Good Agricultural Practice Procedures for the control of *Ceratitis capitata* (Mediterranean fruit fly) and *Ceratitis rosa* (Natal fruit fly) on table grapes destined for export to the People's Republic of China

Standard practice under South African conditions

1. NATURE AND SCOPE OF PROBLEM

Ceratitis capitata, Mediterranean fruit fly, and *Ceratitis rosa*, Natal fruit fly, are polyphagous fruit fly species that attack many economic crops. They are serious pests of pome fruit, stone fruit and table grapes in South Africa, and control in orchards and vineyards is standard practice.

Fruit flies do not generally originate in commercial fruit plantings. At the beginning of each season and up until about December, most commercial vineyards are essentially free from fruit flies, as there are few if any fruits attractive to fruit flies and susceptible to infestation. All infestation in commercial vineyards originates from neglected host trees and wild host plants in home gardens in cities, towns and villages, and on farms and in natural vegetation. Fruit flies only move into commercial vineyards once fruit starts ripening and develops colour and aroma. Most commercial fruit is infested shortly before harvest.

Adult fruit flies feed on a variety of substances, including the juice of damaged fruits, nectar, plant sap, honeydew from aphids, mealybugs and scale insects, and even bird droppings. After mating, female fruit flies actively seek out ripening fruit and puncture the fruit with their ovipositors to lays eggs just beneath the skin. Oviposition sites appear as small brown spots on the surface of the fruit. Fungi and bacteria may enter these punctures causing secondary infections. Larvae tunnel into the fruit to feed. Once mature, larvae leave the fruit, fall to the ground and pupate just below the surface of the soil.

The key to prevention of infestation of commercial table grapes is to control fruit fly populations successfully and timeously in their breeding grounds – gardens, backyards and wild hosts – <u>before</u> they move into commercial vineyards.

2. MONITORING

A number of different trap designs and lures are available. So-called sticky traps consist of a synthetic sex pheromone-like attractant (a 'para-pheromone'), usually trimedlure or capilure, which attracts only males, and a sticky base to trap the flies that enter the trap. These lures attract both Medfly and Natal fly, although Natal fly is reported to be less attracted to trimedlure than Medfly. In vineyards under the sterile insect technique (SIT), dry traps containing a synthetic food lure attracting both sexes of both species are used.

<u>For conventional chemical control</u>:

- Place traps at a density of 1 trap per 2 ha at the beginning of the season.
- Place traps inside the canopies of vines at about head height, making sure the entrances to the trap are always clear.
- Monitor traps weekly on the same day of the week, continuing for 4 to 6 weeks after harvest. Trap catches should be expressed as flies per trap per day.
- Follow the manufacturer's instructions for trap maintenance and change lures and trap bottoms (where applicable) accordingly.
- Apply control as soon as the first fruit flies are caught in the traps.

<u>For vineyards under area-wide control using SIT</u>:

- Use Chempac® traps. As SIT is an area-wide technique, place traps at a density of 1 trap per 49 ha.

- Monitor traps weekly on the same day of the week. Separately record the species and the numbers of males and females, as well as sterile flies (marked with a fluorescent dye) and wild flies. The presence of wild females indicates the degree of success of the SIT programme.
- If fruit flies are caught in the traps, consult an SIT adviser on the best treatment.

3. CONTROL

Control in fruit fly breeding grounds

Attention should be given to hot spots in non-commercial and wild hosts. If required, control in alternate hosts and home gardens involves the use of bait sprays and/or bait stations, proper sanitation, fruit stripping, and even tree removal.

Control in the vineyard

Control using bait sprays

The main aim of a bait spray is to kill the female fruit flies before they lay eggs, i.e. within 7 days of them emerging from the soil.

- All bait should be applied as coarse droplets (±1-4 mm diameter for bearing vines, to minimize fruit spotting, and ±4-6 mm diameter for non-bearing vines, post-harvest, or non-commercial shrubs and trees). Large droplets are more attractive to flies, and remain damp (and therefore more effective) longer.
- Apply bait weekly to the centre of the vines in an upwards direction to get most droplets on the undersides of the leaves, where most of the fruit flies are found and where it is protected from UV light and rain.
- Apply the bait in the early morning so that it is the fruit flies' first meal of the day – after flies have fed in the morning they may not feed again for a while.
- In very hot, dry conditions twice-weekly applications should be considered.
- Repeat applications of especially the protein/insecticide mixture after rain.
- Continue baiting at least four weeks after harvest to control fruit flies emerging from pupae in the ground. Stop baiting only when no more fruit flies are caught in traps. However, a year-round baiting programme, concentrating in winter on evergreen trees and shrubs around home gardens, gives the best results.
- Two kinds of bait spray are available:

  o A mixture of protein hydrolysate (e.g. Hym-Lure or Nasimex), insecticide (mercaptothion) and water.
  A typical recipe for a protein bait spray is 500 ml mercaptothion 50% EC plus protein hydrolysate (at varying doses depending on the protein hydrolysate used) in 100 L water. Coarse droplets should be applied at 50 to 75 L bait per ha (= 125-187.5 ml mercaptothion a.i./ha). Consult the label and a pest management adviser for further details and application directions.
  Sugar should not be used as an attractant, since it does not attract fruit flies, but merely stimulates them to feed.

  o GF-120 Naturalyte, which is a ready-made bait concentrate containing 0.24 g/L spinosad as the toxin. From 1.0 to 1.2 L GF-120 should be mixed with 4 to 29 L of water – the higher dilution being recommended for fruit trees and vines, and the lower dilution for non fruit-bearing plants. It should be applied in large, scattered droplets at 20 to 30 L bait mixture per ha. GF-120 should be mixed very well before application, and should be applied with equipment purpose-built for GF-120. Consult the label and a GF-120 adviser.

GF-120 is the bait of choice due to its high efficacy and its very favorable ecological profile. It is registered for application by ground or air on all fruit kinds.

Aerial application:

- The aerial application of concentrated fruit fly bait is a very effective manner of fruit fly population suppression.
- For aerial application 1 L GF-120 should be mixed with 1 to 3 L of water and applied at a rate of 2 to 4 L per ha.
- Aerial application must be made with the correct equipment. Details on the type of dispensing tubes and swathe width etc. should be obtained from the GF-120 distributor.

Control using bait stations ('attract & kill')

A bait station is a device loaded with an attractant and insecticide formulation similar to fruit fly bait, which is hung in trees. Fruit flies are attracted to the bait station, feed on the bait and die. The most commonly used is the M3 bait station which is a ready-to-use device containing protein hydrolysate, plant extracts and alpha-cypermethrin in a sponge dispenser. The recommendation is to hang 400 M3 bait stations per ha. Their life-span is up to 3 months, depending on climatic conditions. Magnet Med has been recently registered on stone fruit, pome fruit and grapevines at 50-75 units per ha. Magnet Med contains deltamethrin and has a life span of up to 6 months.

Area-wide control using SIT

This is an integrated strategy which involves mass rearing Medflies in millions per week, sterilizing the males and releasing them weekly in high numbers in specified target areas – under current procedures, mostly in home gardens, backyards and fruit fly hotspots. The sterile males mate with wild, fertile females which then cannot lay fertile eggs. If all actions are carried out correctly, the wild Medfly population rapidly declines after a number of successive generations. SIT must go hand in hand with excellent sanitation and other cultural practices, including bait applications to fruit fly hotspots. Bait sprays should also be applied whenever fruit flies are found in traps in vineyards.

Control using full-cover sprays

In cases of heavy infestation full-cover sprays of registered insecticides can be applied to all trees in every row at varying intervals before harvest. Follow the manufacturer's instructions for dosage, application directions and minimum time between last application and harvest. NB. Withholding periods and residue levels applicable to the markets for which the fruit is destined should be taken into account.

Cultural control measures

- Weekly sanitation is essential. Fallen or out-of-season fruit should be removed and immediately shredded or buried at least 1 metre deep.
- After harvesting, all remaining fruit must be stripped and disposed of as above, or control measures must be maintained until the vineyard has been thoroughly stripped.

Packhouses

Packhouse workers must be trained in identification of infested fruit. Rejected fruit must be removed from the packhouse and destroyed.

4. RECORDS

The following records should be kept in good order and be available at all times for inspection:

- Trap counts;
- Dates when lures and bottoms (where appropriate) were changed;
- Control methods used;
- Dates and volumes of bait sprays (and full-cover sprays, if applied) used, and
- Products used in bait sprays and full-cover sprays.