PAN Germany

Field Guide to

Non-chemical Pest Management

in Sesame Production

Pesticide Action Network (PAN) Germany

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Non-chemical Pest Management in Sesame Production

Pesticide Action Network (PAN) Germany
Hamburg, 2007

Pesticide Action Network (PAN)

Founded in 1982, the Pesticide Action Network is an international coalition of over 600 citizens groups in more than 60 countries, working to oppose the misuse of pesticides and to promote sustainable agriculture and ecologically sound pest management.

PAN Germany was established in 1984 as part of this global network and has continually been involved in initiatives to reduce the use of hazardous pesticides and to promote sustainable pest management systems on national, European and global levels.

Acknowledgements

First, we want to express our gratitude to the universities and organizations that have given the permission to use their photos for the OISAT project. (For more details see p. 17)

We also wish to thank all the individuals, groups and organizations that have prepared the bases for the most control measures presented in this field guide, may it have been by preserving traditional experience, on field trials, on field research or in the lab.

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Table of contents

Prologue 6

How to use this field guide 7

Recommended practices 8

I. Introduction 9

II. Climatic and soil requirement 9

III. Cultural practices 9

IV. Pests, its damages and control measures 11

Weeds 11

Insects/Mites 12

Ants 12

Aphids 13

Whiteflies 13

Beneficial Insects 15

V. Harvesting 16

Photo credits 16

References 17

Tables 17

Table 1: Sesame' growth stages and its pests 12

Table 2: Monthly cropping calendar on growing sesame 17

Table 3: Weekly activities on growing sesame 18

Table 4: Crop life cycle 18

Prologue

Pesticides worth more than 30 billion US dollar are intentionally released into the global environment every year. A high proportion of these is highly toxic and has immediate adverse effects on human health, wildlife, local food sources such as cattle or fish, beneficial insects and biodiversity. Some of them have chronic effects including cancers, reproductive problems, birth defects, hormonal disruption and damage to the immune system. Impacts come from direct exposure in use, spray drift, washing work clothes used while spraying, home pesticide storage, pesticide dumps, and persistence in the environment.

Overall aim of the international *Pesticide Action Network (PAN)* is to eliminate the use of hazardous pesticides, reduce overall use, risk and dependence on pesticides, and increase support for community-based control over a sustainably produced food supply. PAN is committed, in its projects, strategies and campaigns to place pesticide concerns in the broad political and economic context in ways that will advance the fight against rural poverty and enhance pro-poor development and ethical trade. PAN aims to help local communities use the initiatives to benefit their day-to-day lives.

PAN Germany is part of the international Pesticide Action Network. It is supporting non-chemical pest management on tropical crops that are commonly grown by small landholder farmers through the project: Online Information Service for Non-chemical Pest Management in the Tropics, OISAT (www.oisat.org).

OISAT is web-based system to distribute information on non-chemical pest management that is easy to read and easy to understand. Information provided via www.oisat.org is relevant to small-scale farmers who intend to produce crops using safer and more affordable non-chemical pest management practices. It provides varied information on how to lower the cost of production based on recommended insect/mites pests, disease, and weeds control methods.

The ‘Field guide on Non-chemical Pest Management on Sesame’ is an excerpt taken from the website, www.oisat.org. It enables to provide farmers with practical guides and alternatives to eliminate the use and their dependence on synthetic pesticides for the management of sesame pests. The recommended practices are safer, more affordable, and easy to follow. Most of the farm practices, the farmers can do by themselves and the materials that are needed are found in their backyards or in their kitchens or can be purchased in the local agricultural suppliers.

Carina Weber
(Executive Director PAN Germany)

How to use this field guide

This manual is designed to let you grow sesame as easy as possible.

It provides you the suggested appropriate management practices on how to grow sesame. In the pest pages, each pest has a brief description of its lifecycle, damage it causes, and its control measures. It is very important to know how the insect/mite pest develops because the adult does not always cause the damage and sometimes it is not even found where the damage occurred. Included in the control measures are cultural practices, physical control, plant extracts, other homemade solutions, and other practical methods. Also, as not to confuse you with the beneficial insects, a separate page with photos of them and their conservation and management are included.

For example, you notice that the leaves have holes when you're out in the field. What would you do? First, have a closer and careful examination of your plant. If you find the pest and can't identify it, turn the following pages and look at the illustration of an insect and/or the damage or symptom in each pest entry. Once you have identified the pest, look into the corresponding control measures on how to eliminate and/or lessen its population density. You have various options like: cultural practices; physical control (e.g. handpicking); plant extract (e.g. ginger spray); other homemade solution (e.g. soap spray); other method (use of baits).

However, with every effort made to provide you with complete information on the pest control in sesame growing, the recommendations may vary from every location. It is highly suggested that you have to try the various control practices in small scale especially for the plant extracts and other homemade solutions, in order to make adjustments that are adaptable to your local farm conditions before going into large scale application.

Fill up the forms at the end of this manual to have a record of activities each time you grow sesame.

And best of all, remember always to develop a marketing plan to sell all your products!

Recommended practices

Throughout this field guide you will find suggestions for stopping or lessening the pests' population before they have control over your sesame field. To make a plan for you to grow a healthy crop, the following tips are the steps you ought to take:

1. Learn to identify the insects
2. Select the proper variety that is well adapted to your local conditions
3. Always select good and diseased-free seeds. If possible, treat seeds to kill seed borne pathogens and insect pests
4. Have a healthy soil, but always keep in mind that over-fertilizing isn't necessarily better
5. Practice crop rotation by planting on the next cropping season- crops of different family group
6. If possible practice intercropping to improve the field's bio-diversity and to encourage natural enemies
7. Follow the recommended planting distances
8. Prepare the soil thoroughly by appropriate tillage
9. Always practice proper field sanitation by removing and pruning infested plant parts, keeping the area free of weeds and other plant residues, and cleaning regularly all farm tools and implements
10. Monitor your plants regularly
11. When in doubt, always ask for assistance from experts

When controlling pests using the plant extracts and other homemade solutions, the following are the standard procedures for their preparation and application;

1. Select plants/plant parts that are pests-free.
2. When storing the plants/plant parts for future usage, make sure that they are properly dried and are stored in an airy container (never use plastic container), away from direct sunlight and moisture. Make sure that they are free from molds before using them.
3. Do not use cooking and drinking utensils for the extract preparation. Clean properly all the utensils every time after using them.
4. Do not have a direct contact with the crude extract while in the process of the preparation and during the application.
5. Make sure that you place the plant extract out of reach of children and house pets while leaving it overnight.
6. Always test the plant extract formulation on a few infested plants first before going into large scale spraying.
7. Wear protective clothing while applying the extract.
8. Wash your hands after handling the plant extract.

I. Introduction

About Sesame

Scientific name: Sesamum indicum
Family: Sesame family
Other names: Benne seed
Beni
Benneseed
Benniseed
Gingelly
Sim sim
Til

Uses

1. edible oil
2. spice
3. flour
4. animal feed

Advantages of planting sesame

1. excellent rotation crop of cotton, corn, peanut, wheat, and sorghum
2. reduces nematode populations that attack cotton and peanut
3. excellent soil builder- improves the soil texture and moisture retention
4. lessens soil erosion – the composted sesame leaves left on the soil binds the ground
5. retains soil moisture better for planting the next crop
6. increases the yield of the following crop
7. resistant to drought
8. tolerant to insect pests and diseases
9. a low cost crop and one of the best alternative specialty crops

II. Climatic and soil requirement

Temperature requirement: 25 - 37° C. Sesame is a summer crop and drought tolerant that can withstand high heat.

The seeds will not germinate at all at temperature below 11° C and below 20° C growth is reduced.

Soil requirement: Sesame is adaptable to many soil types but it thrives best on well-drained and medium-textured fertile soil. It does not grow well on heavy clay soils and on salty soil or irrigation water containing high concentrations of salt. It will die on waterlogged area.

Soil pH: 5 - 8 soil pH

III. Cultural practices

Seed selection

Always choose seeds of the same type and variety. Mixing different varieties will result to uneven height, maturity, and seed quality.

Field preparation

During the land preparation, choose the tillage practices that will ensure to keep the soil in its best physical condition for a favorable crop's growth and development.

Plow and harrow the soil to a depth which will physically support the plant and allow the use of sufficient moisture and nutrients; sufficient enough to control weeds; and must leave the soil surface level. A level field improves water use efficiency, helps control in crop weeds and allows the rapid removal of excess water.

Level the soil by plowing and harrowing. Make the furrows at desired depth and distance during the last plowing.

Seed requirement

3-5 kg/ha in furrow sowing and 8kg/ha in broadcasting

Increase the planting rate if the seeds are planted deep, soil moisture is limited, soil temperature is cool, or the soil is compacted, cloddy, or trashy. Decrease the planting rate if the soil is well prepared and have adequate moisture.

Row spacing

Distance in between furrows

75 cm x 75 cm; 90 cm x 90 cm; 100 cm x 100 cm.

A closer row spacing for irrigated or high rainfall areas and wider spacing for dry areas.

Planting

Sow the seeds after rain or wet the soil prior to sowing. The seeds to germinate need adequate moisture in the soil for around 3 days. Never sow the seeds on dry soil, always wait for rain or irrigation water.

Sow 25-35 seeds/ft when planting in well prepared soil with good moisture

Sow 30-40 seeds/ft when planting on soil that is deep, compact, and cloddy; in cooler temperatures, in less than good moisture; and in fields with hills and low spots

Sesame seeds are very small and for them to emerge, they push together the soil. Planting less seed/ft usually ends up in missing plants

In most situations, sesame plant adjusts to the population density in a given area. If the population is too high, it will self-thin itself, wherein in a low population, it will develop more branches to fill the spaces.

For the tropics, sowing is usually done from the 3rd week of May until the 1st week of July.

Thinning

When the plants attain height of 10-15 cm, remove the weak and diseased plants.

It is important to achieve 22plants/meter in order to attain a high yield.

Try to maintain the plant population of 222,000 plants/ha to attain the maximum yield.

1. Fertilization

NPK kg /ha

Sesame requires 30-60 kg Nitrogen: 10-15 kg of phosphate: 10-15 kg potash. Split the fertilizer application (50:50 or 70:30 ratio) during land preparation and sidedressing at the beginning of the flowering stage. You can do the next fertilizer application during your first weeding that is 4-5 weeks after sowing.

For the rate of phosphate and potash requirement, better have soil analysis to determine the exact amount. 5 tons of compost or farm manure incorporated during land preparation is also recommended

For Vietnam condition, a study conducted by Foundation for Agronomic Research on balance fertilization of sesame in Vietnam has the following recommendations:

1) Basal application of 5 tons of farmyard manure 15 kg Nitrogen: 45 kg phosphorus: 30 kg potassium and 400 kg of lime improved yield by 49-57%

2) 100% basal application of 5 t FYM/ha, 500 kg mixed NPK/ha (application ratio of 3:9:6), and 400 kg lime/ha

a) NPK to be applied two times- 70% basal and 30% topdressing during 4 - 5 leaf stage

b) NPK to be applied 3 times- 60% basal, 30% topdressing during 4 - 5 leaf stage and the remaining 10% during 7- 8-leaf stage.

Commercial inorganic fertilizer is not allowed in organic farming. Ask assistance from the local agriculturist office for advice in growing organically and in order to maintain and supply the nutrient requirement of the plants.

2. Water requirement

Sesame grows well in areas with 16 - 18 inches of annual precipitation. It needs water during the seedling and flowering stages

IV. Pests, its damage & control measures

Weeds

Weeds are the unwanted plants found in your fields and gardens. They compete with your crops for nutrients, moisture, and sunlight which can decrease the crop quality, higher the production costs due to increase cultivation and hand weeding, and considerably reduce the crop yields. They also serve as the alternate hosts of insect/mite pests and diseases.

Preventative methods

- Thorough land preparation, example: by plowing and harrowing
- During the seed bed preparation, make sure that the seed bed is free of weeds.
- Place the fertilizer where the crop has the access to it but the weeds do not. This allows the crop to be more competitive with weeds.
- Keep the surroundings of your farm free of weeds, unless they are maintained and intended as habitat for natural enemies

Mechanical and physical methods

Do weeding 4-5 weeks after sowing. The weeds are easier to control on their earlier growing period. If possible, do not let the weeds to flower. Remove them from the field before they start to flower. The weed-bearing seeds that are removed should not be placed in compost pile for the seeds may not be killed in the process of decomposition. The compost might be the source of the reintroduction of weeds into your fields.

The weeds can be removed through hilling-up the furrows with a plow, hoeing, mowing, or cutting.

Insects/Mites

Table 1: The sesame growth stages and its pests

Growth stages	Insect/mite Pests	Explanation on growth stages
0 stage Seeds	*Ants*	---
Seedling stage Leaves	*Aphids* *Whiteflies*	Seedlings start to emerge 3 - 5 days after sowing. Critical stage is about 3 weeks after sowing.
Vegetative stage Foliage	*Aphids* *Whiteflies*	When the seedlings have developed 4 - 7 true leaves.
Reproductive stage Flowers, Foliage	*Aphids* *Whiteflies*	Flowers start about 36-45 days after planting and stop 70-90 days after planting
Maturation stage Fruit capsules	*Aphids*	Physiological maturity normally occurs 90 - 110 days after planting depending on varieties, moisture, fertility, and temperatures. Sesame normally dries down in 130-160 days.

Ants

Damage

Ants take the sown seeds back to their colony and feed on germinating seeds and on young seedlings. They tend insect pests like aphids, scales, whiteflies, mealybugs, and other honeydew producing insects. These actions result in missing hills, thus loss of plant stand, uneven growth distribution in the field, and an increased incidence of diseases caused by the mentioned insect pests.

Description

Eggs are delicate, soft, white, and are laid in clusters of 75-125 eggs.

The larva is grub-liked, legless, very soft, and whitish in color. It inflicts no damage as it depends on the worker ant (older sibling) for care and food. The pupa is whitish and develops inside the ant's nest. It has visible legs and in some cases, wings. The pupal stage is the transitional stage between the larva and the adult which emerges during the final molt.

An adult ant varies in color, from blackish to reddish-brown depending on its species. It has robust mandibles with strong teeth that could inflict painful bites. It has elbowed- antennae, a thin waist, and if it is winged, the hind wings are smaller than the front wings and have few veins.

Ants are also beneficial insects because they prey on termites, eggs, pupa, and caterpillars of other insect pests. Nevertheless, **ants should not be introduced into vegetable gardens for insect pest control.**

Suggested control practices

Cultural practices

1. Increase the seeding/seedling rate. This practice turns out cheaper than with the use of insecticide.
2. Control aphid, whitefly, and other insects that excrete honeydew. The ants are likely to be found in plants infested by these insects because they protect them for their food.

Spray solutions

Ant oil spray

Mix 2 tbsp dish washing soap, 2 tsp vegetable oil, 2 tbsp salt, and few drops of vinegar into 4 liters of water.

Aphids

Damage

Both the nymphs and the adults pierce the plant tissues to feed on plant sap. The infected leaves become severely distorted when the saliva of aphids are injected into them. Heavily infested ones will turn yellow and eventually wilt because of excessive sap removal. The aphids' feeding on the plant causes crinkling and cupping of leaves, defoliation, and stunted growth.

Aphids produce large amounts of a sugary liquid waste called honeydew. A fungus, called sooty mold, grows on honeydew deposits that accumulate on leaves and branches, turning leaves and branches black. The appearance of a sooty mold on plants is an indication of an aphid infestation.

Description

The eggs are very tiny, shiny black, and are found in the crevices of bud, stems, and barks of the plant.

The nymphs look like the young adults, mature within 7-10 days, and are then ready to reproduce.

The adults are small, 3-4 mm long, soft-bodied insects with two projections on the rear end and two long antennae. Their body color varies from yellow, green, brown, to purple. Females can give birth to live nymphs as well as can lay eggs. However, the primary means of reproduction for most aphid species is asexual, with eggs hatching inside their bodies, and then giving birth to living young. Winged adults, black in color, are produced only when it is necessary for the colony to migrate, or there is either overcrowding in colonies, or unfavorable climatic conditions.

Sugested control practices

Cultural practices

1. Control and kill ants. Cultivate and flood the field. This will destroy ant colonies and expose eggs and larvae to predators and sunlight. Ants use the aphids to gain access to nutrients from the plants.
2. Avoid using heavy doses of highly soluble nitrogen fertilizers. Aphids love tender, juicy leaves. Practice split application: during seedling and flowering stage.

Traps

Sticky board traps

Place 1-4 sticky cards per 300 sq m field area. Replace traps at least once a week. To make your own sticky trap, spread petroleum jelly or used motor oil on yellow plywood, 6 cm x 15 cm in size or up. Place traps near the plants but faraway enough to prevent the leaves from sticking to the board. Traps when hung should be positioned 61 cm zone above the plants.

Yellow basin trap

Half-fill yellow pan or basin with soapy water. Place the pan close to the plant but exposed enough so that aphids will see it.

Botanical pesticides

Ginger rhizome extract

Grind 50 g of ginger and make into paste. Mix with 3 liters of water. Strain. Add 12 ml of soap. Mix well. Ten (10) kg of ginger is needed for 1 ha.

Custard apple leaf extract

Boil 500 g of leaves in 2 liters of water until the remaining liquid is about ½ liter. Strain. Dilute filtrate with 10 -15 liters of water.

Spray solutions

Ammonia spray

Mix 1 part ammonia with 7 parts water. This spray also controls flea beetles.

Soap spray

Mix 2½ tablespoons of liquid soap to a galloon of water.

Whiteflies

Damage

Both the larvae and adults pierce and suck the sap of the leaves. This causes the weakening and early wilting of the plant resulting in reduced plant growth. Their feeding may also cause yellowing, drying, premature dropping of leaves that result in plant death. Whiteflies produce honeydews that serve as the substrates for the growth of black sooty molds on leaves and fruit. The mold reduces photosynthesis causing the poor plant growth of the plant. They are the most important carriers of plant viruses that cause diseases of fiber crops, vegetables, fruit trees, and ornamentals.

Description

The eggs are tiny, oval-shaped, about 0.25 mm in diameter, and stand vertically on the leaf surface. Newly laid eggs are white then turn brownish. They are deposited on the underside of leaves, sometimes in a circle or oval-shaped patterns.

The larvae are transparent, ovate, and about 0.3-0.7 mm in size and they move around on the plants looking for a feeding site upon hatching. The pupae are dirty-white and surrounded by wax and honeydews. During this stage, the red eyes of the emerging adults are visible.

The adults are about 1mm long with two pairs of white wings and light yellow bodies. Their bodies are covered with waxy powdery materials. They are found feeding on top of the plants. A female can produce as many as 200 eggs in her lifetime and mating is not necessary. It takes about 40 days to develop from egg to adult.

Sugested control practices

Botanical pesticides

Garlic oil spray

Chop finely 100 g of garlic. Soak the chopped garlic in mineral oil for a day. Add ½ liter and 10 ml of soap. Dilute filtrate with 10 liters of water. Constantly shake the container or stir the extract while in the process of the application to prevent oil from separating.

Madre de cacao & neem

Shred 1 kg of Madre de cacao leaves and 1 kg of neem leaves. Soak leaves in 5 liters of water for 3 days. Strain. Add water to make up 20 liters of filtrate. Spraying interval is 4-5 days.

Neem oil extract

Add 15 ml of neem oil into 1 liter of soapy water. Constantly shake the container or stir the extract while in the process of application to prevent oil from separating.

Spray solution

Soap spray

Mix 2 ½ tablespoons of liquid soap to a galloon of water.

Potato starch spray

Mix 2-4 tbsp potato flour to 1 liter of water and add 2-3 drops of liquid soap. Shake the mixture and spray thoroughly before spraying.

Beneficial Insects

The following are some beneficial insects that are indigenous on your fields and gardens or can be introduced for the control of pests.

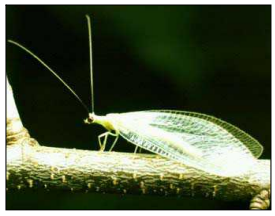
Braconid

Damsel bugs

Diadegma

Ground beetles

Hoverflies



Lacewings

Ladybird beetles

Rove beetles

Spiders

Tachinid flies

Trichogramma

Conservation of the beneficial insects

1. Provide hiding sites and alternative habitats such as mulches and other ground covers.
2. Plant small flowering plants on borders, hedges, and other perennial habitats as source of food and shelter
3. No indiscriminate use of synthetic pesticides.

V. Harvesting

The harvesting starts when 75% of the fruit capsules are ripened. The crop dries above where it will be cut, stems tend to change from green to yellow to red in color and the leaves will begin to fall off. Physiological maturity normally occurs 90 - 110 days after planting and normally dries down in 130 - 160 days, depending on variety and climatic condition.

Make bundles and stalked upright for drying. One week after harvesting, thrash and winnow the seeds. The seeds for storage must have 10 % moisture content.

Photo credits

page

01 Sesame flower. PIER. *http://www.hear.org/pier/species/sesamum_indicum.htm*
13 Ants. Takumasa Kondo
14 Aphids. AVDRC
15 Whiteflies. University of California, *http://www.uckac.edu/whitefly/newhomepage.htm*
16 Damsel bug. University of Georgia, *http://www.cpes.peachnet.edu/lewis/1nabid.jpg*
16 Diadegma. Cornell University
16 Ground beetle, Spider & Tachinid fly. IRRI & Queensland University.
IRRI, Los Banos, Philippines.
16 Hoverfly. *http://www.canola-council.org/slides/pests/insects/insects.html*
16 Lacewing. Photo courtesy of Clemson University - Department of Entomology
16 Ladybird beetles. Kok, L.; Kok, V. http://www.ento.vt.edu/~kok/Biological_Control/Main_body.htm
16 Rover beetles. Jim Kalisch & Barry Pawson
16 Trichogramma. Cornell University.

References

Most of the photos in this field guide are taken from the OISAT PAN Germany website www.oisat.org.

BALSES (2003): Balance fertilization of sesame in Vietnam. Foundation for Agronomic Research. http://www.ppi-far.org/far/farguide.nsf/$webindex/article=1B0441DF06256DFE006D99A4D96064B5!opendocument

Langham, R.; Smith, G.; Wiemers, T.; Wetzel, M. (2004): Southwest sesame grower's pamphlet. Sesaco Corporation. www.sesaco.net

Oplinger, E. et. al. (1990): Sesame. Departments of Agronomy and Soil Science, College of Agricultural and Life Sciences and Cooperative Extension Service, University of Wisconsin-Madison, WI 53706 and Department of Agronomy and Plant Genetics, University of Minnesota, St. Paul, MN 55108. http://corn.agronomy.wisc.edu/AlternativeCrops/Sesame.htm

Smith, D.; Grichar, W. G.; McCallum, A. (2000): Sesame. Texas Agricultural Experiment Station, College Station and Yoakum. http://cipm.ncsu.edu/cropprofiles/docs/ussesame.html

Tables

Table 2. Monthly cropping calendar of activities

Management practices	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Seed procurement												
Land preparation	-											
Fertilization												
Irrigation												
Pests monitoring												
Pests control												
Harvesting												
Post harvest												

Table 3. Weekly activities

Field activities	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Care of seedlings																				
Land preparation																				
Fertilizer application																				
Cultivation																				
Irrigation																				
Weeding																				
Control of insect pests and diseases																				
Harvesting																				

Table 4. Crop lifecycle

Growth stages	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Seedling												
Vegetative												
Reproductive												
Maturation												

For more information
on non-chemical pest management see:

www.oisat.org

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