

Extension briefs for August and September

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 or acephate (Spectra Stem) 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 and only three applications are permitted per season.

Mealybug

S.D. MOORE AND T.G. GROUT

Once again, mealybug infestation levels appeared to be high in several regions of the country last season. This could have been exacerbated by high thrips pressure, leading to disruptive application of thripicides well into the season, and by the disappearance of buprofezin as a corrective treatment for mealybug. As preventative treatment of mealybug is almost twice as effective as corrective treatment, when in doubt, it is strongly advised that a preventative treatment for mealybug be applied. This can be done pre-blossom or closer to petal drop, using an organophosphate, as described for thrips, or using buprofezin or one of the newer options, such as Closer, Tivoli or Lesson if just for mealybug. Where a parasitoid augmentation programme is being followed for mealybug, the earlier in the season releases are initiated, the more effective they are. This might be a problem where early thripicides are detrimental to the parasitoids.

False codling moth

S.D. MOORE

It may be very tempting to neglect orchard sanitation in winter, as false codling moth (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. In the warm northern areas of the country, FCM activity starts a lot earlier than in the Cape regions. Consequently, it may be beneficial to initiate mating disruption earlier in the season than usual. Check with your agrochemical supplier if the product registration permits you to do so.

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. Honey bee populations will benefit if sprays need to be applied during bloom because these products are harmless to bees.

Citrus flower moth

S.D. MOORE

Moths of the citrus flower moth (also known as the lemon borer moth), *Prays citri*, are attracted to lemon blossoms. Growers should inspect these blossoms in spring to determine whether they are infested with larvae or pupae. These can be identified by their colouration, which is usually greenish and the association of webbing with pupation. Even if the damage to, and loss of blossom is not considered sufficiently severe to justify control measures, no intervention may allow the development of a second generation. It is the moths of this second generation which lay their eggs on the lemon fruitlets. Hatching larvae can potentially cause severe damage. Therefore, it is more effective to control the first generation. An experimental threshold for intervention based on pheromone delta trap catches has been set at 150 moths per trap per week. However, there is no

trapping system registered yet. This equates to an infestation level of 5% blossom clusters with larvae and pupae, which will lead to approximately 5% fruit damage. No plant protection products are registered for use against the lemon borer moth. However, there are a number of pesticides which are registered for other pests on citrus that are effective, including Bt (DiPel) and mevinphos.

CROP AND FRUIT QUALITY MANAGEMENT

P. CRONJÉ

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 optimal 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 10 representative trees should start four to six weeks before the expected harvest date. Titratable acidity is determined by titration with sodium hydroxide, sugar content (Brix) is determined using a refractometer and the sugar to acid ratio calculated. Fruit colour should be read from a colour chart. The aforementioned data should be plotted on a graph in order to determine the optimal picking window. Growers should adhere to the time and temperature protocols for each citrus type to ensure optimal shelf life of the fruit (Cutting Edge No. 99). 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 as soon as possible after harvest. All of 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). Removal of all dead wood is important to reduce fruit blemishes and reduce the inoculum of latent pathogens, which cause postharvest decay. A light intensity level of at least 30% of full sunlight is necessary for optimal photosynthesis, and sufficient light intensity levels also improve fruit colour development. In dense and old trees, light intensity inside the tree canopy can drop to below 30% and adversely affect fruit set and size. At least one "window" cut should be made to allow for adequate light distribution to improve bearing wood within the tree canopy. An increase in photosynthesis and light distribution will promote increased fruit size and internal fruit quality, better fruit colour, increased rind condition and less variation in fruit quality within the canopy. Pruning should be used as a thinning technique by pruning more heavily after a light crop (if a heavy crop is expected in the subsequent season) and when the orchard has a history of alternate bearing. A follow-up of regrowth management in the summer is critically important to maintain light management throughout the season. Proper pruning also improves spray penetration, leading to effective control of target pests and diseases. This is especially important for the effective control of phytosanitary pests and diseases. Pruning tools should be sanitised on a regular basis with a 10% Jik solution, to prevent spreading of viral diseases, and should be done at least after each row, and 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. If leaf N levels are sufficient, consider replacing the foliar urea application with a 1.5% KNO₃ application, only if leaf K levels are below optimum.



J.J. BESTER



M.C. PRETORIUS



W. MOMMSEN



C. SAVAGE

Fruit set treatments according to cultivar requirements need to be applied. A general guideline cannot be given as fruit set treatments differ by cultivar and, in many cases, by orchards depending on the previous crop load. Specific treatments include the application of gibberellic acid (GA₃) and trunk or branch girdling, especially for weakly parthenocarpic cultivars that have a poor set. Girdling during full bloom improves set, as the removal of bark temporarily restricts carbohydrate allocation to roots and allow for utilisation by flowers. Be careful not to girdle too deep into the trunk, or to remove a strip of bark. Moisture stress should be avoided at all costs during full bloom, fruit set and early fruit growth, as these periods are characterised by the cell division stage of fruit development, during which water supply is of critical importance.

GEÏNTEGREERDE BEMESTING

P. RAATH

STIKSTOFBEMESTING VAN SITRUS

Aan die einde van die groeiseisoen

1. Blaar en grondmonsters moes aan die einde van die groeiseisoen 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 mikrospruite 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 een en vier 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 penologiese stadium van die boord. As breë riglyn kan die volgende gebruik word:

Periode	Fenologie	N (% van totale toediening)
Julie	Seldifferensiasie en seldeling	25
Augustus	Knopbreek, blom en vrugset	25
September	Vrugset en selgroei	25
Oktober	Vruggroei	15
November/ Desember	Vruggroei	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 grond-oplossing. Stikstofkonsentrasies wat hoër as 150-200 mg/l is het geen addisionele voordeel nie. Oormaat stikstof lei tot maontlike logging van die stikstof en maontlike probleme met vrugkwaliteit.
3. Stikstoftoediening moet verkieslik aan die einde van die groeiseisoen gestaak word sodat die stikstof-inhoud 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. Ensure that the water and fertilisers do not penetrate deeper than the upper root zone (30-40 cm).

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

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

M.C. PRETORIUS EN J. VAN NIEKERK

Aalwurms

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 kostedoeltreffende aalwurmbeheerstrategie daar te stel.

Die gebruik van chemiese aalwurmdoders vir die beheer van die sitrus-aalwurm word nie aanbeveel voor ten minste 30 mm reën geval het nie. Elke aalwurmdodertoediening 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, soos uiteengesit op die etiket van die betrokke produk. Afwyking van hierdie aanwysings kan lei tot oneffektiewe beheer en dus, '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 fito-toksisiteit te voorkom. Om effektiewe werking van die fosfonate te verseker behoort opvolgtoedienings, ten minste twee, maar verkieslik drie toedienings, twee maande uitmekaar toegedien word. Indien kraagvrotletsels voorkom kan 'n stamverf of blaarbespuiting aangewend word (drie aanwendings per seisoen met agt weke intervalle). Vir wortelvrotbeheer word drie blaarbespuitings (met agt weke intervalle) aanbeveel. Die eerste bespuiting behoort direk na blomblaarval gedoen te word – nie tydens blom nie, aangesien dit die moontlikheid verhoog van blomme wat sal afval. Dit word sterk aanbeveel om nuwe aanplantings en nie-draende bome op 'n fosfonaatprogram van drie aanwendings per jaar, twee maande uitmekaar, te hou om gesonde wortel-ontwikkeling te verseker. Produsente word gemaan om seker te maak dat bome nie oorbesproei word nie.

FRUIT AND FOLIAR DISEASES

P. MOYO

Alternaria core rot

Alternaria core rot (also known as navel-end rot or black rot) is caused by the fungus *Alternaria alternata*, and occurs in all areas of Southern Africa. The disease is most prevalent on citrus cultivars, such as navels and clementines, which are characterised by the presence of a secondary fruitlet called the navel. The navel develops at the stylar end of the fruit and varies in size. The formation of the navel-end opening and its size is influenced by climatic conditions during fruit set. Under cool weather conditions, the secondary fruit style successfully fuses with the style of the primary fruit, such that both the secondary and primary style abscise, during petal fall, resulting in a closed navel-end. However, under extreme weather conditions (e.g. warm, dry and windy conditions), the primary fruit style abscises prior to fusion with the secondary fruit style resulting in the formation of a cavity between the primary and the secondary fruit. Such cavities provide entry points for fungi, such as *A. alternata*, to penetrate and form infections which remain quiescent until favourable conditions stimulate further growth of the fungus.

Alternaria core rot is linked to fruits with large or malformed navel ends.

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

Botrytis on lemons

The role played by *Botrytis* and the damage that it can do to lemon fruit drop and the formation of ridging of the rind is still not clear. Damage can be caused during blossom on lemon petals when prolonged wetting and cool weather occur simultaneously. Producers in the Eastern Cape enlisted on the Adcon system can make use of their early warning forecasts for *Botrytis*. Benomyl is the most effective fungicide to control this fungus and should be sprayed at the balloon stage during blossom which can also form part of the black spot control programme.

POSTHARVEST PATHOLOGY – WASTE PREVENTION W. DU PLOOY, K.H. LESAR AND C. SAVAGE

By this time of the citrus season all processes are in full motion. The strain of the season may be taking its toll on management and this may lead to poor management of critical control points. Below are a few suggested critical control points that should be well managed.

Critical control points for improved postharvest disease management

- Monitor the incidence of **insect activity** in the orchards and institute appropriate measures to reduce their populations, especially fruit fly and FCM numbers that could increase with hotter weather.
- Monitor **orchard sanitation**:
 - Advise the orchard managers and producers if sanitation is being improperly managed or neglected, as this can also fulfil an overbridging role for FCM from one season to the next, it is important to follow the FCM Management System (FMS) correctly.
 - Removal of rotten and fallen fruit is crucial to keep spore loads down and to reduce the risk of postharvest decay.
- Monitor **injuries** to fruit during picking, handling and transport to the packhouse. Advise orchard managers and/or producers accordingly.
- Keep the **time from harvest to the first fungicide treatment** to a minimum, it is strongly recommended to treat at least within 24 hours after picking.
- Ensure that all **fungicide applications** are **replaced** frequently as per protocol and kept clean.
- Keep the fruit **dumping site** where fruit will enter the packhouse as clean as possible.
- Ensure proper **removal of any rotten fruit** before sanitising and treatment of the fruit.

- Have a **sanitation action** between fruit sorting and the first fungicide application.
- Ensure that fruit are **dry** before entering the fungicide treatment.
- Manage the **concentration** of imazalil in the fungicide treatment by doing regular titrations.
- **Do not wax wet fruit** – this could result in a severe risk to fruit quality.
- Apply the **correct amount of wax** onto the fruit (i.e. 1.0 - 1.5 l per ton of fruit) and ensure an even spread of the wax over the whole fruit.
- Reduce the **time** from harvest to **cold chain storage**.
- **Packhouse sanitation** should be a continuous process and not just a daily or weekly activity.
- Store fruit destined for the **juicing** factory as **far away** from the packhouse as possible and have it **removed** as soon as possible.

Below is a quick checklist for the critical measurements for the chemical applications:

Checklist for chemical application

- Chlorine application
 - Solution pH: 6.5 - 7.5
 - Chlorine concentration: 75 - 100 ppm (free active chlorine)
 - ORP: 800 mV
- Fungicide dip tank
 - Imazalil concentration: 500 ppm
 - Solution pH: not higher than six
 - 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 and poor disease control
 - The wax solution should be agitated continuously (24 hours a day, seven days a week)
 - Thiabendazole tends to precipitate to the bottom of the wax drum and cannot be fully re-suspended
 - Drying tunnels after the wax applicator should not be overheated
 - Obtain the optimal temperature for the specific wax from the wax manufacturer
 - The correct drying of the wax is crucial to ensure that the desired effect is gained. ❀