

Extension briefs for April & May

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INTEGRATED PEST MANAGEMENT

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PHYTOSANITARY PESTS: All the recommendations made in the Extension Briefs for February and March also apply to this period. Fruit fly control in citrus areas is critical due to phytosanitary concerns around fruit fly pests. Fruit fly control should be initiated in mid-summer, and in areas with historically high fruit fly numbers, control should start as early as December, particularly in those areas with mixed deciduous or mango and citrus cultivation. Monitoring numbers of fruit flies and false codling moth (FCM) is also critical.

Bear in mind that for Medfly, the threshold in a Capilure baited trap is four males per week, whilst for Natal or Cape fly the threshold in a Capilure baited trap is two males per week. The Oriental fruit fly (OFF) *Bactrocera dorsalis*, is present in Limpopo, Mpumalanga, North-West and Gauteng provinces as well as in the KwaZulu-Natal province. This excludes the magisterial districts of Amajuba, uMgungundlovu, uMzinyathi, uThukela and Zululand. The pest is also declared absent from the Western Cape, Eastern Cape, Northern Cape and Free State provinces.

Surveillance monitoring of OFF using methyl eugenol baited traps is a requirement for phytosanitary registration of citrus, for export to special markets. Trap details and trap servicing should be recorded as per trapping guidelines (<http://www.citrusres.com/downloads/market-access>). In areas where OFF is absent, growers should continue monitoring and suspect specimens should be reported immediately to the relevant authorities. In areas where OFF is present, the threshold in a methyl eugenol baited trap is three flies per trap, per week. When using Questlure in a Sensus trap, the threshold is one female fly per trap, per week, irrespective of the fly species. If thresholds are exceeded, control actions must be increased. Control actions for fruit flies include the use of protein bait sprays and/ or bait stations and orchard sanitation.

Where OFF is present, growers should also apply registered methyl eugenol-based Male Annihilation Technique (MAT) (e.g. Invader-b-Lok, a block impregnated with Chempac ME lure and malathion, or Static Spinosad ME). Growers are also advised to take measures to ensure that fruit moved out of affected production areas is not infested with OFF; and those growers in areas where OFF is present should apply for a removal permit, if fruit is to be moved out of the area.

Growers must conduct sanitation at least once a week to split, stung or infested fruit in the trees, or fruit that has fallen to the ground. For participation in the FCM Risk Management System (FMS), it's mandatory that growers continue to monitor infestation of fallen fruit under data trees in each orchard each week. The exact number of data trees required is determined by the orchard size, as calculated by Phytclean. A final spray for FCM is recommended at least four weeks before harvest. During harvesting, pre-sorting of any potentially infested fruit must be conducted in the orchard. On delivery, packhouses must conduct inspections for FCM infestation on samples from all orchards. Changes have been made to the details of the requirements for these inspections within the FMS and packhouses must familiarise themselves with these. On the pack line, all fruit with blemishes that could be associated with FCM must be graded out, and sorting tables must be very well lit to facilitate optimal sorting.

BLEMISH FACTOR ANALYSIS: The analysis of fruit blemish factors on the tree just prior to or shortly after harvest, provides the grower with an evaluation – in commercial terms – of all control programmes implemented during the season and also assists with pest management decisions for the season to follow. With the trend towards selective picking and a variable degree of culling occurring in the orchard, it is more accurate to conduct the final analysis of fruit blemish factors before picking starts. Care must be taken to include fruit from inside the tree and all blemish factors or pest

infestations should be recorded, whether they are sufficient to cull the fruit from export quality, or not. Having taken the sample, it is important to record separately each pest or blemish factor that is severe enough to downgrade a fruit in its own right. This procedure determines which fruit in the sample have more than one factor that can warrant its culling from export.

CROP & FRUIT QUALITY MANAGEMENT

P.J.R CRONJÉ & O.P.J. STANDER

GENERAL: Stage II of fruit development is ending, with stage III commencing with little or no increase in fruit size as the fruit matures. This manifests in increased juice content, total soluble solids (Brix°) and reduction of titratable acidity (TA). Lower autumn temperatures will affect rind colour, but GA3 (Progibb®) and nitrogen applications later than five months prior to harvest will result in retarded colour development.

MATURITY INDEXING: It's best to commence maturity indexing on early and mid-season cultivars, in order to harvest at optimal maturity, as well as to facilitate an adequate shelf life. Weekly samples from 10 representative trees should start four to six weeks before the expected harvest date. Titratable acidity is determined by titration with sodium hydroxide, while sugar content (Brix°) is determined by a refractometer. The fruit colour, as well as the sugar-acid ratio calculated should be read from a colour chart. Results should be recorded and used in comparison with previous seasons in order to identify and manipulate possible problems with internal and external quality parameters.

PICKERS' TRAINING AND MONITORING: Training of pickers is important, especially because the workers need to become familiar with important protocols relevant to the picking and handling of fruit. Picking bags should always be carried on the side of the waist to avoid crushing of fruit between the body and the ladders, bins or trees; and picking bags must be free of leaves, shoots or sand and kept dry throughout. To avoid lesions on fruit, finger nails of pickers should be short, and clippers and ladders handled correctly (with no long stems, and contact between ladders and fruit kept to a minimum). Low-hanging fruit that is very close to the ground, touching the ground, or that has dropped should be removed a day or two prior to harvesting an orchard. This lowers the risk of sour rot and brown rot development in export cartons. Sorters wearing gloves should be stationed at each bin, to monitor fruit quality.

PRUNING: When it comes to early cultivars (Satsuma and

Clementine), pruning should be done during this period, as soon as possible after harvest. Heavy pruning is recommended after a light crop, if a heavy crop is expected, and when the orchard has a history of alternate bearing. Old twigs and dead shoots should also be removed to limit wind damage of the next season's crop. Pruning should be effective to ensure sufficient light distribution and spray penetration into the centre of the canopy.

POSTHARVEST FOLIAR UREA APPLICATION: A foliar application (low biuret urea at 1%) can be applied on early cultivars (Satsuma and Clementine) as soon after harvest as possible.

CITRUS BLACK SPOT DISEASE (CBS) MANAGEMENT

P.H. FOURIE

GENERAL: At this stage, most growers should have completed all their scheduled preharvest sprays for CBS. Since CBS symptoms only appear on mature fruit, absence of preharvest symptoms is not necessarily indicative of successful CBS control. It's advisable to assess the CBS risk of orchards to exclude export from high-risk orchards to CBS sensitive markets. Here are some suggested criteria that can be used:

- CBS history of orchard: older orchards tend to have more CBS, but various factors (such as cultivar susceptibility, topography, orchard condition, canopy density and efficacy of spray deposition) can influence the disease pressure. If monitoring records were kept, growers would be able to identify orchards with a higher CBS incidence. Orchards where CBS disease incidence was high in the previous two seasons can expect a higher inoculum pressure in the past season.
- Inoculum management: monthly removal of all fallen leaves from late winter through the fruit susceptibility period has been shown to be as effective as full CBS spray programmes. Conversely, pruning debris that is left in the orchard will contribute to the inoculum pressure. It is unclear to what extent shredding of pruning debris will limit ascospore production on leaves, but growers are advised to at least shred their pruning to a very fine particle size (<5 cm²); the smaller, the better! Likewise, removal of all out-of-season fruit is important to limit pycnidiospore inoculum.
- Prevailing weather conditions: the CBS pathogen can only infect fruit if warm and wet conditions are experienced during the fruit susceptibility period (four to five months after fruit set). A comparison of suitability of weather conditions for CBS experienced in the past season with previous seasons will be indicative of the relative risk. Growers are also encouraged to register on CRI-PhytRisk (www.cri-phytrisk.co.za).

cri-phytrisk.co.za) to compare the CBS infection forecasts for the season with the spray programme that they followed. If all infection periods were protected, the CBS risk should be lower, assuming that sprays were effectively applied during weather conditions suitable for spraying (this can also be observed from CRI-PhytRisk), and that effective fungicide coverage and deposition was achieved.

GRONDGEDRAAGDE SIEKTES

M.C. PRETORIUS & JAN VAN NIEKERK

PHYTOPHTHORA EN AALWURMBEHEER:

Winterreënval gebiede soos die Wes-Kaap moet nou *Phytophthora* en aalwurmontledings laat doen. Beheerprogramme moet begin na die eerste goeie winterreëns. Beheermaatreëls moet 'n program van twee, maar verkieslik drie toedienings twee maande uitmekaar insluit. Dis belangrik om op residu-weerhoudingstydperke van aalwurmdoders te let, en om die etikette van die verskillende produkte deeglik deur te lees.

WORTEL EN KRAAGVROT: *Phytophthora* wortel en kraagvrot beheerprogramme in die Wes-Kaap kan in die herfs begin. Ridomil wortelsone behandeling (2.1 ml/m^2) en fosfonaat blaarbespuitings kan gebruik word. Drie fosfonaat toedienings, twee maande uitmekaar, behoort gedoen te word. Let op weerhoudingstydperke.

Baie belangrik: Lees die etikette van die verskillende produkte deeglik, veral die waarskuwings. Vermoed die gebruik van die fosfonate, indien toestande voorkom wat bome onder enige vorm van stremming plaas. Bo en behalwe droogte en hitte, kan bergwindtoestande ook bome onder tydelike verwelkte toestande plaas, wat 'n gevaar vir blaarbespuitings inhou. Bome moet dus nie tydens, of kort na sulke toestande gespuit word nie. Laastens, beïnvloed drag ook 'n boom se gevoeligheid vir droogtespanning. Hoe hoër die drag, hoe gevoeliger is die boom vir uitdroging en hoe groter is die risiko vir fitotoksiteit ("stippeling").

BRUINVROT: Herfsreëns kan lei tot ernstige na-oesbederfverliese deur *Phytophthora* bruinvrot. 'n Enkele vrug, wat besmet is met bruinvrot, kan tydens verskeping die res van die vrugte in 'n uitvoerkarton laat bederf.

In die somerreënvalgebiede word bruinvrot veroorsaak deur die patoogeen *Phytophthora nicotianae* var. *parasitica*. Dit affekteer die vrugte op die onderste 1.5 m van die boom, naaste aan die grondoppervlak. Dit behoort dus redelik veilig te wees om slegs hierdie onderste band vrugte te spuit in boorde waar die *Phytophthora*-insidensie nie hoog is nie.

In die winterreënvalgebiede kom *Phytophthora citrophthora* ook voor. Dis 'n patoogeen wat hoër op in die boom versprei en

wat vrugte tot bo in 'n sitrusboom kan besmet. Die totale blaaroppervlak in hierdie streke moet gespuit word. Bruinvrot ontwikkel slegs wanneer die klimaatstoestand gunstig is vir die patoogeen (*Phytophthora*) om te kan infekteer en ontwikkel. Indien dit 'n droë najaar is en geen of ligte reën buitjies voorkom, is voorkomende bespuitings nie nodig nie. Indien dit 'n nat winter of najaar is, moet bome gespuit word. Kontakswamdoders soos Koper (200 g/100 l) of mancozeb (200 g/100 l) kan gespuit word om bruinvrot te beheer. Daar is egter beperkinge t.o.v. mancozeb vir sekere markte.

Beide hierdie produkte is slegs kontakmiddels en kan deur reën en besproeiing afgewas word. Daar is ook 'n gevaar dat indien die kopertoedienings en proteïenvrugtevlieglokase te na aan mekaar toegedien word, fitotoksiteit op die skille kan voorkom. Hierdie gevaar is hoër tydens kleurbreek. *Sistemiese fosfonaat swammiddels is uiters effektief vir die beheer van bruinvrot, waarvoor Fighter en Brilliant vir teengebruik geregistreer is. Die fosfonate is ook effektief teen bruinvrot, indien dit in 'n wortelvrotprogram as 'n blaarbespuiting gebruik word. Geeneen van die fosfonaatstamaanwendings is effektief teen bruinvrot nie.*

WATERBESTUUR / WATER MANAGEMENT

J.T. VAHRMEIJER

BESPROEINGSKEDULERING / IRRIGATION SCHEDULING: Mature citrus trees require between 7 000 m³ and 10 000 m³ of water per hectare, per year. Water is lost through evaporation, run-off, leaching and transpiration, which in some instances, along with leaching are beneficial to the trees and, therefore not viewed as a loss. However, non-beneficial losses should be kept to a minimum. Non-beneficial leaching occurs when water penetrates to below the root zone.

Evaporation is largely determined by climatic factors such as radiation, temperature, relative humidity and wind. Run-off is determined by the infiltration rate, slope and application rate.

Evaporasie kan verminder word deur te verseker dat druplyne bo-op riewwe vasgemaak is om te verhoed dat water teen die kante van riewwe afloop. Sodoende word die oppervlakte verminder waarvandaan water kan verdamp. Die grondoppervlak kan ook met organiese materiaal bedek word om verdamping te verminder. Afloop kan verder beperk word deur seker te maak dat die toedieningstempo van die besproeiingswater nie hoër is as die infiltrasietempo van die grond nie. Die periode van besproeiing moet genoegsaam wees om die wortelsone tot veldkapasiteit te benat, sonder om die wortelsone te versadig en sodoende oormaat dreinerig of afloop te veroorsaak. Die instandhouding van besproeiingstoerusting is belangrik om te verseker dat die toerusting in 'n goeie toestand is en dat daar geen lekkasies is nie.

The difference between field capacity and the actual soil water content is called the “soil water depletion”. Irrigation timing and the amount of water to be applied are determined by monitoring or estimating soil water depletion, as well as applying water when the depletion reaches a pre-selected level called the management allowable depletion.

Grondvoogsensors wat die grondwaterinhoud meet, is h beter aanduiding vir wanneer en hoeveel besproei moet word as die gebruik van gewasfaktore, of die sogenaamde kalendermetode. Dis wanneer besproeiing op h voorafbepaalde tyd plaasvind, byvoorbeeld elke Dinsdag en Vrydag.

TENSIOMETERS: They’re installed in pairs. The ceramic cup of the first tensiometer must be in the root zone and the second cup below it. For most soils the reading should be between -5 and -20 kPa, at field water capacity.

A tensiometer that remains on zero or even -5 kPa for too long is indicative of water-saturated conditions. As the soil dries out, the tension slowly increases (and readings become more negative), until a certain inflection point is reached.

This point is characteristic of the soil and lies between -30 and -70 kPa. The tension increases rapidly after the inflection point has been reached.

For sandy soils, irrigation should probably commence at a tension of -30 kPa, and in clay soil at -40 to -50 kPa. However, it is important to note that these values are characteristic of the soil and should be determined for each irrigation block.

Irrigation is scheduled according to the readings of the shallow tensiometer. The deeper placed tensiometer monitors over and under-irrigation. A continued low reading on a deeper placed tensiometer indicates over-irrigation. However, increasingly higher readings, in spite of irrigation, signal under-irrigation.

KAPASITANS “PROBES”: Kapasitans “probes” meet op verskillende dieptes die relatiewe waterinhoud van die grond. Hierdie metings geskied op h kontinue basis (elke 30 of 60 minute). Die sagteware maak voorsiening dat h versadigingspunt, h hervulpunt en ‘n droë punt gekies kan word.

Indien die grafiek daal tot by die hervulpunt, kan daar met besproeiing begin word. In gronde met h hoë klei-inhoud is dit moeiliker om die verandering in die waterinhoud van die grond waar te neem.

PROFIELPUT: h Profielput in die wortelsone van die bome kan weekliks of selfs twee-weekliks gegrawe word. Die waterinhoud van die grond word dan visueel waargeneem en die besproeiingskedulering word daarvolgens beplan. Die voordeel van hierdie metode is dat probleemareas geïdentifiseer en geïnspekteer kan word.

POSTHARVEST PATHOLOGY-WASTE PREVENTION CHECKLIST

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THE ORIGIN OF DECAY: All the postharvest citrus diseases are present in the orchard. Around 1% of the fruit harvested will have established green mould infections, and this needs to be dealt with swiftly by the packhouse. The packhouse needs to convey the importance of the following practices to orchard management:

- Sanitation to minimise the inoculum (spore) load in the orchard.
- Establish protocols to minimise wounding of fruit during harvesting. Prevention of wounds will dramatically reduce the incidence of infections.
- Optimise FCM and fruit fly control to minimise wounds and the risk of decay.
- Treat the fruit within 24 hours of harvesting. This will enable the postharvest fungicide/s to curatively control established infections.

THE PACKHOUSE CAN MAKE OR BREAK IT: The time taken from the tipping of fruit to wax application is short, and every single process must be managed diligently to reduce the risk of waste.

CHLORINE TREATMENT:

- Measure ORP, it should be ± 800 mV.
- If ORP is too low, adjust the pH and concentration.
- The pH should be 6.5 - 7.5.
- Concentration should be 75-100 ppm (active chlorine), or 100-200 ppm (total chlorine)
 - o The concentration needs to be monitored continuously, and an automatic dosing system is highly recommended.

PRE-PACKHOUSE DRENCH:

- The 2019 CRI fact sheets list all the possible options for the pre-packhouse drench and need to be consulted (<http://www.citrusres.com/postharvest-recommendations-factsheets-2019>).
- It is imperative to have adequate water flow, in order to have all the fruit in all the bins drenched thoroughly; drenches must deliver at least 500 L drench mixture/bin/min.
- Pre-suspend fungicides in warm water and add to the tank while agitating, remembering to use the order SC > EC > SL, then fill the tank to the correct level.
- Exposure time: 1-3 minutes.
- Replace mixture after 150 bins (1000 L tank), or 200 bins (2000 L tank), or 300 bins (3000 L tank).
- Constant agitation – the system must be in operation for at least 15 minutes before use.

FUNGICIDE DIP TANK AND IN-LINE DRENCH:

- The fungicide of choice for use in the aqueous applications for 2019 is imazalil sulphate, for all markets. Updated recommendations for the 2020 season for export to the EU will be made available through the course of the year.
- The imazalil sulphate concentration should be managed continuously by means of titration, and maintained at 500 ppm.
- The pH level of the imazalil solution should be kept stable to ensure consistency in terms of residue loading. An automatic dosing system for pH is recommended:
 - o pH 3 will result in lower residue levels (around 1 ppm), but can still give excellent curative control, if exposure time is 60-90 seconds, and fruit is treated within 24 hours of infection.
 - o pH 6 will result in higher residue levels (around 2-3 ppm), but the exposure time needs to be limited to 45 seconds to prevent MRL exceedance.
- The CRI fact sheets list all possible options for the fungicide bath or in-line drench, and need to be consulted (<http://www.citrusres.com/postharvest-recommendations-factsheets-2019>).
- If not replaced on a daily basis, the fungicide solution should be pasteurised every evening by increasing the temperature to no less than 60°C, keeping it there for 20 minutes, and then letting the solution cool down overnight.

WAX APPLICATION:

- Fruit should be dry when entering the wax applicator – wet fruit hampers the efficacy of this treatment.
- It is highly recommended that imazalil is applied in the dip tank, and thereafter in the wax. The wax application ensures good protective control and sporulation inhibition of green mould, while the aqueous application provides excellent curative control.
- Wax containers / tanks containing fungicides should be gently agitated continuously (i.e. 24 hours a day) to ensure that the thiabendazole and imazalil do not precipitate, but remain in solution form. Precipitated chemicals will result in MRL exceedance from wax lower down in the container, while the top layers will not have enough residue to

give the desired protection. Containers should also be tightly sealed to prevent the wax formulation from deteriorating:

- o Do not use air bubbles as an agitation measure, as they break down the wax formulation due to liberation of the volatiles and oxidation of the solvent system.
- o Do not over-agitate the wax, as this also eliminates the volatiles that are an integral part of the wax during film formation after application.
- Ensure that fruit is totally and uniformly covered in wax; if not, contact your wax suppliers for support.
- Wind from the drying tunnel is not to blow back onto the wax applicator. This will cause wax to dry on the last brushes, causing hardening of the bristles. Such hardened bristles are ineffective in wax application and could cause injury to the fruit rind.

COLD CHAIN:

- Fruit should be placed under cold storage as soon as possible.
- Maintaining the cold chain will reduce the incidence of green mould infections and physiological rind disorders.
- The cold chain is to be maintained.

SANITATION:

- Packhouse sanitation is all about keeping inoculum (spore) levels as close to zero as possible
- No fruit should be present on the floor. Waste fruit should be removed immediately, with none standing around (even in bins). Also:
 - o Remove and discard any waste fruit in closed containers from the packhouse, as soon as possible.
 - o Do not allow fruit destined for the juice factory to be anywhere near your packhouse.
- Sanitation is an effective way of preventing fungicide resistance from developing.

REMEMBER: Fresh citrus fruit is a high-risk, perishable commodity. The fruit is alive and, therefore respiring; and the shelf life and quality need to be maintained. The packed export crop must be moved from the packhouse into the cold chain as soon as possible, thereby reducing the risk of loss of quality and waste. Always handle fruit post-harvest according to the Time and Temperature Protocols for citrus: refer to Cutting Edge No. 99.