 15 days after the first rains and will then constitute a severe threat to the first sowings (millet, maize). The best way to cover such a large agricultural area is to entrust crop infestation treatment to the farmers, to provide them with dusting bags (Propoxur 1%, Fenitrothion 2%). These treatments should not only be made within the fields, but also along and around the fields, because even these nymphs are very mobile.

Thus, sensitizing and training of farmers must be assisted by PVO's, extension workers from regional development agencies or trained farmers from rural communities or villages.

However, farmers cannot be expected tp treat infestation remote from their fields in the deep bush (fallows, ranges, classified forests). This will be the responsibility of the National Crop Protection Service teams which maintain high performance equipment (UNIMOGS, EXHAUST, SPRAYERS) with the assistance of rural community established teams.

b. Adult Control

Then, adult grasshopper control should be performed through spraying with liquid formulation:

- ULV formulation for indirect or remote protection of crops since they may be phytotoxic.
- EC formulation for close protection of crops.

2. Aerial treatment

Aerial treatment (Annex II) takes place only when there is a widespread grasshopper infestation which exceeds the available means for ground treatment. It aims at combating heavy insect densities in the reproduction area and at preventing their movement (North or South) along the tropical front.

Aerial treatment will always be preceded by an intensive search of the region suspected of heavy infestation, it should also be made through the lead of reconnaissance aircraft and reporting ground teams (National Crop Protection Service, Senegalese and French Air Forces). In Casamance, the overdose of insecticide is necessary because of the density of the vegetation cover and the resistance of certain grasshopper species (Kraussaria, Cataloipus).

As the Oedaleus senegalensis distribution area covers Senegal almost entirely and its most conspicuous and substantial damages affect rainfed crops (millet, sorghum, maize) "coming up and harvest" control operations will be finally scheduled in 3 major phases based on the grasshopper hatching and migration according to rainfall and intertropical front during the rainy season.(Table III). Areas for ground and aerial treatment are estimated in the following Table IV:

TABLE IV. ESTIMATION OF AREAS INFESTED BY GRASSHOPPERS IN SENEGAL (1987/88)

PHASE	Period	Intervention Area	Ground Treatment (Ha)	Aerial Treatment (Ha)
I	Mid June -	Groundnut Basin Centre-South	155,000 ha	100,000-200,000 ha
	Mid August	Southern Area of North Groundnut Basin (Diourbel, Mbacké, Touba, Deali...)	115,000 ha	
I & II	Mid June - October	CASAMANCE	140,000 ha	170,000 ha
II	Mid August - October	MATAM/BAKEL		60,000 ha
		North Groundnut Basin River Valley		270,000 ha
III	October	Clearing of escaped populations of Phases I & II	70,000 ha	100,000 (?)
	- Late November	Senegal River Valley (Recession Crop)	40,000 ha	
TOTAL			520,000 ha	700,000-800,000 ha

Besides the magnitude and intensity of the infestation of Oedaleus senegalensis (early June-Nov), it is also necessary to note the destructive activities of the other 3 pest group whose infestation periods vary according to the environmental areas.

In Casamance, the early rains and their long duration further the hatching and development of the Oedaleus senegalensis and other sedentary locusts. The latter group is active (Cataloipus, Kraussaria augulifera, Hieroglyphus daganensis, Krausella amabile, Zacompsa festa, Zonocerus variegatus) between August and November and causes heavy damages to cereals from the flowering to the harvest. Thus, it is necessary for farmers to take appropriate control measures by mid-June.

Aioloqus simulator pose a threat to recession crops in the Senegal River Valley (late Oct-Nov). The best control strategy is baiting which ensures timely protection of the seedings. With powder (Propoxur 1%) and cereal bran, farmers will make baits and arrange them in 2mx2m packs in their fields.

Another secondary species, the Zonocerus variegatus causes also heavy damage in the off-season vegetable crops. They are often active in the Niayes and the cultivated lowlands of St. Louis, Dakar, Thies and Kaolack.

V. REQUIREMENTS FOR THE CONDUCT OF THE GRASSHOPPER CONTROL CAMPAIGN ACCORDING TO THE PROPOSED PLAN OF ACTION

Pesticide, equipment, vehicles, flight hours, training costs and technical assistance requirements etc., are estimated based on the strategy proposed for next year's grasshopper control campaign and the current and future availabilities during National Crop Protection Service campaign. These requirements are as follows:

1. Areas to be treated and amount of products required for 1987-88 agricultural season based on the strategy adopted

*1st Phase: mid June-mid August

a. South-Centre Area and Casamance: 1st generation hatchings

i. farmers level: around 25% of acreage 100,000 CFA francs (baits plus powder) - close protection of crops (sowings)

ii. NCPs intervention: crop protection and treatment of fallows (not very large areas which do not need aerial interventions) - 55,000 ha (15000 ha through dusting and 4,000 ha through ULV spraying)

iii. aerial treatment: fallows and classified forest 100,000 ha (locust assumption) to 200,000 ha (highest assumption)

b. (Diourbel-Mbacke-Touba-Dahra) area: as of late July, 1st generation hatchings plus emergence of images towards the North.

i. farmers level: almost 25% of cereal cultivated lands - 60,000 ha (baits plus powder) - close protection of crops (sowings)

ii. National Crop Protection Service Intervention: Crop protection and fallow treatment - 55,000 ha (15,000 ha through dusting and 4,000 ha through ULV sparying)

In the overall, the areas treated are:

*farmer level: 16,000 ha, which involves 16,000 tons of propoxur 1% (on young larva preferably) on Fenitrothion 2.5% for dusting as well as 80 tons of Propoxur 1% and 900 tons of bran for baits farmers will be requested to contribute most baits, to the provision of bran/millet or sorghum.

*National Crop Protection Service level: 110,000 ha for which ULV, which requires 450T of Propoxur powder 1% or Fenitrothion 2.5% and 40,000l of Fenitrothion 500 ULV. The figure of treated areas correspond more or less to the capacities.

*Aerial interventions: 200,000 ha which require 100,000l of Fenitrothion 500 ULV or its equivalent.

*2nd Phase: Mid August-Early October

During this period, action will be taken here and there, and there will be larger coverage conducted at a greater speed. To ensure safety, the National Crop Protection Service will be reinforced with treatment vehicles and equipment for its ground intervention. It is desirable that DPV be equipped at the minimum with a 4x4 mounted pickup at each department (or 30 vehicles), a 4x4 mounted vehicle at each CSPV 95 vehicles) and ten mounted 4x4 vehicles at the Central level (reinforcement beams-safety margin).

Oedalus Control from Diourbel to the North, Casamance and departments of Matam/Bakel

*National Crop Protection Service interventions: 140,000 ha of which 100,000 ha ULV sprayed and 40,000 ha dusted, which required 50,000 liters of Fenitrothion 500 ULV and 600 tons of Propoxur 1% dust or Fenitrothion 2.5% - close protection of crops and small pockets - nearly 30% of acreage cultivated with cereals.

*Aerial treatment: Nearly 60% of areas were treated last year. As a more effective and earlier control will be made in phase 1 and that more specific areas to be treated will be delineated (smaller aircrafts and further surveys):

-Diourbel-Dahra-Louga-Mbacke-Gossas Area: 270,000 ha.

-Matam-Bakel Region: 60,000 ha

-Casamance: 170,000 ha. In this region, ha/mix of pesticide will be more important, given the density of the plant cover (0.75 liter/ha of Fenitrothion ULV 500 or 0.355 liters/ha of Fenitrothion ULV 1000, if adequate planes are used).

In the overall, the areas treated are:

-National Crop Protection Service Level: 140,000 ha. which require 50,000 liters of Fenitrothion 500 ULV (or its equivalent) and 600 tons of Propoxur powder 1% or Fenitrothion 2.5%)

-Aerial interventions: 500,000 ha. which require 290,000 liters of Fenitrothion 500 ULV (or its equivalent).

*3rd Phase: October-November

a. Elimination of residual populations (nearly 50% of areas treated in phases 1 and 2) and 3rd generation in the South-Centre area and Casamance:

*National Crop Protection Service intervention: 70,000 ha. sprayed with ULV.

*Aerial interventions: 100,000 ha.

b. Control of Aiolopus among recession crops.

*National Crop Protection Service intervention: 30,000 ha. sprayed with ULV.

*Farmer level: 100,000 ha. through dusting and baits (cf phase 1).

In the overall, the areas treated in phase 3 are:

*farmer level: 10,000 ha. which require 100 tons of Propoxur 1% or Fenitrothion 2.5%, 10 tons of Propoxur 1% and 100 tons of bran.

*National Crop Protection Service: 100,000 ha. which require 50,000 liters of fenitrothion 500 ULV (or equivalent).

*aerial intervention: 100,000 ha which require 50,000 liters of Fenitrothion 500 ULV (or equivalent).

Finally, the amount of pesticide required given the control strategy proposed can be summed in the following table:

Treatment	Insecticide	Phase I Mid June Mid-August	Phase II Mid-August October	Phase III October November	Total
Ground	* Baiting				
	- cereal bran	900 T	-	100 T	1,000 T
	- Propoxur 1%	80 T		10 T	90 T
	* Propoxur 1% or	2,050 T	600 T	100 T	2,750 T
	Fenitrothion 2.5%				
Aerial	* Fenitrothion 500 ULV				
	equivalent (Carbaryl,	140,000 l	340,000 l	100,000 l	580,000 l
	Malathion, Diazinon)				

Plan 100,000 liters of technical or ULV Fenitrothion ULV 1250 G.1 (96% ULV) if aircraft able to use Fenitrothion 1000 ULV at the rate of 0.25/ha. could be used.

As the supply of pesticide unde KR286 will not intervene at the best only at the end of the campaign, it will be necessary for safety reasons, to purchase:

-1,000 tons of Propoxur powder 1% or Fenitrothion 2.5%
-1,000,000 liters of Fenitrothion ULV 1000 or equivalent (if planes could function at the rate of 0.25 liters/ha.
-320,000 liters of Fenitrothion 500 ULV or equivalent
-1,000 tons of bran

2. Vehicles

The purpose is to be equipped at the beginning of phase 2 with:

- 20 UNIMOG
- 20 vehicles in order to establish an equivalent of signalling and surveying teams (4 based at the central level and 10 in the regions). At least 4 out of these vehicles should be equipped with a transmitter receiver set, 45 pickups diesel 4x4 for the interventions (1 per department, 5 at the CSPV level and 10 for a reinforcement team at the central level)
- 10 trailers which can be fixed to UNIMOGs, which would ensure greater flexibility for the distribution and delivery of equipment and supply.

Requirements are described in the general table, given the planned availability at the National Crop Protection Service early in the campaign.

3. Aircraft Intervention and Survey

a. Planes

Phase 1: 2 planes of the type used by OCLALAV (200,000 ha.)

Phase 2: 2 planes of the type used by OCLALAV (100,000 ha.)+ 4 planes which can use Fenitrothion ULV 1000 or 1250g/l at the rate of 0.25 liters/ha.

Estimated total hours of treatment is approximately 1150 (without connections) at the rate of 700 ha./hour.

b. Helicopter: It is necessary to conduct grasshopper control surveys in the areas which are difficult of access (Walo and Casamance). Requirements should not exceed, given last year's experience of, 60 flight hours. It should be noted that a helicopter is available for rental in Casamance (Diola Hotel). A French Air Force Helicopter can possibly be rented.

It would be desirable to buy two planes (for example Britten Norman Pilatus BN2 illustrative price delivered in Dakar 250 million CFA francs which will be manned by Senegalese Air Force pilots after training).

4. Supply Requirements

a. Diesel Engine Motor Dusters (Stella Berthoud duster for instance with Lambardini engine) and duster fixed to a plug, (for example Stella Berthoud or Jacto)

To reinforce intervention capacities in case of severe and widespread attacks than expected and to allow in such a case to apply swiftly the insecticide powder currently stored, especially during phase 1 and 2, it would be necessary to have 50m range diesel engine motordusters and dusters available which could, if necessary, be mounted on vehicles available at departmental level agricultural divisions and regional dvelopment agencies. The interest of the use of these dusters is that treatment equipment do not need a high technology.

b. Canon type ULV sprayers mounted on plugs on diesel driven engine (see general requirements table). The number of heavy duty dusters or ULV sprayers in the table recaputilating the requirements relevant to the vehicles on tractors equipment available at the National Crop Protection Service, and those requested as supplement so that they can perform dusting or ULV spraying activity according to the needs.

c. Radio Network: The National Crop Protection Service maintains 8 ICOM IC 735 sets provided by FAO without antenna and maintenance equipment. The manufacturer is not represented in Dakar, according to the instructions, they can broadcast only in one of the frequencies alloted to the National Crop Protection Service and the OCLALAV (14708 khz). It would be at least necessary to provide mobile sets to the 4 vehicles for the Dakar based survey teams and to the 5 secondary centres of Crop Protection

which will likely serve as bases for surveys and interventions (Matam, Missira, Nganda, Ogo, Richard Toll). The requirements are provided in detail in the general table.

d. Further requirements: Camping equipment, protection equipment, spraying control equipment, catching equipment, etc. (See general table)(Table VI)

5. Fuel for Ground Survey and Intervention:

*Phase 1: Based on the number of vehicles available at the National Crop Protection Service and the schedule, fuel needs for interventions during this phase can be stimulated at 83,000 liters of diesel oil for 110,000 ha.

*Phase 2: By extrapolation, requirements can be estimated at 105,000 liters of diesel oil for the intervention.

*Phase 3: 75,000 liters of diesel oil for 100,000 ha.

Surveys during the campaign: 55,000 liters approximately.

In the overall, fuel requirements for surveys and intervention can be estimated at 320,000 liters of diesel oil.

6. Control of equipment and pesticide delivery costs

Based on 27 CFA francs/Km/ton for transport, for an estimated 4,000 tons and an average transport distance of 500 km, costs can be estimated at 54 million CFA francs.

7. Temporary Workers

Costs based on the hiring of 300 day laborers at the average cost of 1,500 CFA francs/day for 5 months

PESTICIDES, VEHICLES AND EQUIPMENT REQUIREMENTS FOR THE GRASSHOPPER CONTROL CAMPAIGN (1987/1988)

TYPE OF EQUIPMENT	QUANTITY	AMOUNT MILLION CFAF
Fenitrothion ULV 1000 (or equivalent)	100,000 l	560
Fenitrothion ULV 500 (or Equivalent)	320,000 l	960
Propoxur 1% PP or Fenitrothion 2.5% PP	1,000 T	350
Cereal bran	1,000 T	20
Unimog (preferably) or equivalent (intervention)	7	120
Pickup 4x4 diesel double cab with radio (survey)	3	21
Pickup 4x4 diesel (Intervention)	16	80
Trailers (8T) fixable to Unimogs (pneumatic brakes)	8	32
Canol type ULV Motorsprayers + set of spare parts (ex. modified Jacka 400 CA)	23	41
Sprayer ULV fixed to a plug (ex. Jacko AJ401 LH)	6	4.5
Plugged Canon type dusters (Jacko or Stella Berthoud)	20	8
Diesel Engine Canon type duster (Lombardini engine with Stella Berthoud)	25	25
Radio network (Thompson CSF TRC 495 model)		
- B.V mobile set mounted on survey vehicle including helicopter antenna with antenna cushion, feed, micro-1 frequency	4	
- Fixed BLV set (installed at CSPV levels), including antenna, large band with masts, microfeed with pedal, 4 quartz guided frequencies (5661, 5465, 8025 and 14,708 Khz)	5	
- Solar panel (GS160 with Leroy-Sommer cells) regulator	4	
- Sets of spare parts for maintenance		
- Installation costs		
Set of camping equipment for 6 people, including 1 detachable shelter made of heavy linen, 1"papote" box, 1 gas stove complete with pressure reducing valve, 1 portable absorption refrigerator (butane fed, 120V and 220V), 1 ice box, camp bed with mattress for survey (survey and intervention)	10	10
Set for sprayers check (1 chronometer + 1 250 ml test-tube, 1 599 ml test-tube, 1 Windmeter Dryer calibrated in Km/h,	10	1
1 Topothread with reloading reel	10	1
Surveyor compass	10	0.5
"Lovibond" kit with deonizer for monitoring of cholinesterases among pesticide operators (marketed by Ciba-Geigy)	4	1.5

TYPE OF EQUIPMENT	QUANTITY	AMOUNT MILLION CFAF
Protection equipment (uniforms, glasses, mask with recharge canisters, box, gloves)	100 T	8
Mask with forced ventilations and pesticide filter, with refillable feed, feedwire on 12V cell, refill filters (tractor operators)	10	2.5
Generators	10	4.5
Simple design rain gauges	300	1.5
Pesticide manual pump	100	3
Pumping Station for refilling of aircrafts	1	3.5
Back or ventral duster (Jacto)	300	8
ULV Atomizer with centrifugal pump (Hudson Porta Pack or Holder SP 75)	100	15
Miscellaneous (capture equipment, design of extension sheets, first aid kits, jerrycans, drums)		5
Spare parts and tyres		34
Fuel for surveys and interventions (+ diesel fuel)		80
Delivery of equipment and pesticides (rate of 27 CFA/t/km)		54
1250 aircraft flight hours (survey)		22
Aircraft purchase (example: Britten Normal BN2)	2	500
Training		12
Temporary labor, handling cost		80
Reporting of aerial treatments and ground logistics of planes		( )
Technical Assistance		( )
TOTAL		3397.5

VI. EVALUATION OF PESTICIDE IMPACT ON PESTS AND ENVIRONMENT

Should donor entomologists be involved as technical experts in the grasshopper control activity, it is desirable in cooperation with their Senegalese counterparts (NCPS or ISRA/CILSS Integrated Management) that they diversify their research program in the following areas:

1. Evaluation of insecticide impact on pests and environment as ground and aerial treatments are implemented.

2. Survey of loss profile for some crops (millet, maize, sorghum) infested very often by grasshoppers.

3 Efficiency test of various mixes of some insecticides deemed efficient against grasshoppers.

4. Evaluation of other non chemical control methods (farming systems, pests, parasites) for grasshopper population reduction). The satisfactory results of these control measures will enable farmers to find other control alternatives given insecticide shortage (the Government will not be able to provide further supply) and reduce the use of costly pesticides. (1500-3000 CFA francs/l).

5. Design of an integrated on-farm grasshopper management pilot program involving village population (farmers, students, youth groups, women) in survey and signalling of grasshopper infestations. (Table I)

VII. EVALUATION OF THE CAMPAIGN RESULTS AND PROSPECTS FOR THE 1988/89 CAMPAIGN

VIII. ANNUAL REPORT

ANNEXES & TABLES

ACTION PLAN OF 1987 GRASSHOPPER CONTROL CAMPAIGN IN SENEGAL

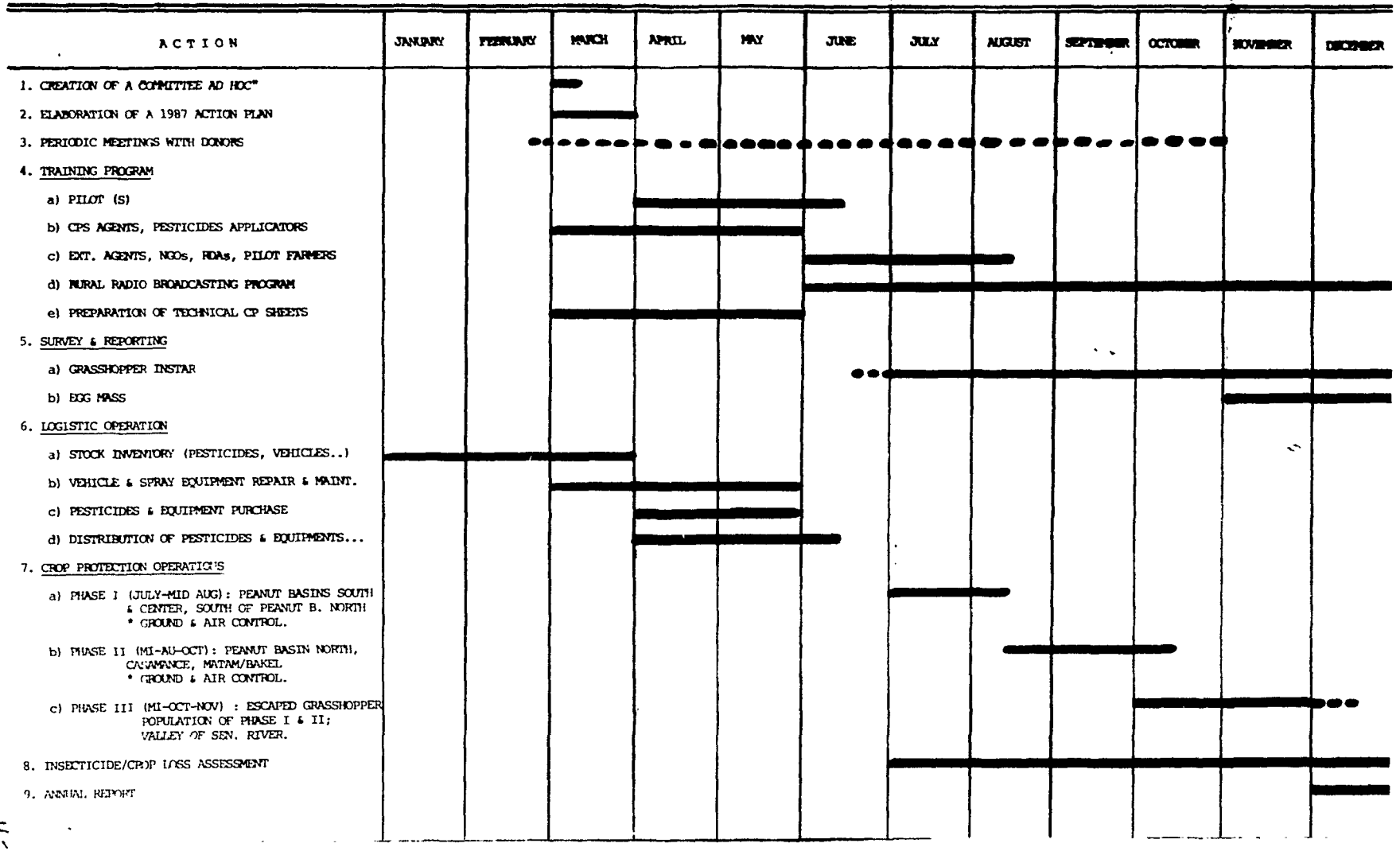


Table I.

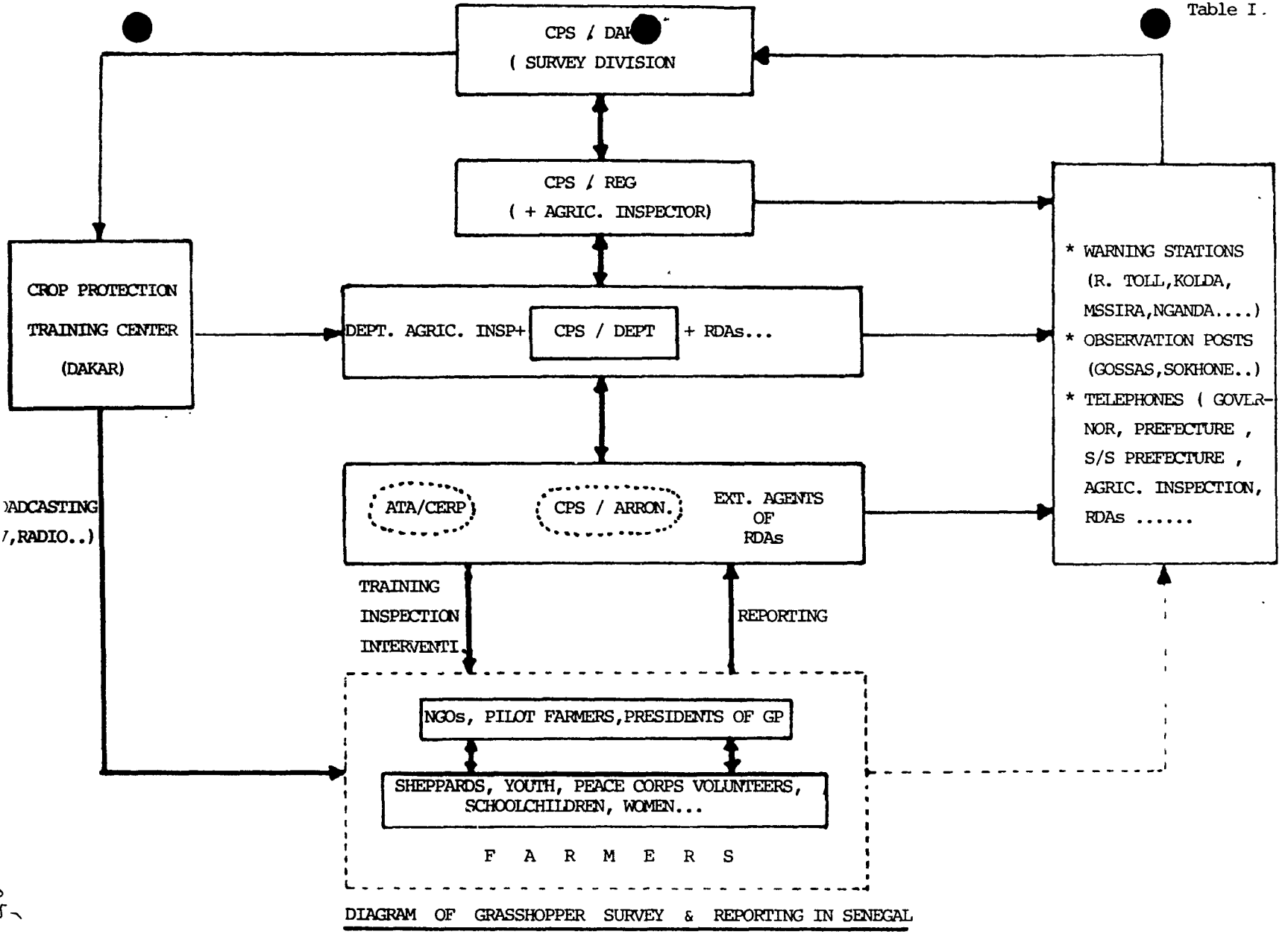


DIAGRAM OF GRASSHOPPER SURVEY & REPORTING IN SENEGAL

SUMMARY TABLE OF DIFFERENT CONTROL MEASURES BASED ON THE DIFFERENT STAGES OF GRASSHOPER DEVELOPMENT AND INFESTATION LEVELS

GRASSHOPPER INFESTATION RATE	INFESTED AREA	GRASSHOPPER DEVELOPMENT STAGES	GROUND CONTROL			AERIAL CONTROL		
			INSECTICIDE	CONTROL MEANS	APPLICATORS	INSECTICIDE	CONTROL MEANS	APPLICATORS
LOCALIZED	SMALL CULTIVATED AREAS	NYMPHS (STAGE:1-4)	DUSTING (Propoxur 1%; Fenitrothion 2.5%)	*BAITING: cereal bran + dust *DUSTING BAGS *DUSTER *BELLOWS	FARMERS			
	* FALLOW * GRASSLAND * FOREST * LARGE CULTIVATED AREA	NYMPHS (STAGE:1-4)	FORMULATION EC or ULV (Carbaryl Malathion, Fenitrothion, Diazinon	* UNIMOG	*CPS team assisted by pilot farmers selected from rural communities or villages			
		NYMPHS (STAGE:1-5) ADULTS		*EXHAUST *ULV SPRAYER				
GENERALISED		NYMPHS & ADULTS				*FORMULATION ULV (Carbaryl Fenitrothion, Malathion, Diazinon)	AIRCRAFTS	*PILOTS assist by ground support (CPS, Ag Ext. Agents, Force, Health Agents)

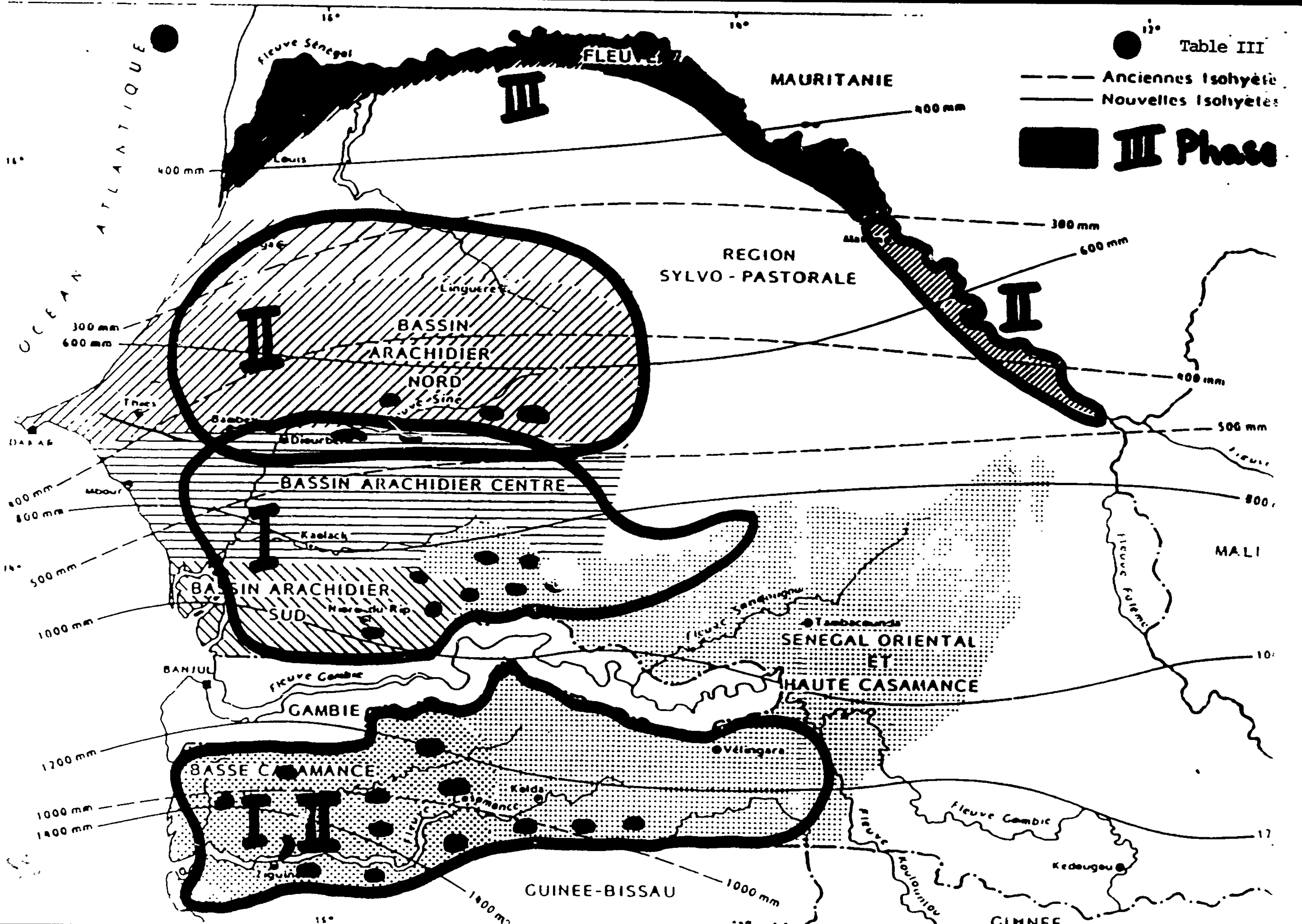


Table III
Anciennes Isohyètes
Nouvelles Isohyètes
III Phase
MAURITANIE
Fleuve Sénégal
III
OCEAN ATLANTIQUE
400 mm
300 mm
600 mm
REGION
SYLVO-PASTORALE
BASSIN
ARACHIDIER
NORD
II
Linguere
Thies
DAKAR
Diourbel
Mbour
BASSIN ARACHIDIER CENTRE
I
Kaolack
BASSIN ARACHIDIER
SUD
Nioro du Rip
500 mm
800 mm
1000 mm
MALI
Tambacounda
SENEGAL ORIENTAL
ET
HAUTE CASAMANCE
BANJUL
Fleuve Gambie
GAMBIE
Vélingara
BASSE CASAMANCE
Kolda
I, II
1200 mm
1400 mm
Ziguinchor
GUINEE-BISSAU
Fleuve Gambie
Kedougou
GUINEE

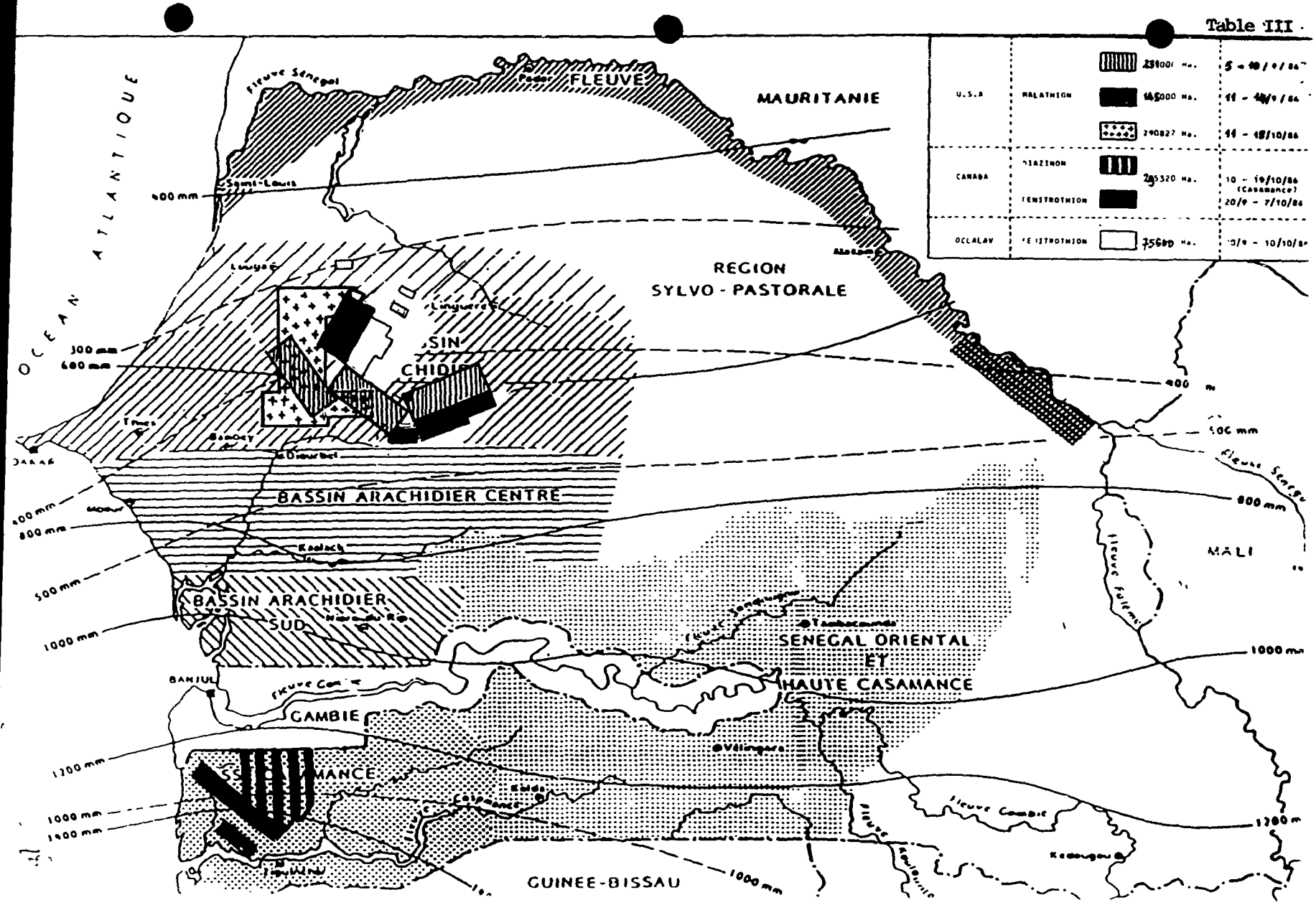


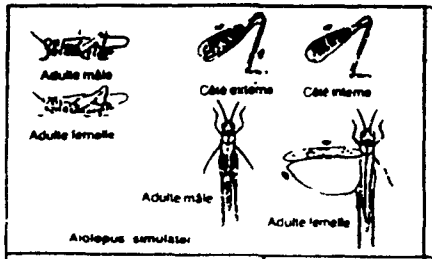
Table III
U.S.A
MALATHION
CANADA
FENITROTHION
FLEUVE
MAURITANIE
OCEAN ATLANTIQUE
Fleuve Sénégal
Saint-Louis
REGION
SYLVO - PASTORALE
BASSIN ARACHIDIER CENTRE
BASSIN ARACHIDIER
SUD
SENEGAL ORIENTAL
ET
HAUTE CASAMANCE
MALI
Fleuve Falémé
Fleuve Gambie
BANJUL
GAMBIE
GUINEE-BISSAU
Ziguinchor
Kolda
Tambacounda
Kaolack
Diourbel
Thiès
Louga
Linguère
Matam
Kédougou
300 mm
600 mm
400 mm
500 mm
800 mm
1000 mm
1200 mm
1400 mm
1600 mm

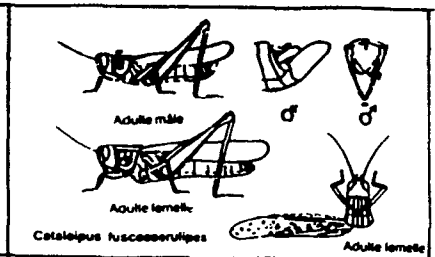
REPUBLIQUE DU SENEGAL
DIRECTION DE PROTECTION DES VEGETAUX
USAID
Km15, ROUTE DE RUFISQUE, DAKAR, SENEGAL

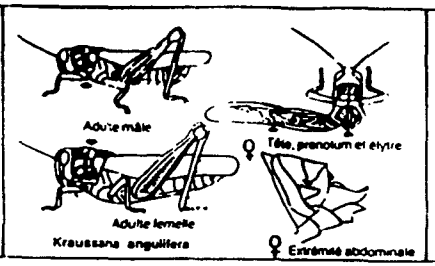
Annex I

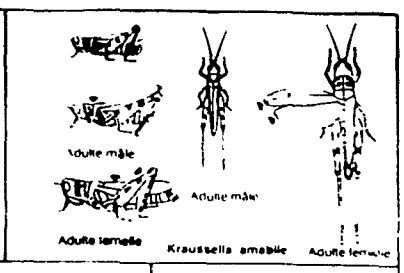
IDENTIFICATION DES SAUTERIAUX LES PLUS COMMUNS AU SENEGAL

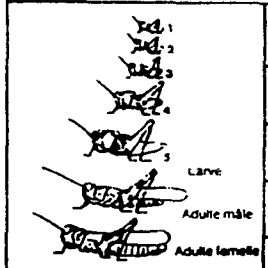
(CAMPAGNE AGRICOLE 1986/1987)

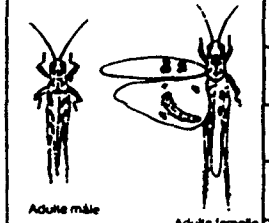




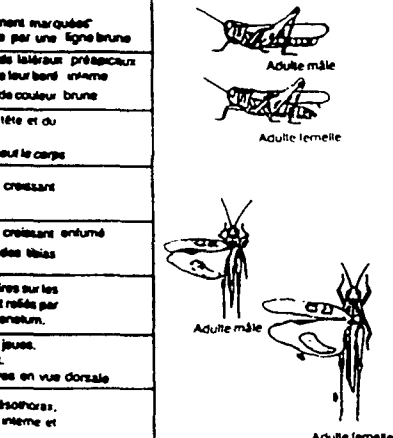


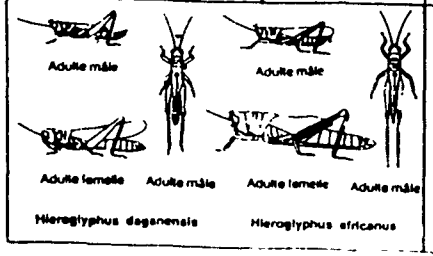


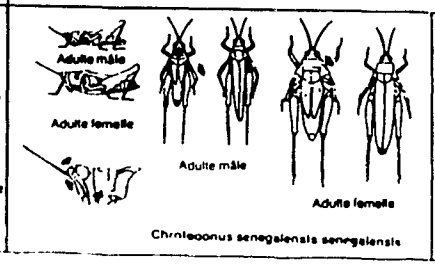


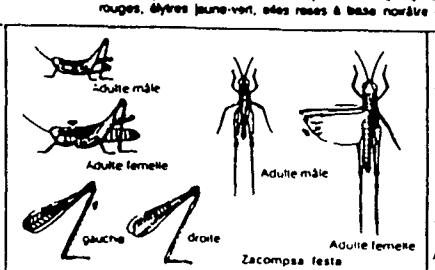


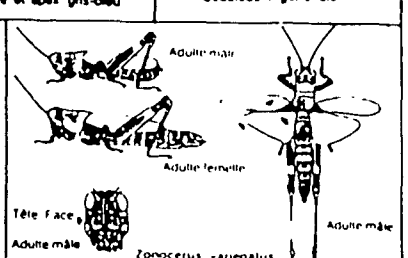
Aiolopus simulator	Fovéoles temporales allongées, trapézoïdales. Pigmentation des pattes postérieures côté externe et côté interne Moitié des élytres, apex des ailes enfumé.	Fémurs postérieurs 3 fois plus longs que larges Tibias postérieurs beaucoup plus courts que les fémurs
Cataleipus fusceseerulipes	Plaque sous-génitale du mâle à apex excisé. Cerques du mâle moins de deux fois plus longs que la hauteur de la dilatation terminale.	Plaque sous-génitale du mâle large de profil. Taches claires des lobes latéraux du pronotum fortement marquées Carène supéro-externe des fémurs postérieurs longée par une ligne brune
Kraussaria angulifera	Tubercule prosternal fortement recourbé vers l'arrière, touchant presque le mésosternum, renflé en son milieu, à apex sub-aigu. Plaque sous-génitale du mâle trilobée, à lobe apical conique et	aigu, les lobes latéraux sont des expansions des bords latéraux présecteurs Cerques avec une petite dent ou un tubercule à la base de leur bord interne Quatre taches claires sur les bords latéraux du pronotum de couleur brune
Kraussella amabile	Peignes striduloteires sur la face interne des fémurs postérieurs Fovéoles temporales profondes, avec des bords relativement aigus Taches noires sur les fémurs postérieurs côté externe et côté interne	Couleur générale jaune, avec les côtés latéraux de la tête et du thorax gris bleu, dessins noirs Elytres et ailes enfumées à l'apex Finement velu sur tout le corps
Oedaleus senegalensis	Pronotum généralement marqué d'un X. Bord postérieur du pronotum arrondi.	Ailes postérieures de couleur jaune à la base, grand croissant enfumé s'étendant de l'avant à l'arrière de l'aile
Oedaleus nigeriensis	Pronotum généralement marqué d'un X. Bord postérieur du pronotum anguleux.	Ailes postérieures de couleur jaune à la base, grand croissant enfumé Côté interne des fémurs postérieurs et partie apicale des tibias postérieurs souvent rouge orangé.
Hieroglyphus africanus	Fastigium du vertex court, dépassant peu le niveau des yeux. Bord postérieur du pronotum en angle obtus. Tête conique, obtuse, robuste. Taches noires sur le dessus des tarses postérieurs. brachyptère et longipère.	Premier et troisième sillons non reliés par des bandes noires sur les parties latérales du pronotum, alors, tous les sillons sont reliés par des bandes noires irrégulières sur la partie dorsale du pronotum.
Chrotogonus senegalen. senegalensis	Bord antérieur du prosternum constituant un large collier couvrant les parties postérieure et inférieure de la bouche. Eperons des tibias postérieurs plus courts que le segment basal.	Front de profil rarement en gradin, rugueux ainsi que les joues. Ocelles latéraux moyens à petits, bien distincts des yeux. Bords latéraux du pronotum non distinctement concaves en vue dorsale
Zacompsa festa	Carènes latérales du pronotum absentes entre le premier et le deuxième sillon transversal, presque complètement effacées dans la métazone	Taches pigmentaires noires sur la tête, le pronotum, le mésothorax, le métathorax, les élytres, les pattes postérieures côté interne et côté externe Apex des ailes enfumé
Zonocerus variegatus	Bord antérieur du prosternum ne couvrant pas les parties postérieure et inférieure de la bouche Partie dorsale du pronotum lisse	Premier tergite abdominal possédant un tubercule glandulaire Couleur générale du corps noire et jaune avec quelques taches rouges, élytres jaune-vert, ailes roses à base noirâtre et apex gris-bleu

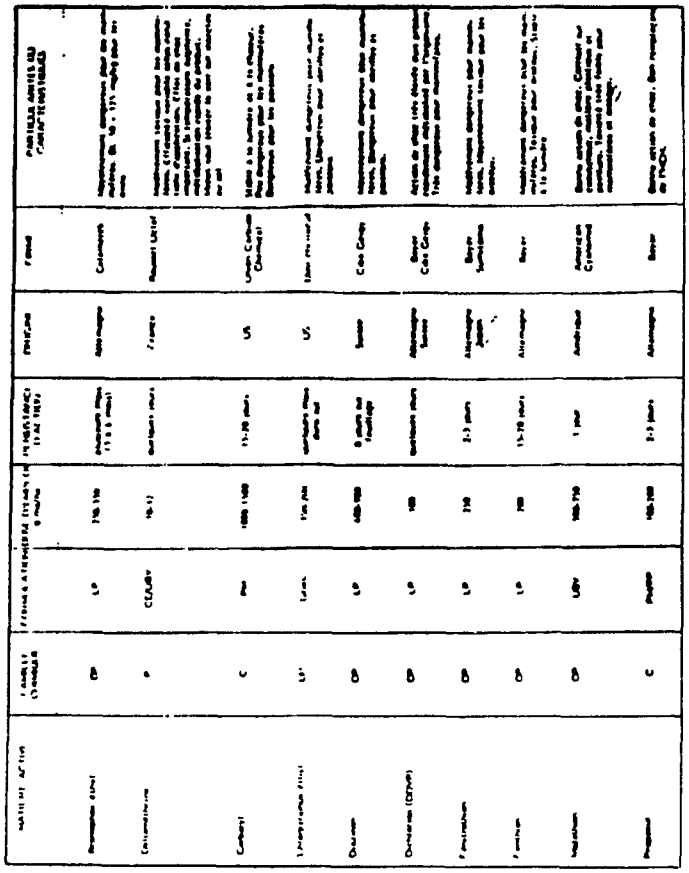






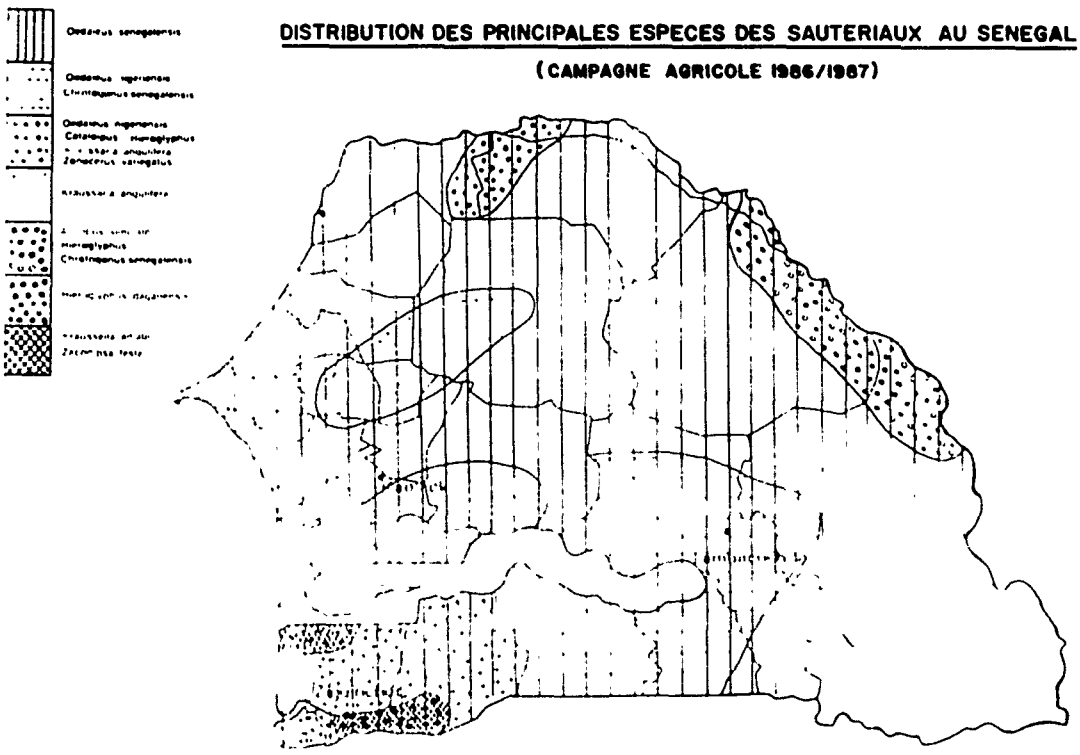






DISTRIBUTION DES PRINCIPALES ESPECES DES SAUTERIAUX AU SENEGAL

(CAMPAGNE AGRICOLE 1986/1987)

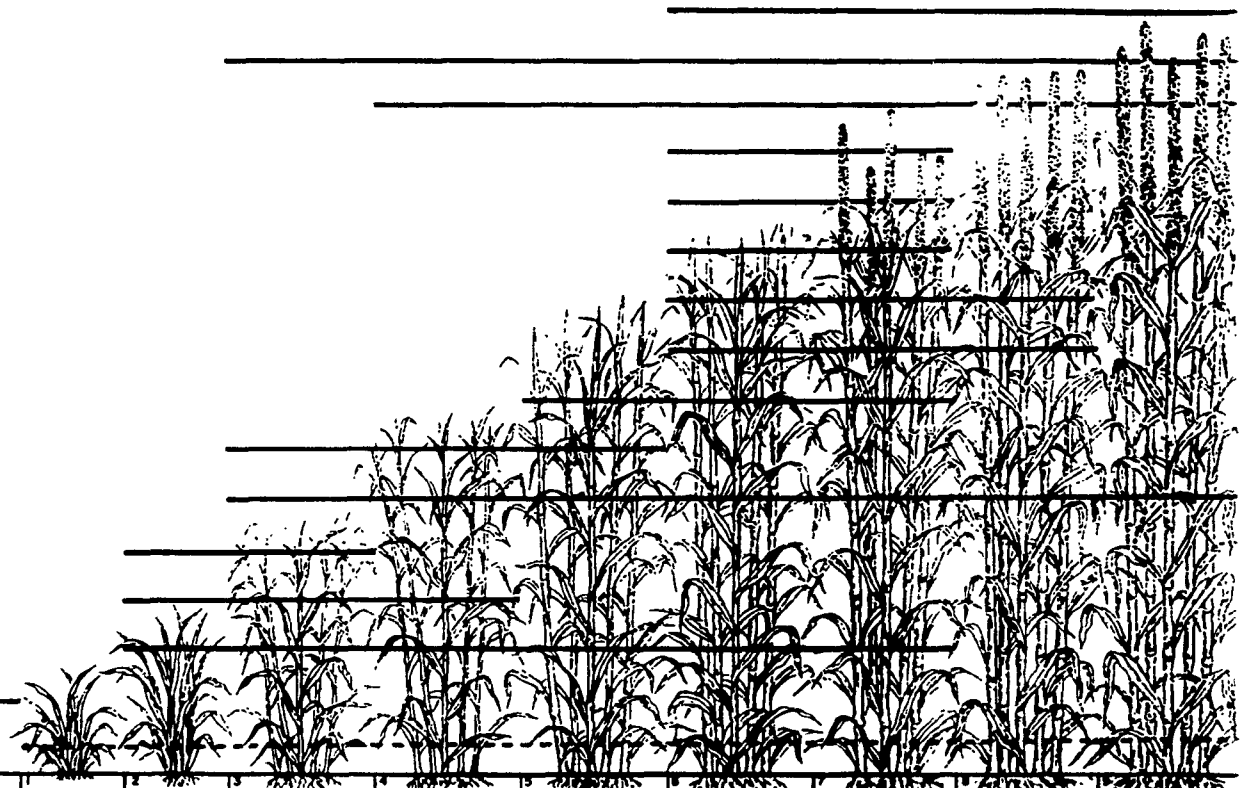


Annex I

DIRECTION DE PROTECTION DES VEGETAUX
USAID
Km15, ROUTE DE RUFISQUE, DAKAR, SENEGAL

LES INSECTES RAVAGEURS ET MALADIES DU MIL (SOUNA) DANS LA REGION CENTRE ET NORD DU SENEGAL

1 CHARBON (Polysporium sp.)
2 MIL DIOU (Sclerospora graminicola)
3 STRIGA spp
4 PUNAISE (Dysdercus sp.)
5 CECIDOMYIE (Geromyia penniseti)
6 MELOIDES (Epicolaspis spp.)
7 MINEUSE D'EPI (Rhaguva albipunctella)
8 CHENILLE DE L'EPI (Heliothis armigera)
9 FORFICULE (Forficula senegalensis)
10 NOCTUELLE (Diphtima leroyi)
11 FOREUR DE TIGE (Acigona ignefusalis)
12 CHRISOMELE (Lema planifrons)
13 NOCTUELLE (Spodoptera exigua, S. exempta)
14 CHENILLE POILUE (Amsacta melanoi)
15 IULES
16 SAUTERIAUX



0	1	2	3	4	5	6	7	8	9
Emergence du coléoptile	Apparition de la 3e feuille	Apparition de la 5e feuille. Développement des racines adventives, la plante devient vert foncé et vigoureuse	Apparition des talles. Développement des racines latérales. Formation des 1er et 2e entre-noeuds, initiation de l'épi.	Allongement des entre-noeuds, de la tige en séquence, initiation des tiges et des épillets.	Gonflement de l'épi qui reste encore enfermé dans la gaine de la feuille paniculaire	Apparition des stigmates au bout de 3-5 jours après épiaison, suivies de celle des anthères - 50 % Floraison	Formation des grains laiteux au bout de 6 à 7 jours après la fécondation	Formation des grains pâteux caractérisé par l'augmentation du taux d'amidon et la diminution du % d'humidité dans l'endosperme	Maturité physiologique marqué par la présence d'un point noir au niveau de la graine, l'endosperme se durcit.

Levée — Tallage (1er Sarclage, Engrais, Démariage, 2è sarclage) — Montaison-Epiaison-Floraison (35e j/r, 55e j/r, 75e j/r) — Maturation (95e j/r)

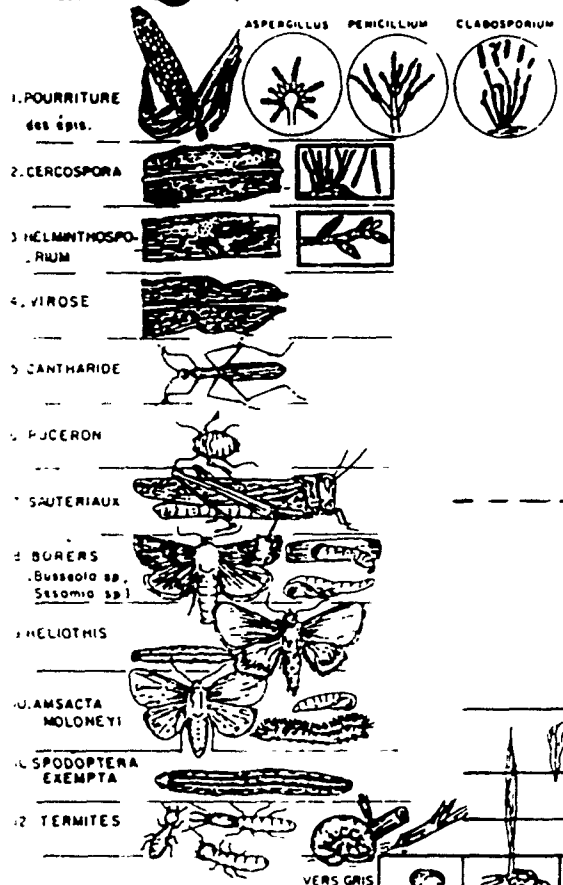
STADES VEGETATIFS | DEVELOPPEMENT DE L'EPI | FORMATION DES GRAINES

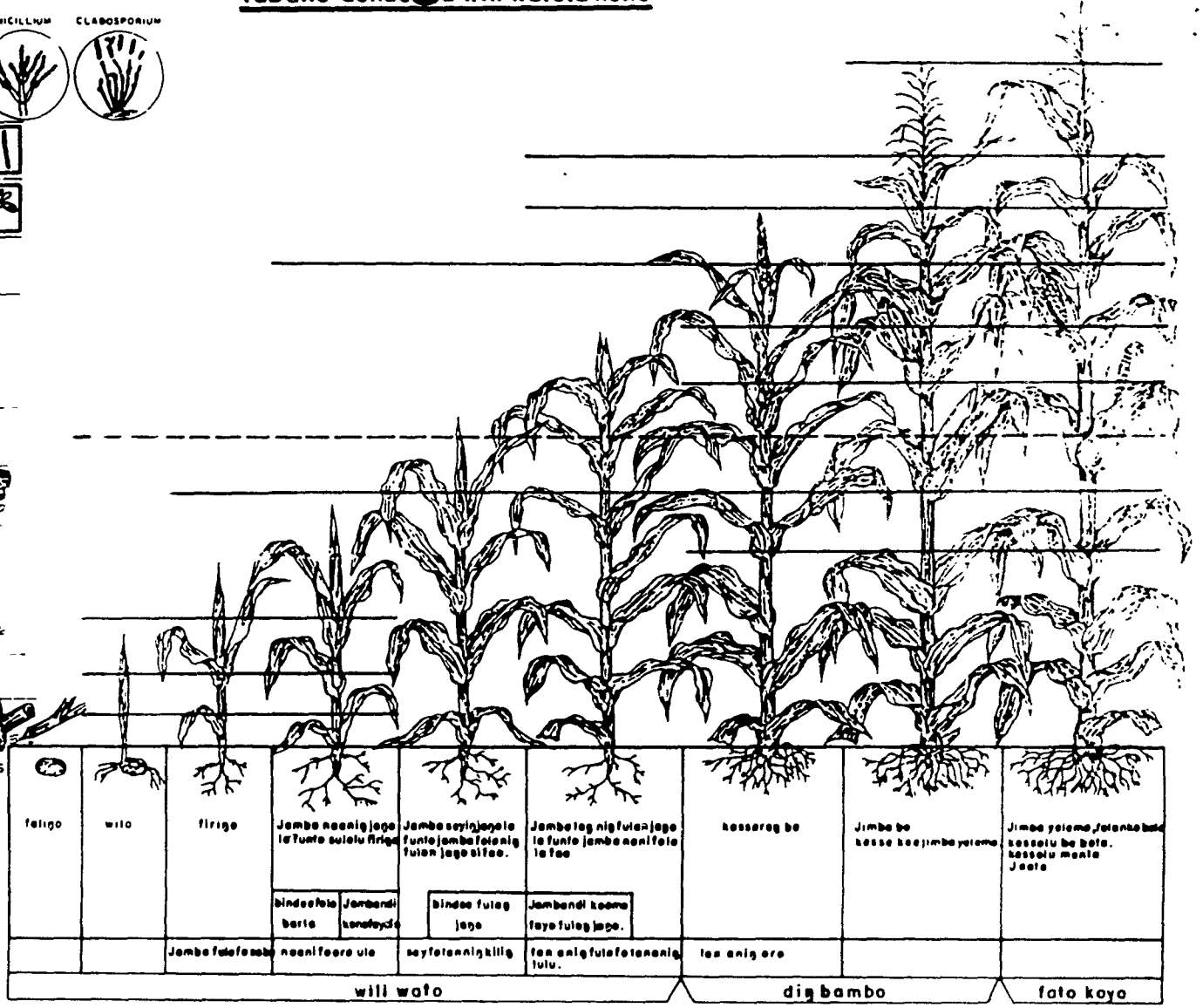
SOMIVAC/PIDAC

Section Prote[illegible]es Vegetaux

tubaño dokud[illegible]a wili watolu kono

Annex I

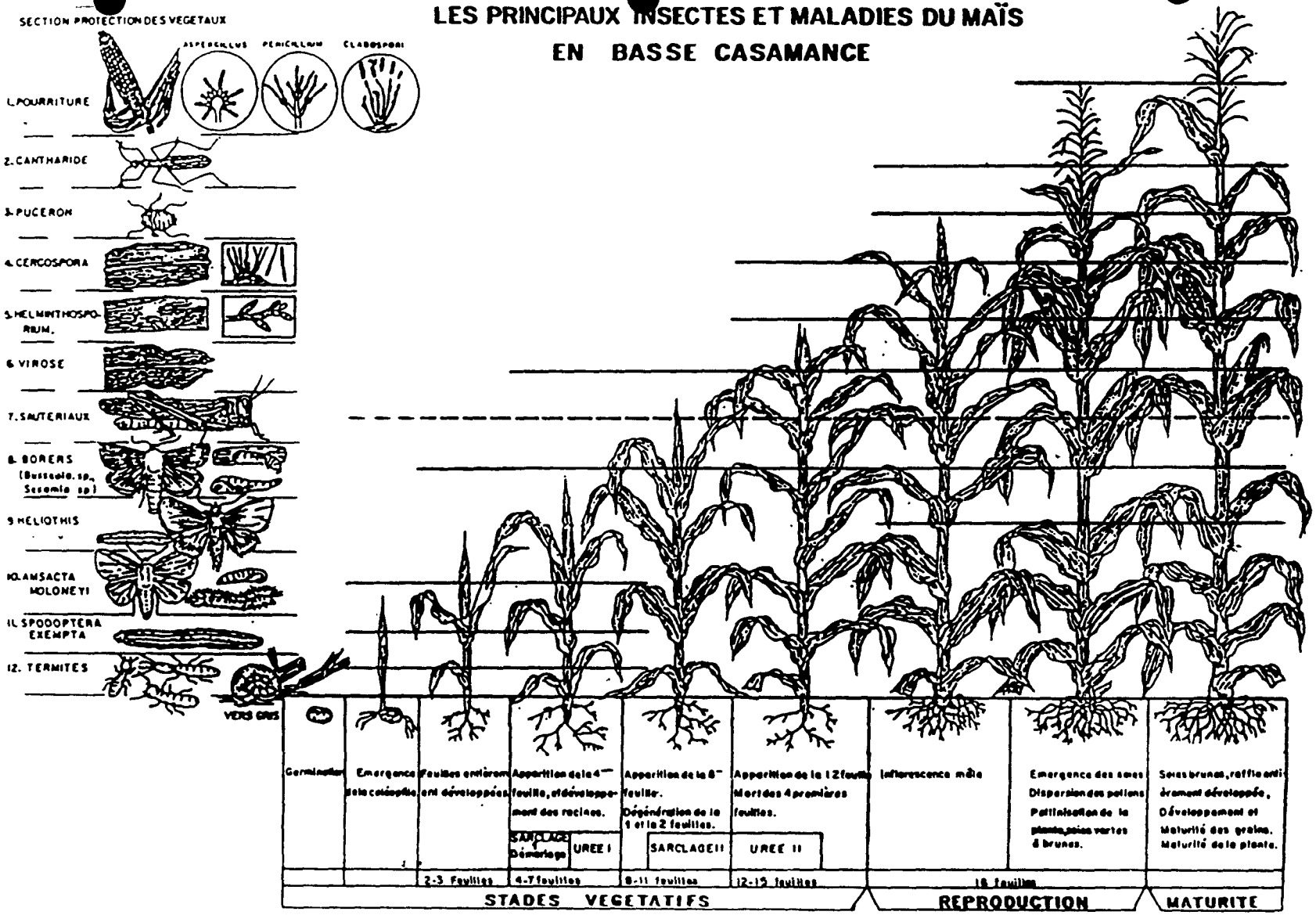




SOMIVAC

SECTION PROTECTION DES VEGETAUX

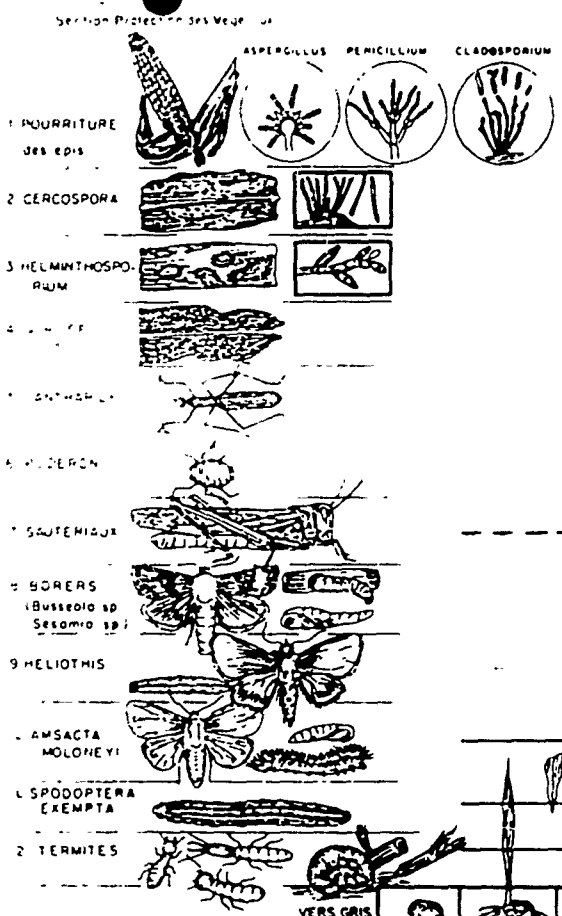
LES PRINCIPAUX INSECTES ET MALADIES DU MAÏS EN BASSE CASAMANCE

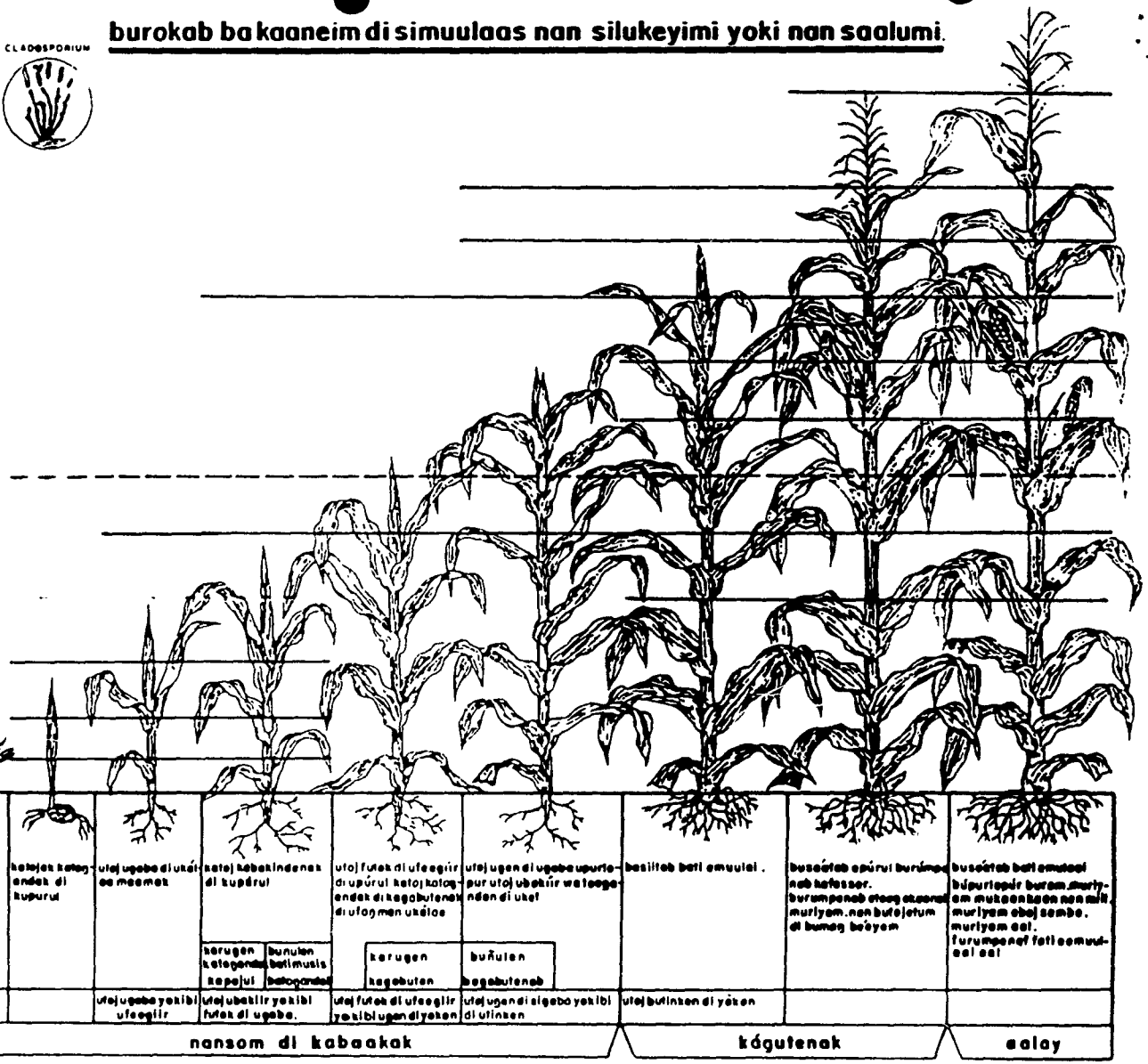


SOMA ...

Section Protection des Vege ...

burokab ba kaaneim di simuulaas nan silukeyimi yoki nan saalumi.





ecumb	katojat katogendek di kupurul	utoj ugobe di ukúdoo meemat	katoj kobaxindenas di kupúrul		utoj futek di ufoegtir di upúrul katoj katogendek di kagobutenek di ufoymen ukáloo		utoj ugen di ugobe upurtopur utoj ubatiir wa toogendek di ukaf		basiitab bati emuulai .	buseótab epúrul burúmoonab kafesser. burumpenab etoog atoonat muriyem. nan butojetum di bumog bobyem	buseótab bati emuloal búpurtapir burom muriyem mukoonkoon nan mili muriyem oboj sombo. muriyem oal. furumpenaf fati eomuuloal oal
			kerugen kategendek kapoju	bunulen batimusis batogendek	kerugen kagobuten		buñulen bogobutenob				
		utoj ugobe yoxibi ufoegtir	utoj ubatiir yoxibi futek di ugobe.		utoj futek di ufoegtir yoxibi ugen diyoken		utoj ugen di ugobe yoxibi di utinken		utoj butinken di yóken		
nansom di kabaakak									kágutenak		oalay

Annex II

AIRCRAFT PERFORMANCE TABLE

Assumptions:

1. Three hours of boom time are available on an average day. This would mean that approximately four hours of good spraying conditions are available to allow for time in turns and in the case of multiple loads - ferry time and loading time.

2. Small planes can usually be located within 15 minutes of the spray area. Large planes usually need 30 minutes or more.

3. In the case of multiple loads, rapid reloading of the spray system is available.

4. In some cases more acreage can be treated by reducing the load and making multiple loads.

Annex II

AIRCRAFT PERFORMANCE

		AIRCRAFT CATEGORY			
		D	C	B	A
		AG WAGON PAWNEE	THRUSH AIR TRACTOR	PV-2 DC-3	DC-6 DC-7
SWATH					
Feet		100	150	500	750
Meters		30	46	152	230
CAPACITY					
Gallons		150	400	1,000	3,000
Liters		568	1,514	3,785	11,356
SPEED					
Miles per hour		100	125	200	240
Kilometers per hour		161	201	322	386
PERFORMANCE					
Acres per minute		20	38	202	364
Hectares per minute		8.2	15.3	81.8	147.2
Acres per hour		1,212	2,273	12,121	21,818
Hectares per hour		491	920	4,905	8,830
MALATHION/FENITROTHION					
Hours per load		2	2.8	1.3	2.2
Acres per load		2,400	6,400	16,000	48,000
Hectares per load		971	2,590	6,475	19,425
Acres per day	*	4,000	6,400	25,600	48,000
Hectares per day	*	1,620	2,590	10,360	19,425
CARBARYL					
Minutes per load		48	68	32	53
Acres per load		960	2,560	6,400	19,200
Hectares per load		388	1,036	2,590	7,770
Acres per day	*	2,110	5,120	12,800	38,400
Hectares per day	*	855	2,070	5,180	15,540

* Figures are approximate --- Spray conditions, ferry distance, length of runs, insecticide and fuel capacity, etc., etc. may increase or decrease these figures. Possible evening flying is not considered here either.

Doc 3560A

ACTION PLAN FOR THE 1987 LOCUST CAMPAIGN IN SENEGAL

SENEGAL

ACTION PLAN

PD-ABC-870
1 OF 1 (24X)
1987