AGRICULTURE AND NATURAL RESOURCES DIVISION

Plant Protection Guide for Open Field Production

Cucurbits

(cucumber, courgette, marrow, melon, squash, pumpkin)

September 2015

Introduction

This guide is written to assist farmers growing cucurbits (cucumber, courgette, marrow, melon, squash and pumpkin) under open field production.

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. Biopesticides (non-chemical pesticides based on natural enemies) and natural enemies are promoted as much as possible.

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 cucurbits.

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 crop daily if possible. Walk along each row looking at the entire plant, particularly examining any which stand out in the row as looking obviously sick, slower growing or discoloured.
- There seem to be more pests and disease on the plants in the outer rows of fields and less away from the edges.
- Look for discoloured leaves, insect droppings, and leaves with holes in them, or speckled with pale yellow spots.
- Look particularly on the underside of leaves for aphids and caterpillars.

Plant protection:

- Clean away weeds, they can harbour pests.
- Pick off any caterpillars and brown, drooping leaves and take them away for burning, to stop infestations arising.
- 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.
- If there is a choice, use a biopesticide instead of a chemical one. This protects natural enemies.
- 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.

- Cucurbits grow best in well drained sandy soils (eg those in the Longwood area). They will grow in heavy clay soils but harvesting can be difficult when the soils are wet.

- Cucurbits like slightly acid soils , with slight differences between them:
    - Cucumber, marrow and pumpkin pH 5.5 to 7.5
    - Courgette pH 5.5 to 7.0
    - Gem squash, butternut squash pH 5.5 to 6.5
    - Melon pH 6.0 to 6.5

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

Cucurbits can be grown all the year round, although cucumbers, courgettes, melon and the squashes grow best over the warmer summer period, October to April, and pumpkin can do well over the cooler winter period, May to September, as long as the plant is germinated during the warmer period.

The common pests and diseases will vary depending on the season.

Summer cucurbits (October to April):

- Pumpkin fly
- Whitefly
- Red spider mite
- Powdery mildew

Winter curcubits (May to September):

- The same pests as attack summer cucurbits occur, but in much lower numbers.

General pests and diseases which can attack all the year round:

- Caterpillars

Other problems which may affect cucurbits:

- Fruit rot
- Poor pollination and fruit set

3. Specific information on target pests and diseases

Fungal diseases

Powdery mildew

Powdery mildew may be caused by several species of fungus which attack the large, soft leaves of cucurbits, covering them with a powdery white deposit. Small patches of white grow until the entire leaf is covered; see the photo below. It is encouraged by hot, dry soils

combined with moist weather conditions. Although all cucurbits are susceptible, symptoms are less common on cucumber and melon as many commercial cultivars have resistance.

Infected leaves wither and die, and yields are affected, with fewer or smaller fruit produced, and both flavour and storability can be affected.

Signs to look out for:

- White powdery patches on the upper surface of the leaves.
- Older plants are affected first. The fungus usually develops first on leaves near the crown, and on shaded lower leaves.

Management:

When sourcing seed, look for resistant varieties where possible.

In dry weather, keep the soil well watered. When signs are first seen, cut away the infected leaves and burn them, to prevent the mildew from spreading too quickly.

There are 2 organic remedies which can give a level of preventative control:

- Milk. Mix a 10% to 30% solution of milk with water and spray every 3 days. Any type of milk will work – milk powder, skimmed, semi skimmed, whole milk – as it is the proteins, not the fats, which have the anti-fungal properties.
- Baking powder. Mix 1 teaspoon (about 5ml) in 1 litre of water and spray every 3 days.

If powdery mildew appears later on there is no locally available pesticide which is registered for it. Note that powdery mildew is a completely different problem to downy mildew which doesn't occur on St Helena and yet is common in South Africa. A product listed for downy mildew won't be effective against powdery mildew.

The ANRD spraying service has an effective product, Nimrod (active ingredient bupirimate), and can be called in: applied at 14 day intervals, with a maximum of 6 sprays per crop.

Insect and Mite pests

Whitefly

Whitefly *Trialeuroides vaporariorum* are very prevalent in the hotter summer months. The adult females lay eggs on the underside of young plants, so adults and eggs can be found on the upper leaves, young grubs on lower leaves, and older grubs on the bottommost leaves.

Whitefly are not strong flyers and blow around on the wind, often finding new crops by accident this way. They like to fly in the evening, around dusk, which is when the adults mate and the females lay eggs.

Signs to look out for:

- Early infestation - adult white flies on the upper leaves of plants (left photo)
- Heavy infestation – adults on upper leaves, lower leaves underside covered with green pupae (right photo).

Management:

Whitefly are very difficult to control as most are resistant to many pesticides, including Garden Ripcord and Malathion. A natural enemy exists, a tiny parasitic wasp called *Encarsia formosa*, it can be seen as small black dots among the green dots of whitefly larvae; both can be seen on the right photo, above. However, unfortunately *Encarsia* seems unable to keep up with whitefly in open field production and doesn't give good control.

There are no pesticides registered for use against whitefly in open field production which will work against our resistant population. Some farmers have success applying a spray of soapy water every 3 days, once the first signs of whitefly are seen.

Pumpkin fly

It is very frustrating to watch a healthy plant produce lots of young fruit and then to see them rot away before the fruit can mature. Some of this rot will be due to bacteria or abortion by the plant (see below, under "Other problems") but in many cases you can see large white blunt-ended maggots in the stung fruit. This is the young of the pumpkin fly. The adult fly is about the size of a house fly, red-brown in colour with a yellow band at its waist; see the photo above.

The pumpkin fly, *Dacus ciliatus*, originally comes from Africa where it is a pest of minor importance. It is believed to have arrived on St Helena in the early 1970s or 1980s as it was not recorded in a report on the islands pests in 1973. In Africa there are a number of other related species which cause far more damage, and we are lucky we don't have them here. The pumpkin fly is related to the Mediterranean fruit fly which stings fruit.

The adult female fly attacks all cucurbits – cucumber, courgette, marrow, melon, pumpkin and squashes. It is also known from tomatoes. The male fly does no damage at all as the female stings in order to lay eggs. 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. When the maggots are ready they form a cocoon, either inside the fruit or in the soil.

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 sitting on the upper surface of the leaves, or walking over the fruit looking for places to lay eggs.

Management:
If you don't have many plants, the simplest control is to keep the developing fruit well hidden by allowing the vine to grow along the headlands in long grass, or wrap the young fruit in paper or cloth to provide a physical barrier to the fly.

Where this is not possible, use a general insecticide such as Malathion (active ingredient mercaptothion) as soon as the first stings are seen: spray at 10 day intervals as required.

Biological control

In 2002 ANRD brought in the parasitic wasp *Psytallia phaeostigma* on a trial basis for pumpkin fly control. This wasp stings the young of the pumpkin 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 wasp is controlling the numbers of the pumpkin fly.

Caterpillars

There are four types of caterpillar which attack crops, two green ones (two kinds of looper, *Trichoplusia ni* and *Ctenoplusia vittata*; right photo, above) and two which can be either green or brown (the army worm *Spodoptera littoralis* and the bollworm *Helicoverpa zea*). Signs to look out for and management are the same, so they are treated collectively here.

Signs to look out for:

- Leaves nibbled down, particularly in larger plants, dark round droppings on leaves.

Management:
Treat when caterpillars are first seen:

- If infestation is localised nip off all the caterpillars seen, both large and small, and either squash or drown them.

- If infestation is widespread use a general insecticide such as Malathion (active ingredient mercaptothion): one treatment is usually enough to control an infestation.

The ANRD spraying service can also apply a biopesticide, Dipel (active ingredient *Bacillus thuringiensis*), which is effective against young caterpillars at an early stage of infestation, but not so good with older ones. Dipel is compatible with whitefly management as Malathion can kill the wasp *Encarsia* which controls whitefly grubs (see above, under whitefly).

Red spider mite

The red spider mite *Tetranychus urticae* tends to be found in the hotter, lowland areas such as Jamestown, The Briars and Harpers. They suck the sap from plant leaves, and the surface of the leaf develops a spotty appearance as lots of tiny mouths suck out the green juice from the underside. If you turn the leaf over, you will see numerous tiny red dots moving slowly around – these are the mites. In advanced stages a web is formed over the leaf in which the mites live. It is most prevalent in the hotter summer months.

Signs to look out for:

- Pale speckling on the upper surface of leaves, small dark red dots and light webbing on the underside.

Management:

Mites like conditions to be hot and dry so a light misting of water over the plants in the evening every other day will help deter and reduce their numbers. Red spider mites aren't insects so the normal insecticides like Garden Ripcord and Malathion do not work well, and you need a specific miticide.

Treat when mites are first seen:

- Dynamec (active ingredient abamectin): spray at 7 day intervals, maximum of 6 sprays per crop.

If mites recur at a later stage of the crop when the maximum number of Dynamec applications has already been applied, call in the ANRD spraying service which has other products with different modes of action.

Other problems

Fruit rot:
A certain number of developing fruit will rot due to various bacteria and fungi, such as Anthracnose black rot, Phytopthora soft rot, Fusarium rots. Check inside the rotten fruit - if you do not see large (up to 1cm) blunt-ended white maggots then it is probably not the pumpkin fly. If you see small flies hovering in the air around rotting fruit these are vinegar flies which feed on the rot. Their maggots are smaller than those of the pumpkin fly, and have pointed ends. They are secondary pests only there because of the rot, and there is no need to take action to control them.

Bacterial and fungal rots are often related to wet conditions as the fruit ripens, particularly where the fruit is in contact with the soil. Pack dry straw, dry grass or shredded paper under developing fruit to protect it from wet soil.

Poor pollination and fruit set:
All cucurbits have different male and female flowers, and require insects in order for the female flower to be pollinated. Bees are the best pollinators for cucurbits, and the simplest solution is to position a bee hive near the crop. Cucurbits produce relatively few, large flowers and bees will need alternative flowers in the area to keep them supplied. Herbs and open-headed flowers such as asters and daisies are ideal. Hand pollination using a soft paint brush to transfer pollen from the male to the female flowers can also be done.

In cooler weather, butternut produces mainly female flowers which may enlarge for a while and then abort. Pumpkin responds to cool weather by producing mainly male flowers, which will not set fruit. This is related to the temperature, so avoid planting squash during the cooler months. You need to have both male and female flowers from different plants at the same time in order for the flower to pollinate and set fruit.

4. Pesticide and spraying guide

Plant protection template for open field cucurbits

Pest / disease	Product trade name	Active ingredient	Resistance code*	Details	Harvest interval
Powdery mildew	Milk Baking powder	Milk proteins Sodium bicarbonate	Not applicable	Spray at 3 day intervals Spray at 3 day intervals	0 days 0 days
Whitefly	Soapy water	Fatty acids	Not applicable	Spray at 3 day intervals	0 days
Pumpkin fly	Malathion or Malasol	Mercaptothion	1B	Follow label instructions for "Crucifers"	10 days
Caterpillar	Malathion or Malasol	Mercaptothion	1B	Follow label instructions for "General: Army Worm"	10 days
Red spider mite	Dynamec	Abamectin	1B	Spray every 7 days up to 4 treatments	7 days

*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
Powdery mildew	Nimrod	Bupirimate	Group A: 8	Up to 6 treatments Can mix with Dynamec	2 days
Whitefly	No product available				
Pumpkin fly	No product available				
Caterpillars Caterpillars (young stages)	Supasect Dipel	Cypermethrin *Bacillus thuringiensis*	3A 11	Spray at 14 day intervals Can mix with Dynamec and broadly compatible with other products	7 days 0
Red spider mite	Dynamec	Abamectin	1B	Spray every 7 days up to 4 treatments	7 days

*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
Nimrod (Bupirimate)	Powdery mildew	None available
Supasect (cypermethrin)	Caterpillars	Malathion or Malasol (mercaptothion)
Dipel (*Bacillus thuringiensis*)	Caterpillars (young stages)	None available

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