

Eggplant

Crop group: Solanaceae (sweet pepper, tomato, eggplant)

Summary

The best insect pest and disease management is prevention and knowledge. Each farm will usually have a few insect pests and diseases that regularly infest or infect their eggplant crops and usually one or two regularly cause major crop loss unless actively managed. Learning which are the major insect pests or diseases, early signs of infestation or infection, understanding what conditions favour their growth and what are their natural enemies lead to specific management practices that will give the best outcomes [Refer to the pest and disease specific factsheets for more information]. However, there are some general crop management or 'cultural' practices that can be used to reduce chances of bringing pests and diseases into crops and once there, in minimising their spread. Crops that have optimal (not too much or too little) nutrition and water, and growing in environmental conditions that they are suited to, will grow more quickly, produce higher yields and in general be more resistant to disease infection and outgrow damage (See the Best Practice Guides for Eggplant).

Site selection

Practice crop rotation and choose a site that has not recently grown eggplants or other solanaceous crops, such as tomatoes, chillies or sweet pepper, to reduce soil borne diseases. Do not plant next to, down-wind or down-slope of an older eggplant crop to reduce movement of insect pests or diseases from the older to younger crop.

Land preparation

Waterlogging favours many soilborne diseases, stops plants growing and reduces their chance of resisting infection or infestation so good drainage is important. Raised beds, soil amendments and protected cropping can reduce chances of waterlogging. Make soil more suppressive by adding microbial inoculants such as EM, Vermi-compost, chicken dung and other organic matter as soil amendments. Cabbage residues, wild sunflower (*Tithonia diversifolia*) and hagonoy (*Chromolaena odorata*) were proven effective in reducing soil-borne diseases, especially bacterial wilt caused by *Ralstonia solanacearum*. (Note: these plants should only be used if locally abundant. Do not plant in new areas as they are common weeds). If soil pH is acidic, lime should be applied to the soil at a rate of 250 g/m.



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Seedling production

Use certified disease-free seed and clean planting materials. Clean media for planting seeds (sterilized best), monitor seedlings, grow seedlings away from main production area and net well to prevent pest infestation. Check seedlings are pest and disease free before transplanting (see Best Practice Guide to Seedling Production). If flea beetles are regular eggplant pests, then growing seedlings on raised tables will reduce chances of the seedlings being infested.

Transplanting

Handle seedlings with care when pricking and transplanting. Extra care should be done to minimise root wounding. Fungicide drenching may be applied to newly transplanted seedlings to protect them from soil-borne fungi. Fine netting, covering seedlings will reduce flea beetle infestation, but is only economical if flea beetle attack is usually severe.

Use sticky traps around seedling production area and in newly transplanted crop to trap sucking insects to reduce potential of early colonisation of crop.

Vegetative

Eggplant fruit shoot borer (EFSB) is a major and regular pest of eggplant throughout the Philippines and should be actively managed to reduce pest numbers. Monitor establishing plants looking for wilted shoots and small holes in stems usually with small amounts of dark coloured frass within or around outer edge. Cut just below the entry hole and destroy larva. Check leaf terminals for EFSB or cutworm larva and destroy larva. Eggplants can be attacked by a number of other sap sucking pests which at times can cause severe damage, but in most circumstances are not major pests. Check undersides of leaves as most insect pests will be found there, especially next to leaf veins. Where possible squash eggs, aphids, whitefly, thrips and newly hatched cutworm larva. Leafhoppers, thrips, whitefly and red spider mites can all cause leaf speckling, (see table below for specific information).

Not all insects found in a crop are causing damage, some are likely to be 'natural enemies' or 'beneficials' and if maintained will assist in managing pest insect populations. Learn to recognise the common natural enemies. Monitor pest and natural enemy populations 1–2 times per week and record numbers per plant to track whether populations are increasing or decreasing. If pest populations are increasing and

natural enemies absent or in very low numbers an insecticide spray may be needed. Where possible choose insecticides that are specific to the pest group and least toxic to natural enemies and humans. Always read the label and use appropriate personal protection when spraying.

Monitor the plants for disease symptoms such as wilting, stunting, leaf spots, leaf and shoot blights. Rogue infected plants showing systemic symptoms and carefully prune away infected parts for localized diseases. If pruning needs to be done, sanitary pruning should be done, i.e. disinfect pruning tools after use on every plant. Bacterial wilt and blight can be transmitted via pruning tools. Preferably carry a container for pruned plant materials (eg. a plastic bag) during pruning and immediately place the pruned diseased plant parts inside the bag to minimise dispersal of inoculum to healthy plants. Control weeds to minimize alternate reservoir of plant pathogens or vectors of plant diseases.

Regulate moisture; do not over-irrigate the plots since a film of moisture in the soil is favourable to bacterial wilt dissemination to other plants. Drain the field quickly after rain by providing drainage canals, especially in an open field cultivation. Isolate diseased spots. Prevent water flow in or out of the section and limit the traffic of people and machinery in the infested area. Disease spots can be biofumigated with cabbage residues, hagonoy (*Chromolaena odorata* or wild sunflower (*Tithonia diversifolia*)). (Remember, these plants should only be used if locally abundant. Do not plant in new areas as they are common weeds). More frequent irrigation for a shorter time is less favourable for disease.

Avoid excessive nitrogen fertilization, especially with ammonium forms of fertilizer since they will make plants susceptible to most pests and diseases. Fungicides can be applied to control fungal diseases. Copper-based fungicides can also be applied to protect plants against bacterial leaf spots and blights. Resistance boosters such as chitosan, benzothiadiazole and phosphonates, if available, may also be sprayed on plants.

Flowering/Fruit set

Monitor closely for EFSB larvae or bore holes in buds, flowers, shoots, and young fruit. Remove and destroy larvae in infested fruit. Monitor for cutworm eggs and small larvae as they will burrow into fruit soon after hatching. Check on underside of leaves and tap flowers for thrips as they can scar developing fruit. Aphids, scale and

mealybugs can become serious pests particularly when plants are nutrient or water stressed. If pest populations are increasing and few natural enemies are present an insecticide spray may need to be applied.

Monitor the plants for the presence of leaf spots and blights because they may also affect the incoming fruit. Monitor also for early fruit drop and rots. If this occurs, try to check soil nutrients and inspect the early fruit for possible infections. To minimize bacterial fruit spots and canker, avoid overhead irrigation and water splashes. Protected cultivation is recommended if feasible. Protectant fungicides may be applied to the fruit and the whole plant at fruit setting to prevent infection by fungal and bacterial diseases that may affect the fruit. Water splashes are a major source of fruit infections. This can be minimized by applying mulches.

Fruit development

Collect any EFSB or cutworm infested, or disease infected fruit and properly dispose to ensure no pests can continue to develop or diseases spread.

Monitor the plants for the presence of leaf yellowing, leaf spots and blights because they may also affect the fruit. Monitor for water soaked patches, dark round lesions on fruit, deformed fruit and fruit rot. Avoid overhead irrigation and

water splashes to minimize blights. Protected cultivation is recommended if feasible. Protectant fungicides may be applied to the fruit and the whole plant at fruit setting to prevent infection by fungal and bacterial diseases that may affect the fruit. Do not apply fungicides when the fruit are about to be harvested

Harvesting

Collect any infested fruit and properly dispose of it to ensure no pests can continue to develop. Do not harvest during rainy days and when the conditions are wet. It is important that the fruit are dry during harvest. Do not let the fruit come in contact with the soil. When it cannot be avoided that the fruit gets wet during harvest, dry them before packing into containers, transporting or storing.

Postharvest

As soon as possible after harvest has finished the crop should be removed and ground ploughed to prevent pest populations continuing.

In the tables below are some of the common major diseases or pests that can be found in eggplant and a summary of useful information, see the individual disease or pest factsheets for more detailed information.

Proper identification of the problem is a pre-requisite for effective pest and disease management.

Table 1. Major diseases of eggplant


Image	Disease name	Damage symptoms	Management strategies
	Bacterial wilt (<i>Ralstonia solanacearum</i>)	Sudden wilting of plant. Plant can die. Root system/stem damaged. Internal symptoms include brown discoloration of the vascular vessels.	Resistant varieties or grafting to resistant rootstock. Crop rotation. Remove infected plants. Avoid planting in areas with bacterial wilt history. Biofumigation of soil with cruciferous residues.

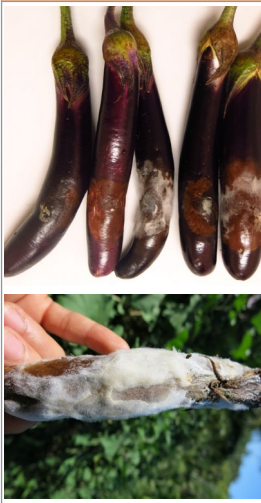




Image	Disease name	Damage symptoms	Management strategies
	<p>Phytophthora blight and fruit rot (<i>Phytophthora nicotianae</i> and <i>Phytophthora parasitica</i>)</p>	<p>The roots and crowns turn brown and rot causing plants to wilt. Infected fruit initially develop dark, water-soaked patches that become coated with fluffy white mycelia. Fruit may wither but remain attached to the plant. Fruit rot.</p>	<p>Use raised beds and drip irrigation. Rotate crops. Remove diseased plants and adjacent healthy plants. Use mulch on beds. Grow eggplant under protected cultivation. Destroy infected seedlings immediately. Use wide plant spacing for better air circulation and allow rapid drying of leaves.</p>
	<p>Fusarium wilt (<i>Fusarium oxysporum</i> f. sp. <i>melongenae</i>)</p>	<p>Starts with yellowing of the lower leaves and wilting of the plant. Brownish internal vascular discoloration.</p>	<p>Use of resistant varieties if available. Removal of infected plants. Long crop rotation with non-hosts, check soil pH, apply lime when necessary. Biofumigate soil with wild sunflower. <i>Tithonia diversifolia</i> (Note: this plant should only be used if locally abundant. Do not plant in new areas as it is a common weed).</p>
	<p>Sclerotium wilt (<i>Sclerotium rolfsii</i>)</p>	<p>Wilting of the shoot. Whitish mycelial mat can be seen at the base, going up to the stem of the plant. Initial whitish, round sclerotial bodies form. Later turn brown.</p>	<p>Practice sanitation in the nursery and farm. Ensure all equipment is free of soil before being brought to a farm or transferred from farm to farm. Rapidly eliminate plants that show initial symptoms of the disease and quarantine the area where it is found. Disinfect hands after handling infected plants. Herbicides for weed control. Formalin as fumigant for treatment of seed beds or fields for valuable crops. PCNB applied to the soil early, before infection.</p>
	<p>Cercospora leaf spot (<i>Cercospora melongenae</i>)</p>	<p>Small, circular to oval chlorotic spots with light to dark tan centers and dark spots that can be observed with a hand lens or dissecting microscope.</p>	<p>Use disease-free seedlings. Field sanitation: destroy weeds. Collect and bury infected plant residues. Prune and destroy, severely infected leaves Avoid overhead irrigation. Spray protectant fungicides. Grow under protective cultivation.</p>
	<p>Phomopsis blight (<i>Phomopsis vexans</i>)</p>	<p>Round dark lesions on fruit and leaves, that can prematurely drop. The fungus forms concentric patterns and dark structures on the fruit surface.</p>	<p>Sanitation; removal of infected plants. Avoid use of excess nitrogen.</p>



Image	Disease name	Damage symptoms	Management strategies
	Powdery mildew (<i>Erysiphe cichoracearum</i>)	Small circular to irregular, whitish, powdery moulds appear on upper and lower leaf surfaces, starting at the older leaves. Affected leaves eventually turn yellow and necrotic.	Apply protectant fungicides before or upon the onset of infection. Provide for air circulation around plants by carefully pruning and destroying infected parts of the plants. Avoid excessive nitrogen fertilization.
	Choanephora blight (<i>Choanephora cucurbitarum</i>)	Starts with yellowed patches on leaves which becomes blighted. In severe cases, blighting of the entire shoot may occur. May also affect the fruit that appear rotten with masses of greyish fungal growth.	Grow eggplant under optimal conditions. Plant in well- drained soil. Avoid dense plantings. Use drip irrigation; avoid overhead irrigation.

Table 2. Major pests of eggplant



Image	Pest name	Damage symptoms	Management strategies
	Fruit and shoot borer (<i>Leucinodes orbonalis</i>) MAJOR PEST	Major pest of eggplant. Eggs laid on shoots, flowers and fruit. Larvae bore holes into shoots, flowers, buds and young fruit. Plant wilts and dies above stem bores. Bored flowers and buds abort. Frass often seen around holes in fruit.	Sanitation: removal (pruning) and disposal of infested shoots and fruit. Disposal as soon as possible after crop harvest of whole plants. Use male sex pheromone lures (BITAG).
	Red spider mite (<i>Tetranychus kanzawai</i>)	Leaf speckling, webbing, drying. Spider mites are more serious in protected cropping and hot dry weather.	Monitor, and remove newly infected leaves. Wet leaves and high humidity reduce mite activity Pressurized water spray and soap solution Naturally occurring beneficial predatory mites Abamectin Sulphur Dinotefuran










Image	Pest name	Damage symptoms	Management strategies
	<p>Thrips (especially <i>T. palmi</i>)</p>	<p>Silvering, yellowing or browning of leaves, especially around main veins. Fruit deformed or scarred.</p>	<p>Yellow sticky traps for monitoring. Light coloured bed mulch. Pressurized spraying of water and soap solution. Pesticides</p>
	<p>Aphids (<i>Aphis gossypii</i>)</p>	<p>Feed by sucking sap usually from the undersides of leaves,. High numbers can be found on underside of leaves and in flower buds. Infested leaves often become cupped downwards and may appear wrinkled. Heavy infestations may result in wilting. Young plants may have reduced or stunted growth. High populations are favored by dry weather conditions.</p>	<p>Remove heavily infested plant/part. Predatory beetles, syrphids and lacewings. Pressurized water and soap solution. Pesticides Biologicals</p>
	<p>Leaf hopper (<i>Amrasca biguttula</i>)</p>	<p>Nymphs and adults suck sap. Feeding underside of the leaves, damage cause distortion and curling of leaves and stunted growth. Damage similar to that caused by mites and thrips.</p>	<p>Resistant varieties (if available) for leafhopper. Organo phosphates for leafhopper Synthetic pyrethroids for leafhopper Dinotefuran for leafhopper</p>
	<p>Whitefly (<i>Bemisia tabaci</i>)</p>	<p>Suck plant sap from leaves. High populations can cause leaves to turn yellow, appear dry, or fall off from plants.</p>	<p>Yellow sticky traps (for monitoring and control). Intercropping practices using non-host crops. Remove weeds. Plant tolerant varieties. Parasitic wasps. Synthetic pyrethroids</p>

Image	Pest name	Damage symptoms	Management strategies
	Mirid bug (<i>Helopeltis collaris</i>)	Nymphs and adults suck sap of shoots and young leaves causing brownish patches and distortion of leaf. When feeding on a stem they can girdle causing plant wilting and death above.	Removal of infested leaves.
	Mealybug (<i>Pseudococcidae</i>)	Nymphs and adults suck sap on shoots and stems. Cause curling of leaves and stunted growth. Drying of infested plant part. Common during dry months.	Pruning and proper disposal of infested plant/part. Pressurized spraying of water and soap solution.
	Cutworm (<i>Spodoptera litura</i>)	Early instar larvae feed close together causing windowing. Larger larvae separate and chew larger ragged holes in leaves. Chew holes in fruit, depositing frass causing fruit rots.	Hand pick egg mass and larvae. Removal and disposal of infested plant/parts. Plant trap crops such as castor plant. Plough soil to minimise pupae survival between crops. Pesticides Biologicals Resistant varieties if available
	Leaf-eating lady beetle (<i>Epilachna tredecimpunctata</i>)	Spiny larvae and adults chew underside of the leaves leaving skeleton/windowpanes. Adults can also chew ragged holes.	Remove egg clusters, alternate weed hosts, crop debris. Pesticides Biologicals
	Flea beetle (<i>Psylliodes balyi</i>)	Adult beetles are small, shiny and jump. They cause small raggedy shot-gun like holes in the leaves.	Grow seedlings on raised benches and covered with fine netting to avoid infestation. Do not plant new crops next to older or infested crops. Minor leaf damage is unlikely to reduce yield, so only use pesticides if severe damage. Biologicals

Refer to the Pesticide table for further information.

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For more information, see individual factsheets and crop best practice guides also produced from this project.

Other information available from www.plantwise.org.

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