AGRICULTURE AND NATURAL RESOURCES DIVISION

Plant Protection Guide for Open Field Production

Carrots

January 2015

Introduction

This guide is written to assist farmers growing carrots 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.

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 carrots.

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 insect pests.

Section 4 provides guidance on the pesticides available for the protection of carrots.

- The first template is for the locally available products.
- A template is also given showing the products available from the ANRD spraying service, plus a table showing which products can be tank-mixed together, to help farmers plan their spraying regimes if they chose to use the ANRD 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 holes in the rows, discoloured leaves, insect droppings, or leaves browned and drooping.

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.
- 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.

- Carrots need light soils (eg those in the Longwood area) to grow well. They tend to grow stunted or bent in heavy or stony soils.

- Carrots prefer neutral soils, pH 5.5 to 7.

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

Carrots can be planted all the year round.

The common pests and diseases will vary depending on the season. Carrots have very few pests in St Helena, and there are no known bacterial or fungal diseases. They are most vulnerable at the seedling stage from crickets, once past this stage they are rarely attacked by pests.

Summer carrots (October to April):

- Leafhopper

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

- Caterpillars
- Crickets

Other problems which can occur with carrots are:

- Germination problems
- Greening
- Fanging
- Bitter taste

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4. Specific information on target pests and diseases

Insect pests

Caterpillars

There are four types of caterpillar which attack crops, two green ones (two kinds of looper, *Trichoplusia ni* and *Ctenoplusia vittata*) 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:

- 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). Check the product label for application rates.

Crickets

Crickets (*Gryllus bimaculatus)* are common all over the island. They look superficially like cockroaches but their bodies are more rounded, are darker and less glossy. Their presence often goes undetected as they fly down onto plots at night and leave before dawn.

Crickets have small, weak jaws and are incapable of damaging larger or tougher plant material so their activity is confined to very young or tender plants. The mysterious pest known as the "nightfly" which attacks young carrot seedlings to devastating effect is actually a swarm of crickets.

It is difficult to predict where crickets will attack a crop as they don't seem to follow a regular pattern. Some plots will be damaged once and not again for a long time, so general preventative sprays are usually a waste of time and money.

Signs to look out for:

- Leaves nibbled down, especially in young carrot seedlings where entire rows can be destroyed overnight.

Management:

- 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). Check the product label for application rates.

Leafhopper

The leaf hopper (*Empoasca* sp) is a small bright green insect which appears to jump or hop from the leaves when they are disturbed, hence the name. There is another brown species (currently unidentified) which is relatively new to the island and not so common, but it is also a pest. Leafhoppers suck plant sap and attack a wide range of plants but usually only the younger stages. It is rarely bad enough to justify pesticide use. Encouraging seedlings to grow quickly and strong through good composting, fertilizing and watering will often leave leafhoppers behind.

Signs to look out for:

- Pale spots on the leaves, with a characteristic speckled appearance.

Management:

- If leafhopper attack is high to the point where plant survival is compromised, use a systemic insecticide such Aphicide (active ingredient dimethoate). Check the product label for application rates.

Other problems

Germination problems:

Carrot seed is quite sensitive to the depth of planting, and germination problems are common. If seed is planted too deep poor germination will result and this is often reported as a pest attack, blaming caterpillar or crickets. With pests, however, the seedlings appear before they are cut down, whereas with germination problems, few or no young plants appear above the ground.

Greening:

The top of the carrot root will go green if it is exposed to sunlight. It is not poisonous but looks ugly and affects the market price. It can be prevented by ensuring that the tops of the roots re covered in soil.

Fanging:

Fanging is the name given to roots which have split to two or three from a single top. This is either due to too much nitrogen in the soil. If it is common in your plot you are advised to rotate the planting of carrots with an alternative crop such as cabbages or similar leafy crops, which like high nitrogen. They will reduce the nitrogen levels for the next planting of carrots.

It can also be due to stony soils, as the stones stop the root from growing straight. In this case, if it is not feasible to remove the stones, consider planting alternative crops.

Bitter taste:

The sweetness of carrots will depend on the soil and amount of sunlight reaching the crop. Bitter carrots can be due to many things, many of them incurable, such as the direction the plot faces (north, south, east or west) and the amount of shade given by surrounding hills or trees.

5. Pesticide and spraying guide

Plant protection template for open field carrots

Pest / disease	Product trade name	Active ingredient	Resistance code*	Details	Harvest interval
Caterpillar, crickets	Malathion	Mercaptothion	1B	Apply as a full cover spray when needed	10 days
Leaf hopper	Aphicide	Dimethoate	1B	Apply as for "aphids"	14 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
Leaf hopper	Danadim Progress	Dimethoate	1B	Apply when need as a full cover spray	7 days
Caterpillars, crickets	Supasect	Cypermethrin	3A	Spray at 14 day intervals	3 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 available through the ANRD spraying service. In some cases the active ingredient is the same and the products are more or less identical, while in others ANRD can offer a better, professional grade product, or alternative active ingredient for resistance management.

ANRD product	Pest or disease	Locally available product
Supasect (cypermethrin)	Caterpillars, crickets	Garden Ripcord (cypermethrin) Malathion (mercaptothion)
Danadim Progress (dimethoate)	Cabbage aphid, leaf miner	Aphicide (dimethoate)

6. 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