AGRICULTURE AND NATURAL RESOURCES DIVISION

Plant Protection Guide for Open Field Production

Brassicas

(cabbage, broccoli and cauliflower)

January 2015

Introduction

This guide is written to assist farmers growing brassicas 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 brassicas.

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 brassicas. 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, 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 discoloured leaves, insect droppings,and leaves with small windows scrapped into them, or holes.
- 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 such as those helping to keep diamondback moth numbers low.
- 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.

- Brassicas like heavy clay soils (eg those in theSt Paul's area)
- Brassicas prefer alkaline soils, with slight differences between them:

- Cabbages pH 6 to 7.5
- Broccoli pH 6 to 7
- Cauliflower pH 5.5 to 7.5

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

Brassicas grow best over the cooler winter period, May to November.

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

Summer brassicas (October to April):

- Ringspot
- Cabbage aphid
- Diamondback moth
- Leaf miner

Winter brassicas (May to September):

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

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

- Caterpillars
- Slugs

Other problems which can occur with brassicas are:

- Bumpy leaf

3. Specific information on target pests and diseases

Fungal diseases

Ringspot

In wetter weather brassicas sometimes get infected with a fungus which causes round, brown spots on the leaves, called Ringspot. Badly infected plants will not thrive and yields are affected. Funguses spread themselves by sending out very fine spores on the wind. They only do this when the weather is damp and so fungus problems are rare in hot dry weather.

Ringspot is not very common in St Helena.

Signs to look out for:

- Round brown spots on the leaves.

Management:

- If the plants are badly affected by the time you see the spots it may be too late to save them as the fungus will be well entrenched. Pull out the affected plants and burn them. If you leave them lying on the headlands or put them on the compost heap the fungal spores will be able to spread out on the wind and infect other plants.
- If you catch it early, a spray with a copper fungicide such as Virikop (active ingredient copper oxychloride) will help. Spray according to the label instructions.

Insect pests

Cabbage aphid

There are many different kinds of aphid in St Helena and the species which attacks brassicas is specific to this type of crop. The cabbage aphid, *Brevicoryne brassicae*, feeds by sticking her needle like mouth into the plant leaf and sucking out the plant juice.

The female aphid can produce live young without mating, all her offspring are female and are capable of bearing life female young in their turn. This means that numbers can get very high very quickly and a single individual can start a new infestation on her own. Most individuals don't have wings but winged ones are produced occasionally, and their job is to fly off and find new plants.

Signs to look out for:

- Leaves lose colour and turn yellow.
- The aphids are blue grey in colour and occur in dense groups tucked on the underside of leaves. They are often overlooked until numbers get very high. There can be one or two very badly affected plants among others with few or no aphids on them.
- Ladybirds, hoverfly larvae and lacewing larvae all take aphids and one sign that you have infested cabbages will be observations of larger than usual numbers of these natural enemies hunting on the crop.

Management:

Biological control

There are at least two species of small parasitic wasp present on St Helena (see photo to the right) which presumably arrived at the same time as the pest. Sadly, they don't seem to be able to give control when aphid numbers are high, probably because the aphids breed so fast.

Stung aphids can be spotted very easily because they form a smooth brown skin over the aphid body; these are called "mummies".

Pesticides

- For early infestations, to prevent them spreading or building higher and encourage natural enemies, spray a 2% soap solution every 2 or 3 days.
- For higher infestations use a systemic spray (one which works by entering the plants system so that the aphids suck it up with the plant juice when they feed) such as Aphicide (active ingredient dimethoate), applied according to label instructions. Some natural enemies will be killed accidentally but most will survive.

Diamondback moth

The diamondback moth (DBM, *Plutella xylostella*) has a long history on St Helena, being known from the nineteenth century. It was recorded present but not a major pest in 1959 but by the 1990s it had become the main pest of brassicas, probably due to overuse of pesticides from the 1960s onwards which led to high levels of pesticide resistance in DBM and killed off all the natural enemies. By 1997 the DBM had become effectively uncontrollable and was having a major impact on cabbage growing.

The adult moth gives the name as it has a pattern of three diamond shapes on its back. The caterpillar is small and bright green, with no markings. It is very wriggly if disturbed, jumping off the leaf to hang below on a silk line. Young army worm caterpillars can be similar in size and colour but they just curl up when disturbed and are not so wriggly.

The first stage of the larva is as a leaf miner, inside the leaf, where it is very hard to kill.

DBM is mostly a problem for cabbages as it is a pest of leaves; for broccoli and cauliflower the leaves are less important and it isn't cost-effective to control a light infestation.

Signs to look out for:

- Windows in leaves as the caterpillars scrape the green tissue from the underside to leave the transparent leaf skin. These windows are characteristic of DBM.
- Holes in leaves, typically smaller than those caused by caterpillars (1 to 2 cm in diameter, or less)

Management:

Cabbage varieties

Some varieties are more susceptible to DBM than others. Select these varieties to grow in winter, when pests are least active, and more resistant varieties in summer.

Copenhagen is a popular variety of cabbage but is very vulnerable to pests such as DBM and caterpillars due to the very characteristics which make it popular to people, it's relatively soft, sweet leaves. This variety should therefore only be planted in winter.

Greenstar is rarely attacked by DBM. Red cabbage varieties such as Red Drumhead are also rarely attacked by pests and their slightly peppery flavour makes them highly prized by many consumers.

Biological control

DBM was the subject of a biological control programme in 1998 in order to overcome the problem of pesticide resistance. Now, three introduced biological control agents (the parasitic wasps (*Diadegma* sp., *Cotesia plutellae* and *Diadromus collaris*) together give control in most cases, although outbreaks can still occur in the hotter, summer months.

Biological control agents can be encouraged into the plot by planting rows or clumps of flowers such as parsley or marigolds, as the adult wasps feed on nectar.

Pesticides

DBM isn't very susceptible to pesticides but the biological control agents are, therefore care needs to be taken when considering sprays as you can end up making the situation worse, not better.

A general insecticide such as Garden Ripcord (active ingredient cypermethrin) or Malathion (active ingredient mercaptothion) can be effective **if** it is used infrequently and according to label directions. If used too often, DBM quickly becomes resistant and the biological control agents are killed off.

A more sustainable solution is to use the microbial pesticide known as "Bt", common trade name Dipel (active ingredient *Bacillus thuringiensis*). This is specific to DBM and young

caterpillars which eat the sprayed leaves and die within 1 to 3 days. Biological control agents are unaffected and can continue to hunt and kills the surviving DBM. A Dipel application is available via the ANRD spraying service.

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 (see the photo above).

Management:

Pesticides will kill off the 3 biological control agents searching for diamondback moth and can end up causing more harm than good (see the section on diamondback moth), so must be used with some caution if diamondback moth is also present.

- If infestation is localised nip off all the caterpillars seen, both large and small, and either squash or drown them.
- If caterpillar infestation is widespread use a general insecticide such as Garden Ripcord (active ingredient cypermethrin). Check the product label for application rates.
- If diamondback moth is also present you may need to contact ANRD to apply Dipel (active ingredient *Bacillus thuringiensis*) after applying the general insecticide to prevent an outbreak of diamondback moth. Note that Dipel will control young caterpillars, so a single application of Dipel could be used to give control of both caterpillars and diamondback moth without using general insecticides, as long as the caterpillars are mostly small.

Leaf miner

The leaf miner (*Liriomyza brassicae*) is the grub of a small black and gold fly (see photo above) which can be seen sitting on the edges of brassica leaves in sunny weather. The egg is laid inside the leaf and the fly maggot grows up inside in complete protection, creating distinctive tunnels inside the leaf. The maggot can be seen outside sometimes, when the leaf gets very hot or waterlogged, it is bright orange and 2 to 4 mm long.

Leaf miners attack the thicker, outer leaves of plants and tend not to go for the inner leaves which are too thin for the maggots to grow in.

Signs to look out for:

- The pale track of tunnels inside the leaf.

Management:

Pesticides are rarely required as leaf miners target the outer leaves of younger plants and it isn't worth spraying as damage caused won't affect the final crop. Also, there is a negative interaction between managing leaf miner and the much more serious pest, diamondback moth. Pesticides applied for leaf miner will kill off the 3 biological control agents searching for diamondback moth and end up causing more harm than good (see the section above on diamondback moth). Encouraging seedlings to grow quickly and strong through good composting, fertilizing and watering will usually leave leaf miners behind.

<u>Biological control</u>

Because of the risk of spraying to control leaf miner can end up causing a bigger diamondback moth outbreak, the Integrated Pest Management programme in 1998 introduced a biological control agent for leaf miner, the parasitic wasp *Diglyphus begini*.

<u>Pesticides</u>

- Only **if** leaf miner attack is high to the point where plant survival is compromised, use a general insecticide such as Garden Ripcord (active ingredient cypermethrin), or a systemic insecticide such Aphicide (active ingredient dimethoate). Check the product label for application rates.

Slugs and snails

Slugs and snails are voracious pests of many plants and can be difficult to control. There are at least two species of snail (the introduced *Helix aspersa* and endemic *Succinea sanctae helenae*) and one species of slug (*Milax gagates*) of concern to the farmer, and probably more. Slugs and snails both require moist conditions to flourish and a vegetable plot provides an ideal environment for them and their silvery trails can be seen criss-crossing the ground in the mornings.

Signs to look out for:

- Silvery slime trails on leaves or on the ground (see photo above)
- Holes in leaves

Management:

- Keep the area clear of weeds and decaying vegetation which can act as refuges for slugs and snails overnight.
- Don't plant brassicas too close together or the mature plants form a dense, impenetrable leafy canopy. This creates a favourable microclimate underneath for pests such as lugs and snails.
- Mulches of wood ash, ground eggshell, sharp grit, ginger or fennel leaves will repel slugs and snails.
- A 50% solution of vinegar sprayed onto the plants is said to help.
- Slug and snail traps can be made from margarine tubs sunk into the ground with about one inch of the rim sticking up so that ladybirds and ground beetles don't fall in (these are beneficial insects to the farmer). Bait the trap with a puddle of beer or fermenting brew made from sugar, water and yeast. Aim for 1 trap for every 10 square feet of ground to be protected. These can protect seed beds effectively.
- If all else fails there are a range of slug pellets available locally. Note that slug pellets are poisonous to dogs but dogs find them very attractive, so if you have a dog make sure you place the pellets out of reach, under a raised stone for example.

Other problems

Bumpy leaf:
This is a condition of the larger leaves of older plants which is often seen over the summer months. It consists of lots of small bumps on the outer leaves and can appear overnight. The condition is believed to be the result of a large change in air temperature from the hot day to the cool night.

The cells at the surface of the thicker leaves are not as flexible as those on the younger ones and so burst, giving the bumps we see. It is not a pest and there is no control required – the outer leaves are not the ones you'd want to harvest and they are still fit for animal feed or composting.

4. Pesticide and spraying guide

Plant protection template for open field brassicas

Pest / disease	Product trade name	Active ingredient	Resistance code*	Details	Harvest interval
Ringspot	Virikop	Copper oxychloride	M1	Follow label instructions for "Crucifers: Bacterial Spot"	3 days
Cabbage aphid	Aphicide	Dimethoate	1B	Apply when needed as a full cover spray	14 days
Diamondback moth				Diamondback moth is resistant to most pesticides	
Caterpillar	Garden Ripcord	Cypermethrin	3A	Follow label instructions for "Cruciferae"	4 days
Leaf miner	Garden Ripcord Aphicide	Cypermethrin Dimethoate	3A 1B	Follow label instructions for "Cruciferae" Apply as for "aphids"	4 days 14 days
Slug and snails	Various commercial slug pellets	Various		Follow label instruction and protect from dogs	

*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
Cabbage aphid	Danadim Progress	Dimethoate	1B	Apply when need as a full cover spray	7 days
Diamondback moth	Dipel	*Bacillus thuringiensis*	11	Apply when need as a full cover spray	0
Caterpillars	Supasect	Cypermethrin	3A	Spray at 14 day intervals	3 days
Leaf miner	Danadim Progress	Dimethoate	1B	Apply when need as a full cover spray	7 days

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

ANRD products: tank mixes – what can be sprayed with what

	Danadim	Dipel	Supasect
Danadim		Yes	Yes?
Dipel			No

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
Dipel (*Bacillus thuringiensis*)	Diamondback moth	No biopesticide available
Supasect (cypermethrin)	Caterpillars, leaf miner	Garden Ripcord (cypermethrin)
Danadim Progress (dimethoate)	Cabbage aphid, leaf miner	Aphicide (dimethoate)

Copper based fungicide not stocked	Ringspot	Viricop (copper oxychloride)

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