ORCHARD INSPECTION

1 INTRODUCTION

Efficient inspection is the cornerstone of, and fundamental to, both IPM and these guidelines. A good inspection system provides early warning of developing pest populations, reinfestation which may occur after treatment and provides information on performance of the biocontrol complex. Where natural enemies are expected to provide control, inspection is required to ascertain whether such expectations are being fulfilled. In addition, orchard inspections may be an essential phytosanitary requirement for access to certain export markets. Orchard inspections can therefore assist in the following ways:

- Immediate decision making based on intervention thresholds.
- Intra-seasonal decision making based on pest and natural enemy trends.
- Inter-seasonal decision making based on comparisons of results between seasons.
- Choice of market based on fruit infestation levels for phytosanitary pests.

The following issues will be important facets of any inspection system:

- Training of scouts.
- Farm and orchard maps.
- Inspection sites in orchards.
- Inspection procedure.
- Recording of inspection data.
- Interpretation of inspection data.

2 ORCHARD SCOUTS

An orchard inspection system is totally dependent on the scouts used to inspect the orchards. The position of orchard scout should be seen as the most important and influential job for any labourer on the farm. Candidates should meet the following criteria:

- They must be shown to have 20/20 vision.
- They must have a positive attitude towards their job, otherwise they will not be accurate or thorough enough.
- They must be well trained.
- They must understand the principles of scouting so that they do not bias results to please their employer.

There is an unavoidable monotony aspect to routine inspection that needs to be countered. The basic requirements to minimize this factor are training, motivation and dissemination of information on interpretation of counts with consequent decisions. Incentives for good work should also be considered.

Apart from initial training in basic identification of pests, damage symptoms and natural enemies, scouts should be checked at regular intervals to see whether they are maintaining standards. This is particularly important in the case of cursory examinations. It is therefore best to have more than one scout to reduce the risk of poor decisions based on erroneous information. Ideally, trained scouts should be adaptable enough to notice and record problems of very infrequent occurrence.

3 FARM AND ORCHARD MAPS

Orchard maps facilitate the organisation of inspection systems, the interpretation of inspection data and subsequent execution of control operations. They need not be to scale and can simply comprise orchard outlines on a general plan of the farm or part of a farm in the case of large plantings. Aerial photographs of plantings are useful when preparing the maps. Depicted areas should preferably be prepared in a format that can be easily photocopied. The maps can be used to record various aspects of orchard operations, siting of inspection points or routes, and fluctuations in pest presence. Colour-coded pins or crayons can, for example, be used to represent different degrees of pest infestation.

Copies of the maps can be utilised to show the development of a particular pest infestation in the same area. A Geographic Information System (GIS) can be a valuable tool for this purpose.

These general suggestions can be adapted to suit individual needs. The basic point is that the maps should provide farm management with updated information on pest and natural enemy population levels so that appropriate action can be taken when needed.

4 INSPECTION SITES IN ORCHARDS

In Paragraph 8 below and under the appropriate pest in Chapter 3, certain traps are described which can be utilised to monitor the presence of specific pests. They need to be located in orchards according to prescribed requirements. However, in the case of most pests listed in these guidelines, it is necessary to inspect relevant infestation sites on the trees themselves. This can either be done by designating specific, representative and permanent data collection trees in orchards, or by selecting trees at random along a representative transect through the orchard. The use of **permanent data trees** has two distinct advantages:

- They increase the sensitivity of the inspection programme.
- They facilitate the checking of survey data as required.

The number of trees per orchard or block designated for regular inspection will depend on the block size, topography and the staff available for inspection. **It is recommended that 5 trees be inspected per hectare.** Small isolated blocks of less than 1 ha still require 5 data trees. However, in the case of extremely large, uniform blocks, fewer trees per hectare can be used.

Whether permanent or randomly selected data trees are used for monitoring, they should be laid out according to a pattern suited to the orchard concerned. The simplest pattern may be a diagonal transect where the first or "location tree" can be placed on the outer corner of an orchard and other trees selected every couple of rows on a diagonal line towards the opposite corner of the block. With larger blocks, the trees can be spaced out along a “V”- or “W”-shaped path. Suitably numbered marks or plaques can be fixed to the trunks of permanent data trees so that they can be easily recognised by the scouts concerned. With time, scouts will become well aware of the position and number of each data tree.

The results of orchard inspection act as early warning systems of pest presence and provide an indication of the efficacy of control options used. Over time, it can be expected that permanent data trees will provide the basic information for formulating control policy against various pests in the area they represent. Until this stage is reached for particular pests, and in the case of pests such as bollworm which can cause serious damage rapidly on a patchy basis, rapid sweep surveys can be conducted in the general area of data trees to confirm that they are reflecting the pest position in the area concerned. Where pest treatment threshold levels are exceeded, assessments of natural enemy populations should be conducted before deciding on what action to take.

5 INSPECTION PROCEDURE

Nationally and internationally, inspection is often based on what has been termed **impression surveys**. With this informal approach scouts move about orchards according to individual preferences and form impressions of pest presence that are then conveyed to management in subjective terms.

Experienced scouts can no doubt form reliable impressions of the pest situation with such surveys. However, it remains difficult, if not tedious, for management to check the accuracy of the inspection reports received. It is also difficult to use such reports to promote long-term growth in pest control expertise. Furthermore, if scouts move away from a planting their knowledge goes with them and their replacements must start to accumulate information from scratch. For these reasons it is considered that inspections on individual trees should be conducted according to a formally defined procedure. This system is sensitive, easy to supervise and facilitates the recording of data and case histories for future short or long term reference.

The designation of **inspection units** on a data tree will be related to the pests involved. They will usually encompass the range: Terminal twigs, leaves, blossom or new growth clusters and fruit. **None of these plant parts should be removed during inspection**. In most cases the units commence their existence free of pest damage. Therefore the progressive infestation of, or damage to units, recorded on a "present or absent" basis, will readily clarify the development of a pest infestation and indicate natural enemy activity. Examination of 10 units

per data tree will provide the required sensitivity and simultaneously simplify calculations to record data in percentage form.

Such counts can be supplemented by **cursory examinations** of tree canopy and framework for initial signs of pest and natural enemy presence which can be noted, e.g., ants, red scale on wood, coccinellid larvae on ant bands. The combination of specific counts and cursory examinations conducted on a regular basis will yield a sensitive record of pest and natural enemy activity. In practice, from early spring to Christmas, enough pests are usually present to require weekly inspections.

6 RECORDING INSPECTION DATA

The results of each inspection round should be recorded for permanent reference. Such records will enable both control programmes and seasons to be compared. They will also maintain inspection continuity in the event of staff changes.

The total tabular layout used for recording inspection data will need to be tailored to meet the requirements of particular plantings. In practice, separate tables are usually required for recording data in the field and preparing summaries for reference purposes. Where necessary the latter can be converted into presentations involving graphs or orchard maps to readily indicate the location and status of infestations.

In tables for use by pest scouts it has been found to be convenient to dedicate one 10 by 10 square table to an individual pest or natural enemy on a particular plant unit. Four such tables can be fitted on an A4 sheet (Figure 1) so that up to four different pests or natural enemies on different plant units can be monitored simultaneously in one 2 ha block (larger orchards will require more trees and therefore more than one sheet). On each tree, 10 units of a particular type are examined for the presence or absence of the selected pest/natural enemy or its damage/feeding symptoms. The presence of a single pest/natural enemy specimen or any degree of recent damage will result in the unit being regarded as infested and this will be noted in the particular square.

Apart from the squares assigned to individual plant units, two columns of squares to the right of each table can be used to record the total number of units infested per tree.

Alternatively, these columns can also be used to enter symbols representing any other pest that may have been observed in the cursory examination of that particular tree. The symbols for use in this manner are defined in CRI's Identification Manual for Citrus Pests and natural enemies along with photographs and information on the pests and certain natural enemies. (In Figure 1 the results of cursory examinations were entered in the fourth 10 by 10 block which was not being used for a specific pest/natural enemy.) The percentage of plant units infested with a particular pest or natural enemy can be rapidly determined from each table. In addition, the need to quantify infestations of additional pests or the population levels of specific natural enemies, recorded in cursory examinations, can be based on the number of trees on which these were recorded. Below each table a space is provided for further general comments.

7 INTERPRETATION OF INSPECTION DATA

Over time, regular inspection and the related written records will provide a good basis for fine-tuning intervention thresholds for pests in a particular planting. This will promote strategies which favour natural enemy activity.

During the early phases of interpreting data from a recently initiated inspection system, it will be reasonable to adopt a conservative attitude to pest presence in order to avoid crop loss or tree damage. The size of the area to be treated can be related to the threat posed by the particular pest.

7.1 A simulated inspection exercise

Figure 1 is intended to simulate the results of an inspection conducted in a 2 ha grapefruit orchard in Mpumalanga approximately 6 weeks after petal fall. The following interpretation of the simulated data is offered as an exercise in the use of systematic inspection. The comments relate only to the information and inspection data concerned and ignore the probability that there

were additional inspections in previous weeks that could have resulted in treatments being applied. The specific pests and natural enemies which the pest scout was asked to inspect for were citrus thrips (larvae and adults) on the fruit, live mealybug under the calyx and on the fruit cheeks, live red scale and *Aphytis* adults on the twigs. Cursory examinations of the 10 data collection trees were requested to determine whether there were any other problems.

7.1.1 Fruit

The examination of fruitlets indicated a low infestation of mealybug which should be controlled biologically, provided ant control is maintained and disruptive sprays not applied. The infestation by thrips requires immediate action, preferably with a product which will cause minimal disruption to the natural enemy complex of mealybug.

7.1.2 Twigs

The extent of red scale infestation of terminal twigs confirms the need for a summer oil spray within three weeks because numbers of *Aphytis* are relatively low.

7.1.3 Cursory examinations

These inspections indicate the fairly general presence of aphids on the new growth flush producing honeydew resulting in the formation of sooty mould on the foliage canopy. The growth of sooty mould will be stopped by the oil spray for red scale. If baits are to be used for thrips control a treatment for the aphids will have to be applied. Ant activity indicates that trunk bands for the control of these pests must be checked for bridges. The presence of *Nephus* sp. larvae on the ant bands confirms that the low mealybug infestation will probably be controlled biologically. Lowveld citrus mite is on the increase on the foliage but will be controlled by the oil spray for red scale. The presence of a degree of fruit and foliage burn on the lower canopy of data trees requires immediate attention by management to determine the cause. If it can be attributed to a weedkiller or other operation that is still in progress, immediate steps must be taken to alert the operators concerned to prevent further damage. Subsequent inspections will indicate the impact of the suggested treatments and also the suitability of the decisions taken.

8 INSECT TRAPS FOR MONITORING

A wide range of traps is used internationally to monitor specific pest populations on various crops. Several traps are available for the monitoring of insects in southern African citrus orchards. The use of available traps reduces the possibility of applying unnecessary and disruptive treatments for the control of citrus thrips, false codling moth (FCM), fruit fly and leafhoppers. In the case of phytosanitary pests such as fruit flies and FCM, which are difficult to monitor in any other way, they offer a means of ensuring that the control of these pests is adequate. In these guidelines yellow adhesive traps for attracting citrus thrips, leafhoppers and many natural enemies are discussed under citrus thrips in Chapter 3; red scale pheromone traps are discussed under red scale; dry plastic traps containing lures for fruit flies under fruit flies, and a sticky pheromone trap for FCM is discussed under FCM.

NAME:	Joe	ORCHARD:	Sand 3
PEST:	Thrips	DATE:	7/11
UNIT:	Fruit		

UNIT

TREE	1	2	3	4	5	6	7	8	9	10	L	A
1			L					A			1	1
2	A		A				L				1	2
3		L			L						2	
4									A			1
5							L				1	
6				A								1
7					A			L			1	1
8												
9	A				L						1	1
10											1	
L=Larvae, A-adults											8	7

NAME:	Joe	ORCHARD:	Sand 3
PEST:	M/bug	DATE:	7/11
UNIT:	Fruit		

UNIT

TREE	1	2	3	4	5	6	7	8	9	10	C	S
1			C	C			S		C		3	1
2	C							C			2	
3					C		S				2	1
4										C	1	
5				C						C	2	
6		C									1	
7			C								1	
8												
9					C			C	S		2	1
10									C		1	
C=calyx, S=side of fruit											15	3

NAME:	Joe	ORCHARD:	Sand 3
PEST:	Red scale	DATE:	7/11
UNIT:	Twigs		

UNIT

TREE	1	2	3	4	5	6	7	8	9	10	RS	A
1		RS					A			RS	2	1
2												
3					A							1
4												
5												
6												
7									A			1
8		RS									1	
9												
10						A					1	
											4	3

RS = Red scale

A = Aphytis

NAME:	Joe	ORCHARD:	Sand 3
PEST:	Others	DATE:	7/11
UNIT:	Whole tree		

UNIT

TREE	1	2	3	4	5	6	7	8	9	10
1	A	AP								
2			O	N						
3	A	AP		N						
4			O							
5			O							
6	A	AP		N						
7		AP								
8				N						
9	A	AP								
10										
	4	5	3	4						

A = Ants, AP = aphids

O = lowveld mite, N = Nephus

Sooty mould where AP bad

Leaf & fruit burn on low branches

Figure 1. An example of scouting records in a grapefruit orchard in Mpumalanga.