DESERT LOCUST

INFORMATION BOOK

Self Help Africa

A GUIDE FOR LOCUST CONTROL TEAMS

February 2021

selfhelpafrica.org

Abbreviations and Acronyms

4WD	Four Wheel Drive
BCG	Baringo County Government
CABI	Centre for Agriculture and Bioscience International
DL	Desert Locust
EC	Emulsifiable Concentrate
FAO/DLIS	The Food and Agriculture Organization/Desert Locust Information Service (Locust Watch Group)
km	Kilometre
MoALF&C	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
NDVI	Normalized Difference Vegetation Index
NGOs	Non-Governmental Organizations
NMD	Number Median Diameter
SHA	Self Help Africa
SMS	Short Message Service
SOPs	Standard Operating Procedures
ULV	Ultra Low Volume
VAR	Volume Application Rate
VMD	Volume Median Diameter
WP	Wettable Powder

Definition of Terms

Feeding Bands and swarms mainly feed during roosting, sometimes hopper bands feed on low growing vegetation during migration or movement

Gregarious In this phase, large number of individual locusts aggregate

Grouping Assembling of hoppers and adults on the ground shortly after and before roosting

Jekyll & Hyde transformation Having a two-sided nature, of which one side is good (solitarious) and the other bad (gregarious)

Movement Bands and swarms move only during the day, but under exceptional conditions can move at night when temperature is high or when the moon is full

Roosting Resting on the plants at night, early morning or at temperature above 36^0

Solitarious This is the phase when individual locusts mostly live in isolation from each other

Transients This is the intermediate phase when locusts are grouping and starting to act as a single mass and are either changing from solitary to gregarious (gregarization) or from gregarious to solitrious (dissociation)

Contents

1. Introduction

Since the beginning of July 2019, hopper bands and swarms of Desert Locust (DL) originating from Yemen have been infesting farmland and rangeland in the Horn of Africa region comprising mainly Somalia, Ethiopia, Kenya, Uganda, Djibouti and Eritrea. The infestation represents a substantial risk to food security and livelihoods of about 13 million people who are mainly smallholder farmers and pastoralists in the region of which 2.1m are in Kenya.

From January, 2020, Kenya has been experiencing the heaviest Desert Locust crisis in over 70 years. Numerous immature and mature swarms continued to move throughout northern and central counties. Aerial and ground control operations are continuing in the affected counties which as of September, 2020 are confined to Samburu, Turkana, West Pokot, Laikipia and Baringo out of the initial 27 affected counties. The Food and Agriculture Organization (FAO) Locust Watch Group (FAO/DLIS) reports that there is still a threat of a bigger invasion and hence surveillance continues across the country and the region.

The Desert Locust plague of 1986-89 and the subsequent upsurges in the 1990s, 2007 and now 2019/2020 demonstrate the continuing capability of this historic pest to threaten agriculture and food security over large parts of Africa, the Near East and Southwest Asia. There is a need for a permanent system of well-organized capacity building in areas prone to invasion to enhance capacities and build experiences of survey and control teams to be able to treat hoppers and adults efficiently in an environmentally safe and cost-effective manner. It is important to note that even during locust recession periods capacity building systems should not be allowed to deteriorate.

This desert locust information booklet and its Standard Operating Procedures (SOPs) are resource documents containing information on best practice for identification, surveillance and control of DL. This information should be disseminated as widely as possible to personnel involved in locust management so that it can be used to help make locust control safer and more efficient. The counties are encouraged to embed this training within the extension infrastructure to influence staff at all levels from senior county management, field officers, and to other stakeholders such as Non-governmental organizations (NGOs), farmers and pastoralists who may assist with locust management activities.

With financial support from a private donor, Self Help Africa (SHA) and its partners including the Ministry of Agriculture, Livestock, Fisheries and Cooperatives (MOALF&C), County Government of Baringo (CGB) and Centre for Agriculture and Bioscience International (CABI) developed this information booklet as part of efforts to strengthen capacities of stakeholders in Baringo County and beyond.

The booklet contains comprehensive guidance on identification of desert locust, conducting surveillance, monitoring and reporting, control and environmental and social safeguards. Training and community awareness mechanisms will be developed to disseminate this information to the wider community.

We would like to acknowledge the work of the Food and Agriculture Organization of the United Nations and The Desert Locust Control Organization of East Africa whose global and regional leadership on research respectively on prediction and control have provided us with a substantial amount of reference materials.

2. The Desert Locust

The Desert Locust *Schistocerca gregaria* (Forskal 1775) is one of around twelve types of short-horned grasshoppers. Desert locusts are the most devastating migratory pests in the world, they are highly mobile and feed on large quantities of any kind of green vegetation, including crops, pasture and fodder. They cause damage by eating the leaves, flowers, fruits, seeds, bark and growing-points of crops.

Desert locusts have the capacity to change their habitats and behavior from solitary life to a gregarious life, thus their numbers rise, stay together in dense groups and start migrating in groups called swarms. Solitarious forms (inoffensive, low numbers and densities) are harmless to crops whereas their gregarious phase (form dense and is highly mobile, with marching bands of hoppers and flying swarms of adults) causing destructive damage.

Desert locusts undergo a Jekyll and Hyde transformation when they get crowded together such as on diminishing areas of green vegetation and stop being solitary creatures to become “gregarious” mini-beasts. They change colour and form groups that can develop into huge flying swarms of ravenous marauding pests building colossal numbers up to 10 billion individuals and stretch over hundreds of kilometres.

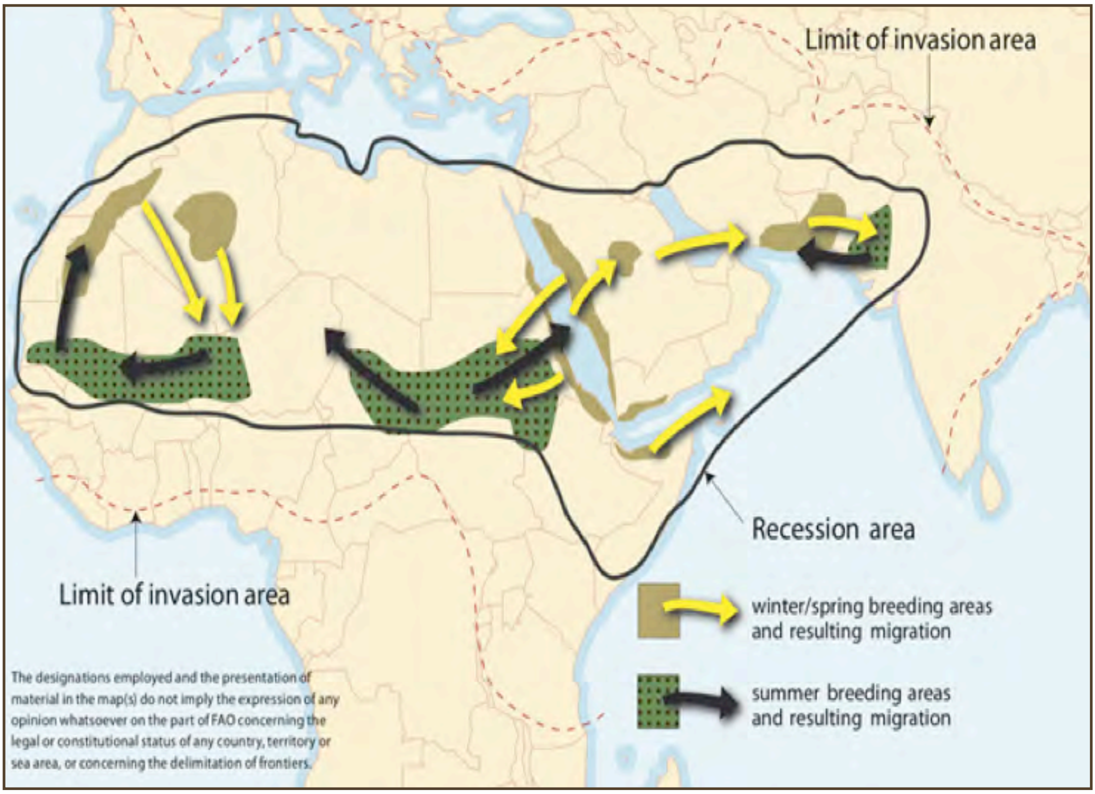
Desert locust swarms fly with the wind at roughly the speed of the wind. They can cover from 100 to 200 kilometers in a day, and will fly up to about 2,000 meters above sea level. They travel between 150 and 200 km/day and have the ability to form dense mobile swarms in the adult stage and hopper bands in the nymphal stages.

The pest can eat its own weight (average 2 gm) in fresh vegetative food per day meaning that an average swarm can destroy crops sufficient to feed 2,500 people for a day, according to the UN’s Food and Agriculture Organisation (FAO).

Desert locusts arrived in Kenya on 28th December 2019 and have been reported in 27 counties. Among the 27 counties which experienced the invasion are Marsabit, Isiolo, Garissa, Tharaka Nithi, Kitui, Embu, Mandera among others. Remnant invasions remain in Turkana, Samburu, Baringo, Laikipia and West Pokot to date.

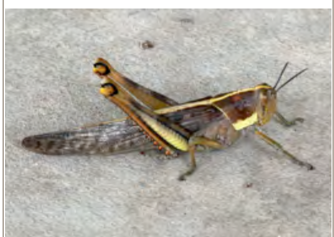
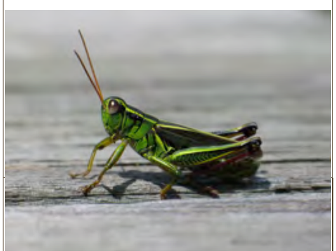
It is believed that cyclones and heavy rains of 2018-19 prepared fertile ground for their movement into the East Africa region since conditions including warmth and heat favour laying of eggs and breeding. They avoid cold highland areas.

Introduce diagram



Desert Locust Recession and Invasion zones © FAO 2020

Differences between Desert Locust, Tree Locusts and other Grasshoppers

Desert Locust	Tree Locust	Grasshoppers
• Desert locusts have the ability to alter their behaviour, colour and shape in response to change in density • Desert locusts have the capacity to become gregarious at high population densities, form large swarms and migrate over large distances • Adult desert locusts form swarms which travel long distances, hopper stage form bands that are black and yellow in colour at gregarious phase • Desert locusts migrate during daytime  Mature adult desert locust © FAO, 2019  Immature adult desert locust © FAO, 2019	 Green Tree Locust © Wikipedia • Tree locusts look bigger than desert locusts in size and mostly are found in lowland and riverine areas • Tree locusts do not form bands but remain scattered. Although in some cases they can form groups • Tree locust swarms migrate at night	• Grasshoppers don't form bands or true swarms • Some species of grasshopper like Oedaleus senegalensis occasionally form small loose swarms  Grasshopper © Wikipedia/Quartl  Grasshopper © Wikipedia/Keith Pomakis

Desert locust pronotal end attaching the thorax is more inwardly curved than that of tree locust

Desert locust (top) and a tree locust (below) © FAO,2019

- Tree locust is darker in colour as opposed to the desert locust
- Tree locust has a longer antennae than the desert locust
- Desert locust pronotal end attaching the thorax is more inwardly curved than that of tree locust
- The upper side of the pronotum in the tree locust is slightly raised compared to the relatively flat one on the desert locust
- Tree locust has a broader hind femur than the desert locust
- Tree locusts look bigger than desert locusts in size

3. Desert Locust Ecology, Life Cycle and Behavior

a. Ecology

Ecology is the study of the relationships between living organisms and their physical environment. The desert locust occurs naturally as isolated individuals (solitarious) in the desert areas (recession areas), however when rains fall causing the density of green vegetation to increase, they aggregate and feed more. As the locust population density increases, they deplete food resources in their immediate environment, this forces them to group into bands and swarms and move invading other regions normally not their natural habitats (invasion areas) in search of more food.

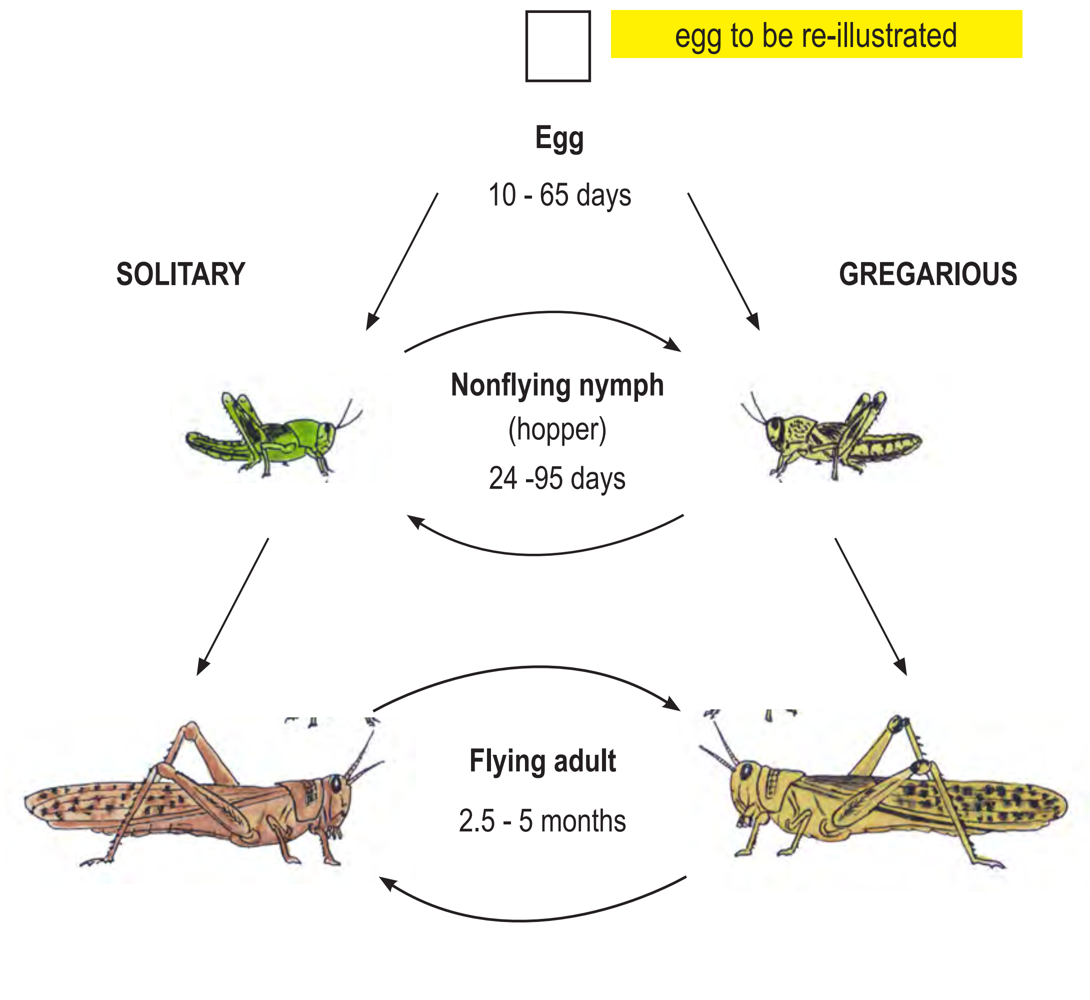
Areas where DL are likely to invade would include:

- Moist sandy areas with green natural vegetation
- Desert areas that have received recent rainfall
- Areas where locals report that locusts are present
- Formerly infested areas or where control was carried out
- Areas that could possibly receive locusts from neighboring Counties/Countries

b. Desert Locust Life cycle

- Desert locust undergoes three stages namely Egg, Hopper/Nymph and Adult
- Weather conditions and availability of food influences the length of each developmental stage
- Desert locust can transition between solitary and gregarious phases depending on weather conditions and availability of food
- Desert locust can complete 2-5 generations a year

- Desert locust generally moves during the day at warm temperatures but can exceptionally move during the night during warm temperatures and at full moon
- Desert locusts tend to have a shorter life cycle in warmer temperatures as opposed to cooler temperatures
- In each of the stages of the life cycle, the hopper (3rd to 5th instars) and the immature adult are the most active stages in the life cycle. However the immature stage is the most destructive since they are very mobile and heavy feeders



General life cycle of a Desert locust

i. Egg stage

- Eggs are laid in moist coarse sand to silty clay soils 10-15 cm below the surface
- Females deposit a batch of eggs, called egg pods, at intervals of 7-10 days
- Solitarious females lay 3-4 egg pods each containing 100-160 eggs
- Gregarious females lay 2-3 egg pods each enclosing 60-80 eggs
- Eggs incubation period can range between 10 and up to 70 days
- The length of incubation period for the eggs depends on temperature and soil moisture. 10 - 14 days in the summer breeding regions, 25 - 30 days in the cooler regions and up to 70 days in the cooler regions of North Africa

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A female laying (Left), Eggs laid in the soil (Right)

Adult female locust laying eggs in the sand ©icipe

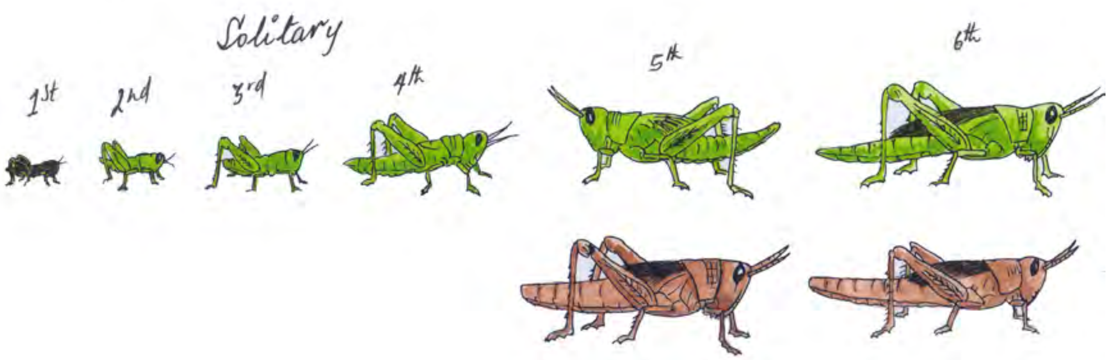
ii. Hopper Stage

Desert locust Nymph © FAO, 2019

- The hopper stage gradually moults to increase in size across the instar stages
- Solitary phase undergoes six instars in its life cycle, all with uniform green colour
- The Gregarious phase undergoes five instars, the 1st instars are black, while the 2nd, 3rd, 4th and 5th instars have distinct black and yellow patterns
- Hopper development takes about 22 days under warm conditions (37^0C) and up to 70 days under cool conditions (22^0C)
- To adjust their body temperatures, hoppers bask in the early morning and roost at mid-day
- Green vegetation is important as a source of food and shelter
- Large mortality (perinatal mortality) commonly occurs in the first instar stage aggravated by cannibalism and predation and not all emerged hoppers survive to fledge
- At the final moult or the fledged young adult is known as a **fledgling**

The following key characteristics are useful in identifying hopper stages:

- Solitary phase undergoes 6 hopper stages while the gregarious undergoes 5 hopper stages
- Solitary hoppers are all green all through the 6 hopper stages but sometimes the last two instars (5th and 6th) become brown while in gregarious phase, the first instar is black while the remaining instars maintain a black and yellow pattern



key features for identifying hopper stages

iii. Adult stage

- Adults do not grow in size but gradually increase in weight (an adult weighs 2g)
- Female adults are generally larger than males in size
- Maturity is usually associated with the onset of the rainy season
- Under dry condition locust can remain immature up to 6 months
- Under favourable ecological conditions maturation takes place rapidly (2 to 4 weeks)
- Male adults mature earlier and release hormones that induce female maturity
- Mature adults do not feed or move much as they search for favourable breeding areas and settle to copulate and lay
- Adult life span varies from 3-6 months depending on weather and ecological conditions

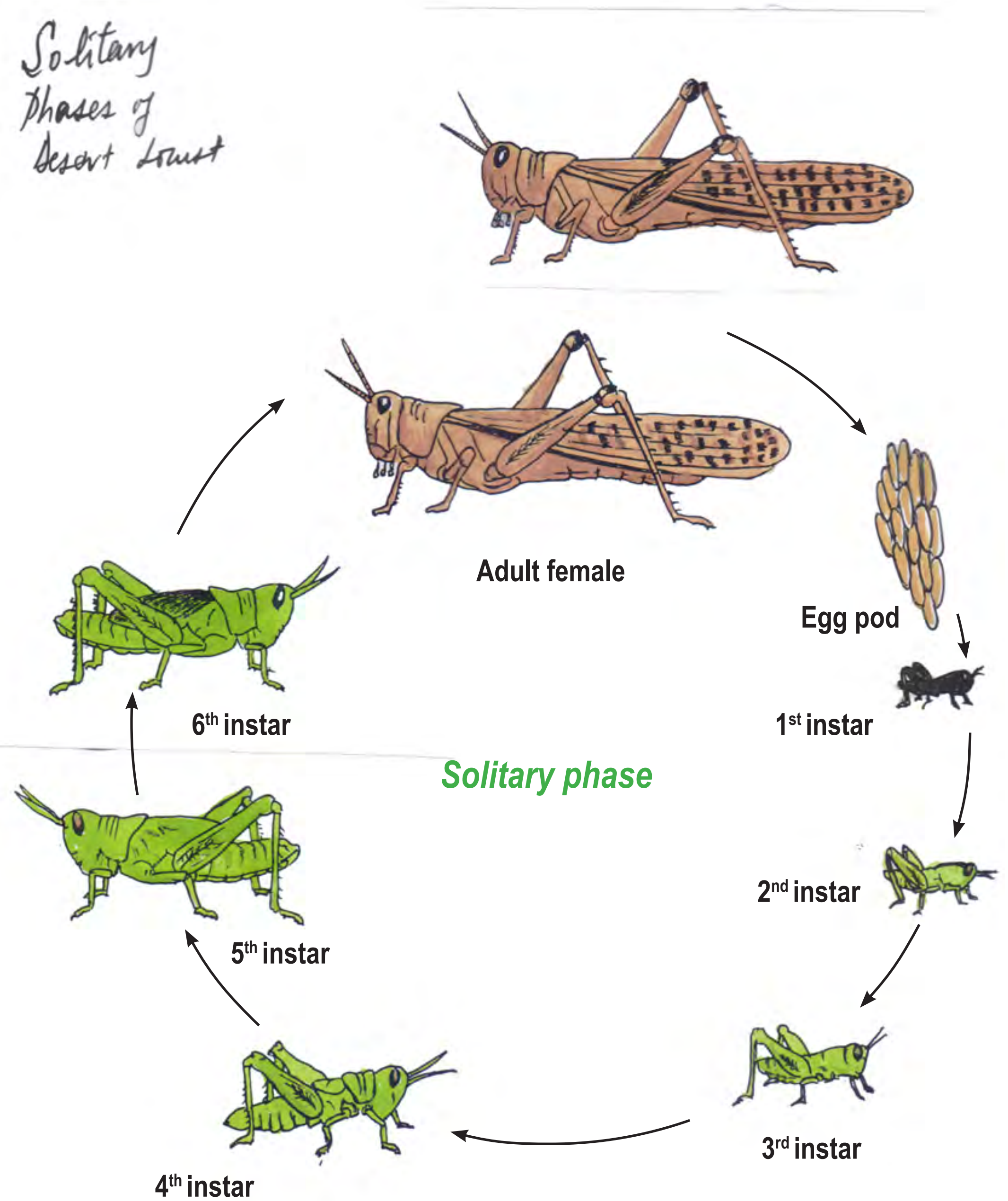
Solitarious Adult

- Immature adults are usually pale grey to brownish in colour
- Mature males change to pale yellow, while females show no change in colour
- They are usually less mobile and migrate at night
- 100% take off takes place at >27^0 environmental temperature and can fly up to 10 hours

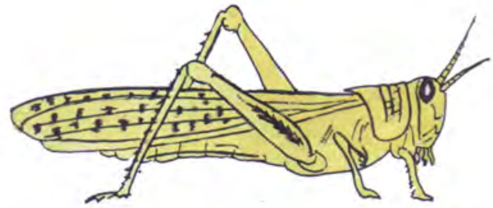
Gregarious Adult

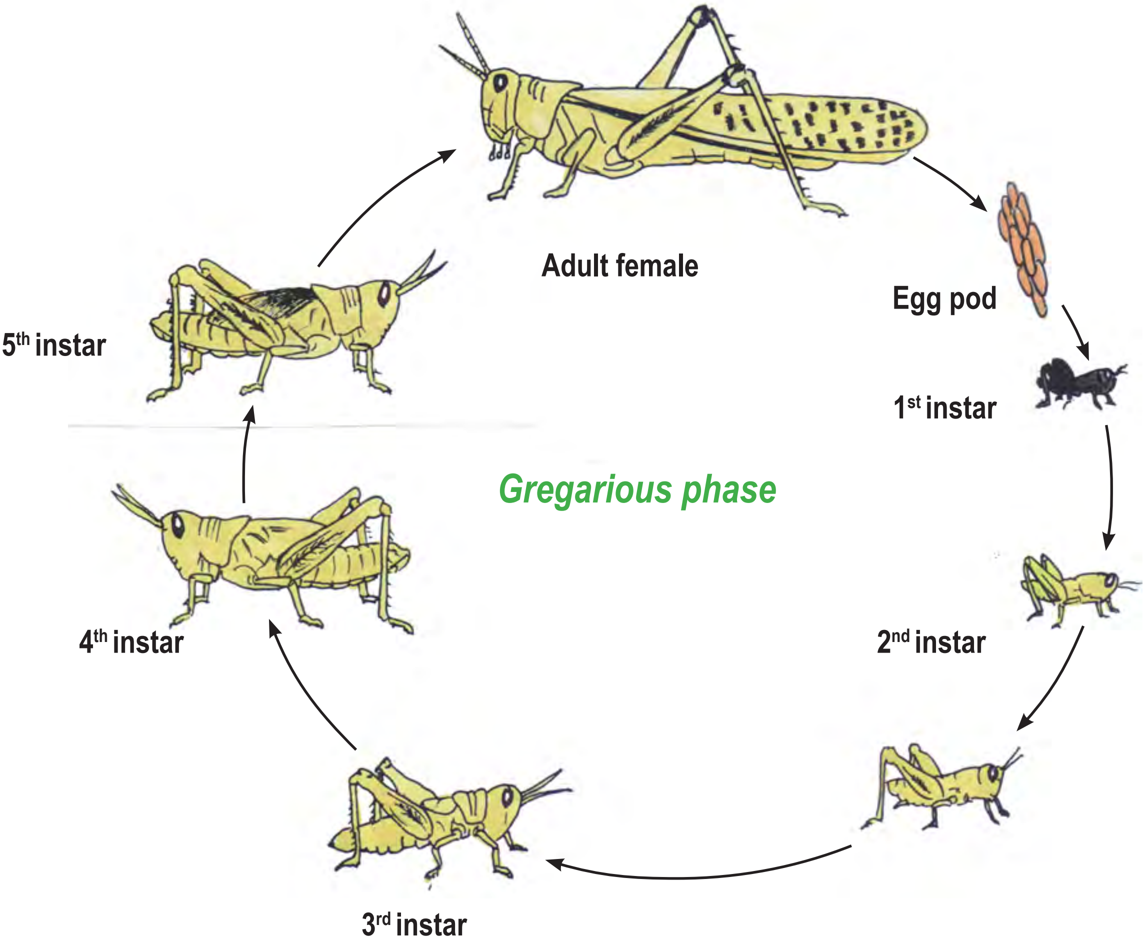
- Fledglings take about 10 days to harden the wings to be able to fly
- After wing hardening, the locust is referred to as an immature adult, pink in color
- Immature adults are very mobile and heavy feeders hence very destructive
- Mature adults are bright yellow in colour which is prominent in the males
- They usually migrate during the day
- Take off usually occurs 2-3 hours after sunrise in warm weather and 4-6 hours in cool weather
- The adults can fly a distance of up to 150 to 200 km in a day
- Swarms settle just before sunset, and spend the night on vegetation (roosting)
- In the morning they descend to the ground and bask in the sun

Desert locusts mating © Wikipedia/Adam Matan



Solitary phases of desert locust





gregarious phases of desert locust

Standard Operation Procedure for identification of a Desert locust

The Desert locust occurs in Solitarius and Gregarious phases which differ morphologically. The most prominent and of most concern due to its economic importance is the gregarious phase hence this SOP is developed for basic identification of the gregarious phase of the Desert locust.

Morphological identification of the Desert locust

Morphological identity includes colour, shape and size.

a. Hopper identification

Consider the pest a desert locust hopper if you see the following.

Characteristic	**Gregarious Hoppers**
Density	Dense groups and very mobile (marching) hopper bands
Colour	Black hoppers in the early instar stages becoming yellow and black in the later instars
Femur	Yellow background with two black vertical bands on the upper and inner side and one black horizontal large black streak on the outer side
Abdomen	Yellow background with a prominent black horizontal stripe on the side and dorsal view
Eyes	Clear or/and completely red/brown

b. Adult identification

Consider the pest a desert locust adult if you see the following:

Characteristic	**Gregarious Adults**
Density	Dense groups and very mobile (flying) adult swarms
Colour	Pink/red while immature becoming yellow in the mature stages
Forewing	Distributed small brown patches becoming more dense posteriorly
Hindwing	Pale (immature) or yellow (mature) when stretched

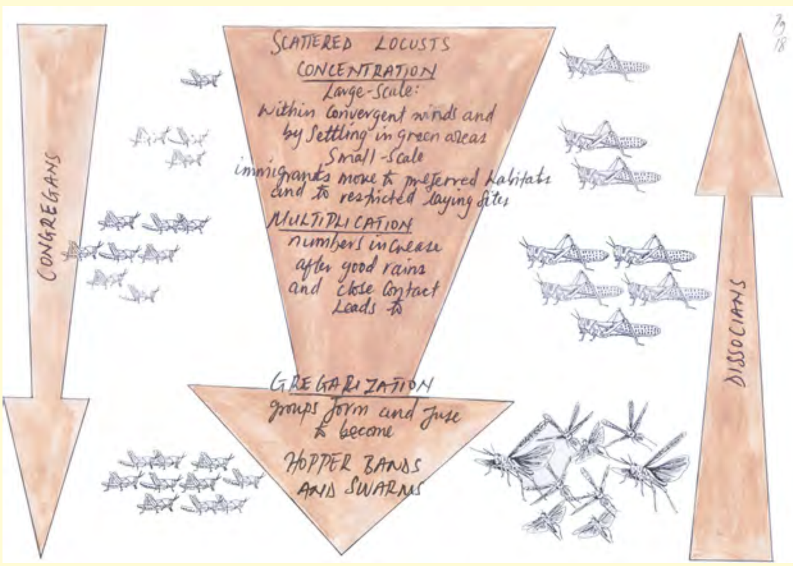
Characteristic	Gregarious Adults
Density	Dense groups and very mobile (flying) adult swarms
Colour	Pink/red while immature becoming yellow in the mature stages
Forewing	Distributed small brown patches becoming more dense posteriorly
Hindwing	Pale (immature) or yellow (mature) when stretched
Antennae	Shorter than the head and the pronotum combined
Pronotum	Relatively flat pronotum seen from side view and broadly rounded at its rear edge
Femur	Yellow background with two black vertical bands on the upper and inner side which become pale as they mature
Eyes	Clear, stripped or/and completely dark brown
Eggs	Fewer but bigger eggs

Note: For accurate identification of the Desert locust, there is need for careful observation

c. Behavior

i. Desert locust phases

Desert locust transitions into either solitary or gregarious phases depending on temperature and favorable ecological conditions.



Processes involved in phase transformation

There are three processes involved in phase transformation i.e. concentration, multiplication and gregarization.

Concentration

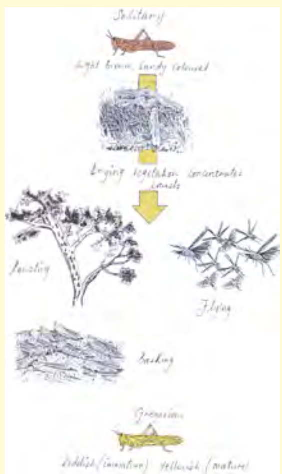
- When favorable habitats shrink, locusts aggregate in small areas suitable for survival
- Often occurs in habitats, having patches of relatively dense vegetation separated by large areas of bare soil (less uniform)
- Adult concentration may occur in an area where there is wind convergence forcing flying locust to settle and form groups
- Hopper concentration occurs when they are sheltering, basking, feeding, and roosting

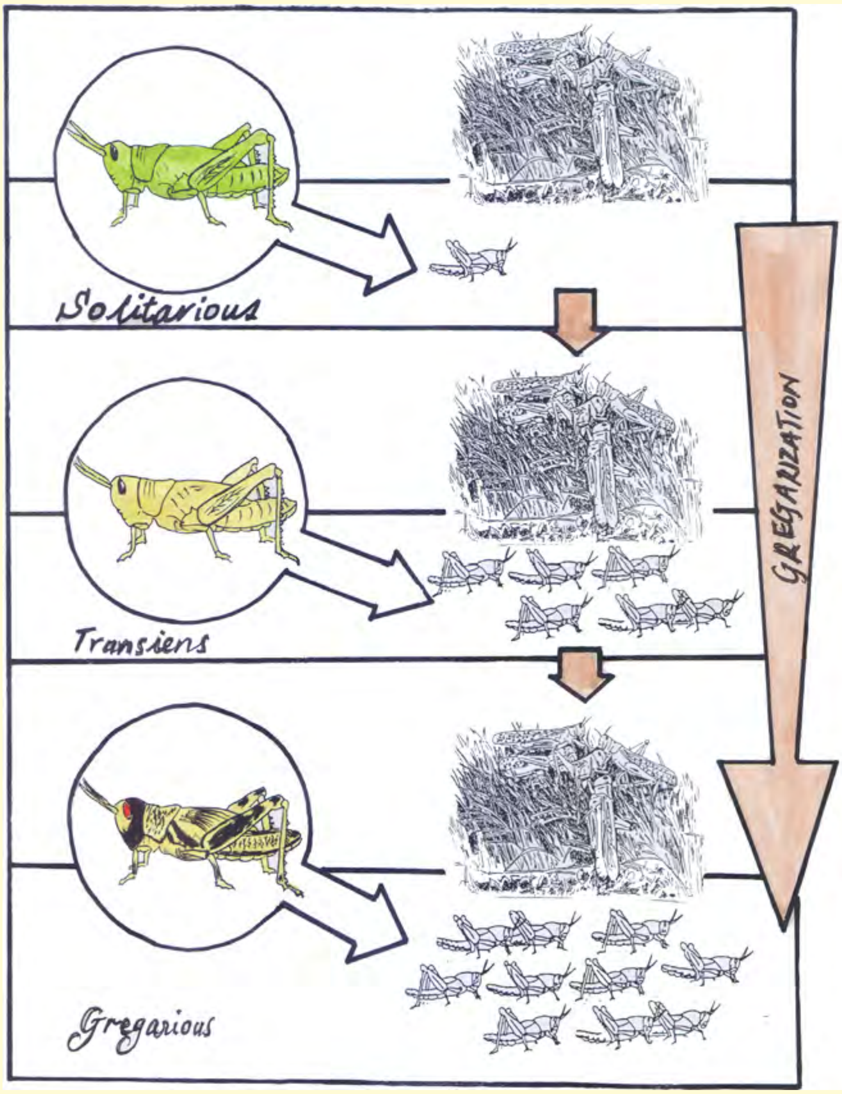
Multiplication

- Increasing the number of locusts in small areas that offer the basic needs for breeding

Gregarization

- When locusts concentrate and multiply in an area, they signal each other and form groups
- If ideal conditions persist for several successive generations, the resulting population will change accordingly and become gregarious





ii. Desert Locust Band/Swarm Behaviour

Band Formation

- When hoppers increase in numbers they can form small groups. Later these groups join up to form a large group or band

Swarm Formation

- Swarms usually originate in areas where winds converge. Also originate from hoppers bands, after passing their stages of development in a relatively uniform manner

Swarm Density

- A medium swarm may contain up to 50 million locusts
- Generally, swarm density ranges from 20-150 million locusts/km^2

Table: Swarm and band density classification

Description	Hopper bands density	Adult swarms density
Very small	1-25 m^2	< 1 km^2
Small	26-2 500 m^2	1-10 km^2
Medium	2 501 m^2-10 ha	11-100 km^2
Large	11-50 ha	101-500 km^2
Very large	50+ ha	500+ km^2

Table: Characterization of the swarm/ band behaviour

Behaviour	Definition	Mutual Reaction	Density/Ha
Isolated	Very few present	Not occuring	< 25
Scattered	Some low numbers	Some reaction but no groups seen	25 - 500
Group	Forming ground or basking groups	Occuring with groups	500 +

iii. Swarms Structure

Stratiform swarms

- It looks like a flying sheet, usually flat and tens of meters deep
- Occurs during cool, overcast weather or in the late afternoon

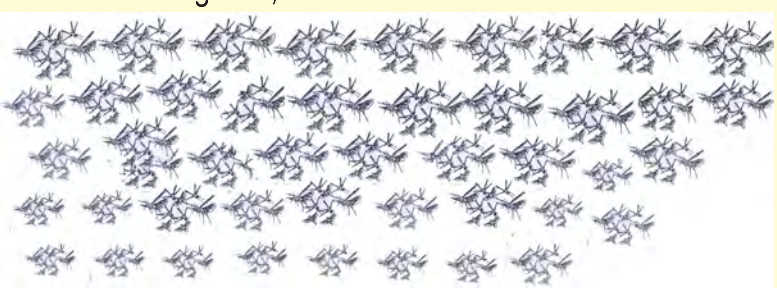


Figure: Structure of a stratiform swarm

Cumuliform swarms

- Takes the form of a hanging curtain usually 1500-2000 m above ground level
- Usually seen in sunny conditions
- Shape changes with change in the density of different parts of warms

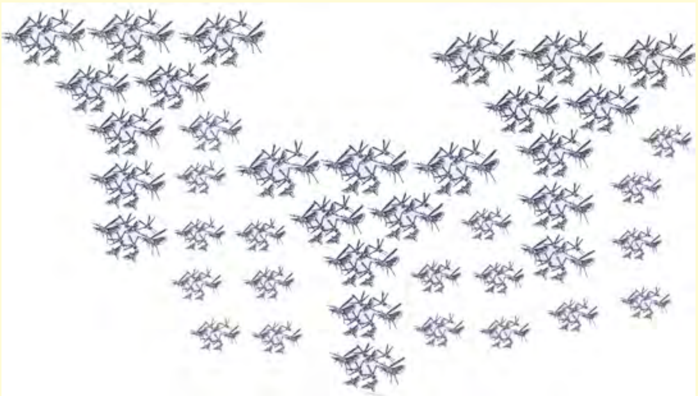


Figure: Structure of a cumuliform swarm

iv. Invasion Levels

Outbreak

- Usually occurs when locust numbers increase through concentration, multiplication, and gregarization
- Outbreaks take place over several months, often localized and restricted to certain habitats
- Forms small hoppers bands low density and at times swarms may develop
- The small swarms often disperse and re-form
- At this stage, the population may still not be fully gregarious

Upsurge

- It is a result of several outbreaks occurring at the same time followed by two or more generations
- This situation is dependent upon a series of substantial and widespread rains
- As the upsurge develops, there will be a sort of adult migration from one breeding area to the next

Plague

- Plague is widespread and heavy infestations of locusts, that occur as bands and swarms which invade an area beyond recession area
- Usually starts with a calm period, followed by several outbreaks and upsurges

v. Locusts decline

Outbreak, upsurges and plagues usually decline because of a combination of factors:

- Failure of rainfall in an area where successful breeding usually occurs
- Migration to areas not suitable for breeding or survival
- Intervention through control operations

4. Desert Locust Management

a. Desert Locust Survey

Surveys are undertaken to collect information in order to assess the locust situation and habitat conditions in the field. Based on Survey results indicate the need for further survey(s) or the initiation of control operations can be initiated.

i. Importance of Conducting Surveys

Surveys help to collect relevant information which is critical in decision making and containing the population of Desert Locusts. The main reason for conducting surveys is to:

- Find what locusts exist
- Monitor changes in population
- Provide early warning
- Identify control target
- Allow for better planning
- Make accurate forecast
- Inform other Counties and stakeholders

ii. How To Plan A Survey

Surveys need to be well planned for efficient and effective utilization of resources. To conduct as DL survey effectively some decisions have to be made:

- Who should make a survey
- Where to make a survey
- When to make a survey
- Whether it is an assessment or a search survey
- Whether it is a ground or aerial survey

iii. Survey Process

A logical approach is required in monitoring Desert Locusts and their habitat in order to collect the maximum amount of information in the shortest possible time, using minimum resources.

Steps to be followed in survey process

Step 1. Identify who will carry out the survey

This will be a Locust Field Officer but it could be a local scout or extension agent and then followed up by a Locust Field Officer to confirm findings.

Step 2. Determine where and when to carry out the survey

This should be in those places where and at times when you expect to find locusts;

Step 3. Decide which type of survey

Either assessment or search depending on the prevailing condition for instance if there has been reported outbreak or its in recession areas

Step 4. Decide on the method to use to conduct the survey

Whether the survey is to be done by ground or by air. Aerial survey is more suitable for identifying areas of green vegetation after rainfall. It will not find solitarious locusts

Step 5. Prepare the vehicles and make sure you have the necessary equipment

Choose the right type of vehicle depending on the terrain of the area to be surveyed

Step 6. Make a rapid assessment survey

This is usually done by foot and vehicle transects at survey stops and by interviewing people along the route unless you know that locusts are present when search surveys can be done.

Step 7. Collect the required information and record

This one can use the elocust3m app (which can be downloaded from play store) or the manual form.

Step 8. Transmit the survey results to the Locust Unit headquarters as quickly as possible

Step 9. If significant populations are found

Make a search survey to identify as precisely as possible the extent and size of the infestations, and the control requirements

Step 10. Plan the next survey

Based on the survey results, plan the timing and location of the next survey

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Note: Only qualified and experienced locust field officers supplemented by agricultural extension agents and trained scouts should conduct surveys

Fig xx . A good locust monitoring programme involves qualified locust field officers as well as local scouts and extension agents

iv. Where and when to make a survey

Surveys should be undertaken in areas where locusts are most likely to be present. This depends on the distribution of rainfall, temperature and the presence of green vegetation in historical locust habitats within the County as well as in neighbouring Counties. Results from an initial survey by air to identify green areas can be used to reduce the large areas required to be checked by ground. Remote sensing imagery and meteorological data may also be of help in identifying areas of green vegetation or where it may have rained (NDVI and Rainfall information).

Particular attention should be given to those areas that are known to be attractive to locusts and those where infestations have frequently occurred in the past (for instance in Baringo areas in Tiaty Sub County, Baringo North, Baringo South, Mogotio, Baringo Central and parts of Eldama Ravine). For these areas it is important to carry out surveys after rainfall occurs, usually waiting about two weeks to allow vegetation to become green. Also the areas which bordering Turkana, Samburu and Laikipia Counties.

Surveys should be carried out after rains have been reported or are thought to have fallen. They should be undertaken to confirm reports of locusts received from villagers, travellers, traders or pastoralists. Surveys should also be organized if there is a threat of locust invasion from a neighbouring area or County in order to detect the arrival of any incoming populations.

Survey itineraries should include those areas previously identified with green vegetation or locust infestations, areas that are known to have been favourite locust habitats in the past and areas in which there is no information. Survey routes should avoid roads and tracks and concentrate on areas where locust infestations are most likely to be found. An itinerary may be modified during the survey according to the results at each survey stop.

Surveys should be carried out during the day when locusts are most likely to be seen. The precise timing will depend on the temperature, weather and habitat. In general, it is best to undertake surveys from shortly after sunrise to about midday and again in the afternoon for a few hours just before sunset. At midday when the temperature is high (above 38°C), adults and hoppers are likely to seek shelter inside the vegetation and will, therefore, be difficult to see.

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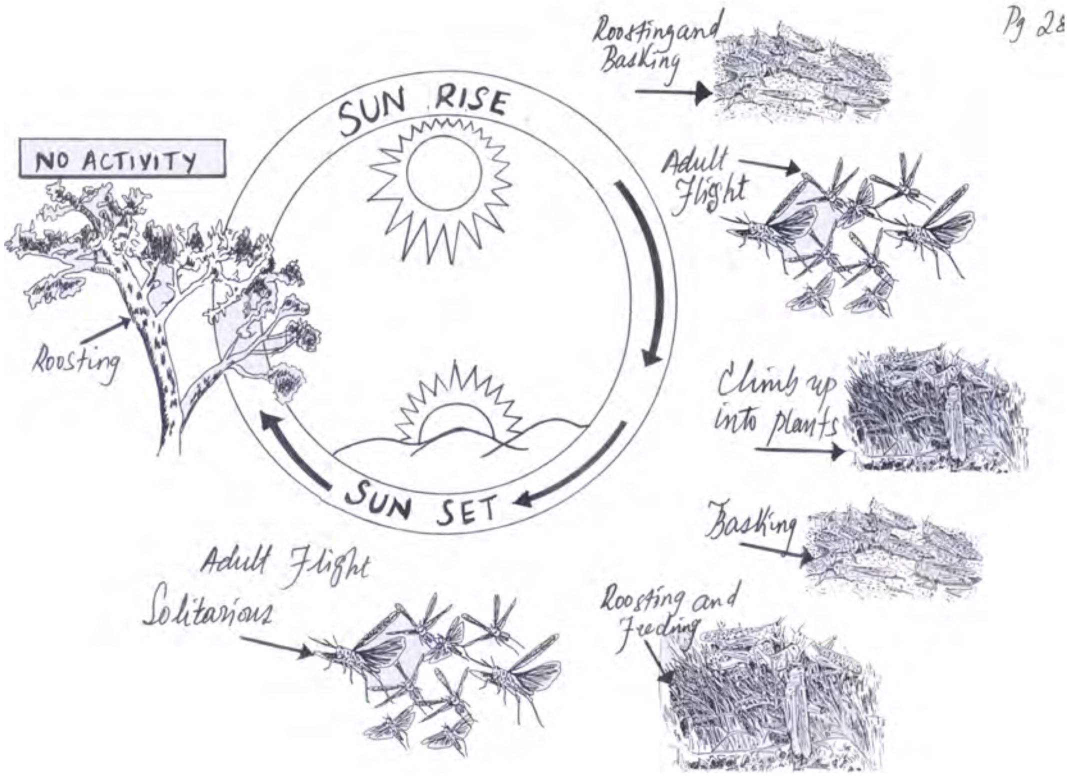
1. Where and when to survey during the year



2. When to survey during the day (time)

v. *Types of Survey*

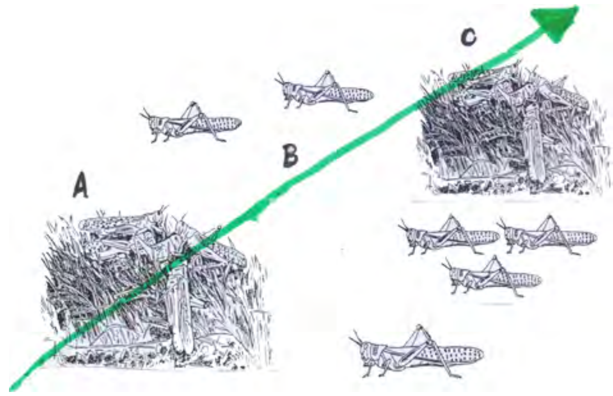
There are two basic types of surveys that can be distinguished

Assessment Surveys

Assessment surveys are conducted in areas that have a history of locust breeding or presence, or where rain has recently been reported or thought to have occurred, or where reports of locusts have been received from locals, pastoralists, scouts or agricultural extension agents. The purpose of assessment surveys is to:

- Monitor locust populations and assess the suitability of the habitat for breeding
- Determine whether significant populations are present that may require control

It's the first type of survey to be undertaken in order to determine if locusts are present in an area or to identify areas of green vegetation. Estimates of locust densities made at each survey stop can be used to identify those areas where significant numbers of locusts (i.e. gregarious locusts, groups or high numbers of solitary locusts) are present.



Assessment survey

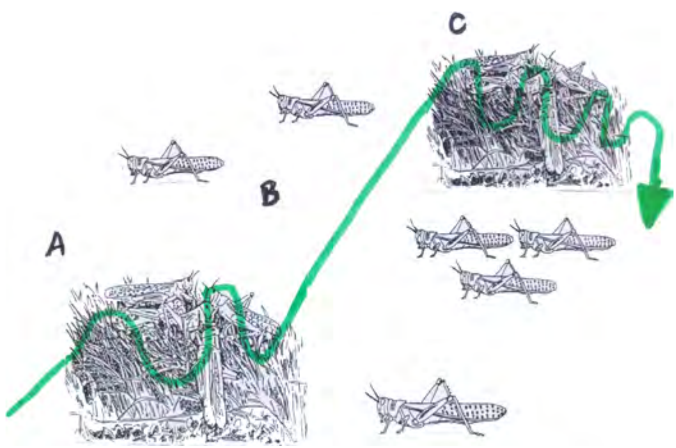
Search Surveys

They are conducted in areas known to contain significant populations in order to:

- Estimate the total infested areas
- Delimit the areas that require control

Results from searching will allow decisions on if, when and how control should be conducted.

Search survey is conducted in which the particular area is carefully checked to determine the geographical extent and size of the infestations. From this information, the scale of risk and level of required control can be estimated. If insignificant numbers of locusts are found during an assessment survey, then there is no need to carry out a search survey. Instead, another assessment survey should be conducted at a later date, depending on habitat conditions and rainfall.



Search survey

vi. Methods of Survey

There are three survey methods: foot transects, vehicle transects and aerial transects. These methods can be used when making assessment or search surveys.

Foot Transect

Vehicle Transect

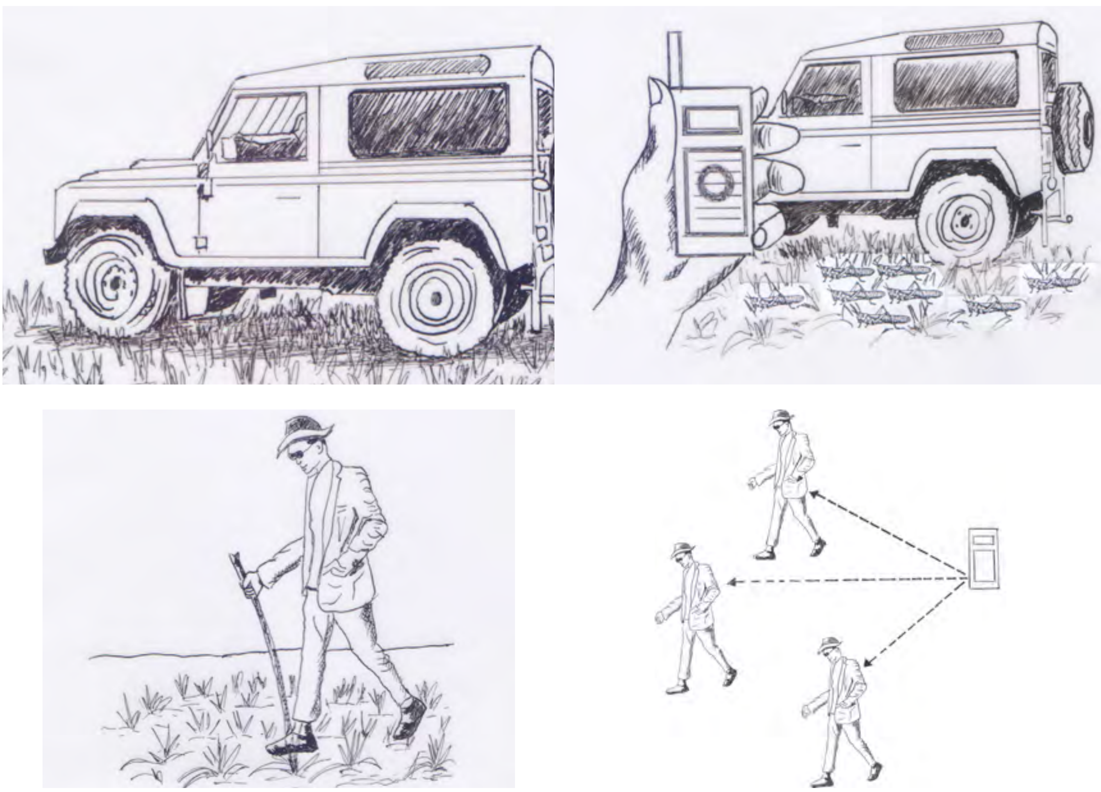
Aerial Transect

Foot Transect

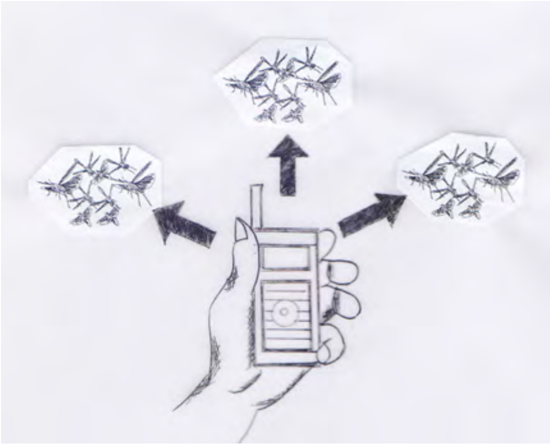
Foot Transect

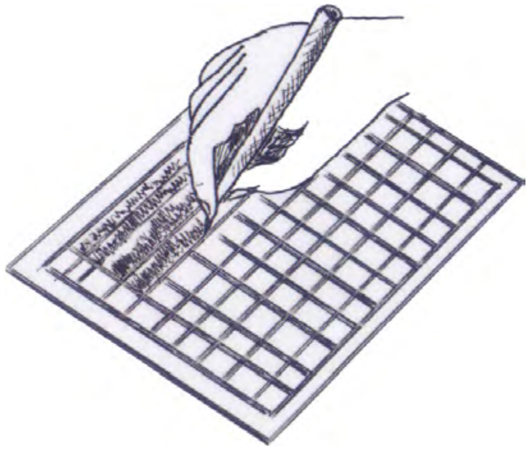
A foot transect consists of walking a certain distance in the area of survey and making observations in order to collect data about locusts, rainfall, vegetation and soil. While the distance does not always have to be the same or very precise, the observations should be detailed and thorough.

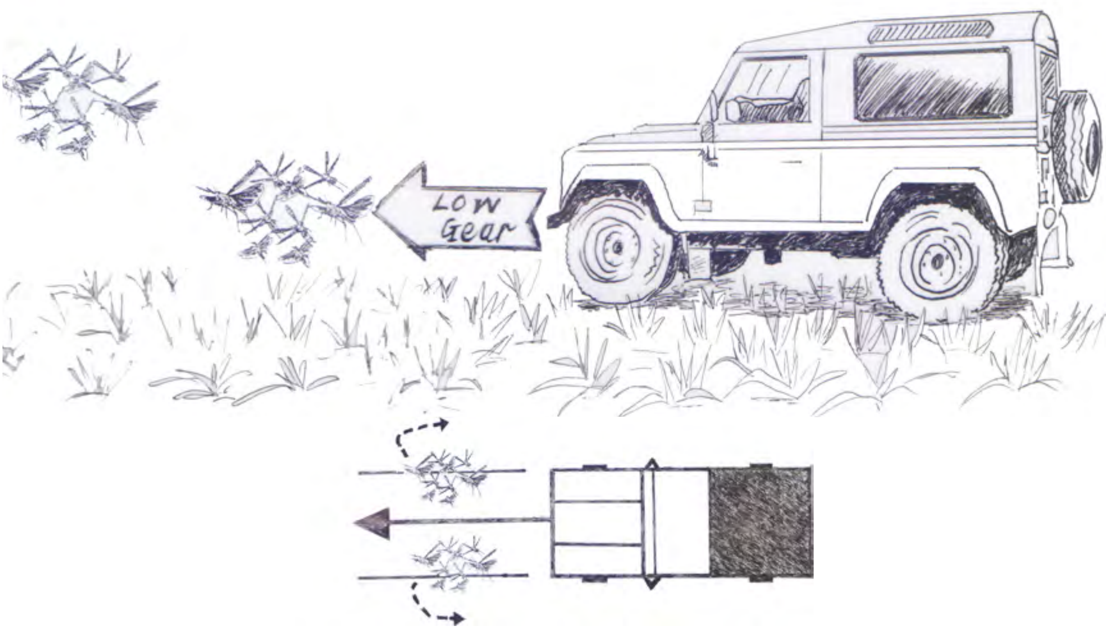
- Best done when temperature >20^0C and wind <6m/s
- Spend about 15-20 minutes for collecting data
- Walk for about 300 meters
- Count the adults which fly out
- Estimate transect width (2 meters)
- Inspect at least 10 bushes or 10 spots of $1m^2$ size on the ground for hoppers
- Check soil moisture



How to make a Foot Transect







How to make a Vehicle Transect

Standard Operating Procedures (SOP) for Desert Locust

Adopted from FAO Sops Ground Survey

Objective

The objective of the Standard Operating Procedures (SOP) for Desert Locust Survey is to give concise instructions for effective and safe ground survey operations against the Desert Locust. These instructions are intended for use by the field staff who are involved in Desert Locust monitoring to help them avoid dangerous, ineffective or wasteful operations.

The instructions focus on:

- Survey equipment
- Survey types and methods
- Data collection and reporting
- Using eLocust and GPS

Survey Process

This SOP will explain steps on how surveys need to be followed before, during and after survey operations. The SOP's explain how a survey can be carried incase of an invasion or in anticipation of an invasion.

Preparations

- Three months before survey operations
- Determine what type and number of vehicles are required for survey operations
- Select competent survey teams and provide them with training or refresher training
- Check and service the vehicles
- Check that the commonly needed spare parts and spare tires are available, and vehicles are well equipped

- Make sure that operational funds are allocated for the proposed survey period in the field to cover field allowances, fuel, etc.
- Make sure that sufficient equipment (GPS, eLocust, Phone Chargers, Powerbanks) are available for each survey team

Before Survey Operation

Step 1:

Based on information from all possible sources (nomads, locals, villagers, travellers) combined with rainfall and habitat data, determine what areas need to be surveyed and when. The Locust Information Officer should provide this information.

Step 2:

Use maps (google maps) to help determine the planned survey route.

Step 3:

Prepare the vehicles and make sure that all field and communication equipment are working. The phone should be fully charged and power banks too.

Step 4:

Ensure that survey officers know how to use the equipment and make surveys.

Step 5:

Decide what type of survey. If you do not know if locusts are present or not, make a rapid assessment survey. If significant locust populations are already present, then make a search survey to estimate the total infested area and delimit the areas that require control.

During Survey

Step 6:

Go to an area where locusts are likely or already known to be present and make either a foot or a vehicle transect.

Step 7:

Before starting the foot or vehicle transect, record the date and the GPS latitude/ longitude coordinates on the in eLocust3m. This is usually done inside the vehicle.

Step 8:

If you are making a foot transect, get out of the vehicle and collect data about locusts, vegetation and soil. If you are making a vehicle transect, stay in the vehicle and collect data about locust adults and vegetation.

Step 9:

Return to the vehicle (or stop if you made a vehicle transect) and record your observations on the eLocust3m.

Step 10: Drive to the next survey area.

After Survey Operations

Step 11:

Check that all of the relevant details are on the ELocust3M application .

Step 12:

Submit the results after collecting (Check reporting using elocust3m).

Step 13:

Check and, if necessary, repair the equipment so it is ready for the next survey.

Where and when to make surveys

Where

- In sandy areas where the natural vegetation is green
- Desert areas that have received recent rainfall
- Areas where locals report that locusts are present
- Areas previously infested by locusts or where control was carried out
- Areas that could receive locusts from neighbouring countries

When

- During the year
- Regularly during the rainy season
- About two weeks after rain has fallen (to allow sufficient time for the vegetation to become green)
- If there is no information from a certain area about rainfall, ecological conditions or locusts
- During the day
- When temperature is 20-38°C
- From shortly after sunrise to about midday
- In the afternoon for a few hours just before sunset

Survey types

Assessment

- Generally the first type of survey undertaken in the field to determine if locusts or green vegetation are present
- Undertaken in areas that have a history of locusts or breeding, where rain has recently fallen, or where nomads, locals, scouts, farmers or agricultural extension agents have reported locusts
- Purpose is to monitor the locust and habitat situation and to determine whether significant populations are present that may require control

Search

- If significant populations are found during an assessment survey, then a search survey should be undertaken
- An intensive survey to estimate the total infested areas and to delimit the areas that require control
- From the results of search surveys, the scale of the risk and level of required control can be estimated

Survey methods

Foot transect

- Walk about 300 m into the wind or crosswind
- Observe the vegetation greenness and density
- Stop several times to check the soil moisture
- Count any locust adults that fly up, note their colour, behaviour and maturity (estimate the width of the strip in which adults are being disturbed, usually about 1 - 4 m on either side of you)
- Temperature must be above 20°C
- Stop occasionally and closely inspect the ground and vegetation for hoppers, noting what instar stage, colour, behaviour and number per bush or square metre. Repeat this up to 10 times
- Record your observations in eLocust3m
- Drive to the next survey stop

Vehicle transect

- Drive upwind or crosswind for at least 1 km
- Drive at a walking pace in low (4WD) gear
- Count adults that fly up in front of the vehicle
- Keep track of the distance using the odometer
- Count only when temperature is above 20°C and wind speed is less than 6 m/s

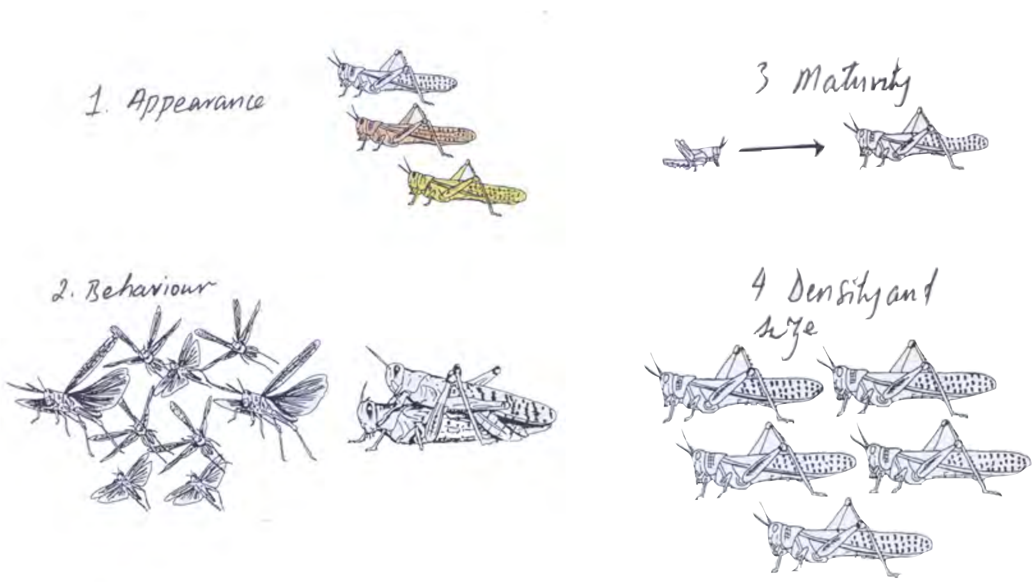
b. Reporting

A logical approach is required in order to manage and analyse information at the national level and county levels so that it can be used for effective planning and decision-making. Information is usually managed by at least one person who is responsible for managing by at least one person who is responsible for managing locust and environmental data. This person is usually known as a Locust Information Officer and should be based at a centralized Locust Unit Headquarters (Headquarters at Nairobi Kilimo House). It is his/her role to analyse all available data and to provide the Head of the Unit and other stakeholders with information, forecasts and technical advice about the locust situation and the resources needed to deal with it.

i. Importance of Reporting

The information collected during survey is critical in management of desert locusts. It helps:

- To plan on survey and control
- To decide the control target so that mobilize resources
- To assess the prevailing current situation
- To forecast breeding and migration
- To request assistance from different partners/stakeholders
- To evaluate campaign of managing desert Locust



Locust information to collect

ii. What Information is Needed

The most important primary data/information required to help to assess the current locust situation properly and prepare an accurate forecast are four:

- Information on ecology
- Information on rainfall
- Information on presence or absence of locusts/ hoppers
- Information on locust control

iii. Locust information to collect

The location and date should be associated with each of the above collected data types.

Location

The location is the name of the place where the survey or control was undertaken, its latitude and longitude coordinates obtained from a map or a GPS. Using the Elocust3m application gives the location automatically. The date is the day,month and year that corresponds to the specific data type. In the case of ecological,locust and control data, this will be the date of observation or when the control was undertaken. In the case of rainfall, it should be the date when the rain actually fell rather than the date when it was reported.

Ecology

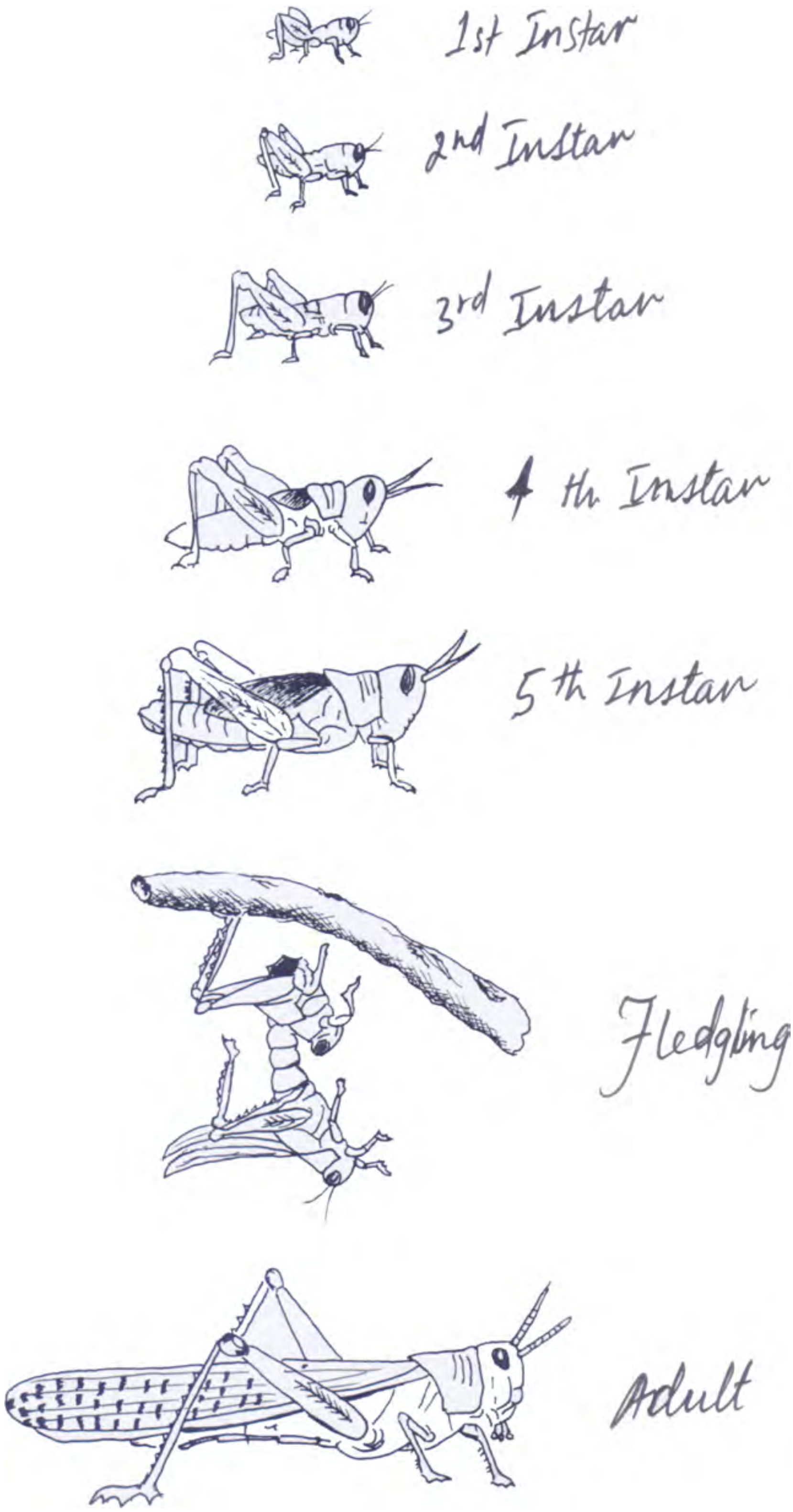
This data consist of an estimate of the size of the area (in hectares) in which each survey or control was undertaken, it's very clear in the application

Rainfall

Rainfall data consist of the date and amount of the last rain that fell. A rough estimate can often be obtained by asking locals during a survey. The date and quantity of the first rains of the season can also be useful.

Locust/Hopper data

Locust data consist of details on different stages of the locust and the application has pop ups indicating the different stages for hatching (hopper) and adult maturity, density, appearance, phase, behaviour, laying and area infested at each survey or control location. Image can be added (Important to give the different stages in pictorial/illustration from hatching.



Locust stages

c. Control data

Indicates if Control has taken place and the data consist of the name, application rate and quantity of the pesticide used, the area treated (in hectares), the method of application and a rough estimate of the efficacy of the operations in terms of percent kill. If control is being carried out after a survey team has identified the target infestation, then this should be linked to the survey report. This should help to overcome the difficulty of knowing which of the infestations have been controlled.

d. Reporting on Elocust3m Application

ELocust3m is an application for smart phones that captures data about desert locust presence. The information is used to guide appropriate response, produce situation maps and forecasts of future development. The rollout of eLocust3m app supports the Ministry of Agriculture (MoA) with timely information that covers a larger survey area.

It works whe the users in the field enters the data into the eLocust3m app. It is saved and uploaded when internet connection is available. MoA receives the data, checks it and uses it to plan survey and control operations. The MoA then sends the data to the FAO Desert Locust Information Service (DLIS) where it is used to assess and forecast the situation and shared with all countries. The application can be downloaded by field staff of partners/organizations that have operational presence in desert locust affected areas.

How to record data using ELOCUST3M

Survey and Reporting Using Elocust3m

Procedure of Using Elocust3m Application

i. Using an android phone download the application from google play store or use the following https://play.google.com/store/apps/details?id=plantvillage.locustsurvey

ii. After downloading, complete the installation and registration on your phone (Use your phone number as your Identity when Registering

iii. Location on your phone can be on

iv. After opening the application ‘HOME’ you will see GPS and NET if your phone has captured satellites

v. At the phone screen it will display situation of Locusts in Kenya and any other important information

vi. Inorder to start reporting, tap on the second icon below the screen indicating ‘All reports’ (If you have ever reported all your reports will be displayed)

vii. For new report its important to tap ‘NEW REPORT and new screen will appear’ FAO Desert Locust Report and Control Form’

The Form will indicate the following:

- Date - Automatically updated
- Location - Automatically Updated if you are in an area with network or visible satellites
- Location GPS (Latitude, Longitude, Altitude and Accuracy) -This information is important in control
- Locust type - Drop down where you will select what you can see on the ground - Indicates different stages of the locust with pictorial (hatching, Hopper types, Adult at different stages and no locust, just select one
- Hopper Instar - Gives the different Instars of hoppers - Select the Instars from the drop down
- Area (Ha) - The estimated area of invasion to report or control
- Treated - Indicate if control has taken place (You have to indicate if locusts or hoppers are present for it to be active

viii. There is a comment section where you can make comments of any other information

ix. Take an image or Video closely (30cm) and upload

x. Submit...You have submitted now

xi. The next Icon is on ‘CHAT’ here you will see what other people are reporting and you can chat there

xii. The Last Icon is on Settings - This indicates more information about the application and your account and you can even share the app with another person

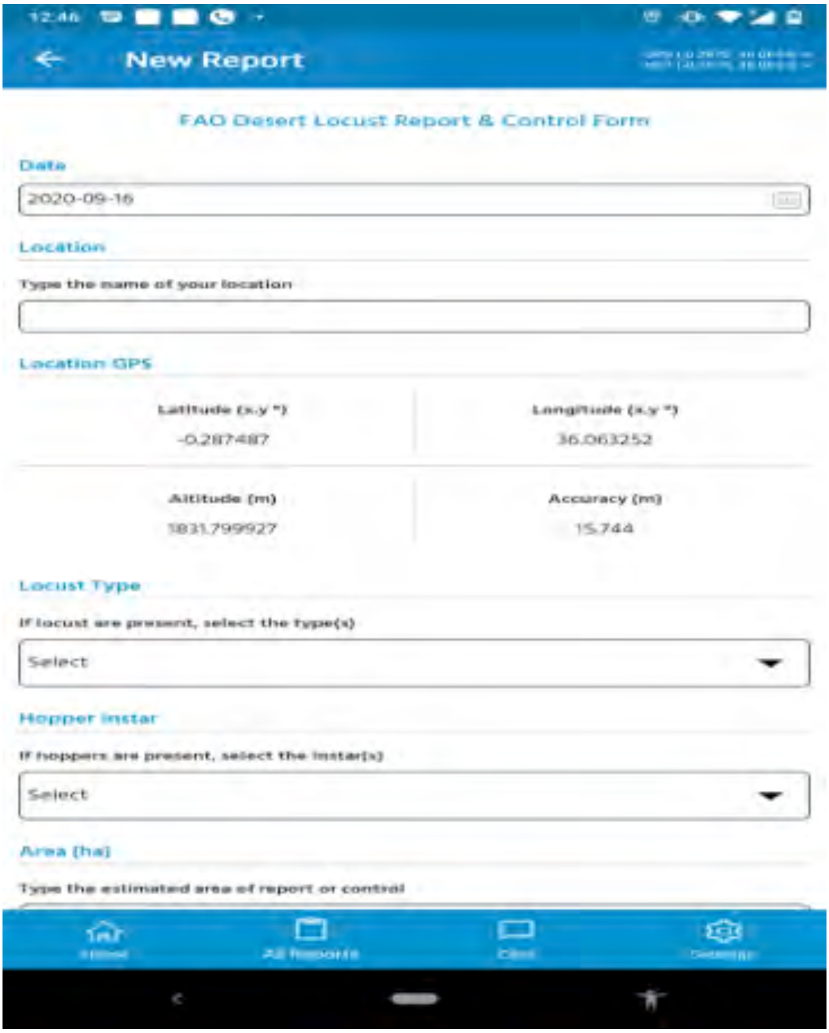


Fig xxE: locust3m Desert Locust -Sample of how a new report screen will appear

5. Desert Locust Control Operation

a. What is the control target and where is it?

Desert Locusts may be nymphs(hoppers), or they may be winged adults. They may be in solitarious phase (dull-coloured and living individually) or in gregarious phase (tending to gather in groups). Gregarious groups of nymphs (hopper bands) and large groups (swarms). Locusts may also be in a transiens phase, the transitional phase between solitarious and gregarious phases. Adults may either be sexually mature.

The decision will be based on the age, phase and maturity of the locusts, numbers and density, closeness to vulnerable crops and likelihood of breeding. However, it is usually very wasteful to control solitarious and other low-density locusts scattered over a large area. The decision may also be influenced by ecological or environmental considerations.

i. If control is necessary, what factors will influence the methods used?

Size of infestation

If the targets are small and few in number, they can be controlled using low speed, simple methods. However, if the infestation is heavy and widespread, a method is required to treat large areas quickly.

Stage of locusts

If they are adults, a quick response and fast work rate are usually required to prevent them migrating to other areas, especially if they are sexually mature.

Where they are

If bands or swarms are close to crops, there is even greater need for a method that can start quickly and give rapid results.

What resources are available for control?

Sometimes the most appropriate equipment or materials are not available at the right place at the right time and control must be carried out with whatever is available.

b. Desert Locust Control Process

When locusts are found, there are a series of steps that need to be followed before, during and after the control operations see Figure x.1 below to help determine if control is necessary.

To be re-done and deleted

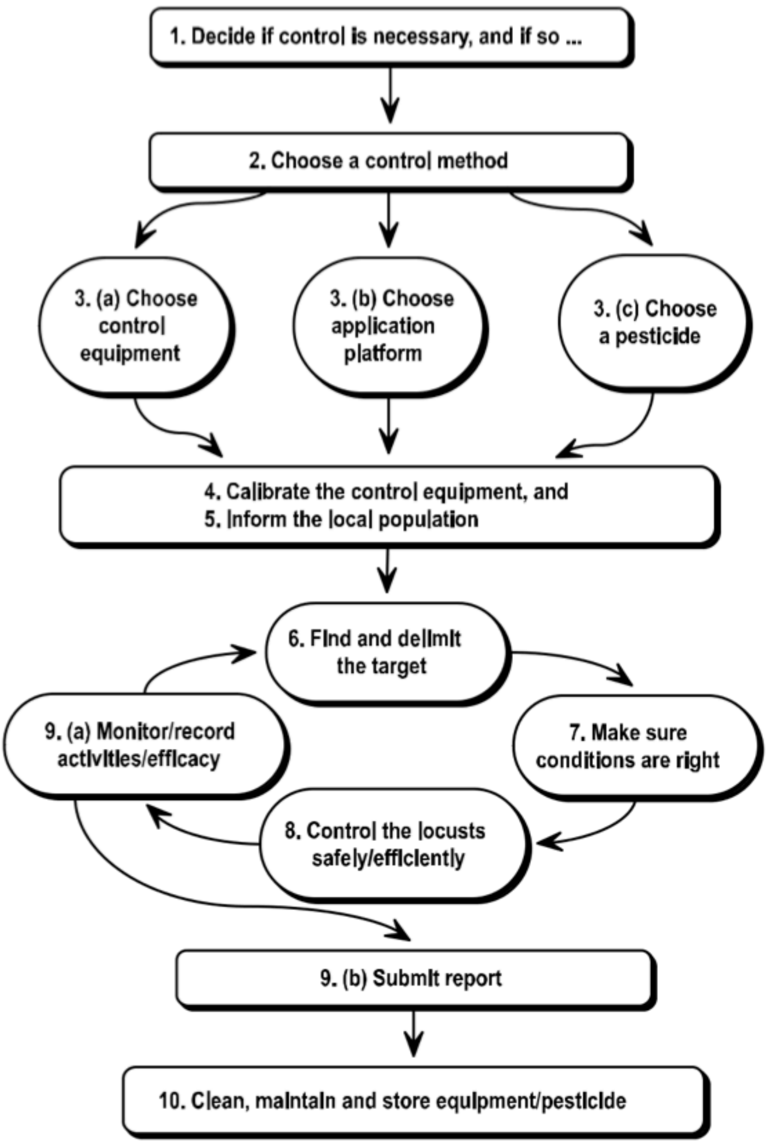


Figure 1: Process of control decision making

Steps to Determine if Control is necessary

Step 1: Decide whether control is necessary

This will depend on the type of target and where it is

Step 2: Decide upon the scale and timing of the operation required

If control is necessary, will depend on factors such as how big the infestation is, how urgent it is to get started and how quickly the infestation must be treated.

Step 3: Choose a control method

This will include equipment, insecticide and technique. The method will depend on factors such as size of infestation and urgency, but also on what resources are available.

Step 4: Calibrate the control equipment

To ensure that the correct amount of insecticide is applied in the right way to the right place

Step 5: Ensure that control will be safe to people and the environment

Local populations should be informed so that they can move livestock, beehives and people away. Avoid sensitive ecological areas.

Step 6: Find and delimit the target

Locate the locusts and mark the boundaries of the infestation.

Step 7: Check weather conditions

Ensure that weather conditions are suitable for the control method.

Step 8: Carry out the control

Step 9: Monitoring

Monitor control operations and efficacy and record all relevant details for inclusion in a control report

Step 10: Clean, service and store equipment. Store unused insecticides safely

c. Choosing An Appropriate Application Method

Locust control primarily lies with the National and County Agriculture office. The role of the extension officer is to conduct surveillance, community awareness and reporting. Community members are encouraged to report to the nearest agriculture office once they sight locusts within their vicinity. When locusts are found, there are a series of steps that need to be followed before, during and after the control operations.The table below shows advantages and disadvantages of different control methods.

Advantages and disadvantages of different control methods

Method	Advantages	Disadvantages
Mechanical	• Low cost • Low environmental impact • No specialist equipment required	• Slow • Often ineffective • Labour intensive
Baiting	• Insecticide well targeted at locusts • Little specialist equipment required	• Large quantities of bait required • Arduous mixing process • Slow application
Dusting	• Little specialist equipment required	• Large quantities of dust required • Slow application • Control may be poor • Inhalation risk to operators
Spraying	• Faster work rate • Liquid insecticides give more rapid and reliable control	• Spraying equipment required • Training and protective clothing • Required for safe and effective control

d. Control Methods

Spraying

Spraying is the most commonly used method for locust control. It involves using a sprayer to atomize a liquid pesticide, i.e. to break it into droplets, which are then distributed over the target area.

Water-based spraying

Water-based spraying is common in conventional agricultural crop protection. It usually involves applying hundreds of litres of insecticide/water mixture per hectare. The insecticide formulation, i.e. the mixture supplied by the manufacturer, is usually an emulsifiable concentrate (EC), but may also be a wettable powder (WP) or other type of formulation. Water-based spraying is rarely carried out on a large scale against Desert Locusts because the work rate is low and the large volumes of clean water are difficult to find in most Desert Locust habitats.

Ultra low volume (ULV) spraying

A technique using much smaller volumes of spray liquid, called ultra low volume (ULV) spraying is the most efficient and commonly used method. The special formulation, known as a ULV (or UL) formulation, is usually supplied ready to spray.

In order to spread such small volumes over the target, the liquid must be broken up into small droplets light enough to be carried easily by the wind. To prevent these small droplets evaporating in the hot conditions that are typical during locust control operations, ULV formulations are based on oil rather than other solvents such as water or petrol fractions which may be too volatile.

These small droplets do not deposit (land on surfaces) very easily. They fall very slowly, so tend to be carried sideways by the wind rather than sedimenting (raining down) on to horizontal surfaces.

ULV Sprayers

Special sprayers are required for ULV spraying if the insecticide is to be used safely and efficiently. Several important factors must be considered:

- Droplet size (depends on the atomizer)
- Droplet spectrum (depends on the atomizer)

- Work rate (depends on the sprayer platform and flow rate)
- Operator safety (depends on various design features)
- Ease of use (depends on various design features)
- Reliability (depends on construction materials and design)

Droplet size

One of the most important components of the sprayer is the part that makes the droplets, i.e. the atomizer, since the droplets must be of the right size to be effective.

If droplets are either too large or too small, control may be poor and insecticide will be wasted. Large droplets fall much more quickly than small droplets. Droplets that are too large fall on the soil near the sprayer, droplets of the right size are carried some distance by the wind and are more likely to impact on vegetation and/or locusts, and droplets that are too small are blown out of the target area.

Large droplets also contain a large volume of insecticide so that when they fall on the ground, they are very wasteful. A large droplet contains sufficient insecticide for eight droplets of half its diameter so if droplet size is increased, the number of droplets per litre is greatly decreased.

The ideal droplet diameter for locust control is thought to be between 50 and 100 µm, but this is a very large range and there is little field evidence of exactly which size is best under different circumstances.

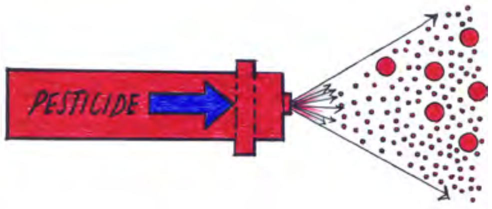
Choosing an atomizer

The three main types of atomizer available for locust control are hydraulic nozzles, air-shear nozzles and rotary atomizers.

Hydraulic nozzles

Liquid is forced under pressure through a small hole and is broken up into droplets as it comes out (Figure xx). Hydraulic nozzles are commonly found on lever-operated knapsack sprayers and on tractor/aircraft spray booms. Generally, the droplet spectrum from hydraulic nozzles is not suitable for ULV spraying since the droplets are usually large (VMD 200-400 µm) and the droplet spectrum is very wide (R is more than 2.5).

Smaller droplets can be produced by smaller nozzles, higher pump pressures and the air shear caused by aircraft-mounted nozzles moving through the air at flying speed, but droplet spectrum will still be quite wide.



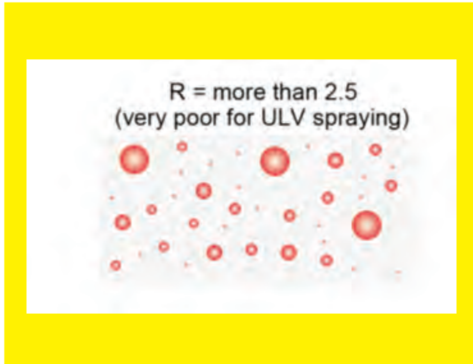
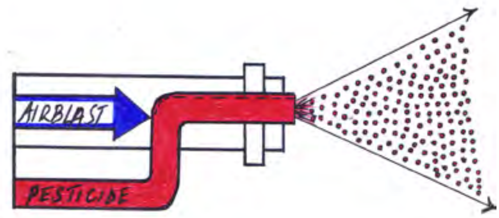


Figure 1: Hydraulic nozzle

Air-shear nozzles

Liquid is released from a pipe into a blast of air that breaks the liquid into droplets (Figure XX). Air-shear nozzles are often used on knapsack mist blowers. The exhaust nozzle sprayer (ENS) has a type of air-shear nozzle with the airblast provided by exhaust gases from the spray vehicle . Faster airblasts produce smaller droplets.



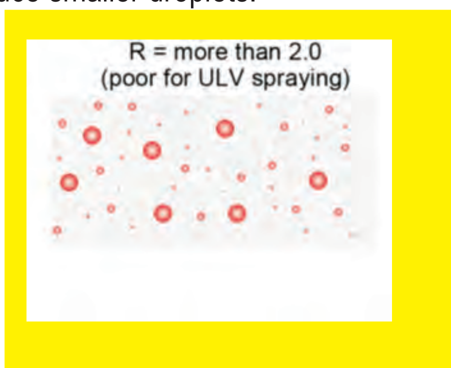


Figure 1: Air-shear nozzle

Rotary atomizers

Liquid is fed on to a rotating surface that throws the liquid off in droplets (Figure xx). The faster the rotation, the smaller the droplets. Some rotary atomizers have spinning discs that produce a very narrow droplet spectrum, especially if they have teeth on the edge. Droplet spectrum is narrowest with a low flow rate and, if a greater flow rate is required, several discs can be stacked one behind the other. Rotary atomizers are the most efficient type of atomizer for ULV spraying.

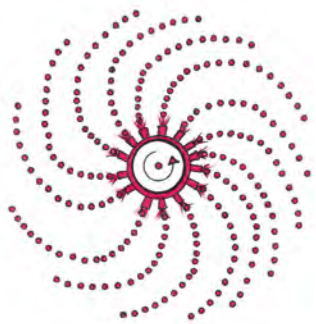
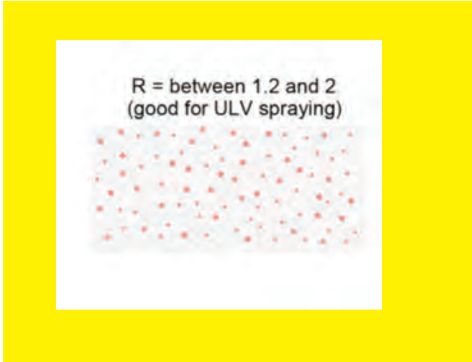


Figure 1: Rotary atomizer



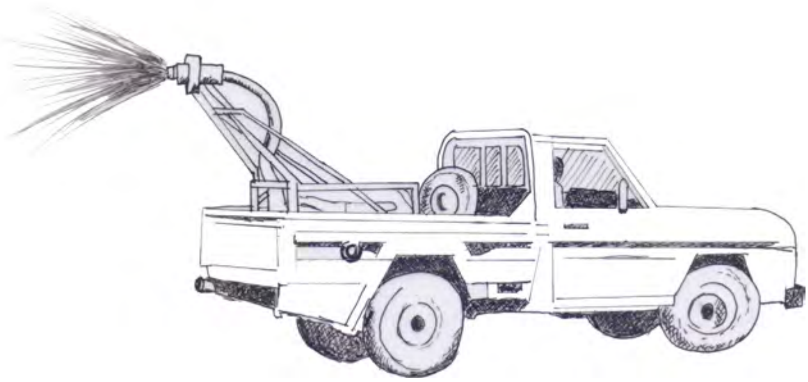
Choosing a sprayer platform

A platform carries the sprayer. ULV sprayers can be carried by an operator (portable sprayer), mounted on a four-wheel drive pick-up truck or on an aeroplane or helicopter .

Characteristics of different sprayer platforms

Performance factor	Portable	Vehicle	Aircraft
Work rate?	slow	medium	fast
(full coverage spraying)	(15 ha/day)	(100 ha/day)	(5,000 ha/day)
Speed of response?	fast	fast	can be slow
Spray in rocks/hills?	yes	no	yes
Spray on soft sand?	yes	no	yes
Spray single bands?	yes	yes	not efficiently
Spray settled swarms?	difficult	difficult	yes
Spray flying swarms?	no	no	yes
Easy monitoring?	yes	usually yes	no, difficult
Involve community?	possible	possible	no
Appropriate target size?	1 up to 10 ha	1-100 ha	over 25 ha

A. Portable ULV Sprayer



B. Vehicle-mounted ULV Sprayer

B. ULV Sprayer

Figure xx. Different types of sprayer platform

Other sprayer factors

Appropriate flow rate

The sprayer flow rate must be adjustable to apply the right volume of insecticide on each hectare. Flow rate should also be easily measurable and quickly adjustable so that it can be checked and set regularly .

Operator safety

The sprayer must be safe for the operator. For example, an operator should not have to go close to the vehicle sprayer to turn it on and off. Controls should be mounted inside the vehicle cab.

Reliability

Locust sprayers should be of a rugged and durable design since they will be used in rough conditions, often far from a workshop. Maintenance will, however, be necessary from time to time, so routine servicing and replacement of parts must be possible in the field without special tools or facilities.

Practicality

The sprayer must be practical to use in the field. An example of a sprayer that is not practical would be one where the insecticide tank is very small so that frequent refilling is necessary.

Spreading ULV Spray Evenly Over the Target

A good ULV sprayer produces droplets in a small size range (narrow droplet spectrum). and these are carried downwards by gravity and sideways by the wind. When the wind passes over the ground surface, especially if vegetation is present, it causes turbulence, i.e. mixing of the air.

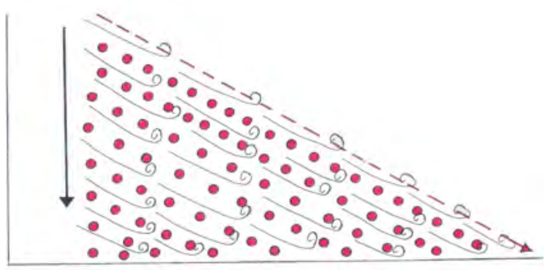


Figure xx. Different types of sprayer platform

This turbulence mixes the droplets upwards and downwards so that some are deposited close to the sprayer and some far away from it. This produces a deposition profile shown by the bar chart and curve in Figure xx. Small amounts are deposited near the sprayer, building up to a peak some distance downwind, then tailing off further downwind.

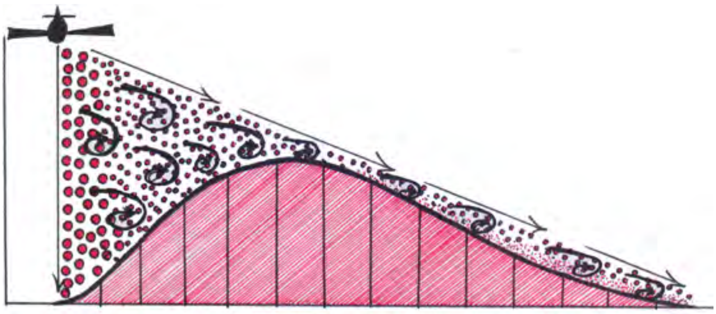


Figure xx. Different types of sprayer platform

These different droplet sizes behave in different ways – the smaller droplets are usually carried further by the wind (Figure xx).

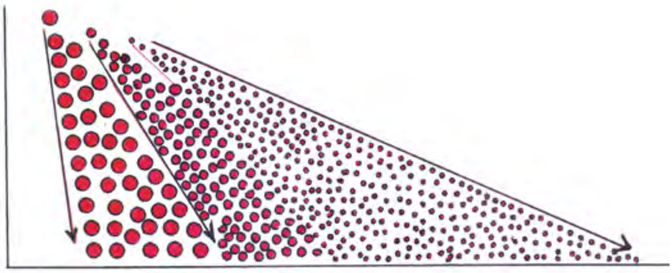


Figure xx. Different types of sprayer platform

Although turbulence is useful for droplets in the right size range because it helps to spread them more evenly over the target area and carry them deep into vegetation, very small droplets fall so slowly that turbulence may carry some of them upwards (Figure xx) so that they drift away and do not deposit in the target area.

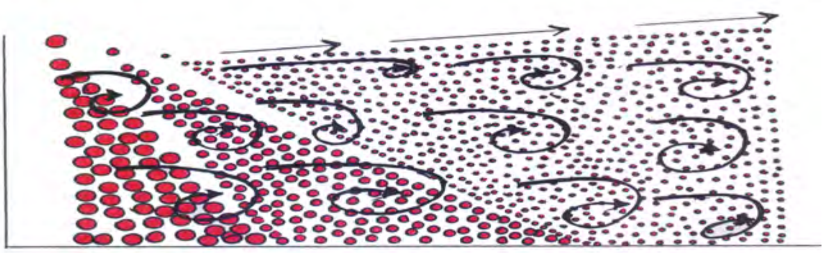


Figure xx. Different types of sprayer platform

Choosing an Insecticide

Most of the locust control carried out in the last 40 years has used conventional chemical insecticides (organochlorines, organophosphates, carbamates and pyrethroids). They work either by direct contact action (droplets land on the locusts) or by secondary contact action (locusts touch the droplets on the vegetation) or by stomach action (locusts eat the sprayed vegetation). The insecticides are usually neurotoxic.

However, there are some newer chemical and biological products which offer advantages such as lower environmental impact, lower operator hazard and greater logistical efficiency, e.g. large areas can be treated in a short time. Some of the characteristics that need to be considered when choosing locust control insecticides are:

- ***Efficacy*** **-** the more toxic the active ingredient is to the locusts, the smaller the amount of active ingredient needed
- ***Safety*** **-** the product should ideally have a low toxicity to mammals and to other animals such as birds and fish
- ***Specificity*** - ideally the product should be toxic to locusts but not to other types of arthropod
- ***Persistence*** - the longer the product remains biologically active in the field, the more effective it is because it can kill locusts later as they emerge from eggs or arrive in the area
- ***Route of entry*** **-** whether it is a contact or stomach action product will determine its suitability for different targets, e.g. flying swarms need a product with contact action
- ***Speed of action*** **-** the faster the product works, the less crop damage will be caused and the better the feedback the control team has on the effectiveness of operations. However, sometimes speed of action is not important, e.g. for hopper bands far from crops
- ***Shelf life*** **-** the longer a product can be stored before use the better. If it is not needed immediately it will still be effective in future years
- ***Availability*** - locust insecticides must be available as ULV formulations in large quantities at short notice
- ***Cost*** **-** insecticides are one of the most expensive elements in any control campaign so cheaper products will greatly reduce control costs

Conventional chemical insecticides

There are three commonly used types of active ingredient (a.i) - the toxic part of insecticides.

Advantages and disadvantages of the main types of conventional insecticides for locust control

Insecticide	Advantages	Disadvantages
Organochlorines	• Persistent in the environment	• Dangerous to humans and the environment **- not recommended**
Organophosphates and carbamates	• Fast knockdown • Low mammalian toxicity	• Some dangerous to mammals some kill birds and fish • Broad spectrum activity
Mixtures or cocktails	• Combine good features of two insecticides	• Two insecticides and calibrate • Broader environmental impact

New and alternative types of chemical insecticide

Some other types of chemical product with useful new characteristics have recently been introduced or are undergoing testing for locust control.

Advantages and disadvantages of new and alternative products for locust control

Product	Advantages	Disadvantages
Insect growth regulators (IGRs), e.g. diflubenzuron, teflubenzuron	• Persistent • Very low mammalian toxicity • Quite low environmental impact • Selective due to stomach action	• Slow action (>3 days) • Little effect on adult locusts • Effects on freshwater arthropods

Product	Advantages	Disadvantages
Phenylpyrazoles, e.g. fipronil	• Persistent • Formulations have relatively low mammalian toxicity • Stomach and contact action • Low mammalian toxicity • Highly specific – safer to environment • Possibility to produce locally formulation	• Slow at low doses (1-2 days) • Broad spectrum - many other non-target arthropods are affected • Very slow action and variable locust mortality • May have short shelf life or difficulties • Difficult to produce in large quantities rapidly and cheaply
Chloronicotinyls, e.g. imidacloprid	• Formulations have relatively low mammalian toxicity • Stomach and contact action	• Little data available for control
Botanical insecticides, e.g. neem	• Can be produced at village level in small quantitiesStomach and contact action	• Slow action and usually incomplete kill
Semiochemicals	• Pheromones may be highly specific and safe products	• No direct kill or evidence of other operational efficacy • None available commercially
Biopesticides, e.g. Metarhizium anisopliae var. acridum	• Low mammalian toxicity • Highly specific – safer to environment • Possibility to produce locally formulation rapidly and cheaply	• Very slow action and variable locust mortality • May have short shelf life or difficulties • Difficult to produce in large quantities

Calibration Factors

Whichever ULV sprayer, platform and insectide have been chosen, calibration is required, i.e. the measurement and adjustment of various parts of the sprayer in order to apply the correct amount of insecticide, in the right size spray droplets, to the right place.

Three factors need to be calibrated to achieve an efficient result

Droplet size

It is necessary to check that the sprayer is adjusted to produce a droplet size that will spread and deposit well over the target area and deposit reasonably well on locusts and/or vegetation (current recommendation is a VMD of 50-100 µm). The droplet size may have to be adjusted for different spraying situations.

Emission height

The height at which the cloud of spray droplets is emitted will influence where the wind carries the drops, so if height is adjustable, it must be set so that insecticide is well distributed over the target area. In general, the higher the emission, the wider the swath, but if the emission is too high, there is a risk that the droplets will not come down in the target area. If the wind is very strong the height should be reduced when possible.The emission height for aircraft will have to be higher for milling/flying swarms and possibly for barrier spraying too. Similarly it may have to be higher to allow for undulating terrain, tall trees or other obstacles. Vehicle-mounted airblast sprayers can be angled up or down to alter the effective emission height (up to around 8 m).

Recommended dose of insecticide

This will usually be given on the pesticide label. If no dose guidance is given on the pesticide label,. If there is no recommended dose, the manufacturer should be contacted for guidance or field trials carried out to establish a dose.

ULV Spray Strategies

There are several different types of ULV spray strategy to deal with different types of locust target. In practice, two or more of these are often combined in a campaign. They are usually full coverage techniques, i.e. the whole target area is sprayed, but some strategies spray only part of the area.

Spraying single hopper bands (spot treatment)

This involves marking a block of land which has a relatively high proportion of its surface area covered by bands, say up to four percent. The whole block is then sprayed by vehicle or aircraft. This is wasteful of insecticide and has a greater potential environmental impact, but may be the only method fast enough to treat an area containing many bands before they fledge, i.e. become adults with wings.

Barrier spraying to control hopper bands

This means spraying a persistent insecticide in strips with large unsprayed areas in between. As the bands in the infested area move, they eventually encounter these sprayed strips and eat the sprayed vegetation.

Spraying settled swarms

This means spraying swarms that are roosting on vegetation, usually either in the morning before take-off or in the late afternoon when the swarms have settled again. The advantage of spraying swarms is that there are many millions of locusts gathered in one place; Swarms are also sometimes sprayed while laying eggs, although they usually disperse before laying and are not such a dense target.

Spraying flying swarms

Swarms are sprayed from aircraft while they are either milling (some of them making short flights around the roost site in the morning or evening) or in full flight.

Demarcating

How to find and delimit the target

Finding individual targets - bands and swarms

The mechanism for finding locust targets will vary from one region to another.. If the survey teams have identified an area infested with bands, or there are reports from the local community of locusts in an area, the control teams will go to that area in vehicles to spray and/or direct the spray aircraft. If the locusts are very far from the locust base or are in very difficult terrain, such as mountains, then a spray aircraft might go there on its own, but aerial spraying without ground support should be avoided if possible. It is always better to have a ground team to direct the aircraft and check on application and efficacy.

When a band or swarm is located, the search team can either mark the location of the target for control teams/aircraft that will arrive later or, if it is equipped with spraying equipment, it can carry immediately out the control itself. If the target is to be marked for later control, flags can be used or, better still, the map coordinates (latitude and longitude) can be recorded with a handheld global positioning system (GPS) unit if one is available. These coordinates can be given to ground spray teams also equipped with GPS, or relayed to spray aircraft pilots (if there is radio communication and GPS on board) to guide them to the targets.

Delimiting and marking individual targets - bands and swarms

Before spraying starts on large bands or swarms, the control team should delimit the target. This means driving or walking around it and, if possible, placing flags, people or vehicles at the corners of a spray area that is big enough to cover the target. If the target is large (more than 1 km^2) and it is planned to spray it by aircraft, GPS coordinates can be recorded for the four corners for relaying to the pilot and/or smoky fires can be lit at each point. The smoke also helps the pilot to judge the wind direction, although the aircraft may be fitted with its own smoke generators for this purpose. The spray area should extend some metres beyond the edges of bands to be sure of covering them. If a band is moving, extend the spray area even further (20-40 m) in the direction of movement so that the locusts move into sprayed vegetation.

Delimiting a block of bands or a scattered swarm

Marking the extent of a block of bands or scattered swarm is even more difficult than marking individual targets. There is not usually time to carry out an accurate search from a vehicle to find all the locust targets, so the technique often used is to drive a transect through the suspected infested area in one direction to determine where the infestation starts and ends. The vehicle then goes to the middle of this line and drives a second transect across the block at 90 degrees to the first one to see how far the infested area extends to either side. These lines form a cross in the middle of a rectangular or square block. If the block is not too big, the vehicle then drives around the edge of the block to mark the corners, and the size is adjusted if necessary to include locusts which are outside the original rectangle.

If the area of bands or swarms is very large, a more systematic method is necessary to demarcate the spray block. Drive a pattern through the suspected infested area. The spacing between the lines will depend on whether the targets are swarms or bands. It should be possible to spot settled swarms or scattered patches of adults at a distance of around 100 m to either side, so a spacing of about 200 m can be used. Bands are difficult to see at more than 50 m distance so a spacing of about 100 m should be used. Since there will be no markers to guide the vehicle, drive on compass bearing, a GPS can be used to navigate instead of a compass and can be very useful for marking the corners of the large spray block.

Weather conditions for ULV spraying

When to spray

The best time for spraying is usually in the morning between 0800 and 1100 hours and in the afternoon after 1600 hours. Effective spraying may be possible before 0800 hours if the wind is strong enough. It may also be possible to spray effectively between 1100 and 1600 hours if it is either cloudy and relatively cool (less than about 30°C) or if there is a steady wind over 4 m/s that will tend to prevent convection.

When not to spray

Three weather factors are important for ULV spraying:

Wind

Never spray when there is no wind because the spray will not be spread properly over the swath and the operator is likely to be contaminated because the spray is not being carried away from him/her. There should be a steady wind of at least 2 m/s measured at a height of 2 m (a distinct breeze felt on the face). Do not spray when the wind is more than 10 m/s (dust and leaves are blown around) since it is not easy to predict where the spray will deposit.

Sunshine

Never spray when there is strong convection. Convection occurs when the sun rises high in the sky and heats up the ground. The hot ground warms up the air near to it, which then rises and may carry spray droplets out of the target area.

Convection usually occurs on hot afternoons but may also occur in the late morning, especially if there is very little wind. Convection cannot usually be seen (except when strong updrafts pick up dust or if spray aircraft have smoke generators) but it can be detected by taking notice of wind strength and direction.

Rain

Never spray if rain is falling or seems likely to fall soon, because the rain may wash off some of the insecticide from the vegetation.

Demarcating small targets

Driving around and marking a large hopper band or swarm.

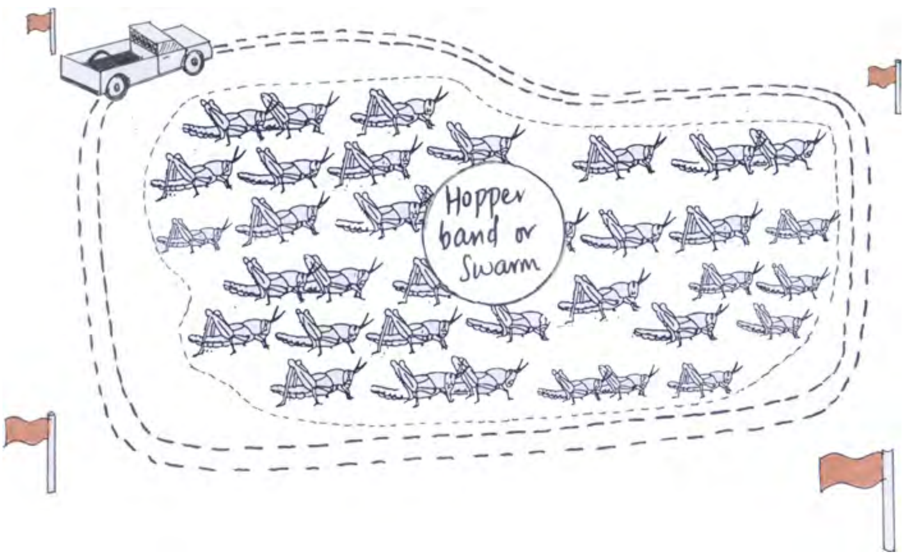


Figure xx.

Tip: when a hopper band is found, there will be others in the area. If no hopper bands are found, it does not mean there are none in the area – they may simply not have been found.

Demarcating a block of targets

Driving two lines through a block of bands or a scattered swarm to delimit the target.

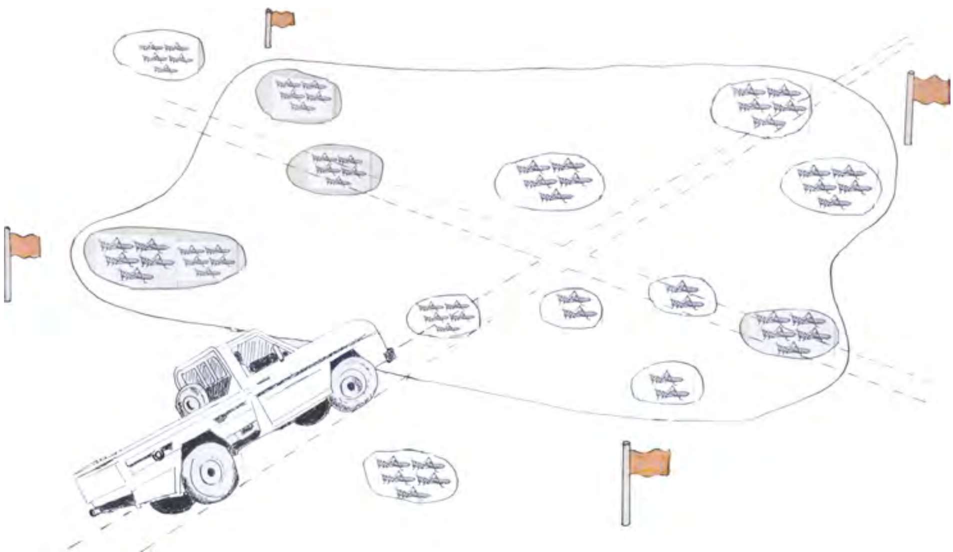


Figure xx.

Demarcating a big block of target

Driving systematically through an infested area to locate bands or swarms and to delimit the infested area.

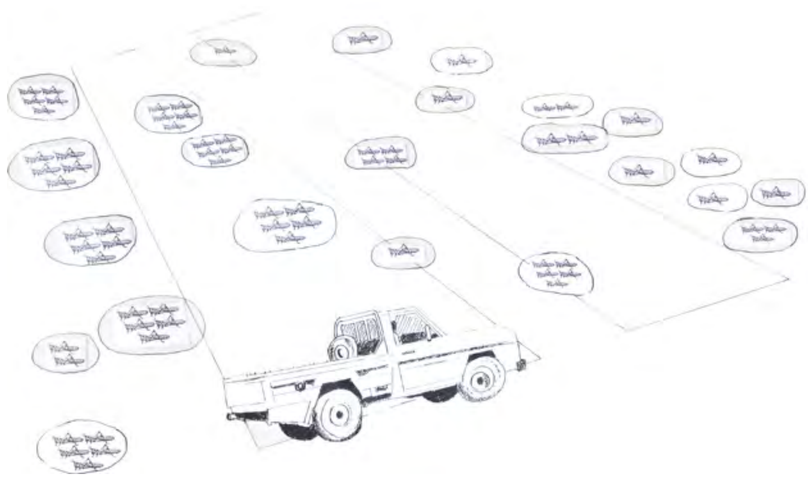


Figure xx.

How to spray ground targets (on the soil or on vegetation)

The basic procedure for full coverage spraying (also called blanket spraying) is the same for all ground targets i.e. bands, blocks of bands or settled swarms. The procedures and principles are also the same whether the sprayer is portable, vehicle or aerial, although some practical details may differ, e.g. aircraft filling, calibration and cleaning will be done at the airstrip.

Step 1: Delimit and mark the target area

This means finding and marking the corners of the block to be sprayed .

Step 2: Check weather conditions are suitable, i.e. steady wind and no convection.

Step 3: Check wind direction and take all spraying equipment and personnel to the downwind edge of the area to be sprayed.

Step 4: Put on protective clothing and read the insecticide label.

Step 5: Fill the sprayer (using filters, funnels and/or pumps) and calibrate the sprayer for droplet size, emission height and dose.

Step 6: After moving all other non-spraying personnel, vehicles and equipment to the upwind side of the target area so that they will not be contaminated with insecticide, start spraying across the direction of the wind (at right angles to it), making sure spray is carried away from you. If there are flagmen or some other means of measuring and following the exact track spacing, the application will be more accurate and efficient

Step 7: Follow spray passes when spraying

When you reach the other side of the spray area, stop spraying and move upwind by the distance of one track spacing. Spray the new pass in the opposite direction to the first pass. Move upwind again, and continue in this way until the whole area is sprayed. Make two spray passes at the upwind edge to compensate for underdosing there, or make an extra spray pass upwind of the target area.

Step 8: Stop spraying when wind drops or becomes very strong

If the wind drops or becomes very strong (more than 10 m/s), stop spraying and wait for the right conditions. If the wind direction changes by more than 45 degrees, stop spraying, go to the new downwind edge and start from Step 6 again, spraying the remaining unsprayed area.

Step 9: Cleaning the sprayer

When spraying is finished, empty any remaining insecticide back into the insecticide container. Clean the sprayer by putting a small amount of diesel fuel or kerosene into the tank and spraying it off over the target area. Clean the outside of the sprayer using diesel fuel or kerosene on a cloth.

Step 10: Store unused insecticide

Store unused insecticide and the sprayer in a safe place away from children, animals and food. Wash your body and protective clothing as soon as possible.

Step 11: Disposal

Dispose of empty pesticide containers properly.

Aerial spraying of flying swarms

The advantage of spraying flying swarms is that flying locusts collect droplets efficiently since they are moving quickly (about 3 m/s) and their wings are beating even faster.

The flying swarms may be milling around the roost site or they may be in full flight either as stratiform swarms (low flying up to heights of 100 m) or cumuliform swarms (flying up to heights of 1 000 m or more)). Swarms are usually stratiform in the morning and late afternoon, and become cumuliform in the heat of the day when convection takes place from the hot ground. These flight patterns are not completely separate and swarms may take a form halfway between stratiform and cumuliform.

Spraying milling swarms

Spraying swarms as they are settling in the late afternoon, or as they are making short flights before departure in the morning, is an efficient and effective technique. Afternoon spraying may be more effective since the locusts will rest and feed on the contaminated vegetation during the night and following morning. The locusts in milling swarms are often much more densely gathered than those in flying swarms.

As with settled swarms, in theory, better control should be obtained by spraying the swarm twice, using half the flow rate for hopper band treatment, to allow locusts to change positions between runs.

Spraying swarms in full flight (air-to-air spraying)

The aim when spraying flying swarms is to keep the spray within the swarm for as long as possible. Swarms usually move downwind, but at less than the wind speed so it is no use spraying at the front of the swarm since the spray cloud will move ahead of the swarm.

Spraying stratiform swarms

The aerial spraying technique is almost the same as that for milling swarms, but with a greater emission height. The aim is to produce droplets that will fall slowly through the swarm so that they can be collected by the flying insects. However, many locusts in stratiform swarms may be settled, so a droplet which is large enough to reach the ground eventually is also desirable. Droplets in the 75-100 µm range are a reasonable compromise between these conflicting requirements.

Spraying cumuliform swarms

The concept of dose does not really apply to spraying cumuliform swarms – it is more like a space spray than a surface spray. The only advice available is to spray repeatedly just above the densest part of the swarm on the upwind side using half the emission rate for settled locust treatment. Continue spraying until the swarm disappears. The spray should remain within the swarm for a long time and the movement of the locusts should bring them into the spray cloud.

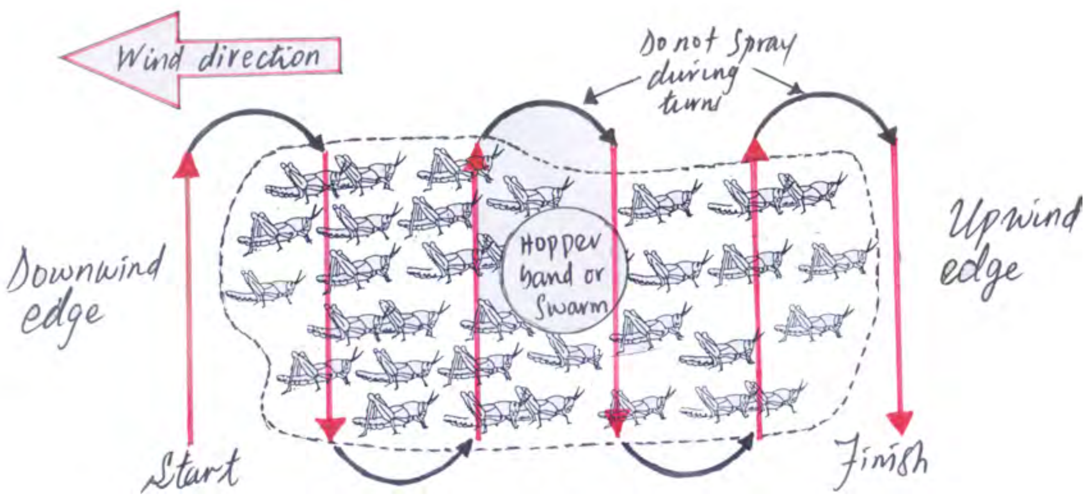


Figure xx.

Method of track marking, i.e. guidance to the ends of the spray passes, is important in order to achieve accurate application. It is very difficult for any sprayer operator, whether he/she is a portable sprayer operator, vehicle driver or aircraft pilot, to estimate the correct track spacing and spraying direction, especially on long spray runs.

Barrier spraying

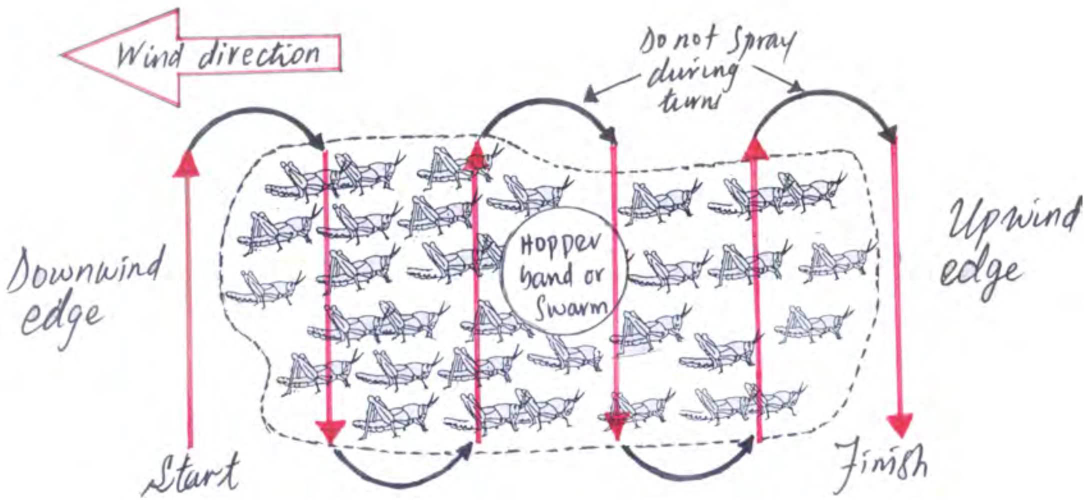


Figure xx.

Marking track spacings for settled targets

ULV spraying will give a reasonably uniform deposition even if track spacings are not very accurate. For example, if an aircraft that is supposed to be using a track spacing of 100 m makes one spacing of 110 m, then a spacing of 90 m, the fact that the swaths overlap means that the deposition uniformity will still be acceptable. However, if the pilot consistently uses a 90 m track spacing, then the result will be an overdose of more than 10 percent – a considerable financial waste and unnecessary environmental risk. It is the undesirable consequences of these consistent errors that make it worthwhile to have some system of track marking or GPS track guidance.

Ground spraying

For ground spraying with portable and vehicle-mounted sprayers, one person with a large flag is sufficient at each side of the spray block. They should calibrate their pace so that they know how many paces to use for 10 m or for 30 m, and they should pace out the correct track spacing for the end of every spray pass. Even if there are two or more sprayers working in formation, one flagman at each side of the block should be sufficient. The flagman guides the leading sprayer who is always furthest downwind and the other sprayers estimate their distance upwind from him/her. GPS track guidance is becoming available for vehicle-mounted sprayers that will improve track spacing accuracy considerably.

Aerial spraying

Flag marking for aircraft is more difficult because the track spacings are larger and the aircraft moves very quickly. It is not usually possible for a single flagman to measure out 100 m to the next spray pass in the time it takes for the aircraft to turn at the edge of the block. It is easier to have two flagmen at each edge, and for the upwind one to be ready in position by the time the aircraft begins its turn. Special mirrors with sights can be used instead of flags Vehicles can also be used as markers if they are available. The vehicle odometer can be used to measure the track spacings, but this should be checked for accuracy against a measured 100 m line.

Standard Operation Procedure for Desert Locust Ground Control

Objective

The objective of the Standard Operating Procedures (SOP) for Desert Locust Control is to give concise instructions for good insecticide application against the Desert Locust. These instructions are intended for use by the field extension staff in Baringo County who are involved in Desert Locust operations in order to help them to avoid dangerous, ineffective or wasteful control operations.

The instructions focus on ULV insecticide spraying ULV spray equipment and Techniques for safe and efficient operations.

1. Control process

A series of steps needs to be followed before, during and after control operations.

- PREPARATIONS three months before control operations
- Select control teams and provide them with training or refresher training
- Check and service the vehicles and motorcycles
- Check and test all spray equipment and check that commonly needed spare parts are available
- Distribute the required quantity and type of insecticides to the likely spray sites
- Make sure that operational funds are allocated for the proposed control period to cover field allowances, fuel, etc.
- Liase with Pest Control office to ensure that aircraft are available in the country for control operations. Check that airstrips have been maintained

Before control operations

Step 1. Choose appropriate control method (equipment, insecticide and technique), which depends on infestation size, urgency of action and work rate required.

Step 2. Calibrate your spray equipment in order to assure the correct amount of insecticide is applied in the right way and in the right place.

Step 3. Ensure that local inhabitants are informed about the date, time and location of control operations, so that they can move their livestock, beehives and families to safety.

Step 4. Find the wind direction in order to establish a spray direction at right angles to it and demarcate the infested area.

Step 5. Make sure that temperature, wind and rainfall conditions are suitable for the control operation.

During control operations

Step 6. Make sure that:

- All staff who are handling or applying insecticide use full protective clothing
- All spraying equipment and personnel are at the downwind edge of the area to start spraying (from downwind towards upwind)
- All other non-spraying personnel, vehicles and equipment are at the upwind edge of the target area to avoid contamination by the sprayed insecticide
- Start spraying cross-wind (at right angles to the wind direction), moving upwind after each spray pass, making sure to measure the correct track spacing using flagmen or other means
- Make an extra spray pass upwind of the target area to prevent under-dosing at the upwind edge
- Stop spraying if the wind drops (less than 1 m/s) or becomes very strong (more than 10 m/s) and wait for the right conditions
- Stop spraying if it starts to rain or seems likely to rain soon
- Stop spraying if the wind direction changes by more than 45 degrees, adjust your new spray line and spray the remaining area

After control operations

Step 7. Monitor and record all relevant details on the Spray Monitoring Form

Step 8. Empty any insecticide remaining in the sprayer back into the original insecticide container. Clean and maintain equipment, and store the sprayers, the insecticide and the empty containers in safe places.

Step 9. Wash yourself and the protective clothing as soon as possible

2. Control team and field equipment

Control Teams are composed of: two Extension/ locust control trained officers, drivers and vehicles and support staff.

Equipment: to be available include:

- Hand-held GPS (1)
- Maps
- Compass (internet enabled phone)
- Clipboard, paper and pen
- Oil sensitive paper to sample ULV droplets
- Bucket and plastic measuring cylinder or jug
- Tool kit First aid kit
- Cages for mortality assessment
- Water and soap for washing
- Sets of protective clothing for all staff handling insecticides

3. Principles of ULV application

Ultra low volume (ULV) spraying uses small amounts of concentrated insecticide. In locust control, about 0.5-1.0 litre/hectare is applied. It is oil-based to prevent evaporation and is usually applied ready to spray.

Droplets of spray are carried by the wind. In full coverage treatments, the insecticide is sprayed as overlapping swaths onto the control target so that a uniform deposit is achieved and the locusts receive enough insecticide. Remember:

- Do not spray during the hottest part of the day (1100-1600 hr) when convection may occur and carry the spray up into the sky instead of down onto the locusts
- Do not spray at low wind speeds less than 1 m/s
- Do not spray at high wind speeds more than 10 m/s

4. ULV spray equipment

A good ULV sprayer uses rotary atomizers (spinning discs or rotating cages) to produce droplets in a small size range (50-100 um). If droplets are too large or too small, control will be poor and insecticide wasted.

ULV sprayers can be carried by an operator (portable) or vehicle-mounted sprayer, aircraft-mounted sprayer. The principles of use are the same for all of them, but the scale and speed of operation are different.

Portable sprayers

- For small areas (15 ha/day)
- For situations where a slow work rate is acceptable
- In rocks and hills
- On soft sands
- For single hopper bands only (not for swarm control)

Vehicle-mounted sprayers

- For medium-sized areas (100 ha/day)
- For situations where a medium work rate is required
- For single bands
- Not recommended in rocks and hills Not recommended on soft sand Difficult to spray swarms

- Aircraft-mounted sprayers
- For large areas (5,000 ha/day or more)
- For situations where a fast work rate is required
- In rocks and hills
- On soft sand
- To control swarms (settled and flying) Not efficient for spraying single bands

5. Calibrating ULV spray equipment

Spray equipment must be calibrated before the actual spraying takes place.

What is calibration?

The sprayer needs to be adjusted in order to apply the recommended amount of insecticide, in the right size spray droplets, to the right place.

When do you calibrate spray equipment?

- When the sprayer is new
- When the insecticide formulation or concentration is changed
- When the volume application rate (VAR), track spacing or forward speed is changed
- Before the beginning of the campaign and on a daily basis during it

6. Recording and reporting

Monitoring is very important in order to document the activities and to allow later analysis of the successes and failures of any campaign.

The form should be completed in order to include details on the location, rainfall, ecology and locusts. Both forms should be returned to the County and National Locust Unit headquarters as soon as possible for review. Any problems (lack of protective clothing, overdosing, poor efficacy, non-target effects, etc.) can be noted on the form so they can be addressed later.

7. Cleaning, storing and disposal

Spray equipment should always be clean and ready to use. Properly dispose empty containers.

Always wear protective clothing while handling insecticides

Sprayers

- Drain unused insecticide back into the original containers
- To clean the sprayer, put some kerosene or diesel into it and spray it over the target area or waste ground, away from water bodies or supplies used by people or livestock; never dump this liquid in one place such as a pit
- Carry out any repair or required maintenance
- Wash the outside of the sprayer with a cloth soaked in diesel or kerosene
- Store the cleaned sprayer safely in a store
- Insecticide storage
- Keep insecticide in original containers in a cool locked store to reduce deterioration caused by high temperatures
- Use older insecticides first (first-in-first-out system)

Disposal of empty insecticide containers

- Clean empty insecticide containers three times inside and out with diesel or kerosene
- Collect the small volume of washings and dispose of by adding them to the insecticide in sprayer tanks during the next control operations or, if it is the end of the season, pour them into insecticide containers that are not full
- Never use empty containers for any other purpose than insecticides
- If they are to be recycled, they should be transported back to manufacturer
- Containers for disposal should be punctured, crushed and sent back to national authorities for appropriate disposal

6. Health, Environmental and Social Safety Standards

Safe use of pesticides

Most pesticides will have an adverse effect if they enter the body. The main routes of absorption are through the respiratory tract (inhalation), through the skin (dermal absorption) and through the digestive tract (ingestion).

Pesticide users and handlers are advised to ensure they avoid or minimize exposure to pesticides by wearing personal protective equipment that comprise but not limited to; respirators and face shields that protect nose, mouth and eyes, hand gloves, gum boots, overall/ aprons and proper washing of oneself and the protective equipment after any pesticide application and handling and proper storage of pesticides to avoid accidents and exposure to the environment.

Figure xx. Put warning signs

Pesticides should only be used if there is an economically important need and all pesticides must be used strictly in accordance with their label recommendation. Product selection must assess the potential exposure hazard of the selected formulation and determine what control measures and dose rates the label recommendations advocate.

The use of appropriate Personal Protective Equipment (PPE) is essential for protecting operator health and advice on its use will be found on the product label. Effective health monitoring records will be able to provide early warnings and identify changes in operator health, which may be attributed to working with pesticides.

As well as the workers handling and spraying pesticides the public must be safeguarded, both during, and after spraying, for example where they might have access to a treated area. Maybe livestock also ought to be prevented from re-entering treated areas immediately after spraying.

i. Operator health surveillance

The health of operators exposed to pesticides must be monitored. The surveillance should cover health records and medical checks, which can alert medical authorities of any health changes, which might be related to exposure during work. Health surveillance can also indicate that safety practices and the selection and use of PPE remain adequate for the products being used.

Figure xx. Do not spray against the wind

ii. Application timing

In relation to safe and efficient pesticide use correct application timing is often poorly understood. The optimum time to spray is determined by the crop, pest, weed and disease growth stages. For DL, recommended spray time is between 6.00 am to 9.00 am when they are relatively inactive due to low temperatures and the weather is generally calm.

Figure xx. Do not use leaking or defective equipment

iii. Product transport and storage

Pesticides should be transported and stored in their original, labelled containers (packages). The containers must be checked for leaks and damage and must always remain clearly labelled. They should be stored in cool, dry places, out of reach of children and in rooms not frequently used for other purposes.

Figure xx. If it is not possible to transport pesticides as only load, then keep them away from passengers and remainder of the load

Figure xx: Do NOT buy or transport damaged packs

Figure xx: Store pesticides separately and in a secure way

iv. Product handling

The product label is usually the first reference for guidance on handling the formulated pesticide products. It will usually describe the requirements for the use of Personal Protective Equipment (PPE) both for handling the concentrate and for the diluted spray solution to be used in the field. The careful selection, use and maintenance of PPE are essential to ensure that the user is adequately protected.

Figure xx: Read the label!

Only approved safety equipment must be used. Certain toxic chemicals may only be approved for use if they are handled and dispensed via fully tested and officially approved closed dispensing systems. Such systems reduce operator and environmental contamination.

Figure xx: Use approved safety equipment

v. Chemical container management – disposal of chemical containers after use

Unfortunately, empty chemical containers often have second-hand values. However, empty pesticide containers must never be re-used by users.

Containers can be thoroughly cleaned manually even when they have contained viscous formulations however automatic rinsing systems are becoming common and are mandatory on field sprayers in many countries.

Figure xx: Do not wash pesticide containers to re-use them

Figure xx:

Figure xx: Contact the local authority for disposal

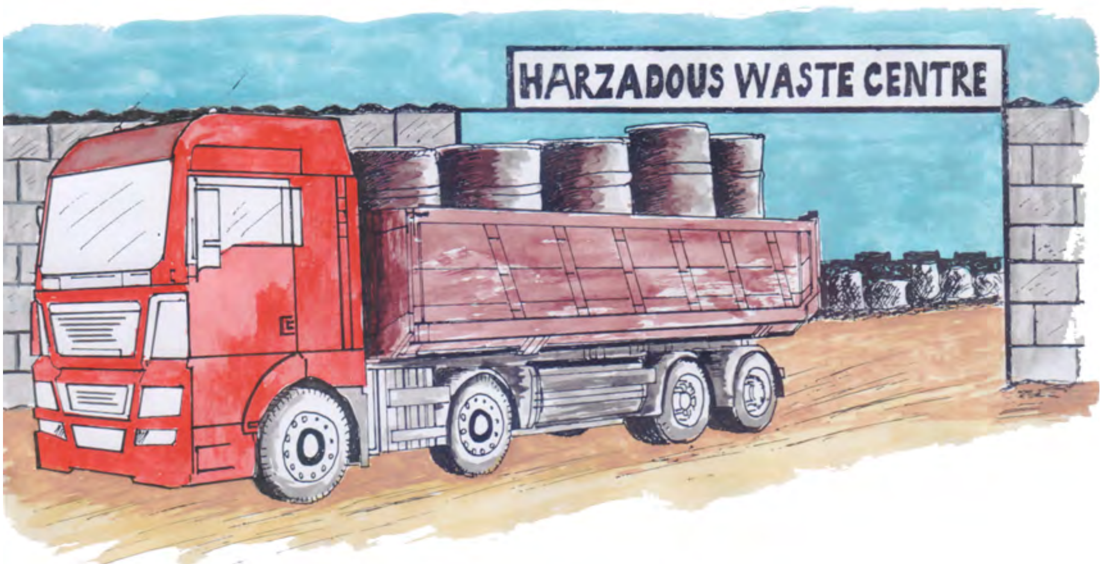


Figure xx: Bring containers to special place for hazardous waste collection

Some countries allow controlled burial for empty containers; however, burial sites must not be close to waterways. Hot incineration offers an alternative method of disposal, however, local regulations must be consulted.

The problems associated with container rinsing and disposal can be eliminated by using systems of returning chemical containers to suppliers, where they can be refilled or recycled.

vi. Accident procedures

If an accident occurs during transport or handling a pesticide, the spillage may result in fire, injury to humans, property damage or environmental contamination. Rapid action must follow the accident to minimise adverse effects. It is essential that pesticide transporters and users are familiar with label recommendations and procedures in the event of an accident and the appropriate authorities (Environmental, Water, Police etc) are informed of the accident and the corrective procedures followed. All spillage incidents and the actions taken must be accurately recorded.

Vehicles used to transport pesticides must be decontaminated following an accident or spillage.

vii. Personal protection

There are three principal routes that chemicals enter the body:

a) Accidental or deliberate ingestion

Figure xx: Pesticides can be eaten accidentally

b) Dermal, through handling, measuring and pouring the concentrate

Figure xx: Pesticides go through the skin

c) Inhalation of small particles or dust during handling and spraying

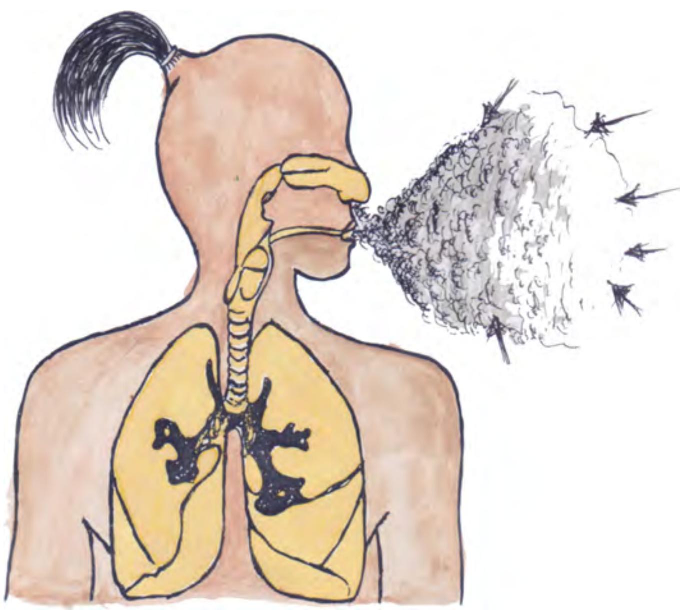


Figure xx: Pesticides go through the skin

Dermal exposure represents the most common hazard. Avoiding exposure by using PPE and by paying attention to personal hygiene by washing exposed parts of the body after work and before eating, smoking and toileting will minimize risk. Personal Protective equipment must be selected in accordance with the label recommendation. It must be comfortable to wear/use and be made of material, which will prevent penetration of the pesticide.

Figure xx: Wash contaminated skin and clothing with abundant water and soap

PPE will only remain effective if it is correctly selected and maintained. Where the equipment is damaged, repairs must restore it to its original condition otherwise the item must be replaced. Items such as the respirator must be checked on a regular basis and filter elements changed in accordance with the manufacturer's instructions.

Remember, products containing the same active ingredient but sold under different brand names may pose different risks due to the product formulation. Care must be taken to always refer to the individual label for the product being used.

viii. Protecting water bodies e.g. water pans

Figure xx: Do not contaminate the environment

7. Frequently Asked Questions

Are desert locusts also grasshoppers?

Yes they are. The main difference is that Locusts are part of a large group of insects commonly called grasshoppers which have big hind legs for jumping. Locusts belong to the family called Acrididae. Locusts differ from grasshoppers in that they have the ability to change their behaviour and habits to that of a destructive nature and can migrate over large distances.

Why do locusts change their behaviour

As Desert Locusts increase in number and become more crowded, they change their behavior from that of acting as an individual (solitarious) insect to that of acting as part of a group (gregarious). The appearance of the locust also changes: solitary adults are brown whereas gregarious adults are pink (immature) and yellow (mature). Up until 1921, it was thought that the Desert Locust was actually two different species of locusts.

Why is it important to collect information on locust behaviour and who will use this?

By carefully observing locust behaviour, the experienced Locust Field Officer can often see the first signs of the change in locust phase; that is, from solitarious to gregarious and vice versa. This can be seen by watching how the locusts behave individually and together; for example, are they starting to behave similarly, concentrate or form groups? This is important in deciding which infestations are significant, which pose a threat and which should be controlled.

Can locusts hurt humans?

Locusts do not attack people or animals. There is no evidence that suggests that locusts carry diseases that could harm humans.

Where do desert locusts come from?

The desert locust swarms started crossing the border into Kenya from Ethiopia and Somalia on 28th December 2019. The locusts invaded 28 counties in the drylands.

Have desert locusts only invaded Kenya?

No. They have invaded many countries in the Horn of Africa - Djibouti, Eritrea, Ethiopia, Kenya, Somalia and Uganda.

The desert locusts have been seen moving from one county to the other. Why is that?

Desert locusts are poor fliers and will always move with the wind across counties depending on the availability of needed resources. Immature desert locusts move in search of suitable vegetation (food) and while mature locusts move in search of breeding habitats. Mature adults prefer arid and semi-arid conditions that favour breeding.

Will desert locusts leave Kenya for good?

We do not know for sure. The nature of DL is that they are migratory and rely a lot on wind patterns for their movement from one area to another. The Kenyan invasion region is characterized by two breeding seasons, winter breeding (February - April) and Spring breeding (March - May). Swarms emerging from Spring breeding will be carried by the Southerly winds to Ethiopia and South Sudan. However, it is likely that Northerly winds will bring swarms to Kenya from Summer breeding areas of Sudan and North Ethiopia during months of December and January.

What is the best way to report that there are desert locusts in my area?

You should report this to the nearest Locust Control Unit. Send SMS, call or WhatsApp to the provided telephone number. You may also report through the elocust3m app if you have been trained on how to use it.

How do I know which comments are important enough to write down?

You should write down your observations or interpretation of the situation, especially anything related to locust behaviour such as changes in the population from solitarious to gregarious, and those concerning breeding or migration. The comments section is a good place to write down general observations about the habitat in between the survey stops. Lastly, you can note details of the last time locusts were present at the survey stop, indicating the dates and the types of infestations. Use a different characteristic like colour change

Is it easier and less expensive to wait for pastoralists, villagers, farmers, traders and others to report locusts rather than carrying out ground surveys by a Locust Control Unit?

This may be true but it will usually mean that you will be late in reacting to the situation, and before you know it, you may be faced with large locust infestations and an emergency. Desert Locust numbers normally first increase in desert areas before moving into cropping areas, by the time they are reported by farmers or agricultural extension agents, the numbers will often be so high that immediate action is required. This does not allow enough time for planning or responding in a calm manner. If surveys are done more proactively with specialized teams visiting desert areas and checking for green vegetation and locusts, then it is more likely that the early signs of a population buildup will be detected and you will not be surprised with unexpected reports of locusts. These areas can then be monitored and control measures taken before numbers increase to such an extent that large areas have to be treated or crops are threatened. Again, this approach requires an active Locust control Unit that is highly mobile with the ability to undertake regular surveys and control outside cropping areas.

Is it enough just to carry out surveys in agricultural areas such as farms?

Absolutely not! Desert Locusts by their nature are more often present in the desert than in cropping areas. As their numbers increase and as natural vegetation becomes dry, they may then move into cropping areas. Therefore, if surveys are only conducted in agricultural areas as a means of monitoring the situation, the early stages of a buildup in the locust populations will be missed and you may find yourself suddenly facing an outbreak or upsurge situation.

Is it necessary to collect and report information from those places where no locusts were found?

Yes. This helps the national Locust Information Officer as well as FAO Desert Locust Information Service (DLIS) in Rome to analyse the current situation better by understanding where surveys were conducted and where locusts were not found even though the habitat is favourable for them. If this information is not reported, it is difficult to plan follow-up surveys and to forecast future developments.

Is it possible to find all locust infestations during a survey?

It is practically impossible to find every single locust or locust infestation during a survey, regardless if it is done by ground or air. This is because it is not possible to survey every square metre of locust habitat. Therefore, survey results should be considered as samples which are used to estimate the real situation. Experienced officers in locust-affected countries and other researchers suggest that perhaps about half of the locust infestations present in a given area are detected during surveys, depending on the habitat, accessibility and locust infestations in surrounding areas.

Are foot transects more accurate than vehicle transects for counting locusts?

Both are types of sampling methods that estimate the number of locusts present in a specific area. Foot transects may give a more accurate representation of the locust population at a particular spot but they can cover only a small area while vehicle transects may provide a better estimate of the extent of the locust infestation.

Vehicle transects sound much easier and faster to make, so why not just use this method for making locust surveys?

Vehicle transects can be a useful method of surveying over large areas such as plains. However, it is not possible to check for hoppers which means that it may be easy to miss breeding that could be in progress. This can only be done by foot. To make a good transect, the vehicle must be driven very slowly and the Locust Control Unit must concentrate and watch carefully for any adults that are disturbed.

Is it better to keep expensive equipment in storage and use it only during control operations or during locust plagues?

The basic equipment used for surveys is relatively cheap considering the high cost of purchasing and applying pesticides. Keeping the equipment such as vehicle mounted ULV sprayers, handheld ULV sprayers and knapsack sprayers in storage and not using it makes the job of the Locust Control Unit much harder. As a result, they will not be able to collect some information with precision, for example, the coordinates of the survey. It is much better to use the equipment on a regular basis and to replace it when it wears out or breaks. This is also a good way to keep trained officers familiar with using and maintaining equipment such as GPS and compasses. If it is necessary to keep electrical equipment in storage for any length of time, batteries should be removed.

Who carries out locust control operations?

Locust survey and control are primarily the responsibility of the Ministry of Agriculture in locust affected countries and are operations undertaken by national locust units. There are also County Locust Control Units that assist with survey and control operations. During times of outbreaks and plagues, external assistance from the donor community and other international organizations is usually required.

Is it better to have a centralized or a decentralized programme for monitoring locusts?

Because Desert Locusts can easily and quickly move across administrative boundaries in a country, it is difficult to decentralize a monitoring programme and still ensure that it is effective. Often, poor communications and coordination between regions within a country hamper effective planning. Some counties may carry out surveys and send reports to the National Unit while others do not. Therefore, a small centralized Locust control Unit that can easily respond to environmental conditions and locust threat by undertaking a survey anywhere in the county.

Why should one not spray a swarm of desert locusts as soon as you see it?

Only authorized Locust Control Units have been authorized to control desert locusts with recommended chemicals. The authorized spray teams have been trained on best time to spray locust swarms and on safe use of chemicals.

What is the best time to spray desert locust swarms?

It is best to spray locust swarms at sunrise or at sunset when they are least mobile.

Why is it not advisable to attempt to control desert locust using mechanical methods such as beating, loud noise or smoke?

These methods may not have a significant effect in controlling locusts and only encourage big swarms to scatter to small swarms. It results in dispersing locusts, which makes it even more difficult for targeted pesticide applications.

Can desert locusts be controlled by spraying their eggs/pods?

No, this method of control may not be sufficient because the locust eggs are encased in pods and most are laid underground and therefore cannot be easily penetrated by sprayed chemicals.

Is spraying of pesticides the only way of controlling desert locust?

Extensive research is in progress on biological control and other means of non-chemical control of locusts. The current focus is primarily on pathogens and insect growth regulators. Thus far control by natural predators and parasites is limited since locusts can quickly migrate away from most natural enemies. Although giant nets, flamethrowers, lasers and huge vacuums have been proposed in the past, these are not in use for locust control. People and birds often eat locusts but usually not enough to significantly reduce population levels over large areas.

Can I utilize used pesticide drums for water storage for household use?

No! This is not recommended because the residue from the chemicals in the drums is hazardous. The Locust control Unit should ensure that they are destroyed and disposed off as soon as the chemical has been utilized.

Can desert locusts be used for human and animal consumption?

Yes. People in several countries collect locusts using large nets and by other means. Locusts are usually stir-fried, roasted or boiled and eaten immediately or dried and eaten. Dried locusts can also be included in animal feed formulations. The locusts can be consumed as long as the locusts have not been sprayed with hazardous pesticides.

Why can't we harvest them for food, or process them for animal feed, instead of spraying?

Currently, there is no harvesting technology developed to capture desert locusts. Coupled with high numbers (one swarm of desert locusts has 40-50 million individual locusts). Harvesting for food or feed may not be an effective method to control locusts. Further, large numbers or swarms are unsafe as they are exposed to different human interventions as they pass across different countries.

8. Bibliography

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