Consortium for International Crop Protection

4321 Hartwick Road Suite 404 College Park Maryland 20740 USA
Telephone (301) 403 4223 ☐ Cable CONSORTICP
Telex 5106013963 ☐ FAX (301) 403-4226

ASSIGNMENT IN BURKINA FASO

A report on the 1986 grasshopper control program in northern Burkina Faso

Duane E. Bartholf
Consultant
Consortium for International Crop Protection

October, 1986

USAID/Burkina Purchase Order
No 9291002, AID-324-1986
and AID-400-86

INTRODUCTION

The northern half of Burkina Faso forms a small portion of the southern edge of the Sahel, the northeastern part of Burkina jutting up like a wedge between Mali and Niger

During the later stages of the 1985 crop year, the provinces of Oudalan, Soum, Seno, Sourou and Yetanga suffered considerable grasshopper damage, in part from migrations moving across the borders of Mali and Niger, and too, from a heavy outbreak of third generation hoppers within these provinces With the movement of hoppers into the maturing croplands already affected by local drouth conditions, the overall loss to the important cereal grains became significant

In 1986 the rains came early to northern Burkina, the first sporadic showers falling in late April By mid-May all of the northern provinces had received enough precipitation for the farmers to till their lands and plant their seeds of millet and sorghum The rains also triggered the hatch of first generation Oedaleus senegalensis, the much-feared migratory grasshopper whose capabilities to wipe out a field of young millet of sorghum is second only to the Desert Locust

The young O senegalensis nymphs, along with considerable numbers of non-economic species of grasshoppers, moved from their hatching grounds in adjacent natural grasslands into the lush, green fields of young cereal grains, destroying thousands of hectars in a matter of days. In the Yetanga province alone, more than six thousand hectars along the Mali border were planted four times before the farmers gave up and abandoned their fields Lesser numbers of hectars were reported abandoned in each of the other northern provinces.

The Burkina Crop Protection and ORD (Organization for Regional Development), and organization who, during periods of emergency, work in close cooperation with /crop Protection, put what resources they had against the grasshopper outbreak. They distributed propoxur 1% dust and dusting bags to the farmers in outlying villages, and using motor-driven backpack blowers, began treating those fields reported to have heavy concentrations of grasshoppers

Two factors were working against the control operations from the start. First, large amounts of the propoxur 1% dust, the bags having labels dated 1982, proved totally ineffective, the insecticide having lost its toxicity laying in storage The second, dusting with the backpack blowers was limited to croplands under attack, the crews by-passing the adjacent natural

grasslands, although these areas contained high grasshopper populations and the sites of heavy egg deposition. These grasslands became the source of reinfestation to the treated fields

By mid-June, with reports continually coming in of new areas under attack and the reinfestation of treated fields, the Government of Burkina initiated an appeal for assistance This early appeal was for more insecticide dust, dusting bags, and motor-driven blowers.

A number of countries responded immediately, donating large amounts of insecticide and equipment. Armed with these fresh supplies, the Burkina Crop Protection and ORD were in part successful in combating localized grasshopper outbreaks, but were unable to respond and reduce the growing number of hectars reported infested

As the situation continued to deteriorate, GOB, FAO and USAID/Burkina began planning for an expanded operation. To effectively control the populations of grasshoppers in ever-increasing numbers of hectars, and with reports arriving that some migration of O senegalensis were being observed crossing the borders form Mali and Niger, aerial application of liquid pesticides was deemed necessary. GOB assembled and aerial treatment plan based on outdated documents calling for the use of

three small planes They later increased the number to six planes.

In early August, the French and Canadian governments each agreed to supply two small aircraft for a total of four FAO would sponsor a coordinator for the airplanes All were scheduled to arrive in Burkina around September 10

A number of concerned countries responded, as well as organizations such as UNICEF and the UNITED NATIONS Pledges to donate insecticides, aircraft and support personnel came in

Shortly after the CICP consultant's arrival in Burkina Faso, on August 15, meetings were held with key people in USAID/Burkina who would have an important role in the up-coming program, as well as several representatives of donor countries. Meetings were also held with the FAO representative in Burkina, Gana Diagne, who, prior to joining FAO, was a director with OICMA, and well aware of the advantages of using aircraft to combat large outbreaks of grasshoppers and Desert Locust

It was agreed that the CICP consultant would draw up a work plan covering pre-treatment procedures, spray operations utilizing large and/or small planes, and post-treatment monitoring of the treated areas The work plan would wait, however, until the consultant could make an assessment of the problem areas

SURVEY & CONTROL

The Burkina Crop Protection and/or ORD have supervisory officers and small crews headquartered in each of the provinces, working on a number of agricultural programs Most of these officers are dedicated, intelligent, aggressive, vitally concerned individuals. Some have degrees in entomology, agronomy and related fields, obtained in France and/or the United States Under normal conditions their work progresses smoothly However, during emergency outbreaks, they are handicapped by the lack of a good reporting and communication network, equipment, and, to a lesser extent, financial support

During the assessment survey in the northern provinces in late August, the CICP consultant was accompanied for a day or more in each province by these officers They were quite able to count grasshoppers and calculate accurately density of populations. However, the form they used to record their finding at each stop was both complicated and time-consuming. They were introduced to the USDA, Plant Protection's method of counting grasshoppers per square yard, enlarged to conform to a square meter The findings at each stop could be recorded on a map. This idea was met with mixed feelings It was admittedly faster, but their headquarters still insisted on the use of a form to record the stop. Consequently, their method of recording survey stops was not

discouraged.

During late August heavy rains came, washing out roads and in many places large, shallow lakes formed. These conditions hampered the consultant's survey, but still, upon returning to Ouagudougou on September 1, a reasonably accurate figure of 300,000 hectars had been found to contain economic populations of grasshoppers, practically all being second generation O. senegalensis in fourth and fifth instar stage of development

One area in Seno province was found to be unique. Here an area containing approximately 12,000 hectars of millet was already in the flowering stage, and being ravaged by heavy populations of adult O. senegalensis, some fields exceeding 50 hoppers per square meter An estimated 30% loss to the millet crop was observed at the time The adjacent native grasslands were equally infected, and considerable copulating was in progress The farmers said that these hoppers had migrated into their fields a few days before from Niger, less than one kilometer away They had tried dusting their fields with no results, and produced empty insecticide bags to prove it The label read Propoxur 1% dust, and dated, 1982 One farmer told the consultant, "If something isn't done for us within the next two weeks, all of us will be dead|"

During early September the Work Plan for the aerial program was completed, translated into French, and distributed to the Crop

Protection and ORD Officers Short training sessions were held, using the Plan to advantage. The Work Plan advocated the use of Malathion or Sevin-4-Oil in preference over Fenitrothion because of their approval by EPA and proven non-harmful effects on the environment

On September 13, Messrs, Tim Knight, AID/Washington and Bob Adams, USFS, arrived in Ouagadougou An immediate meeting was held with USAID Director Mr Herb Miller, and several USAID staff officers. Among the many topics covered regarding the up-coming program, it was resolved that the CIPC consultant's contract be extended for another 30 - 45 days

It was also decided that more detailed survey work was required before a large plane operation in Burkina Faso could be justified. It was agreed that USAID/Burkina would fund a helicopter delivered to Ouagadougou by France, for use in survey work in areas inaccessible to ground vehicles and that 50 flying hours would be sufficient time to conduct the survey. It was later found that an additional 20 hours were needed to complete the survey program

On September 19, 20, and again on September 24, 25, the CICP consultant worked with Dr George Popov, the latter coming out of retirement to work under contract for FAO, primarily to conduct surveys in Niger and Mali, with a short stop-over in Burkina

Dr. Popov is still considered one of the world's top experts on African grasshoppers and locust. The CICP consultant knew Dr Popov well, having worked with him in Yeman in 1963, and again in Nigeria, Cammeron and Chad in 1974

In the Dori area in Seno province Dr. Popov and the CICP consultant came upon a large band of migrating Aiolopus simulatrix, often called Aiolopus simulator These hoppers were in the fourth instar, marching south-west with the wind Their number averaged 100 per square meter, covering a 3 x 4 kilometer area of natural grasslands Dr. Popov counted 500 nymphs on a single clump of grass In their line of march lay 720 hectars of maturing millet

Dr. Popov explained that A. simulator-simulatrix are migratory, doing great damage to crops in many areas of West Africa They have a unique characteristic in that they produce a single generation a year, hatching out during the Sahel's first rains They go through 5 instars, becoming adults near or at the end of the rainy season During the dry season the adult hoppers find shelter in the cracks in the ground, surviving on chaff that falls into these cracks With the start of the wet season they emerge, copulate and lay their eggs Within a few weeks hatching takes place and the cycle is repeated

It must be mentioned that this migrating band of A. simulatrix

was knocked out by a Crop Protection crew using motor-driven backpack dusters and 2% Propoxur dust The CICP consultant accompanied by the Crop Protection supervisor later monitored the area, and found that better than 95% mortality had been attained

The same area was again put under attack in early October by migrating adult O senegalensis, causing considerable damage to the maturing millet. A Canadian-funded Ag Wagon spraying Fenitrothion was able to treat the area before the total crop was lost

It was generally agreed by Crop Protection, USAID/Burkina, FAO, and the Canadian representative that the four small planes scheduled to arrive in Ouagadougou on or about September 15 from Abijon, Ivory Coast, start in Dori area, Seno province. 400,000 hectars were economically infested, millet fields were being consumed, and ground crews using Propoxur dust were fighting a losing battle

The Djibo area in Soum province, as well as Ouahigouga in Yatenga province contained considerably fewer economically infested hectars. In Yatenga province the heavier concentrations of O senegalensis appeared to be just south of the Mali border. Sporadic, but heavy rains in the area as late as early October kept the roads impassable East of Djibo in Soum province large areas were beginning to suffer from drought conditions and was of

greater concern to the farmers than the grasshoppers

The four planes arrived in Ouagadougou, but procuring enough 55 gallon (200 liter) barrels for gasoline to keep the planes flying in the remote northern provinces became a serious problem When the barrels did arrive, most came from Abijon

The French Coordinator, Monsieur Jon Puech, working under the auspices of FAO, elected to send the planes to three different locations Two were sent to Ouahigouga, one each to Djibo and Dori. This decision was strongly opposed by USAID and Crop Protection, but the decision held

With only one plane in Dori, it was decided to locate and treat several small blocks containing the highest populations of grasshoppers within the 400,000 hectar infested area Three areas were decided upon, and comprised a total of 55,000 hectars.

The Djibo area did likewise, arriving at a figure of 30,000 hectars out of an approximate 75,000 If all went well, each Ag Wagon would spray approximately 3,600 hectars a day before heat and/or winds would halt the operations.

The approximate dates the window of opportunity for effective grasshopper control in Burkina Faso is open from September 15 through October 10 In general, after September 15, the rains

are diminishing and pose little threat to spray operations and treated areas. After October 10, heavy copulation and egg-laying takes place. Too, in most areas, crops are matured and drying up, having little attraction to the last generation of gravid females and battered males The grasshoppers tend to move back into the now greener grasslands for egg deposition and final attempts at survival

Spraying operations started in the Dori and Djibo areas on September 27,. In Yatenga province, where 17,000 liters of Diazinon had been placed, the day spraying commenced is not known

On September 29, the Intertropical Front, having lain above the Mali/Burkina border for weeks, suddenly moved south of Dori, whipping like the body of a reptile westward across Burkina

That evening two large swarms of O. senegalensis struck the villages of Gorum-Gorum in Oudalan province and Dori, filling the streets with grasshoppers and chasing the occupants indoors. Eating outside, a favorite site for many of the villagers, became impossible Houses, where doors were left open, forced the occupants to seek refuge elsewhere.

This sudden movement of the front scattered the concentration of grasshoppers in the proposed treatment areas to almost non-

economic levels, and lightly reinfested the treated areas

Quick surveys found high hopper populations concentrated in native grasses and crops adjacent to now-dry stream beds These areas became the treated sites.

The French Coordinator made the decision to move the spray plane working in Djibo to Dori, and replace it with one of the two planes operating in Yatenga province The second plane arrived at the Dori airstrip on October 2

On October 6 the Intertropical Front moved back north and hung just above the Mali/Burkina border Dr. Popov had mentioned that this could happen, and would keep the O. senegalensis in southern Mali from migrating south This rare phenomenon did occur, and spray operations continued without interference from further migrations or adverse weather

In the Dori area, approximately 50,000 hectars were treated, Djibo area reported 30,000 hectars treated In the Ouahigouga area in Yatenga province 17,000 liters of Diazinon were applied before starting on the supplies of Fenitrothion. Reports of mortality on treated areas ranged from 50% to 99% This was not confirmed by the CICP consultant, nor was the total hectars treated figure established

The USAID supported helicopter, having sat in Ouagadougou for over a week due to special fuel problems, became operational on October 9. The helicopter was put to work surveying Seno, Oudalan, Soum, Sanmatenga, Bam and Yatenga provinces The surveying with the helicopter, an important tool for such an operation, proved without a doubt that the sudden movement of the Intertropical Front on September 29, had indeed scattered the hoppers over a vast area of northern Burkina

The use of the helicopter continued until the CICP consultants' departure from Burkina on October 23, and was scheduled to be used through October 28

SUMMARY

Contrary to some reports that may have reached Washington, the CICP consultant found the Burkina Crop Protection had a good command structure, with knowledgeable and capable people in key positions There was no evidence of uncoordinated operations or using poor judgement They relied on the CICP consultant for advice, but the final decision was their own. They say immediately the folly of separating the small airplanes, where utilizing them as a single unit could have had an effect on reducing crop loss.

The Burkina Crop Protection have a poor reporting and communication network during emergencies Remote grasshopper outbreaks are usually not reported Telephones are often out of order Operational radios at weather stations and police posts are few and far between, and often not available

Because the program got off to such a late start, and the inability of the spray planes to effectively reduce the grasshopper populations in any of the northern province, Burkina Faso could be faced with a disastrous year in 1987 If favorable weather conditions come after the 1986-87 dry season, more than 700,000 hectars could be hosting heavy infestations In a land where subsistence farming is a way of life, this could be catastrophic.

Most crop damage can be expected to occur shortly after the young plants emerge in May and June, and again late August, September and early October during the flowering stage of the millet and the milky stage of the sorghum.

Fenitrothion 96% ULV was applied at 1/4 liter per hectar. One micronair spray system was attached to each wing of the aircraft. Droplet sizes were fairly constant at 005 Dye cards were used to ascertain this.

Monitoring of the treated areas continued through most of the operation An overall 85% mortality was achieved in the areas treated with Fenitrothion There were no adverse effects to the environment observed or reported.

Some dead beetles, possibly Carabidae, were found in the treated areas

RECOMMENDATIONS

In view of the potential outbreak of grasshoppers in 1987, USAID and Burkina Crop Protection should contact the 1986 donor countries and make plans for a more effective control program The plan should include an adequate number of spray planes and sufficient amounts of approved insecticide Also, a starting date should be agreed upon so timely control operations will be directed against the nymphal stages of the grasshoppers

AID should continue to discourage the use of long residual chlorinated hydrocarbon insecticides, and encourage the use of approved and proven insecticides of U.S manufacture for use against grasshopper outbreaks

Experts who have studied grasshopper and locust outbreaks, as well as most meteorologists in West Africa, tend to agree that favorable conditions for such outbreaks will continue for a number of years AID should consider a long-range plan for U S. participation, and take full cognizance of FAO'S expertise and established role

The micro-computer developed by Mr Michele Bernardi, who has models in operation in Burkina Faso and Niger might be explored for use in predicting grasshopper and locust outbreaks.

It is believed that aerial treatment should be geared to start in mid-September and end in early October During this period the rains have diminished and cool days prevail. Too, the last generation of grasshoppers are still in the nymphal stage.

The weather bureau stated that normally the Intertropical Front's southerly retreat passes over northern Burkina in late September Spray operations started on/or about September 15, would eliminate or reduce to non-economic levels any migrations from the north

AID should consider assembling a cadre of knowledgeable people, experienced in grasshopper and locust control techniques for guidance to AID and effected countries for short-term assignments

ACKNOWLEDGEMENTS

Appreciation to "Flip" Phillips for recommending me to the Consortium for International Crop Protection, and who was responsible for the cable from Dakar containing all the characteristics of the grasshopper O senegalensis.

To George Cavin, who had just returned from a long assignment to Mali, still took the time away from his family and drove to San Antonio to answer a multitude of questions, give a full account of the problems and what to expect in Western Africa.

To Dick Dyer, Chief Pilot, USDA, PPC, who supplied me with enough nozzle calibration, swath widths, and aircraft performance and other pertinent information to last a lifetime

Mrs. Eleanor Dawes, CICP, must be recognized, for it was she who was instrumental in getting me off to Africa on the right foot

To Dr. Altman, S&T, agriculture, who led the way through the maze of washington offices, answered questions, and equipped me with so much technical material another suitcase was needed.

Great appreciation to USAID Director Herb Miller, and his very capable staff of officers including Charles Kelly, for their almost daily assistance during my assignment in Burkina Faso.

To Mr Dominick, Director for "Save the Children" in Dori, who supplied a "guest house" and cook at a nominal charge, and was a welcome relief at the end of a hard day

To the International Red Cross who graciously allowed us to set up our sleeping cots in their compounds in the villages of Aribinda and Djibo, and to the American Missionary, who supplied our survey crew with a house and cool water during our stay in the village of Sebba

And to Tony Enison, my very able Ghanian interpreter, whose loyalty and concern for my well-being made my assignment in Burkina enjoyable and memorable.

CONTACTS

People the CICP consultant met during his assignment in Burkina Faso

U S Ambassador, Leonardo Neher

USAID, Director, Mr Herb Miller

USAID, Acting Director, John Tuleja

USAID, IPM Project Officer, David Songer

USAID, Mission Disaster Relief Officer, Boudouin de Marcken

USAID, Disaster Relief Coordinator, Charles Kelly

Burkina Crop Protection Service, Director, Traore Salifou

Burkina Department of Agriculture, Director, Monsieur Bonu

Canadian Representative, Monsieur Gilbert Benharosh

French Embassy, Monsieur Bourreau Michel

West German Embassy, First Secretary

Burkina/FAO Representative, Gana Diagne

FAO Consultant, Dr George Popov

FAO Aircraft Coordinator, Monsieur Jon Puech

ATTACHMENTS

1 Grasshopper survey form used by Burkina Crop Protection Service

2. Province outline map of Burkina Faso

3. Province outline map of Burkina Faso, showing control areas

4 Work plan

CILSS - PROJET LUTTE INTEGREE

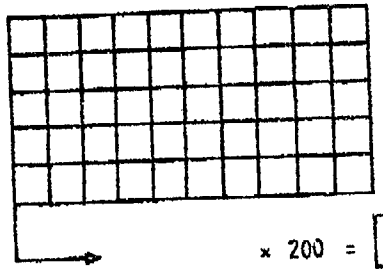
PAYS _____ STATION _____ DATE ☐☐☐☐☐☐ N° DE SERIE ☐

LATITUDE _____ LONGITUDE _____ ALTITUDE _____ RESPONSABLE _____

SURVEILLANCE OEDALEUS SENEGALENSIS

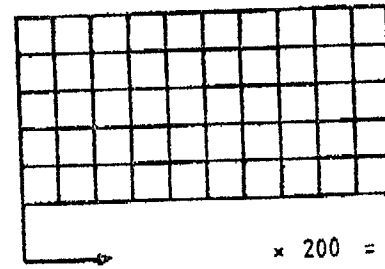
DENSITE ACRIDOFAUNE TOUTES ESPECES CONFONDUES

LARVES /50 Fois 1 m2



× 200 = _____ /ha

AILES /50 Fois 1 m2



× 200 = _____ /ha

CAPTURES 1 HEURE LARVES

Nombres de larves toutes especes confondues

Nombre de larves O S E

Pourcentage de larves O S E

DENSITE O S E LARVES _____ /ha

CAPTURES 1 HEURE AILES

Nombre d ailes toutes especes confondues

Nombre d ailes O S E

Pourcentage d ailes O S E

DENSITE O S E AILES _____ /ha

STRUCTURE DE POPULATION O S E

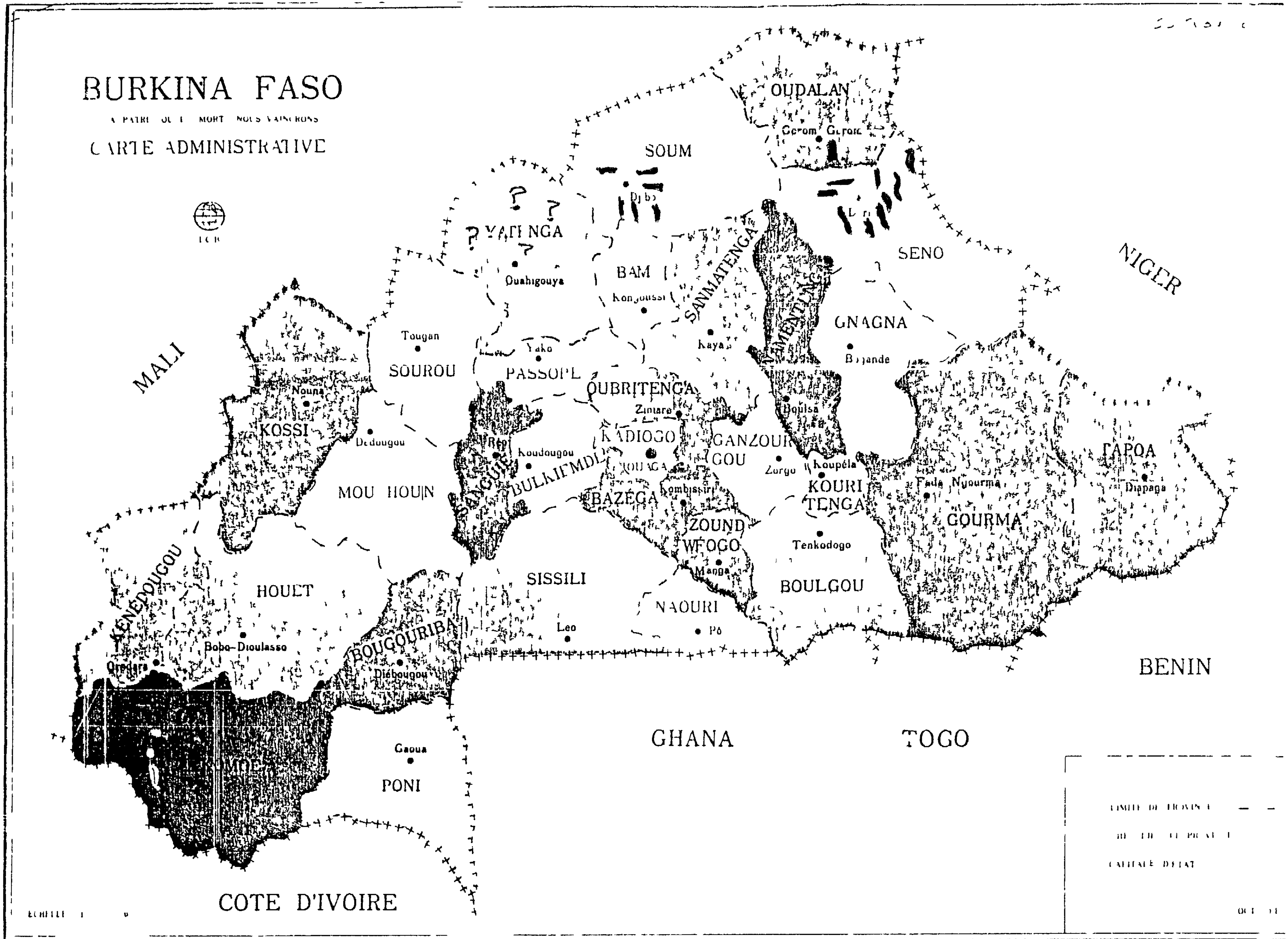
LARVES						AILES									
						MALES				FEMELLES					
L1	L2	L3	L4	L5	T	1	2	3	T	1	2	3	4	5	T

CAPTURES DES AILES AU PIEGE LUMINEUX

	LUNDI	MARDI	MERCREDI	JEUDI	VENDREDI	SAMEDI	DIMANCHE
MALES							
FEMELLES							
TOTAL							

This form used by the Burkina Crop Protection doring grasshopper surveys.

I pointed out that gathering all this information is time-consuming - Not really pertinant.


BURKINA FASO
CARTE ADMINISTRATIVE
MALI
NIGER
BENIN
TOGO
GHANA
COTE D'IVOIRE
OUDALAN
SOUM
SENO
YATENGA
Ouahigouya
BAM
Kongoussi
SANMATENGA
Kaya
GNAGNA
Bogande
Tougan
SOUROU
Yako
PASSORE
OUBRITENGA
Ziniare
KOSSI
Nouna
Dedougou
MOUHOUN
Koudougou
BULKIEMDE
KADIOGO
OUAGA
GANZOURGOU
Zorgo
Koupéla
KOURITENGA
Boulsa
BAZEGA
Kombissiri
ZOUNDWEOGO
Manga
Tenkodogo
BOULGOU
Fada Ngourma
GOURMA
TAPOA
Diapaga
KENEDOUGOU
HOUET
Bobo-Dioulasso
Orodara
BOUGOURIBA
Diébougou
SISSILI
Leo
NAOURI
Pô
Gaoua
PONI

WORK PLAN

INTRODUCTION

The effectiveness of any aerial control program depends on sound planning Ideally, the person(s) who will supervise an aerial program should have a major role in the planning and organization of the operations

PLANNING

1 Areas

When areas to be treated are large and will require the use of more than one spray plane, or involve separated geographic entities, operations can usually be managed more effectively by dividing the areas scheduled for treatment into units Large units may require separate supervision and staffing.

2 Units

Units should be divided into blocks so that flight lines (spray runs) for small, single engine spray planes will be no longer than 3-5 kilometer For large, multi-engine planes the flight lines should be no longer than 10-13 kilometers If the terrain is such that automobile headlights, or mirrors can be used to signal the spray planes on their runs, longer distances may be authorized. It must be considered that the longer the spray run, the chance for pilot-error is increased and results in poor

application

3 Boundaries

Natural boundaries such as highways, roads, railroads, prominent hills, rocks, rivers, brush patches, buildings, etc. should be utilized as boundary markers whenever possible When no natural markers exist, white cheesecloth, one meter square, should be posted between stakes, or on high vegetation Only white should be used, other colors tend to blend in with the color of the terrain. White colored markers can be seen by the spray pilots for considerable distances.

When it is planned to use more than one spray plane in a unit, the blocks within the unit should be arranged so that the pilots can treat their assigned blocks without danger of collision on turns Where this is impossible or impracticable, implementing tandem spraying techniques could be utilized

Blocks containing sensitive areas such as water ponds and reservoirs, poultry farms, beehives, etc should be arranged so that spray runs and/or turns will be avoided or held to a minimum over these areas.

Blocks which contain towns and/or villages, or are immediately adjacent to these people-congested areas, should be arranged so as flying or turning over these areas will be avoided during the spray run

Units and blocks within units should be divided into as rectangular shapes as possible to enable the spray pilot to fly

straight, parallel swaths. When boundaries are curved or crooked, pilots are inclined to straighten up the flight lines, resulting in skips, wide swathing and missed areas, which result in multiple treatments Always plan for spray swaths to run north and south to avoid the pilot from having to fly into the rising sun, as would be the case in east-west spray runs

4 Notification

Law enforcement officials, and officers in charge of the military, as well as commercial airline officials should be informed of the proposed serial operations, proposed dates, time of day spray aircraft will be operating, and the location(s) under consideration Local medical officials should be supplied with information regarding the insecticide to be used and the proper antidote to be used in case of an accident. The label from the pesticide container is an excellent source for this information

5 Maps

Maps are essential aids for planning field work, orienting surveyors, flagmen, and pilots, and should be large enough to show treatment areas Maps are useful in graphically recording hectars treated each day

OBSERVATION

I Aircraft

A four-place airplane is most valuable in any spray program.

This plane can be used to show the spray pilots the boundaries of the blocks they will be assigned to treat, aerial observation of the spray planes during operations and emergency flights to medical facilities in case of an accident

AIRPORTS

I Airstrips

Airports or airstrips must be adequate in length to accommodate the type of aircraft to be used on the program The person(s) in charge should obtain the following information

A. Is there adequate space for loading spray planes without interfering with each other or other traffic?

B Can the aircraft be loaded near the takeoff runway to avoid excessive taxing?

C Is the insecticide loading site available to delivery trucks?

D Is there adequate space and security for pesticide storage?

E Is aviation fuel available?

F. Are medical facilities near operational site?

2. Airport, airstrip size

For multiengine aircraft, the length of runway must be a minimum of 2 25 kilometers, the width must be no less than 38 meters wide

3. Storage

A minimum supply of pesticide should be available to meet the

requirements of the spray planes for at least five long operating days without replenishment.

Storage and loading sites should be located near the end of the runway from which take offs will be started. However, these sites must be far enough away so as not to interfere with other aircraft using the runway

If the airstrip has an appreciable slope, storage and loading facilities, should be located at the high end.

4. Pumping equipment

Pumps used for unloading delivery trucks, or recirculating the pesticides should be located so as not to interfere with the aircraft loading pumps Where barrels are used to replenish insecticide, they should be placed so they are readily available, but away from the actual aircraft loading site

PERSONNEL

1 Operations Supervisor

The **Operations Supervisor** is in overall charge of the spray operations He should determine the number of personnel required for each operational phase of the program and assign personnel to specific duties coordination the work of fieldmen who scout and delimit the areas to be treated.

The supervisor will divide areas into blocks once the areas to be treated have been determined, and assign personnel to these areas He will also determine the amount and type of equipment needed by ground personnel For example a man assigned to

loading aircraft would not need a radio, whereas a person assigned to a spray area would not necessarily require gloves. The Operations Supervisor will report daily to Ouagadougou on the extent of spray operations and requirements

2. Airstrip Supervisor

Each airport, or airstrip should have one man assigned to be the Operations Supervisor(s) representative when aircraft are being flown. This **Airstrip Supervisor** correlates information from the field personnel and relays this information to the pilots, and/or Operations Supervisor directing aircraft loading personnel and is responsible for radio communications between the base and field

3 Timekeeper

Each airport should have a **Timekeeper** to record each aircraft take off and landing time, liters pumped into each spray plane, total liters of pesticide used each day, and determining amount of pesticide remaining in storage This information should be reported to Operations and Airstrip Supervisor

4 Scouts

Scouts are needed to delimit areas to be treated with pesticides and when necessary, flag treatment block boundaries The Scouts

should be equipped with radios A scout locates and marks on maps areas to be treated within a control area together with the location of hazards to aircraft During spray operations the scout will record on maps the areas treated daily and pass this information to the Airstrip Supervisor. The Scout will also

perform other duties as may be required to get a program into operation.

5 Flagmen

Flagmen are required when precise application of insecticide is needed small areas, sensitive and populated areas, and where exact spray runs are necessary Flagmen should be instructed in the use of radio, and on reporting favorable, as well as unfavorable conditions to the Airstrip Supervisor.

Flagmen should be thoroughly familiar with their assigned work areas prior to actual control operations

6 Laborers

A number of **laborers** will be required to handle insecticide, fuel and other equipment at the airstrip. These personnel should be trained in the minimal safety standards for the handling of insecticides and operating around aircraft. The laborers will report to the Airstrip Supervisor

Considerable equipment is needed to conduct a safe and successful program The following items should be considered before operation being

7 Organigram

An organigram detailing the operation and staffing of the aerial spraying units is attached to this plan.

- Several barrels of clean water located at airport for washing off minor splashes of insecticide from skin, and for washing

hands and face before eating. Plenty of soap.

- Cloth or towels for drying off hands and face, or other parts of body after washing.
- Two-way radios, equipped with correct communication crystals to transmit between spray and observation aircraft, between ground personnel and base
- Radios for Scouts, Flagmen and airports/airstrips. White cheese cloth for marking boundaries, and for aircraft guidance.

- Adequate number of vehicles Trucks, pickups, trail bikes used for transporting gasoline, insecticide, scouts, flagmen, other personnel assigned to the program
- Shovels to spread soil over insecticide spills at base of operations.
- Fire extinguishers in the event of fire
- Protective clothing hats, coveralls, rubber gloves and boots to be used where needed by assigned personnel.
- Paper, pencils, maps.
- Thermometers are useful in recording temperatures Several first-aid kits.

OPERATIONS

1. Briefing

Hold briefing session with all personnel, including pilots, before work starts, and as often as necessary during the course

of the program Describe the program, its purpose, the procedures to be followed, sensitive areas, populated areas, obstructions and hazards within the treatment areas, precautions in handling the pesticide, and other safety measures

2 Pilot Briefing

Pilot briefing is best accomplished through the use of an observation plane If a plane is not available, it is advantageous to locate flagmen on the corners of the block, and the pilot use his empty spray plane to locate the flagmen. Also, a trip by a vehicle with scout, flagman and pilot to the treatment block is often all that is necessary.

3. Weather

Weather plays a most important role in a successful program A gentle breeze is usually helpful in good displacement of the pesticide droplets Strong winds usually blow the droplets where treatment is not desirable or needed. Cool temperatures during spraying operations is essential. Hot climate conditions in the treatment areas usually prevent the pesticide from reaching the ground due to heat thermals rising from the soil and vegetation. When air and ground temperatures are equal, or ground temperatures are higher than air temperatures, the spraying should be terminated for that day. Mirrors placed on the ground are helpful to determine if droplets are reaching the ground

4 Guidance

White cheese cloth flags attached to poles will often help the

pilot line up on his run. Mirrors, flashed at the pilot can be seen for many kilometers. Often, headlights of the flagging vehicle are helpful - especially before the sun comes up, and should be used whenever practical to do so

5 Post-treatment surveys

Twenty-four to thirty-six hours after operations have begun, surveys of the treated areas should be conducted. If misses in the treated areas are located, cheesecloth markers on sides and ends should be placed, so these areas can be easily found by the spray pilot and treated

6 Hectars and liters

As soon as possible after each day's operation, hectars treated and liters sprayed should be compared. This comparison will be extremely helpful in determining if application rate is correct. If incorrect dosage rates are determined to be taking place, immediate remedial measures should be implemented

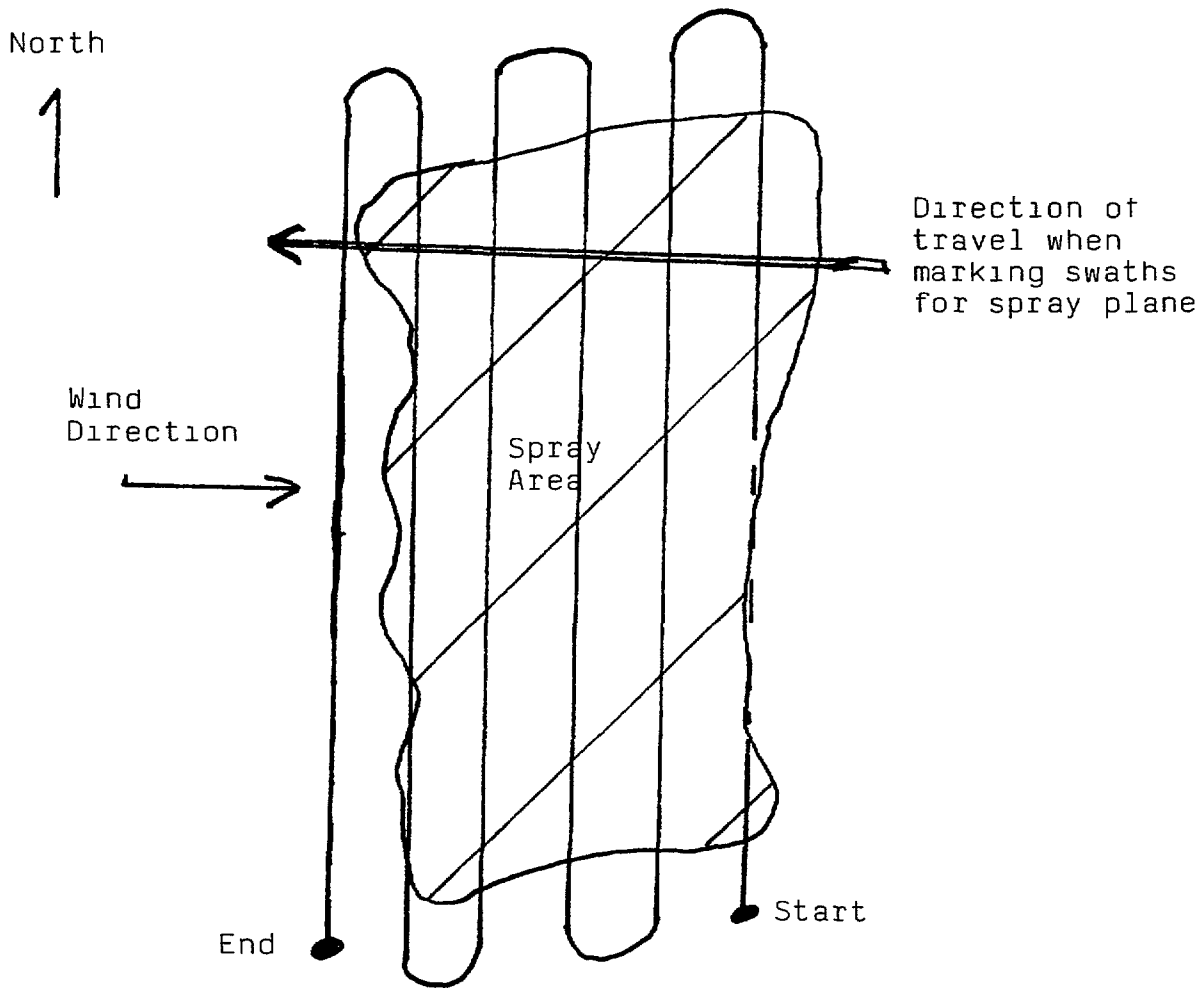
7 Maintain a daily inventory of pesticide, so that replenishment can be ordered, so an adequate supply is always available All equipment should be inventoried at the end of the program, and broken or inoperative items should be replaced All data recorded during the program, results of the operation(s) should be filed for a time period designated by the over-all director of operations.

8 Reporting

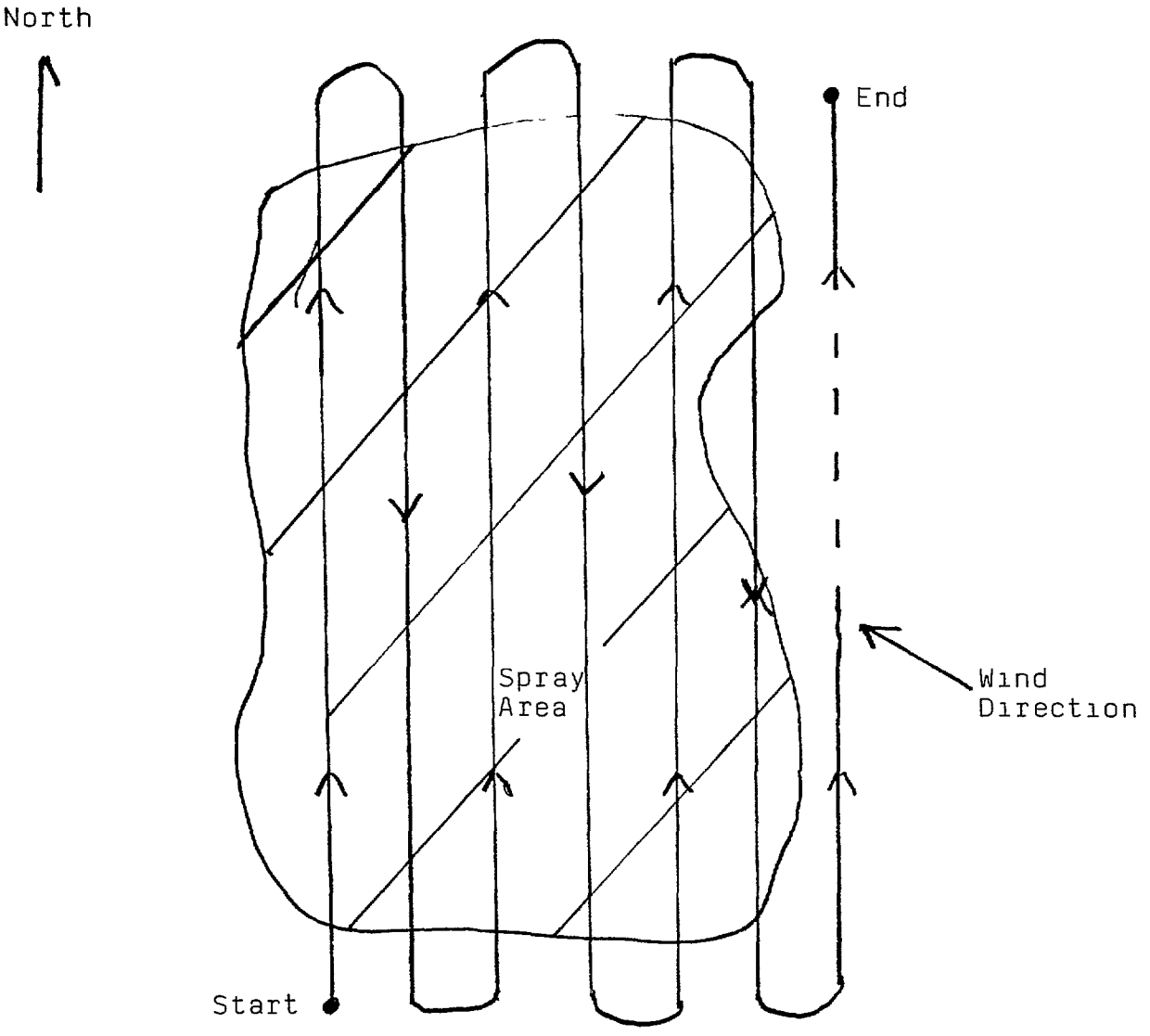
Daily reports should be received by the Operations Supervisor

from Scouts and the Timekeeper on the amount of insecticide used, area sprayed and aircraft use time, in addition to other major requirements or events of the operation. This information should be communicated on a daily basis (following the reporting day) to the Operations base in Ouagadougou by the most efficient means possible

When ever possible, aircraft should be guided so their spray runs are north and south This avoids having to fly into the sun during early morning operations

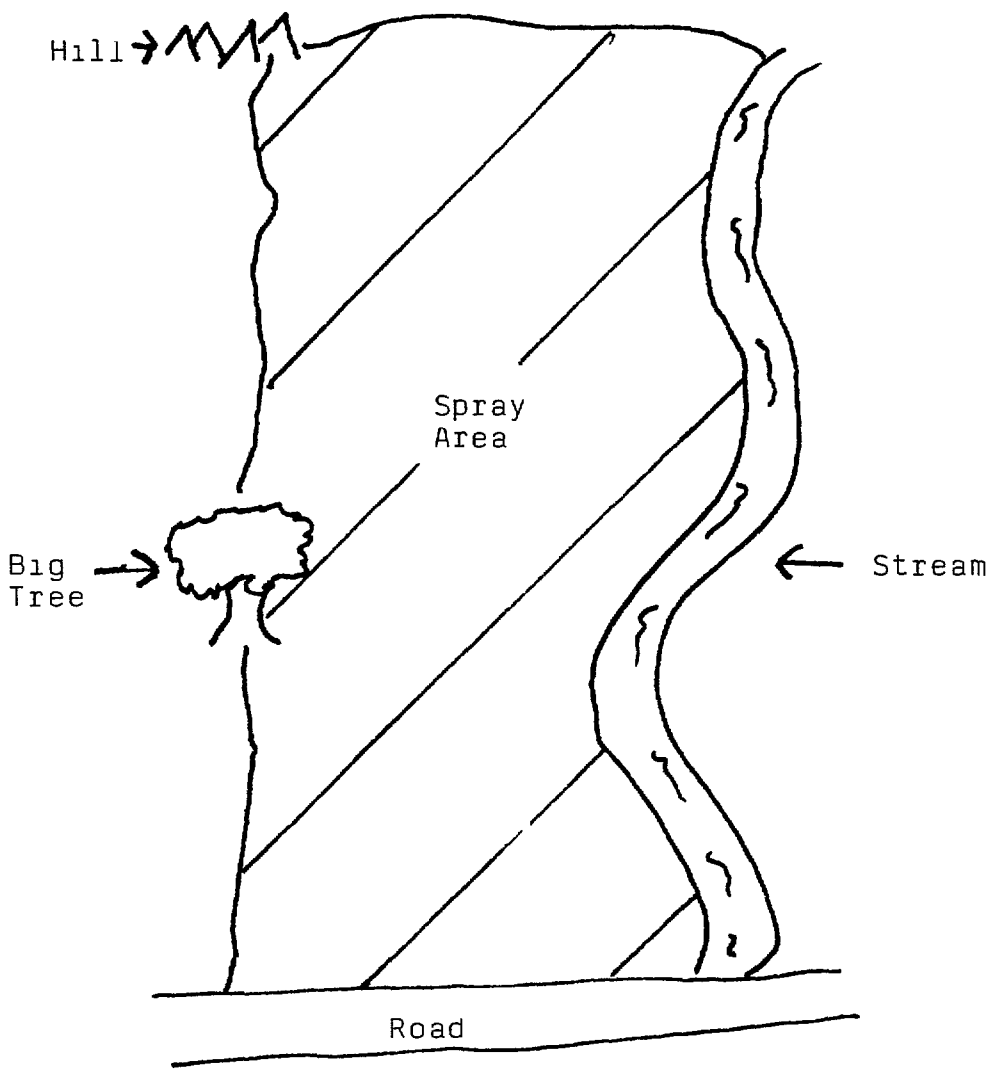


If you are marking swaths for the spray plane, never let the plane fly over you Once you are certain the pilot sees your position and is "lined" up on you, move forward to the next swath



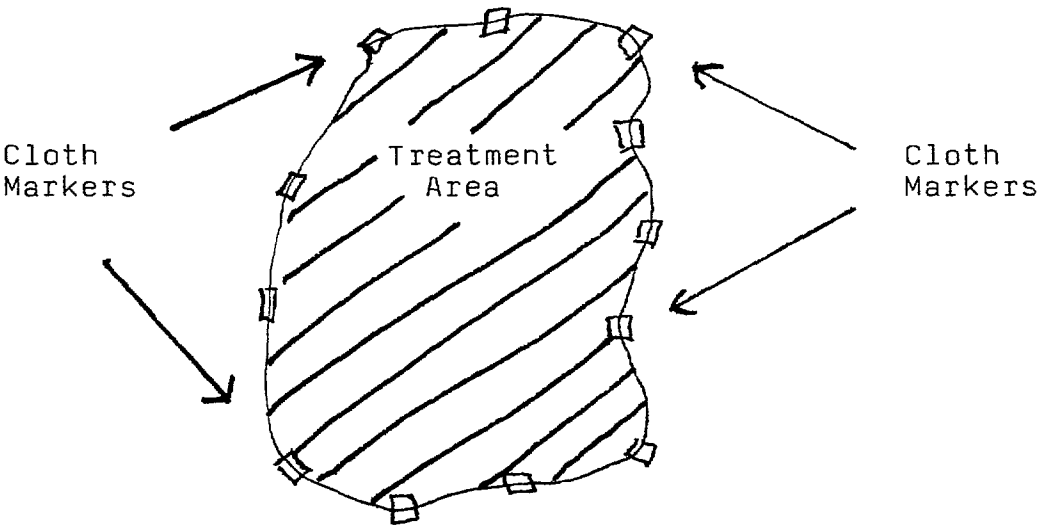
The aircraft will always spray cross-wind and make their turns into the wind Should the wind shift directions before the target area is completed, the pilot will make adjustments so as to avoid flying through the previous spray swath

Use natural boundary markers whenever possible Pilots can see and use natural boundary markers easier than trying to see white cloth markers



Where grasshopper populations exist and there are no natural markers to help define the area you want treated, you will have to use large white pieces of cloth to mark the ends and sides of the area These cloth markers should be no less than one meter wide and two meters long

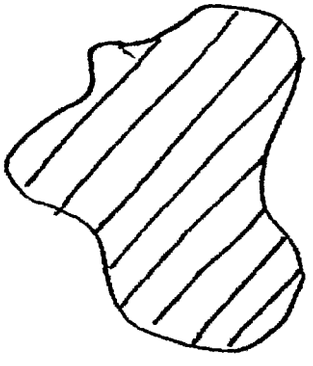
Hang or tie the corners of the cloth to trees, bushes, etc on the side of the tree or bush that faces the area you want to be sprayed



If small, isolated infestations are found, and are too small for the spray aircraft to treat, mark the area with white flags and alert the ground treatment people as to the location They should be able to eliminate the problem with ground sprayers and/or dusters.

Usually an area is too small when it is less than two hectars in size

Area less than two hectars



ORGANIGRAM

AERIAL OPERATION UNIT