

H.F. LE ROUX & J.J. BESTER *Citrus Research International*

INTEGRATED PEST MANAGEMENT

CITRUS THRIPS T.G. Grout

Suppressing citrus thrips populations on the spring growth flush will assist in lowering populations experienced at petal fall. On younger trees a methamidophos stem treatment is a useful option for this. An alternative may be an organophosphate that cannot be sprayed after petal fall but sprays should be completed before flowers open to reduce any impact on honey bees. If mealybug requires control, the organophosphate could be sprayed at full cover. These treatments will also reduce developing populations of citrus psylla. Avoid using abamectin at this time because it will be needed for citrus thrips control in summer.

False codling moth (S.D. Moore)

It may be very tempting to neglect orchard sanitation in winter, as FCM levels are usually low and Valencias being harvested at this time are generally less susceptible to FCM than some of the earlier season cultivars. However, this would be a big mistake. It has been shown that Valencias can fulfil an overbridging role for FCM from one season to the next. The most effective way in which to ensure the lowest FCM inoculum possible at the start of a season, is to diligently continue sanitising orchards until the previous season is truly over. Most importantly, growers must ensure that no fruit whatsoever remains on trees or on the orchard floor after harvesting is completed.

BOLLWORM S.D. Moore

Depending on the region of the country, which influences temperature and blossom phenology, bollworm may begin invading orchards as early as September or even August. Growers should therefore begin weekly blossom inspections for bollworm eggs and

larvae no later than early September. Particularly if a biological product, such as DiPel, Helicovir or Bolldex, is going to be used, sprays should be applied as soon as eggs begin to hatch. This can only be determined by vigilant and regular scouting but honey bee populations will benefit if sprays need to be applied during bloom because these products are harmless to bees.

CROP AND FRUIT QUALITY MANAGEMENT

Paul Cronje & Jakkie Stander

General. It is important to keep managing and monitoring fruit pickers throughout the harvest season in order to reduce cull of export fruit, caused by picking injuries. Pruning of early- and mid-season cultivars should commence as quickly as possible after harvest to allow ample time for flower induction.

Maturity indexing. Maturity indexing is done to predict the rate of change in fruit maturity in order to harvest fruit at a maturity that would maintain acceptable commercial shelf life. The aim is to define changes or rate of change in acids and sugars and to build up a database over a number of years for comparisons. Random sampling of fruit every week from each of ten representative trees should start 4 to 6 weeks before the expected harvest date. Titratable acidity is determined by titration with sodium hydroxide, sugar content (Brix) is determined using a refractometer, the sugar:acid ratio calculated and fruit colour should be read from a colour chart. All these data should be plotted on a graph in order to determine the optimal picking window. It is important to maintain good records of the maturity indicators over a number of years, in order to identify and possibly manipulate possible problems associated with internal and external quality parameters.

Degreening and postharvest rind disorders.

The two publications "Common Defects Associated with Degreening of Citrus" by Andy Krajewski and Tim Pittaway and "Postharvest Rind Disorders of Citrus Fruit" by Paul J.R. Cronje are a must for any grower. Both are available from CRI. Contact Bella Thulare at 013 759 8000 or bella@cri.co.za.

Pruning of early and late cultivars should be done during this period as soon as possible after harvest. All the following should be removed during pruning: old, broken and dead shoots/twigs; weak and entangled shoots crossing each other; and rootstock regrowth (water shoots) or regrowth from the main frame. Light levels of 30% of full sunlight are necessary for optimal photosynthesis and light also improves colour development. In very dense trees, and especially older trees, light levels drop to below 30% inside the tree and adversely affect fruit size so at least one "window" cut should be made to allow for adequate light distribution to improve bearing wood within the tree. Increase in photosynthesis and light distribution will lead to increased fruit size and internal fruit quality, better fruit colour, increased rind condition and less variation in fruit quality within the canopy. Pruning can also be used as a thinning technique by pruning more heavily after a light crop if a heavy crop is expected and when the orchard has a history of alternate bearing. Pruning in the winter and not later than September, improves the light distribution and the quality of the bearing wood inside the tree. A follow up of regrowth removal at pruning cuts in the summer is important. Pruning tools should always be sanitised with 10% Jik when moving from one orchard to another.

One or two **pre-bloom foliar urea** applications (low biuret urea at 1%) should be applied for uniform flowering and fruit set,

especially when leaf N levels are low and a light blossom is expected.

Fruit set treatments according to cultivar requirements need to be applied. Specific treatments include the application of gibberellic acid (GA) and girdling, especially for parthenocarpic cultivars that have a poor set. Girdling during full bloom improves set. A general guideline cannot be given as fruit set treatments differ by cultivar and, in many cases, by orchard depending on the previous crop load. Moisture stress should be avoided during full bloom, fruit set and early fruit growth.

GEÏNTEGREERDE BEMESTING

J.T. Vahrmeijer

STIKSTOFBEMESTING VAN SITRUS

Aan die einde van die groei-seisoen

1. Blaar en grondmonsters moes aan die einde van die groei-seisoen geneem gewees het (Februarie tot Mei).
2. Resultate van die blaar- en grondontledings tesame met boordinligting (ouderdom van bome, onderstam, kultivar, verwagte opbrengs, ens.) word gebruik vir bemestingsaanbevelings.

Waar mikro-spuite of enige ander stelsel behalwe druppers gebruik word:

1. Begin met stikstoftoedienings in Julie met die uitsondering van die Wes-Kaap en Hartswater wat in Augustus begin.
2. Afhangende van die klei-inhoud van die grond word die stikstof tussen 1 en 4 toedienings verdeel.

Waar druppers gebruik word.

1. Begin met die stikstoftoedienings in Julie met die uitsondering van die Wes-Kaap en Hartswater wat in Augustus begin.
2. Verdeel die volumes wat per maand aanbeveel is in ten minste weeklikse toedienings.
3. Stikstoftoediening geskied volgens die fenologiese stadium van die boord. As breë riglyn kan die volgende gebruik word:

Periode	Phenologie	N (% van totale toediening)
Julie	Seldifferensiasie en seldeling	25
Augustus	Knopbreek, blom en vrugset	25
September	Vrugset en selgroei	25
Oktober	Vrug-groei	15
November/ Desember	Vrug-groei	10

Blaarbespuitings:

1. Dien ureum toe as 'n blaarbespuiting in Julie om vrugset te bevorder of na Oktober vir stikstof-aanvulling.
2. Die kritiese vereistes vir suksesvolle blaarvoeding is die kontaktyd wat die blare nat bly, druppelgrootte en die konsentrasie van die voedingselement in die spuit-oplossing.

Om die logging van stikstof te beperk kan die volgende gedoen word:

1. Dien stikstof in die middel van of aan die einde van die besproeiingsiklus toe.
2. Voorkom 'n oormaat van stikstof in die grondoplossing. Stikstofkonsentrasies wat hoër is as 150-200 mg/L het geen addisionele voordeel nie. Oormaat stikstof lei tot moontlike logging van die stikstof en moontlike probleme met vrugkwaliteit.
3. Stikstoftoediening moet verkieslik aan die einde van die groeiseisoen gestaak word sodat die stikstofinhoud in die grond gedurende die wintermaande kan afneem.
4. Die regte hoeveelheid water moet toegedien word tydens besproeiing. Dit is onvermydelik dat 'n sekere hoeveelheid stikstof geloog word tydens besproeiing, maar oorbesproeiings versnel die proses en 'n groot hoeveelheid stikstof kan verby die wortelsone geloog word. Reënval moet ook in ag geneem word tydens besproeiingskedulering.

NITROGEN FERTILISATION OF CITRUS

At the end of the growing season:

1. Leaf and soil samples should have been taken between February and May.
2. Results from the soil and leaf analyses with additional information such as tree age, tree

vigour, expected yield rootstock, etc. are used to compile a fertiliser programme.

When micro-jets or any other system except drippers are used

1. Start with nitrogen fertilisation in July with the exception of the Western Cape and Hartswater which should start in August.
2. Split the nitrogen application in one to four portions, depending on the clay content of the soil.

When drip irrigation is used:

1. Start with nitrogen fertilisation in July with the exception of the Western Cape and Hartswater which should start in August.
2. Split the volumes recommended per month into at least weekly applications.

Period	Phenology	N (% of total application)
July	Cell differentiation and start of cell division	25
August	Bud break, flowering and fruit set	25
September	Fruit set and cell growth	25
October	Fruit growth	15
November/ December	Fruit growth	10

Ensure that the water and fertilisers do not penetrate deeper than the upper root zone (30-40 cm).

Foliar spray of nitrogen:

1. Spray the urea in July to improve fruit set and after October to supplement nitrogen.
2. The critical requirements for successful foliar sprays are contact time, droplet size and concentration of the nutrient element in the spray solution.

Four measures can be used to prevent or minimise the downward movement of nitrate:

1. Inject nitrate in the middle of, or late, in an irrigation event.

2. Avoid excessive concentrations of nitrate in the soil solution. Nitrate concentrations greater than 150-200 mg/L don't provide any additional benefit, and supplying more N fertiliser simply increases the risk of leaching by successive irrigation or rainfall events. Oversupplying N can also lead to fruit quality issues.

3. Complete the N supply programme by the end of the growing season to allow depletion of nitrate in the soil by winter.

4. Ensure that only the right amount of water is applied. Some movement of nitrate may be inevitable with each irrigation cycle, but overwatering is likely to speed up that process and move nitrate beyond the root zone. Allowing for expected rainfall when calculating the depth of water to apply will also help reduce the likelihood of leaching.

GRONDGEDRAAGDE SIEKTES

AALWURMS M.C. Pretorius

Grond- en wortelmonsters kan in die lente getrek word en na die Diagnostiese Sentrum in Nelspruit gestuur word vir ontleding sodat die aalwurmpopulasie in die wortels bepaal kan word. Die resultaat sal dien as 'n bestuurshulpmiddel om 'n koste doeltreffende aalwurmbeheerstrategie daar te stel.

Die gebruik van chemiese aalwurmdoders vir die beheer van die sitrusaalwurm word nie aanbeveel alvorens ten minste 30 mm reën geval het nie. Elke aalwurmdoder-toediening behoort met 'n behoorlike besproeiing opgevolg te word om te verseker dat die middels deeglik deur die grondprofiel gewas word. *Toedienings behoort slegs volgens etiketaanbevelings toegedien te word. Afwykings van die geregistreerde dosisse, om kostes te bespaar, lei tot oneffektiwiteit. Dit is belangrik om 'n program te volg, een aalwurmdodertoediening per seisoen is 'n mors van geld!*

PHYTOPHTHORA

Phytophthora wortelvrot – die gebruik van fosfonaatprodukte is 'n uiters effektiewe en bekostigbare beheermaatreël wat suksesvol deur produsente gebruik word. Dit is van uiterste belang dat die etiket deeglik bestudeer word asook die waarskuwings voordat die produk gebruik word om effektiviteit te verseker en fitotoksiteit te voorkom. Indien kraagvrotletsels voorkom kan 'n stamverf of blaarbespuiting aangewend word, drie aanwendings per seisoen met 8 weke intervalle. Vir wortelvrotbeheer word drie blaarbespuitings, met 8 weke intervalle aanbeveel.

FRUIT AND FOLIAR DISEASES

ALTERNARIA CORE ROT G.C. Schutte

Alternaria core rot, also known as navel-end rot and black rot, occurs in all areas of southern Africa. The disease is most prevalent on those citrus cultivars such as navels and Clementines characterised by the presence of a secondary fruit called the fruit-navel, which varies in size and develops at the stylar end of the primary or main fruit. These fruitlets are extremely sensitive to environmental stress conditions during early stages of development and are therefore also prone to diseases such as navel-end rot and physiological disorders.

Alternaria core rot is linked to large fruit-navels or to the abnormal growth of the secondary fruit into primary-fruit locules, which lead to the formation of points of entry through which fungi can penetrate to form infections that remain quiescent until favourable conditions stimulate further fungal growth.

The style and stigma of navel blossoms are milky white at first and then turn light brown in colour and abscise cleanly. This happens one week after petals have dropped and young fruit are ± 8 mm in size. The two sets of stylar tissue present in the primary and

secondary fruit locules can be injured during the blossom period if harsh weather conditions prevail for one or more days (hot days $>25^{\circ}\text{C}$), and low relative humidity ($<20\%$) followed by heavy dew during the evenings. This causes the outer or primary style to turn brown and dry out, while the inner or secondary style remains unaffected inside the outer style and continues to develop and swell in size to result in longitudinal cracks in the outer tissue. The longitudinal cracks enlarge as the orange increases in size. The inner ovary projects even more as the orange approaches maturity. This results in a large, irregular-shaped navel-end and creates an ideal site for *Alternaria* infections.

Score (50 ml/100 L water) and Folicur (80 ml/100 L water) are registered for control of the disease.

POST HARVEST PATHOLOGY – WASTE PREVENTION

K.H. Lesar, A. Erasmus & P.H. Fourie

Packing and harvest schedules should be extreme at this stage of the season, but basic practices should not be neglected now. Below are a few factors that should be focused on.

PRECAUTIONS AND RECOMMENDATIONS

- Minimise injuries to fruit during picking, handling and transport to the packhouse.
- Monitor the incidence of insect activity in the orchards and institute appropriate measures to reduce their populations. Especially fruit fly and false codling moth numbers which could increase with hotter weather.
- Insect damage to fruit contributes to injuries and possible infection by the wound pathogens.
- Make use of the indigo carmine mixture to monitor the incidence of injuries to the fruit during picking.
- Handle the fruit as a perishable product,

8STE SITRUSNAVORSINGSIMPOSIUM:

17-20 Augustus 2014

Hiermee word kennis gegee van die 8ste Sitrusnavorsingsimposium wat vanaf 17-20 Augustus 2014 aangebied sal word by die Champagne Sports Resort in die Drakensberge naby Winterton. Vir laat registrasie doeleindes en meer inligting gaan na

www.citrusresearchsymposium.co.za.

8TH CITRUS RESEARCH SYMPOSIUM:

17-20 August 2014

This is to remind everybody that the 8th Citrus Research Symposium will take place from 17-20 August 2014 at the Champagne Sports Resort in the Drakensberg mountains near Winterton. For late registration purposes and more information go to

www.citrusresearchsymposium.co.za.

because it is a perishable product.

- Ongoing removal of dead wood from trees.
- Ongoing weekly or twice-a-week orchard sanitation is a non-negotiable requirement.
- Minimise the delay between picking and treatment. The longer the delay the higher the risk for high decay.
- The first fungicide application must be applied within 24 hours from harvest on hard citrus and within 12 hours for soft citrus.
- Packed fruit must be cooled down as soon as possible.
- Culled or waste fruit and/or fruit destined for juice factories should be removed from the packhouse premises on a daily basis.

CHECKLIST FOR CHEMICAL APPLICATION

Chlorine application

- Solution pH: 6 - 7
- Chlorine concentration: 75 – 100 ppm
- ORP: 750 mV

Fungicide dip tank

- Imazalil concentration: 500 ppm
- Solution pH: not higher than 6
- Exposure time: 1 – 3 minutes in a solution at pH3 or not longer than 45 seconds in a solution at pH6
- Maintain the concentration by following the advised imazalil top-up protocol

Wax application

- Fruit should be dry when they reach the wax applicator
 - Wax load should be between 1.0 and 1.5 litres per ton fruit depending on manufacturers' recommendations
- Over application can lead to MRL exceedance | Under application will lead to poor fruit quality preservation**

variation and poor disease control

- The wax solution should be agitated continuously (24 hours a day, 7 days a week)

Thiabendazole tends to precipitate to the bottom of the wax drum and cannot be fully suspended again

- Drying tunnels after the wax applicator should not be overheated

Obtain from the wax manufacturer the optimal temperature for the specific wax
The correct drying of the wax is crucial to ensure that the desired effect is gained

Phytophthora brown rot

Adequately skirt trees to minimise the risk of *Phytophthora* brown rot infection after rainfall. Do not pick skirt (low hanging) fruit for packing. Remove this fruit before harvesting and send for processing.

Spray contact fungicides only (copper at 200 g per 100 L) as a preventive measure against *Phytophthora* brown rot after rainfall. Contact fungicides must be re-sprayed after any follow-up rainfall. Foliar applications of phosphonates for the control of Root and Collar rot will be effective against brown rot.

PACKHOUSE

Ensure that packhouse chemicals are applied at recommended concentrations and packhouse procedures and critical control points are *managed* diligently.

Pack very strictly with regard to injuries, creasing, over-mature fruit, etc.

IMPORTANT POINTS TO REMEMBER All damaged fruit are HIGH RISK for export.

Latent and wound pathogen infections on

the tree lead to further development of latent pathogen infections and the spread of wound pathogen infections in exported cartons.

Over-ripe fruit, past optimal internal quality, that are destined for cold disinfection markets are less resistant to cold damage during storage/shipping and more susceptible to decay. Minimise the delay between picking and packing.

Fruit arriving in the market with quality problems often sells at reduced prices and ultimately becomes a major loss for the grower. Producers must be aware of the risk involved in exporting this fruit and decide whether to export the fruit, or not.

Keep next season in mind

Orchards should be stripped from any leftover fruit after harvest

- Fruit should be removed from the orchard, mulched and buried
- Do not let this fruit be left close to an orchard and allowed to rot
- The purpose of this exercise is to reduce and limit the amount of pathogen inoculum in the orchard, which will reduce the disease pressure in that specific orchard during the next season

The best time to remove dead wood is directly after harvest

- Latent pathogens survive on dead wood in trees
- Pruning in order to open the tree canopy should also be done now, this will reduce the development of dead wood

As you go through the packing season make notes of problems and faults in the packline, which should be addressed during the off-season