ANRD

AGRICULTURE AND NATURAL RESOURCES DIVISION

Plant Protection Guide for Open Field Production

Fruit trees

(peaches, nectarines and other fruits)

September 2015

Introduction

This guide is written to assist farmers growing fruit trees: peaches, nectarines, guavas and other fruit.

The approach taken is that of prevention and the early detection of pests and diseases to avoid a build up to a damaging level. The aim is to minimise the use of chemical pesticides. This is in the interests of the end consumer of the produce, to reduce the development of pesticide resistance, to protect the environment and last but by no means least, to cut down on costs.

The guide has five parts:

Section 1 gives some general guidelines on scouting, hygiene, plant protection and record keeping.

Section 2 gives information on cropping, how to grow healthy fruit trees.

Section 3 gives information on specific information on target pests and diseases, giving signs to look out for and how to prevent and treat them for: fungal diseases and insect pests.

Section 4 provides guidance on the pesticides available for the protection of open field cucurbits. Refer to the label for application and harvest interval details for other crops.

- The first template is for the locally available products.
- A template is also given showing the products available from the ANRD spraying service.

Section 5 gives details of where to find further information and technical support.

We hope that it is useful and welcome all comments and suggestions for improvements.

1. Some general guidelines

Scouting:

- Check the trees regularly, and at least weekly once they have begun flowering. Check the as many developing fruit as you can access.
- Look for signs of stings or other damage.
- Look for discoloured leaves, insect droppings, and leaves with holes in them, or speckled with pale yellow spots.

Plant protection:

- Clean away weeds, they can harbour pests and compete with the tree for nutrients in the soil.
- Pick off any stung or rotten fruit still on the tree. Also pick up any fallen fruit, as they will breed fruit flies. Put all collected fruit in a drum of water to drown the fruit fly maggots. Once this is well-rotted down it makes a good liquid feed for the tree.
- Use as little pesticide as possible. This saves you money, protects the pesticide sprayer, the consumer of the crop and also the environment, and also reduces the chances of pesticide resistance developing so that sprays will continue to work when you really need them.
- Always read the pesticide label carefully.

Records:

- Keep records of all the sprays you use.
- Keep records of what you harvest (weights and/or prices) so you know if you're breaking even.

The guidelines given here are based on a regime of frequent crop inspections and action taken against pests and diseases as required, using pesticides compatible with the natural enemies which occur on the island.

2. Cropping guidelines

Soil

Soil is critical for the health of a plant as this is where it gets nearly all of its nutrients and water, and it is also the plants' anchor.

- Fruit trees grow best in well drained soils.
- Fruit trees vary in their preferences for acid or alkaline soils:
    - Apple pH 5.0 – 6.5
    - Lemon, orange pH 6.0 – 7.5
    - Peach, nectarine pH 6.0 – 7.0

- Pear pH 6.0 – 7.5
- Plum pH 6.0 – 8.0

Alkaline soils (pH range 7.0 to 8.5) can be acidified by adding organic material such as compost or manure. Acid soils (pH range 4.5 to 5.5) can be neutralised by adding lime. This is best done around 4 weeks before planting.

Time of year

The common pests and diseases are as follows:

All fruit:

- Fruit fly
- False codling moth

Citrus trees:

- Citrus scale
- Citrus aphid
- Citrus woolly whitefly

The citrus psyllid used to be common on the island. It is a small insect which causes a lot of little bumps on the leaves by hiding underneath and sucking out the plant juices. In 2001 ANRD introduced a tiny parasitic wasp, *Tamarixia dryi* which stings the psyllid and kills it. It does no other harm. It is now very rare to see the citrus psyllid and so it is not included in this guide. If you think your tree is suffering from citrus psyllid, please call Pest Control at ANRD on 24724.

Pruning

Pruning produces new growth which in turn produces more fruit. Fruit trees need to be open to sunlight, as shaded branches won't produce as much fruit. Pruning them opens up all branches to the sun. It also makes them easier to spray if you plan on using pesticides for fruit fly control. The guidelines below refer specifically to peach trees but can be applied to any type of fruit tree.

- Prune the tree once all the fruit has been harvested or fallen but before it starts flowering again, this is around May to July for peach trees. The ideal shape to aim for is a bowl, open in the centre so sunlight can warm and ripen the fruit, and not so tall that you can't reach the fruit to pick it.

- Remove all the suckers, the shoots that come up near the roots of the tree. Take off any water shoots near the top of the tree. These are like suckers that grow off the top branches.

- Remove all dead wood, and diseased or tangled branches. Pruning cuts should be clean and angled so that moisture runs off. Ragged breaks are points for infection of diseases and pests.

- Choose 4 to 6 primary branches and cut off all the rest. All the branches you cut should be growing up at a 45 degree angle. Prune your tree in a V-shaped pattern, all branches should have the appearance of the letter “V” and wide enough apart that a small bucket could be tossed between each of them without ever hitting a branch. Prune your tree near the base of the branch, and pruning cuts should be clean and angled so that moisture runs off. Ragged breaks are points for infection of diseases and pests.

- Avoid removing more than 1 quarter of the tree in any one year as it will take a long time to recover. Rehabilitate old trees over a number of years.

- Finally, clear grass and weeds away from the base of the trunk as they are competing with the tree for water and nutrients. Feed the tree once a year when it blossoms with an all-purpose fertilizer. Use about 1lb for a young tree and 2lb for an old tree, sprinkled all around on the ground for about the extent of the canopy. Leave a space of 6 to 12 inches from the trunk.

Feeding and watering

- Feed the tree once a year when it blossoms using an all-purpose fertiliser, using about 1lb for a young tree and 2lb for an old tree, sprinkled all around on the ground for about the extent of the canopy. Leave a space of 6 to 12 inches from the trunk.

- Once the fruit starts forming, add a mulch of well-rotted compost around the base of the tree.

- Water demand is greatest when the fruit is forming, so if there is no rain at this period give the tree about 10 gallons per square yard every 2 weeks or so.

- If the tree is bearing many fruit, thin them out a little by pinching them off when small. That way you will get fewer but bigger, juicier fruit rather than many smaller ones.

3. Specific information on target pests and diseases

Insect pests

Fruit fly

The Mediterranean fruit fly, or Medfly for short (*Ceratitis capitata*) probably arrived on St Helena around the late 19th century. It is a type of fly, and related to the pumpkin fly. This species is a worldwide pest of fruit and recognised as one of the worst of a number of species. It is a pest of peaches, nectarines, loquats (especially the sweet yellow variety), sweet oranges, medlar, guava, fig, rose apple and tomatoes.

The adult female fly stings fruit in order to lay eggs, laying 5 to 8 eggs at a time and up to 300 in her lifetime. The male fly does no damage at all. Several females can sting the same fruit. As she lays eggs, she excretes into the hole and this causes the unripe fruit to rot, so providing her maggots with nice soft food. The fruit tree responds to the rot in young fruit by cutting it off at the stem and aborting it, so the rotten fruit falls to the ground. Larger fruit respond to being stung by trying to "spit out" the eggs in a stream of clear gum. This is called gummosis and also traps some adult flies by the legs, killing them. The sight of peach fruit with strings of clear gum hanging off them is a sign of fruit fly attack.

The maggots are white and quite active, living in the outer flesh of the fruit below the skin. Once they are full size, about 1cm long, they jump from the fruit to the ground – they can jump up to 1m away – and burrow into the soil to form a cocoon. If conditions are dry and cool they can remain in the cocoon for up to 6 months before they hatch.

Adult flies feed for several days before mating takes place, feeding on high protein food such as bird droppings and carcasses.

Fruit flies come out during the day and are most active in the late morning. Only the female flies approach fruit trees when they are looking to lay eggs. The rest of the time they, and the adult males, are mostly in the surrounding trees and bushes.

Signs to look out for:

- Patches of soft brown rot on the developing fruit: when broken open the white maggots can be seen.
- Adult flies can be seen over the day walking over the fruit looking for places to lay eggs.

Management:

- A well cared for tree is stronger and better at repelling fruit flies, so follow the guidelines for pruning, feeding and watering outlined in Section 2.

- Fruit flies are attracted to the smell of fir trees, cedar, and wild mango trees so clear these away from the vicinity of fruit trees.

- Once the tree starts blossoming, apply a drench of Garden Ripcord insecticide (active ingredient cypermethrin) to the soil all around the base of the tree to the extent of the canopy. This will kill any fruit flies in the soil, before they emerge as adults. Repeat this twice, 2 weeks apart, following label instructions.

- Female Medflies can be killed before they mate and start laying eggs by placing protein baits laced with poison in and around the fruit trees. Various products are available, such as Eco Fruitfly Bait or M3 bait stations.

- Poison baits have the big advantage that they can be used from blossom drop right through to the final fruits on the tree, don't harm bees or other beneficial insects, or involve putting insecticides on the fruits themselves.

- Pesticide treatments are applied to the fruits themselves. Products can be Leybacid (active ingredient fenthion), Garden Ripcord (active ingredient cypermethrin) or Malathion (active ingredient mercaptothion).

    - Leybacid is better at killing fly and moth maggots in the fruit.

    - Garden Ripcord and Malathion are better at killing female flies and moths before they lay eggs.

- To work out when to start spraying you need to count back from when you expect to make your first harvest. You are the best judge of when this is as you know your trees best. Count back to work out when the first spray should be applied:

    - For Leybacid, the course is 3 sprays. The safety period between harvest and the last spray is 10 days, and the period between each spray is 21 days.

    - For Garden Ripcord, the course is 4 sprays. The safety period between harvest and the last spray is 14 days, and the period between each spray is also 14 days.

    - For Malathion, the course is weekly once first signs have been seen. The safety period between harvest and the last spray is 10 days.

Never harvest fruit before the safety period is up, it may still contain pesticide residues which are harmful to your health.

Poison baits and pesticide sprays are compatible: you can use the baits to protect the crop early and late in the season, and a spray to protect the fruit at their most vulnerable, ripening stage.

Biological control

In 2002 ANRD brought in two tiny parasitic wasps, *Fopius ceratitivorous and Psytallia concolour,* on a trial basis for fruit fly control. This wasp stings the young of the fruit fly to lay its eggs inside the maggots body, and the young wasps kills the maggot as they grow. Unfortunately, despite spreading widely around the island, there is no evidence yet that the wasps are controlling the numbers of the fruit fly.

False codling moth

The False codling moth (*Thaumatotibia leucotetra*) is a small grey-brown moth which cones out during the night, so is rarely seen. The female moth lays an egg, either on the developing fruit itself, or on a leaf nearby, and a single female can pay up to 800 eggs in a lifetime of up to 2 months.

The maggot bores into the fruit, with the younger maggots just under the skin and older ones near the centre. Usually only a single maggot survives in each fruit. Maggots are pink-white in colour and grow up to 2cm long, with clearly visible legs. They are very active and when disturbed they can move very fast.

The false codling moth tends to be abundant in alternate years, so there will be 1 year with few fruit attacked, followed by 1 year with bad attack.

False codling moth and fruit fly maggots tends to be mutually exclusive, you either get one or the other but never both.

Signs to look out for:

- Small wound sites where the maggot has burrowed into the fruit, these are usually discoloured. As the maggot burrows deeper into the fruit as it grows, signs of false codling moth are harder to spot than fruit fly.
- Patches of soft brown rot on the developing fruit: when broken open the large pink-white maggot can be seen.

Management:

- A well cared for tree is stronger and better at repelling false codling moth, so follow the guidelines for pruning, feeding and watering outlined in Section 2.
- Once the tree starts blossoming, apply a drench of Garden Ripcord insecticide (active ingredient cypermethrin) to the soil all around the base of the tree to the extent of the canopy. This will kill any false codling moth in the soil, before they emerge as adults. Repeat this twice, 2 weeks apart, following label instructions.
- Pesticide treatments are applied to the fruits themselves. Products can be Leybacid (active ingredient fenthion) or Garden Ripcord (active ingredient cypermethrin).
    - Leybacid is better at killing moth maggots in the fruit.
    - Garden Ripcord is better at killing female moths before they lay eggs.

- To work out when to start spraying you need to count back from when you expect to make your first harvest. You are the best judge of when this is as you know your trees best. Count back to work out when the first spray should be applied:
    - For Leybacid, the course is 3 sprays. The safety period between harvest and the last spray is 10 days, and the period between each spray is 21 days.
    - For Garden Ripcord, the course is 4 sprays. The safety period between harvest and the last spray is 14 days, and the period between each spray is also 14 days.

Never harvest fruit before the safety period is up, it may still contain pesticide residues which are harmful to your health.

Citrus scale

Scale insects are so-called because they look like small brown fish scales attached to the twigs and smaller branches of fruit trees. There are various species and some also attack fruit. Because of their brown colour they are often overlooked at first, but numbers can be high.

Beneath each brown scale is a small insect with its mouth clamped tight to the tree, sucking out the plant juice. Some species have sugary droppings and so can lead to the growth of sooty mould, which cause the blackening of the leaves.

Signs to look out for:

- Small brown scales like fish scales stuck to the branches
- Black mould growing on the leaves

Management:

Treat when scale insects are first seen, spot spraying infested areas. There are two products locally available:

- Malathion (active ingredient mercaptothion), spot spray, 7 day harvest interval
- Aphicide (active ingredient dimethoate), spot spray, 14 day harvest interval: do not apply Aphicide to rough lemon or Seville oranges

Citrus aphids

The citrus aphid (*Toxoptera citricidus*) is a dark brown/black aphid which attacks citrus trees. The young shoots get infected and the first sign are often very subtle, the leaves start to curl over and are stunted. The aphids line up along the vein of the stem and can be hard to spot. Once the infestation gets going, however, the dense sticky masses of black aphids are very obvious.

The aphid feeds by sticking her needle like mouth into the plant leaf and sucking out the plant juice. Infested plants lose colour and the leaves turn yellow. The female aphid can produce young without mating, all her offspring will be female too and capable of doing the same thing. This means that numbers can get very high, very quickly and only a single individual can start up a new infestation. Winged individuals are produced occasionally, and their job is to fly off and find new plants to infest.

Signs to look out for:

- Young shoots curl over, and are stunted
- Leaves turn yellow
- Dense sticky mass of black aphids
- Many ladybirds moving around on the tree

Management:

Ladybirds, hoverfly larvae and lacewing larvae all take aphids and can be encouraged by planting flowers such as herbs or Asters in the vicinity of citrus trees.

Treat when first seen, spot spraying infested areas:

- Aphicide (active ingredient dimethoate): do not apply Aphicide to rough lemon or Seville oranges

Citrus woolly whitefly

The citrus woolly whitefly (*Aleurothrixus flocossus*) is related to the whitefly detailed above. The grubs form a dense wool of white waxy threads. It was the subject of a biological control programme and is now rare. The photo above shows woolly whitefly together with ants, which are harvesting the sugary droppings of the woolly whitefly, and a ladybird which is eating the woolly whitefly.

Signs to look out for:

- Dense white waxy "wool" at the growing points of citrus branches and under leaves.

Management:

There are no pesticides which will effectively kill the woolly whitefly. The only solution is to spray infested branches with a 2% soapy water spray twice a week, and severely prune the infested branches off the tree. However, because of the difficulty of controlling woolly whitefly, it was the target of a biological control programme by ANRD.

Biological control

In 2000 ANRD introduced the tiny parasitic wasp *Cales noaki*, which stings the whitefly and kills it. It does no other harm. Since that time the wasp has spread over the island and it is unusual to see large patches of woolly whitefly now. As soon as they get bigger, the wasp finds them and they die away again.

4. Pesticide and spraying guide

Plant protection template for fruit trees

Pest / disease	Product trade name	Active ingredient	Resistance code*	Details	Harvest interval
Fruit flies	Garden	Cypermethrin	3A	Spray at 14 day	14 days

	Ripcord Malathion	 Mercaptothion	 1B	intervals Spray at 7 day intervals	 10 days
False codling moth	Garden Ripcord	Cypermethrin	3A	Spray at 14 day intervals	14 days
Citrus scale	Aphicide Malathion	Dimethoate Mercaptothion	1B 1B	Spot spray	14 days 7 days
Citrus aphid	Aphicide	Dimethoate	1B	Spot spray	14 days
Citrus woolly aphid					

*Pesticides are given codes depending on their mode of action. Resistance management is about alternating products with different codes.

Tank mixing two or more products to apply at the same time can damage the plant or be ineffective if the products aren't compatible. Consult the label for compatibility, or contact ANRD for advice.

Pesticides available through the ANRD spraying service

Pest/disease	Product trade name	Active ingredient	Resistance code*	Details	Harvest interval
Fruit flies	Garden Ripcord Lebaycid	Cypermethrin Fenthion	3A 1B	Spray at 14 day intervals Spray at 21 day intervals	14 days 21 days
False codling moth	Garden Ripcord Lebaycid	Cypermethrin Fenthion	3A 1B	Spray at 14 day intervals Spray at 21 day intervals	14 days 21 days
Citrus scale	Danadim Progress	Dimethoate	1B	Spot spray	14 days
Citrus aphid	Danadim Progress	Dimethoate	1B	Spot spray	14 days
Citrus woolly aphid					

*Pesticides are given codes depending on their mode of action. Resistance management is about alternating products with different codes.

Equivalent products to those used by the ANRD spraying service

The table below gives the products available locally which are equivalent to those only available through the ANRD spraying service.

ANRD product	Pest or disease	Locally available product
Lebaycid (fenthion)	Fruit fly, False codling moth	Garden Ripcord (cypermethrin), Malathion (mercaptothion)
Danadim Progress (dimethoate)	Citrus aphid	Aphicide (dimethoate)
Danadim Progress (dimethoate)	Citrus scale	Aphicide (dimethoate), Malathion (mercaptothion)

5. Support and advice

ANRD can provide technical advice and support to assist you in identifying pests and other problems on your crops, checking soil pH, and also offers a complete professional spraying service. Call Pest Control or Farmer Support on 24724.

There is a wealth of information available on the internet. Some useful websites are:

- ANRD IPM webpage: http://www.sainthelena.gov.sh/integrated-pest-management/
- Atlas of plant diseases http://www.atlasplantpathogenicbacteria.it/index.htm
- IPM Online (University of California): http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html
- Plantwise Knowledge Bank: http://www.plantwise.org/KnowledgeBank/Home.aspx
- Pests of Field Crops in Southern Africa: http://www.pestsandcrops.com/index.htm