Fruit flies and avocado production

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ARC-TROPICAL AND SUBTROPICAL CROPS

FRUIT FLY SPECIES ASSOCIATED WITH AVOCADO PRODUCTION
In South Africa, the Mediterranean fruit fly, Ceratitis capitata (Wiedemann), the Marula fruit fly, Ceratitis cosyma (Walker), the Natal fruit fly, Ceratitis rosa Karsch and the Cape fruit fly, Ceratitis quilicii De Meyer, Mwatawala and Virgilio are four fruit fly species associated with avocado production. The Natal fruit fly was split into two species and the Cape fruit fly was described as a new species. All the above-mentioned fruit flies are indigenous to South Africa. The Mediterranean fruit fly is considered to be of lesser importance and numbers are usually lower in orchards in comparison to the other Ceratitis spp. Of the two closely related species, the Cape fruit fly has the widest distribution and, at this stage, it seems that the Natal fruit fly is more restricted to the lower altitude areas in the northern part of the country. The Oriental fruit fly, Bactrocera dorsalis (Hendel), was reported for the first time in South Africa in 2010 in the northern part of the country. The Oriental fruit fly is an invasive species of Asian origin. It is considered to be present in Limpopo, Mpumalanga, Gauteng, North West and some district municipalities of KwaZulu-Natal but is absent from the Northern Cape, Western Cape, Eastern Cape and Free State. Therefore, the Oriental fruit fly is present in the main subtropical fruit production areas of South Africa.

THE IMPORTANCE OF FRUIT FLIES FOR AVOCADO PRODUCTION
The avocado is a climacteric fruit that ripens after harvest. Some fruit fly species are not able to penetrate the hard avocado fruit. The avocado is also not a good host for the development of fruit fly species and usually, under normal orchard practices, no larval development takes place in fruit on the tree. Callus tissue formation around the fruit fly eggs deposited in the pulp has been reported. A study conducted in South Africa indicated that ‘Hass’ avocado is a conditionally non-host for the Mediterranean fruit fly and a poor but potential host for the Marula fruit fly and Natal fruit fly. Oriental fruit fly was not able to lay eggs in uncompromised fruit and larval development took place in punctured fruit in a study conducted in Tanzania and Kenya. In field studies, fruit damaged by false codling moth were found to harbour Oriental fruit fly. Therefore, the Oriental fruit fly laid eggs where the false codling moth lesions were. Fruit flies are of quarantine importance when host fruit are exported to countries where these flies are absent and can possibly become established. Although fruit flies usually do not cause a lot of damage to fruit, fruit flies can find shelter and food in avocado trees.

MONITORING OF FRUIT FLIES
Monitoring of fruit flies is very important in the management of the flies in orchards. Monitoring helps to: (1) identify species present in the orchard; (2) track changes in population levels; (3) give an indication of the numbers present; (4) determine the time for control actions to start; and (5) determine the efficacy of control measures. Pest monitoring is important for compliance to GLOBAL GAP standards. In order to obtain a removal permit from the Department of Agriculture, Forestry and Fisheries for movement of fruit from areas where Oriental fruit fly is present, evidence of monitoring and suppression must be provided. In areas where the Oriental fruit fly is absent, it is essential to do surveillance for early detection. The minimum required trap density for surveillance is 1 trap per km² or 1 trap per 100 ha, with at least 1 per Production Unit Code. The attractant recommended for the survey is the para-pheromone methyl eugenol which is used together with bucket-type traps such as Moroccan trap, Lynfield trap, Chempac Bucket trap and McPhail trap.

LURES AND TRAPS FOR MONITORING
Ceratitis fruit fly species
Monitoring of fruit flies should commence just after fruit set and should continue until harvest. Various types of traps and lures are available for the monitoring of fruit flies. Lures for monitoring fruit flies can be broadly divided into two groups, i.e. male lure and food baits. Male lures are specific and are known to have a high efficacy in attracting male fruit flies over a long distance. Food baits attract both males and females. They are not species specific, do not attract flies over a long distance and give an indication of fruit flies present in the vicinity of the trap. Food baits, however, can also attract a number of non-target insects.

Capilure is a male lure and can be used for monitoring Ceratitis species. Capilure contains trimedlure and attracts males of the Mediterranean fruit fly, Cape fruit fly and Natal fruit fly. It can be used together with a Sensus trap. Capilure does not attract the Marula fruit fly, which is an important species for avocado production. Therefore, traps baited with Capilure cannot be the only attractant used in avocado orchards for monitoring Ceratitis species.

Questlure and Biolure® Fruit Fly are food baits that can be used for monitoring Ceratitis species. Questlure contains protein hydrolysate and plant...
extracts and attracts both sexes of the Mediterranean fruit fly, Marula fruit fly, Cape fruit fly and Natal fruit fly and can be used together with a Sensus trap. Biolure® Fruit Fly contains ammonium acetate, trimethylamine hydrochloride and 1,4-diaminobutane (putrescine) and attracts both sexes of the Mediterranean fruit fly, Marula fruit fly, Cape fruit fly and Natal fruit fly. Biolure® Fruit Fly can be used together with a McPhail-type trap. Usually one of the above-mentioned traps is used per 2 hectares for monitoring of fruit flies. 

Dichlorvos containing blocks must be placed in the Chempac Bucket Trap, McPhail trap and the Sensus trap. Replacing of food attractants, male lures and dichlorvos blocks is important – follow the directions for use. Usually one trap is placed per 2 hectares of orchard after flowering until harvest. Traps must be hung on the shady side of trees between 1.5 to 2 m above the ground. Ensure that the trap entrance is free from the foliage in order to allow free air movement and easy access for flies. Traps should not be exposed to the sun, wind or dust. The wire of the trap must be coated with a sticky barrier or Vaseline to avoid the access of ants. To avoid damage to traps, do not hang them in the working space of tractors and spray machines. Trap counts should be taken every seven days.

Lures and traps for monitoring the Oriental fruit fly
Various types of traps and lures are available for the monitoring of the Oriental fruit fly. Male lures and food baits can be used for monitoring the Oriental fruit fly. Invader Lure™, M.E. Pherolure® and Chempac ME Lure are male lures and contain methyl eugenol and attract the Oriental fruit fly. Chempac Bucket-, Lynfield-, McPhail- or Moroccan trap can be used together with the methyl eugenol. In areas where the Oriental fly is not present, one methyl eugenol-containing trap must be placed per 100 hectares for surveillance purposes and continued monitoring is recommended. In areas where the Oriental fruit fly is present, one trap per 5 hectares can be used.

Biolure® Fruit Fly is a food bait and can be used for monitoring females and males of the Oriental fruit fly. A McPhail-type trap can be used with Biolure® Fruit Fly.

Dichlorvos containing blocks must be placed in the traps. Replacing of food attractants, male lures and dichlorvos blocks is important – follow the directions for use. Traps must be placed out as previously described.

Threshold levels
Growers are advised to use traps for monitoring fruit flies as well as fruit inspections to determine the presence of fruit fly lesions. Trapping is an indirect method of sampling. Fruit fly host plants near avocado orchards may influence trap catches. Growers are also advised to keep good records of fruit fly numbers trapped. These records can be used as a reference to compare each season to another. Fruit flies can be suppressed in avocado orchards by using the bait application technique. Because high numbers of the Oriental fruit fly are trapped in avocado orchards with methyl eugenol-baited traps, producers are advised to use the male annihilation technique for the Oriental fruit fly as well as the bait application technique. Although not all species can lay eggs inside the avocado and due to the fact that avocado is not a good host for the development of fruit flies, it is still important to monitor fruit fly species and inspect fruit for lesions. Thereby, producers can make informed decisions on the management of fruit flies in avocado orchards. Fruit flies can cause lesions and eggs can be laid in fruit with surface lesions or defects. Therefore, there is some risk involved when exporting avocado fruit – although the risk is negligible. As a guideline, producers must keep the different Ceratitis fruit fly species below 1 fruit fly/trap/day in the food bait lures. Therefore, less than 7 per week in Sensus traps with Questlure or McPhail-type traps with Biolure® Fruit Fly. Oriental fruit fly must be kept as close to zero as possible in McPhail-type traps with Biolure® Fruit Fly.

SUPPRESSION OF FRUIT FLY SPECIES
Bait sprays
Control is based on the use of hydrolysed proteins in combination with an insecticide. The method targets adult flies, especially females, and aims to attract and kill them before they can lay eggs in the fruit. Bait sprays suppress Ceratitis fruit fly species as well as the Oriental fruit fly. The bait attracts the fruit flies to the spot of application where they feed on the bait, ingest the insecticide and die. The spray should be targeted to lower surfaces of the leaves to enhance the persistence of the bait and reduce exposure to the sun and the chances of washing off by rain. This is applied when monitoring data indicates that fruit flies are present in high numbers. Bait applications can be applied weekly, depending on monitoring data. The bait is applied to the tree in the form of coarse droplets with a tractor-operated bait applicator. Baiting can also be done by the use of knapsack sprayers. Examples of protein hydrolysates are Hymlure RFU, Lok-Lure and Buminal. These protein hydrolysates can be used in combination with trichlorfon SP (950 g/kg active ingredient), mercaptothion WP (250 g/kg active ingredient) or mercaptothion EC (500 g/l active ingredient). Trichlorfon and mercaptothion cannot be used on export fruit. GF-120™ NF is a bait concentrate, which should first be diluted with water before being applied. The product contains spinosad and is also registered for fruit fly control. GF-120™ NF can be used on export fruit.

Bait Station
The M3 Fruit Fly Bait Station™ is registered for the control of fruit flies in subtropical fruit orchards. A high number of plastic fruit fly stations consisting of a sponge impregnated with protein hydrolysate and alpha-cypermethrin are deployed in the orchard. Four hundred per hectare are deployed in orchards and must be placed out 4 weeks before fruit become susceptible to fruit fly attack. The technique is less harmful to non-target organisms and the environment and, as the insecticide is not directly applied to the fruit, problems with residues are minimized.

Male annihilation technique
The male annihilation technique involves the attraction and killing of male fruit flies using a high density of bait stations or substrates consisting of a male lure combined with an insecticide to reduce the male population to such a low level that mating does not occur. This suppression method is recommended for control
of the Oriental fruit fly in areas where the fly is being detected in monitoring traps. The male annihilation technique must be used in combination with the application of bait sprays or with the use of bait stations. For the Oriental fruit fly, methyl eugenol is used in combination with an insecticide. Males are attracted to the bait stations or substrate and die if they come into contact with the insecticide. Fiber blocks impregnated with methyl eugenol and mercaptotiothion can be used and examples of products available in South Africa are Invader-b-Lok™. Chempac Methyl Eugenol Liquid can be used together with mercaptotiothion, and fibre blocks can be impregnated with the mixture. Static Spinosad ME™ is also available in South-Africa. It is a ready-to-use insecticidal bait substrate for selective attraction and control of the Oriental fruit fly males.

Orchard sanitation
Orchard sanitation entails the collection and removal of all fallen fruit on the ground. This can contribute towards the reduction of fruit fly numbers, because larvae can crawl out of the fruit and pupate in the soil. In avocado orchards there are usually not a lot of fruit on the ground and fruit fly larvae usually do not develop on fruit on the tree, however, soft fruit on the ground can harbour fruit flies. Removal of this fruit is labour intensive but can be effective if done on a regular basis.

Natural enemies
Parasitoids and predators are present in avocado agro-ecosystems, which can contribute to the suppression of fruit flies. Efforts to conserve natural enemies in commercial orchards through more efficient management may contribute to the overall suppression of fruit flies.

Eradication of useless host plants
Useless host plants serve as a breeding ground and source of fruit flies, and must be eradicated when found in the vicinity of the orchard. An example of such are wild-growing guavas and bugweed.

Post-harvest control
A cold-mitigating treatment to provide phytosanitary security to importing countries was developed for the Oriental fruit fly in ‘Hass’ avocado. There were no survivors in the treatment of an estimated 153,001 individuals in four replicates at an average fruit pulp temperature of 2°C. Fruit were kept at this temperature for 18 days. A cold disinfestation treatment for ‘Hass’ avocado for Mediterranean-, Natal fruit fly and Marula fruit fly was developed. The third instar of the Marula fruit fly was shown to be the most cold tolerant. No survivors were present from 49,795 third instar larvae subjected to the cold treatment at 2°C for 20 days.
Direct connection to Retail

The Fruit Farm Group South Africa is a leader in the marketing, distribution, packaging, production and propagation of fresh sub-tropical fruit from Southern Africa. The Fruit Farm Group has well-established, best-in-class operations located in strategic production regions across South Africa and other countries.

Our regenerative farming methods aim to produce the healthiest fruit and vegetables nature can grow. At the same time, we foster living soil and functioning ecosystems that work to retain water and provide plants with the nutrients they need.

We believe:
- Healthy soils produce healthy food
- A vibrant ecosystem makes our farms more successful
- The regeneration of the Earth’s natural resources is our responsibility

“TFFG have well established, ‘best in class’ partners in ripening, pre-packing & distribution centres across USA, EU, UK & India.”

“Our mission is to produce the healthiest food that nature can grow; deliver a positive impact on our environment; and inspire change across the whole food industry.”

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Ensure You Invest Wisely,
Make the Right Nutritional Choice!

Foliar fertilization is an important tool for the sustainable and productive management of crops:

✓ When soil conditions limit availability of soil applied nutrients;
✓ In conditions when high loss rates of soil applied nutrients may occur;
✓ When the stage of plant growth, the internal demand and the environment conditions interact to limit delivery of nutrients to critical plant organs;
✓ When certain foliar applications are tested and proved to result in measurable and positive plant parameter responses.