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### Zucchini/Courgette

Scientific name: *Cucurbita pepo*

Order/Family: **Violales: Cucurbitaceae**

Common names: **ornamental gourd, marrow, gourd, summer squash**

Pests and Diseases: **[Anthracnose](#)      [Aphids](#)**

**[Downy mildew](#)      [Epilachna beetles](#)      [Fruit flies](#)**

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**General Information and Agronomic Aspects**

Cocoa  
 Coconut  
 Coffee  
 Cotton  
 Cowpea  
 Cucumber  
 Eggplant  
 Green gram  
 Groundnut  
 Maize  
 Mango  
 Millet  
 Okra  
 Onion  
 Papaya  
 Passion fruit  
 Peas  
 Peppers  
 Pigeon pea  
 Pineapple  
 Potato



Geographical  
 Distribution of  
 Zucchini in Africa

**Fruits, leaves and flowers of Zucchini and other Cucurbita species are used as vegetables, and their seeds are consumed roasted as a snack food (CAB 2006). Zucchini has a mild flavour and is very watery. It is often harvested when still very young. At this stage it is also called squash or courgette. Because the fruit has very little flavour of its own it is often used as a base for making savoury dishes. The seeds can be scooped out of and a replaced with a filling - this can then be baked (Plants for a Future 2003). Ornamental gourds are cultivars of C. pepo with small, bitter and inedible fruits in many shapes, sizes and colours (CAB 2006).**

**Climatic conditions, soil and water management**

**Zucchini requires a rich, well-drained soil that is able to retain moisture. It grows best in a sunny and sheltered position. Plants are tolerant of light shade. It prefers a pH of 5.5 to 5.9, but tolerates up to 6.8 (Plants for a Future 2003). It responds very well to fairly heavy applications of good compost or well-decomposed manure in the planting hills or ridges. Drought stress quickly reduces fruit setting, so during dry spells irrigation is a must, preferably watering below the leaves or using drip**

**Pumpkin****irrigation.****Rice****Sesame****Sorghum****Propagation and Planting****Soybean****Spider plant****Spinach****Sugarcane****Sweet****potato****Tea****Teff****Tomato****Wheat****Yam****Husbandry****[Zucchini/Courgette](#)**

**Sole cropping is normally used for commercial production. Zucchini and squashes are also planted in home gardens as fresh vegetables. Cultural practices to improve growth and development include the removal of growing tips to check growth in case of trailing varieties.**

**Pests/  
diseases/  
weeds****Medicinal  
plants****Harvesting**

**Fruit and vegetable processing**  
**Natural pest control**

**Zucchini and other summer squashes, from which the immature fruit is used as a fresh vegetable, develop very rapidly. The first marketable fruits can be harvested 50 to 60 days after planting, or 3 to 6 days after appearance of the female flower. During the harvest season the fruits are harvested two to three times per week. (CAB 2006)**

**Cultural practices**

**Crop yields for summer squash (immature fruits) are 7 to 12 t/ha. Unless grown for seed, mature fruits are not marketable, so plants are removed when yields become too low. Indicative figures for seed yield of Zucchini and other squashes are 400 to 1500 kg/ha. In seed production, isolation between fields of different Cucurbita species is recommended, not only for reason of purity but also for obtaining maximum yields (pollen of other species may cause reduced fruit set).**

**Summer squash of good quality (no attacks of fruit flies - little dots on fruits developing into sores full of white larvae) can be kept for up to 14 days when stored at 7 to 10°C and 85 to 95% RH (CAB 2006).**

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**Information on Pests**

## **General Information**

**Courgettes are affected by similar pests and diseases as other cucurbits; this is plants belonging to the family Cucurbitacea, including melons, squash, pumpkin, and cucumber.**

**The leaf-feeding Epilachna beetles are a serious problem for Cucurbita growers. Aphids and various leaf beetles can also cause problems on courgetes.**

**For more information on courgette pests refer to datasheet on cucumber (click here).**

**Fruit flies (*Bactrocera cucurbitae*, *Dacus* spp and *Ceratitis capitata*)**

**Fruit flies are the most serious insect pests on zucchini/squash with the ability to totally wipe out any marketable fruit.**

**Fruit flies are about 4-7mm long, they pierce the fruits and lay eggs in fruits. The fruit fly maggots feed inside the fruit causing sunken, discoloured patches, distortions and open cracks. These cracks serve as entry points for fungi and bacteria, causing fruit rot.**



**Fruit fly**

**External fruit fly damage symptoms on courgette**

**What to do:**

- **Frequent applications of neem can keep fruit fly attack to a minimum. For more information on neem [click here](#).**
- **Avoid continuous cultivation of cucurbits at the same place since this may lead to fruit fly outbreaks.**
- **Destroy all infested fruit**
- **In small plots, wrap individual fruits or bag them with newspaper or paper bags to prevent fruit flies from laying eggs fruits. Wrapping or bagging should be started shortly after fruit set.**

© M. K. Billah, icipe



**Fruit fly**

**Fruit fly**

**Fruit fly ...**

**Fruit fly ...**

**[More Information on Fruit flies](#)**

- **Spray with a pyrethrum solution in the evenings after the bees are mostly back in their hives (after 6 pm). There is a product commercially available called Flower-DS, made of natural pyrethrum and acceptable in Organic certified systems (see Hygrotech Company, contact-addresses below).**
    - **Precautions: Be careful to spray late in the evening, follow the spraying instructions. Wear masks and skin protection.**
    - All insect poisons are also poisonous to humans even if coming from natural sources.**
    - **Frequency of spraying: start shortly after beginning of flowering, and repeat approx every 5 days or according to counts.**
- 

### ***Aphids (Aphis gossypii)***

The cotton aphid (*Aphis gossypii*) is common on cucurbits, including cucumber. Colonies of green to blackish aphids are found on tender shoots, mainly on the lower leaf surface, where they suck sap. The growth of the attacked shoots is stunted and the leaves are curled and twisted. Aphids excrete honeydew, which leads to growth of sooty mould, and may attract fruit flies. Aphids, in particular winged aphids, transmit virus diseases (e.g. cucumber mosaic virus) when moving from plant to plant.

#### What to do:

- Plant barrier crops
- Apply sticky traps
- If necessary spray with botanicals (e.g. neem extracts). Spray only attacked plants (spot spraying).
- Use reflective mulch (e.g a polyethylene sheet covered with a thin



Cotton aphid  
Cotton aphid (*Aphis gossypii*) is a small aphid. Adults range from just under 1-1.5 mm in body length.

© Mississippi State University Archive,  
Mississippi State University,  
Bugwood.org

[More Information on Aphids](#)



**layer of aluminium that is spread out on the growing bed at planting time). Covering the ground with a material like aluminium foil repel winged aphids, delay aphid colonisation and may delay virus infection**

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**The Epilachna beetle (*Epilachna chrysomelina*)**

**Adults of the Epilachna beetle, also known as the African melon ladybird are 6 to 8 mm long, reddish in colour with a number of black spots on the wing cases. The larvae are 7 to 9 mm in length, soft and covered with dark coloured spines. They pupate on leaves. Both adults and larvae feed on the leaves leaving a fine net of veins. Damaged leaves shrivel and dry up. They may also gnaw stems and eat holes in fruits.**



**Epilachna beetle  
Epilachna beetle (*Epilachna chrysomelina*) and damage caused on water melon**

**© A. M. Varela, icipe**

**These beetles are most likely to be a**

**problem during establishment when plants are small; young plants can be entirely destroyed. Older plants can tolerate considerable leaf damage, but during flowering fruit set maybe affected. This beetle is a vector of squash mosaic virus. The Epilachna beetle attacks all cucurbits. They often fly into a crop from nearby crops.**

#### **What to do:**

- **Do not grow pumpkins near crops attractive to the Epilachna beetle (e.g. other cucurbits, potatoes, maize)**
- **If necessary apply neem products. Simple neem-based pesticides are effective controlling this pest. For instance, weekly foliar sprays of aqueous neem kernel extracts at concentrations of 25, 50 and 100 g/l and neem oil applied with an ultra-low-volume (ULV) sprayer at 10 and 20 l/ha**

**significantly reduced feeding by  
Epilachna beetles in squash and  
cucumber in Togo (Ostermann and  
Dreyer, 1995)**

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## Information on Diseases

### General Information

**Courgettes are affected by similar pests and diseases as other cucurbits; this is plants belonging to the family Cucurbitacea, including melons, squash, pumpkin, and cucumber.**

**Anthracnose (*Colletotrichum orbiculare*) is the most destructive disease. It causes defoliation and lesions on the fruits.**

**Other fungal diseases, mainly affecting the leaves and stems are:**

- **Powdery mildew (*Erysiphe cichoracearum*)**
- **Downy mildew (*Peronospora cubensis*)**
- **Scab (*Cladosporium cucumerinum*)**

**Many important virus diseases affect cucurbits. These include Cucumber**

**mosaic cucumovirus (CMV), Watermelon mosaic 2 potyvirus (WMV-2), Watermelon mosaic 1 potyvirus, Zucchini yellow mosaic potyvirus (ZYMV), Squash leaf curl bigeminivirus (SLCV).**

**For more information on these diseases refer to datasheet on [cucumber \(click here\)](#).**

**Powdery mildew (*Sphaerotheca fuliginea* and *Erysiphe cichoracearum*)**

**Symptoms first develop as a whitish talcum-like powdery growth on lower leaf surface. The powdery growth is composed of fungal spore mass. These areas covered by white powdery growth may enlarge and join up to cover both lower and upper leaf surfaces. Severely affected leaves dry, turn brown and become brittle. Vines can be also attacked. Secondary effects of the disease include sun-burning**



**Powdery mildew  
Severe powdery mildew  
attack (*Sphaerotheca  
fuliginea*) (here on  
cucumber)**

**and premature ripening of fruits.**

**Powdery mildew affects cucumber, gourd, muskmelon, pumpkin, squash and watermelon. Other hosts include African violets and pawpaws. The powdery mildew fungi are influenced by plant age, humidity and temperature. Foliage is most susceptible 16 to 23 days after unfolding. The fungi reproduce under dry conditions. Infection increases as humidity increases, but does not occur when leaf surface is wet. Optimum temperature for infection is about 27.4° C. However, infection can take place at a temperature as high as 32° C and relative humidity as low as 46%.**

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[More Information on Powdery mildew](#)**

**What to do:**

- **Use resistant varieties, if available**
- **Spray with sulphur based fungicides, which provide good control**
- **Destroy weeds belonging to the**

## cucurbit family

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### **Downy mildew (*Pseudoperonospora cubensis*)**

**Symptoms on leaves appear as small, pale-yellow areas on upper leaf surface. Under humid conditions, a purplish, grey whitish growth may be seen on the underside of the yellowish spots. Affected leaves curl, shrivel and die.**

**Most downy mildew fungi require cool weather for reproduction and development. This is not true of the cucurbit downy mildew fungus. Optimum temperature for infection is at 16 to 22° C. It can survive when temperatures are over 37.8° C. The most critical factor for infection is a film of moisture and / or long dew periods on leaves. Disease spread is primarily by wind and rain splash. The fungus attacks only members of the**



**Downy mildew  
Downy mildew (*Peronospora* sp.) attacking the upper leaf face**

**© Jürgen Kranz (Courtesy of EcoPort, [www.ecoport.org](http://www.ecoport.org))  
[More Information on Downy mildew](#)**

**cucumber family, mostly those that are cultivated, although it can infect wild cucumber and a few other weed hosts.**

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**Anthracnose (*Colletotrichum orbiculare*)**

**It is the most destructive disease. It causes defoliation and lesions on the fruits.**

**The fungus can attack all the above-ground plant parts. Cotyledons (seed leaves) of affected seedlings droop and wilt. Lesions (elongated spots) may form on stems of affected seedlings near the ground. Spots on leaves start as small yellowish areas that enlarge and turn brown. The affected tissue dries, breaks and the whole leaf dies. On vines, the spots are elongated and may kill the vines.**

**Symptoms are most noticeable on fruits.**



**Anthracnose  
Anthracnose (*Colletotrichum orbiculare*) damage to pumpkin leaf (*Cucumis sativus*).**

**© Clemson University -  
USDA Cooperative Extension  
Slide Series,  
[www.insectimages.org](http://www.insectimages.org)**

**Spots on fruits are circular, black, and sunken. When wet, the centres of the spots become salmon coloured due to a mass of fungal spores. Affected fruits can be destroyed by secondary soft-rot organisms, which enter through broken rind. The fungus is seed-borne. It can survive in crop debris and in weeds belonging to the cucurbit family. Fungal development is promoted by wet conditions, high relative humidity and moderate temperatures (20 to 23.9° C). Its host range includes cucumber, gherkin, gourd, muskmelon, and watermelon. Cucurbit weeds can also be attacked.**

**More Information on Anthracnose**

**What to do:**

- **Use resistant varieties, if available**
- **Use disease-free seeds**
- **Practice crop rotation**
- **Destroy volunteer cucurbits and weeds**



## Virus diseases

Many important virus diseases affect cucurbits. These include

- Cucumber mosaic cucumovirus (CMV)
- Watermelon mosaic 2 potyvirus (WMV-2)
- Watermelon mosaic 1 potyvirus
- Zucchini yellow mosaic potyvirus (ZYMV)
- Squash leaf curl bigeminivirus (SLCV).

What to do:

- For more information on these diseases refer to datasheet on cucumber ([click here](#)).



Zucchini yellow mosaic potyvirus on *Cucurbita pepo*. ZYMV provokes in cucurbit crops very severe symptoms of stunting, yellowing, necrosis (occasionally), mosaic, leaf deformations, fruit discolorations and deformations.

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## Information Source Links

- **AIC, Nairobi (2003). Fruits and Vegetables Technical Handbook**
- **AVRDC International Cooperators' Factsheet on Cucurbits**  
[www.avrdc.org/LC/cucurbits/publications.html](http://www.avrdc.org/LC/cucurbits/publications.html)
- **Beije, C.M., Kanyangia, S.T., Muriuki, S.J.N., Otieno, E.A., Seif, A.A., Whittle, A.M. (1984). Horticultural Crops Protection Handbook. National Horticultural Research Station, Thika. KEN/75/028 and KEN/80/017/**
- **Blay, E., Cudjoe, A. R., Braun M. (eds) (2000). Handbook of crop protection recommendations in Ghana: An IPM approach. Vol 2; vegetables. Plant Protection & Regulatory Services Directorate (PPRSD) and the Integrated Crop Protection Project, German Development Cooperation (GTZ).**
- **Bohlen, E. (1973). Crop pest in Tanzania and their control. Federal Agency for Economic Cooperation (BFE). Veralgh Paul Parey. ISBN 3-489-64826-9.**
- **CAB (2005). Crop Protection Compendium, 2005 Edition. © CAB International Publishing. [www.cabi.org](http://www.cabi.org)**
- **CAB (2006). Crop Protection Compendium, 2006 Edition. © CAB International Publishing. [www.cabi.org](http://www.cabi.org)**
- **EcoPort. The consilience engine. [www.ecoport.org](http://www.ecoport.org)**

- **Ekesi, S., Billah M. K. (eds) (2006. A field guide to the management of economically important tephritid fruit flies in Africa. ICIPE. ISBN: 92-9064-179-7.**
- **Ministry of Agriculture and Rural Development (Kenya) (MoARD) & Japan International Cooperation Agency (JICA) (2000). Local and Export Vegetables Growing Manual. Reprinted by Agricultural Information Resource Centre, Nairobi, Kenya. 274 pp.**
- **Ostermann, H. and Dreyer, M. (1995). Vegetables and grain legumes. In: The Neem tree *Azadirachta indica* A. Juss. and other meliaceous plants sources of unique natural products for integrated pest management, industry and other purposes? Edited by H. Schmutterer in collaboration with K. R. S. Ascher, M. B. Isman, M. Jacobson, C. M. Ketkar, W. Kraus, H. Rembolt, and R.C. Saxena. VCH. pp. 392-403. ISBN: 3-527-30054-6**
- **Park SoDeuk, Kwon TaeYong, Lim Yang Sook, Jung KiChae, Choi BooSull (1996). Disease survey in melon, watermelon, and cucumber with different successive cropping periods under vinylhouse conditions. Korean Journal of Plant Pathology, 12(4):428-431.**
- **Plants for a Future (2003). Edible, medicinal and useful plants for a healthier world. <http://www.pfaf.org/database/plants.php?Cucurbita+pepo>**
- **Sherf, A.F., Macnab, A.A. (1986). Vegetable Diseases and Their Control. 2nd. Edition. John Wiley & Sons Inc. USA. ISBN: 0-471-05860-2**

- **University of Georgia: College of Agricultural and Environmental Sciences, Department of Horticulture Vegetable Crops: Pumpkin.**

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## Contact Links

- **For information on small scale farming techniques, seeds, equipment and insecticides (e.g. pyrethrum solution).**

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**Passion fruit**

**Scientific name:** *Passiflora edulis* (purple passion fruit) / *P. edulis* var. *flavicarpa* (yellow passion fruit)

**Order/Family:** Violales: Passifloraceae

**Common names:** Maracuya

**Pests and Diseases:** Aphids

Broad or yellow tea mite    Brown spot    Bugs

Fruit flies    Fusarium wilt

Leafmining flies (leafminers)    Mealybugs

Phytophthora blight    Root-knot nematodes

Septoria spot    Spider mites    Thrips

Woodiness potyvirus    Brown spot, Septoria spot, Phytophthora blight, Woodiness potyvirus, Bugs, Broad or yellow tea mite

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**General Information and Agronomic Aspects**

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**Sorghum**  
**Soybean**



**Geographical  
 Distribution of  
 Passion fruit in  
 Africa**

**Passionfruit is a native of southern Brazil where it grows on the edges of rain forests. There are two distinct forms: forma edulis, the purple passionfruit, occurs in cool environments at higher altitudes, and forma flavicarpa, the yellow passionfruit, which is at home in the tropical lowlands. The two types were distributed throughout the tropics and subtropics via Europe and Australia during the 19th century.**

**The passion is a perennial climbing plant, which was introduced into Kenya in the 1920's. From 2001 to 2005 export from Kenya of passion fruit was around 1000 tons per year, against a total**

**production of around 30,000 tons yearly.**

**The fruit may be eaten fresh, but mostly the pulp is extracted and preserved by heating or cooling. The juice has a unique and intense flavour and high acidity, which makes it a natural concentrate. When sweetened and diluted it is very palatable and blends well with other fruit juices. Typical processed products are ice cream, sherbet, nectar, juices, concentrate, squash, jams and jellies. Passiflora plants are often cultivated as ornamentals for their showy flowers.**

**Spider plant****Spinach****Sugarcane****Sweet  
potato****Tea****Teff****Tomato****Wheat****Yam****Zucchini/Courgette****Pests/  
diseases/  
weeds****Medicinal  
plants****Fruit and  
vegetable  
processing****Natural pest  
control**

**Passion flowers are widely employed by herbalists and natural health practitioners around the world today. They are mostly employed as a sedative, hypnotic (inducing sleep), nervine, anti-spasmodic and pain reliever.**

**Climatic conditions, soil and water management**

**The yellow passion fruit grows best at altitudes of 0-800 m and is used mainly for the fresh fruit market. It can also be used as a rootstock for grafting of the purple variety; the purple passion fruit forms virtually no flowers below 1000 m and should be grown at altitudes of 1200-2000 m.**

**The mature purple passion fruit tolerates light frosts and can be grown in the subtropics. Other varieties exist such as the so-called banana passion fruit growing in highland areas and often climb very tall trees. It is yellow at maturity but with soft velvety skin and pink flowers quite different from the commercial passion fruits. The banana passion fruit is mainly used in sweetened juices, as it is not usually very sweet on its own.**

**All varieties grow on a wide range of soils; but light to heavy sandy loams, of medium texture and at least 60 cm deep are most suitable.**

**Heavy clay soils have to be drained and very sandy ones need heavy**

## Cultural practices

manuring. A pH of 5.5-7 is preferred. If the soil is too acidic, lime must be applied. Good drainage and aeration are essential to minimise the incidence of diseases such as collar rot.

### Varieties

Purple passion fruit, especially, grows well on as little as 900 mm rainfall in Africa, provided the rainfall is well distributed. The vines require sheltered locations without extreme temperatures: Optimum temperatures for the purple variety are between 18-25°C and for the yellow variety 25-30°C. Critical temperatures were established for hybrid cultivars in Australia as follows: below 20°C pollen does not germinate and at 18-15°C both growth and flowering are set back, whereas temperatures above 30-32°C stimulate growth at the expense of flowering and fruit set (CABI).

### Propagation and planting

Passion fruit is generally propagated from seed, although cuttings and grafting can be used. Seed should be rubbed clean of pulp and dried in the shade. Germination takes 2-4 weeks. Fresh seeds are much easier to germinate than seeds older than one or two months. Older seeds can be soaked for at least one day to improve germination. Seedlings are often raised in polythene bags, 15 cm wide and 25 cm deep. Three seeds per



bag are sown at a depth of 1 cm and thinned to leave one after two months. Cuttings are set in coarse sand and later transplanted into bags or a nursery bed. The seedlings grow slowly and require 3-4 months to reach the transplanting height of 15-25 cm. Seedlings must be hardened off by leaving them in an open, shaded area for a day or two.

Grafting is often used to control diseases. Yellow passion fruit is used as resistant rootstock although other *Passiflora* species, in particular *P. caerulea* L., show much greater resistance to *Phytophthora* root rot and *Fusarium* collar rot. Moreover, *P. caerulea* is tolerant of root-knot nematodes and to exposure to -1.5°C; it can be propagated from leaf and stem cuttings and is compatible with *P. edulis*. Wedge and whip grafts on seedling rootstocks - sometimes on rooted cuttings - are used.

Within 5-7 weeks after transplanting, each plant will have up to four healthy laterals. From then on the vine grows very rapidly; the first flowers are produced 5-7 months after transplanting when the vine can be 10-15 m long.

Light is the essential factor for flowering and in passionfruit this is particularly true for floral development and fruit set. That is why training and pruning are important to ensure adequate exposure of the shoots. Depending on the climate there may be one to three harvest peaks

**(purple passionfruit) or a single, often very long harvest season (more common with the yellow passionfruit).**

### **Land preparation**

**Deep ploughing and harrowing is necessary to remove hard pans in the soil. Passion fruit has a deep root system; therefore proper land cultivation is necessary. Commercial plantations adopt a row spacing of 1.2-1.8 m and a within-row spacing of 3 m. This gives around 1900-2700 plants/ha. Planting holes of 45 x 45 x 45 cm should be filled with topsoil mixed with up to 10 kg compost or manure. Transplanting is done at the start of the rainy season.**

**At planting the soil around the plants should be firmed down to establish good root/soil contact. In order to avoid fungal infection the grafting spot should not have any contact with the soil during and after planting. The seedling should then be irrigated to ensure quick rooting and establishment of the plant.**

### **Husbandry**

**Early growth of passion fruit is slow and regular weeding is essential. Care should be taken when weeding in order to avoid any injury to the plant. Mulching along the rows or around the base of the plants greatly facilitates weed control and protects the roots. Elaborate trellises have**

been used in Australia and South Africa, but in East Africa, especially at closer spacing, a single wire trellis has been found to be as good. A 14-gauge galvanized wire is tightly stretched along the tops of hardwood posts 15 cm in diameter and 3 m long, dug in to a depth of 0.6 m; these posts are spaced 8 m apart. The trellis should be erected when the field is planted so that the main shoot and one vigorous lateral can be tied to the wire with a string. If laterals do not emerge in time, they can be forced to leaf out by pinching off the shoot tip. When the vines reach the wire they are trained in opposite directions along it. All laterals below the wire are pruned off. Laterals emerging along the wire are allowed to hang down freely; they are the secondary shoots branching into tertiary shoots. Secondary and higher-order shoots are the fruiting wood, which has to be thinned and rejuvenated by pruning.

Regular fertilization is necessary for optimum yields. Frequent sprays with compost tea or similar organic foliar feed should be applied starting from 1 month after planting and at least every 3 months after that. Mixing EM or BM with foliar sprays may prevent fungus attacks.

### Pruning

Old unproductive shoots and dead wood must be removed. Also secondary shoots reaching the ground must be cut off about 5 cm above the ground. The laterals which bear fruit should be left to hang down

**freely from the wire and the entangling tendrils removed to allow free air and light penetration and reduce incidences of disease and pest epidemics. Disinfect with commercial detergent all equipment used for pruning regularly to avoid spread of viral diseases.**

### **Intercropping**

**A wide range of vegetables and other crops can be intercropped with passion fruit. Intercropping with annuals is recommended; especially vegetables like beans, cabbages and tomatoes are agronomically suitable. Other recommended crops include potatoes, beetroots, Swiss chard, carrots, spinach, strawberries, eggplants, peppers, onions, leeks and head lettuce. However, cucurbits (cucumbers, pumpkin, and squashes) are not recommended due to the woodiness virus and fruit flies. Other crops that should not be intercropped with passion fruits are maize, cowpea, sorghum, okra, sweet potatoes and other creepers (GTZ, 1978). Intercropping can help in erosion control particularly when fed with good compost.**

### **Rotation**

**To avoid build up of soil borne diseases strict crop rotation should be practiced (see suitable crops under intercropping). Passion fruits should not be grown for more than 2-3 years on the same plot.**

## **Yield**

**If a plantation is cropped for 3 years; of the total crop, roughly 50% is produced in the first year, 35% in the second, and 15% in the third year. The sharp decline in yield level, which is even more marked in areas with disease problems, is the main reason to replant fields after the second or third crop.**

**Average yields amount to 10-15 t/ha per year for the purple and 20-25 t/ha per year for the yellow passionfruit. Much higher yields are possible; yields as high as 50 t/ha per year for purple passionfruit have been reported from Kenya.**

## **Harvesting**

**Fruit drops to the ground when fully mature. It is collected every second day; at this stage it looks shrivelled and unattractive, but for processing fruits should be picked at this stage. For fresh fruit markets, especially the export market, fruit is picked after full colour development when the whole fruit is purple or canary yellow, but before shrivelling and drying set in.**

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## **Information on Pests**

## **Biological methods of plant protection**

**Nematodes, especially the root-knot nematodes (*Meloidogyne incognita*, *M. javanica* and *M. arenaria*), are the most serious pests on passion fruit. Practical control measures are crop rotation and the use of tolerant rootstocks.**

**Several species of sucking bugs feed on passion fruit. They suck and pierce leaves and young fruits; these are minor pests.**

**Fruit flies that feed on passionfruit include the melon fly (*B. cucurbitae*) and the Mediterranean fruit fly (*Ceratitis capitata*) and the Queensland fruit fly (*B. tryoni*). Pierced young fruit shrivels and falls; later injuries cause damage which lowers the grade. Spraying of biopesticides may be necessary if destruction of infested fruit and the use of baits do not adequately check the pest.**

**Mealybugs (*Planococcus citri* and *P. kenya*) are usually controlled by their natural enemies.**

**The same to applies mites which incidentally do much damage: the red spider mites and the broad mites.**

## Examples of Passion Fruit Pests and Organic Control Methods

### Mealybugs (*Planococcus citri* and *P. kenya*)

Mealybugs infest fruits and foliage. They can be serious pests in the warm season, if natural enemies, which usually control them, are destroyed by spraying with pesticides.

They are 3-5 mm long, soft, elongate oval and somewhat flattened

What to do:

- **Conserve natural enemies. Mealybugs are usually controlled by a wide range of natural enemies. However, use of pesticides may kill these natural enemies leading to mealybug outbreaks.**



**Mealybugs**  
Female mealybugs on passion fruit leaf. Female mealybugs are 3 to 5 mm long and their body is usually covered with a waxy secretion.

© A.M. Varela, icipe  
**[More Information on Mealybugs](#)**

### ***Aphids (Aphis gossypii and Myzus persicae)***

**Aphids damage plants by sucking plant sap causing curling, wrinkling or cupping of infested leaves, giving plants a deformed shape. They spread viruses and excrete honeydew, which coat the plants and leads to growth of sooty mould, which can diminish the photosynthetic capacity of plants. Aphids are usually controlled by natural enemies if they have not been disturbed for instance by the use of broad-spectrum pesticides.**

#### **What to do:**

- **Plant the crop in well prepared, fertile land, but do avoid applying nitrogenous fertilizer, as this will promote new growth, which is make the plants juicy and attractive to**



#### **Aphids**

**Green peach aphids (*Myzus persicae*) on pepper leaf. Adult wingless females are oval-bodied, 1-2 mm in body length, of very variable colour.**

**© Magnus Gammelgaard  
[More Information on Aphids](#)**



## aphids.

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### Leafmining flies (*Lyriomyza* spp)

Feeding and egg laying by leafmining flies cause stippling of leaves. This can kill seedlings and in older plants allows entry of disease-causing microorganisms. Feeding by maggots causes mining (tunnelling) of leaves reducing the productive leaf area. Heavily attacked leaves may drop off, and may lead to yield losses.

#### What to do:

- Control by natural enemies is important
- Ploughing can help in exposing pupae to desiccation and natural enemies
- Neem products are effective for controlling leafminers



Leafminer

Severe leafminer damage (*Lyriomyza* spp) on passion fruit

© A.M. Varela

[More Information on Leafmining flies \(leafminers\)](#)

## Bugs

Several species of sucking bugs feed on passion fruit. The most important are:

- The green stinkbug (*Nezara viridula*)
- The brown stinkbug (*Boerhavia maculata*)
- Coreid bugs such as the giant coreid bug or tip wilter (*Anoplocnemis curvipes*) and the leaf footed plant bug (*Leptoglossus membranaceus*).

Bugs suck sap from the growing tips or developing fruits. The bugs pierce the terminal buds, which eventually wilt and die back. Young plants may be killed if the attack is severe. The punctured young fruits develop localised hardened spots that remain on the fruit reducing their market value.

What to do:



Tip wilter  
Adult tip wilter (*Anoplocnemis curvipes*) is 2.5cm long.

© A.M.Varela, icipe



Tip wilter   Stinkbug...   Green stin...   Leaf foote...



Bug damage

- **In small orchard bugs can be hand picked and destroyed.**
  - **Watering and irrigation discourage bugs.**
  - **Old crops or sprouting stumps left in the field provide refuges for bugs so they should be destroyed or dig into the soil.**
  - **Growing strong smelling plants such as garlic and onion or near the crop is reported to reduce infestations.**
  - **Spraying plants with a soapy solution helps to wash off young bugs.**
- 

**Fruit flies (*Bactrocera cucurbitae* and *Ceratitis capitata*)**

**Fruit flies that feed on passion fruit in Africa include the melon fly (*Bactrocera cucurbitae*) and the Mediterranean fruit fly (*Ceratitis capitata*).**



**Pierced young fruit shrivels and falls; later Fruit fly**

**injuries cause damage that lowers the market value of the fruit. However, the incidence of fruit flies on passion fruit is low, and usually of not economic importance. So control may not be necessary.**

**What to do:**

- **Collect and destroy all fallen fruits at least twice a week during the fruit season.**
- **Do not put collected damaged fruits into compost heaps. Instead, burn them or bury them at least 50 cm deep, so that the fruit flies cannot reach the soil surface.**
- **Remove fruits with dimples and those that ooze clear sap. This method is more laborious than picking the rotten fruits from the ground, but it is also more effective.**
- **Whenever possible, wrap fruit in**

**Mediterranean fruit fly (*Ceratitis capitata*). Adult mediterranean fruit flies are 4-7 mm long, brightly coloured, usually in brown-yellow patterns. The wings are spotted or banded with yellow and brown margins.**

**© Scott Bauer, USDA  
Agricultural Research  
Service,  
[www.insectimages.org](http://www.insectimages.org)  
**More Information on Fruit  
flies****

**newspaper or paper bags to prevent fruit flies from laying eggs on the fruit. This has to be done well before the fruit matures.**

- **Pick overripe fruits, as they attract fruit flies.**
  - **Physical methods include fruit fly traps and fruit bagging, see on fruit-fly datasheet**
- 

### **Spider mites (*Tetranychus* spp.)**

**Their feeding causes tiny yellow or white speckles, eventually leaves become yellowish and may drop, and may led to complete defoliation. Heavily infested plants may become stunted. A heavy infestation might also cause vine dieback and shrivelling and dropping of immature fruit.**

**What to do:**



**Spider mites  
Two-spotted spider mite.  
The adult female is 0.6 mm long. The male is smaller.**

- **Field hygiene is important for the management of spider mites. Old crops or weeds infested with mites can cause infestation of any new crop.**
- **Natural enemies such as predatory mites are important for control of spider mites.**

© Warwick HRI, University of Warwick.

**[More Information on Spider mites](#)**

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**The broad mite or yellow tea mite  
(*Polyphagotarsonemus latus*)**

**It is the most important mite pest of passion fruit in Kenya. Broad mites are tiny (0.1-0.2 mm long) and cannot be seen with the naked eye, and are even difficult to detect with a hand lens. An attack by the broad mites can be detected by the symptoms of damage.**

**Their feeding produces discoloration, necrosis of tissues and deformation. Initial attack occurs on stems of terminal shoots**



**Broad mites  
Broad mite damage on  
passionfruit**

© A.M. Varela, icipe

**and young terminal leaves. Attacked young leaves are stunted, deformed (slender, twisted or crumpled), fail to elongate and finally may wilt and dry. Stems of terminal shoots may become slightly swollen, roughened or russeted. As a result the growth of the plant is affected and flower production reduced causing considerably yield reduction. A bronzed dusty appearance may occur on affected plant parts. Attacked fruits become deformed and show white to tan or brown scars on the skin. This damage usually does not affect the internal quality of fruits but affect their market value. Severely attacked fruits may fall. Symptoms remain for a long period of time after control.**

**What to do:**

- **Broad mites are attacked by predacious mites. Phytoseiulus persimilis is not very much attracted to broad mites.**

**Amblyseius spp are better predators of broad mites, in particular *A. californicus* is used for control of broad mites in different parts of the world.**

- **Broad mites can be effectively controlled with sulphur sprays. However, sulphur is toxic to predatory mites and can have phytotoxic effects on young leaves and shoots at high sulphur dosages and when applied during hot weather.**
- 

## **Nematodes**

**Amongst nematodes infesting passion fruit the root-knot nematodes (*Meloidogyne incognita*, *M. javanica* and *M. arenaria*), are the most serious pests. Characteristic symptoms of infestation by root-knot nematodes are formation of galls or knots on roots, yellowing of leaves, stunting and eventual wilting of the affected plants.**



**Root-knot nematodes  
Root-knot nematodes  
(*Meloidogyne incognita* / *M.***



### What to do:

- Rotate with cassava, cereals, maize, Baby corn, sweet corn, sweet potato, onions, cabbages / kale, garlic or fodder grasses (e.g. Sudan grass)
- Use of tolerant rootstocks (e.g. *P. caerulea*)
- Maintain high organic matter (farmyard manure / compost) in the soil
- Incorporation of neem at transplanting

*javanica*) (here on tomato roots). Affected plants are normally stunted and eventually wilt and die. The most characteristic symptom is formation of root galls (knots) and these can be seen with the naked eye. Affected roots rot.

© Bridge J., EcoPort  
[More Information on Root-knot nematodes](#)

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### Information on Diseases

#### Biological methods of plant protection

The most important disease on passion fruit is brown spot (*Alternaria passiflorae*) on leaves, vines and fruits. Phytophthora blight (*Phytophthora nicotianae*) causes the wilting of shoot tips and crown rot,

particularly where water stagnates occasionally. **Septoria spot**, caused by the fungus *Septoria passiflorae*, causes extensive spotting of leaf and fruit, and occasionally of the stem. Yellow passionfruit and its hybrids are more tolerant of these diseases.

**Fusarium wilt** (also called collar rot) is caused by the soilborne fungus *Fusarium oxysporum* f.sp. *passiflorae*; the shoots wilt, followed by a complete collapse of the plant. Grafting to wilt-resistant yellow passionfruit rootstocks is the most practical way of control. Damping-off caused by *Rhizoctonia solani* and *Pythium* spp. can be a problem in nurseries and soils should be sterilized.

A number of virus diseases have been reported, notably passionfruit woodiness potyvirus (PWV). They are spread by aphids (*Aphis gossypii* and *Myzus persicae*) and pruning knives. Other virus diseases are ringspot from Côte d'Ivoire, which is similar to PWV. The most practical control is to use clean planting material, clean pruning tools and resistant hybrids, or rootstocks of yellow passionfruit.

## Examples of Passion Fruit Pests and Organic Control Methods

## Brown spot (*Alternaria passiflorae*)

The most important disease worldwide is brown spot on leaves, vines and fruits. Symptoms are brown spots, up to 10 mm diameter, on the leaves, often extending along the veins and drying out in the centre. On the stems, spots are up to 30 mm long, and when they occur at the leaf axils may kill the vine, resulting in dieback. On the fruit, the spots are light brown, round and sunken; they often merge, covering large areas, and produce red-brown spore masses. Spores, produced on the leaf, stem and fruit, are dispersed by wind-blown rain. Warm, moist weather favours disease development. (EcoPort)

### What to do:

- Yellow passion fruit and its hybrids are more tolerant of this disease.
- Field sanitation (collection and disposal)



Brown spot  
Alternaria leaf spot on  
passion fruit

© A. A. Seif, icipe



Brown Brown  
spot... spot

**of fallen diseased fruits, leaves and vines)**

- **Pruning vines to reduce density and thereby reducing humidity within the crop. It also facilitate better air circulation, light and spray penetration and cover.**
- **Timely sprays with copper based fungicides. During humid weather, when the vines are growing rapidly, reduce the intervals between spray applications to 2 or 3 weeks to ensure that new growth is adequately protected.**

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### **Septoria spot (*Septoria passiflorae*)**

**The disease attacks leaves, stems and fruits. Brown spots up to 2 mm with minute, black dots (fruiting bodies containing fungal spores) develop on leaf surface. Infected leaves fall readily leading**

**to defoliation of vines. Similar spots may form on the stems albeit elongated. On fruits light-brown spots studded with minute black dots may be formed. The spots often join up to cover large areas of the fruit. Affected fruits ripen unevenly. Spores produced by black dots (fruiting bodies) are blown to adjacent vines during wet, windy weather thus further spreading the disease. The disease is spread by rain, dew and overhead irrigation. Warm moist weather favours disease development.**

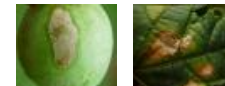
**What to do:**

- **Disease management measures for brown spot disease (see above) are equally applicable for Septoria spot.**



**Septoria spot**  
**Septoria spot on passion fruit. Note fruiting bodies seen as minute black dots within the spots.**

© A. M. Varela, icipe.



**Septori Septori**  
**s... l...**

**Fusarium wilt (*Fusarium oxysporum* f.sp. *passiflorae*)**

**Fusarium wilt (also called collar rot) symptoms consist of yellowing of leaves, the collar region of affected plant at soil level turns brownish and vertically cracks and vines wilt followed by a complete collapse of the plant. On dissection of infected stem, vascular tissues show brown discoloration.**

**What to do:**

- **Affected parts should be removed and burned. Snap off the affected parts or remove the affected plant manually.**
- **Do not cut tissue and then use the knife on healthy plants.**
- **Keep the base of the plant clear of grass and weeds, which favour fungal growth.**
- **Grafting to wilt-resistant yellow**



**Fusarium wilt  
Wilting of passion fruit vines  
due to Fusarium wilt**

© A. M. Varela, icipe



**Fusarium Fusarium Fusarium**

**W... W... W...**

**More Information on  
Fusarium wilt**

**passion fruit rootstocks (e.g. *P. caerulea*) is the most practical way of control.**

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**Phytophthora blight (*Phytophthora nicotianae* var. *parastica*)**

**Affected leaves are water-soaked and light-brown in colour. They fall readily, leading to defoliation of the vines. Affected areas of the stem are first purple and later brown above the graft union. They may completely girdle the stem causing wilting and collapse of the vine. Fruit symptoms comprise of large, water-soaked areas. Diseased fruits fall readily and in wet weather become covered with white, fungal growth.**

**Another strain of the fungus (*Phytophthora cinnamoni*) causes root rot. Yellow and purple varieties have different patterns of susceptibility. The yellow vine is susceptible to *P. cinnamoni*, and the purple vine is more**



**Phytophthora blight  
Phytophthora blight on  
passion fruit**

© A. A. Seif, icipe



**Phytop Phytop**

**susceptible to *P. nicotianae*. Both fungus strains attack both passion fruits and can cause root rot, wilt, damping off and leaf blight. Fungal spores are initially produced in wet soil beneath the vines and are splashed up to lower leaf canopy.**

**The disease is favoured by wet, windy weather.**

**What to do:**

- **Good field sanitation**
- **Pruning and keeping a grass sward under the vines to minimize spore splashed up to the lower leaves**
- **Graft to resistant rootstocks (e.g. )*P. caerulea***
- **The application of copper-based fungicides every 2-3 months during the wet season reduces disease incidence in areas where the disease is likely to be serious. Stem lesions may be painted with a copper fungicide. For more information on copper-based fungicides click here .**



## Passion fruit woodiness potyvirus (PWV)

A number of virus diseases have been reported, notably the passion fruit woodiness potyvirus. Affected leaves show light and dark green mosaic pattern often with light yellow speckle. Sometimes small, yellow ring spots may develop on upper leaf surface. Infected fruits are small and misshapen with very hard rind and small pulp cavity. When affected fruit is cut, the inside rind tissue may have brown spots. Some strains of the virus cause cracking of affected fruits.

They are spread by aphids (*Aphis gossypii* and *Myzus persicae*) and pruning knives. The virus has a wide host range including bananas, cucurbits and many weeds.

**What to do:**



Woodiness virus  
Passionfruit woodiness  
virus - Fruit cracking

© A.A.Seif, icipe



Woodir Woodir Woodir

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- **Use clean planting material**
  - **Clean pruning tools**
  - **Use resistant hybrids, or rootstocks of yellow passion fruit**
  - **Remove diseased vines from the field**
  - **Do proper weeding**
  - **Avoid planting bananas and cucurbits near passion fruit fields**
- 

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### Information Source Links

- **AIC (2003). Fruits and Vegetables technical handbook, revised edition 2003. Agriculture Information Centre, Nairobi, Kenya**
- **CAB International (2006). Crop Protection Compendium, 2006 edition. Wallingford, UK [www.cabi.org](http://www.cabi.org)**
- **Cooper, J., Dobson, H., Orchard, J. (2004). Passion Fruit Technical Itinerary. NRI - MU/PIP COLEACP, Brussels, Belgium.**
- **Economic Review of Agriculture 2006. Ministry of Agriculture, Nairobi Kenya**
- **GTZ. (1978). Passion fruit growing in Kenya. A Recommendation for Smallholders. By German Agricultural team in Kenya.**
- **Griesbach, J. (1992). A Guide to Propagation and Cultivation of Fruit**

**Trees in Kenya. Published by German Technical Cooperation of Germany (GTZ). ISBN: 3 88085 482 3.**

- **Integration of Tree Crops into Farming Systems Project (GTZ) & Ministry of Agriculture and Rural Development, Kenya (2000). Tree Crop Propagation and Management - A Farmer Trainer Training Manual.**

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**Coconut**

**Scientific name: *Cocos nucifera***

**Order/Family: Arecales: Areaceae**

**Local names: Mnazi (Swahili)**

**Pests and Diseases: [African palm weevil](#)**

**[African rhinoceros beetle](#)**

**[Bud rot](#)**

**[Coconut bug](#)**

**Beans**

**Coconut mite**

**Lethal bole rot**

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**Introduction**

**Okra**

**Coco palms *Cocos nucifera* L. (French.: cocotier; Spanish.: cocotero)**



<b>Onion</b>	<b>originate from Melanesia. South east Asia is still an important cultivation region today. The coconut is a monocotyledon plant, and can therefore only proliferate via seeds. It can produce an <u>inflorescence</u> on each leaf axil, which can then have either male or female blossoms. These are formed on the side, so that generally, the coco palm is cross-fertilised by a variety of bee species, other insects and the wind. Coco palms live to an average age of 60 years old.</b>
<b>Papaya</b>	
<b>Passion fruit</b>	
<b>Peas</b>	
<b>Peppers</b>	
<b>Pigeon pea</b>	
<b>Pineapple</b>	
<b>Potato</b>	
<b>Pumpkin</b>	
<b>Rice</b>	
<b>Sesame</b>	<b>The coconut palm is an important tree in most tropical islands and along the coastal regions of tropical Africa. It is a multipurpose tree. Every part of the coconut palm can be used. The juice from the <u>inflorescence</u>, which can contain up to 15% sugar, is used to make palm-wine. Half-ripened nuts (6-7 months old) are often eaten fresh. The juice can be drunk, and milk is squeezed out of the meat (endosperm). Fully ripened nuts (after 11-12 months) provide the so-called copra, which is made from the firm meat of the nut.</b>
<b>Sorghum</b>	
<b>Soybean</b>	
<b>Spider plant</b>	
<b>Spinach</b>	
<b>Sugarcane</b>	
<b>Sweet potato</b>	
<b>Tea</b>	
<b>Teff</b>	
<b>Tomato</b>	
	<b>Copra is high in oil and protein content (65% oil, 25% protein). Coconut oil is produced from drying and pressing the copra. Grated coconut is made from fresh copra. The hard coconut shells are used to make charcoal. When they have been finely grated, coconut shells are used as fillers for objects made of plastic, such as buttons, containers and other objects. Coconut fibres are used in the upholstery industry, to make</b>

**Wheat** ropes, as mulching material or as a substitute for peat. The leaves and  
**Yam** wood are used as building material and to make household objects (e.g.  
**Zucchini/Courgette** baskets, brooms) and tools.

**Pests/  
diseases/  
weeds**

Climatic conditions, soil and water management

**Medicinal  
plants**

Site requirements

**Fruit and  
vegetable  
processing**

Coconut needs a continuous supply of water, which can be provided by regular rainfall of about 1250 mm per annum, or from ground water (at a depth of 1-3 m). It can not tolerate water logging though. The northern Kenya coast receives only a rainfall of 750-1000 mm and this restricts production. Coconut grows best at average temperatures of around 26-27°C. Because of its temperature requirements, the coconut palm cannot normally grow above 750 m. However, near to the equator and in areas where other conditions are favourable for coconut development, it is possible to grow the crop up to about 1300 m. Growth is stimulated by a sufficient supply of chlorine in the soil. The coconut palm can withstand up to 1% salt in the soil.

**Natural pest  
control**

**Cultural  
practices**

These conditions are generally found in tropical and subtropical coastal regions with little rainfall. Coconut palms can also grow on deep, water-logging free, alluvial soil, away from the coast - yet low chlorine content

**in the soil could have negative effects. Consider these conditions when choosing a site.**

**Depending on the site, coconut palms can be cultivated on agroforestry systems. As a plant of the upper storey, with essential light requirements, the coconut palm towers above such crops as citrus plants, cacao and others.**

## **Propagation and planting**

### **Seeds**

**The quality of the seeds is important for the forthcoming yield from the palm. For this reason, the seeds should originate from a healthy, and productive stock plant. Usually, the seedlings are raised in state tree nurseries. If no tree nursery can be found which comply with the requirements of organic cultivation, then the seedlings will have to be raised on the site.**

**Two different main groups are cultivated in the commercial sector: the tall plants of the Typica group, which generally need to be cross-fertilised, and dwarf types of the Nana group, where self-pollination is the norm. Tall varieties should always be chosen for agroforestry systems,**

**because these are the only sorts that can reach up to the upper levels intended for them, and thus fully develop. Dwarf palms grow very slowly, and are easily overshadowed in the system, hindering their full development. In addition, the Nana variety reacts more sensitively to drought and some diseases than Typica varieties.**

**Three distinct types grow in Kenya: the "East African tall", the "Pemba Dwarf" and hybrids. The following hybrids have been introduced to increase yields and quality of coconut in Kenya:**

- **PB 121 ("Malayan Yellow Dwarf" x "West African Tall")**
- **A72 ("Green Dwarf" x "West African Tall")**
- **"Tahiti Tall" x "West African Dwarf"**
- **"Yellow Dwarf" x "Tahiti Tall"**
- **"Reussell Tall" x "West African Tall"**

**The hybrid PB 121 has shown to be particularly high yielding (Griesbach, 1992).**

**Before sowing, the nuts are sorted; use only those nuts containing water. Cut away the shell on the germinating side of the nut to facilitate germination, and soak the nuts in water for 14 days, before sowing them in loose soil that can drain easily. Lay the nuts lengthways in the soil with**



**the upper side visible. Sow nuts in nursery beds at a distance of 45 cm. Use coconut fibres as mulching material between the rows leaving the planting area uncovered.**

**On smallholdings, the nuts are often merely set out in shaded areas, lightly dug in, and then covered over with organic material.**

### **Planting methods**

**Nuts usually begin to germinate after 12 weeks in the nursery beds. There, they require no additional fertiliser, as the endosperm provides them with sufficient nutrients. When the seedlings are planted in beds outside the rainy season, then the beds need to be irrigated twice a week with around 5 l water/m<sup>2</sup>. Select the strongest seedlings after the 5th month and label them for transplanting. Around 20-40 % of the seedlings will be unusable. Suitable seedlings germinate earlier, and have thicker leaf bases. Early leaf-development is a sure sign of a strong plant. Transplant seedlings after 9-10 months, by that time they should have developed 4-5 fully opened leaves. Remove seedlings from the nursery beds, shorten their roots, and plant again as soon as possible.**

**The distances between the plants should be between 7.5 x 7.5 m and 6 x 9 m, depending on the cultivation method used and the other crops being grown, or similar distances resulting in an average density of 150-180 trees/ha. The recommended normal spacing for tall hybrids is 8 x 8 m or**

**9 x 9m, and for dwarf hybrids 7 x 7 m. The planting holes should be about 60 cm deep and 60 cm in diameter. The planting hole should be dug at least one month before planting and immediately filled with a mixture of topsoil, wood ash and well-rotted manure which is allowed to settle. Transplanting should be done at the beginning of the rains. Place the plant in the hole about 30 cm below the soil level. Fill the remaining space in the hole gradually as the palm becomes bigger. By using this planting method the palms are less susceptible to drought periods. This method should not be used when the ground water is relatively high. The nut should be earthed up only to the collar of the shoot to avoid soil entering the leaf axils.**

**The young seedlings need to be protected from bites when animals (cattle and other livestock) are being raised.**

### **Diversification strategies**

**Organic coconut cultivation does not allow for monocropping. Existing plantations can be improved by sowing at least one bottom crop of plants that offer ground coverage. Legumes can be planted here as green fertilisers. In multi-level agroforestry systems, cacao, bananas, pineapples and many other crops can be used. Spices such as ginger and turmeric also thrive under palms. If animals are kept, fodder crops**

**should be integrated in a crop rotation system underneath the coconut palms.**

**If possible large plants should be used from the nursery beds when setting up agroforestry systems including coconut palms. This applies not only to coconut palms, but also to all types of palms integrated within agroforestry systems. Coconut palms will grow on any sites that are suitable for cacao, bananas, citrus (oranges) or papaya. On citrus plantations, a slightly lower density should be used (120-150 plants/ha) than for e.g. cacao (150-180 plants/ha).**

**Three phases can be identified in the development (life cycle of the coco palm) of the crop:**

<b>Life cycle</b>	<b>Shade</b>	<b>Mixed crops</b>
<b>1st phase: up to 8th year</b>	<b>A full frond will only have developed after 8 years; during this time, only partial shade is available</b>	<b>Cultivation of annual crops possible.</b>
<b>2nd phase: from 8-</b>	<b>Comparatively large amount of shade</b>	<b>Cultivation of shade-tolerant varieties</b>

<b>25th year</b>		
<b>3rd phase: older than 25 years</b>	<b>Shade reaching to the ground diminishes as trees attain full height</b>	<b>High amounts of sunlight allows cultivation of plants needing lots of light.</b>

### **Nutrient supply and organic fertilisation**

**The level of nutrient extraction on a coconut palms/mixed crop system can be balanced by encouraging the decomposition of organic material that is made available, e.g. through mulching material, green fertiliser and tree trimming. A dense crop of legumes or use of other plants providing ground coverage as bottom crops, and which are regularly supplied with mulching material, will provide a sufficient supply of nitrogen for the plants. It is important to take care that all harvest and processing residues, such as coco fibres and press-cakes from the oil-extraction process, are returned to the plantation. This also applies to the potassium-rich ash resulting from burning the coco husks. If insufficient organic material is produced on the plantation, the deficit can be balanced by regularly adding compost. The compost should be enriched with any wood ashes (or coco husk ashes) that are available.**

**The compost is spread out in a circle 3-5 m underneath the palms, and preferably covered over with coco shell mulching material. The latter may be especially necessary in systems lacking enough additional vegetation.**

**A deficiency in potash will result in a large reduction of yield for coco palms. The vast majority of the potassium is thereby contained in the fruit water of the coconuts. On cultivation systems which include cacao, returning the cacao shells to the site will supply sufficient potassium to balance out the extraction. The continual pruning of crops on diversified agroforestry systems provides an important source of nutrients (e.g. of potassium).**

**When providing a nutrient supply to coco palms, it should be noted that it can take up to 36 months before inflorescence begins. This means that measures to supply nutrients, or to counteract deficits or other morphological disturbances, will take 3 years before they have an effect on production.**

**Due to their symbiosis with endomycorrhizae fungi (phosphate supply), and their tolerance of soil salts (which are often harmful to the other crops), coco palms, as well as other varieties of palm, have a beneficial effect on the growth of the other crops in an agroforestry system.**

**Keep area around the tree free of weeds. Coconut will suffer from too much competition from weeds and bush regrowth. Recommended weed control methods include slashing by hand or grazing by cattle. Avoid weeding with mechanical implements as these can damage the roots of the tree. The economic life of a coconut tree is about 25-30 years. After this period, the low producers, dead and diseased trees should be removed from the field and replaced with new seedlings.**

### **Crop monitoring**

**The nuts ripen during the entire year. As a rule, a harvest is carried out every 1-2 months, when the ripened coconuts are harvested directly from the tree - farmers should not wait until the nuts fall from the tree. The nuts are fully ripened when the coconut water can be clearly heard sloshing against the inside when they are shaken. Harvesting too early can unfavourably affect the quality of the copra.**

### **Harvesting**

**Stock plants that are suitable seed providers produce 100 nuts per year and up to 180 g copra per nut. In drier areas yields are usually 15-20 nuts/tree/year. Harvest fully-ripened nuts intended to provide seeds after 11-12 months. Cut down nuts and lower them carefully (e.g. by rope). Do not allow the nuts to fall down. Following the harvest, store nuts for a**

**short break in a covered, well- ventilated place. (Naturland e.V. 2000)**

### **Copra drying**

- **Sun drying**

**Remove the husk first. Dry nuts on a clean surface to reduce moisture from 45% to 6%. In fine weather this takes about 5 days. Turn the pieces occasionally and cover them at night and in rainy weather.**

- **Kiln drying**

**Make a fire in the pit of the kiln. Use the coconut shells as fuel as they heat well and smoke little. Put the copra on a wire mesh platform over the fire and protect it from the rain. This takes about 4 days.**

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### **Information on Diseases**

### **Biological methods of plant protection**

**In a balanced cultivation system, which includes middle and bottom**

**crops, as well as nitrogen-fixing green manuring plants (legumes), diseases and pests requiring some form of control measures will rarely occur, especially when enough birds are present on the plantation. These are often present in multi-level cultivation systems (see diversification strategies above).**

**Most of the problems concerning disease and pests have the following causes:**

- **Cultivation in a monoculture, or with too few different varieties.**
- **Too little distance between species that grow to the same height; failure to trim agroforestry systems.**
- **Degenerated or poor soil, lack of organic material.**
- **Unsuitable sites (water-logging, too dry, soil not deep enough for roots).**

**In most cases, the most effective cure is to alter the entire system of cultivation. If a system is not yet in a state of ecological equilibrium, bud rot or heart rot, caused by *Phytophthora palmivora*, can occur in all of the producing regions - where it is widely spread. In cases of heavy infestation by *Phytophthora palmivora*, harvest-losses can be lessened by using Bordeaux mixture, or any other copper-rich spraying preparations, which are permitted in organic farming systems. These measures should**



**only be undertaken in cases of emergency. In less harmful cases, removing any infested plants from the plantation will result in the infection being limited. Amongst the young trees in tree nurseries, an attack of termites may occur. The termites can be effectively combated by pouring a thin layer of sand from the soil over the exposed parts of the buried nuts. Young coco palms are also susceptible to the rhinoceros beetle and coconut caterpillars. Pheromone traps have been successfully utilised in Sri Lanka against the rhinoceros beetle. In emergency cases, butterfly caterpillars can be regulated with *Bazillus thuringiensis*.**

**The trunks of young seedlings are often protected against pests by painting them with tar. This is not allowed on organic plantations, and the black covering also causes the plants to heat up unnecessarily. An alternative is to paint the trees with a mixture of sulphur, soil and lime, (1 : 2 : 1) added together with water to make a thick paste. If necessary, the paste may need to be renewed, as rain will wash it off.**

**Considerable damage can be caused in regions with large coco palm monocultures by the mycoplasmosis, a fungi that grows in cuts in the fronds. The disease can be brought under control by removing infested plant parts or whole palms. Coconut red weevil and Rhinoceros beetle only usually damage young palms, yet may also, in exceptional cases, cause damage to mature crops. In acute cases, they can be combated by**

**closing the larvae tunnels, and with pheromone traps.**

**In coco palm monocultures, rodents, and especially rats, can develop into a serious epidemic which is then difficult to bring under control again. Metal plates affixed to the trunks will effectively stop them from climbing up the trees, though.**

### **Examples of Coconut Diseases and Organic Control Methods**

#### **Lethal bole rot (*Marasmiellus cocophilus*)**

**In East Africa, *Marasmiellus cocophilus* causes death of palms up to 8 years old, seedlings being highly susceptible on transplanting to the field. Root infections occur, leading to decay of basal tissues and finally a rot of the spear leaf. On older palms, the first symptoms are a general wilt of the fronds, which remain as a 'skirt' around the trunk. The spear leaf dies and a**



**Lethal bole rot  
Lethal bole rot  
(*Marasmiellus cocophilus*)**

**foul-smelling soft rot develops at the base of the leaves. A dry, reddish-brown rot with a yellow margin is typically present at the base of the bole. Cavities within these areas of rot are lined with mycelium (fungal growth) in young palms, 2-4 years old, but rare in 4-6-year-old palms, and absent in mature palms.**

**Fungal bodies (like small mushrooms) commonly occur on exposed roots, leaf bases of seedlings, exposed tops of seed nuts and on the soil surface around holes (growing from coconut debris) where diseased palms had been removed 2 years previously. On average, there is only about 8 weeks from the time of onset of symptoms till the death of the palm; this interval depends on the extent of fungal decay in the bole.**

**Spread occurs through soil, root contact between palms, infected coconut debris and probably by airborne basidiospores (fungal spores). Infection also occurs via**

**© Grahame Jackson  
(EcoPort, [www.ecoport.org](http://www.ecoport.org))**

wounds.

**What to do:**

- **Uproot and burn affected palms immediately after detection of the disease.**
- **Replant with healthy seedlings. This will be successful only if the infected soil is treated.**

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### **Lethal yellowing (*Phytoplasma*)**

**Symptoms include necrosis of inflorescences, yellowing of leaves and premature shedding of all fruit (nut fall) regardless of their developmental stage. Aborted nuts often develop a brown-black calyx-end rot reducing seed viability. Premature nut fall is accompanied or followed by inflorescence necrosis. This symptom is most readily observed as newly mature inflorescences emerge from**



**Lethal yellowing disease  
Lethal yellowing disease of  
coconut palms. Note yellow  
leaves and a dead palm**

**the ensheathing spathe. Normally light yellow to creamy white in colour; affected inflorescences are instead partially blackened (necrotic) usually at the tips of flower spikelets.**

**As disease progresses, additional emergent or unemerged inflorescences show more extensive necrosis and may be totally discoloured. Such symptom intensification results in the death of most male flowers and an associated lack of fruit set. Yellowing of the leaves usually starts once necrosis has developed on two or more inflorescences and discoloration is more rapid than that associated with normal leaf senescence. Yellowing begins with the older (lowermost) leaves and progresses upward to involve the entire crown. Yellowed leaves turn brown, desiccate and die. In some cases, the advent of this symptom is seen as a single yellow leaf (flag leaf) in the mid-crown. Affected leaves often hang down forming a**

**without leaves.**

© B. Loehr, icipe



**Lethal Lethal  
yel... dis...**

**skirt around the trunk for several days before falling.**

**A putrid basal soft rot of the newly emerged spear (youngest leaf) occurs once foliar yellowing is advanced. Spear leaf collapse and rot of the apical meristem invariably precedes death of the palm at which point the crown topples away leaving a bare trunk. Infected palms usually die within 3 to 6 months after the appearance of the first symptoms.**

**Lethal yellowing symptomatology may be complicated by other factors. For example, non-bearing palms lack fruit and flower symptoms. Foliar discoloration also varies markedly among coconut ecotypes and hybrids. For most tall-type coconut palms, leaves turn a golden yellow before dying whereas on dwarf ecotypes leaves generally turn reddish to greyish-brown. Phytoplasmas are transmitted in a persistent (circulative-propagative) manner primarily by insect vectors belonging to**

**the families *Cicadelloidea* (leafhoppers) and *Fulgoroidea* (planthoppers).**

**What to do:**

- **Use genetically resistant ecotypes (Malayan Yellow Dwarf) and hybrids (Malayan Yellow Dwarf x Panama Tall). This is the only practical long-term solution to Lethal yellowing.**

### **Bud rot (*Phytophthora palmivora*)**

**Bud rot (also called heart rot) caused by the fungus (*Phytophthora palmivora*) has an extensive host range of more than 200 plant species and it is widespread in the tropics including tropical Africa. The fungus enters into the plant by infecting tender host tissues (leaves, buds or young nuts). Affected leaves turn yellow and later brown.**



**Bud rot (heart rot)  
Seedling (right side)  
affected by dry bud rot**

**The heart leaf becomes chlorotic, wilts and collapses. The disease may spread to older, adjacent leaves and spathes, producing a dead centre with a fringe of living leaves. Light brown to yellow, oily, sunken lesions may be found on leaf bases, stipules or pinnae. Internally, the tissues beneath the bud are discoloured pink to purple with a dark brown border. Affected leaves progressively drop. Infected nuts show brown to black necrotic areas with a yellow border developing on the surface; internally, they have a mottled appearance. Young nuts are highly susceptible and fail to mature, they then fall off the tree; older infected nuts ripen normally.**

#### **What to do:**

- **Remove and destroy infected debris and infected coconut trees. This helps to reduce spread.**



- **Do not irrigate nurseries at dusk or at night to avoid prolonged periods of free moisture.**
- **Plant resistant varieties. Malaysian dwarf varieties, such as Malayan Yellow Dwarf, Bali Tall, Malayan Yellow Dwarf x Palu Tall hybrids, and other varieties originating in South-East Asia, show resistance.**

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## **Information on Pests**

### **Biological methods of plant protection**

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**Most of the problems concerning disease and pests have the following causes:**

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- **Degenerated or poor soil, lack of organic material.**
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**In most cases, the most effective cure is to alter the entire system of cultivation. If a system is not yet in a state of ecological equilibrium, bud rot or heart rot, caused by *Phytophthora palmivora*, can occur in all of the producing regions - where it is widely spread. In cases of heavy infestation by *Phytophthora palmivora*, harvest-losses can be lessened by using Bordeaux mixture, or any other copper-rich spraying preparations, which are permitted in organic farming systems. These measures should only be undertaken in cases of emergency. In less harmful cases, removing any infested plants from the plantation will result in the infection being limited. Amongst the young trees in tree nurseries, an attack of termites may occur. The termites can be effectively combated by pouring a thin layer of sand from the soil over the exposed parts of the buried nuts. Young coco palms are also susceptible to the rhinoceros**

**beetle and coconut caterpillars. Pheromone traps have been successfully utilised in Sri Lanka against the rhinoceros beetle. In emergency cases, butterfly caterpillars can be regulated with *Bazillus thuringiensis*.**

**The trunks of young seedlings are often protected against pests by painting them with tar. This is not allowed on organic plantations, and the black covering also causes the plants to heat up unnecessarily. An alternative is to paint the trees with a mixture of sulphur, soil and lime, (1 : 2 : 1) added together with water to make a thick paste. If necessary, the paste may need to be renewed, as rain will wash it off.**

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**In coco palm monocultures, rodents, and especially rats, can develop into a serious epidemic which is then difficult to bring under control again. Metal plates affixed to the trunks will effectively stop them from climbing up the trees, though.**

## Examples of Coconut Pests and Organic Control Methods

### **Termites (*Coptotermes formosanus*)**

**Termites can be a serious problem for coconut palms, particularly for young trees in tree nurseries, or trees that have just been transplanted into the field. Termites live in the soil in hills, construct tunnel from the hills to the palms and feed on all parts of young coconut palms. Damage occurs mainly during the dry season.**

**Many plants have a repellent or even insecticidal effect on termites and can be applied as spray directly against termites or as barrier around the trunk of coconut palms:**



**Termites  
Termites (*Coptotermes formosanus*)**

**© Scott Bauer, USDA  
Agricultural Research  
Service, Bugwood.org**

- **Neem: seeds and leaves (extracts or cake)**
- ***Quassia indica* or *Q. amara*: bark and leaves**
- **Sandalwood: wood**
- **Chinaberry, persian lilac (*Melia azedarach*): bark, branches, leaves, extracts**
- ***Euphorbia* sp.: "In Tanzania, especially in Dar es Salaam and coast regions, farmers plant with each seedling two or three sticks of *Euphorbia* sp. to protect the young palms from termite attack. On nurseries the *Euphorbia* plants can be planted around the seedbed to prevent access of termites to the palm seedlings and young palms. When the palms have grown big the euphorbia is simply cut down. The practice is widespread and farmers are convinced that it really does keep termites off the susceptible seedlings (personal communication Z.**



Termite Coconut  
se...

**Seguni, MARI)".**

**What to do:**

- **Place nurseries in land without termites.**
- **Alternatively, raise palms in polyethylene bags and check them always for termites.**
- **Pour a thin layer of sand from the soil over the exposed parts of the buried nuts.**
- **Help termite enemies (birds, insect predators) to have close habitats by the above mentioned diversification strategies.**
- **Traditional methods for controlling termites include: Flooding mounds, Digging out mounds and removing the queens, Suffocating the colony by**

## burning

### Adult coconut bug (*Pseudotheraptus wayi*)

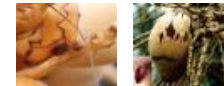
The coconut bug (*Pseudotheraptus wayi*) is the most important pest of coconuts in East Africa. A related species of coconut bug, *Pseudotheraptus devastans*, causes similar damage to coconuts in West Africa.

Adult bugs are brown in colour and 1.2 to 1.4 cm long. They lay eggs singly on the flowers or young nuts. Nymphs are red brown to green brown in colour and have long antenna. Adults and nymphs suck on flowers and developing fruits causing flower abortion and early nutfall. The toxic saliva of the bugs causes necrotic sunken lesions (scars) and cracks on the nuts. Attacked young nuts excrete gum. Many of the attacked young nuts fall off. Nuts older than three months at the time of attack



Coconut bug  
Adult coconut bug (*Pseudotheraptus wayi*) on coconut bunch

© B. Loehr, icipe



Coconu Coconu  
bu... bu...

**may not be aborted but remain small and have scars. Yield losses are difficult to assess since many of the nuts (over 70%) fall naturally. Nuts which abort naturally, do not show scars or gummosis. Two bugs per palm can cause considerable damage. Damage is usually less serious in intercropped coconuts. The bugs also feed on cashew, mango, cocoa and guava.**

**The predatory red weaver ant is an efficient natural enemy of the coconut bug. Weaver ants build nests on palms and other trees by joining leaves with silk produced by their larvae. They forage on the canopy chasing away or killing coconut bugs. Palms with weaver ants are usually free of damage by the coconut bug. Good control is achieved is more than 60% palms are occupied by thriving colonies of weaver ants. Unfortunately other ants present in coconut plantations fight weaver ants, and themselves do not**



**protect (or not as effective as weaver ants) the palms against coconut bugs. These ants such as big headed ant (*Pheidole megacephala*), the crazy ant (*Anoplolepis custodiens*), and the long legged ant (*Anoplolepis longipes*) among others, kill or displace weaver ants, as a result palms are severely damaged. These competing or antagonistic ants need to be managed to allow weaver ants to do their beneficial work.**

#### **What to do:**

- **Keep bushes and trees that are hosts for weaver ants in the surrounding of coconut fields.**
- **Intercrop coconuts with plants favoured by weaver ants such as citrus, soursop, guava, mango, etc**
- **In areas where the bigheaded ant is dominant keep ground vegetation. If there were no ground vegetation this**

**ant would be forced to search food on the trees and would displace weaver ants.**

- **Connect the canopy of neighbouring palms/trees with sticks, wire, or ropes. Weaver ants can easily walk among trees searching for food and set up new nests avoiding other ants active on the ground.**
- **Where weaver ants are not present transfer weaver ant nests into the field by collecting nests from bushes around and placing them onto coconut palms or other host plants in the field. Care should be taken not to mix ants from different colonies since they would fight. Do not place nests collected from different trees or trees far apart on the same trees since they are likely to belong to different colonies and will kill each other. The best time for collection of nests is during the rainy season, since in this period many new queens**

**are present in the ant nests, and these may get established in the orchard and start new colonies. Ants in nests introduced without the queen will die out after some time (they may live up to 8 months) and new introductions are needed.**

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**The African rhinoceros beetle (*Oryctes monoceros*)**

**It is a stout beetle, about 3.5 to 5 cm long, shiny dark brown to black in colour with a curved horn on the head, hence its common name. The adult flies at night to palms and bore into the hearth of the palms spear, chewing and cutting the youngest unopened leaves and the vegetative bud.**

**Attacked leaves continue to develop and unfold showing a characteristic V-shape damage. If the whole growing point is eaten, the palm usually dies, particularly**



**Rhinoceros beetle  
Rhinoceros beetle adult,  
real size: 3.5 to 5 cm long**

**© KARI, National  
Horticultural Research  
Centre.**

**young palms less than four years old. The boreholes are often marked with a bundle of fibres pushed out of the hole by the beetle. This beetle is a serious pest in plantations where field sanitation is neglected. Eggs are laid in rotting plant material, especially dead palm trunks, compost heaps and rubbish dumps. The larvae (grubs) and pupae develop in rotten coconut logs and other decaying material.**



**Rhinoc Rhinoc Rhinoc Rhinoc**



**Iron  
rods**

### **What to do:**

- **Fell, chop and remove dead palms to eliminate breeding sites.**
- **If logs cannot be removed, check the decaying end. Collect and destroy grubs.**
- **Hook out beetles in young palms. Push a 30 cm long iron rod with a hook at one end is pushed into the tunnel bored by the beetle while feeding. If the beetle is still inside it will be hooked out.**

**The coconut mite (*Aceria (=Eriophyes) guerreronis*)**

**This mite is tiny and difficult to see with the naked eye. When very many mites are together they appear as fine whitish dust. The coconut mite attacks and damages the upper part of the nutlets under the sepals of up to 6 months old nutlets. Attack is severe during the dry season. Attacked nuts may fall or have a scarred husk, which often splits. The nuts of coconuts showing light scarring on the husk are not seriously affected but in heavily scarred nuts there is significant damage to the nuts.**

**What to do:**

- **Remove mature and prematurely fallen nuts. Although few mites are normally found on old bunches, they could rapid**



**Coconut mite damage  
Nuts damaged by the  
coconut mite (*Aceria  
(=Eriophyes) guerreronis*)**

© A. M. Varela, icipe

**colonise young bunches.**

- **Provide balanced fertilisation to the palms. Mite damage seems to increase with increasing levels of nitrogen, and decrease with potassium. This suggests that the addition of N fertiliser could worsen the mite problem. However, the increased yield from fertiliser input could be greater offset than any increased loss due to worsened mite attack.**
- **Fertilization can play a role on mite damage. Damage seems to increase with increasing levels of nitrogen, and decrease with potassium. This suggests that the addition of N fertiliser could worsen the mite problem. However, the increased yield from fertiliser input could be greater offset than any increased loss due to worsened mite attack.**
- **Spray young bunches with Sulphur(wettable sulphur at high**

dosage of 0.5%)

- **Spray neem kernel extracts. Reportedly neem extracts are effective against this mite. For more information on neem click here.**

### The coconut scale (*Aspidiotus destructor*)

A number of scales feed on leaves and fruits of coconut palms. The most damaging is the coconut scale (*Aspidiotus destructor*). This scale is bright yellow and round (females) or reddish and oval (males) covered with a semitransparent greyish white flat scale. The scale diameter is 1.5 to 2.0 mm. Females are always wingless and remain under their scale their entire life. Adult males have one pair of membranous wings, move about actively in search of females and do not feed during the adult stage. Eggs are protected underneath the scale or shell of the mother



Coconut scale  
Coconut scale (*Aspidiotus destructor*) on coconut

© B. Loehr, icipe



Coconu Coconu

**insect until they hatch. Upon hatching the SC... SC... young scales leave the maternal scale, take up a position and start feeding. They do not move afterwards. They are found mainly on the undersides of the leaves, but frond stalks, flower clusters and young nuts can also be attacked.**

**A severe infestation of this armoured scale forms a continuous crust over flower spikes, young nuts and the lower surface of leaves. The leaves become yellow and eventually die. The crown dies leading to collapse of the infested plant. Attacks of young nuts cause shrivelling of nuts leading to premature nut falls. Mostly young coconut trees of up to 10-15 years are vulnerable to damage.**

**Scales may infest palms throughout the year, but damage is usually more severe during the dry season. Neglected plantations are particularly susceptible. The coconut scale also attacks many species of fruit trees, such as avocado,**



**breadfruit, mango, guava and papaya. Other major hosts are cocoa, cassava, cotton, oil palm, papaya, rubber, sugarcane and tea. It also attacks a range of ornamental plants including roses.**

### **What to do:**

- **Conserve natural enemies. They usually keep scales under control. Ladybird beetles and parasitic wasps are particularly effective in controlling the coconut scale**
- **Avoid or restrict movement of infested plants in areas where the coconut scale is a problem, to avoid spread of the scale.**
- **Destroy infested plants and plant parts. This may help to eradicate scales from new areas. However, this scale is difficult to eradicate due to its wide host range.**
- **Provide good growing conditions for**

**the palms. Healthy palms in well-drained soils are seldom seriously infested.**

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**African palm weevils (*Rhynchophorus phoenicis*)**

**Adults are large weevils (40-55 mm in long), with a long snout and reddish brown in colour, and generally with two reddish bands on the thorax. Females lay eggs on wounds of various origins, on the mature stem as well as in the crown. Upon hatching the larvae (grubs) penetrate into the living tissues of the palm, feeding on the shoot and young leaves, where the insect completes its development in about 3 months. The damaged tissues turn necrotic and decay. Sometimes the grubs feed on the growing point killing the palm. Grubs are whitish-yellow, legless, and oval in shape; their head is reddish brown, and is armed with strong mandibles. Fully-**



**Palm weevil  
African palm weevil adults  
(*Rhynchophorus phoenicis*).**

**© Reproduced from: Date Palm Cultivation: FAO Plant Production and Protection Paper. Food and Agricultural Organization of the United Nations. Rome, 2002. (www.fao.org)**

**grown grubs are 50 to 60 mm long. The pupal stage is passed within a cocoon of vegetal debris made by the grub at the end of its development. The African palm weevil usually damages young palms, yet may also, in exceptional cases, cause damage to mature crops.**



**Palm weevi.. Palm weevi..**

**The primary means of control for African palm weevil is preventative, using cultural and sanitary methods.**

**What to do:**

- **Avoid wounds during plantation management. Adults are attracted to the odour of feeding sites and to injured palms, in which they lay their eggs.**
- **Remove all heavily attacked and wounded palms, along with those showing distinct growth disorders.**
- **Trap weevils. Traps made from thinned**

**or wild palms that have been felled and split into longitudinal sections divert weevils away from cultivated palms, because adults are attracted to the chemicals emitted from damaged wood. Trap- heaps are frequently burnt and replaced with fresh trap wood. Burn trap- heaps frequently and replace them with fresh trap wood. Older traps can be sprayed with palm sap to maintain their effectiveness.**

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## **Rodents**

**In coconut palm monocultures, rodents, and especially rats, can develop into a serious epidemic, which is then difficult to bring under control again.**

### **What to do:**

- **Affix metal plates to the trunks to stop rodents from climbing up the trees.**
-

## Information Source Links

- **Anon. (1990). Hypothesizing about palm weevil and palm rhinoceros beetle larvae as traditional cuisine, tropical waste recycling, and pest and disease control on coconut and other palms... can they be integrated? The Food Insects Newsletter, 3(2):1-4.**
- **Bohlen, E. (1973). Crop pests in Tanzania and their control. Federal Agency for Economic Cooperation bfe. Verlag Paul Parey. ISBN: 3-489-64826-9.**
- **CAB International (2006). Crop Protection Compendium, 2006 edition. Wallingford, UK [www.cabi.org](http://www.cabi.org)**
- **Field Crops technical Handbook (2002). Agricultural Information Centre, Nairobi Kenya**
- **Griesbach, J. (1992). A Guide to Propagation and Cultivation of Fruit Trees in Kenya. Schriftenreihe de GTZ, No. 230. Published by Technical Cooperation- Federal Republic of Germany (GTZ). ISBN: 3 88085 482 3**
- **Hill, D. (1983). Agricultural insect pests of the tropics and their control. 2nd edition. Cambridge University Press. ISBN: 0-521-24638-5.**
- **Integration of Tree Crops into Farming Systems Project & Ministry of Agriculture and Rural Development, Kenya (2000). Tree Crop Propagation and Management - A Farmer Trainer Training Manual.**

- **Kessing, J.L.M., Mau, R.F.L. (2007). Crop Knowledge Master. Coconut scales *Aspidiotus destructor*. Updated by: J.M. Diez April 2007. [http://www.extento.hawaii.edu/kbase/crop/Type/a\\_destru.htm](http://www.extento.hawaii.edu/kbase/crop/Type/a_destru.htm)**
- **Naturland e.V. (2000). Organic Farming in the Tropics and Subtropics. Exemplary description of 20 crops. Coco palms. [www.naturland.de](http://www.naturland.de)**
- **Pest of the Month. Coconut Scale Insect *Aspidiotus destructor* Signoret (Hemiptera:Dispidae). [http://www.spc.int/pps/pest\\_of\\_the\\_month\\_-\\_january\\_2005.htm](http://www.spc.int/pps/pest_of_the_month_-_january_2005.htm)**
- **Van Mele, P., Cuc, N. T.T. (2007). Ants as friends. Improving your tree crops with weaver ants. (2nd edition). Africa Rice Center (WARDA), Cotonou, Benin and CABI, Egham, U.K. 72 pp. ISBN: 92-913-3116.**
- **Varela, A. M. (1993). Studies on the distribution and importance of the coconut mite *Eriophyes guerreronis* Keifer, as a pest of coconut palms in Tanzania. Internal report. National Coconut Development Programme (NCDP).**
- **Varela, A. M. (1997). Establishment of *Oecophylla longinoda* Latreille (Formicidae), a predator of the coconut bug *Pseudotheraptus wayi* Brown (Coreid) in new areas in Tanzania. Proceedings of the International Cashew and Coconut Conference, Dar Es Salaam. Pp 442-446.**
- **Way, M. J., Khoo, K. C. (1992). Role of ants in pest management. Annual Review of Entomology. Vol 37: 479-503.**

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[Cashew](#)[more Images](#)**Cashew****Scientific name: *Anacardium occidentale*****Order/Family: Sapindales: Anacardiaceae****Local names: Mkorosho / mkanju (Swahili)****Pests and Diseases: [Anthracnose](#)****[Cashew stem girdler](#)    [Cashew weevil](#)****[Coconut bug](#)    [Helopeltis bugs](#)    [Mealybugs](#)****[Powdery mildew](#)    [Thrips](#)    [Aphids](#)****[General Information and Agronomic](#)****[Information on Diseases](#)****[Aspects](#)****[Information on Pests](#)****[Information Source Links](#)**

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## **General Information and Agronomic Aspects**



### **Geographical Distribution of Cashew in Africa**

**Cashew trees are grown along the coastal plains of Kenya and Tanzania. Cashews are evergreen trees with deep taproots, originating from the northern part of South**





Cashew tree

© A. M.Varela

**Pigeon pea**

**Pineapple**

**Potato**

**Pumpkin**

**Rice**

**Sesame**

**Sorghum**

**Soybean**

**Spider plant**

**Spinach**

**Sugarcane**

**Sweet**

**potato**

**Tea**

**Teff**

**Tomato**

**Wheat**

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**Zucchini/Courgette**

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**America. The Portuguese introduced cashew to Mozambique in the 16th century where it flourished forming extensive forests; eventually it also became dispersed in East Africa. Cashew is grown along the coastal plains of Kenya and Tanzania**

### **Uses**

**The kernels or nuts have a high nutritional as well as commercial value and are used for human consumption either raw or roasted. The cashew nut apple is rich in Vitamin C (about 5 times higher than the orange) and is used for the production of juice, wines, spirits, jam, pickles and chutneys.**

**The liquid of the shell is used for brake linings, heat proof and waterproof paints and protective varnishes. Cashew nut wood is of poor quality but can be used as firewood if mixed with other types**



**weeds of wood.**

**Medicinal plants**

**Fruit and vegetable processing**

**Natural pest control**

**Cultural practices**

**Cashew apples and nuts**

**© A. M. Varela**

**Climatic conditions, soil and water management**

**Cashew trees are usually grown at altitudes of between 0-500 m above sea level (asl), but can grow up to 1000 m asl. They can be very drought resistant provided their roots can penetrate deeply into the soil and draw water from the subsoil. For mature trees 500 mm of rainfall per year is adequate, but seedlings should be watered until properly established. If rainfall is below 900 mm per year plant at the widest spacing indicated. Cashew nut trees tolerate a wide range of soils provided they are deep and well drained. They can grow quite well on infertile soils but do not do well on coral outcrops at the coast.**

**Varieties**

**Improved varieties available at KARI - Mtwapa Research Centre (Kenya Agriculture Research Institute), Kenya include A41, A47A, A75-83, A81**

**and A100.**

### **Planting material**

**Select seeds from healthy, high yielding trees. Before planting, sort out seeds by the water density method as follows:**

- **Place the seeds in a bucket of sea water (100g salt per 5 litres of water) and select the seeds that sink for planting. Those that float have poor germination and growth potential.**
- **Sun dry seeds for planting for several weeks to prevent mould and rotting.**
- **Do not plant seeds that are more than one year old**
- **Good, selected seed may be purchased from the KARI - Mtwapa Research Centre, Kenya**

### **Land preparation and planting**

**Clean the field and dig holes 30cmx30cmx40cm deep and refill with topsoil mixed with 1 bucket of well-rotted manure or compost. Due to their extensive root system cashew nut trees compete for water and nutrients and therefore should be well spaced. Their canopies should not**

**touch one another since this interferes with production of flowers and hence fruit setting.**

**Recommended spacing in good rainfall areas is 12mx 6m, giving 139 trees per ha. In low rainfall areas spacing of 12mx12 m (69 trees/ha) is recommended to give the trees a better chance for survival.**

**Only the healthiest trees are worthwhile keeping for long growing periods.**

**Planting methods include:**

- **Direct planting of seeds:** This method has the advantage that less labour is needed but there is higher risk of death during dry season and also a higher risk of early diseases. Plant 3 seeds per hole covered by 6-8 cm of soil
- **Raising seedlings in polybags in the nursery:** This method has the advantages that it is easier to water the seedlings properly, which is particularly important in the dry season, and that is possible to select the strongest and healthiest plants for transplanting. Disadvantages are that more labour is required and it is a bit more expensive. Seedlings in polybags should be transplanted 6 weeks after sowing in order to avoid damage to the taproot

## **Intercropping**

**This can be done before the canopies close. Most annual crops can be used apart from cotton and sweet potatoes, which are host plants for *Helopeltis* bugs, major pests of cashew. Do not interplant young trees with pasture because of the high competition for water during the dry season.**

### **Husbandry**

**No fertiliser is required, but well rotted manure at planting is beneficial. Keep the area around the tree (1 ½ times the size of the canopy) should be kept clean of weeds for the first 2 years to avoid competition. If planted on a slope the tree should have a U-shaped mound of soil below it to collect rainwater for improved growth. Seeds germinate within 2-4 weeks.**

**Thin after 3-4 months leaving only the strongest plant at each site. Protect seedlings from monkeys, rodents and bucks by placing wire cages or thorns around the seedlings. Support plants with a stick and trim off side shoots up to 60-90 cm from ground level. When trees are mature, prune dead wood or any borer damaged or intergrowing branches to give the canopy air and light.**

### **Harvesting**

**Trees normally bear fruit when they are 2 ½ - 3 years old. They reach**

**maturity after 9-10 years and may have an economic life span of 30-40 years if well cared for. Harvesting starts at the beginning of October and continues till the end of December. Pick only the nuts that have dropped down and remove the attached apple by a twisting action. Pick on a weekly basis in the dry season and daily in wet weather to avoid fruit rotting or insect damage. Store only dry nuts. Average yield is about 6 kg/tree but with good husbandry 12 kg/tree can be obtained.**

### **Grading**

**Cashew nuts are graded into 2 categories:**

- **FAQ (Fair Average Quality) - normally about 75%. These are healthy nuts with pinkish to greyish colour with no shrinkage or distortion.**
- **UG (Under Grade) - normally about 25%. Nuts which may have some blackish colour, distortion or shrinkage but not rotten.**

**Sun dried raw nuts for one to six days to reduce moisture content to 9% or less for safe storage and to mature the seed through the infra red and violet rays of the sun. Correctly dried nuts are pinkish in colour and produce a rattling sound when shaken. No mark can be made on a dry nut with a thumbnail. Dry raw nuts can be stored under dry conditions for at least two years without losing their flavour, but they are generally**

**processed within one year of harvesting.**

**The decortication of cashew nuts is hampered by the liquid contained in the cashew nut shell. This liquid is a viscous, oily liquid, pale yellow to dark brown in colour with a bitter taste and caustic properties; it causes blisters on human skin unless precautions are taken, and it will spoil kernels on contact. In traditional artisanal cashew processing the nuts are put in an open pan over an open fire and stirred continuously to avoid scorching until they start burning, then they are thrown on sand to extinguish the fire and to remove the remaining humidity on the outer skin.**

**In industrial processing the nuts are graded in different size classes and rehumidified at about 16% moisture by spreading water over them for about two days to make the kernel elastic and to fill the cells of the shell with water. Then, they are roasted in a hot oil bath heated to 192°C for about 90 seconds depending on the size of the nuts. Through the roasting process, the cells of the shell break and about 25 % of the shell liquid flows into the bath. The remaining liquid on the outer shell is removed with sawdust.**

**Both the artisanal and the industrial methods make the shell brittle so that they can be broken easily.**

**Another method to avoid contamination of the kernel with the shell liquid is to deep-freeze the nuts and split the shells while frozen.**

**There are different methods for manual cashew shelling. The simplest consist of placing the prepared nuts on a stone using a hardwood stick to crack the shell. A semi-mechanised process uses a pair of knives shaped in the contour of half a nut. The knife system is also used in industrial plants. In another industrial processing method centrifuges are used to crack the shells; shells and kernels are then separated in an air stream, heated shells are lighter and blow away.**

**After shelling the kernels have to be dried to about 6% moisture content, thereafter the testa can be peeled off easily. Kernels are then graded, rehumidified to 8% and packed in airtight containers filled with carbon dioxide (CO<sub>2</sub>) and sealed. The CO<sub>2</sub> inhibits infestation by insects and is slowly absorbed by the nuts thus producing a vacuum that prevents shaking and breaking of the nuts during transportation.**

**Cashew apple processing:**

**Apples are steamed under pressure or cooked in a 2% salt solution to remove the astringency. Addition of gelatine, pectin or lime juice clears the cashew juice from remaining undesirable contents.**



## Information on Pests

### Helopeltis bugs (*Helopeltis schoutedeni* and *H. anacardii*)

Helopeltis bugs, also known as mosquito bugs or mirid bugs, are the most important pests of cashew. These bugs are slender, delicate insects, about 7- 10 mm long with long legs and antennae, the antenna being nearly twice as long as the body. The females are red and the males brown to yellowish red. They lay eggs inserted into the soft tissue near the tips of flowering or vegetative shoots. Nymphs (immature bugs) are yellowish in colour. Both adults and nymphs feed on young leaves, young vegetative and flowering shoots, and developing fruits.



Helopeltis bug  
F. Haas, icipe

© Body size 7-10 mm long



Helope Helope Helope Helope

**Attacked leaves are deformed and show angular lesions, particularly along the veins, which may drop off, so that the leaves appear as if attacked by biting insects. Feeding on the stalks of the tender shoots causes elongated green lesions, sometimes accompanied by exudation of gum. Severely damaged shoots die back due to the effect of bug saliva in combination with fungi, which enter the plant tissue through the feeding lesions; the subsequent development of numerous auxiliary buds causes a bunched terminal growth known as 'witches broom'. In case of serious infestations the trees may appear as if scorched by fire. Bug feeding on developing apples and nuts causes brown sunken spots. The growth of trees is seriously retarded and fruit formation of attacking flowering shoots is reduced.**

**What to do:**

- **Monitor the crop regularly. Helopeltis attack occurs very suddenly and great vigilance is very important to control this pest, particularly during the rainy season or when water is available leading to flushing (production of young shoots) when Helopeltis populations normally build up.**
- **Conserve natural enemies. Weaver ants build nests on cashew trees providing good protection against this and other bug pests.**
- **Do not interplant cashew with crops that are host for Helopeltis bugs, such as cotton, tea, sweet potato, guava and mango.**

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### **Coconut bug (*Pseudotheraptus wayi*)**

**Adult bugs are reddish brown in colour and 12 to 14 mm long. Nymphs are red brown to green brown in colour and have**

**long antennae. Bug feeding causes necrotic bruise-like depressions; a hard lump develops, which can be easily removed when the fruit is peeled. The bug sucks on the developing fruits causing pockmarks. The kernels are also affected showing spots, which lower their market value.**



**Coconut bug  
Adult coconut bug**

**What to do:**

- **Conserve natural enemies. Weaver ants nest on cashew trees deterring and feeding on coconut bugs.**

© A.M.Varela, icipe



**Coconut Weaver  
bu... ant...**

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**The cashew weevil (*Mecocorynus loripes*)**

**The cashew weevil is large weevil, about 20 mm long, and of a knobbed appearance.**

**It is dark grey-brown in colour. The female weevil lays single eggs in small holes in the bark of the trunk or branches. The larvae are legless grubs, whitish in colour with a brown head. They bore through the bark and move downwards tunnelling under the bark while feeding on the sapwood.**

**Brown-black gummy frass is seen on the trunk and main branches. Heavily attacked trees become ringed by damaged sapwood and eventually die. Neglected plantations are likely to be severely attacked. Fully-grown larvae pupate in a chamber about 2 cm below the bark.**

#### **What to do:**

- **Cut away bark from damaged areas of lightly infested trees and kill the larvae and pupae underneath. Repeat this every month for a further six months if required.**



**Cashew weevil  
Adult cashew weevil  
(*Mecocorynus loripes*). Real  
size: about 20 mm long.**

© A. M. Varela

- **Destroy severely infested trees. First collect and destroy all adult weevils; then fell the tree and remove the bark to expose all larval galleries; kill all larvae and pupa and burn the tree.**
- 

### **Red-banded thrips (*Selenothrips rubrocinctus*)**

**Adults of the red banded thrips are dark brown or blackish. Nymphs are pale yellow with a broad transverse red band on the dorsal side of the abdomen. Thrips attack older leaves, flowers and shoots. Attacked leaves drop off leaving bare shoots with few young leaves at the tip. Infestation of flowers causes poor fruit formation. Locally limited infestations may cause considerable damage.**

#### **What to do:**

- **Conserve natural enemies. Anthocorid**



**Red-banded thrips  
Immature stage of the red  
banded thrips. Note a bright  
red band across the  
abdomen of immature thrips.  
Real size: about 1 mm long.**

© A. M. Varela

**More Information on Thrips**

## **bugs are important in natural control of thrips.**

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### **Mealybugs (*Pseudococcus longispinus*)**

**The long-tailed mealybug (*Pseudococcus longispinus*) attacks shoots, inflorescences, apples and nuts. Affected parts appear completely white. Trees infested during the flowering stage fail to produce fruits, whereas those infested at the nut swelling stage produce discoloured nuts, which result in a lower grade. However, cutting tests showed no difference in kernel outturn between clean and discoloured nuts. Mealybugs have been a problem for cashew growers in Tanzania.**

**The body of the adult female is 2.0-3.6 mm long, soft, elongate oval and somewhat flattened.**



**Mealybugs  
Mealybugs on leaf**

© A.M. Varela, icipe  
**[More Information on Mealybugs](#)**

## What to do:

- **Conserve natural enemies. Mealybugs are usually controlled by a wide range of natural enemies. However, use of pesticides may kill these natural enemies leading to mealybug outbreaks.**
- 

### Cashew stem girdler (*Paranaleptes reticulata*)

Adults are a long horn beetles, with a body length of 25-35 mm and with antennae longer than the body. The head and the thorax are dark brown; the wing cases are orange with large black blotches giving them a reticulate appearance. Adult beetles girdle branches from 3-8 mm in diameter leaving a V-section cut; only a narrow, central pillar round the pith zone is left, which eventually breaks off. Female beetles lay elongated eggs in transverse



Cashew stem girdler  
(*Paranaleptes reticulata*)  
Lamiinae/Ceroplesini.  
*Paranaleptes reticulata*  
Thomson, 1877 Distribution:  
Ethiopia, Somalia, Kenya,



**slits made in the bark of the girdled branch Tanzania, Uganda at points above the girdle. Larvae are yellow, in colour and reaches a length of 45 mm when fully grown. They mine in dead wood of the girdled branches. Pupation takes place in the dead wood. The lifecycle takes one year. This beetle is a common but usually minor pest of cashew in the Coast Province of Kenya. However, neglected plantations may be severely damaged. It is also present in Tanzania.**

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#### **What to do:**

- **Once a year (in November or December) collect and burn all girdled branches should be collected and burned. Only the dead or dying part of the branch above the girdle needs to be collected.**

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## Information on Diseases

### **Anthracnose (*Colletotrichum gloeosporioides*)**

The disease attacks young plant tissues and can cause severe crop loss when it infects flowers, which turn black and die. Young leaves, cashew apples and nuts are similarly affected. Infected young terminal shoots die back. The disease is promoted by warm, damp conditions.

#### **What to do:**

- Prune dead branches and twigs and remove from the field. They constitute the principal source of infection.
- Though pesticide application on cashews is not practised in East Africa, copper based fungicides are known to



**Anthracnose**  
**Anthracnose blight on**  
**cashew**

© J.M. Waller/CABI  
**More Information on**  
**Anthracnose**

**be effective against anthracnose.**

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**Powdery mildew (*Oidium anacardii*)**

**This disease is particularly serious in coastal areas south of Dar es Salaam in Tanzania. Infected panicles and leaves are coated with white, powdery fungal growth. In severe attacks the entire panicle may be infected and the fruit and nuts fail to set.**

**What to do:**

- **Pesticide application is not practised in cashew fields. However, sprays of powdered kelp, potassium / sodium bicarbonate and sulphur provide good control of powdery mildew.**



**Powdery mildew  
Powdery mildew on young  
cashew leaves**

© A.A.Seif, icipe

**[More Information on Powdery mildew](#)**

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**Information Source Links**

- **Acland, J. D. (1980). East African Crops: An Introduction to the Production of Field and Plantation Crops in Kenya, Tanzania and Uganda. FAO. Longman Group Limited London. ISBN: 0 582 60301 3**
- **Agricultural Information Center (AIC) (2002). Field Crops Technical Handbook. Min of Agriculture, Nairobi, Kenya .**
- **Behrens, R. (1996). Cashew as an Agroforestry Crop- Prospects and Potentials. Tropical Agriculture. GTZ. Margraf Verlag. ISBN; 3-8236-1257-3.**
- **Bohlen, E. (1973). Crop Pests in Tanzania and their Control. Federal Agency for Economic Cooperation (bfe). Verlag Paul Parey. ISBN: 3-489-64826-9.**
- **Griesbach, J (1992). A Guide to Propagation and Cultivation of Fruit Trees in Kenya. Schriftenreihe No. 230, Eschborn, Germany: GTZ. ISBN 3-88085-482-3**
- **Integration of Tree Crops into Farming Systems Project (GTZ) and Ministry of Agriculture and Rural Development, Nairobi, Kenya (2000). Tree Crop Propagation and Management - A Farmer Trainer Training Manual.**
- **Ministry of Agriculture, Livestock Development and Cooperatives. Tanzania. Annual reports. Plant Protection Division.**
- **Hill, D. (1983). Agricultural insect pests of the tropics and their control. 2nd edition. Cambridge University Press. ISBN: 0-521-24638-5.**

Feb 7, 2009 - [Disclaimer](#) [Search](#)[Publications](#) [Publications TOF](#)[TOF](#)[Home](#) [Help](#) [Contact](#)You are here: [Home](#) > [Plant Health](#) > [Crops/ fruits/ vegetables](#) > [Avocados](#)[Back](#)[Print](#) [Crops/ fruits/  
vegetables](#)[African  
Nightshade  
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Cashew](#)[more Images](#)**Avocados****Scientific name:** *Persea americana***Order/Family:** Laurales: Lauraceae**Local names:** Parachichi (Swahili)**Pests and Diseases:** [Anthracnose](#)[Avocado root rot](#)    [Cercospora fruit spot](#)[Coconut bug](#)    [False codling moth](#)    [Fruit flies](#)[Scab](#)    [Scales](#)    [Spider mites](#)    [Thrips](#)[General Information and Agronomic](#)[Aspects](#)[Information on Pests](#)[Information on Diseases](#)[Fresh Quality Specifications for the  
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## General Information and Agronomic Aspects



**Geographical  
Distribution of  
Avocado in Africa**

**The avocado is native to the Americas but grows well in Kenya. It is very nutritious with a high protein and oil content and is becoming increasingly important as an export crop. The avocado oil is cholesterol free, of the monounsaturated type believed to protect against heart disease and certain kinds of cancers. The fruit is nearly sodium free, is rich in potassium and dietary fiber, vitamin B6, C, D and E. It is eaten as fresh fruit, in salads, soups, ice cream, also used to make avocado oil, perfume and avocado paste.**

### **Climatic conditions, soil and water management**

**Depending on variety, avocado grows well from 0-2100 m above sea level (asl). The varieties 'Tonnage', 'Simmonds', 'Booth 7&8' are suited to lowland areas between 90 and 800 m asl. 'Hass' and 'Nabal' are suited to altitudes 800-2100 m asl. 'Fuerte' and 'Puebla' are suited to altitudes 1500-2100 m asl.**

<b>Pigeon pea</b>	<b>Avocado grows successfully on many types of soil provided they are deep, with good water holding capacity and free draining. Water logged or saline soils are unsuitable because avocado plants are sensitive to excessive soil moisture and high salinity. The optimum pH is 5.5-6.5. Temperatures between 16 and 24°C are good for growing avocados. Maximum temperature for avocado is 33°C. Above this temperature avocado fruits and trees can be damaged. High temperatures and direct sunshine can cause sunburn damage to exposed fruit. Avocado will not grow where frost can occur. An annual rainfall 1200 mm is optimal for good production. Water requirements are not less than 1000 mm/year. If supplementary water is required not more than 50 mm at a time may be applied. Climatic conditions with alternating dry and rainy seasons are best for avocados.</b>
<b>Pineapple</b>	
<b>Potato</b>	
<b>Pumpkin</b>	
<b>Rice</b>	
<b>Sesame</b>	
<b>Sorghum</b>	
<b>Soybean</b>	
<b>Spider plant</b>	
<b>Spinach</b>	
<b>Sugarcane</b>	
<b>Sweet potato</b>	
<b>Tea</b>	
<b>Teff</b>	
<b>Tomato</b>	
<b>Wheat</b>	
<b>Yam</b>	
<b>Zucchini/Courgette</b>	<b>Varieties</b>
<b>Pests/ diseases/</b>	<ul style="list-style-type: none"> <li>• <b>'Fuerte'</b>. Hybrid of Guatemalan and Mexican races with thin skinned green-pebbled fruit of very good flavour. This variety has many lines with different shapes; the pear shaped fruit is preferred in the export market. Matures 6-8 months after flowering.</li> <li>• <b>'Haas'</b>. Vigorous grower and bears medium-sized, rounded, rough-skinned, black fruits. Propagates well. Matures 8-9 months after flowering.</li> </ul>

**weeds**

**Medicinal plants**

**Fruit and vegetable processing**

**Natural pest control**

**Cultural practices**

- **'Nabal'**. Bears fruit in alternate years. Its green fruits have a good flavor. Matures 8-9 months after flowering.
- **'Puebla'**. Spreading, dark green tree bearing deep purple to maroon round fruit. This variety is normally used as a rootstock. Matures 5-7 months after blossoming.
- **Others**: 'Reed', 'Simmonds', 'Booth 7&8', 'Pinkerton', 'Bacon', 'Lula' and 'Taylor'

'Fuerte' is the main variety grown in Kenya. The variety 'Hass' is developing strongly, especially among small growers. These two varieties are grown for the export market. Other varieties ('Reed', 'Booth8', 'Puebla', 'Pinkerton', 'Simmond', etc.) are grown but not exported (Mugambi, 2002)

### **Propagation and planting**

Select healthy, egg sized seeds and plant them in boxes or seedbeds. Immediately after germination transplant the seedlings into 4 liter pots, tins or polythene bags. Water them regularly until they are pencil thick. Grafting should be carried out when the seedling reaches pencil thickness. The wedge grafting method is most successful. Grafting should be done at the point where rootstock is soft. The scion should be dormant at the time of grafting and should match the size of the stock.



**Wrap the grafting point thoroughly to exclude water from the union and prevent it from drying out.**

### **Land preparation**

**The fields should be cleaned by removing tree stumps, bushes and perennial weeds. Then the land should be mowed or cultivated.**

### **Planting out**

**Generally a spacing for pure stands of avocados of 9m x9m will be suitable. Dig holes of 60cmx60cm by 60cm deep keeping the top soil and the sub soil separate. Mix the top soil with one 20 litre bucket of well rotted manure or compost and 1-2 handfuls of Mijingu rock phosphate. Remove the plant from its pot keeping the root and soil structure intact (easiest if it has been properly wetted ahead of time) and plant out using only the topsoil mixture to fill the hole.**

**The subsoil may be used to make a basin around the tree. Water immediately after planting if it is not in the rainy season. Shade the young plants with banana leaves or similar material after planting and when they are putting up a new flush. If planted in a windy area, a windbreak will be necessary to protect the plants from leaning to one side and to help prevent leaf shedding and fruit drop and bruising.**

## Manuring

One avocado tree can yield 250-300 kg of fruit per harvest season. This causes a high demand on the soil to release nutrients. To determine the right amount of manures to apply the soil should be tested annually, otherwise the following table can be used as a guide for organic farmers for manuring individual trees:

Age of tree (years)	Nitrogen and potassium Liters animal urine mixed 1:4 with water in split applications	Mijingu rock phosphate	Additional potassium Ashes - handfuls	Manure or compost decomposed
1-3	8	500g	-	15 Kg
4-5	16	900g	-	15 Kg
6-7	30	1.4 Kg	1	30 Kg
8-9	46	1.4 Kg	2	30 Kg
10-14	60 (three 20 liter buckets/year, mixed with 12 buckets of water, divided into several applications)	2 Kg	4	30 Kg

<b>15+</b>	<b>80 (four 20 liter buckets/year mixed with 16 buckets of water, divided</b>	<b>2.5 Kg</b>	<b>8</b>	<b>30 Kg</b>
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into several applications  
Adapted from AIC advice for conventional farmers replacing conventional fertilizers with natural products to get the same amount of nutrients.

If chicken manure is available, it can be used instead of animal urine as follows, but spread on top of the soil far enough from the tree stem to avoid burn it:

<b>Age of tree (years)</b>	<b>Chicken manure Kg/tree/year</b>	<b>Additional Mijingu Rock phosphate</b>	<b>Additional potassium Ashes - handfuls</b>	<b>Compost decomposed</b>
<b>1-3</b>	<b>1.5</b>	<b>150g</b>	<b>-</b>	<b>15 Kg</b>
<b>4-5</b>	<b>3</b>	<b>300g</b>	<b>-</b>	<b>15 Kg</b>
<b>6-7</b>	<b>6</b>	<b>450g</b>	<b>1</b>	<b>30 Kg</b>
<b>8-9</b>	<b>9</b>	<b>450g</b>	<b>2</b>	<b>30 Kg</b>
<b>10-14</b>	<b>12</b>	<b>800g</b>	<b>4</b>	<b>30 Kg</b>
<b>15+</b>	<b>15</b>	<b>1 Kg</b>	<b>8</b>	<b>30 Kg</b>

**Trace elements: In spite of heavy applications of manures and compost, deficiencies may occur in avocado orchards. Usually these are seen as various degrees of discolouration. Accurate analysis can be made from plant analysis laboratories. The following list can be used as a guideline meanwhile:**

<b>Mineral</b>	<b>Symptom</b>	<b>Control</b>
<b>Zinc</b>	<b>Mottled leaves with light yellow areas between the veins and abnormal development of growing shoots</b>	<b>Apply 250 g zinc sulphate for each year of age to a maximum of 4.5 kg/tree. The application should be done in a 60 cm circle around the tree</b>
<b>Manganese</b>	<b>Progressive yellowing of the margins and interveinal parts of the leaves while the veins remain green</b>	<b>Spray the young leaves with foliar spray of manganese sulphate</b>
<b>Iron</b>	<b>Loss of green colour in leaves</b>	<b>Apply 360 g iron chelate per tree in acid soils. In normal soils 250 g of iron sulphate in 10 l of water/per tree correct iron</b>

		<b>deficiency</b>
<b>Chlorine</b>	<b>High concentration of chlorine in the soil may cause leaf burn, also damage the root system</b>	<b>Apply lime and compost to neutralize the chlorine.</b>

## **Pruning**

**Initial pruning may be done to give the tree a good shape. Otherwise pruning is limited to the removal of dead wood and parasitic plants.**

- **Remove all sucker and dead branches from main trunk branches**
- **Prune canopy to keep the tree to a height of 5-8 m and for ease of picking. The tree is very susceptible to sunburn, therefore pruning should be minimized.**
- **Root pruning of the larger tree roots by cultivating to a depth of 50 cm around the edge of the tree canopy**

**The area around the tree should be kept clean by weeding and removal of all dropped fruits.**

## **Harvesting**

**Harvesting starts at 3-4 years from planting but a good yield is obtained from the 6th year onwards. It is not easy to tell when the fruits are ready for harvesting unless they are of the varieties that change colour at maturity. Harvest a sample and keep at room temperature. If they soften within 7-10 days without shrivelling then the fruit of that age are ready for harvesting.**

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## **Information on Pests**

**Insect pests are not serious constraints to avocado production at present.**

**The most common insect pests attacking avocados are:**

**False codling moth (*Cryptophlebia leucotreta*)**

**The false codling moth is small (wingspan of 16-20 mm), dark brown to grey in colour. The moths are active at night. Female moths lay single eggs mostly on the fruit. After emerging from the egg, the young caterpillar tunnels into the fruit and the fruit sap thus liberated forms a typical white crystalline excrescence on the surface of the fruit. When moths lay eggs on young fruits the caterpillars usually die and thus large caterpillars are seldom found.**

**However, the caterpillars are able to develop if fruits are approaching maturity when infested. The young caterpillar is creamy-white with a dark brownish head. With age the body turn pinkish red. The fully-grown caterpillar is 15 to 20 mm in length. When mature the caterpillar leaves the fruit and pupates in the soil or beneath surface debris.**



**False codling moth  
Caterpillar of the false  
codling moth (*Cryptophlebia  
leucotreta*). The fully-grown  
caterpillar is 15 to 20 mm in  
length.**

© A. M. Varela, icipe

### **What to do:**

- **Proper orchard sanitation in combination with natural enemies normally keep this pest under control.**
  - **Infested fruits (both on the tree and fallen fruits) should be removed regularly (twice a week), and buried at least 50 cm deep, or dump in a drum filled with water mixed with a little used oil. The fruits should be left in the drum for one week.**
  - **This moth also attacks citrus, cotton, maize, castor, tea, guava and carambola fruits. Other host plants include wild guava plants, oak trees and wild castor . These other host plants should be included in the sanitation programme.**
  - **If possible, remove wild host plants from around the orchard.**
- 

### **Fruit flies**



**Avocados, especially thin-skinned varieties might be attacked by various species of fruit flies. Some fruit flies lay eggs under the skin of the fruit that is just beginning to ripen, but others attack young and old fruit. When the fruit reaches about the size of a golf ball a sting lesion appears as a slight puncture mark surrounded by a white exudate. As the fruit develops the lesion becomes dry and turn into distinct star-shaped crack on the skin surface.**

**What to do:**

- **Practise orchard sanitation**
- **Practise monitoring**
- **Apply baits (see more under fruit fly site)**



**Fruit fly  
Mediterranean fruit fly  
(*Ceratitits capitata*). Adult mediterranean fruit flies are 4-7 mm long, brightly coloured, usually in brown-yellow patterns. The wings are spotted or banded with yellow and brown margins.**

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Agricultural Research  
Service,  
[www.insectimages.org](http://www.insectimages.org)  
[More Information on Fruit](#)**

**flies****Scales**

**Scales are small, stationary brown greenish insects occasionally found sucking sap from avocado leaves. Soft scales such as *Coccus* spp. excrete large amount of honeydew, which lead to the development of sooty mould on leaves, branches and fruit. Honeydew attracts ants, which while feeding on the honeydew protect scales from natural enemies.**

**Armoured scales such as the coconut scale (*Aspidiotus destructor*) may encrust young twigs, leaves and fruit. They do not produce honeydew. Scales are usually not a problem in avocado orchards; however, damage can be serious on young trees and small twigs may be killed. Although the presence of scales on the skin of fruit**



**Armoured scales  
Armoured scales on  
avocado fruit. The scale  
cover of the adult female is  
oval to circular, 1.5-2.0 mm  
across, fairly flat, very thin  
and translucent**

© A. M. Varela, icipe



**Armou Armou**

**does not cause internal damage, it may lead to rejection of fruit, especially if grown for export.**

**S...**

**S...**

**What to do:**

- **Conserve natural enemies. Scales are usually kept under control by parasitic wasps, ladybird beetles and lacewings, provided no broad spectrum pesticides are used and no ants are present.**

---

**Thrips (e.g. the black tea thrips *Heliothrips haemorrhoidalis* and the red banded thrips *Selenothrips rubrocinctus*)**

**Thrips are small, slender insects (1-2 mm long) with two pairs of fringed wings. Adult thrips attacking avocado are dark brown or black, and the immature stages are yellow in colour. The red-banded thrips can be distinguished by a bright red band across the abdomen of immature**



**Red banded thrips  
Immature stage of the red  
banded thrips (*Selenothrips***

**thrips.**

**Thrips are sometimes troublesome pests in avocado. They may cause damage to the leaves and fruit. Affected parts become whitish or silvery and are usually covered by dark-coloured droppings.**

**On fruit, feeding begins near the calyx, gradually producing a scar that can cover the whole fruit. Attacked fruits develop a leathery brown skin. Feeding is most common on young fruit; economic damage generally occurs on fruit up to 2 cm in length (2-3 weeks after fruit set). Older fruit with thicker skin is less susceptible to attack.**

**What to do:**

- **Conserve natural enemies. Thrips are attacked by predatory thrips, lacewings and predatory bugs. Control measures**

***rubrocinctus*). Note a bright red band across the abdomen of immature thrips. Real size: about 1mm long.**

© A. M. Varela

**[More Information on Thrips](#)**

**are rarely needed.**

**Bugs (Coconut bugs, *Helopeltis* bugs, stink bugs)**

**Adult coconut bugs (*Pseudotheraptus wayi*) are brown in colour and 10 to 15 mm long. Nymphs are red brown to green brown in colour and have long antenna. The adults and nymphs of the coconut bug feed on young and mature avocado fruit. Bug feeding causes necrotic bruise-like depressions. A hard lump develops, which can be easily removed when the fruit is peeled.**

***Helopeltis* bugs also known as tea mosquito or mired bug are slender, delicate bugs, about 7- 10 mm long and have long legs and antenna. The females are red and the males brown to yellowish red. The bugs prefer to feed on young**



**Coconut bug  
Adult coconut bug  
(*Pseudotheraptus wayi*. Real  
size 10 to 15 mm long.**

© A.M.Varela, icipe



**Coconut Helopeltis Brown  
bu... stin...**

**plant tissue piercing the shoots, stems, leaves peduncles, petioles and fruits; their feeding cause brown necrotic patches. Attacked leaves present angular lesion, which often drop out leaving holes as it attacked by biting insects. Feeding on young shoots causes dieback of the shoots. Feeding on fruits cause first a dark water-soaked mark around the feeding puncture, turning into a lesion with a light brown center and black edge. The fruit may exude sap that forms a whitish deposit as it dries.**

**Stink bugs are shield-shaped bugs variable in size (6 to 15 mm long) and colour (green to brown or reddish brown). They emit a characteristic unpleasant odour when disturbed. They usually feed on the developing fruit; the feeding punctures cause local necrosis resulting in fruit spotting, and deformation.**

## What to do:

- **Conserve natural enemies. Weaver ants in particular, are efficient predators of bugs in the coastal areas of East Africa.**

---

### Spider mites (*Oligonychus* spp.)

**Attack by spider mites (*Oligonychus* spp.) produce circular necrotic spots covered by dense webbing. As mite populations increase feeding causes leaf drop. These mites are more damaging to 'Haas' variety; 'Fuerte' variety is less affected.**

**Feeding by broad mites (*Polyphagotarsonemus latus*) causes leaf distortion. These tiny mites (0.1-0.2 mm long) cannot be seen with the naked eye, and are even difficult to detect with a hand lens. An attack by the broad mites can be detected by the symptoms of damage. Their feeding produces discoloration,**



**Spider mites  
Two-spotted spider mite (*Tetranychus urticae*) (related species). The adult female is 0.6 mm long. The male is smaller.**

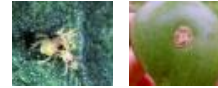
**© Image supplied by  
Warwick HRI, University of**

## necrosis and deformation of tissues.

### What to do:

- **Conserve natural enemies. Mites are attacked by a range of natural enemies which can keep the pest under control provided that the natural enemies are not killed by application of pesticides.**
- **Wash the leaves with water using high-pressure hoses. This helps to reduce mite populations.**
- **Irrigate and fertilise adequately heavily infested trees to maintain the flush of new growth that occurs after leaf shed due to mite attack. However, care should be taken not to overfertilise trees to avoid promoting mite populations.**

## Warwick



Spider mit... Broad mite

More Information on Spider mites

---

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**Information on Diseases**



## Scab (*Sphaceloma perseae*)

The fungus readily infects young, succulent tissues of leaves, twigs and fruits. Lesions appear as small dark spots, slightly raised, oval to elongated. These spots join up, giving a corky appearance to the surface of the fruits, impairing the appearance but not the internal quality of the fruit. Fruits are only susceptible when young until about half size development. The fungus requires moist conditions for sporulation and infection.



Scab  
Scab (*Sphaceloma perseae*)  
on avocado fruit

© A.A. Seif, icipe

### What to do:

- Remove dead branches and twigs since they harbour the fungus.
- Remove fallen rotten fruits from the field.
- Apply copper-based fungicides pre-flowering, at fruit formation, and after

## harvest.

---

### **Avocado root rot (*Phytophthora cinnamomi*)**

**This disease can attack trees of any size and age. Leaves of infected trees are small, usually pale or yellow green, are often wilted and fall prematurely giving the tree sparse appearance. In advanced stages of the disease, branches die-back and fruit remains small and crop yield drastically reduced. Feeder roots get blackened, decayed and died. Infected trees die prematurely. The disease is prone in areas subject to flooding and in poorly drained soils. The fungus can be spread or introduced to new areas by use of infected seeds, infested soil, irrigation water containing spores of the fungus and infected seedlings. The host range of the fungus includes Acacia, Camellia, Casuarina, Cypress, Eucalyptus and Grevillea.**

#### **What to do:**

- **Use diseased-free seed.**
- **Treat seed for planting in a hot-water bath at 48 to 50C for 20 minutes. After the hot-water treatment, rinse the seed immediately with clean, cold running water and spread out to dry thoroughly on**

**a clean surface not in contact with the soil.**

- **Use clean nursery soil for container-grown plants. The soil should be well drained and carefully irrigated to prevent excessive moisture. Use tolerant/resistant rootstocks (e.g. Duke No. 6 and 7; G 6).**
  - **Remove diseased trees from the field.**
  - **Avoid movement of soil or water from diseased to noninfested areas.**
  - **Use cultivation equipment first in healthy portion of the orchard before use in diseased areas. Washed and dry cultivation equipment after use in diseased areas.**
- 

### ***Anthracnose (Colletotrichum gloeosporioides)***

**This fungal disease is primarily a post-harvest problem when fruit is at maturity stage. Infection takes place when fruit is still very young and the fungus stays dormant till the fruit ripens. The disease appears as depressed spots on the fruit and the spots are manifested as a rot,**



**Anthracnose  
Anthracnose (*Colletotrichum gloeosporioides*) on avocado**

**which can penetrate deep into the flesh. In fruit. wet weather, the spots may be covered with mass of slimy, salmony pink fungal spore mass. The disease may develop very rapidly in storage if conditions in storage are humid and warm.**

© A. A. Seif, icipe  
**More Information on Anthracnose**

**The anthracnose fungus lives saprophytically on twigs, rotten fallen fruits and dead or dying infected leaves. The fungus is spread by water splash.**

**What to do:**

- **Remove dead branches and twigs since they harbour the fungus.**
- **Remove fallen rotten fruits from the field.**
- **Apply copper-based fungicides pre-flowering, at fruit formation, and after harvest.**

## **Cercospora fruit spot (*Pseudocercospora purpurea*)**

**The disease is primarily a problem to quality of fruits. The severity of infection varies from season to season and can cause losses of up to 60%. The lesions appear as small light-yellow spots on fruits and leaves. They later become reddish brown and eventually become hard and crack. Mature fruits are resistant. The disease development is favoured by humid conditions and high temperatures. The fungus is essentially spread by water splash and its spores are also wind-borne.**



**Cercospora fruit spot  
Avocado fruit showing a  
lesion caused by  
Cercospora  
(*Pseudocercospora  
purpurea*).**

© A. A. Seif, icipe

### **What to do:**

- **Remove dead branches and twigs since they harbour the fungus.**
- **Remove fallen rotten fruits from the field.**
- **Apply copper-based fungicides pre-**

**flowering, at fruit formation, and after harvest.**

---

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**Fresh Quality Specifications for the market in Kenya**

**The following specifications constitute raw material purchasing requirements.**

<b>PRODUCE:</b>	<b>AVOCADO</b>
<b>IMAGE:</b>	
<b>AVOCADO, Kenya</b>	
<b>GENERAL APPEARANCE CRITERIA</b>	
<b>INTERNAL COLOUR</b>	Creamy pale yellow flesh grading to bright green at skin;
<b>EXTERNAL VISUAL APPEARANCE</b>	Glossy skin with slightly bumpy texture; stem buttons attached.
<b>INTERNAL SENSORY</b>	With firm flesh slightly softening at stem end; medium thin skin which peels easily; no 'off' odours.
<b>SHAPE</b>	Typical pear shape to round shape
<b>SIZE</b>	With no defined size range but per requirements
<b>MATHURITY</b>	With firm flesh slight pressure at stem end.
<b>INSECTS &amp; PHYSICAL DAMAGE</b>	With no evidence of live insects. With no hard lumps in flesh (due to) (fruit) (from) (potting) (egg) (damage). With no hard lumps or scars (that) (burst) (the) (skin). With no damaged or torn button holes. With no skin scarring due to insect chewing. With no soft, deep-seated bruising (distinct from allowable) (no) (to) (be) (considered) (damaged).

AVOCADO, Kenya

### GENERAL APPEARANCE CRITERIA

**INTERNAL COLOUR**

Creamy pale yellow flesh grading to bright green at skin;

**EXTERNAL VISUAL APPEARANCE**

Glossy skin with slightly bumpy texture; stem buttons attached.

**INTERNAL SENSORY**

With firm flesh slightly softening at stem end; medium thin skin which peels easily; no 'off' odours.

**SHAPE**

Typical pear shape to round shape

**SIZE**

With no defined size range but per requirements

**MATHURITY**

With firm flesh slight pressure at stem end.

**INSECTS & PHYSICAL DAMAGE**

With no evidence of live insects. With no hard lumps in flesh (due to) (fruit) (from) (potting) (egg) (damage). With no hard lumps or scars (that) (burst) (the) (skin). With no damaged or torn button holes. With no skin scarring due to insect chewing. With no soft, deep-seated bruising (distinct from allowable) (no) (to) (be) (considered) (damaged).

Published by

- Griesbach, J. (2005) Avocado Growing in Kenya. World Agroforestry

Centre, Nairobi, Kenya. ISBN: 92 9059 173 0.

[www.worldagroforestrycentre.org](http://www.worldagroforestrycentre.org)

- Griesbach, J. (1992). A Guide to Propagation and Cultivation of Fruit Trees in Kenya. Schriftenreihe No. 230, Eschborn / Germany: GTZ.

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Information Source Links

- CAB International (2005) Crop Protection Compendium, 2005 edition.

Wallingford, UK [www.cabi.org](http://www.cabi.org)

- De Villiers, E. A. (1990) Avocado Pest in South Africa. In Framing in South Africa. Avocado Institute for Tropical and Subtropical Crops.

**ISBN: 3-88085-482-3**

- **HCDA. (1996). Avocados. Export Crop Bulletin: No 2 June 1996.**
- **ICIPE (2006). A Field Guide to the Management of Economically Important Tephritid Fruit Flies in Africa. The International Centre of Insect Physiology and Ecology. ISBN: 92-9064-179-7.**
- **KENYAWEB HORTICULTURE. Fruits- Avocado.**
- **Mugambi, D.M. ( 2001). Market Status of Avocado and Associated Products in Kenya. RELMA Working Paper No. 12. RELMA, Nairobi, Kenya.**
- **Muigai, J.K. and Mwaura, F.M. (2005). Preparation and Use of Avocado Oil and Its Products. Chapter 16 in Organic Resource Management in Kenya Perspectives and Guidelines. 2005. Forum for Organic Resource Management and Agricultural Technologies (FORMAT).**
- **National Horticultural Research Station, Thika (1984). Horticultural Crops Protection Handbook. Ministry of Agriculture & Livestock Development, Kenya.**
- **PIP Technical Itinerary Avocado. Pesticides Initiative Programme (PIP) with collaboration of NRI. [www.coleacp.org/pip](http://www.coleacp.org/pip)**
- **Protrade. Avocados. Export Manual Tropical Fruits and Vegetables.**
- **Tree Crop Propagation and Management (2000). A farmer Trainer Training Manual. Integration of Tree Crops into Farming Systems Project- GTZ, Ministry of Agriculture and Rural Development) MoARD.**





**Cassava**

**Citrus**

**plants**

**Cocoa**

**Coconut**

**Coffee**

**Cotton**

**Cowpea**

**Cucumber**

**Eggplant**

**Green gram**

**Groundnut**

**Maize**

**Mango**

**Millet**

**Okra**

**Onion**

**Papaya**

**Passion fruit**

**Peas**

**Peppers**



© Simone Hunziker

**Anthracnose (*Colletotrichum coccodes*)  
on tomato**

**Pigeon pea**

**Pineapple**

**Potato**

**Pumpkin**

**Rice**

**Sesame**

**Sorghum**

**Soybean**

**Spider plant**

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**Sugarcane**

**Sweet**

**potato**

**Tea**

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**Tomato**

**Wheat**

**Yam**

**Zucchini/Courgette**

**Pests/**

**diseases/**



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Series, [www.insectimages.org](http://www.insectimages.org)  
([www.ecoport.org](http://www.ecoport.org))

**Spider mites on tomato. Note  
the mites and their webbing  
visible between the leaves.**

**weeds**

**Medicinal  
plants**

**Fruit and  
vegetable  
processing**

**Natural pest  
control**

**Cultural  
practices**



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Extension Slide Series, Bugwood.org**

**Bacterial spot (*Xanthomonas  
vesicatoria*) on tomato fruit:  
Typical sunken, black spots on  
the fruit and malformation due  
to the bacterial infection.**



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Wageningen, NL, [www.insectimages.org](http://www.insectimages.org)  
(Courtesy of EcoPort, [www.ecoport.org](http://www.ecoport.org))

Damage of Bacterial spot  
(*Xanthomonas campestris* pv.  
*vesicatoria*) on tomato leaf.



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[www.insectimages.org](http://www.insectimages.org)

**Bacterial speck (*Pseudomonas syringae* pv. *tomato*) of tomato seedlings. Note the necrotic lesions and the widespread chlorosis.**



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**Tomato spotted wilt tospovirus:  
mottle in tomato fruit.**



© Mike Pearson (Courtesy of EcoPort,  
[www.ecoport.org](http://www.ecoport.org))

**Damage on tomato fruit and  
leaves caused by the Tomato  
russet mite, *Aculops lycopersici***





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[www.ecoport.org](http://www.ecoport.org))

**Damage of bacterial wilt on tomato.**



© David B. Langston, University of Georgia, Bugwood.org

**Blossom-end rot on tomato.  
Blackened or rotten appearance  
on the blossom end of the fruit  
caused by calcium deficiency**



**and affects all fruiting vegetables. Secondary fungal infections may occur on the affected areas.**

**© David B. Langston, University of Georgia, Bugwood.org**

**Powdery mildew on tomato**



© A. A. Seif, icipe

**Tomato mosaic virus**



© A.A. Seif, icipe

**Early blight symptoms on  
tomato fruit**



© A.A. Seif, icipe

**'Birds eye' symptoms on tomato  
caused by bacterial canker**



© A.A. Seif, icipe

**Mites on tomato leaf.**



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- Eggplant**

**Images**



**Cassava**

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**Cassava roots**

**Green gram**

**Groundnut**

**Maize**

**Mango**

**Millet**

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**Passion fruit**

**Peas**

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**Pineapple**

**Potato**

**Pumpkin**

**Rice**

**Sesame**

**Sorghum**

**Soybean**

**Spider plant**

**Spinach**



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**Cassava (*Manihot esculenta*)**

**Sugarcane**

**Sweet  
potato**

**Tea**

**Teff**

**Tomato**

**Wheat**

**Yam**

**Zucchini/Courgette**



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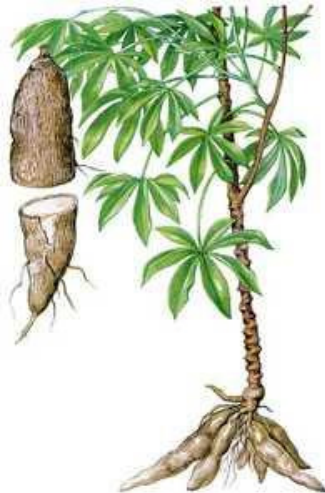
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**Cultural  
practices**



**Cassava (*Manihot esculenta*)**

© Purdue University,  
USA



**Cassava brown leaf spot**

© A.A.Seif, icipe

**Cassava bacterial blight**  
(*Xanthomonas campestris* pv.  
*manihotis*). Angular leaf spots,  
sometimes with yellow haloes,  
rapidly expanding, leading to  
necrosis and leaf fall.



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**Variegated grasshopper**  
**(*Zonocerus variegatus*)**



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**Stripped mealybug (*Ferrisia virgata*)**



error

© A. M. Varela, icipe

Parasitic wasp of mealybugs



© A.M. Varela, icipe

**Scale insect. This is not the cassava scale, but an armored scale (related species)**





© USDA ARS, Bugwood.org

**Cassava brown streak virus  
disease**



Eggs and larva of the cassava green mite (*Mononychellus tanajoa*), real size 0.2 mm.

© F. Haas, icipe

Female of the cassava green mite (*Mononychellus tanajoa*),



**real size 0.8 mm.**

© F. Haas, icipe

**Male of the cassava green mite.  
(*Mononychellus tanajoa*), real  
size 0.8 mm.**



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**Okra (*Abelmoschus esculentus*) with flower**

© CTC/Zeneca/CAB  
International, 2005. Crop  
Protection Compendium,  
2005 Edition. Wallingford,  
UK

**Cotton aphids on okra flower**

- Eggplant**
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- Sesame**
- Sorghum**
- Soybean**
- Spider plant**



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**Parasitised aphids (mummies)  
and aphids killed by fungus**

**Spinach**  
**Sugarcane**  
**Sweet potato**  
**Tea**  
**Teff**  
**Tomato**  
**Wheat**  
**Yam**  
**Zucchini/Courgette**



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**Damage on Okra due to feeding by  
aphids**

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## Cultural practices



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**Spiny bollworm moths on okra**





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**Thrips on okra flower**



© A.M. Varela, icipe

**Okra roots damaged by root-knot nematodes. Note galls or root-knots (left) and healthy roots (right)**



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**Bacterial blight on young okra pod**

© A.A. Seif & A.M. Varela, icipe

**Bacterial blight blackening of**



**veins**

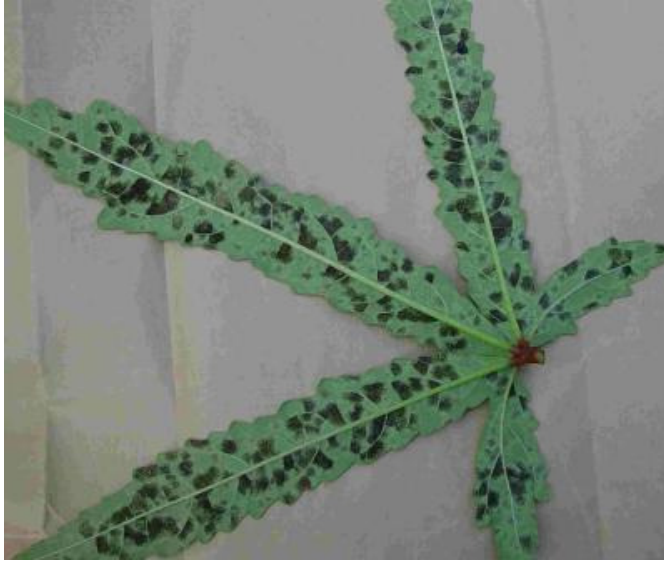
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**Black mould leaf spots on the top side of an okra leaf**



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**Black mould on lower surface of  
okra leaf**



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**Flea beetle feeding on young okra pod**



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**Okra seedling damaged by cutworm caterpillar (right). Note healthy seedling on the left. Close-up of cutworm (inset)**



© A.M. Varela, icipe

**Okra seedlings affected by  
damping-off**





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**Wilting of okra plant due to fusarium wilt**



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**Young caterpillar of African bollworm feeding on okra leaf and a moth (inset).**



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**Young grasshopper feeding on okra leaf**



© A.M. Varela, icipe

**Young okra pods damaged by caterpillar of the spiny bollworm**



© A.M. Varela, icipe

**Caterpillar of a spiny bollworm on okra. Note damage on seeds.**



© A. M. Varela, icipe

**Caterpillar of the leafroller (*Haritalodes derogata*) on okra leaf.**



© A. M. Varela, icipe.

**Nymphs (two to the left) and  
adult cotton stainer on okra.**



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**Brown stink bug (*Halydicoris* sp.) on okra.**





© A. M. Varella, icipe.

**Cotton seed bugs on okra**



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**Powdery mildew on upper surface of an okra leaf.**



© A. M. Varela, icipe

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*Solanum melongena*

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**Eggplant flower**

**Eggplant**

**Green gram**

**Groundnut**

**Maize**

**Mango**

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**Papaya**

**Passion fruit**

**Peas**

**Peppers**

**Pigeon pea**

**Pineapple**

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**Rice**

**Sesame**

**Sorghum**

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**Spider plant**



© Pembroke perennials

**Eggplant**

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**Close-up of an adult of the  
eggplant lace bug. Real size: 3  
mm in length.**

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## Cultural practices



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Thrips damage on eggplant



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**Epilachna beetles larvae and pupae on eggplant. Larvae are about 6 mm long.**





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Bugwood.org

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**Cabbage (*Brassica oleracea* var. *capitata*)**

© www.ecoport.org / B.French

**Kale (*Brassica oleracea* var. *acephala*)**

**Eggplant**  
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**Groundnut**  
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**Rice**  
**Sesame**  
**Sorghum**  
**Soybean**  
**Spider plant**



© <http://botit.botany.wisc.edu>

**Cauliflower (*Brassica oleracea*  
*var. botrytis*)**

**Spinach**

**Sugarcane**

**Sweet  
potato**

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**Kale**

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## Cultural practices



© Monique Hunziker, BioVision

**Cabbage black spot - Cabbage leaf with early stage of alternaria black spot (*Alternaria brassicae*)**



© David C. Novell, Courtesy of EcoPort ([www.ecoport.org](http://www.ecoport.org))

**Cabbage black spot - The spots darken with age, and the centers may become thin and papery or drop out, to produce a shot-hole effect.**



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([www.ecoport.org](http://www.ecoport.org))

**Cabbage webworm caterpillar  
(*Hellula undalis*) and damage on  
a kale leaf.**



© A. M. Varela, icipe

**Caterpillar of the cabbage webworm (*Hellula undalis*) feeding in the stem of a kale plant.**





© A. M. Varela

**Cabbage webworm (*Hellula undalis*) feeding on a cabbage head**



© A. M. Varela, icipe

**Moth of the cabbage webworm  
(*Hellula undalis*)**



© A. M. Varela, icipe

**Full grown larva of cabbage looper  
(*Trichoplusia ni*)**



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from the Crop Protection  
Compendium, 2005 Edition.  
CAB International,  
Wallingford.**

**Caterpillar of the cabbage  
looper**



© A. M. Varela, icipe

**Damage caused by cabbage  
looper on kales**



© A. M. Varela

**Cabbage looper**



© A. M. Varela

**Diamondback moth caterpillars  
feeding on kales**



© A. M. Varela, icipe

**Cabbage damaged by  
diamondback moth**





© A. M. Varela, icipe



**Damage caused by the bagrada bug on cabbage**

© B. Loehr, icipe

**Colony of the cabbage aphid  
(*Brevicoryne brassicae*) on  
kales.**



© A. M. Varela, icipe

**Damage by cabbage aphids on kale.**



© A. M. Varela, icipe

**Damage caused by the cabbage  
aphid on cabbage**



© A. M. Varela, icipe

**The false cabbage aphid  
(*Lipaphis erysimi*) on a kale leaf.**



© A. M. Varela, icipe

**The green peach aphid (*Myzus persicae*) on kales**



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**Cutworm (*Agrotis* sp.)**



**Mines cause by maggots, and a pupa of leafminer flies**

**© A. M. Varela, icipe**

**Sawfly**





© A. M. Varela, icipe

**Sawfly larva and damage on  
raddish**



© A. M. Varela, icipe

**Thrips damage on lower surface of cabbage leaf. Note rough brown patches and small dark spots (*thrips faeces*)**



© A. M. Varela, icipe

**Thrips damage on upper surface of cabbage leaf**



© A. M. Varela, icipe

**The Western flower thrips  
(*Frankliniella occidentalis*).  
Close-up, very much enlarged.  
Real size (0.9 to 1.1 mm)**



© M. Billah, icipe

**Caterpillars of the cabbage  
moth (*Crocidolomia binotalis*)  
feeding on cabbage**



© A. M. Varela, icipe

**Damage caused by caterpillars  
of the cabbage moth  
(*Crocidolomia binotalis*)**



© A. M. Varela, icipe

**The cabbage moth**  
**(*Crocidolomia binotalis*)**



© A. M. Varela, icipe



Heavy attack of the cabbage whitefly (*Aleyrodes proletella*) on kales.

© A. M. Varela, icipe





**Adults and eggs of the cabbage whitefly (*Aleyrodes proletella*).**

© A. M. Varela, icipe

**Adults and immature stages of the cabbage whitefly (*Aleyrodes proletella*).**



© A. M. Varela, icipe

**Bacterial black rot on kales**



© A. M. Varela, icipe



© A. M. Varela, icipe

**Bacterial black rot on kales**

**Bacterial black rot on cabbage**



© A.A. Seif, *icipe*

**Bacterial black rot. Note blackening of water-conducting tissues of the stem**



© A. M. Varela, icipe

**Bacterial soft rot. Note slimy rot (whitish) of the centre of the cabbage head**



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**Black rot on cabbage. Note blackening of veins.**



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**Club-root. Note warty growth in the root system**



© A. A. Seif, icipe

## Cauliflower mosaic virus





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**Rhizoctonia disease: wirestem of seedlings. Diseased plant (right), healthy plant (left)**



© A. A. Seif

**White rust on kales. Note  
pustules on the lower side of  
the leaf**



© A. M. Varela

**Downy mildew on cabbage.  
Symptoms of the lower leaf  
surface**



© A. A. Seif

**Powdery mildew on a cabbage plant**



© A. M. Varela, icipe

**Ring spots on cabbage**



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**Cottony rot (*Sclerotinia sclerotiorum*) on a kale plant**

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**Black leg (*Leptosphaeria maculans*)**

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**Flowers and leaves of common  
bean**

**© Arnaldo Mondadori Editore SpA.  
Courtesy of Ecoport ([www.ecoport.org](http://www.ecoport.org))**

**Common bean (*Phaseolus vulgaris*)**



**Green gram**

**Groundnut**

**Maize**

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**Papaya**

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**Pineapple**

**Potato**

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**Rice**

**Sesame**

**Sorghum**

**Soybean**

**Spider plant**

**Spinach**



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Verlag 1977; Wolf-  
Garten

**Beans (*Phaseolus*) sp. - colour illustration**

**Sugarcane**

**Sweet  
potato**

**Tea**

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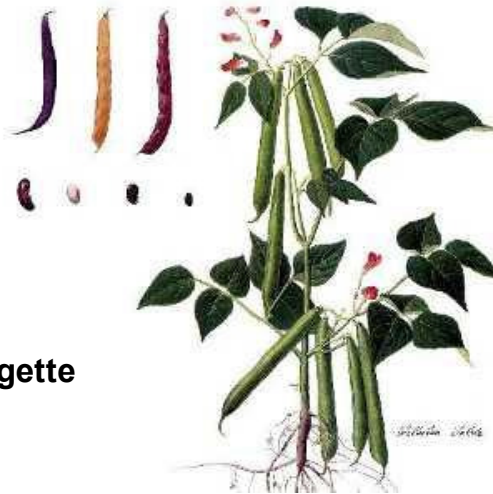
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International, 2005. Crop  
Protection Compendium, 2005  
Edition. Wallingford, UK

**Anthracnose on bean pods**



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**Anthracnose on beans**



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**Anthrachnose on young French bean  
plant**



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**Common blight on beans**



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**Mexican bean weevil - the Mexican  
bean weevil is about 2-3cm long.**



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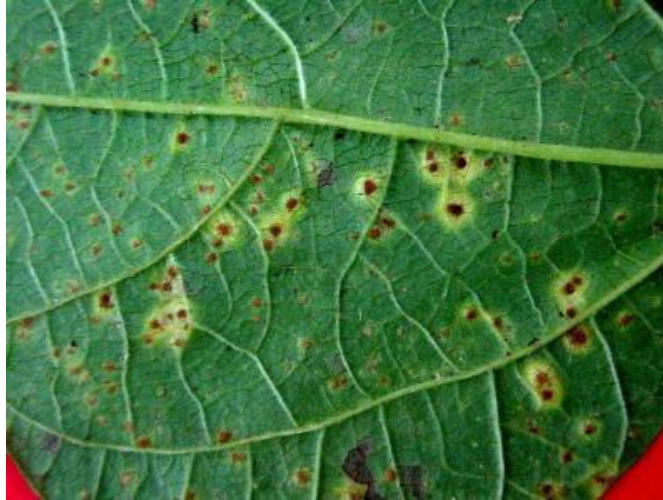
**Spiny brown bugs measure  
about 1cm in length.**



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**Rust on lower leaf surface of French beans. Symptoms are similar on green grams.**





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**Bean rust on upper leaf surface**



© A.A.Seif, icipe

**Fusarium wilt on French beans**



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**Stripped bean weevil on beans**



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**Foliage beetles damage on  
French beans**



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**African bollworm on french beans - Fully grown caterpillars are 3-4cm long.**



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**African bollworm feeding on  
flower of French beans - African  
bollworm caterpillars are 3-4 cm  
long**



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**Bean fly on French beans**



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**Bean seed fly damage on French beans**





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## Bacterial blight on beans



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**Angular leafspots on beans**



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**Angular leafspots on French  
bean pods.**



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**Fusarium root rot on beans**

© A.M. Varela, icipe



**Halo blight on beans**

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**Leafhopper - Adults are 2-2.5mm long.**



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**Root-knot nematode damage on beans**



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## Common mosaic virus on beans



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**Bean fly maggot in a French bean stem.**





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**Bean fly pupa in a French bean stem.**



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icipe



Damage to French bean plants  
by larvae of the stripped bean  
weevil. Note larva inside stem.  
Inset- close-up of larva.

© A. M. Varela



**French bean plants damaged by larvae of the stripped bean weevil.**

**© A. M. Varela**

**French bean pods heavily attacked by black bean aphids.**



© A. M. Varela.

**Heavy attack of black aphids on a French bean plant.**



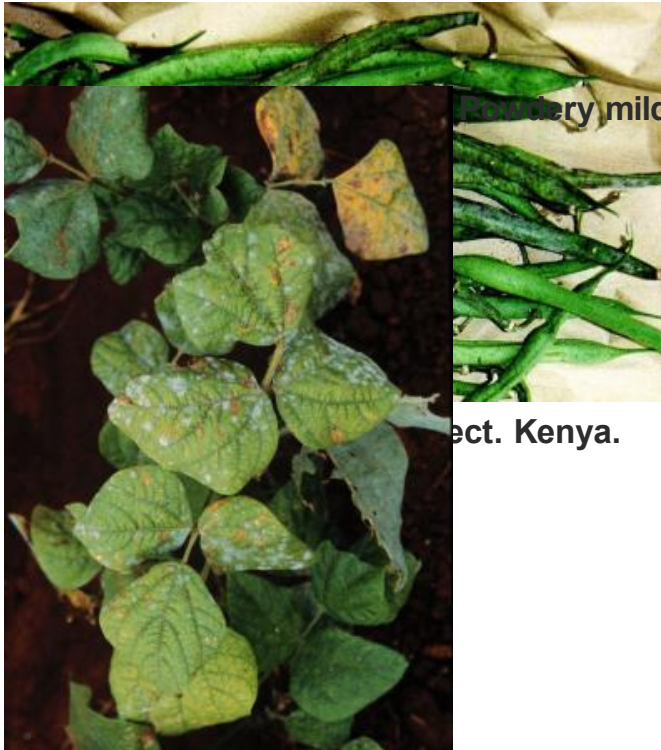
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**Whiteflies on French beans.**



© B. Loehr

**French bean pods with powdery mildew.**



**Powdery mildew on French beans.**

**ect. Kenya.**

**© GTZ- IPM Horticulture  
Project. Kenya.**

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Bell pepper (*Capsicum annuum*)

© Bodie Pennisi, University of Georgia,



**Coconut**

**Coffee**

**Cotton**

**Cowpea**

**Cucumber**

**Eggplant**

**Green gram**

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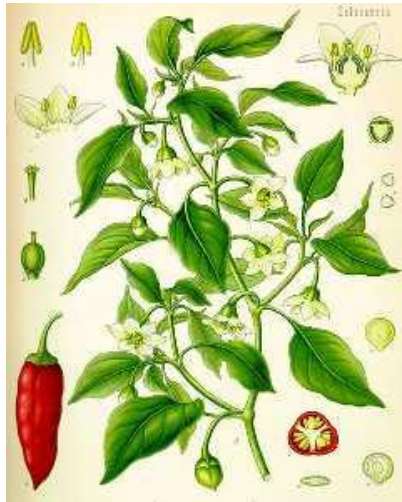


**Chili fruit**

© A.M. Varela, icipe

**Drawing of bell pepper (*Capsicum annuum*)**

**Rice**  
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**Soybean**  
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**Zucchini/Courgette**



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**Bacterial spot of pepper**  
**(*Xanthomonas vesicatoria*)**

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Israel, [www.insectimages.org](http://www.insectimages.org) (Courtesy of  
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**Antracnose (*Colletotrichum capsici*) on sweet  
pepper (*Capsicum annuum*)**



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**Blossom end rot on chillies**



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Seif, icipe

**Bacterial wilt on chillies**



© A.M. Varela, icipe

**Bacterial wilt on chillies**



© A.M. Varela, icipe

## Bacterial wilt on chillies



© A.M. Varela, icipe

## Bacterial wilt on chillies





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**Fusarium wilt on chillies**

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**Chilli field infected with *Fusarium* wilt. Note gaps due to death of plants.**

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**Root infected with fusarium wilt. Note brown discolouration of vascular tissues.**



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icipe

**Damping-off disease in chilli  
field**



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**Damping-off disease in chilli nursery**

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**Initial symptoms of powdery mildew on a chilli leaf.**

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**Powdery mildew on leaves and fruit of chilli. Note fungal growth on pod.**



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**Tomato spotted wilt virus on  
chilli**



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**Whiteflies on chilli leaf**



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icipe

**Fruit fly (*Daccus bivittatus*) on a chilli pod.**





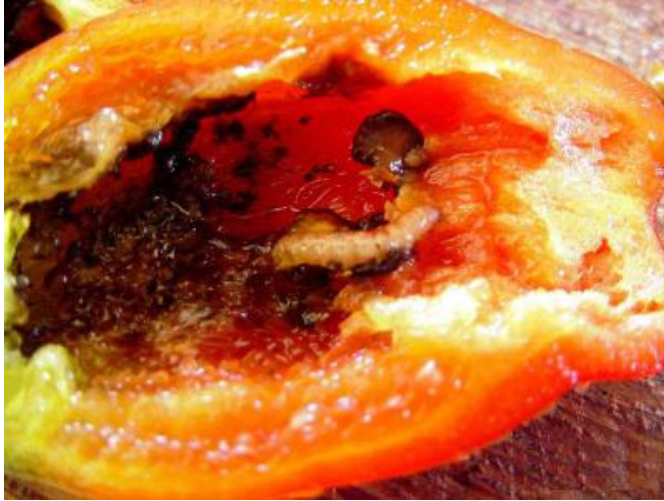
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**Thrips damage on a chilli pod.**



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**Caterpillar damage in chilli fruit**



© A.M. Varela, icipe



**Caterpillar damage on chilli fruit**

© A.M. Varela, icipe



**Broad mite damage on chillies**

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**Broad mite damage on chilli fruit**



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**Chilli plant affected by a virus disease**



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**Cowpeas with green leaves and dry seed pods harvested simultaneously for green leaves and seed pods.**

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**Cucumber**  
**Eggplant**  
**Green gram**  
**Groundnut**  
**Maize**  
**Mango**  
**Millet**  
**Okra**  
**Onion**  
**Papaya**  
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**Peppers**  
**Pigeon pea**  
**Pineapple**  
**Potato**  
**Pumpkin**  
**Rice**  
**Sesame**  
**Sorghum**  
**Soybean**



**Cowpeas ready for threshing.**

© A. Bruntse (Courtesy of Meru Herb Farmers)

**Cowpeas, healthy crop. Multiple disease resistant variety, Nigeria.**



**Spider plant**

**Spinach**

**Sugarcane**

**Sweet**

**potato**

**Tea**

**Teff**

**Tomato**

**Wheat**

**Yam**



**Zucchini/Courgette Williams/CAB International**

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**Cowpea (*Vigna unguiculata*) - Flower,  
pods and leaves.**

## **Cultural practices**



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**Cowpea being grown as a cover crop in a conservation agricultural project in Swaziland. This vigorous biomass production is ideal for this farming method forming mulch to improve soil fertility and restrict weed growth.**

17/10/2011

<b>[www.infonet-biovision.org](http://www.infonet-biovision.org) 201003...



© Roger P. Ellis, Courtesy of Ecoport  
([www.ecoport.org](http://www.ecoport.org))

**Aphids on cowpea**



© A.M. Varela, icipe

**Bean flies on cowpea**



© A.M. Varela, icipe

**Cowpea aphids tended by ants**



© A.M. Varela, icipe

**Legume pod borer (*Maruca  
vitrata*)**



© Ooi P. Courtesy of EcoPort,  
[www.ecoport.org](http://www.ecoport.org)

**Cowpea seed weevil on cowpea**



© Peter Credland, Reproduced from CABI  
2006

**Cowpea mosaic virus**





© Thorben Lundsgaard, KVL, Denmark

**Rust on cowpea (*Uromyces vignae*)**



© Jackson G. (Courtesy of EcoPort, [www.ecoport.org](http://www.ecoport.org))

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vegetables

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**Images**



**Groundnut**

© French B., [www.ecoport.org](http://www.ecoport.org)

**Groundnut plant with flowers**

**Green gram**

**Groundnut**

**Maize**

**Mango**

**Millet**

**Okra**

**Onion**

**Papaya**

**Passion fruit**

**Peas**

**Peppers**

**Pigeon pea**

**Pineapple**

**Potato**

**Pumpkin**

**Rice**

**Sesame**

**Sorghum**

**Soybean**

**Spider plant**

**Spinach**



©

**Groundnut -(*Arachis hypogaea*) - colour illustration**

**Sugarcane**

**Sweet  
potato**

**Tea**

**Teff**

**Tomato**

**Wheat**

**Yam**

**Zucchini/Courgette**

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**Medicinal  
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**Fruit and  
vegetable  
processing**

**Natural pest  
control**

**Cultural  
practices**



© Koehler's Medicinal-  
Plants 1887

**Groundnut plant**



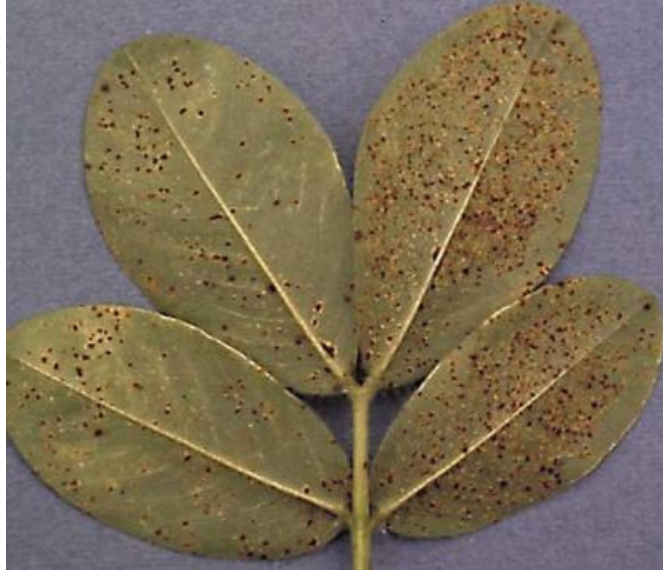
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**Early leaf spot (*Mycosphaerella arachidis*)**



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[www.ecoport.org](http://www.ecoport.org))

**Rust (*Puccinia arachidis*)**



© Gerlach W. (Courtesy of EcoPort,  
[www.ecoport.org](http://www.ecoport.org))

*Corticium rolfsii*





© Gerlach W. (Courtesy of EcoPort, [www.ecoport.org](http://www.ecoport.org))

**Thrips damage on groundnut**



© Steve L. Brown, University of Georgia,  
Bugwood.org

**Two-spotted spider mites  
(*Tetranychus urticae*) on  
groundnut. Females are about  
0.6mm long, males are smaller.**



© Richard Sprenkel, University of Florida,  
Bugwood.org

**Rust (*Puccinia arachidis*)**



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[www.ecoport.org](http://www.ecoport.org)

**Aspergillus crown rot**  
(*Aspergillus niger*)



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[www.ecoport.org](http://www.ecoport.org)

**Groundnut blight (*Sclerotium rolfsii*)**



© Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org

**Caterpillar of the groundnut leafminer (*Proaerema modicella*)**



© E. Neering. Reproduced from the Crop Protection Compendium, 2006 Edition. © CAB International, Wallingford, UK, 2006

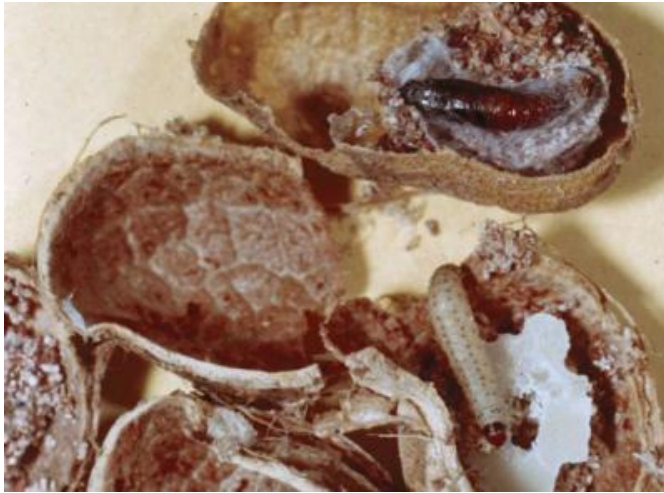
**Groundnut rosette disease.  
Symptoms in a field-infected  
groundnut plant in Malawi.**



© Scottish Crop Research Institute.  
Reproduced from the Crop Protection  
Compendium, 2006 Edition. © CAB  
International, Wallingford, UK, 2006

**Dried currant moth (*Cadra  
cautella*) - The larvae range  
from 1.5 mm to 1.5 cm (15 mm)  
in length and are light brown in  
colour with dark brown spots on  
the skin (cuticle).**





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**Chafer grub**



© A. M. Varela.

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- Cocoa
- Coconut
- Coffee



Green gram seeds

© Pankaj Oudhia (Courtesy of EcoPort, [www.ecoport.org](http://www.ecoport.org))

**Bacterial blight on beans. Symptoms are similar on green grams.**

- Cotton
- Cowpea
- Cucumber
- Eggplant
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- Groundnut
- Maize
- Mango
- Millet
- Okra
- Onion
- Papaya
- Passion fruit



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**Varieties of maize**

- African**
- Nightshade**
- Amaranth**
- Avocados**
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- Cabbage/Kale,**
- Brassicas**
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- Coffee**
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- Cowpea**
- Cucumber**
- Eggplant**
- Green gram**



© Keith Weller, USDA

*Zea mays* - color illustration

**Groundnut**

**Maize**

**Mango**

**Millet**

**Okra**

**Onion**

**Papaya**

**Passion fruit**

**Peas**

**Peppers**

**Pigeon pea**

**Pineapple**

**Potato**

**Pumpkin**

**Rice**

**Sesame**

**Sorghum**

**Soybean**

**Spider plant**

**Spinach**

**Sugarcane**



© PROSEA Foundation/CAB International, 2005. Crop Protection Compendium, 2005 edition. Wallingford, UK

**Example of production and plant nutrient content of animal**

Sweet  
potato

Tea

Teff

Tomato

Wheat

Yam

Zucchini/Courgette

Pests/  
diseases/  
weeds

Medicinal  
plants

Fruit and  
vegetable  
processing

Natural pest  
control

Cultural  
practices

Type of animal	production	%dry matter	Content of Nitrogen kg	Phosphorous kg	Potassium kg
One freesian	11.2 tons	22	61.6	20.2	33.6
Cow zero-grazing yearly	10.8 tons slurry	2.5	64.8	0	80.6
100 chicken houted for egg production 448 days	3 tons	39	42	54	36
1000 broilers 42 days	1.1 ton	36	28.6	13.1	18.7

manure (standard)

© Handbook for farm Planning (LIK, Denmark 1983)



Pupa of grain moth. The final-instar larva spins a silken cocoon and changes to a reddish-brown pupa.

© Clemson University - USDA Cooperative

**Extension Slide Series,  
[www.insectimages.org](http://www.insectimages.org) (Courtesy of  
EcoPort, [www.ecoport.org](http://www.ecoport.org))**



**Bird and fusarium damage on  
maize**

© A.M. Varela, icipe

**Stink bug nymph on maize**





© A.M. Varela, icipe

**Chafer grub (with French bean plant)**



© A.M. Varela, icipe

**Streaked foliage damage caused by maize leafhopper (*Cicadulina mbila*)**



© Agricultural Research Council  
of South Africa (Courtesy of  
EcoPort)

**Satintail (*Imperata cylindrica*)**



© Chris Evans, The University of Georgia,  
[www.insectimages.org](http://www.insectimages.org)

**Satintail close-up. Identification:  
The whitish midribs are often  
off-center.**



© Chris Evans, The University of Georgia,  
[www.insectimages.org](http://www.insectimages.org)

**Damage by plant-feeding ladybird beetle on maize leaf. Note close-up of beetle (inset).**



© A. M. Varela

**Maize streak virus**



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